Palos Verdes Peninsula
Unified School District

Seismic Structural Evaluation and Recommendations

Prepared for Palos Verdes Peninsula Unified School District by:

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September 9, 2016

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Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Sections for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portions of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portions of this report.

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Selection of Sites and Buildings for Review

The selection of buildings for review began with the school sites as listed in the AB300 study prepared by the Division of the State Architect (DSA). From this list site were either added or eliminated by the review team commissioned by the District with more specific knowledge of the District's facilities. From review this the three sites of Miraleste Elementary School (MES) (now known as Miraleste Early Learning Academy, Miraleste Intermediate School (MIS), and Palos Verde Peninsula High School (PEN) were selected for analysis. It should be noted that Malaga Cove site was removed from the DSA developed list since recent seismic upgrade work was completed and Miraleste Elementary School was added to the listed due to its age. It had not been included on the DSA prepared list.

The buildings from each of these site were screened for further review based on age and construction type. These were categorized by the risk factor estimated during the initial Tier 1 screening process for the Tier 2 analysis. Category A contains the buildings thought to have the higher need of retrofit work as determined by the initial screening. Category B includes the other buildings on the campus the older than 1972 and contained structure other than wood framing. Category C included miscellaneous structures not in the original DSA list. It should be noted that the retrofit work recommended after the Tier 2 analysis does necessarily reflect the categorization as determined from the Tier 1 screening. The categories are as follows.

CATEGORY A (considered higher need of analysis from Tier 1 screening)
- MIS Building B Multipurpose/Food Service
- PEN Buildings H & S Classroom Wings

CATEGORY B (other buildings from DSA listed campuses with target age and construction type)
- MIS Building A Admin/Library
- MIS Building C Classroom Wing
- MIS Building D Classroom Wing
- MIS Building E Classroom Wing
- MIS Building F Classroom/Shops
- MIS Building G Gymnasium
- MIS Building H Lockers
- PEN Building A Administration
- PEN Building B Library
- PEN Building C Gymnasium
- PEN Building D Boys Locker
- PEN Building E Girls Locker

CATEGORY C (miscellaneous structures not on the DSA list but added after Tier 1 review)

- MES Building A/B Admin & Classrooms
- MIS Shade Canopies

See site plans for building locations.

Retrofit Recommendations and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

It should be noted that this report addresses the buildings, structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Arrangement

This report is arranged by school campus and then by the individual buildings that are in the scope of analysis. Each building's report section contains the general background information as this introduction so as to be able to be a standalone document.

Each building section contains its own table of contents and is led by the structural analysis sections then the structural retrofit recommendations. It is followed by the architectural section which further develops the recommendations taking into account the implications as noted above. The cost estimating section follows taking into account the retrofit work as well as other work triggered by the structural retrofit item. The supporting appendixes complete each building's section.

Summary

The following is a summary table of the buildings reviewed and list of recommended retrofit items. This is followed by a summary of estimated costs. This is then followed by the individual building full reports arranged by campus.

PVPUSD Tier 2 Seismic Study Summery Table

	Original ASCE 41-13 risk catigory	Tier 1 number of items identified to investigate	Tier 2 number of items deficient	Major seismic retrofit item recommended	Target structural performance	Remarks	conceptial detail number
Miraleste Elementary School							
MES A/B admin/classroom	III	3	2	1. Enhance strait sheathed roof diaphram where ratio is greater then 2:1	S-2		12
MES A/B admin/classroom	"	"	"	2. Enhance stait sheathed roof diaphram where span is greater then 24 feet.	"		12
Miraleste Intermediate School							
MIS A library/admin	III	1	1	1. Enhance strut connection at high roof of library	S-2		1
MIS B multipurpose	III	5	2	1. Add continuous footing to all precast wall panels	S-2		2
MIS C classroom	III	0	0	None	N/A		
MIS D classroom	III	0	0	None	N/A		
MIS E classroom	III	0	0	None	N/A		
MIS F classroom/shops	III	0	0	None	N/A	Further investigation of retaining wall is recommended.	
MIS G gymnasium	III	3	2	1. Enhance roof connection wall ledger	S-2		3
MIS G gymnasium	"	"	"	2. Enhance roof diaphram	"		4
MIS H lockers	III	1	0	None	N/A	Building adjacency issue from tier 1 is addressed by bldg G retrofit.	
MIS canopies	III	1	0	None	N/A	Recommended to repair spalling concrete at canopy roof edges	
Peninsula High School							
PenHS A admin	III	1	0	None	N/A		
PenHS B library	III	7	4	1. Enhance connection of precast panels to concrete frame, foundation and roof	S-2	All the recommended retrofit items apply to building H and building S similar reverse.	5
PenHS B library	"	"	"	2. infill some openings or add brace frames in some locations	"	Recommended to repair spalling concrete at numerous locations on both builings H & S	6
PenHS H&S classrooms	III	4	4	1. Add steel drag struts at low roof diaphram to concrete shear walls on grid lines F and H	S-2		7
PenHS H&S classrooms	"	"	"	2. Provide connection from lower concrete roof to shear walls along grid line F and H	"		8
PenHS H&S classrooms	"	"	"	3. Enhance piers for shear along grid line 8	"		9
PenHS H&S classrooms	"	"	"	4. Extend or Enhance pier walls on grid line I and E	"		10
PenHS H&S classrooms	"	"	"	5. Wrap overhead coupling beams to prevent falling debres over egress paths.	"		11
PenHS C gymnasium	III	0	0	None	N/A		
PenHS D boys locker	III	1	0	None	N/A		
PenHS E girls locker	III	1	0	None	N/A		

RE: PVPUSD Seismic Study

Please find in the following report the cost estimate for the PVPUSD Seismic Study project. This estimate is prepared in accordance with the Narrative, Plans and Details by PBWS - Received 8/10/2016 with the following:

CLARIFICATIONS:

- Pricing is based on the entire project scope being awarded as one project to a single contractor
- Cost is based on prevailing wage labor rates
- This estimate represents an opinion of the fair construction cost for this project assuming multiple general contractors competitively bidding on the project with all sub-trades covered with 4 to 5 bids per trade. If a different delivery method is used a premium cost should be expected and will vary depending on the method used. This estimated cost should not be construed as a prediction of low bid

EXCLUSIONS:

- All soft costs
- Permits
- Owner's contingency
- Construction or occupancy phasing
- CM fee

Should you have any questions, please call me at 661-367- 5242.

Sincerely:

Walid Shihayed

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PVPUSD Seismic Study

Conceptual Study by PBWS Dated August 8, 2016

Spreadsheet Level	Total Amount	GC, Fee, Contingency & Esc.	Grand Total
MESAB Miraleste Elementary School Building A/B, Office and Classrooms	133,049	79,935	212,984
MISA Miraleste Intermediate School Building A, Library	55,250	33,194	88,444
MISB Miraleste Intermediate School Building B, Performing Arts	231,550	139,115	370,665
MISG Miraleste Intermediate School Building G, Gymnasium	135,178	81,215	216,393
PENB Peninsula High School Building B, Library	175,710	105,566	281,277
PENH Peninsula High School Buildings H & S, Classroom Wings	368,669	221,495	590,165

Spreadsheet Level	Total Amount
MESAB Miraleste Elementary School Building A/B, Office and Classrooms	
MESAB1 Retrofit Item 1	**133,049**
MESAB Miraleste Elementary School Building A/B, Office and Classrooms	**133,049**

Spreadsheet Level	Total Amount
MISA Miraleste Intermediate School Building A, Library	
MISA1 Enhance Drag Strut Connection at High Roof Over Library	55,250
MISA Miraleste Intermediate School Building A, Library	**55,250**

Spreadsheet Level	Total Amount
MISB Miraleste Intermediate School Building B, Performing Arts	
MISB1 Foundation for concrete wall panels	231,550
MISB Miraleste Intermediate School Building B, Performing Arts	**231,550**

Spreadsheet Level	Total Amount
MISG Miraleste Intermediate School Building G, Gymnasium	
MISG2 Gymnasium roof diaphragm enhancement	115,608
MISG1 Low roof connection to high wall enhancement	19,570
MISG Miraleste Intermediate School Building G, Gymnasium	**135,178**

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Spreadsheet Level	Total Amount
PENB Peninsula High School Building B, Library	
PENB1 Strengthen wall panel connections to concrete frame	111,344
PENB2 Infill to Create Addition Shear Wall	49,367
PENBm Spalling Concrete Repair	15,000
PENB Peninsula High School Building B, Library	**175,710**

Spreadsheet Level	Total Amount
PENH Peninsula High School Buildings H & S, Classroom Wings	
PENH1 Collectors at Low Roof Diaphragms on Grids F and H	105,977
PENH2 Connection of Roof to Shear Wall on Grids F and H	38,182
PENH3 Pier Reinforcing at Grids G8 and H8	27,947
PENH4 Pier Reinforcing at Grids E8 and I8	50,379
PENH5 Jacket Coupling Beams Over Egress Path	131,185
PENHm Spalling Concrete Repair	15,000
PENH Peninsula High School Buildings H & S, Classroom Wings	**368,669**

Estimate Totals

Description	Amount	Totals	Rate	
Direct Cost	**1,099,407**	**1,099,407**		
General Conditions	109,941		10.00	%
Performance & Payment Bond	14,957			
Liability Insurance	10,994		1.00	%
Overhead & Fee	54,970		5.00	%
Construction Cost	**190,862**	**1,290,269**		
Design Contingency	258,054		20.00	%
Escalation	51,611		4.00	%
Construction Cost With C&E	**309,665**	**1,599,934**		
Construction Contingency	159,993		10.00	%
	159,993	**1,759,927**		
SOFT COSTS:				
Architect & Engineering Fees				
Architect Reimbursables				
Testing & Inspection				
Permits and Fees				
Furniture, Fixtures and Equip.				
Total Project Cost				

PBWS ARCHITECTS

Miraleste Early Learning Academy

Building A/B Admin & Classrooms

Seismic Structural Evaluation and Recommendations

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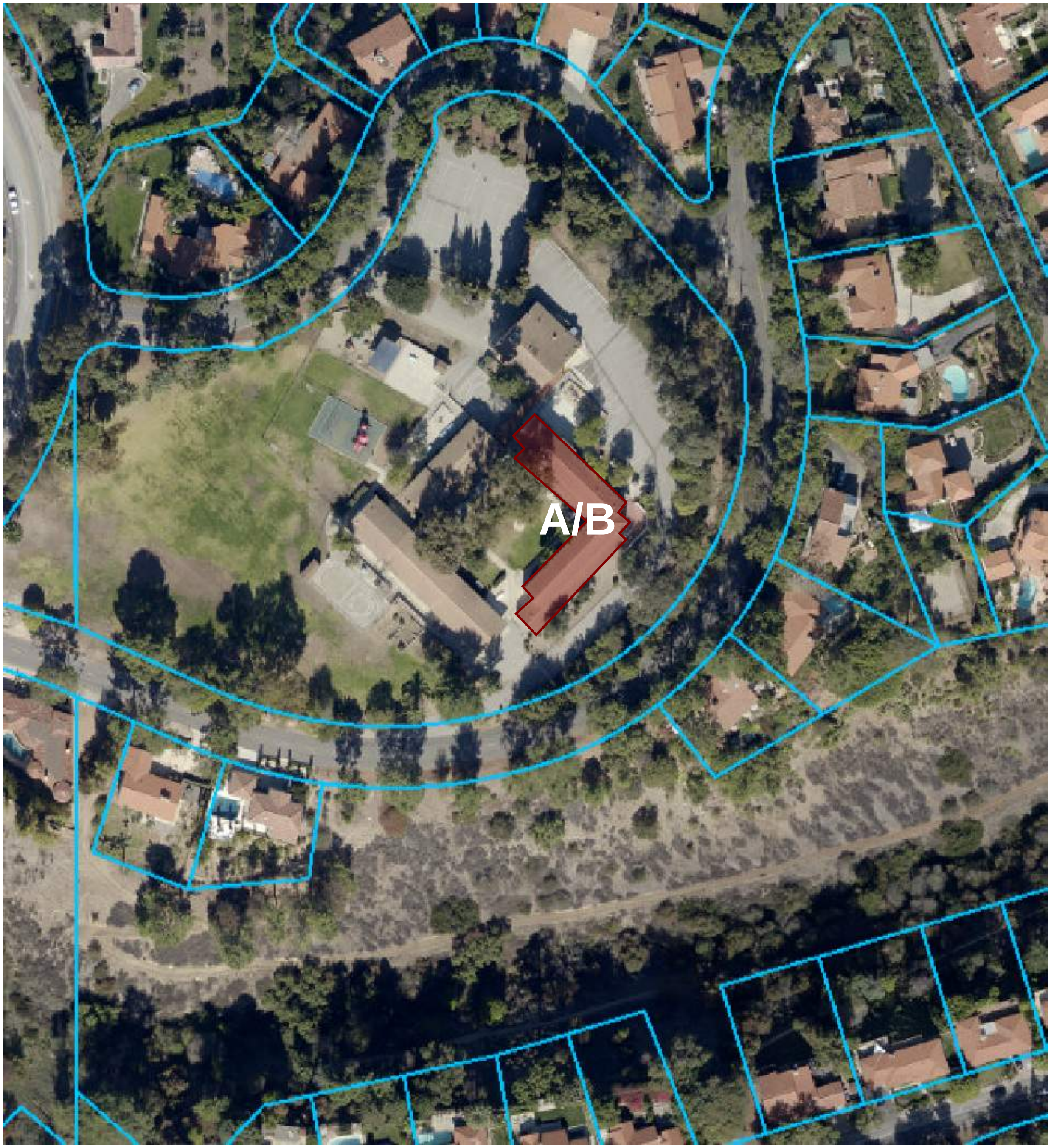

TTG

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
CLASSROOM BUILDING (A+B)

MIRALESTE ELEMENTARY SCHOOL
6245 Via Canada
Rancho Palos Verdes, CA 90275

Terry Tsang, S.E.
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1.0 Introduction- Classroom Building A+B

A multiphase seismic vulnerability assessment of ***Building A+B*** was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation.

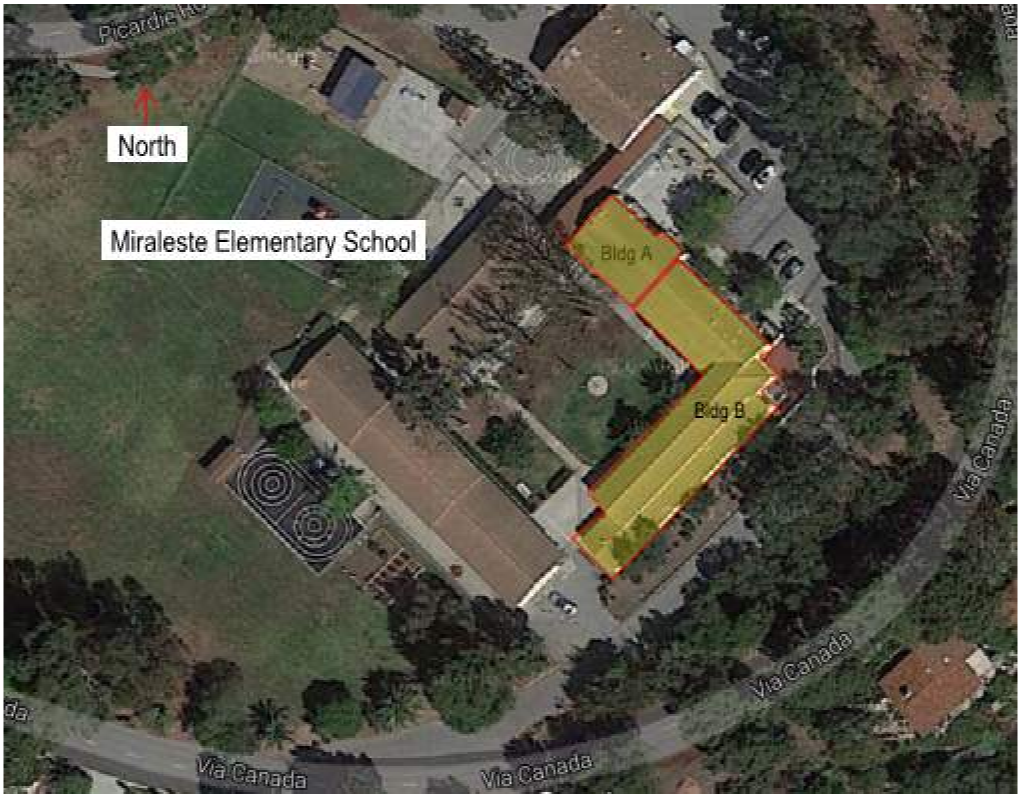
All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Photo 1 – View of East Entrance of the Classroom Building

Photo 2 – View of South Elevation of the Building

Photo 3 – View of North-East Elevation of the Building

An overall campus map of Miraleste Intermediate School, indicating the buildings under evaluation, is provided below. The highlighted building is ***Building A+B.***



Site Map- Building A+B

2.0 Building A+B – Classroom Building

2.1 Site Seismicity

Based on 1955 construction drawings (Sheet S-1 General Notes 3), foundation was based on the allowable soil bearing pressure of 2,320 psf for vertical dead loads plus live loads. There is no geotechnical report available for review.

Per ASCE 41-13 (2012 IBC), for Miraleste Elementary School located at 6245 Via Canada, Rancho Palos Verdes, CA 90275,

Site Coordinates = 33.75203°N, -118.32375°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.515g; $S_{1,20/50}$ = 0.197 g
Fa = 1.388 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.010 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.715g
$S_{X1} = F_v S_{1,20/20}$ = 0.396g

2.2 Building Description

The Classroom Building (A+B) is a one-story building in the eastern portion of the school campus. There are three sheets of drawings, which are undated, showing the architectural design of the original construction of portion B of the building. The existing drawings, dated August 1949 with DSA Application No. 7388, show addition of portion A of the building and portion A is structurally separated from the existing original classroom building portion B. The existing drawings, dated June 1955 for portion B remodeling with DSA Application No. 13178, shows structural remodeling work of the original portion B of the building construction. Functionally, the building consists of classrooms and administrative offices. The portion B of the building is “L” shaped with approximate dimensions of 89’x37’ and 92’x37’ for the two legs of the “L” shape respectively. The portion A of the building is rectangular in shape with approximate dimensions of 50’x37’ located at the North end of the "L" shape portion B of the building. Total footprint of the building, including the roof over covered walkways, is estimated to be ±8,660 square feet; with Portion A having a total floor area of about 1870 square feet and Portion B having a total floor area of about 6790 square feet. Typical average roof height of the classrooms is about 14'-3"; the roof height of the walkway cover is about 10'-0". The roof of Portion A of the building consists of diagonal sheathing over wood joists/rafters/trusses. The roof of Portion B of the building appears to consist of straight sheathing over wood joists/rafters/trusses (The information in available drawings is not clear on if the roof consists of straight sheathing or added diagonal sheathing over original straight sheathing in 1955 remodeling work. See Appendix 1-A, ASCE 41-13 Checklist 16.10.LS for more information; assumed straight sheathed for now). Steel girders are also used at selected locations to support the roof in Portion B of the building. The lateral force resistance of the Portion A of the building is mainly provided by plywood panel shear walls and diagonally sheathed shear walls. The lateral force resistance of the Portion B of the building is mainly provided by reinforced concrete shear walls. The foundation of the building consists of continuous concrete wall footings.

Therefore, based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Wood Light Frame "W1" for Portion A of the building; Reinforced Concrete Shear Walls with Flexible Diaphragms denoted as "C2a".

The structural risk category for the building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Building A+B – Classroom and Administration Building Summary Table	
Year Designed	1949 for Portion A & 1955 for Portion B Remodel (original Portion B design year is not clear; 3 sheets of existing original drawings do not have date).
Drawings	Original structural drawings for Portion A of the building, dated February August 1949, prepared by Hillman & Nowell Structural Engineers. Original architectural drawings for Portion B of the building, undated, prepared by Allison and Allison Architects; remodeling architectural and structural drawings for Portion B, dated 6/21/1955, prepared by Balch-Bryan-Perkins-Hutchason Architects & Construction Management and Eugene D. Birnbaum Structural Engineers.
Gravity System	Wood joists/rafters/trusses/steel girders supported on columns/walls (Flexible Diaphragm)
Lateral System	Wood Shear Walls for Portion A of the building; Reinforced Concrete Shear Walls for Portion B of the building.
No. of Stories & Height	1 Stories; Main Roof: h_n=14.25 ft; Walkway Cover Roof: h_n=10.00 ft
Building Period “T”	0.15 Sec
Base Shear “V”	0.930W = 52.2 kips for Portion A; 0.715 W = 169 kips for Portion B.
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	Straight Sheathed Diaphragm – Inadequate roof diaphragm shear capacity for Portion B of the Building.
Retrofit Recommendations	See Section 4.1 (Strengthening roof diaphragms)

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of ***Building A+B*** is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening, if needed. As a Risk Category ***III***, the Basic Performance Objective for the building was ***Damage Control Structural Performance,*** per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; some were found to be "Compliant" and others were found to remain "Deficient."

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Diagonally Sheathed Diaphragm has span greater than 40 feet. Portion A roof has diagonally sheathed diaphragm with span (41 feet span) slightly more than 40 feet for East-West direction seismic force.
- Tier 1 Deficiency No. 2: Straight Sheathed Diaphragm has aspect ratio greater than 2-to-1. Portion B roof diaphragms have aspect ratio greater than 2-to-1. Diaphragm sheathing information for Portion B of the building is not clear based on available drawings. The sheathing may be single straight sheathed, or added diagonal sheathing over original straight sheathing during 1955 remodeling (See Appendix 1-A, ASCE 41-13 Checklist 16.10LS for more information). Assumed single layer straight sheathed for now, unless more information about existing construction is able to clarify this or verified by field investigation.
- Tier 1 Deficiency No. 3: Straight Sheathed Diaphragm Spans. Portion B roof diaphragm has spans greater than 24 feet.

3.2 ASCE 41-13 Tier 2 Evaluation

The deficiencies listed above were reviewed using a Tier 2 Evaluation procedure, which can be found in Appendix 1-B. Deficiency No. 1, diagonally sheathed diaphragm for Portion A roof having span slightly greater than 40 feet (at about 41 feet), is mitigated by analysis results per ASCE 41-13. The diaphragm has sufficient capacity for load demands; therefore the deficiency No. 1 is considered mitigated.

Deficiency No. 2, straight sheathed diaphragm with aspect ratio greater than 2-to-1, cannot be mitigated by analysis per Tier 2 procedures; the shear capacity of the diaphragms is not sufficient. Similarly, Deficiency No. 3, straight sheathed diaphragm with span greater than 24 feet, cannot be mitigated by analysis per Tier 2 procedures as well. Structural retrofitting will be needed to mitigate these deficiencies.

3.3 Tier 2 Evaluation and Proposed Retrofit Summary Table

Building	Identified Tier 1 Deficiencies	Tier 2 section number	Tier 2 Evaluation Result	Proposed Retrofit
Portion A Target Structural Performance Level: ***S-2 Damage Control***	***16.2 LS Diagonally Sheathed Diaphragm Span***	**5.6.2**	***Adequate***	
Portion B Target Structural Performance Level: ***S-2 Damage Control***	***16.10 LS Straight Sheathed Diaphragm Aspect Ratio Greater than 2:1***	**5.6.2**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in Section 4.1.***
Portion B Target Structural Performance Level: ***S-2 Damage Control***	***16.10 LS Straight Sheathed Diaphragm Span Greater than 24 feet***	**5.6.2**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in Section 4.1.***

4.0 Conclusions

The remaining deficiencies for Portion B of the building are due to the fact that the straight sheathed roof diaphragms do not have the capacity for large spans and aspect ratio. The deficiency in straight sheathed diaphragm may pose a serious collapse hazard if not mitigated.

Given the reasons above, a voluntary seismic retrofit is recommended for this structure to mitigate the deficiency of straight sheathed roof diaphragms in Portion B of the building.

4.1 Proposed Retrofit Options

Summary of Retrofit options:

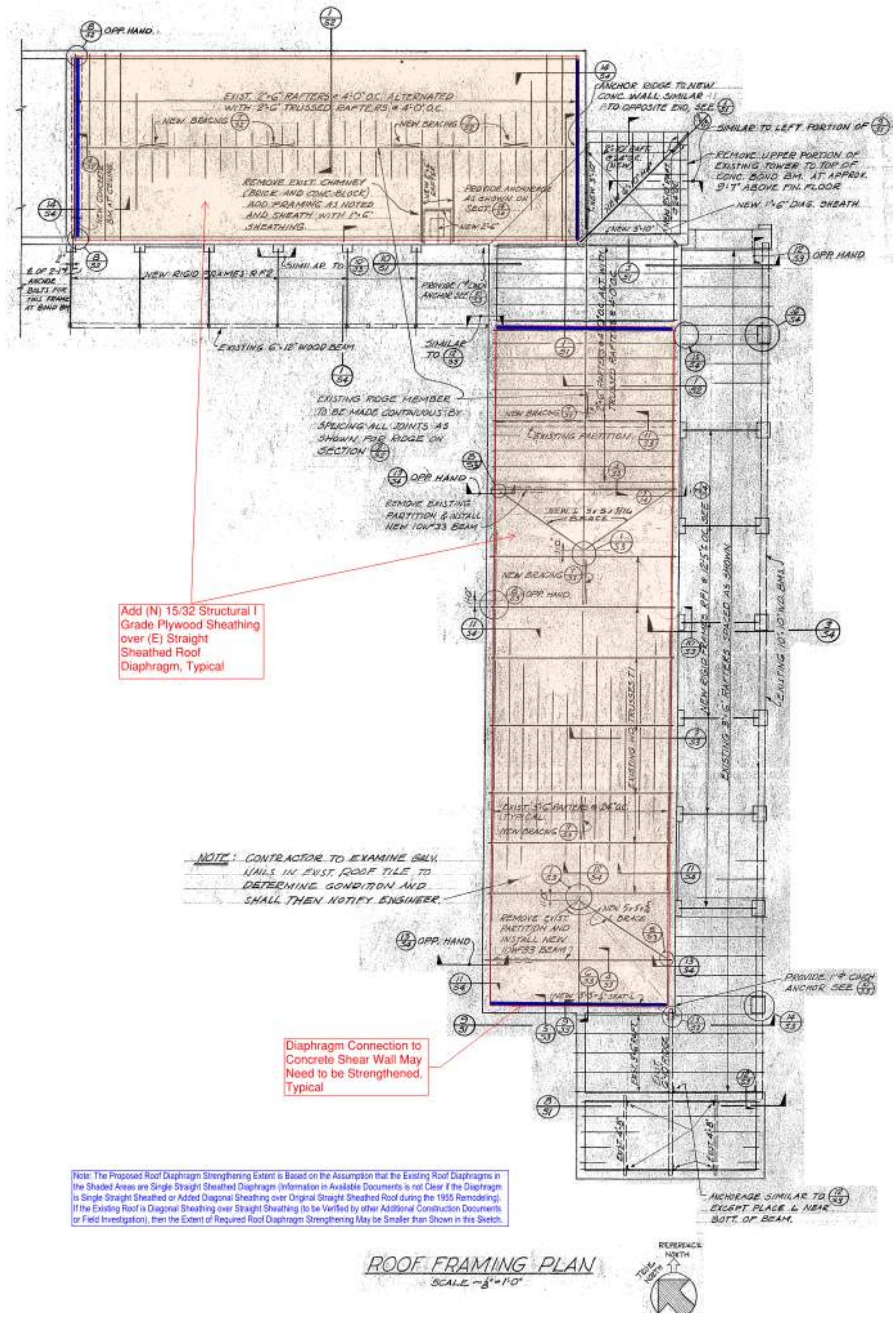
1. Provide new structural roof diaphragm panel overlays over the existing roof diaphragms (See Sketch 1). The new added plywood diaphragm will increase the capacity for the roof diaphragms and allow longer diaphragm span and larger aspect ratios than the existing straight sheathed diaphragm condition. This will mitigate the deficiency of straight sheathed diaphragm in Portion B roof. Final extents of added plywood diaphragms and other details will be further developed in future structural upgrading work.

4.2 Structural Retrofit Selection Recommendations and Conclusions

Based on our analysis of ***Building A+B***, we recommend implementing the following retrofit options:

1. Add New Plywood Diaphragm Sheathing on the Roof of Portion B

   Adding new plywood diaphragm sheathing over existing roof diaphragm will eliminate the deficiency of inadequate capacity of the existing straight sheathed diaphragms. See retrofit Sketch 1 for the proposed diaphragm strengthening scheme.



Sketch 1 – Classroom Building Portion B, Proposed Strengthening of Roof Diaphragms

(Based on Existing 1955 Drawing S-3)

5.0 Documents Reviewed

The following existing architectural and or structural drawings were reviewed:

Date	Architect / Engineer	TTG Comments
Undated	Allison and Allison Architects	Title Block states "Miraleste Elementary School" Architectural Drawings (Sheet Number 1, 2 & 3 only)
August 1949	Marsh, Smith & Powell Architects Hillman & Nowell Structural Engineers	Title Block states "Miraleste School Addition" Structural Drawings (Sheet S-1 & S-2 only) (State of California – Department of Public Works, Division of Architecture Application No. 7388)
June 21, 1955	Balch, Bryan, Perkins & Hutchason Architects & Construction Management Eugene D. Birnbaum Structural Engineer	Title Block states "Miraleste School Remodeling" Architectural Drawings (Sheet A-1 & A-2 only) and Structural Drawings (Sheet S-1 to S-4) (State of California – Department of Public Works, Division of Architecture Application No. 13178)

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Miraleste Elementary School Building A/B, Office and Classrooms

Table of Contents

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part

234 E. Colorado Boulevard Suite 700, Pasadena, California 91101 T: 626.432.5000 F: 626.432.5010 www.pbws.com Architecture Planning Interiors

of the District's facilities. This resulted in the identification and verification of the District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Miraleste Elementary School was one of the earliest school site on the Palos Verdes Peninsula along with the Malaga Cove School built on the West side of the Peninsula. The original building now called A/B was constructed in the late 1920s. It was originally called Miraleste Elementary School and has been in constant use as a public school since that time. It is now referred to as the Miraleste Early Learning Academy. The original building(A/B) was designed by the firm of Allison and Allison Architects. There are two other single story wood frame classroom buildings constructed later that create a court yard arrangement. There is also a wood frame multi-purpose building constructed at a later date.

Building A/B has an L shaped configuration with wings A and B, and is single story with a partial utility basement. It functions as the main entry with staff office and has classrooms in the two wings. There was a tower over the entry and open colonnades along each wing. The building is constructed of unreinforced masonry walls with reinforced concrete bond beams around the tops of the walls. The basement is reinforced concrete construction. One additional wood frame classroom was added to the B wing in in 1950. In 1956 there was a major structural upgrade and remodel to the to this building and to the original building at Malaga Cove School. This upgrade added concrete reinforcing elements to the unreinforced masonry walls and wood roof framing enhancement for the clay tile roof loads. The tower which consisted of both unreinforced masonry and reinforced concrete bond beams was removed. The open colonnades where enclosed to increase the interior space in this remodel project as well.

All portions of the building are of Type-5 non-rated construction and appear fit within the current CBC Type-5B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Item 1

Enhance the Main Roof Diaphragm

This work will consist of providing a new plywood sheathing layer over the existing 1x6 sheathing for the main roof over wings A and B. It is not certain where the 1x6 sheathing has been installed diagonally or strait. In either condition the overlay is recommended to help strengthen the diaphragms due to its long length to width proportion. This will entail removing the existing clay roof tile, storing and reinstalling.

This is not uncommon for this type of roof. Additional tile can be blended in to make up for broken or missing tile when it is reinstalled. This was done for portions of the Malaga Cove School during its renovation. See conceptual detail 12A.

The other part of this work is the connection of the roof diaphragm to the end walls. This would be done by adding a steel straps connected to the end walls with angles and anchors. See conceptual detail 12B

Accessibility Upgrades

The retrofit work has no direct influence on accessibility, however if retrofit work is designed and submitted to DSA there will be some minimum level of access compliance work that will be required as a condition of the obtaining approval. Typically, there are requirements for an accessible path of travel to the subject building from parking and accessible restrooms to serve the building. Even though modernization work has been done which on the campus they may be some work required to meet the requirements of the most current codes and regulations at the time of that the retrofit work is being designed. A separate survey for access compliance is recommended for the entire campus that would be of benefit for future project planning.

Fire & Life Safety

The work should have minimal effect on the fire rated assemblies that exist since all the work in the roof plane. Any assembly disturbed in the process will have to be returned to its original rating condition.

The new work will have no impact on the egress system as currently exists and there are no changes to the egress system in this scope. There is no reconfiguration of spaces or changes of use in the scope that would affect the existing fire/life safety code compliance status of the building with regards to building area, construction type or configuration.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

The retrofit work requires the removal and reinstallation of the clay roof tile on the main roof of both wings but the existing plank sheathing will remain. This fairly extensive but will ultimately preserve the historical appearance of the roof. All the work is confined to the roof plane so it shouldn't impact the walls or interior space. The work can be done over a long break period so it shouldn't have much impact on the school's operation.

8.0 Cost Estimate

PVPUSD Seismic Study
Narrative, Plans and Details by PBWS - Received 8/10/2016

RE: PVPUSD Seismic Study

Please find in the following report the cost estimate for the PVPUSD Seismic Study project. This estimate is prepared in accordance with the Narrative, Plans and Details by PBWS - Received 8/10/2016 with the following:

CLARIFICATIONS:

- Pricing is based on the entire project scope being awarded as one project to a single contractor
- Cost is based on prevailing wage labor rates
- This estimate represents an opinion of the fair construction cost for this project assuming multiple general contractors competitively bidding on the project with all sub-trades covered with 4 to 5 bids per trade. If a different delivery method is used a premium cost should be expected and will vary depending on the method used. This estimated cost should not be construed as a prediction of low bid

EXCLUSIONS:

- All soft costs
- Permits
- Owner's contingency
- Construction or occupancy phasing
- CM fee

Should you have any questions, please call me at 661-367- 5242.

Sincerely:

Walid Shihayed

Walid Shihayed

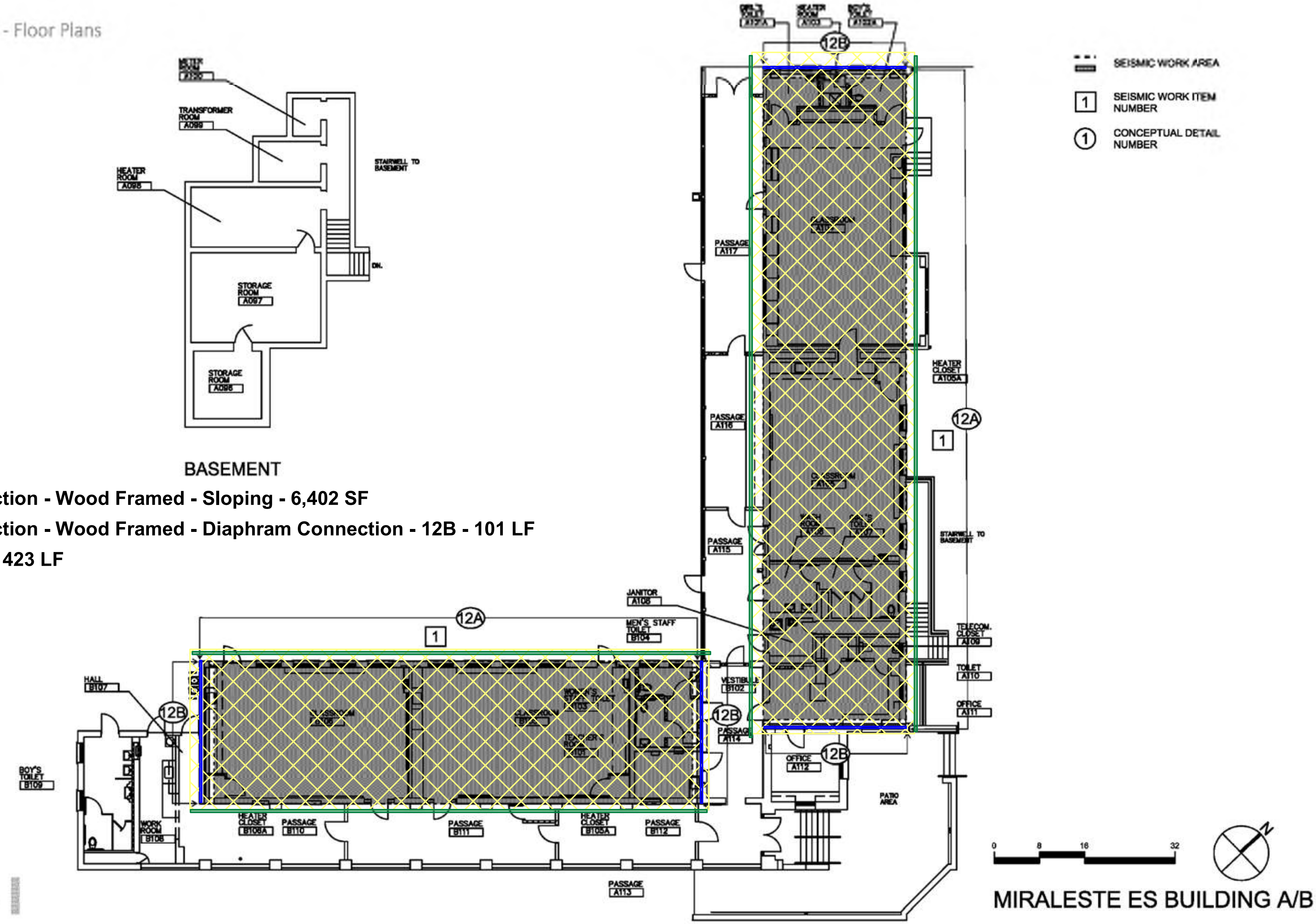
WM2S, Inc.
14908 Live Oak Springs Canyon Road, Santa Clarita, CA. 91387
P: (661) 367 5242, www.WM2S.com

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
MESAB Miraleste Elementary School Building A/B, Office and Classrooms			
0205 Demolition			
02050.000 DEMOLITION			
Remove - Roofing - Tile, Store for Reuse	6,400.00 SF	3.00 /SF	19,200
DEMOLITION			**19,200**
0205 Demolition			**19,200**
0610 Rough Carpentry			
06100.000 ROUGH CARPENTRY			
Diaphragm Connection (assume 24" OC.)	32.00 EA	1,200.00 /EA	38,400
Plywood Sheathing - Roofs	6,400.00 SF	4.50 /SF	28,800
ROUGH CARPENTRY			**67,200**
0610 Rough Carpentry			**67,200**
0750 Roofing			
07300.000 SHINGLES AND ROOFING TILE			
Clay Tile - Reinstall & Replace Missing	6,400.00 SF	6.00 /SF	38,400
SHINGLES AND ROOFING TILE			**38,400**
0750 Roofing			**38,400**
0760 Flashing & Sheetmetal			
07600.000 FLASHING AND SHEET METAL			
Gutters - Remove & Replace	423.00 LF	10.00 /LF	4,230
FLASHING AND SHEET METAL			**4,230**
0760 Flashing & Sheetmetal			**4,230**
0990 Painting			
09900.000 PAINTING			

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
09900.000 PAINTING			
Painting - Exterior Plaster - Toutch up	969.00 SF	2.50 /SF	2,423
Painting - Exterior Plaster	300.00 SF	2.50 /SF	750
Painting - Exterior Metals	423.00 LF	2.00 /LF	846
PAINTING			**4,019**
0990 Painting			**4,019**
MESAB Miraleste Elementary School Building A/B, Office and Classrooms			**133,049**

Partial Totals

Description	Amount	Totals	Rate	
Direct Cost	**133,049**	**133,049**		
General Conditions	13,305		10.00	%
Performance & Payment Bond	1,918			
Liability Insurance	1,330		1.00	%
Overhead & Fee	6,652		5.00	%
Construction Cost	**23,205**	**156,254**		
Design Contingency	31,251		20.00	%
Escalation	6,250		4.00	%
Construction Cost With C&E	**37,501**	**193,755**		
Construction Contingency	19,376		10.00	%
	19,376	**213,131**		
SOFT COSTS:				
Architect & Engineering Fees				
Architect Reimbursables				
Testing & Inspection				
Permits and Fees				
Furniture, Fixtures and Equip.				
Total Project Cost				



1 - Roof Construction - Wood Framed - Sloping - 6,402 SF

2 - Roof Construction - Wood Framed - Diaphram Connection - 12B - 101 LF

3 - Gutter - R&R - 423 LF

PBWS

MIRALESTE ES BUILDING A/B

Appendix 1-A: Tier 1 Screening Checklists

ASCE 41-13 Checklists

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path exists.
X				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.2)	Portion A, type W1 building, is separate from Portion B by 6" separation joint; and Portion A and B have matching roof heights.
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanines.
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	It is one story building, so not applicable.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	It is one story building, so not applicable.
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation.	All vertical elements continuous to foundation.

C	NC	N/A	U	Checklist	Comments
				(§A.2.2.4. Tier 2: §5.4.2.3)	
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	It is one story building, so not applicable.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	It is one story building, so not applicable.
X				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Roof consists of flexible wood diaphragms with minimum of 2 lines of shear wall support. Torsion appears not exist.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
			x	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	No geotech report available.
			x	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	No geotech report available.
			x	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	No geotech report available.

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
X				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.715=0.43 Compliant per review of existing drawings.
X				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Foundation elements are tied together by slab on grade and continuous wall footings.

16.2LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES W1: WOOD LIGHT FRAMES AND W1A: MULTI-STORY, MULTI-UNIT RESIDENTIAL WOOD FRAME

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	There are at least 2 lines of shear walls in each direction.
x				SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the following values (§A.3.2.7.1. Tier 2: §5.5.3.1.1): Structural panel sheathing 1,000 lb/ft Diagonal sheathing 700 lb/ft Straight sheathing 100 lb/ft All other conditions 100 lb/ft	Shear stress is less than 700 lb/ft for shear walls with diagonal sheathing.
		x		STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (§A.3.2.7.2. Tier 2: §5.5.3.6.1)	Stucco shear walls not used.
		x		GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard are not used as shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (§A.3.2.7.3. Tier 2: §5.5.3.6.1)	Gypsum wallboard or plaster shear walls not used.
		x		NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. (§A.3.2.7.4. Tier 2: §5.5.3.6.1)	No narrow shear walls with aspect ratio greater than 2-to-1.
		x		WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (§A.3.2.7.5. Tier 2: §5.5.3.6.2)	Not applicable to one story building.

C	NC	N/A	U	Checklist	Comments
		x		HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-1. (§A.3.2.7.6. Tier 2: §5.5.3.6.3)	Not on a sloping site.
		x		CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (§A.3.2.7.7. Tier 2: §5.5.3.6.4)	No cripple walls.
		x		OPENINGS: Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (§A.3.2.7.8. Tier 2: §5.5.3.6.5)	No openings greater than 80% of the wall length.
				Connections	
x				WOOD POSTS: There is a positive connection of wood posts to the foundation. (§A.5.3.3. Tier 2: §5.7.3.3)	Steel base plate with dowel into concrete foundation provided.
x				WOOD SILLS: All wood sills are bolted to the foundation. (§A.5.3.4. Tier 2: §5.7.3.3)	Wood sills are bolted to foundation.
x				CIRDER/COLUMN CONNECTIONS: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (§A.5.4.1. Tier 2: §5.7.4.1)	Plates and connection hardware are provided.
				High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.	
				Connections	
		x		WOOD SILL BOLTS: Sill bolts are spaced at 6 ft or less with proper edge and end distance provided for wood and concrete. (§A.5.3.7. Tier 2: §5.7.3.3)	Sill bolts at 4'-0" on center provided.

C	NC	N/A	U	Checklist	Comments
Diaphragms					
x				DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (§A.4.1.1. Tier 2: §5.6.1.1)	No split-level diaphragm; no expansion joints.
x				ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. (§A.4.1.3. Tier 2: §5.6.1.1)	All chord elements are continuous.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	Straight sheathing diaphragms not used.
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	Diagonal sheathed diaphragm used.
	x			DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	Diagonally sheathed diaphragm span (at 41 feet) slightly more than 40 feet for East-West direction force. Checked per Tier 2 procedure; Portion A diagonally sheathed diaphragm capacity is sufficient.
		x		OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	No other diaphragms.

16.10LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES C2: CONCRETE SHEAR WALLS WITH STIFF DIAPHRAGMS AND C2A: CONCRETE SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (§A.3.1.6.1. Tier 2: §5.5.2.5.1)	Complete vertical-load carrying system exists.
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	There are at least 2 lines of shear walls in each direction.
x				SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in^2 or $2\sqrt{f'c}$. (§A.3.2.2.1. Tier 2: §5.5.3.1.1)	Average shear stress is less than max {100, $2\sqrt{f'c}$} =100 psi. See calculations in Appendix 1-B.
x				REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (§A.3.2.2.2. Tier 2: §5.5.3.1.3)	Reinforcing steel ratios meet requirements; see calculations in Appendix 1-B.
				Connections	
x				WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Wall anchorage is sufficient. See calculations in Appendix 1-B.
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	Diaphragms are connected to shear walls.

C	NC	N/A	U	Checklist	Comments
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	Wall reinforcement is doweled into foundation.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Seismic-Force-Resisting System					
x				DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (§A.3.1.6.2. Tier 2: §5.5.2.5.2)	Meet requirements.
		x		FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (§A.3.1.6.3. Tier 2: §5.5.2.5.3)	Not applicable. There is no slab which is not part of the seismic force resisting system.
		x		COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than d/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (§A.3.2.2.3. Tier 2: §5.5.3.2.1)	No coupling beams.
Connections					
		x		UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (§A.5.3.8. Tier 2: §5.7.3.5)	No pile caps, so not applicable.
Diaphragms (Flexible or Stiff)					
x				DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (§A.4.1.1. Tier 2: §5.6.1.1)	No diaphragm discontinuity in the building, so compliant.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	No large openings in diaphragms.

C	NC	N/A	U	Checklist	Comments
				Flexible Diaphragms	
x				CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Cross ties exist.
	x			STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	Based on available drawings, Portion B roof diaphragm sheathing information not clear. May be single straight sheathed, or added diagonal sheathing over original straight sheath during 1955 remodeling. Assumed single layer straight sheathed (See Note 1 at the end of the checklist for more information).
	x			SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	As above. Roof diaphragm spans (assumed straight sheathed) greater than 24 feet.
x				DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	Diagonally sheathed diaphragms used in 1955 remodeling where diaphragms in small/limited areas were constructed during the remodeling work. Span not more than 40 feet.
		x		OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	No other diaphragms.

Note 1. Per 1955 remodeling structural drawing, Section 3/S-4 and 11/S-4 appear to show roof diaphragm with double layer of sheathing, possibly adding a new layer of diagonal sheathing over existing during 1955 remodeling work. However, Section 3/S-3, 1/S-2 and 3/S-1 appear to show single layer roof sheathing; and per 3/S-1 single layer existing sheathing is likely to be straight sheathed. Therefore, assumed single layer straight sheathed for now, unless more information about existing construction is available or verified by field investigation.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
				Life Safety Systems	
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	No fire sprinklers or suppression piping present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	No fire sprinklers or suppression piping present; So not applicable
		X		LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	No emergency power observed at site; So not applicable
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	None observed at site; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	No fire sprinklers or suppression piping present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Hazardous Materials	
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
Partitions					
X				LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	Unreinforced masonry walls are braced at a spacing of less than 6 feet.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
				Light Fixtures	
			X	LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Not able to observe because of ceiling type in place
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Cladding and Glazing	
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
Masonry Veneer					
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.

C	NC	N/A	U	Checklist	Comments
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	No URM backup, so not applicable.
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
Parapets, Cornices, Ornamentation, and Appendages					
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
		X		LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	No Canopies; So not applicable
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No Concrete Parapets; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	
Masonry Chimneys					
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
Stairs					
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
Contents and Furnishings					
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2:	No industrial racks observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				§13.8.1)	
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
		X		LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	None observed; So not applicable
X				LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Proper bracing and support was observed
		X		LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent	None observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
				Piping	
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
				Ducts	
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
				Elevators	
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

Miraleste Elementary School Job #: 0215.769
Classroom Building (A+B) Date: Mar-16

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW	Bldg Type= **W1 & C2a**
$C =$	1.3	From Table 4-8 for 1949 Portion A Building
$C =$	1	From Table 4-8 for 1955 Portion B Building
$S_a =$	$\min(S_{XS}, S_{X1}/T)$	From Section 4.5.2.3
$S_{X1} =$	$F_V S_1$	Eq. 2-2
$S_{XS} =$	$F_a S_S$	Eq. 2-1
$S_S =$	0.515	g, mapped spectral acceleration
$S_1 =$	0.197	g, mapped spectral acceleration
$S_{X1} =$	0.396	g
$S_{XS} =$	0.715	g
$T =$	$C_t h_n^{\beta}$	From Section 4.5.2.4
$C_t =$	0.02	
$h_n =$	14.25	ft., average height at sloped roof
$\beta =$	0.75	
$T =$	0.147	sec.
$S_a =$	0.715	g
$V_{B\ 1949} =$	0.930	W
$V_{A\ 1955\ Remodel} =$	0.715	W

USGS Design Maps Summary Report

User–Specified Input

Report Title California Minimum Ss
Fri March 4, 2016 17:57:01 UTC

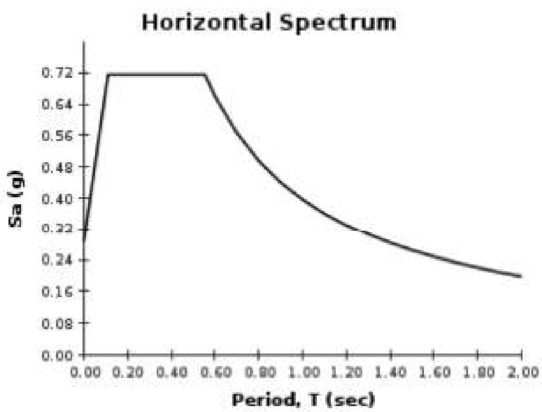
Building Code Reference Document ASCE 41-13 Retrofit Standard, BSE-1E
(which utilizes USGS hazard data available in 2008)

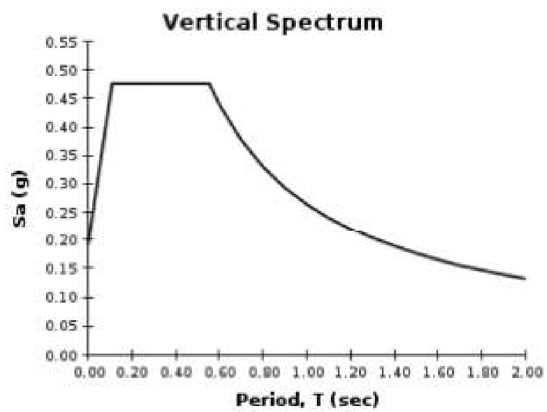
Site Coordinates 33.75203°N, 118.32375°W

Site Soil Classification Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.515 g	$S_{XS,BSE-1E}$	0.715 g
$S_{1,20/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g





Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

Miraleste Elementary School
Classroom Building (A+B)

Job #: 0215.769
Date: Mar-16

Seismic Mass Weight - 1972 Construction

Roof

(Roof area with 1/2" Plywood sheathing)

Roofing Tile	10	psf
1"x6" Diagonal Sheathing	2.5	psf
Wood joists	1.5	psf
Roof truss	4	psf
MEP	3	psf
Ceiling	3	psf
Misc	1	psf
DL =	**25**	**psf**
Use	**25**	**psf**

Wall Weight

4" Conc wall =	50	psf
4" conc + 8" blck wall =	130	psf

TTG

Miraleste Elementary School
Classroom Building (A)

Job #: 0215.769
Date: Mar-16

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation 1949 Classroom Building (A)

Location		Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Building A Roof	Roof	50.0	36.1	1804	25	45.1
	Roof	17.0	4.0	68	25	1.7
	Wood stud walls, out plane	100.0	6.3	625	15	9.4
	Grand Total =			**1872**		**56.2**

Base shear V = 0.930 W
Base shear $V_{A,49}$= **52.2** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x	h_x	$w_x h_x$	Fx	Area	fi
	kip	ft	k-ft	kip	ft2	psf
Roof	56	14.25	801	52	1872.2	27.9
Sum =	56		801	52		

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1 Footnote b for reinforced concrete walls

Wall Forces - Supporting Roof

	Wall Description	Length ft	Width Unit	Aw ft	Force Vj kips	v avg plf
N-S Direction	West 1/2" Plywd	5.0	1.0	5	52	527.5
Wood shear wall	East 1/2" Plywd	10.0	1.0	10		
	Interm dia sheath	18.0	1.0	18		
E-W Directioin		29	1.0	29	52	378.4
Wood shear wall		17.0	1.0	17		
					Max. wall shear (PLF) =	527.5

Per ASCE 41-13 check list 16.2LS, if shear stress less than 700 plf in diagonally sheathed wall, OK
Maximum wall shear is less than 700 plf, O.K.

Portion A Roof Diagonally Sheathed Diaphragm Shear

Portion A Roof	Trib L	Trib W	wi	Diap v
E-W Direction	ft	ft	psf	plf
	20.5	1	27.9	571.8

Max demand Q_{uf}= 572 plf
Diagonally sheathed diaphragm default strength Q_{ce} = 600 plf, per Table 12-2
m factor = 2.0 from Table 12-3
Knowledge factor k = 0.75 from Table 6-1
kmQ_{ce} = 900 plf > Q_{uf}
DCR = $Q_{uf}/(kmQ_{ce})$ = 0.64 < 1.0 O.K>
Diagonally sheathed roof diaphragm is sufficient.

TTG

Miraleste Elementary School
Classroom Building (Portion B)

Job #: 0215.769
Date: Mar-16

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation 1955 Remodel Classroom Building (B)

Location		Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Portion B, Roof	Area 1	21.5	24.6	528.5	25	13
	Area 2	89.8	36.9	3313.3	25	83
	Area 3	67.2	36.9	2479.6	25	62
	Area 4	13.8	24.5	336.9	25	8
	Area 5	10.7	12	128.0	25	3
	12" Walls out-of-plane	124.9	6.25	780.7	75	59
	Windows out-of-plane	124.9	6.3	780.7	10	8
	Grand Total =			**6786**		**236**

Base shear V_{MP72}= 0.715 W
V = **169** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x	h_x	$w_x h_x$	Fx	Area	fi
	kip	ft	k-ft	kip	ft2	psf
Roof	236	22.75	5369	169	6786.3	24.9
Sum =	236		5369	169		

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1 Footnote b for reinforced concrete walls

Wall Forces - Supporting Roof - 1972 Multipurpose Area

	Wall Description	Length ft	Width in	Aw in2	Force Vj kips	v avg psi
N-S Direction	Wall thick 4"	48.0	4.0	2304	169	12.9
	Wall thick 10"	17.0	10.0	2040		
E-W Directioin	Wall thick 4"	28.5	4.0	1368	169	17.4
	Wall thick 10"	15.5	10.0	1860		

Per ASCE 41-13 check list 16.10LS, if shear stress less than max(100, 2f'c^0.5)=109 psi in concrete wall, OK
fc'=3 ksi Average wall shear is less than 109 psi, O.K.

Reinforced Concrete Wall, Reinforcing Steel Ratio

4" Concrete wall with #4 @ 18" Verti & Horizontal at center of wall

Hori ρ=	0.0028	Shall not be less than 0.0012 vertic, 0.0020 in hori direction
Verti ρ=	0.0028	Meeting requirements on reinforcing steel

Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

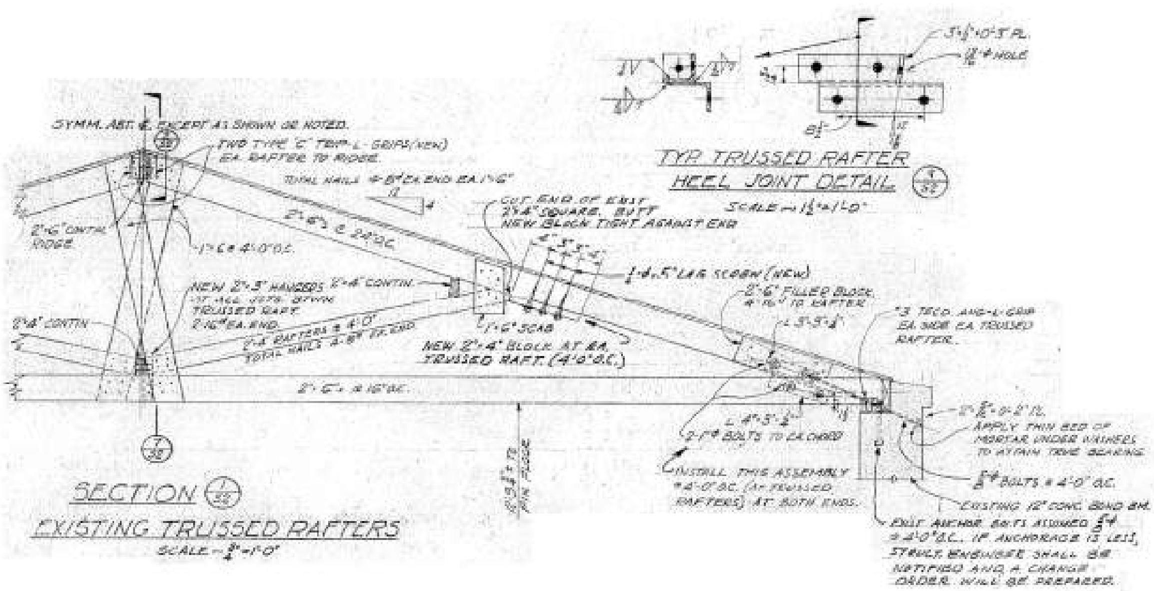
Tc=	$1.2S_{XS}\, w_p\, A_p$ =	111.5	psf	Eqn 4-13
S_{XS} =	0.715			
w_p =	*130*	psf	8" masonry + 4" conc wall,	
Ap =	1	ft2		

Evaluate connection for out-of-plane action per Tier 2 procedure
Per Section C7.5.1.2, connections should be evaluated as force-controled procedure.

C_1C_2 =	1.4	From Table 7-3		
J=	1	Per Section 7.5.2.1.2		
Q_{UF}=	Q_G+/-Q_E/(C_1C_2J)	Eqn 7-35		
Q_G =	0.0	lbs		
Q_E=	669.2	lbs	End shear for 1'x6' wall (WxH)	
Q_{UF}=	478.0	lbs	End shear divided by CJ factor	

Per detail 1/S-2, wall anchors @ S =	4.00	ft	Typical anchor @ 4'-0" per S-4
Out of plane force T_{UF}=	**1,912**	lbs	Each anchor location
Typical anchor capacity per 1/S-2			
5/8" Dia Tie Rod Trod =	13.95	kips	
(2) 1" bolt in 2x6 Chord =2*1170*3=	7020	lbs	
Ncn=min(13950, 7020)=	**7,020**	lbs	>= T_{UF}, Okay

Therefore, wall out-of-plane anchorage is sufficient.



Portion B Roof Diaphragm Shear (Assumed Single Straight Sheathed)

ortion B, W-Wing Rf	Diaph Span	Diaph Width	Span/Width	wi	Diap v
N-S Direction	ft	ft	Ratio	psf	plf
	65.0	24	2.71	24.9	808.2

Max demand Q_{uf}= 808 plf
Straight sheathed (Assumed) diaphragm strength Q_{ce} = 120 plf, per Table 12-2
m factor = 1.625 from Table 12-3 for Damage Control
Knowledge factor k = 0.75 from Table 6-1
kmQ_{ce} = 146 plf < Q_{uf}
DCR = $Q_{uf}/(kmQ_{ce})$ = 5.53 > 1.0 Not Good
Straight sheathed (assumed) roof diaphragm at Portion B West Wing is NOT sufficient.

Portion B, E-Wing Rf	Diaph Span	Diaph Width	Span/Width	wi	Diap v
E-W Direction	ft	ft	Ratio	psf	plf
	88.0	24	3.67	24.9	1094.1

Max demand Q_{uf}= 1094 plf
Straight sheathed (Assumed) diaphragm default strength Q_{ce} = 120 plf, per Table 12-2
m factor = 1.33 from Table 12-3
Knowledge factor k = 0.75 from Table 6-1
kmQ_{ce} = 120 plf < Q_{uf}
DCR = $Q_{uf}/(kmQ_{ce})$ = 9.14 > 1.0 Not Good
Straight sheathed (assumed) roof diaphragm at Portion B East Wing is NOT sufficient.

Portion B Roof Diaphragm Shear (Assumed Diagonally Sheath over Single Straight Sheathed)

ortion B, W-Wing Rf	Diaph Span	Diaph Width	Span/Width	wi	Diap v
N-S Direction	ft	ft	Ratio	psf	plf
	65.0	24	2.71	24.9	808.2

Max demand Q_{uf}= 808 plf
Diagonal/Straight sheath (Assumed) diaphragm strength Q_{ce} = 900 plf, per Table 12-2
m factor = 1.625 from Table 12-3 for Damage Control
Knowledge factor k = 0.75 from Table 6-1
kmQ_{ce} = 1097 plf < Q_{uf}
DCR = $Q_{uf}/(kmQ_{ce})$ = 0.74 < 1.0 O.K.
Diagonal/Straight sheathed (assumed) roof diaphragm at Portion B West Wing is sufficient.

Portion B, E-Wing Rf	Diaph Span	Diaph Width	Span/Width	wi	Diap v
E-W Direction	ft	ft	Ratio	psf	plf
	88.0	24	3.67	24.9	1094.1

Max demand Q_{uf}= 1094 plf
Diagonal/Straight sheath (Assumed) diaphragm strength Q_{ce} = 900 plf, per Table 12-2
m factor = 1.33 from Table 12-3
Knowledge factor k = 0.75 from Table 6-1
kmQ_{ce} = 898 plf < Q_{uf}
DCR = $Q_{uf}/(kmQ_{ce})$ = 1.22 > 1.0 Not Good
Diagnoa/Straight sheathed (assumed) roof diaphragm at Portion B East Wing is NOT sufficient.

DOWEL-TYPE FASTENERS

BOLTS

Table 11B BOLTS: Reference Lateral Design Values (Z) for Single Shear (two member) Connections[1,2]

for sawn lumber or SCL with 1/4" ASTM A 36 steel side plate

Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_{\parallel}$ lbs.	G=0.67 Red Oak $Z_{\perp}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\parallel}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\perp}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\parallel}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\perp}$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_{\parallel}$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_{\perp}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\parallel}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\perp}$ lbs.	G=0.43 Hem-Fir $Z_{\parallel}$ lbs.	G=0.43 Hem-Fir $Z_{\perp}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\parallel}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\perp}$ lbs.	G=0.37 Redwood (open grain) $Z_{\parallel}$ lbs.	G=0.37 Redwood (open grain) $Z_{\perp}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\parallel}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\perp}$ lbs.	G=0.35 Northern Species $Z_{\parallel}$ lbs.	G=0.35 Northern Species $Z_{\perp}$ lbs.
1-1/2	1/4	1/2	730	420	620	350	580	310	580	310	550	290	520	280	510	270	470	240	460	240	450	230
		5/8	910	480	780	400	730	380	720	360	690	340	650	320	640	320	590	290	580	280	560	270
		3/4	1090	550	940	450	870	420	860	410	820	390	780	360	770	360	710	320	690	320	680	310
		7/8	1270	600	1090	510	1020	470	1010	450	960	430	910	410	900	400	820	370	810	360	790	350
		1	1460	660	1250	550	1170	510	1150	500	1100	480	1040	450	1030	450	940	400	930	400	900	390
1-3/4	1/4	1/2	810	480	690	370	640	340	630	330	600	310	570	290	560	280	510	250	500	250	490	240
		5/8	1020	520	870	430	800	390	790	380	750	360	710	340	700	330	640	300	630	290	610	280
		3/4	1220	590	1040	480	960	440	950	430	900	410	860	380	840	370	770	330	750	330	730	320
		7/8	1420	650	1210	540	1130	490	1110	480	1050	450	1000	420	980	420	890	380	880	370	850	360
		1	1630	710	1380	580	1290	540	1270	520	1200	500	1140	470	1120	460	1020	410	1000	410	980	400
2-1/2	1/4	1/2	930	600	860	470	830	410	820	400	780	380	740	350	720	340	650	300	640	290	620	280
		5/8	1370	670	1150	530	1050	470	1040	470	980	430	920	400	910	390	810	340	800	330	770	320
		3/4	1640	750	1370	590	1270	530	1250	520	1180	490	1110	450	1090	440	980	380	960	370	930	360
		7/8	1910	820	1600	650	1480	590	1450	570	1370	530	1290	490	1270	480	1140	420	1120	410	1080	400
		1	2190	880	1830	700	1690	640	1660	620	1570	580	1480	540	1450	530	1300	460	1280	450	1240	440
3-1/2	1/4	1/2	930	620	860	550	830	510	820	510	800	480	770	450	770	430	720	370	720	360	710	350
		5/8	1370	860	1260	690	1210	610	1200	600	1160	550	1130	500	1120	490	1060	420	1050	410	1020	400
		3/4	1900	990	1740	760	1670	680	1660	660	1580	610	1480	560	1450	540	1300	460	1200	450	1220	440
		7/8	2530	1070	2170	840	1990	740	1950	710	1840	660	1720	610	1690	590	1510	510	1480	500	1430	470
		1	2980	1150	2480	890	2270	800	2230	770	2100	730	1970	680	1930	650	1720	560	1690	540	1630	530
5-1/4	1/4	5/8	1370	860	1260	760	1210	710	1200	700	1160	670	1130	640	1120	630	1060	580	1050	560	1030	540
		3/4	1900	1140	1740	1000	1670	940	1660	930	1610	860	1560	770	1550	760	1460	640	1450	620	1420	600
		7/8	2530	1460	2320	1190	2220	1050	2200	1010	2140	920	2070	840	2050	820	1940	700	1920	680	1890	640
		1	3260	1660	2980	1270	2860	1130	2840	1080	2750	1010	2670	920	2640	890	2490	750	2450	730	2360	710
5-1/2	1/4	5/8	1370	860	1260	760	1210	710	1200	700	1160	670	1130	640	1120	630	1060	580	1050	570	1030	560
		3/4	1900	1140	1740	1000	1670	940	1660	930	1610	890	1560	810	1550	790	1460	660	1450	640	1420	620
		7/8	2530	1460	2320	1240	2220	1090	2200	1050	2140	960	2070	880	2050	860	1940	730	1920	710	1890	660
		1	3260	1730	2980	1320	2860	1170	2840	1130	2750	1050	2670	950	2640	930	2490	780	2470	760	2420	740
7-1/2	1/4	5/8	1370	860	1260	760	1210	710	1200	700	1160	670	1130	640	1120	630	1060	580	1050	570	1030	560
		3/4	1900	1140	1740	1000	1670	940	1660	930	1610	890	1560	850	1550	840	1460	760	1450	750	1420	740
		7/8	2530	1460	2320	1280	2220	1210	2200	1180	2140	1130	2070	1080	2050	1070	1940	960	1920	930	1890	870
		1	3260	1820	2980	1590	2860	1500	2840	1470	2750	1400	2670	1270	2640	1230	2490	1030	2470	1000	2420	960
9-1/2	1/4	3/4	1900	1140	1740	1000	1670	940	1660	930	1610	890	1560	850	1550	840	1460	760	1450	750	1420	740
		7/8	2530	1460	2320	1280	2220	1210	2200	1180	2140	1130	2070	1080	2050	1070	1940	980	1920	970	1890	930
		1	3260	1820	2980	1590	2860	1500	2840	1470	2750	1420	2670	1350	2640	1330	2490	1220	2470	1200	2420	1180
11-1/2	1/4	7/8	2530	1460	2320	1280	2220	1210	2200	1180	2140	1130	2070	1080	2050	1070	1940	980	1920	970	1890	930
		1	3260	1820	2980	1590	2860	1500	2840	1470	2750	1420	2670	1350	2640	1330	2490	1220	2470	1200	2420	1180
13-1/2	1/4	1	3260	1820	2980	1590	2860	1500	2840	1470	2750	1420	2670	1350	2640	1330	2490	1220	2470	1200	2420	1180

1. Tabulated lateral design values (Z) for bolted connections shall be multiplied by all applicable adjustment factors (see Table 10.3.1).
2. Tabulated lateral design values (Z) are for "full diameter" bolts (see Appendix L) with bending yield strength (F_{yb}) of 45,000 psi and dowel bearing strength (F_e) of 87,000 psi for ASTM A 36 steel.

AMERICAN WOOD COUNCIL

Use ASD to LRFD factor = 3

Table 11.3.1B Reduction Term, R_d

Fastener Size	Yield Mode	Reduction Term, R_d
$0.25" \le D \le 1"$	I_m, I_s	4 K_θ
	II	3.6 K_θ
	III_m, III_s, IV	3.2 K_θ
$D < 0.25"$	I_m, I_s, II, III_m, III_s, IV	K_D[1]

Notes:
K_θ = $1 + 0.25(\theta/90)$
θ = maximum angle of load to grain ($0^\circ \le \theta \le 90^\circ$) for any member in a connection
D = diameter, in. (see 11.3.6)
K_D = 2.2 for $D \le 0.17"$
K_D = $10D + 0.5$ for $0.17" < D < 0.25"$

1. For threaded fasteners where nominal diameter (see Appendix L) is greater than or equal to 0.25" and root diameter is less than 0.25", $R_d = K_D K_\theta$

11.3.2 Dowel Bearing Strength

11.3.2.1 Dowel bearing strengths, F_e, for parallel or perpendicular to grain loading are provided for dowel-type fasteners with $1/4" \le D \le 1"$ in Table 11.3.2. When fastener diameter, $D < 1/4"$, a single dowel bearing strength, F_e, is used for both parallel and perpendicular to grain loading.

11.3.2.2 Dowel bearing strengths, F_e, for wood structural panels are provided in Table 11.3.2B.

11.3.2.3 Dowel bearing strengths, F_e, for structural composite lumber shall be obtained from the manufacturer's literature or code evaluation report.

11.3.2.4 When dowel-type fasteners with $D \ge 1/4"$ are inserted into the end grain of the main member, with the fastener axis parallel to the wood fibers, $F_{e\perp}$ shall be used in determination of the dowel bearing strength of the main member, F_{em}.

11.3.3 Dowel Bearing Strength at an Angle to Grain

When a member in a connection is loaded at an angle to grain, the dowel bearing strength, $F_{e\theta}$, for the member shall be determined as follows (see Appendix J):

$$F_{e\theta} = \frac{F_{e\|}F_{e\perp}}{F_{e\|}\sin^2\theta + F_{e\perp}\cos^2\theta} \qquad (11.3\text{-}11)$$

where:

θ = angle between direction of load and direction of grain (longitudinal axis of member).

Figure 11B Single Shear Bolted Connections

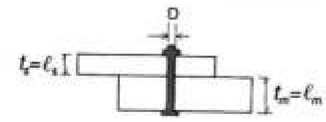
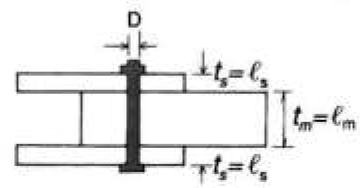


Figure 11C Double Shear Bolted Connections



11.3.4 Dowel Bearing Length

11.3.4.1 Dowel bearing length in the side member(s) and main member, ℓ_s and ℓ_m, represent the length of dowel bearing perpendicular to the application of load. The length of dowel bearing shall not include the tapered tip of a fastener for fastener penetration lengths less than 10D.

11.3.5 Dowel Bending Yield Strength

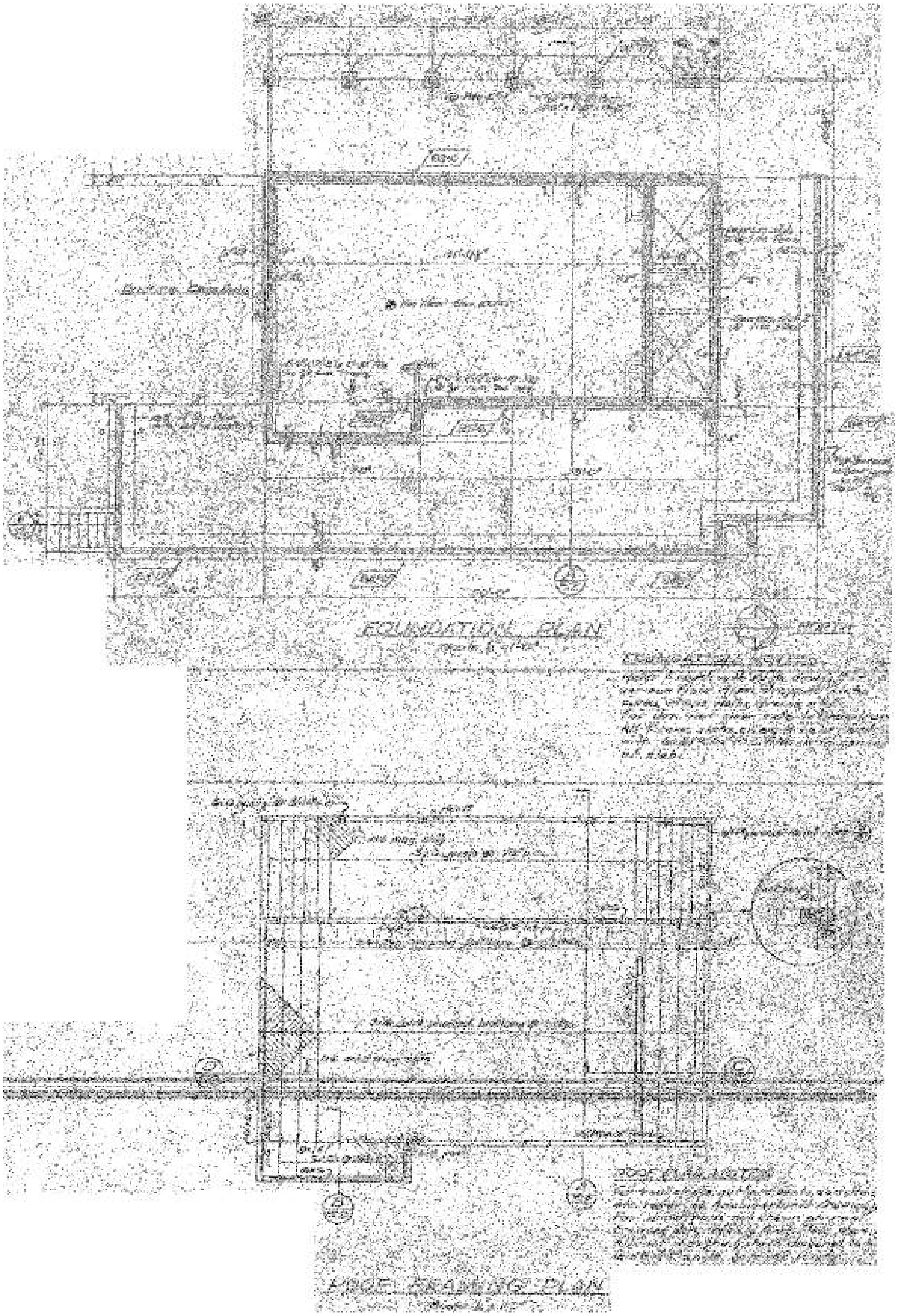
11.3.5.1 Reference design values for bolts, lag screws, wood screws, nails, and spikes are based on bending yield strengths provided in Tables 11A through 11R.

11.3.5.2 Dowel bending yield strengths, F_{yb}, used in calculation of reference design values shall be based on yield strength derived using methods provided in ASTM F 1575 or the tensile yield strength derived using procedures of ASTM F 606.

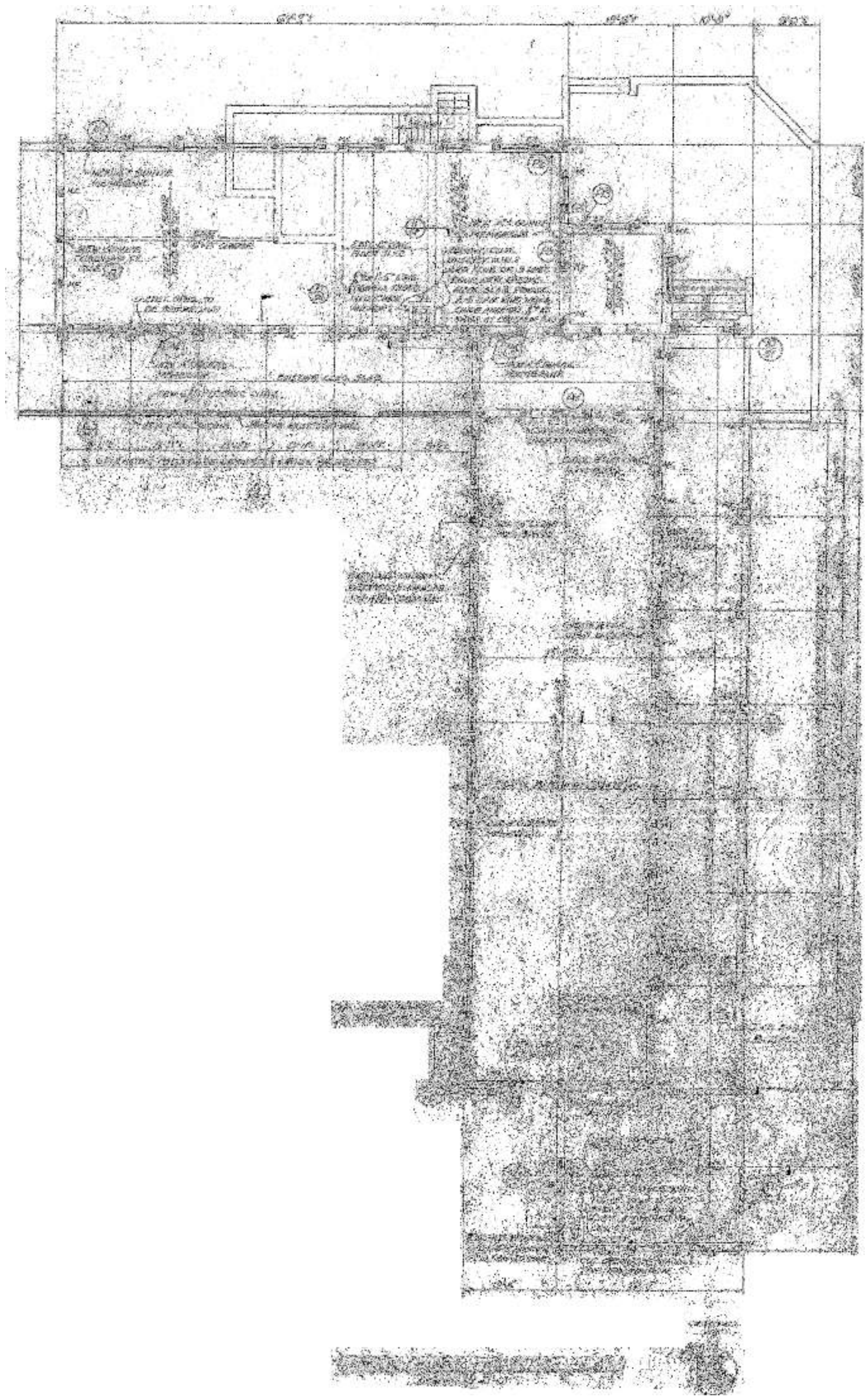
11.3.6 Dowel Diameter

11.3.6.1 When used in Tables 11.3-1A and 11.3-1B, the fastener diameter shall be taken as D for unthreaded full-body diameter fasteners and D_r for reduced body diameter fasteners or threaded fasteners except as provided in 11.3.6.2. For bolts meeting the requirements of ANSI/ASME Standard B18.2.1 for full-body diameter bolts, the fastener diameter shall be taken as D (see Appendix L).

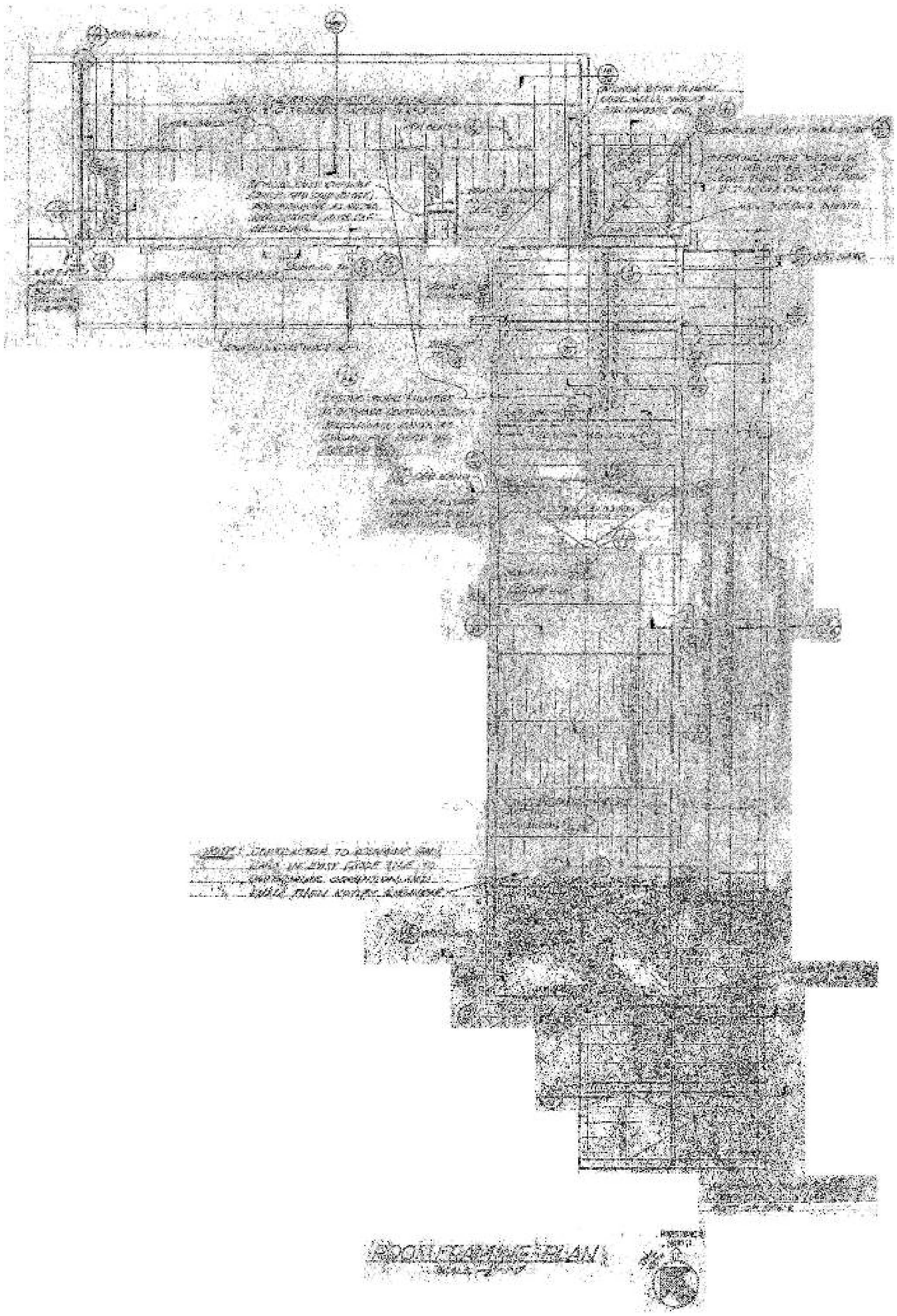
Appendix 1-C: As-Built Plans



Building Portion A, Foundation Plan & Roof Framing Plan (1949 Sheet S1)



Building Portion B, First Floor Framing Plan (1955 Sheet S-2)



Building Portion B, Roof Framing Plan (1955 Sheet S-3)

Appendix 7A – Images of Existing Conditions

Fig 1. Entry with former tower location

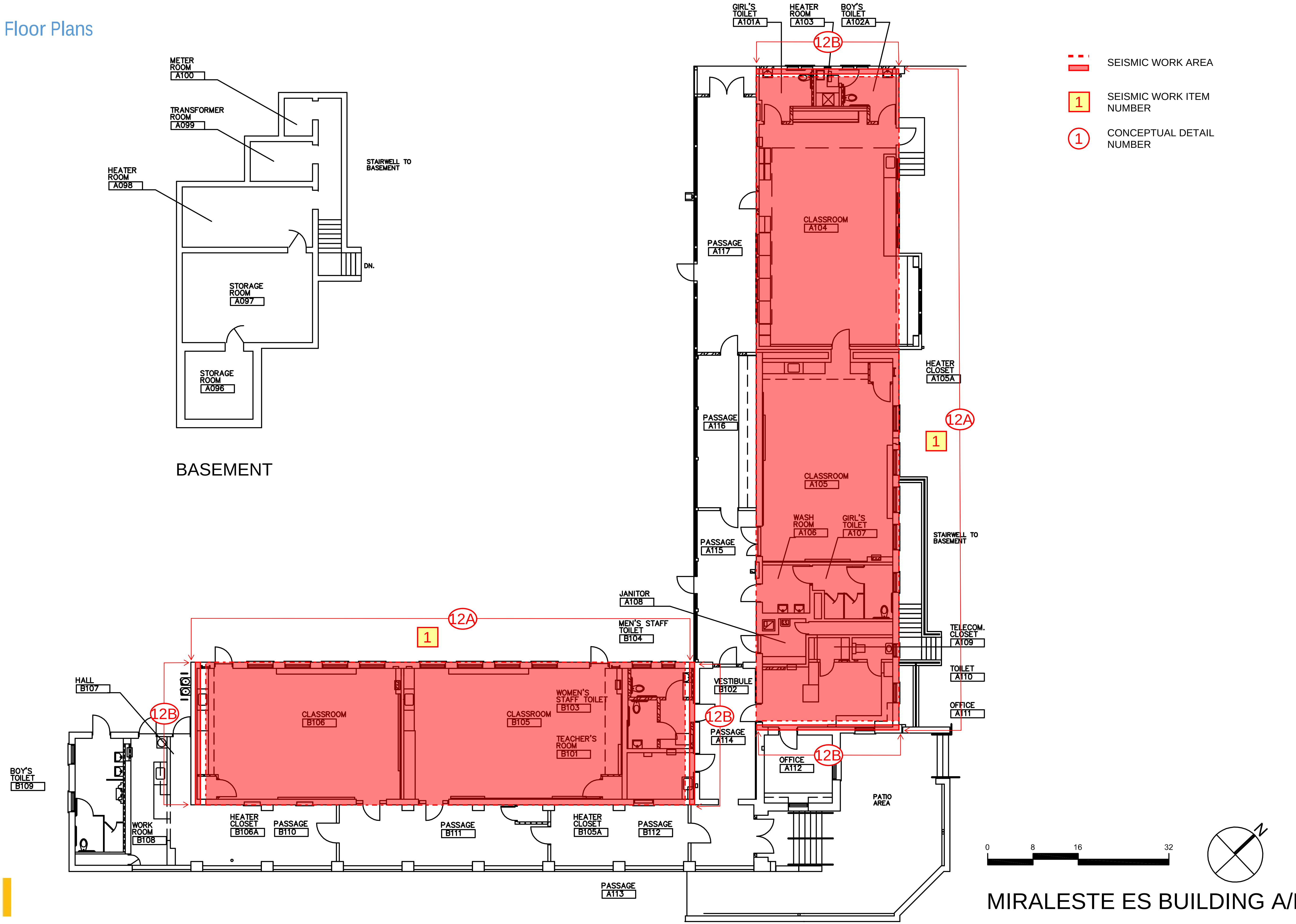
Fig 2. Roof tile at high and low roofs

Fig 3. Gable end of main roof

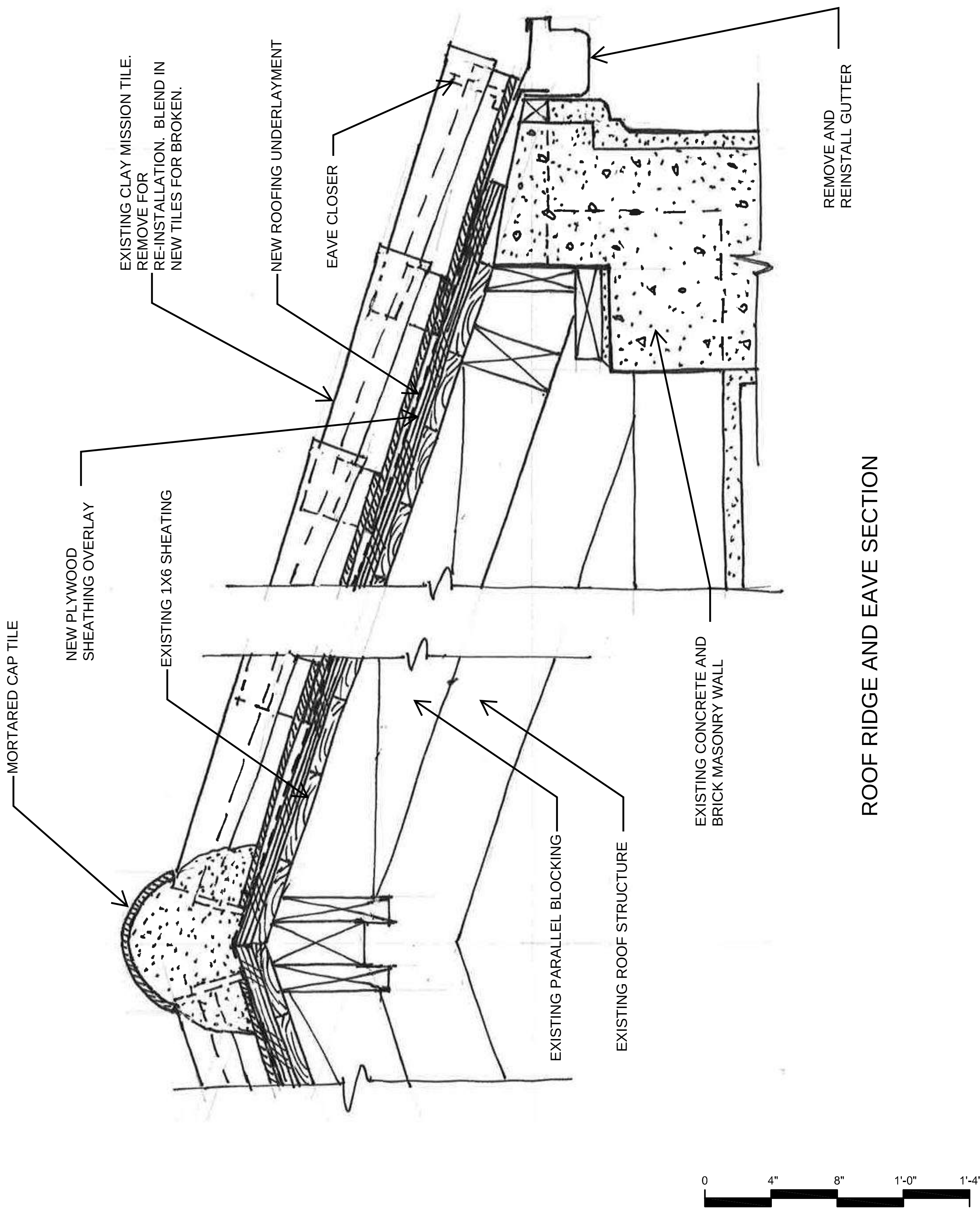
Fig 4. Typical classroom ceiling

Fig 5. Ceiling at enclosed colonnade area

Fig 6. Window wall at typical classroom

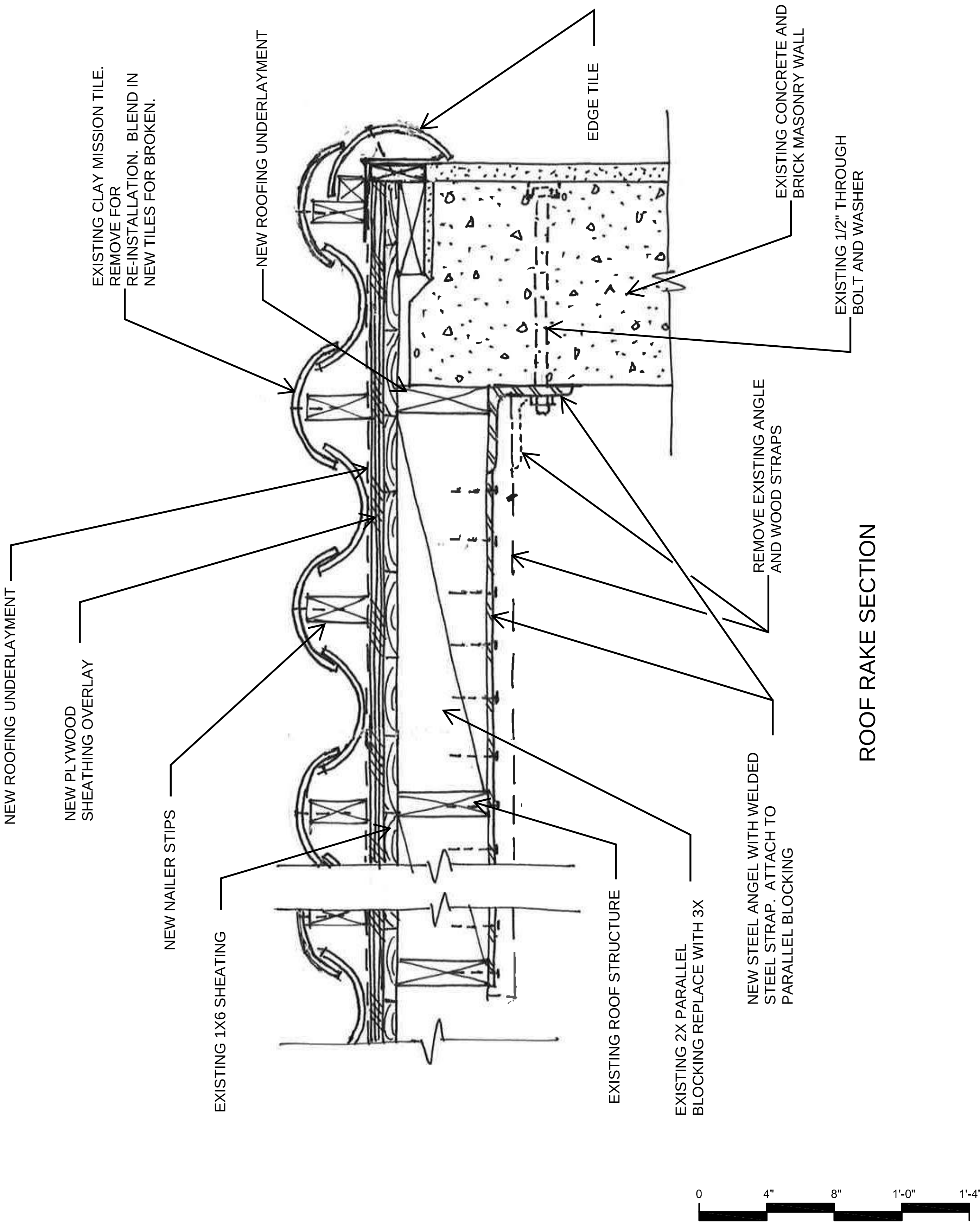

METER ROOM A100
TRANSFORMER ROOM A099
HEATER ROOM A098
STAIRWELL TO BASEMENT
DN.
STORAGE ROOM A097
STORAGE ROOM A096
BASEMENT
GIRL'S TOILET A101A
HEATER ROOM A103
BOY'S TOILET A102A
12B
SEISMIC WORK AREA
1
SEISMIC WORK ITEM NUMBER
1
CONCEPTUAL DETAIL NUMBER
CLASSROOM A104
PASSAGE A117
HEATER CLOSET A105A
12A
1
PASSAGE A116
CLASSROOM A105
WASH ROOM A106
GIRL'S TOILET A107
STAIRWELL TO BASEMENT
PASSAGE A115
JANITOR A108
12A
1
MEN'S STAFF TOILET B104
TELECOM. CLOSET A109
TOILET A110
OFFICE A111
HALL B107
VESTIBULE B102
12B
12B
WOMEN'S STAFF TOILET B103
CLASSROOM B106
CLASSROOM B105
TEACHER'S ROOM B101
PASSAGE A114
12B
OFFICE A112
PATIO AREA
BOY'S TOILET B109
WORK ROOM B108
HEATER CLOSET B106A
PASSAGE B110
PASSAGE B111
HEATER CLOSET B105A
PASSAGE B112
PASSAGE A113
0
8
16
32
N
MIRALESTE ES BUILDING A/B

PBWS



ROOF DIAPHRAGM ENHANCEMENT AT MES BUILDING A/B

12A



ROOF DIAPHRAGM ENHANCEMENT AT MES BUILDING A/B

12B

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ARCHITECTS

Miraleste Intermediate School

Building A Admin/Library

Building B Multipurpose/Food Service

Building C Classroom Wing

Building D Classroom Wing

Building E Classroom Wing

Building F Classroom/Shops

Building G Gymnasium

Building H Lockers

Shade Canopies

Seismic Structural Evaluation and Recommendations

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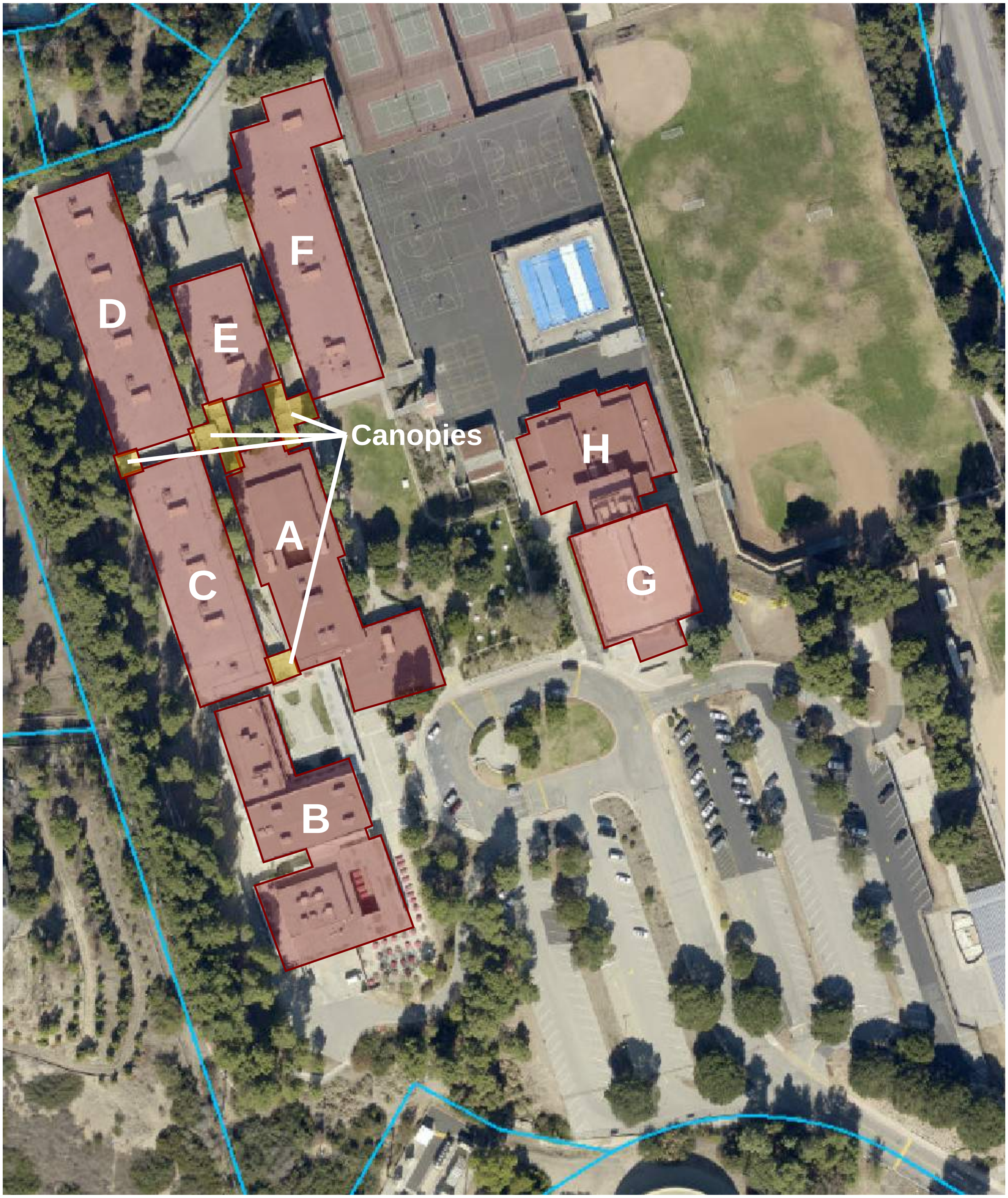
MIRALESTE INTERMEDIATE SCHOOL



STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
LIBRARY & ADMINISTRATION BUILDING (A)

MIRALESTE INTERMEDIATE SCHOOL
29323 Palos Verdes Dr. E,
Rancho Palos Verdes, CA 90275

REGISTERED PROFESSIONAL ENGINEER
TERRY C. TSANG
No.S2992
Exp. 06/30/2016
STRUCTURAL
STATE OF CALIFORNIA

Terry Tsang, S.E.
Structural Engineer S2992
TTG Job No.: 0215.768.00

FEBURAY 2016

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Table of Contents

1.0 Introduction- Library & Administration Building A

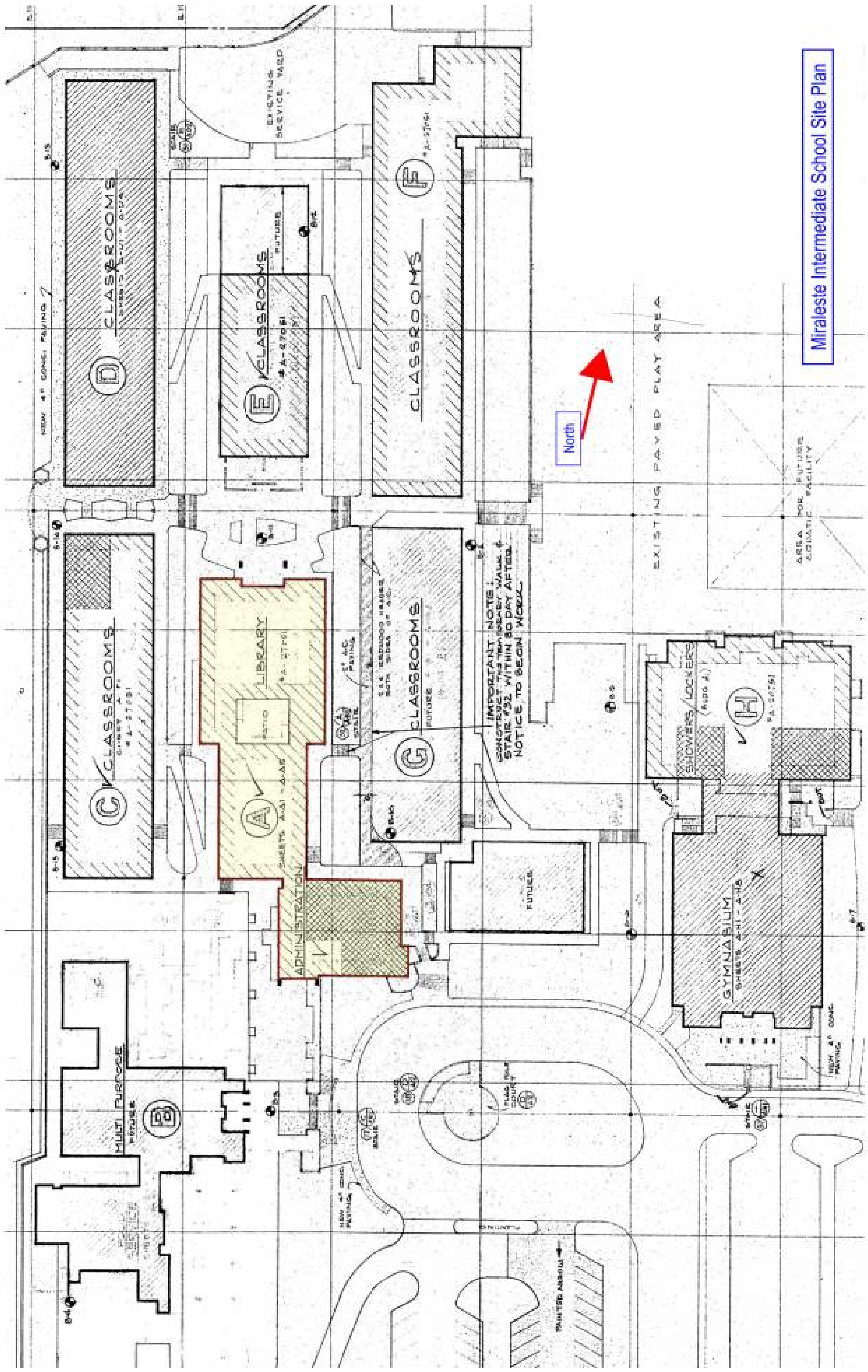
A multiphase seismic vulnerability assessment of ***Building A*** was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Photo 1 – View of North Entrance of the Library & Admin. Building

Photo 2 – View of South Entrance of the Library & Admin. Building

An overall campus map of Miraleste Intermediate School, indicating the buildings under evaluation, is provided below. The highlighted building is ***Building A.***



Site Map- Building A

2.0 Building A – Library & Administration Building

2.1 Site Seismicity

Based on 1967 construction drawings (Sheet ST-1 General Notes 6), foundation was based on the allowable soil bearing pressure of 1,800 psf with width and depth increase to 2,500 psf for vertical dead loads plus live loads. There is no geotechnical report available for review.

Per ASCE 41-13 (2012 IBC), for Miraleste Intermediate School located at 29323 Palos Verdes Drive East, Rancho Palos Verdes, CA 90275,

Site Coordinates = 33.75222°N, -118.32549°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.514g; $S_{1,20/50}$ = 0.197 g
Fa = 1.389 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.010 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.714g
$S_{X1} = F_v S_{1,20/20}$ = 0.396g

2.2 Building Description

The Library & Administration Building is a one-story building in the south-western part of the school campus. The existing drawings are dated February 8, 1967, which shows the proposed building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of one story of library portion, classroom portion and administrative offices portion. The library and classroom portion of the building is rectangular with approximate dimensions of 201’x60’/85’; the administrative office portion is rectangular with approximate dimensions of 66’x89’ located at the south-east corner forming an “L” shape with the other part of the building. Total footprint of the building, including the roof overhangs over covered walkways, is estimated to be ±26,000 square feet. Typical average roof height is about 14'-0"; the roof height of the library clear-story is about 19'-9". The roof of the building consists of plywood panel over wood joist. The wood joists on the library high roof (or the clear-story roof) are supported by tapered steel girders spanning about 52' at 15' spacing; the steel girders are supported by tube steel columns. The wood joists on the rest of the building roofs are supported by Glulam beams of various spans at a typical spacing of about 10'; the Glulam beams are supported by steel girders at the ridge line of the roof and by brick walls at the building perimeter. The lateral force resistance of the building is mainly provided by reinforced brick walls; the portion of the library high roof (or the clear-story roof) is laterally supported by steel frame elements and reinforced brick walls. The foundation of the building consists of continuous concrete wall footing and concrete spread footing under the columns.

Therefore, based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as "RM1".

The structural risk category for the building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Building A – Library and Administration Building Summary Table	
Year Designed	1967
Drawings	Original drawings, dated February 8, 1967, prepared by Donley Bundy & Associates Architects, with Wilson & Thompson Structural Engineers.
Gravity System	Wood joists on steel and Glulam beams/girders supported on columns/walls (Flexible Diaphragm)
Lateral System	Reinforced masonry/brick bearing walls
No. of Stories & Height	1 Stories; Main Roof: h_n=14 ft; Library High Roof: h_n=19.75 ft
Building Period "T"	0.19 Sec
Base Shear "V"	0.714 W = 589 kips Library and Administration Building RM1
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	Load Path – Inadequate Strut Connections in Library High Roof
Retrofit Recommendations	See Section 4.1 (Add Bolts and Connection Plates)

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of ***Building A*** is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening, if needed. As a Risk Category ***III***, the Basic Performance Objective for the building was ***Damage Control Structural Performance,*** per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; some were found to be "Compliant" and others were found to remain "Deficient."

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Load Path, the Library high roof is supported by steel frame element. The drag strut connections of the high roof appears to be weak; therefore the load path may be inadequate.

3.2 ASCE 41-13 Tier 2 Evaluation

The deficiency listed above was reviewed using a Tier 2 Evaluation procedure, which can be found in Appendix 1-B. Deficiency No. 1 (Load Path, weak strut connections) cannot be mitigated by analysis results per ASCE 41-13.

3.3 Tier 2 Evaluation and Proposed Retrofit Summary Table

Building	Identified Tier 1 Deficiencies	Tier 2 section number	Tier 2 Evaluation Result	Proposed Retrofit
Building A Target Structural Performance Level: ***S-2 Damage Control***	***16.1.2 LS Load Path***	**5.4.1.1**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in Section 4.1.***

4.0 Conclusions

The Load Path deficiency is due to the fact that the connections in the collector strut of the library high roof do not have sufficient capacity. The existing strut elements are connected using 2 bolts connections in 3x10 wood strut and the capacity of the connections is not sufficient at certain locations. The above identified deficiency may pose a serious collapse hazard if not mitigated.

Given the reasons above, a voluntary seismic retrofit is recommended for this structure to mitigate the deficiency of inadequate connections in the strut elements in the library high roof.

4.1 Proposed Retrofit Options

Summary of Retrofit options:

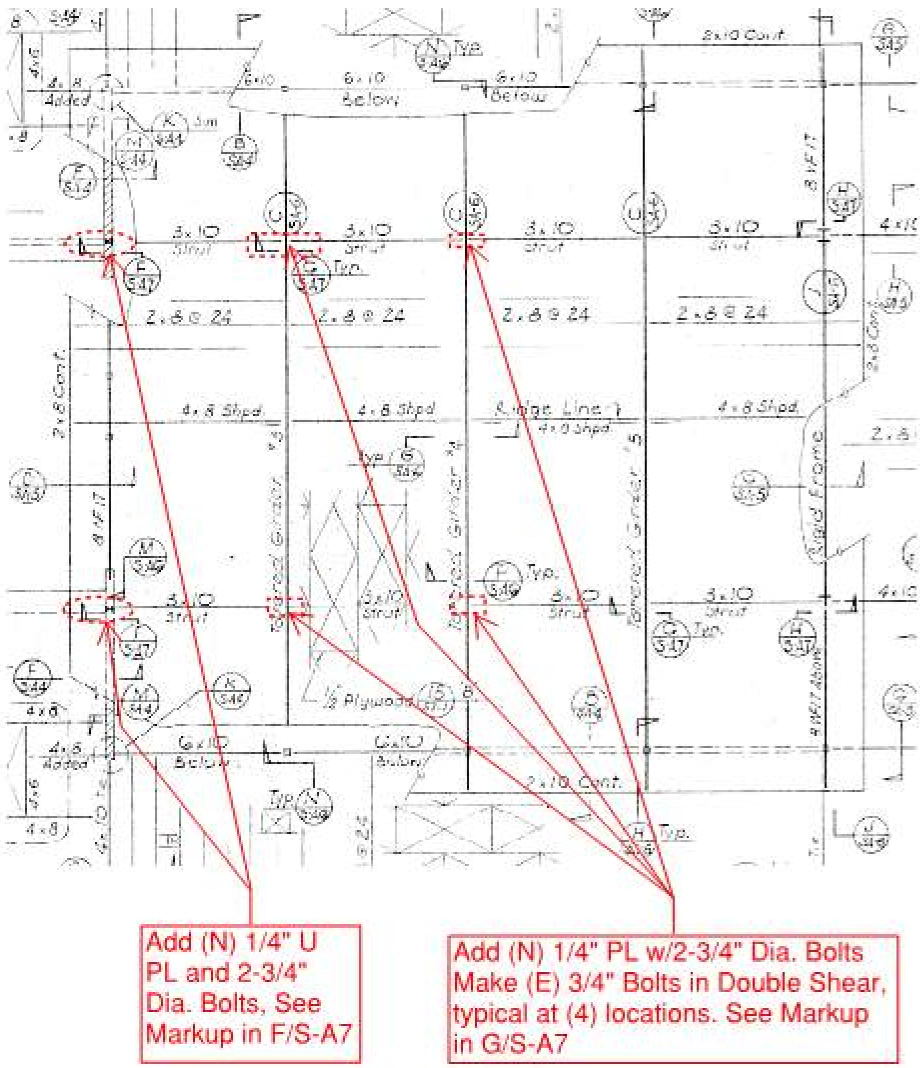
1. Provide new bolts and steel connection plates in the strut connections. The new added bolts will increase the capacity for strut connections. This will mitigate the deficiency of inadequate strut connections in the load path of the library high roof. Final size of the new connection plates, bolts and other details will be further developed in future structural upgrading work.

4.2 Structural Retrofit Selection Recommendations and Conclusions

Based on our analysis of ***Building A***, we recommend implementing the following retrofit options:

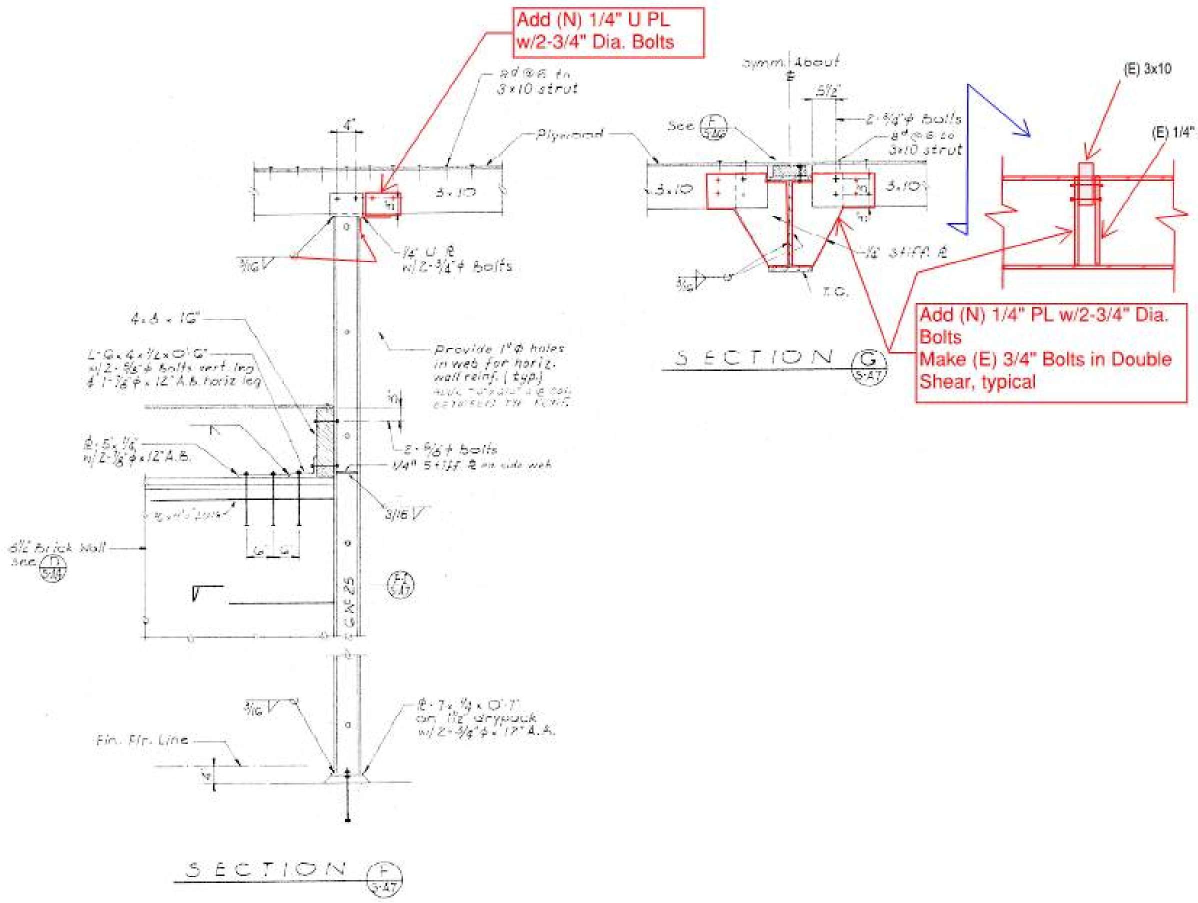
1. Add New Connection Bolts/Plates in the Strut Elements of the Library High Roof

   Adding new connection bolts and plates will eliminate the deficiency of inadequate connection in the strut elements of the library high roof load path. See retrofit sketches for the proposed connection strengthening details.



Sketch 1 – Library High Roof Plan, Proposed Strengthening of Strut Connections

(Based on Existing 1967 Drawing S-A2)



Sketch 2 – Proposed Strengthening of Strut Connections

(Based on Existing 1967 Drawing S-A7)

5.0 Documents Reviewed

The following existing architectural and or structural drawings were reviewed:

Date	Architect / Engineer	TTG Comments
February 8, 1967	Donley, Bundy & Associates (Architect) Wilson & Thompson (Structural Engineer)	Title Block states "Building A, Miraleste High School" Architectural and structural drawings (State of California – Department of General Services, Office of Architecture and Construction Project No. 27051)

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

PBWS ARCHITECTS

7.0 Architectural Section - Miraleste Intermediate School Building A, Library

Table of Contents

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part

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of the District's facilities. This resulted in the identification and verification of the District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Miraleste Intermediate School was originally constructed as a public high school with in the Palos Verdes Peninsula Unified School District. It was constructed in four phases in 1967, 1970, 1973 and 1977. It was originally called Miraleste High School and has been in constant use as a public school since that time. The original campus buildings were designed by the firm of Donley Bundy & Associates and is mostly of reinforced brick and concrete masonry, and wood construction. The building referred to as Building G is part of the 1967 phase.

Building A contains the library on the west end, administration offices on the east end and some classrooms in the middle. The administration portion is a half story down due to the slope of the site. It is a reinforced brick masonry wall structure with a wood roof system and steel at larger spaces.

All portions of the building are of Type-5 non-rated construction and appear fit within the current CBC Type-5B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the

proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Item 1

Enhance Drag Strut Connection at High Roof Over Library
This work is to enhance the connection of the existing 3x10 wood drag struts that run north and south in the high roof over the library. This will consist of providing additional connector plate or bracket length to the existing plates and brackets with additional bolts to hold the ends of the 3x10s. The connectors brackets occur at in the high walls at the south end of the high space and connector plates at the intersections at tapered steel girders (TSG) of the next two bays to the north. The enhancement at the TSG will include an additional plate on the opposite side of the 3x10s with additional bolting so that the bolt will act in double shear. Currently the connector plate is only on one side of the 3x10 member. This work should be able to be done from below by opening up the existing ceiling to access the roof structure from below. The additional plate material may be welded to the existing steel brackets and plates or may be attached to the existing plates by bolting to avoid welding adjacent to the wood members. See conceptual details #1.

Accessibility Upgrades

The retrofit work has no direct influence on accessibility, however if retrofit work is designed and submitted to DSA there will be some minimum level of access compliance work that will be required as a condition of the obtaining approval. Typically, there are requirements for an accessible path of travel to the subject building from parkinsg and accessible restrooms to serve the building. Even though modernization work has been done which on the campus they may be some work required to meet the requirements of the most current codes and regulations at the time of that the retrofit work is being designed. A separate survey for access compliance is recommended for the entire campus that would be of benefit for future project planning.

Fire & Life Safety

The work should have minimal effect on the fire rated assemblies that exist since all the work in the roof plane. Any assembly disturbed in the process will have to be returned to its original rating condition.

The new work will have no impact on the egress system as currently exists and there are no changes to the egress system in this scope. There is no reconfiguration of spaces or changes of use in the scope that would affect the existing fire/life safety code compliance status of the building with regards to building area, construction type or configuration.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

The retrofit work is all within the library high roof plane. There will be some removal of the ceiling finish to access the roof structure for the retrofit work but there should be no need to disturb the roof. This work is relatively unobtrusive and confined to a small area. It should cause minimal disturbance to the operation of the school.

8.0 Cost Estimate

PVPUSD Seismic Study
Narrative, Plans and Details by PBWS - Received 8/10/2016

RE: PVPUSD Seismic Study

Please find in the following report the cost estimate for the PVPUSD Seismic Study project. This estimate is prepared in accordance with the Narrative, Plans and Details by PBWS - Received 8/10/2016 with the following:

CLARIFICATIONS:

- Pricing is based on the entire project scope being awarded as one project to a single contractor
- Cost is based on prevailing wage labor rates
- This estimate represents an opinion of the fair construction cost for this project assuming multiple general contractors competitively bidding on the project with all sub-trades covered with 4 to 5 bids per trade. If a different delivery method is used a premium cost should be expected and will vary depending on the method used. This estimated cost should not be construed as a prediction of low bid

EXCLUSIONS:

- All soft costs
- Permits
- Owner's contingency
- Construction or occupancy phasing
- CM fee

Should you have any questions, please call me at 661-367- 5242.

Sincerely:

Walid Shihayed

Walid Shihayed

WM2S, Inc.
14908 Live Oak Springs Canyon Road, Santa Clarita, CA. 91387
P: (661) 367 5242, www.WM2S.com

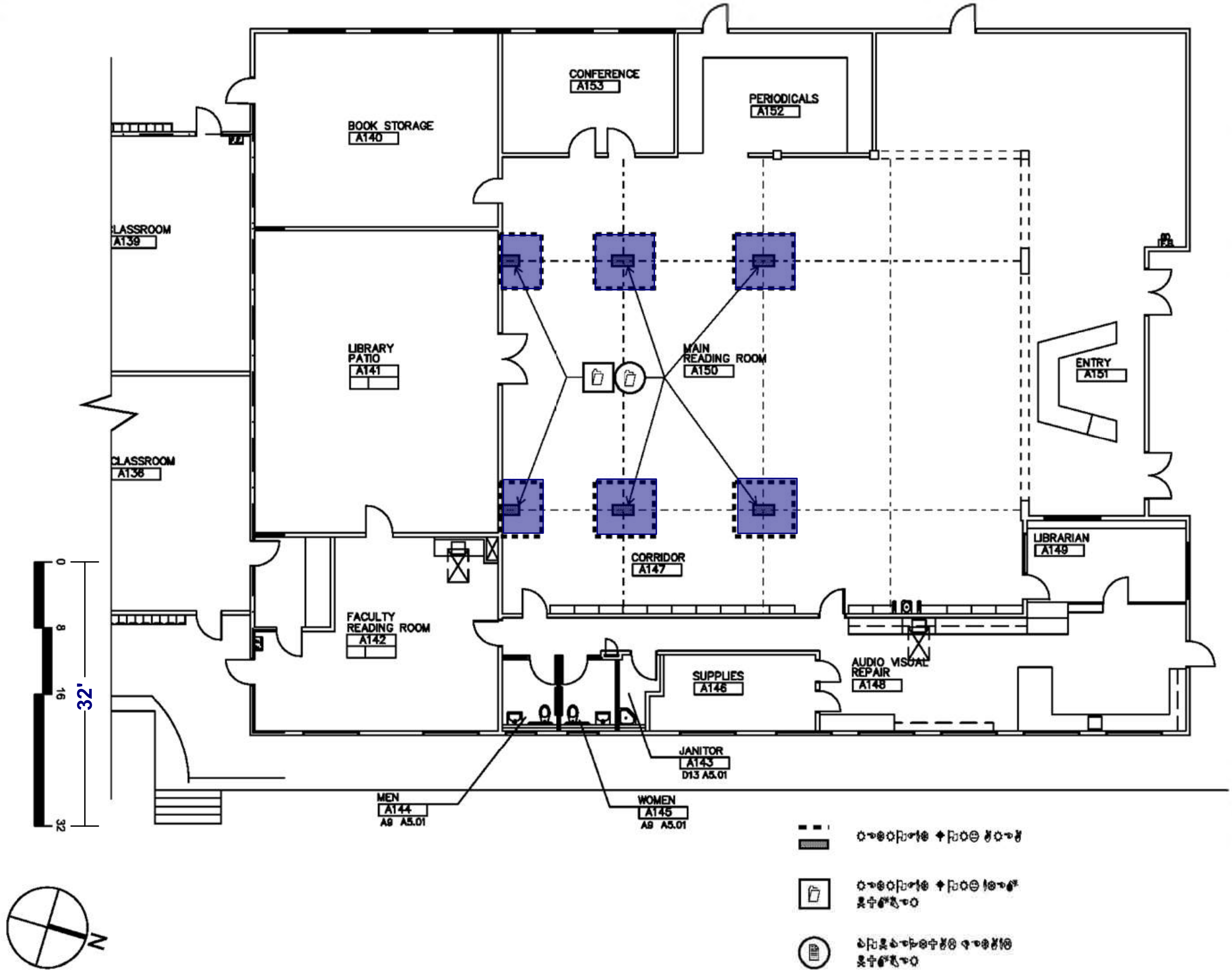
Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
MISA Miraleste Intermediate School Building A, Library			
0100 General Requirements			
01525.000 HOISTS & SCAFFOLDING			
Scaffolding Up to 50' High	250.00 SF	15.00 /SF	3,750
HOISTS & SCAFFOLDING			**3,750**
01530.000 BARRIERS & ENCLOSURES			
Protection Material	1.00 LS	15,000.00 /LS	15,000
BARRIERS & ENCLOSURES			**15,000**
0100 General Requirements			**18,750**
0205 Demolition			
02050.000 DEMOLITION			
Demo Ceiling - Interior Drywall	250.00 SF	4.00 /SF	1,000
DEMOLITION			**1,000**
0205 Demolition			**1,000**
0510 Steel			
05100.000 STRUCTURAL METAL FRAMING			
Additional Connector Plate, Welding & Fire Watch	6.00 EA	4,500.00 /EA	27,000
STRUCTURAL METAL FRAMING			**27,000**
0510 Steel			**27,000**
0925 Plaster And Drywall			
09250.000 GYPSUM BOARD			
Replace Ceiling & Suspension	250.00 SF	25.00 /SF	6,250
GYPSUM BOARD			**6,250**

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
0925 Plaster And Drywall			**6,250**
0990 Painting			
09900.000 PAINTING			
Painting - Interior Ceiling	750.00 SF	3.00 /SF	2,250
PAINTING			**2,250**
0990 Painting			**2,250**
MISA Miraleste Intermediate School Building A, Library			**55,250**

Partial Totals

Description	Amount	Totals	Rate	
Direct Cost	**55,250**	**55,250**		
General Conditions	5,525		10.00	%
Performance & Payment Bond	797			
Liability Insurance	553		1.00	%
Overhead & Fee	2,763		5.00	%
Construction Cost	**9,638**	**64,888**		
Design Contingency	12,977		20.00	%
Escalation	2,595		4.00	%
Construction Cost With C&E	**15,572**	**80,460**		
Construction Contingency	8,046		10.00	%
	8,046	**88,506**		
SOFT COSTS:				
Architect & Engineering Fees				
Architect Reimbursables				
Testing & Inspection				
Permits and Fees				
Furniture, Fixtures and Equip.				
Total Project Cost				

4 - Ceiling - Gyp Board - 254 SF



MIRALESTE IS - BUILDING A
LIBRARY PORTION

MIS_FP_Bldg-A.pdf (98% of Scale); Takeoff in Active Area: All Areas; PVPUSD; WM2S; 8/11/2016 03:17 PM

Appendix 1-A: Tier 1 Screening Checklists

ASCE 41-13 Checklists

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
	x			LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Library high roof is supported by steel frame elements in combination with reinforced brick walls. Calculations show strut connection capacity not sufficient; propose upgrade connections.
X				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.2)	Shade umbrella structure is nearby, but separated from the building and at different height as the roof of the building.
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanines.
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	It is one story building, so not applicable.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	It is one story building, so not applicable.
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation.	All vertical elements continuous to foundation.

C	NC	N/A	U	Checklist	Comments
				(§A.2.2.4. Tier 2: §5.4.2.3)	
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	It is one story building, so not applicable.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	It is one story building, so not applicable.
X				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Roof consists of flexible wood diaphragms with minimum of 2 lines of shear wall support. Torsion appears not exist.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
			x	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	No geotech report available.
			x	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	No geotech report available.
			x	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	No geotech report available.

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
X				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.714=0.43 Compliant per review of existing drawings.
X				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Foundation elements are tied together by slab on grade and continuous wall footings.

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY SHEAR WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	At least 2 lines of shear walls present.
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in2. (§A.3.2.4.1. Tier 2: §5.5.3.1.1)	Shear stress is less than 70 psi.
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. (§A.3.2.4.2. Tier 2: §5.5.3.1.3)	Reinforcing steel ratios meet requirements.
Stiff Diaphragms					
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (§A.4.5.1. Tier 2: §5.6.4)	No precast diaphragm elements.
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Wall anchorage is sufficient.
x				WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the	Connection does not induce cross-grain bending or tension.

C	NC	N/A	U	Checklist	Comments
				wood ledgers. (§A.5.1.2. Tier 2: §5.7.1.3)	
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	There is positive connection for shear transfer between diaphragm and shear wall in all locations
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (§A.5.2.3. Tier 2: §5.7.2)	No precast diaphragm elements.
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	Wall reinforcement is dowelled into foundation.
x				GIRDER-COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (§A.5.4.1. Tier 2: §5.7.4.1)	Positive connection present at girder-column connections.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Diaphragms					
Stiff Diaphragms					
		x		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	No stiff diaphragms.
		x		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	No stiff diaphragms.
Flexible Diaphragms					
x				CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Continuous cross ties present.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	Diaphragm openings adjacent to shear walls are less than 25% of the wall length.

C	NC	N/A	U	Checklist	Comments
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	Diaphragm openings adjacent to exterior masonry shear walls are not greater than 8 feet.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	No straight sheathed diaphragms.
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	No straight sheathed or diagonal sheathing used in diaphragms.
x				DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	All diaphragms are blocked.
x				OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	Only wood panel diaphragms used.
				Connections	
x				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (§A.5.1.4. Tier 2: §5.7.1.2)	Stiff steel anchors used.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
				Life Safety Systems	
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Hazardous Materials	
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4.	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				Tier 2: §13.7.3 and 13.7.5)	
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
				Partitions	
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				joints. (§A.7.1.3. Tier 2. §13.6.2)	
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
			X	LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Not accessible during site visit
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2, and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
				Light Fixtures	
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Observed Compliant
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Cladding and Glazing	
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
				Masonry Veneer	
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2:	No masonry veneer, so not applicable.

C	NC	N/A	U	Checklist	Comments
				§13.6.1.2)	
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	No URM backup, so not applicable.
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
Parapets, Cornices, Ornamentation, and Appendages					
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
			X	LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Not accessible
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No Parapet; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	
Masonry Chimneys					
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
Stairs					
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
Contents and Furnishings					
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the	No industrial racks observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
X				LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	Observed compliant
X				LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Observed compliant
		X		LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent	None observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
Piping					
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
Ducts					
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
Elevators					
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2:	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				§13.8.6)	
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

TTG

Miraleste Intermediate School
Library & Admin. Building (A)

Job #: 0215.768
Date: Feb-16

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW	Bldg Type= **RM1**
$C =$	1	From Table 4-8 for 1972 Multipurpose Building
$C =$	1	From Table 4-8 for 1977 Multipurpose Addition
$S_a = \min(S_{XS}, S_{X1}/T)$		From Section 4.5.2.3
$S_{X1} = F_vS_1$		Eq. 2-2
$S_{XS} = F_aS_S$		Eq. 2-1
$S_S =$	0.514	g, mapped spectral acceleration
$S_1 =$	0.197	g, mapped spectral acceleration
$S_{X1} =$	0.396	g
$S_{XS} =$	0.714	g
$T = C_th_n^{\beta}$		From Section 4.5.2.4
$C_t =$	0.02	
$h_n =$	18	ft., average height at sloped roof
$\beta =$	0.75	
$T =$	0.175	sec.
$S_a =$	0.714	g
$V_{MP\ 1972} =$	0.714	W
$V_{MP\ 1977\ Addtn} =$	0.714	W

USGS Design Maps Summary Report

User–Specified Input

Report Title California Minimum Ss
Mon January 4, 2016 22:43:46 UTC

Building Code Reference Document ASCE 41-13 Retrofit Standard, BSE-1E
(which utilizes USGS hazard data available in 2008)

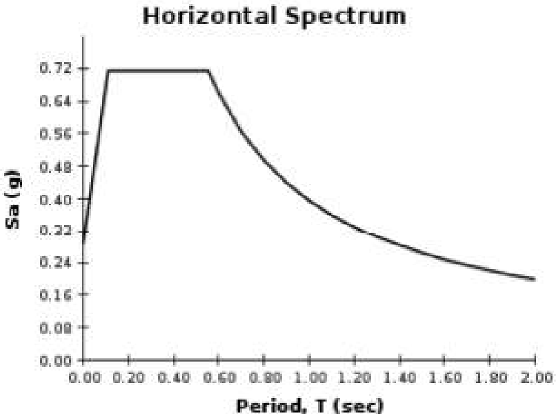
Site Coordinates 33.75222°N, 118.32549°W

Site Soil Classification Site Class D – "Stiff Soil"

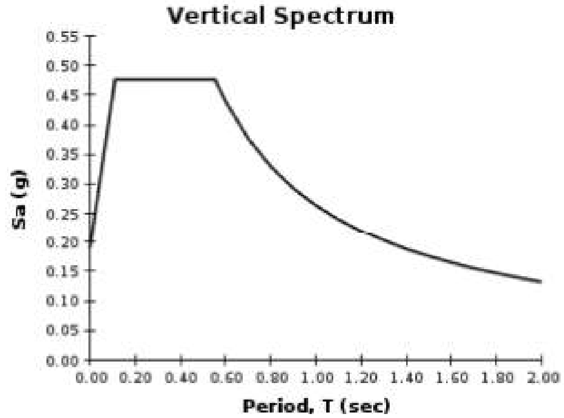
USGS–Provided Output

$S_{S,20/50}$	0.514 g	$S_{XS,BSE-1E}$	0.714 g
$S_{1,20/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g

Horizontal Spectrum



Vertical Spectrum



TTG

Miraleste Intermediate School Job #: 0215.768
Library & Admin. Building (A) Date: Feb-16

Seismic Mass Weight - 1972 Construction

Roof

(Roof area with 1/2" Plywood sheathing)

Roofing	6	psf
1/2" Plywood	1.5	psf
Wd joist 2x typ.	1.5	psf
Rf girders (Glulam/steel)	4	psf
MEP	3	psf
Ceiling	3	psf
Misc	1	psf
DL =	**20**	**psf**
Use	**20**	**psf**

Wall Weight

8.5" brick wall =	85	psf
Wood stud wall =	15	psf

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation 1967 Library & Admin. Building (A)

Location		Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip	Sub-Total ft2	kip
Library Roof	Clear Story	62.0	63.0	3906	20	78	3906	90
	Partion Wall, out of plan	88.0	9.0	792	15	12		
	Low Roof	116.0	92.0	10672	20	213	7384	286
		-60.0	55.0	-3300	20	-66		
		16.0	48.0	768	20	15		
		-28.0	27.0	-756	20	-15		
	8.5" Masonry Walls, out plane	276.0	6.1	1691	82	139		
Classroom Portion	Roof	96.0	80.0	7680	20	154	7680	245
	8.5" Masonry Walls, out plane	176.0	6.1	1078	85	92		
Admin Portion	Roof	80.0	98.0	7840	20	157	7070	204
		-22.0	35.0	-770	20	-15		
	8.5" Masonry Walls, out plane	120.0	6.125	735	85	62		
	Grand Total =			**26040**		**825**		

Base shear V = 0.714 W
Base shear V_{M72}= **589** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x	h_x	$w_x h_x$	Fx	Area	fi
	kip	ft	k-ft	kip	ft2	psf
Roof	825	19	15683	589	26040.0	22.6
Sum =	825		15683	589		

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1
Footnote b for reinforced concrete walls

Wall Forces - Supporting Roof

	Wall Description	Length ft	Width in	Aw in2	Force Vj kips	v avg psi
N-S Direction	Lib	108.0	8.5	11016	589	5.1
Brick 8.5"	Patio	48.3	8.5	4922		
	Classroom	146.0	8.5	14892		
	Admin	77.0	8.5	7854		
E-W Directioin	Lib.	157	8.5	16014	589	6.8
Brick 8.5"	Classroom	95.0	8.5	9690		
	Admin.	32.0	8.5	3264		

Per ASCE 41-13 check list 16.15LS, if shear stress less than 70 psi in wall, OK
Average wall shear is less than 70 psi, O.K.

Reinforced Masonry Wall, Reinforcing Steel Ratio

8.5" Brick wall with #5 @ 24" Verti & Horizontal at center of wall

Hori ρ=	0.0015	Total V&H reinft not be less than 0.0002; min. not less than 0.0007
Verti ρ=	0.0015	Meeting requirements on reinforcing steel

Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

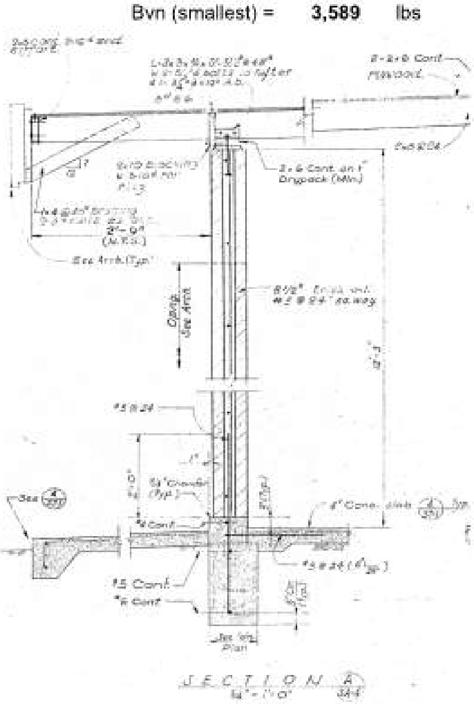
Tc= $1.2S_{XS}\,w_p\,A_p$ =	72.8	psf	Eqn 4-13
S_{XS} =	0.714		
w_p =	85	psf	8.5" brick wall,
Ap =	1	ft2	

Evaluate connection for out-of-plane action per Tier 2 procedure
Per Section C7.5.1.2, connections should be evaluated as force-controled procedure.

C_1C_2 =	1.4	From Table 7-3	
J=	1	Per Section 7.5.2.1.2	
Q_{UF}= Q_G+/-$Q_E/(C_1C_2J)$	Eqn 7-35		
Q_G =	0.0	lbs	
Q_E=	437.0	lbs	End shear for 1'x6' wall (WxH)
Q_{UF}=	312.1	lbs	End shear divided by CJ factor
Wall anchors @ Spacing =	4.00	ft	Typical anchor spacing
Out of plane force T_{UF}=	1,248	lbs	Each anchor location

Typ. anchor capacity per A/SA-4

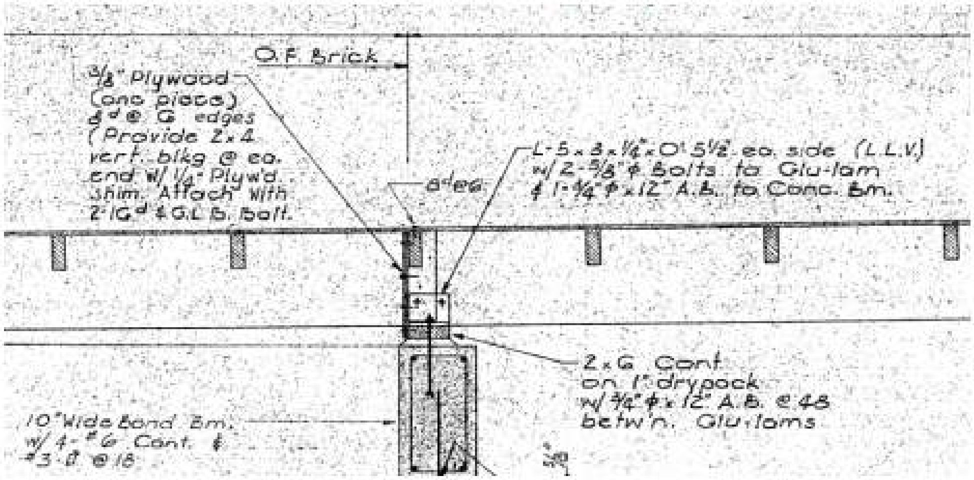
$B_{vn}=4A_{pv}\sqrt{f'm}$ =	3589	lbs	(ACI 530-05, Equation 3-8)
f'm=	1000	psi	
$A_{pv} = \pi\ l^2_{be}\ /2$ =	28.37	in^2	3/4" bolt x 12" long w/ 4.25" min. embed
$B_{vn}=0.6A_bf_y$=	**11,880**	lbs	(ACI 530-05, Equation 3-9)
(2) 5/8" bolt in 2x =2*760*3=	4380	lbs	
Bvn (smallest) =	**3,589**	lbs	>= T_{UF}, Okay



So, wall anchorage per the detail is sufficient.

Typical anchor capacity per A/ST-2

Wall anchors @ Spacing =	10.00	ft	Typical anchor spacing
Out of plane force T_{UF}=	3,121	lbs	Each anchor location
3/4" bolt in concrete =	19.8	kips	
2) 5/8" bolt in 51/8" Glulam =2*2410*3=	14460	lbs	
Ncn (smallest)=	**14,460**	lbs	>= T_{UF}, Okay



BOLTS

Table 11I BOLTS: Reference Lateral Design Values (Z) for Double Shear (three member) Connections[1,2]

for structural glued laminated timber with 1/4" ASTM A 36 steel side plate

Thickness: Main Member t_m in.	Side Member t_s in.	Bolt Diameter D in.	G=0.55 Southern Pine $Z_{\parallel}$ lbs.	G=0.55 Southern Pine $Z_{\perp}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\parallel}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\perp}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\parallel}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\perp}$ lbs.	G=0.43 Hem-Fir $Z_{\parallel}$ lbs.	G=0.43 Hem-Fir $Z_{\perp}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\parallel}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\perp}$ lbs.	G=0.36 Spruce-Pine-Fir(S) Western Woods $Z_{\parallel}$ lbs.	G=0.36 Spruce-Pine-Fir(S) Western Woods $Z_{\perp}$ lbs.
2-1/2	1/4	1/2	-	-	1650	790	1590	700	1500	640	1470	610	1270	490
		5/8	-	-	2190	880	2010	780	1880	700	1840	690	1580	550
		3/4	-	-	2630	980	2410	860	2250	770	2200	750	1900	600
		7/8	-	-	3060	1050	2620	920	2630	830	2570	810	2210	660
		1	-	-	3500	1130	3220	1000	3000	900	2940	880	2530	700
3	1/4	1/2	1720	1100	-	-	-	-	-	-	-	-	-	-
		5/8	2510	1220	-	-	-	-	-	-	-	-	-	-
		3/4	3460	1330	-	-	-	-	-	-	-	-	-	-
		7/8	4040	1440	-	-	-	-	-	-	-	-	-	-
		1	4610	1530	-	-	-	-	-	-	-	-	-	-
3-1/8	1/4	1/2	-	-	1650	980	1590	880	1540	800	1530	770	1430	610
		5/8	-	-	2410	1090	2330	980	2260	880	2230	860	1980	680
		3/4	-	-	3280	1220	3020	1080	2810	960	2750	940	2370	750
		7/8	-	-	3830	1310	3520	1150	3280	1040	3210	1010	2770	820
		1	-	-	4380	1410	4020	1250	3750	1130	3670	1090	3160	880
5	1/4	5/8	2510	1510	-	-	-	-	-	-	-	-	-	-
		3/4	3480	2000	-	-	-	-	-	-	-	-	-	-
		7/8	4630	2410	-	-	-	-	-	-	-	-	-	-
		1	5960	2550	-	-	-	-	-	-	-	-	-	-
5-1/8	1/4	5/8	-	-	2410	1420	2330	1340	2260	1280	2230	1270	2090	1120
		3/4	-	-	3340	1890	3220	1770	3120	1580	3090	1540	2890	1230
		7/8	-	-	4440	2150	4280	1880	4150	1700	4110	1660	3840	1350
		1	-	-	5720	2310	5510	2050	5330	1850	5280	1790	4930	1440
		5/8	2510	1510	2410	1420	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Library Clear-Story Roof Diaphragm Force Transfer

High Rf Drag Line	Trib L	Trib W	Area	wi	W	Fi=0.714W
	ft	ft	ft2	psf	lbs	lbs
High Rf Trib. Area	61	30	1830	20.0	36600	26132
Clear-Sty Window	91	2	182	8	1456	1040
				Sub-total =	38056	27172

High Rf force transferred to brick wall per detail F/SA-7

F1 = **27172** lbs

Mending moment at W6x25 column M_1 = 135.9 kip-ft

Bending capacity of column $M_{ne} = ZF_y$= 64.1 kip-ft   Z = 18.9 in^3

Fy = 40.7 ksi

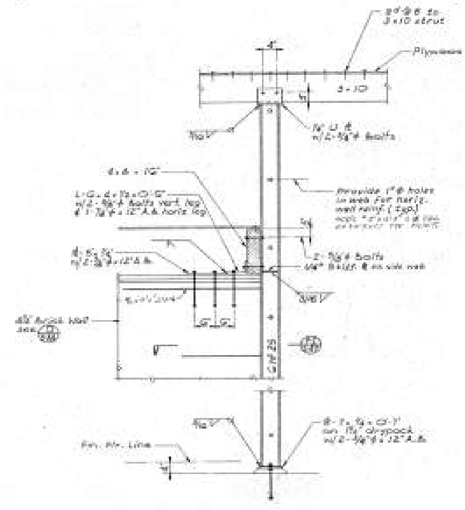
m-factor per Table 9-4 (Damage Control)= 4.0 P/P_{cl} <=0.2

$b_f/2t_f$ = 6.7 < 52/Fy^0.5= 24.8

h/t_w = 19.9 <300/Fy^0.5= 143.0

Capacity m^*M_{ne} = 256.4 > M_1, OK

So, capacity of 6WF25 column is sufficient for transfer diaphragm force to brick wall



SECTION F/SA-7

(2) 3/4" bolt in 3x10 strut =2*2630*3= **15780** lbs, control **< F1, Not Good**

1#6 welded to column = 22000 lbs

(2) 5/8" bolts to column flanges = 25420 lbs   in addition to 1#6 welded

(3) 7/8" bolts in brick wall = 10766 lbs

Total capacity at wall to column = 32766 lbs **> F1, OK.**

So, column is capable to support roof laterally; but the connection at roof is not sufficient.

Table 11G BOLTS: Reference Lateral Design Values (Z) for Double Shear (three member) Connections[1,2]

for sawn lumber or SCL with 1/4" ASTM A 36 steel side plate

Thickness Main Member t_m in.	Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.50 Douglas Fir-Larch $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.49 Douglas Fir-Larch (N) $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.43 Hem-Fir $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.37 Redwood (open grain) $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.35 Northern Species $Z_\parallel$ lbs.	$Z_\perp$ lbs.
1-1/2	1/4	1/2	1410	730	1150	550	1050	470	1030	460	970	420	900	380	880	370	780	310	760	290	730	290
		5/8	1760	810	1440	610	1310	530	1290	520	1210	470	1130	420	1100	410	970	350	950	330	910	320
		3/4	2110	890	1730	660	1580	590	1550	560	1450	520	1350	460	1320	450	1170	370	1140	360	1100	350
		7/8	2460	960	2020	720	1840	630	1800	600	1690	550	1580	500	1540	480	1360	410	1330	390	1280	370
		1	2810	1020	2310	770	2100	680	2060	650	1930	600	1800	540	1760	530	1560	440	1520	420	1460	410
1-3/4	1/4	1/2	1640	890	1350	640	1230	550	1200	530	1130	490	1050	450	1030	430	910	360	890	340	850	330
		5/8	2050	940	1680	710	1530	610	1500	600	1410	550	1310	490	1290	480	1130	400	1110	380	1070	370
		3/4	2460	1040	2020	770	1840	680	1800	660	1690	600	1580	540	1540	530	1360	430	1330	420	1280	410
		7/8	2870	1120	2350	840	2140	740	2110	700	1970	640	1840	580	1800	570	1590	470	1550	460	1490	430
		1	3280	1190	2690	890	2450	790	2410	750	2250	700	2100	630	2060	610	1820	510	1770	490	1710	470
2-1/2	1/4	1/2	1870	1210	1720	910	1650	790	1640	700	1590	700	1500	640	1470	610	1300	510	1270	490	1220	460
		5/8	2740	1340	2400	1020	2190	880	2150	860	2010	780	1880	700	1840	690	1620	580	1580	550	1520	530
		3/4	3520	1480	2880	1110	2630	980	2580	940	2410	860	2250	770	2200	750	1950	620	1900	600	1830	580
		7/8	4100	1600	3360	1200	3060	1050	3010	1010	2820	920	2630	830	2570	810	2270	660	2210	640	2130	610
		1	4690	1700	3840	1280	3500	1130	3440	1080	3220	1000	3000	900	2940	880	2590	730	2530	700	2440	680

Use ASD to LRFD factor = 3

Table 11.3.1B Reduction Term, R_d

Fastener Size	Yield Mode	Reduction Term, R_d
$0.25" \le D \le 1"$	I_m, I_s	$4\ K_\theta$
	II	$3.6\ K_\theta$
	III_m, III_s, IV	$3.2\ K_\theta$
$D < 0.25"$	I_m, I_s, II, III_m, III_s, IV	K_D[1]

Notes:
K_θ = $1 + 0.25(\theta/90)$
θ = maximum angle of load to grain ($0° \le \theta \le 90°$) for any member in a connection
D = diameter, in. (see 11.3.6)
K_D = 2.2 for $D \le 0.17"$
K_D = $10D + 0.5$ for $0.17" < D < 0.25"$

1. For threaded fasteners where nominal diameter (see Appendix L) is greater than or equal to 0.25" and root diameter is less than 0.25", $R_d = K_D K_\theta$

11.3.2 Dowel Bearing Strength

11.3.2.1 Dowel bearing strengths, F_e, for parallel or perpendicular to grain loading are provided for dowel-type fasteners with $1/4" \le D \le 1"$ in Table 11.3.2. When fastener diameter, $D < 1/4"$, a single dowel bearing strength, F_e, is used for both parallel and perpendicular to grain loading.

11.3.2.2 Dowel bearing strengths, F_e, for wood structural panels are provided in Table 11.3.2B.

11.3.2.3 Dowel bearing strengths, F_e, for structural composite lumber shall be obtained from the manufacturer's literature or code evaluation report.

11.3.2.4 When dowel-type fasteners with $D \ge 1/4"$ are inserted into the end grain of the main member, with the fastener axis parallel to the wood fibers, $F_{e\perp}$ shall be used in determination of the dowel bearing strength of the main member, F_{em}.

11.3.3 Dowel Bearing Strength at an Angle to Grain

When a member in a connection is loaded at an angle to grain, the dowel bearing strength, $F_{e\theta}$, for the member shall be determined as follows (see Appendix J):

$$F_{e\theta} = \frac{F_{e\parallel} F_{e\perp}}{F_{e\parallel} \sin^2\theta + F_{e\perp} \cos^2\theta} \quad (11.3\text{-}11)$$

where:

θ = angle between direction of load and direction of grain (longitudinal axis of member).

Figure 11B Single Shear Bolted Connections

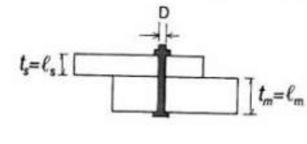
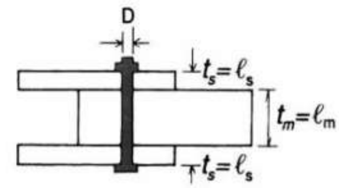


Figure 11C Double Shear Bolted Connections



11.3.4 Dowel Bearing Length

11.3.4.1 Dowel bearing length in the side member(s) and main member, ℓ_s and ℓ_m, represent the length of dowel bearing perpendicular to the application of load. The length of dowel bearing shall not include the tapered tip of a fastener for fastener penetration lengths less than 10D.

11.3.5 Dowel Bending Yield Strength

11.3.5.1 Reference design values for bolts, lag screws, wood screws, nails, and spikes are based on bending yield strengths provided in Tables 11A through 11R.

11.3.5.2 Dowel bending yield strengths, F_{yb}, used in calculation of reference design values shall be based on yield strength derived using methods provided in ASTM F 1575 or the tensile yield strength derived using procedures of ASTM F 606.

11.3.6 Dowel Diameter

11.3.6.1 When used in Tables 11.3-1A and 11.3-1B, the fastener diameter shall be taken as D for unthreaded full-body diameter fasteners and D_r for reduced body diameter fasteners or threaded fasteners except as provided in 11.3.6.2. For bolts meeting the requirements of ANSI/ASME Standard B18.2.1 for full-body diameter bolts, the fastener diameter shall be taken as D (see Appendix L).

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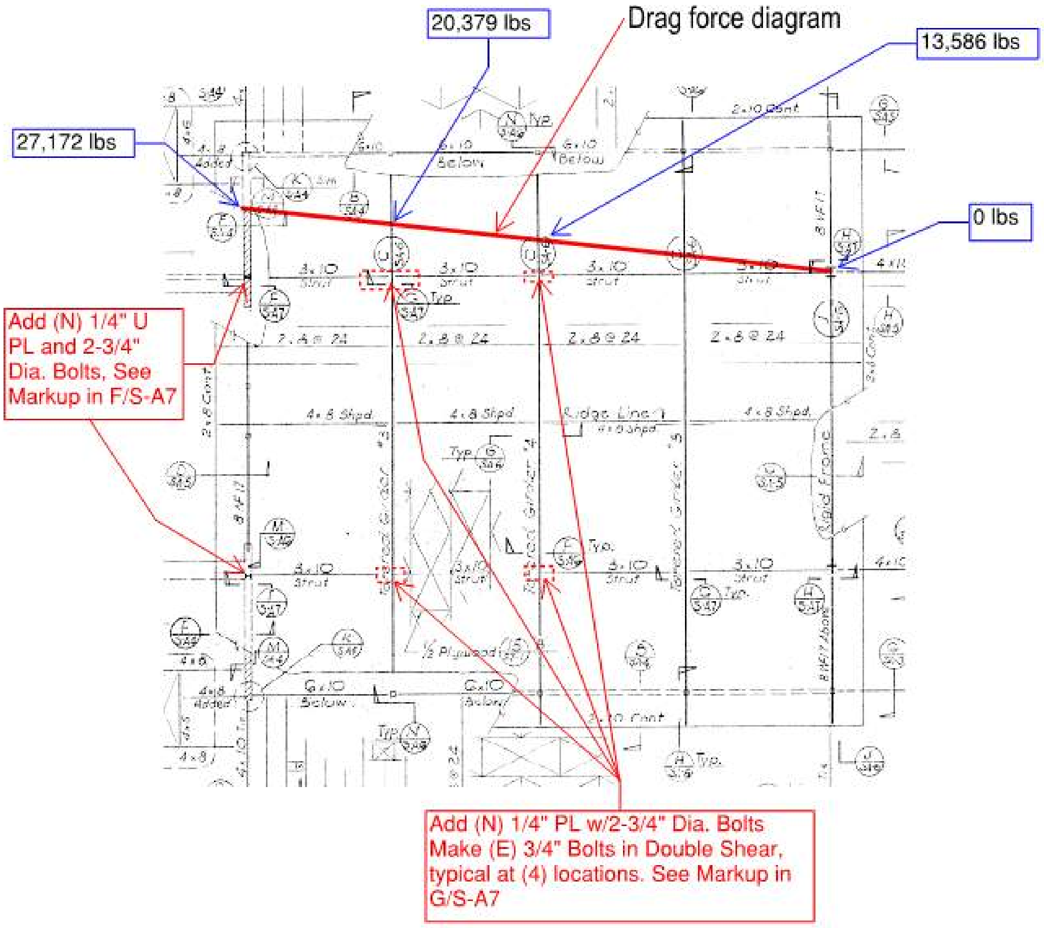
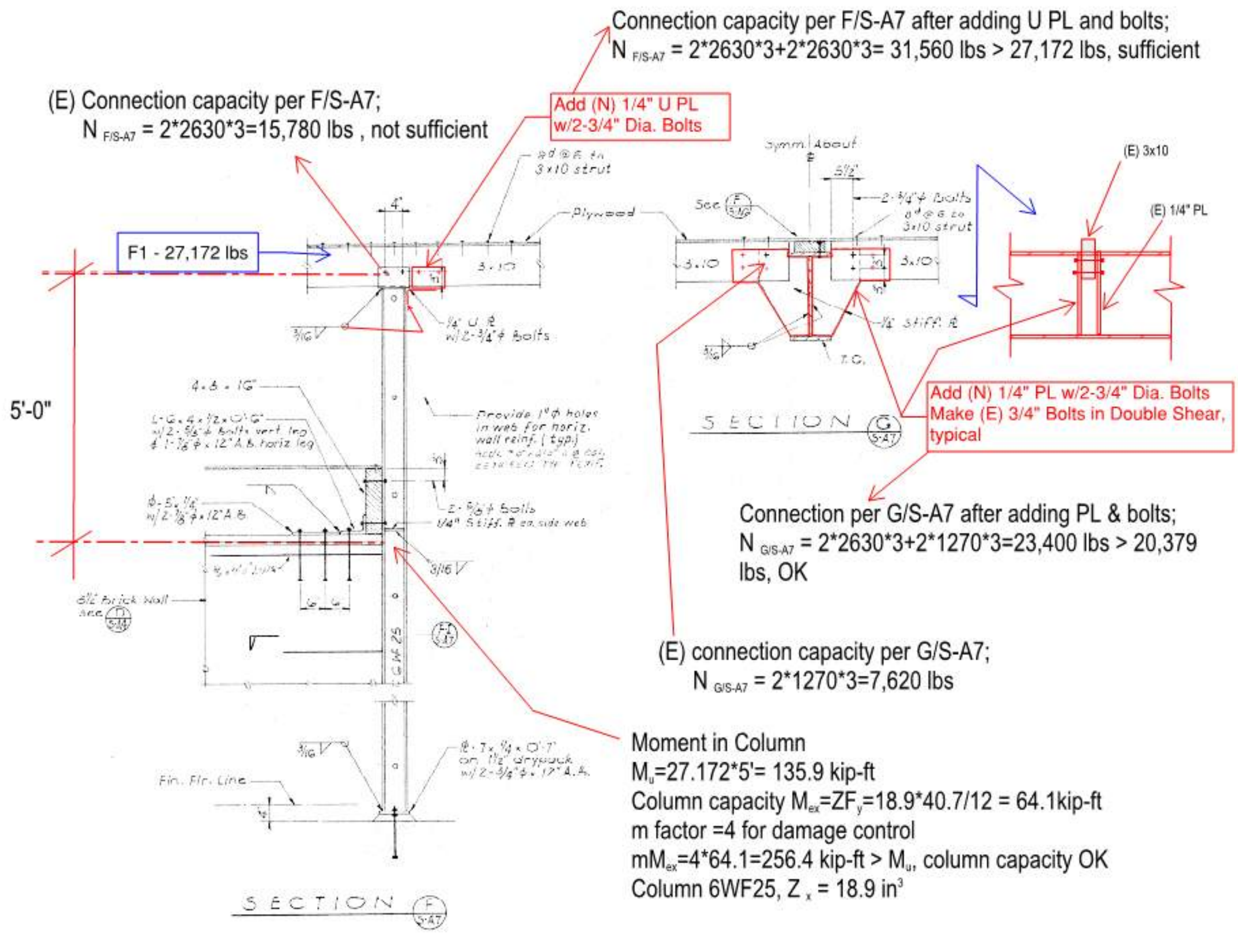
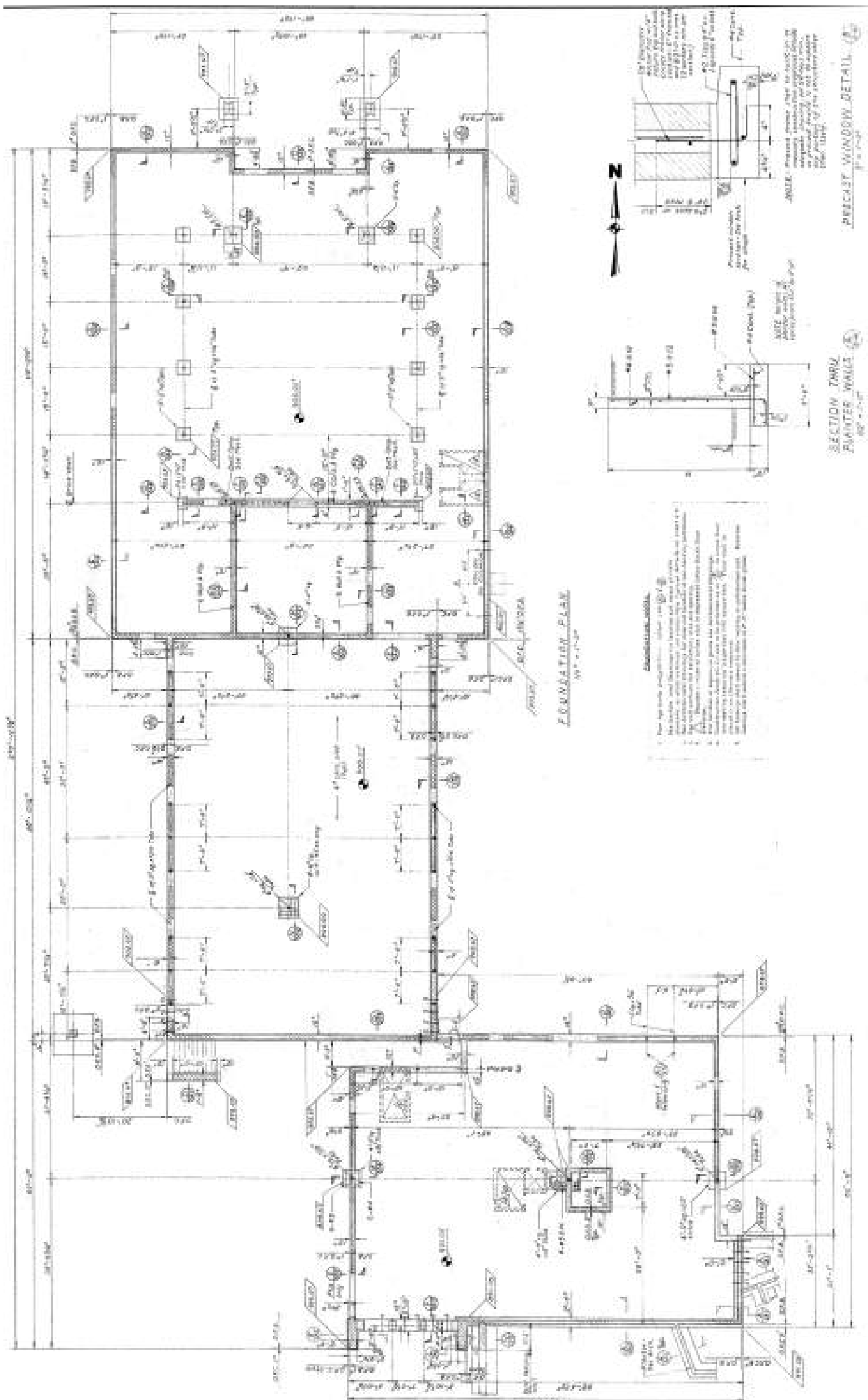
High Roof Diaphragm Force at each drag line F1 = 0.714*(61'*30'*20psf + (61+30)*2*8psf)=27,172 lbs
Force F1 is resisted by columns 6WF25 at drag line

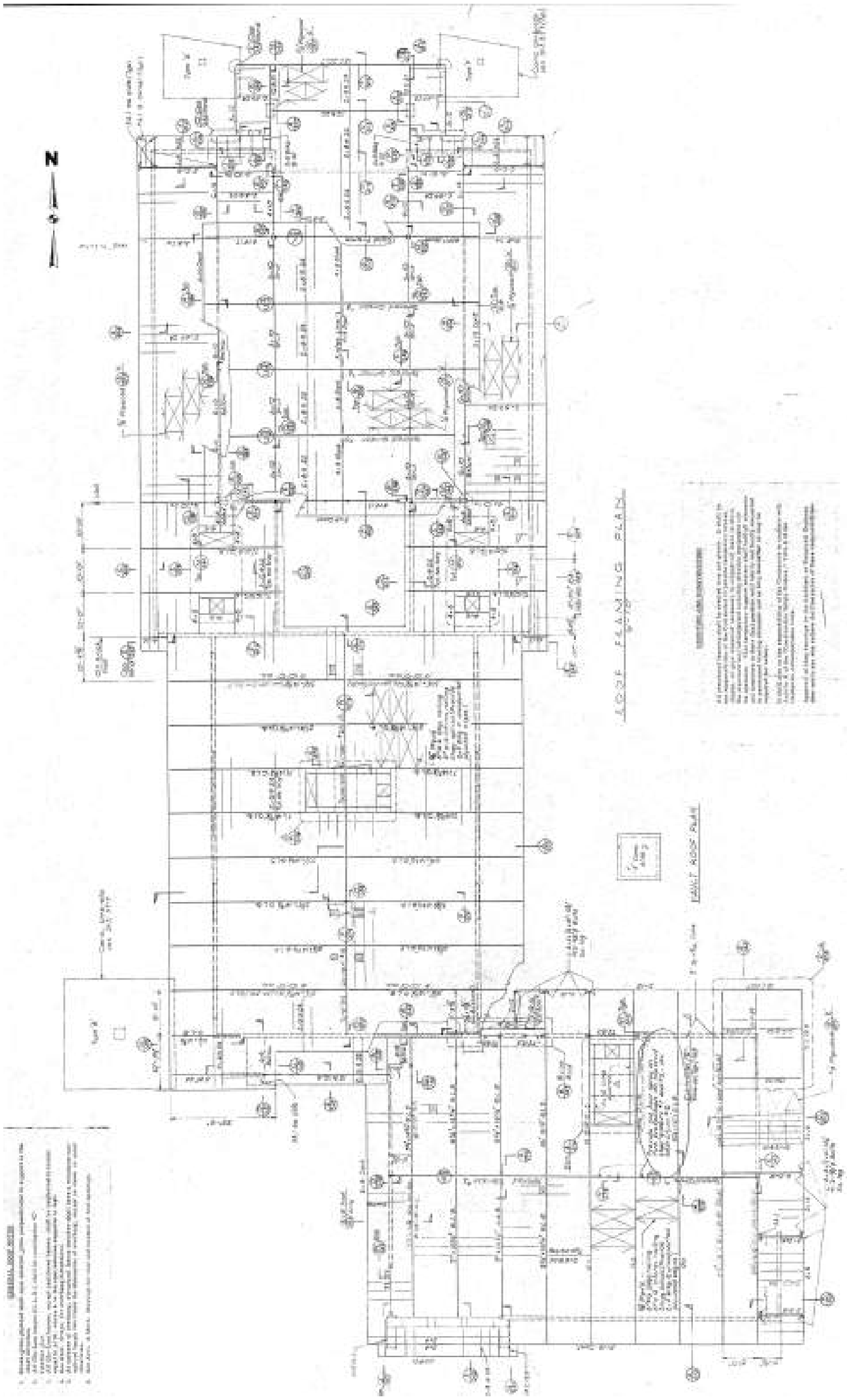



Connection capacity per F/S-A7 after adding U PL and bolts;
N F/S-A7 = 2*2630*3+2*2630*3= 31,560 lbs > 27,172 lbs, sufficient
(E) Connection capacity per F/S-A7;
N F/S-A7 = 2*2630*3=15,780 lbs , not sufficient
Add (N) 1/4" U PL
w/2-3/4" Dia. Bolts
F1 - 27,172 lbs
5'-0"
(E) 3x10
(E) 1/4" PL
Add (N) 1/4" PL w/2-3/4" Dia. Bolts
Make (E) 3/4" Bolts in Double Shear,
typical
Connection per G/S-A7 after adding PL & bolts;
N G/S-A7 = 2*2630*3+2*1270*3=23,400 lbs > 20,379
lbs, OK
(E) connection capacity per G/S-A7;
N G/S-A7 = 2*1270*3=7,620 lbs
Moment in Column
Mu=27.172*5'= 135.9 kip-ft
Column capacity Mex=ZFy=18.9*40.7/12 = 64.1kip-ft
m factor =4 for damage control
mMex=4*64.1=256.4 kip-ft > Mu, column capacity OK
Column 6WF25, Z x = 18.9 in3
SECTION F S-A7
SECTION G S-A7

Appendix 1-C: As-Built Plans



Foundation Plan (1967 Sheet S-A1)



Roof Plan (1967 Sheet S-A2)

Appendix 7A – Images of Existing Conditions

Fig 1. High ceiling with clearstory over the library

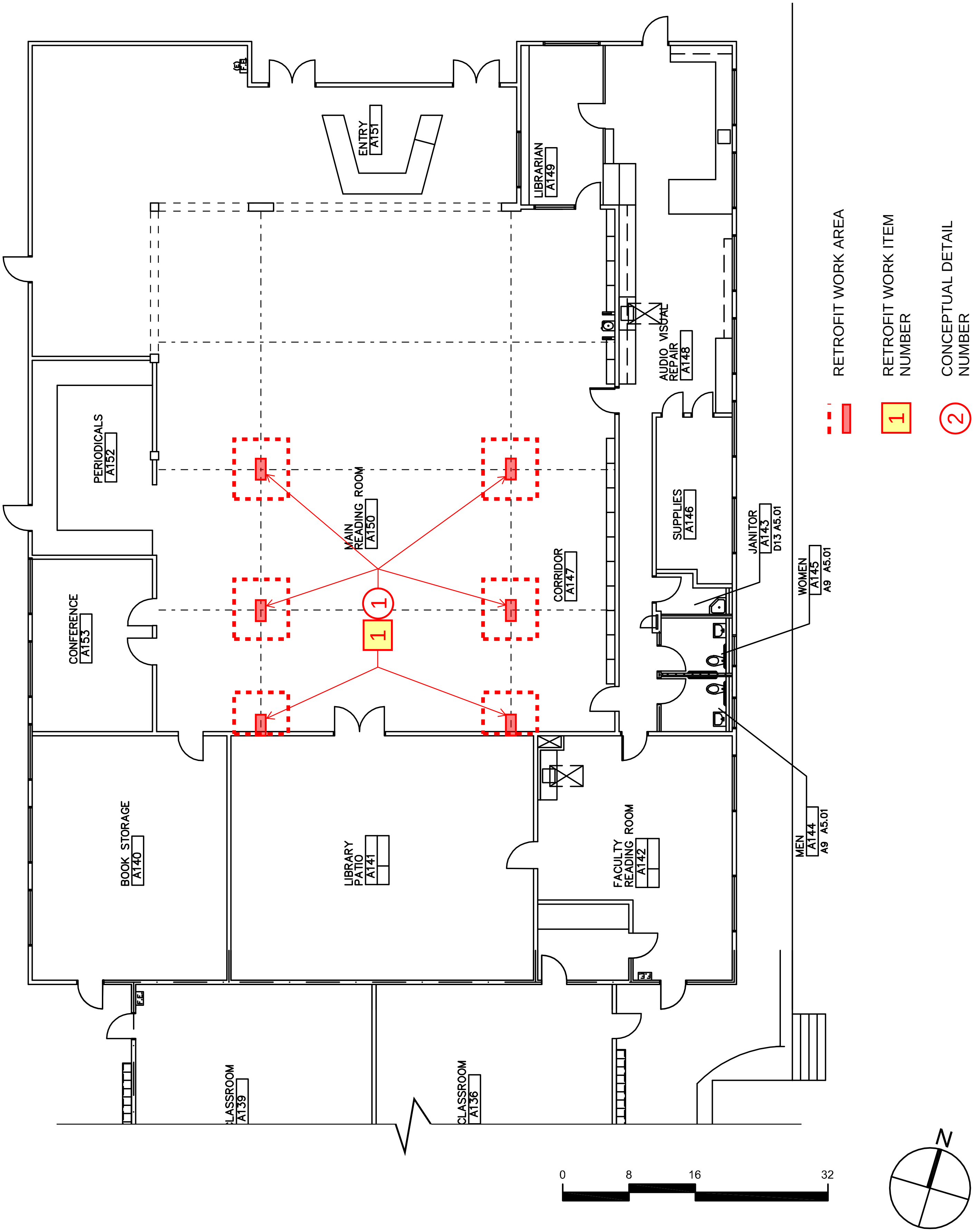
Fig 2. Lower ceiling transition in the library

Fig 3. High ceiling in the library

Fig 4. Exterior soffit at high roof at the library

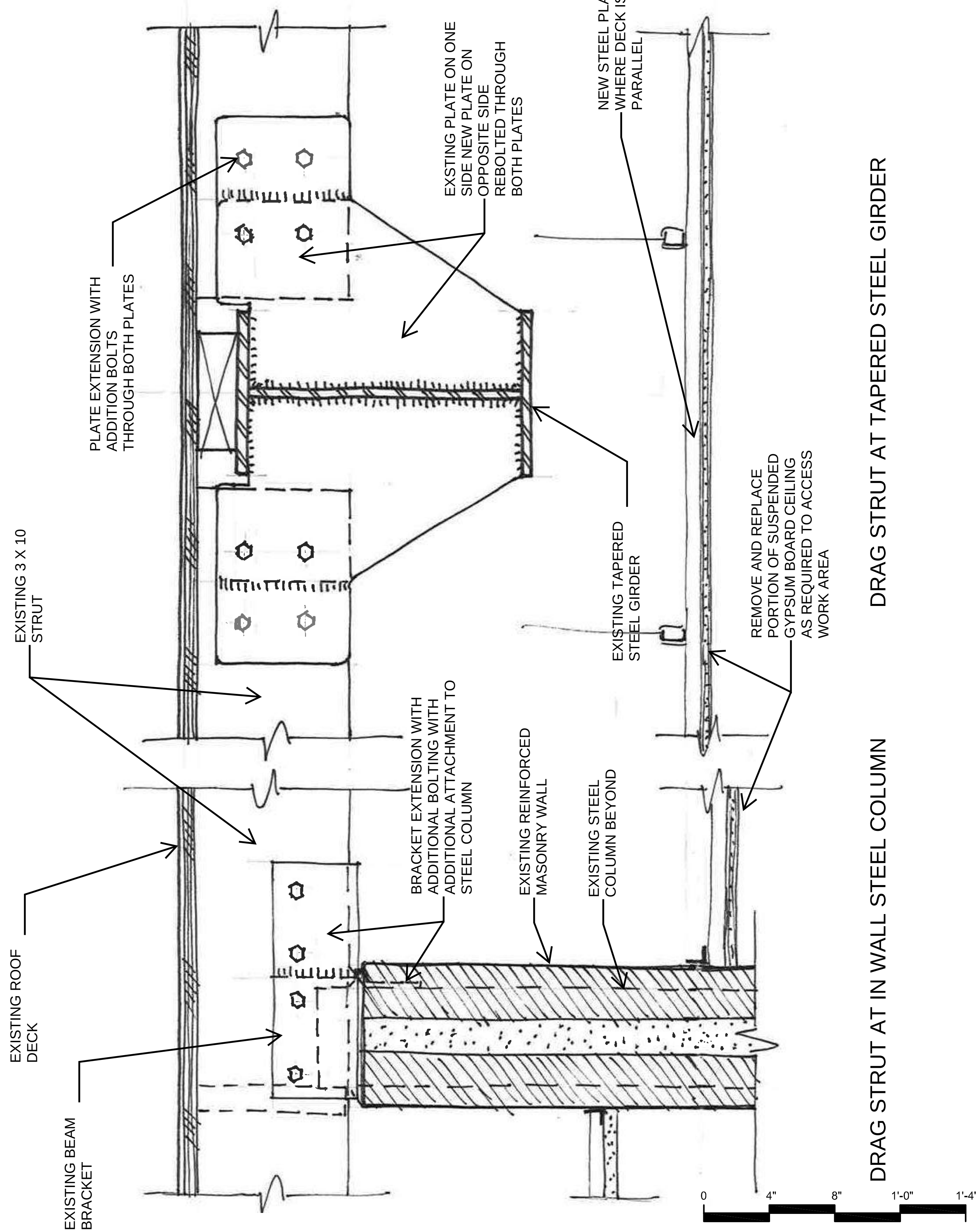
Fig 5. Lower soffit at library entry

Fig 6. Classroom wing adjacent to library



MIRALESTE IS - BUILDING A
LIBRARY PORTION

PBWS



HIGH ROOF DRAG STRUT ENHANCEMENT
AT MIS BUILDING A LIBRARY

1

PBWS

TTG

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
MULTI PURPOSE BUILDING (B)

MIRALESTE INTERMEDIATE SCHOOL
29323 Palos Verdes Dr. E,
Rancho Palos Verdes, CA 90275

Terry Tsang, S.E.
Structural Engineer S2992
TTG Job No.: 0215.766.00

JANUARY 2016

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1.0 Introduction- Multipurpose Building B

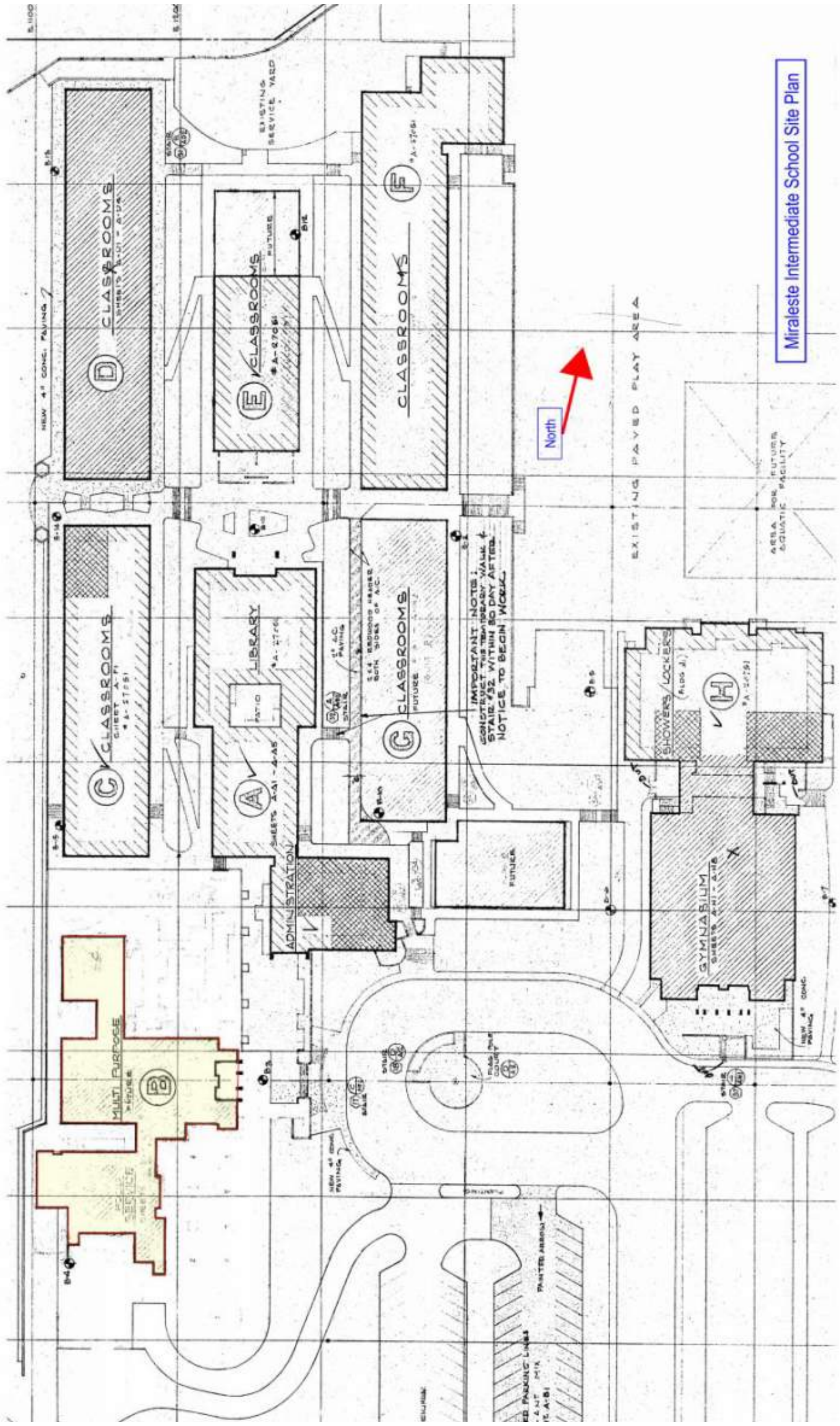
A multiphase seismic vulnerability assessment of ***Building B*** was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Photo 1 – View of East Entrance of the Multipurpose Building

Photo 2 – View of Cafeteria/Food Service Portion of the Multipurpose Building

An overall campus map of Miraleste Intermediate School, indicating the buildings under evaluation, is provided below. The highlighted building is ***Building B.***



Site Map- Building B

2.0 Building B – Multipurpose Building

2.1 Site Seismicity

Based on 1972 construction drawings, original foundation was based on the allowable soil bearing pressure of 3,000 psf for vertical dead loads plus live loads. There is no geotechnical report available for review.

Per ASCE 41-13 (2012 IBC), for Miraleste Intermediate School located at 29323 Palos Verdes Drive East, Rancho Palos Verdes, CA 90275,

Site Coordinates = 33.75222°N, -118.32549°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.514g; $S_{1,20/50}$ = 0.197 g
Fa = 1.389 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.010 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.714g
$S_{X1} = F_v S_{1,20/20}$ = 0.396g

2.2 Building Description

The Multipurpose Building is a one-story building in the south-western part of the school campus. The center portion of the multipurpose building was originally constructed circa 1973 and added cafeteria wing and music room wing circa 1978. The existing drawings for the original center portion are dated December 29, 1972, which shows the proposed multipurpose building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of one story of auditorium portion with raised stage/platform and a small mezzanine floor over restroom as storage space. The original 1972 center portion of the building is rectangular with approximate dimensions of 118.5' x 59.25' with a small toilet wing on the side. Total footprint of the original building is estimated to be ±7,500 square feet. Typical average roof height is about 22'-9". The roof of the original multipurpose building portion consists of plywood panel over wood joist and

Tectum panels over wood joists with diagonal steel rod bracing. The wood joists are supported by tapered steel girders spanning about 59' at 18.5' spacing; the steel girders are supported by cast-in-place concrete columns along the perimeter of the buildings. The lateral force resistance of the building is provided by precast concrete wall panels, which are tied together by cast-in-place concrete columns. The foundation of the building consists of concrete spread footing under the concrete columns.

The 1977 additions of a cafeteria wing and music room wing to the Multipurpose Building are structurally separated from the original Multipurpose Building construction at the roof level) with a 1.5" seismic separation gap. The cafeteria/food service portion of the building addition is rectangular in shape with approximate dimensions of 90' x 87'; total footprint of the cafeteria building is estimated to be ±7,800 square feet with average roof height about 18'. The music room portion of the building addition is rectangular in shape with approximate dimensions of 100' x 45'; total footprint of the cafeteria building is estimated to be ±4,500 square feet with average roof height about 18'. The roof of the 1977 multipurpose building additions consist of plywood panel over wood joists. The wood joists are supported by steel girders; the steel girders are supported by reinforced masonry walls. The lateral force resistance of the building additions is provided by reinforced masonry wall. The foundation of the building consists of concrete continuous wall footing and concrete spread footing under columns.

Therefore, based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Precast Concrete Shear Walls with Flexible Diaphragms denoted as "PC1" for the original 1972 portion and Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as "RM1" for the 1977 additions.

The structural risk category for the multipurpose building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Building B – Multipurpose Building Summary Table	
Year Designed	1972 for original portion and 1977 for additions
Drawings	Original drawings, dated December 29, 1972, prepared by Donley Bundy & Associates Architects, with Wilson & Thompson Structural Engineers. Multi-Purpose Building Addition drawings, dated August 1, 1977, prepared by Donley Bundy & Associates Architects, with Wilson, Thompson & LaBrie Structural Engineers.
Gravity System	Wood joists on steel beams/girders supported on columns/walls (Flexible Diaphragm)
Lateral System	Precast concrete shear walls and reinforced masonry bearing walls
No. of Stories & Height	1 Stories; Main Roof: h_n=22.75 ft; Cafeteria/Music Room Roof: h_n=18 ft
Building Period "T"	0.20 Sec
Base Shear "V"	0.714 W = 295 Kips Original PC1 Multi-purpose Portion 0.714 W = 303 kips Cafeteria Addition RM1
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	Load Path Precast Wall Panels
Retrofit Recommendations	See Section 4.1

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of ***Building B*** is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the “Life Safety” performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the “Life Safety” or “Immediate Occupancy” levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening. As a Risk Category ***III***, the Basic Performance Objective for the building was ***Damage Control Structural Performance,*** per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; some were found to be “Compliant” and others were found to remain “Deficient.”

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Load Path
- Tier 1 Deficiency No. 2: Adjacent Buildings
- Tier 1 Deficiency No. 3: Other Diaphragms
- Tier 1 Deficiency No. 4: Precast Panels
- Tier 1 Deficiency No. 5: Unblocked Diaphragms

3.2 ASCE 41-13 Tier 2 Evaluation

All of the deficiencies listed above were reviewed using a Tier 2 Evaluation. Some of the deficiencies were mitigated base on results of Tier 2 evaluation, which can be found in ***Appendix 1-B***. Deficiency No. 2 (Adjacent Buildings) was mitigated with analysis results per ASCE 41-13 section 5.4.1.2 by insuring that the provided building separation is larger than the expected building displacement at the roof level of the lower building. Deficiency No. 3 (Other Diaphragms) was mitigated with calculations per Tier 2 section 5.6.5. Deficiency No. 5 (Unblocked Diaphragms) was mitigated with calculations per Tier 2 section 5.6.2. Some of the Tier 2 analysis was performed using analysis results from the ETABS model developed for the Tier 2 evaluations. Linear dynamic procedure was used for the analysis of the structure using BSE-1E level seismic response spectrum. Output forces are exported into excel spreadsheet and series of calculation per ASCE 41-13 are performed to verify the components have sufficient capacity for load demands.

The remaining deficient items following Tier 2 evaluation include:

1. Tier 2 Deficiency 1 (Load Path) per Section 5.4.1.1

   Due to lack of load path to foundation under precast walls

2. Tier 2 Deficiency 2 (Precast Panels) per Section 5.7.3.4

   Due to precast wall panels are not connected to foundation

3.3 Tier 2 Evaluation and Proposed Retrofit Summary Table

Building	Identified Tier 1 Deficiencies	Tier 2 section number	Tier 2 Evaluation Result	Proposed Retrofit
Building B Target Structural Performance Level: ***S-2 Damage Control***	***16.1.2 LS Load Path***	**5.4.1.1**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in Section 4.1.***
	16.12 LS Adjacent Buildings	**5.4.2**	***Adequate***	
	16.12 LS Other Diaphragms	**5.6.5**	***Adequate***	
	16.12 LS Precast Panels	**5.7.3.4**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in Section 4.1.***
	16.15 LS Unblocked Diaphragms	**5.6.2**	***Adequate***	

4.0 Conclusions

The Load Path deficiency is due to the fact that the precast panels do not have foundations directly underneath them. The precast panels are connected to concrete columns on each side of the precast panel and the lateral forces are then transferred to the foundation via columns. The shear capacity at the column section is often not sufficient, therefore resulting in load path deficiency, which may result in the partial or total collapse of the building. The deficiency of precast panels is the cause of the deficiency in load path. The above identified deficiencies are major structural deficiencies and pose a serious collapse hazard if they are not mitigated.

Given the reasons above, a voluntary seismic retrofit is recommended for this structure to mitigate these deficiencies.

4.1 Proposed Retrofit Options

Summary of Retrofit options:

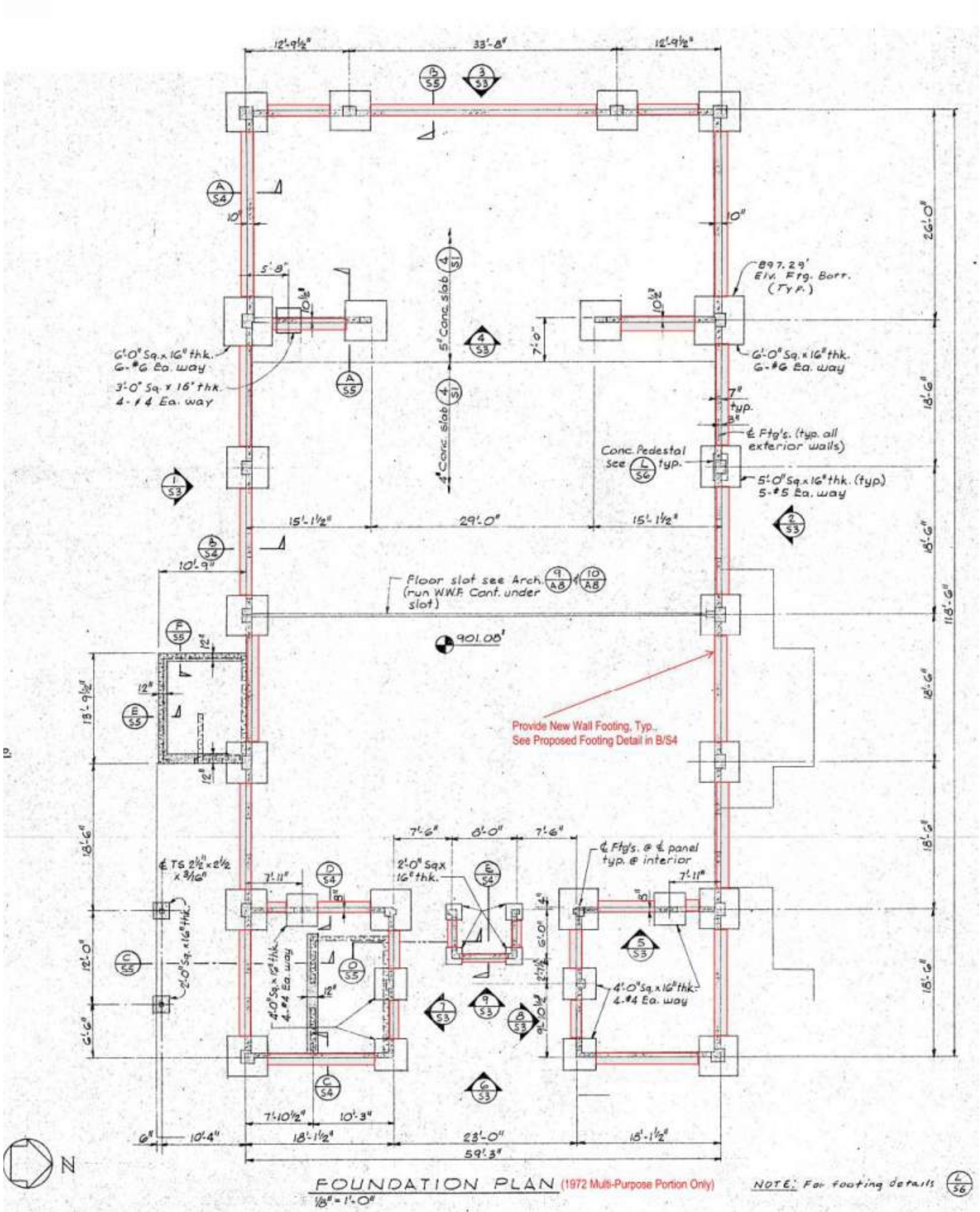
1. Provide new foundation for the precast concrete walls. The new foundation will be connected to the existing precast wall panel and tied to existing columns footing using reinforcing dowels in epoxy embedment. This will mitigate the deficiency of load path and precast wall panels. Final size of the new wall footings and details will be developed in future structural upgrading work.

4.2 Structural Retrofit Selection Recommendations and Conclusions

Based on our analysis of ***Building B***, we recommend implementing the following retrofit options:

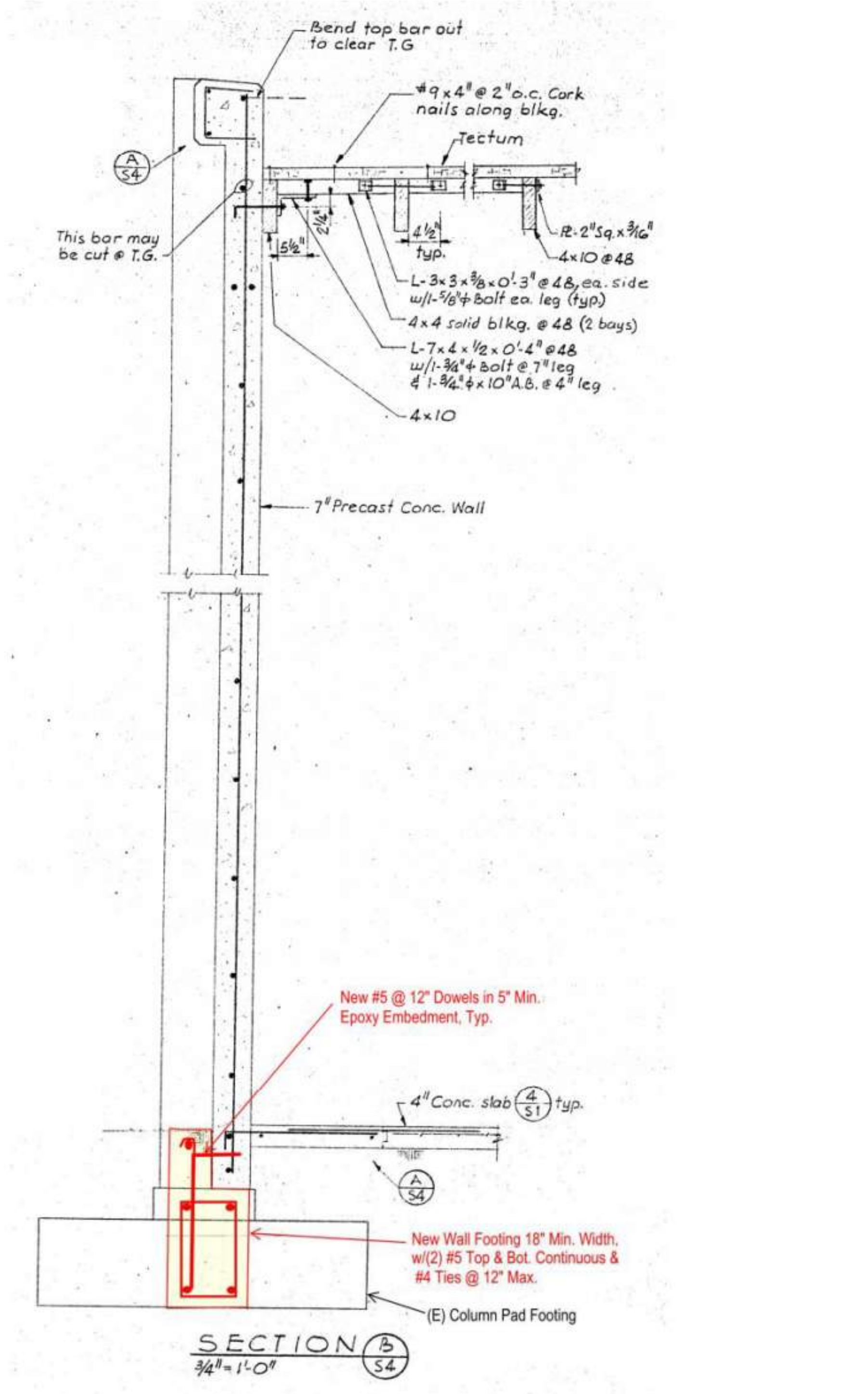
1. Provide New Continuous Footing for Precast Wall Panels

   Adding new wall footing will eliminate the deficiency of load path and precast wall panels; seismic forces will be transferred to foundation directly. See retrofit sketches for the proposed new wall footing and details.



Sketch 1 – Foundation Plan, Proposed New Wall Footing

(Based on Existing 1972 Drawing S-2)



Sketch 2 – Proposed New Wall Footing Section Detail

(Based on Existing 1972 Drawing B/S4)

5.0 Documents Reviewed

The following existing architectural and or structural drawings were reviewed:

Date	Architect / Engineer	TTG Comments
December 29, 1972	Donley, Bundy & Associates (Architect) Wilson & Thompson (Structural Engineer)	Title Block states “Music-Drama Facility Miraleste High School” Architectural and structural drawings (State of California – Department of General Services, Office of Architecture and Construction Project No. 35746)
August 1, 1977	Donley, Bundy & Associates (Architect) Wilson & Thompson (Structural Engineer)	Title Block states “Miraleste High School, Multi-Purpose Building Additions” Structural drawings only (Office of State Architect, Structural Safety Section, Project No. A40131)

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Miraleste Intermediate School Building B, Performing Arts

Table of Contents

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part

234 E. Colorado Boulevard Suite 700, Pasadena, California 91101 T: 626.432.5000 F: 626.432.5010 www.pbws.com Architecture Planning Interiors

of the District's facilities. This resulted in the identification and verification of the District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Miraleste Intermediate School was originally constructed as a public high school with in the Palos Verdes Peninsula Unified School District. It was constructed in four phases in 1967, 1970, 1973 and 1977. It was originally called Miraleste High School and has been in constant use as a public school since that time. The original campus buildings were designed by the firm of Donley Bundy & Associates and is mostly of reinforced brick and concrete masonry, and wood construction. The building referred to as Building B is part of the 1973 phase.

Building B functions as a multipurpose and auditorium space and contains a stage on the south end. It is a tilt up concrete panel wall structure with cast in place concrete piers. It has a tapered steel girder and wood roof system. Adjacent additions were constructed in 1977 and are of wood construction.

All portions of the building are of Type-5 non-rated construction and appear fit within the current CBC Type-5B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the

proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Item 1

Foundation for concrete wall panels

This work will consist of providing new continuous footings under the existing precast concrete wall panels that create all the walls of the multipurpose room. These footings will run between the existing pier footings that support the roof trusses and separate the wall panels. This will require the removal of some adjacent paving on the exterior or floor slab in the interior to allow for excavation. Excavation under the existing walls will be required in sections with the appropriate shoring to allow for the forming and placement of new foundation concrete. This would probably be done for every other wall panels at one time and then the alternate panels to complete the work. The existing footings that support the concrete pears in between the wall panels will have to be maintained in place when the new work is constructed. At the state end of the multipurpose room the floor level and the exterior paving is elevated approximately 3 feet from the main finish floor elevation. This will require deeper excavation in those areas. It will be important to protect and maintain existing underground utilities and in some cases rerouting may be required. See conceptual details #2A. 2B. and 2C.

Accessibility Upgrades

There is a ramp surface the accesses the stage from the exterior that may have to be partially removed to allow for the excavation work. This will have to be replaced to its original condition. If Retrofit work is designed and submitted to DSA there will be some minimum level of access compliance work that will be required as a condition of the obtaining approval. Typically, there are requirements for an accessible path of travel to the subject building from parking and accessible restrooms to serve the building. Even though modernization work has been done which on the campus they may be some work required to meet the requirements of the most current codes and regulations at the time of that the retrofit work is being designed. A separate survey for access compliance is recommended for the entire campus that would be of benefit for future project planning.

Fire & Life Safety

The work should have minimal effect on the fire rated assemblies that exist since all the work is concrete foundation work. Any assembly disturbed in the process will have to be returned to its original rating condition.

The new work will have no impact on the egress system as currently exists and there are no changes to the egress system in this scope. There is no reconfiguration of spaces or changes of use in the scope that would affect the existing fire/life safety code compliance status of the building with regards to building area, construction type or configuration.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

The retrofit work is all under the existing multi-purpose portion of the building superstructure. It should be possible to construct these retrofit footings by excavating from one side to minimize the disturbance to the building and to work around the existing column footings. There will still be considerable removal of floor and exterior paving to allow for the foundation work including the elevated grade portion around the stage to the outside. These will have to be built back to the original condition. There has been an attempt to show excavation for each panel footing from the side that would be the most economical, but there may be conditions discovered in field such as underground utilities that will influence this. The result from the analysis of this is excavation from varying sides for each wall panel based on observable conditions.

8.0 Cost Estimate

PVPUSD Seismic Study
Narrative, Plans and Details by PBWS - Received 8/10/2016

RE: PVPUSD Seismic Study

Please find in the following report the cost estimate for the PVPUSD Seismic Study project. This estimate is prepared in accordance with the Narrative, Plans and Details by PBWS - Received 8/10/2016 with the following:

CLARIFICATIONS:

- Pricing is based on the entire project scope being awarded as one project to a single contractor
- Cost is based on prevailing wage labor rates
- This estimate represents an opinion of the fair construction cost for this project assuming multiple general contractors competitively bidding on the project with all sub-trades covered with 4 to 5 bids per trade. If a different delivery method is used a premium cost should be expected and will vary depending on the method used. This estimated cost should not be construed as a prediction of low bid

EXCLUSIONS:

- All soft costs
- Permits
- Owner's contingency
- Construction or occupancy phasing
- CM fee

Should you have any questions, please call me at 661-367- 5242.

Sincerely:

Walid Shihayed

WM2S, Inc.
14908 Live Oak Springs Canyon Road, Santa Clarita, CA. 91387
P: (661) 367 5242, www.WM2S.com

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
MISB Miraleste Intermediate School Building B, Performing Arts			
0205 Demolition			
02050.000 DEMOLITION			
Remove Concrete Walk	1,202.00 SF	15.00 /SF	18,030
Remove Concrete Slab	527.00 SF	15.00 /SF	7,905
DEMOLITION			**25,935**
0205 Demolition			**25,935**
0220 Earthwork			
02200.000 EARTHWORK			
Excavate For Footing - Hand	219.00 CY	65.00 /CY	14,235
Backfill Walls - Hand	150.00 CY	50.00 /CY	7,500
EARTHWORK			**21,735**
0220 Earthwork			**21,735**
0252 Site Concrete			
02520.000 SITE CONCRETE			
Cast-in-Place Concrete Paving 4"	1,202.00 SF	35.00 /SF	42,070
Concrete HC Ramp - Replacement	1.00 LS	25,000.00 /LS	25,000
SITE CONCRETE			**67,070**
0252 Site Concrete			**67,070**
0320 Reinforcing Steel			
03200.000 CONCRETE REINFORCEMENT			
Foundation Reinforcing (100 #/CY)	69.00 CY	100.00 /CY	6,900
CONCRETE REINFORCEMENT			**6,900**

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
0320 Reinforcing Steel			6,900
0330 Concrete			
03300.000 CAST-IN-PLACE CONCRETE			
Drill & Epoxy Reinforcing Dowel	208.00 EA	35.00 /EA	7,280
Continuous Footings - Underpinning	69.00 CY	800.00 /CY	55,200
Slab On Grade	527.00 SF	50.00 /SF	26,350
CAST-IN-PLACE CONCRETE			**88,830**
0330 Concrete			88,830
0960 Flooring			
09650.000 RESILIENT FLOORING			
Remove & Replace Flooring	527.00 SF	40.00 /SF	21,080
RESILIENT FLOORING			**21,080**
0960 Flooring			21,080
MISB Miraleste Intermediate School Building B, Performing Arts			**231,550**

Partial Totals

Description	Amount	Totals	Rate	
Direct Cost	**231,550**	**231,550**		
General Conditions	23,155		10.00	%
Performance & Payment Bond	3,338			
Liability Insurance	2,316		1.00	%
Overhead & Fee	11,578		5.00	%
Construction Cost	**40,387**	**271,937**		
Design Contingency	54,387		20.00	%
Escalation	10,877		4.00	%
Construction Cost With C&E	**65,264**	**337,201**		
Construction Contingency	33,720		10.00	%
	33,720	**370,921**		
SOFT COSTS:				
Architect & Engineering Fees				
Architect Reimbursables				
Testing & Inspection				
Permits and Fees				
Furniture, Fixtures and Equip.				
Total Project Cost				

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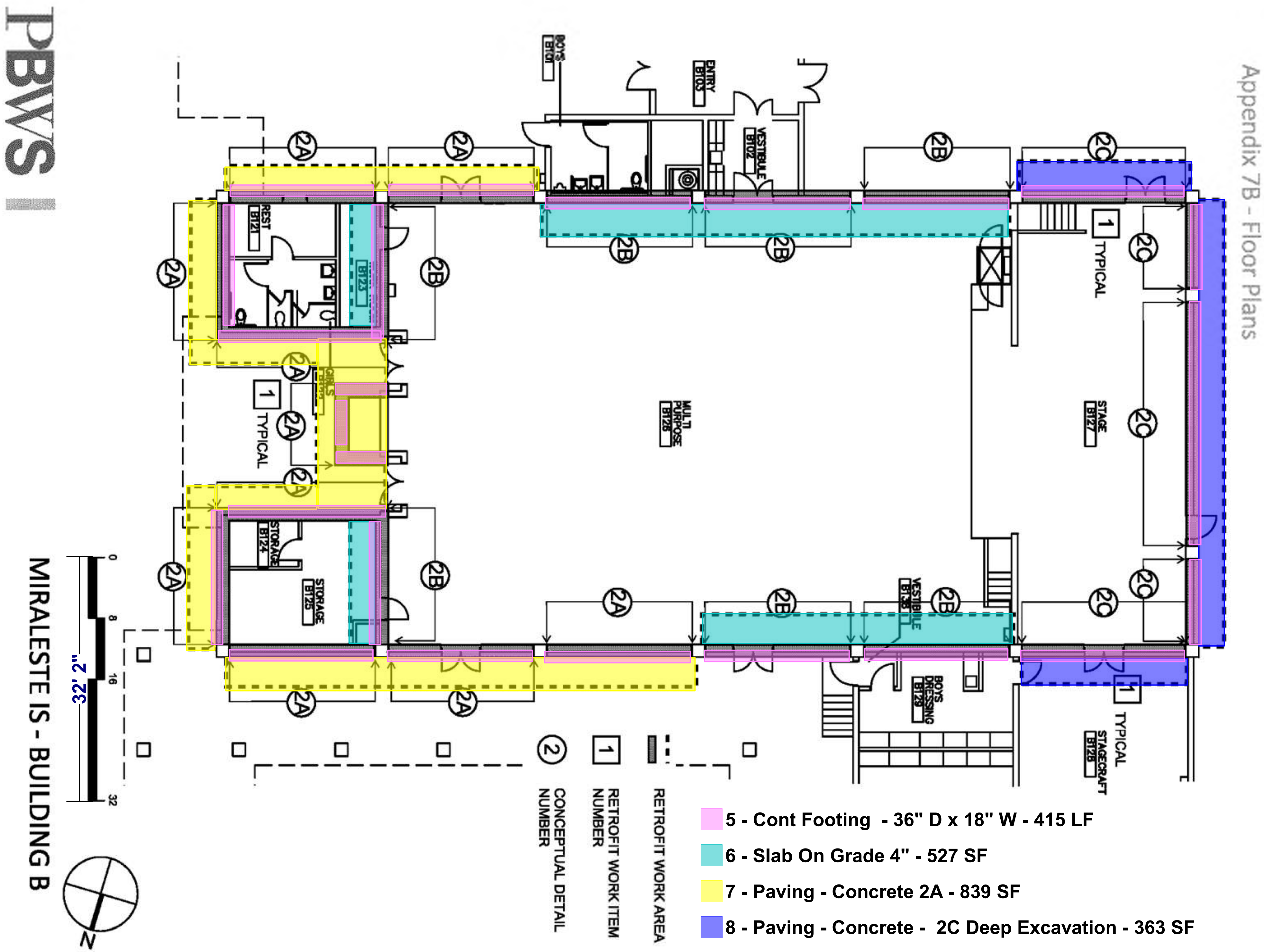


5 - Cont Footing - 36" D x 18" W - 415 LF

6 - Slab On Grade 4" - 527 SF

7 - Paving - Concrete 2A - 839 SF

8 - Paving - Concrete - 2C Deep Excavation - 363 SF

Appendix 1-A: Tier 1 Screening Checklists

ASCE 41-13 Checklists

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
	x			LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	No foundation under precast wall panels, load path incomplete.
	x			ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.2)	The 1977 additions to the main building constructed has 1.5" separation joint for 18'-0" of building height. 1.5" < 0.04*(18') = 8.6" Check separation per Tier 2.
x				MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	Mezzanines are braced independently.
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	It is one story building, so not applicable.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	It is one story building, so not applicable.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	All vertical elements continuous to foundation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	It is one story building, so not applicable.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	It is one story building, so not applicable.
X				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Roof consists of flexible wood diaphragms with minimum of 2 lines of shear wall support. Torsion appears not exist.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
			x	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	No geotech report available.
			x	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	No geotech report available.
			x	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	No geotech report available.

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
X				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.714=0.43 Compliant per review of existing drawings.
X				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Foundation elements are tied together by slab on grade.

16.12LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES PC1: PRECAST OR TILT-UP CONCRETE SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS AND PC1A: PRECAST OR TILT-UP CONCRETE SHEAR WALLS WITH STIFF DIAPHRAGMS

Low Seismicity

Connections

C	NC	N/A	U	Checklist	Comments
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. Commentary Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1	Wall anchorage is sufficient; see calculations.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Seismic-Force-Resisting System					
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. Commentary Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1	At least 2 lines of shear walls in each direction.
x				WALL SHEAR STRESS CHECK: The shear stress in the precast panels, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in^2 or 2 ∫fc′ . Commentary Sec. A.3.2.3.1. Tier 2: Sec. 5.5.3.1.1	Wall shear stress is less than 100 psi; see calculations.
x				REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. Commentary Sec. A.3.2.3.2. Tier 2: Sec. 5.5.3.1.3.	Reinforcing steel ratio meet requirements; see calculations.
x				WALL THICKNESS: Thicknesses of bearing walls shall not be less than 1/40 the unsupported height or length, whichever is shorter, nor less than 4 in. Commentary Sec. A.3.2.3.5. Tier 2: Sec. 5.5.3.1.2.	Wall thickness is not less than 1/40 of unsupported height.

C	NC	N/A	U	Checklist	Comments
Diaphragms					
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab with a minimum thickness of 2 in. Commentary Sec. A.4.5.1. Tier 2: Sec. 5.6.4.	No precast diaphragm elements used.
Connections					
x				WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. Commentary Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3.	Connection will not induce cross-grain bending or tension
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. Commentary Sec. A.5.2.1. Tier 2: Sec. 5.7.2.	Diaphragms are connected for transfer of seismic forces to shear walls.
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. Commentary Sec. A.5.2.3. Tier 2: Sec. 5.7.2.	No topping slab used.
x				GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. Commentary Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1.	There is positive connection using steel anchor bolts.
High Seismicity. Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Seismic-Force-Resisting System					
		x		DEFLECTION COMPATIBILITY FOR RIGID DIAPHRAGMS: Secondary components have the shear capacity to develop the flexural strength of the components. Commentary Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2.	No rigid diaphragms.
x				WALL OPENINGS: The total width of openings along any perimeter wall line constitutes less than 75% of the length of any perimeter wall when the wall piers have aspect ratios of less than 2-to-1. Commentary Sec.	Wall openings less than 75% of the length of any perimeter wall.

C	NC	N/A	U	Checklist	Comments
				A.3.2.3.3. Tier 2: Sec. 5.5.3.3.1.	
				Diaphragms	
x				CROSS TIES IN FLEXIBLE DIAPHRAGMS: There are continuous cross ties between diaphragm chords. Commentary Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2.	Continuous cross ties present.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. Commentary Sec. A.4.2.1. Tier 2: Sec. 5.6.2.	No straight sheathing used.
		x		SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. Commentary Sec. A.4.2.2. Tier 2: Sec. 5.6.2.	No straight sheathed diaphragms used. Wood structural panels used.
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. Commentary Sec. A.4.2.3. Tier 2: Sec. 5.6.2	No diagonally sheathed or unblocked diaphragms in 1972 PC1 construction.
	x			OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. Commentary Sec. A.4.7.1. Tier 2: Sec. 5.6.5	Tectum panel diaphragm with diagonal rod bracing used in 1972 roof construction. Check capacity of diaphragm per Tier 2.
				Connections	
x				MINIMUM NUMBER OF WALL ANCHORS PER PANEL: There are at least two anchors from each precast wall panel into the diaphragm elements. Commentary Sec. A.5.1.3. Tier 2: Sec. 5.7.1.4.	There are at least 2 anchors into diaphragm.
	x			PRECAST WALL PANELS: Precast wall panels are connected to the foundation. Commentary Sec. A.5.3.6. Tier 2: Sec. 5.7.3.4.	Precast panel are connection to columns, but not connected to foundation directly.
		x		UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. Commentary Sec. A.5.3.8. Tier 2:	No pile caps.

C	NC	N/A	U	Checklist	Comments
				Sec. 5.7.3.5	
x				GIRDERS: Girders supported by walls or pilasters have at least two ties securing the anchor bolts unless provided with independent stiff wall anchors with adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. Commentary Sec. A.5.4.2. Tier 2: Sec. 5.7.4.2.	There are at least two ties securing the anchor bolts.

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY SHEAR WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	At least 2 lines of shear walls present.
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in^2. (§A.3.2.4.1. Tier 2: §5.5.3.1.1)	Shear stress is less than 70 psi.
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. (§A.3.2.4.2. Tier 2: §5.5.3.1.3)	Reinforcing steel ratios meet requirements.
Stiff Diaphragms					
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (§A.4.5.1. Tier 2: §5.6.4)	No precast diaphragm elements.
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Wall anchorage is sufficient.
x				WOOD LEDGERS: The connection between the wall panels and the diaphragm does not	Connection does not induce cross-grain bending or tension.

C	NC	N/A	U	Checklist	Comments
				induce cross-grain bending or tension in the wood ledgers. (§A.5.1.2. Tier 2: §5.7.1.3)	
X				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	There is positive connection for shear transfer between diaphragm and shear wall in all locations
		X		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (§A.5.2.3. Tier 2: §5.7.2)	No precast diaphragm elements.
X				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	Wall reinforcement is dowelled into foundation.
X				GIRDER-COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (§A.5.4.1. Tier 2: §5.7.4.1)	Positive connection present at girder-column connections.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Diaphragms					
Stiff Diaphragms					
		X		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	No stiff diaphragms.
		X		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	No stiff diaphragms.
Flexible Diaphragms					
X				CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Continuous cross ties present.
X				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear	Diaphragm openings adjacent to shear walls are less than 25% of

C	NC	N/A	U	Checklist	Comments
				walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	the wall length.
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	Diaphragm openings adjacent to exterior masonry shear walls are not greater than 8 feet.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	No straight sheathed diaphragms.
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	No straight sheathed or diagonal sheathing used in diaphragms.
	x			DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	Unblocked diaphragm having span more than 40 feet. Check shear capacity per Tier 2.
x				OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	Only wood panel diaphragms used.
Connections					
x				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (§A.5.1.4. Tier 2: §5.7.1.2)	Stiff steel anchors used.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
				Life Safety Systems	
			X	LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not accessible during site visit
			X	LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not accessible during site visit
			X	LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Not accessible during site visit
			X	LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not accessible during site visit
X				LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Proper clearance observed
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Hazardous Materials	
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4.	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				Tier 2. §13.6.2)	
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	
				Light Fixtures	
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Proper support was observed
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Cladding and Glazing	
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
Masonry Veneer					
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	No URM backup, so not applicable.

C	NC	N/A	U	Checklist	Comments
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
				Parapets, Cornices, Ornamentation, and Appendages	
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
			X	LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Not accessible during site visit
X				LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	Meet requirements, so complaint.
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items.	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				(§A.7.8.4. Tier 2: §13.6.6)	
				Masonry Chimneys	
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
				Stairs	
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
				Contents and Furnishings	
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-	Proper anchorage was observed

C	NC	N/A	U	Checklist	Comments
				depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
X				LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	Proper bracing was observed
X				LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Proper bracing and support was observed
X				LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	Proper anchorage was observed
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
Piping					
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				Ducts	
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
				Elevators	
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

TTG

Miraleste Intermediate School
Multipurpose Building (B)

Job #: 0215.766
Date: Jan-16

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW	Bldg Type= **PC1 & RM1**
$C =$	1	From Table 4-8 for 1972 Multipurpose Building
$C =$	1	From Table 4-8 for 1977 Multipurpose Addition
$S_a =$	$\min(S_{XS}, S_{X1}/T)$	From Section 4.5.2.3
$S_{X1} = F_vS_1$		Eq. 2-2
$S_{XS} = F_aS_S$		Eq. 2-1
$S_S =$	0.514	g, mapped spectral acceleration
$S_1 =$	0.197	g, mapped spectral acceleration
$S_{X1} =$	0.396	g
$S_{XS} =$	0.714	g
$T = C_th_n^{\beta}$		From Section 4.5.2.4
$C_t =$	0.02	
$h_n =$	22.75	ft., average height at sloped roof
$\beta =$	0.75	
$T =$	0.208	sec.
$S_a =$	0.714	g
$V_{MP\ 1972} =$	0.714	W
$V_{MP\ 1977\ Addtn} =$	0.714	W

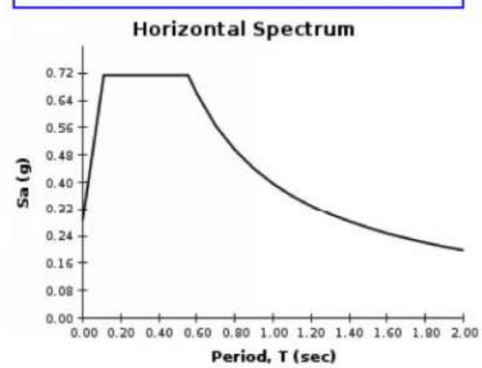
USGS Design Maps Summary Report

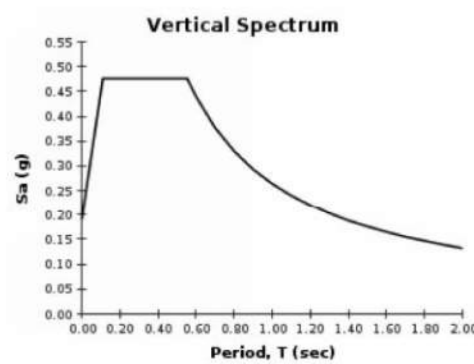
User–Specified Input

Report Title	California Minimum Ss Mon January 4, 2016 22:43:46 UTC
Building Code Reference Document	ASCE 41-13 Retrofit Standard, BSE-1E (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.75222°N, 118.32549°W
Site Soil Classification	Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.514 g	$S_{XS,BSE-1E}$	0.714 g
$S_{1,20/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g





TTG

Miraleste Intermediate School Job #: 0215.766
Multipurpose Building (B) Date: Jan-16

Seismic Mass Weight - 1972 Construction

Roof

(Roof area with 1/2" Plywood sheathing)			*(Roof with 2.5" Tectum board sheathing)*		
Roofing	6	psf	Roofing	6	
1/2" Plywood	1.5	psf	2.5" Tectum	4.5	psf
Wd joist 4x10@48" typ.	1.5	psf	Wood joist	1.5	psf
Roof steel beams	4	psf	Steel Bms	4	psf
MEP	3	psf	MEP	3	psf
Ceiling	0	psf	Ceiling	0	psf
Misc	1	psf	Misc	1	psf
DL =	**17**	**psf**	**DL =**	**20**	**psf**
Use	**17**	**psf**	**Use**	**20**	**psf**

Wall Weight

7" precast conc. wall =	85	psf
8" precast conc. wall =	97	psf
10" precast conc. wall =	120	psf
Wood stud wall =	15	psf

Seismic Mass Weight - 1977 Addition

Roof

(Roof area with 1/2" Plywood sheathing)		
Roofing	6	psf
1/2" Plywood	1.5	psf
Wd joist 4x10@48" typ.	1.5	psf
Roof steel beams	4	psf
MEP	3	psf
Ceiling	0	psf
Misc	1	psf
DL =	**17**	**psf**
Use	**17**	**psf**

Wall Weight

9" brick wall =	90	psf
10" brick wall =	100	psf
Wood stud wall =	15	psf

TTG

Miraleste Intermediate School
Multipurpose Building (B)

Job #: 0215.766
Date: Jan-16

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation - 1972 Original PC1 Building

	Location	Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Roof	Roof Tectum	74.0	59.3	4384.5	20	88
	Roof Plywood	44.5	59.3	2638.9	17	45
	Roof Toilet Wing	44.8	10.8	485.2	15	7
	7" Walls, out plane	185.0	12.3	2275.5	85	193
	10" Walls, out plane	52.0	12.3	639.6	120	77
	wood wall @ toilet	34.8	6	208.8	15	3
	Grand Total =			**7509**		**413**

Base shear V_{MP72}= 0.714 W (1972 Construction PC1 Building)
V = **295** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x	h_x	$w_x h_x$	Fx	Area	fi
	kip	ft	k-ft	kip	ft2	psf
Roof	413	22.75	9399	295	7508.6	39.3
Sum =	413		9399	295		

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1
Footnote b for reinforced concrete walls

Wall Forces - Supporting Roof - 1972 Multipurpose Area

	Wall Description	Length ft	Width in	Aw in2	Force Vj kips	v avg psi
N-S Direction	Wall thick 7"	23.0	7.0	1932	295	9.6
	Wall thick 10.5"	22.5	10.5	2835		
	Wall thick 8"	25.0	8.0	2400		
	Wall thick 7"	37.0	7.0	3108		
E-W Directioin	Wall thick 10"	42.0	10.0	5040	295	4.8
	Wall thick 7"	139.5	7.0	11718		
	Wall thick 9"	34.0	9.0	3672		

Per ASCE 41-13 check list 16.10LS, if shear stress less than max(100, 2f'c^0.5)=109 psi in concrete wall, OK
fc'=3 ksi Average wall shear is less than 109 psi, O.K.

Forces-PC1A

Reinforced Concrete Wall, Reinforcing Steel Ratio

7" Concrete wall with #4 @ 18" Verti & #5 @ 18" Horizontal at center of wall

Hori ρ=	0.0016	Shall not be less than 0.0012 vertic, 0.0020 in hori direction
Verti ρ=	0.0025	Meeting requirements on reinforcing steel

8" Concrete wall with #4 @ 15" Verti & #5 @ 15" Horizontal at center of wall

Hori ρ=	0.0017	Shall not be less than 0.0012 vertic, 0.0020 in hori direction
Verti ρ=	0.0026	Meeting requirements on reinforcing steel

9" Concrete wall with #5 @ 18" Verti & #6 @ 18" Horizontal at center of wall

Hori ρ=	0.0019	Shall not be less than 0.0012 vertic, 0.0020 in hori direction
Verti ρ=	0.0027	Meeting requirements on reinforcing steel

10" Concrete wall with #4 @ 18" Vertical & #5 @ 18" Horizontal Both Face

Hori ρ=	0.0022	Shall not be less than 0.0012 vertic, 0.0020 in hori direction
Verti ρ=	0.0034	Meeting requirements on reinforcing steel

10.5" Concrete wall with #4 @ 18" Vertical & #4 @ 16" Horizontal Both Face

Hori ρ=	0.0024	Shall not be less than 0.0012 vertic, 0.0020 in hori direction
Verti ρ=	0.0021	Meeting requirements on reinforcing steel

Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

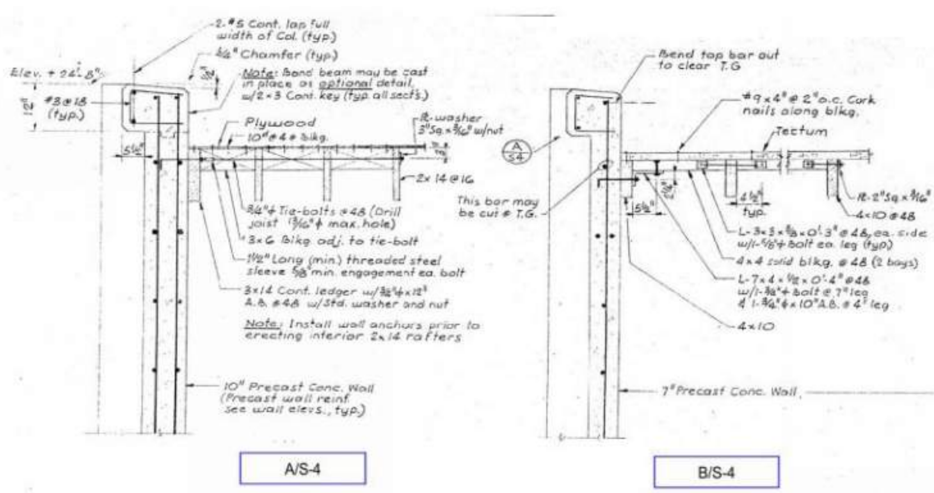
Tc=	$1.2S_{XS}\, w_p\, A_p$ =	102.8	psf	Eqn 4-13
S_{XS} =	0.714			
w_p =	*120*	psf	10" conc wall,	
Ap =	1	ft2		

Evaluate connection for out-of-plane action per Tier 2 procedure
Per Section C7.5.1.2, connections should be evaluated as force-controled procedure.

C_1C_2 =	1.4	From Table 7-3		
J=	1	Per Section 7.5.2.1.2		
Q_{UF}=	Q_G+/-Q_E/(C_1C_2J)	Eqn 7-35		
	Q_{G} =	0.0	lbs	
	Q_E=	1264.6	lbs	End shear for 1'x12.3' wall (WxH)
	Q_{UF}=	903.3	lbs	End shear divided by CJ factor
	Per detail A/S-4, wall anchors @ S =	4.00	ft	Typical anchor @ 4'-0" per S-4
	Out of plane force T_{UF}=	**3,613**	lbs	Each anchor location
	Typical anchor capacity per A/S-4			
	3/4" Dia Tie Rod Trod =	19.8	kips	
	Ncn=	**19.8**	kips	>= T_{UF}, Okay
	Per detail B/S-$, wall anchors @ S =	4.00	ft	Typical anchor @ 4'-0" per B/S-4
	Out of plane force T_{UF}=	**2,529**	lbs	at 7' Wall
	Typical anchor capacity per B/S-4			
	5/8" Dia Tie Rod Trod =	13.95	kips	
	3/4" Bolt in 4x4 =1670*3=	5010	lbs	
	(2) 5/8" bolt in 4x4 =2*1210*3=	7260	lbs	
	Ncn=min(13950, 5010, 7260)=	**5,010**	lbs	>= T_{UF}, Okay

Therefore, wall out-of-plane anchorage issufficient.

Forces-PC1A



Diaphragm Shear Capacity for Other Diaphragms (Tectum Panel Diaphragms)

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 7-25
k=1.0

	w_x	h_x	$w_x h_x$	Fx	Area	fi
	kip	ft	k-ft	kip	ft2	psf
Roof	413	22.75	9399	295	7508.6	39.3
Sum =	413		9399	295		

max shear in Tectum diaphragm = 39.3*18.5'*2*59.25' = 86155.4 lbs = 86.2 kips
Capacity of 2.5" Tectum diaphragm = 1170.0 plf (Ultimate per Tectum catelogue)
Capacity of 2.5" Tectum diaphragm 59.25' long= 69322.5 lbs = 69.3 kips
(2) 7/8" diagonal rod bracing capacity = 0.6*45*2*Cos30 = 46.8 kips
Total of Tectum diaphram plus rod bracing = 116.1 kips > 86.2 kips
OK

So, Tectum diaphrgm (with rod bracing) capacity is sufficient.

TTG

Miraleste Intermediate School
Multipurpose Building (B)

Job #: 0215.766
Date: Jan-16

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation - 1977 Addition Cafeteria Building

Location		Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Roof	Main Roof	87.0	89.7	7801.0	17	133
	Roof Low	98.0	7.0	686.0	15	10
	Roof Low	86.0	22.0	1892.0	15	28
	Roof Low	19.5	36.0	702.0	85	60
	9" Masonry Walls, out plane	146.0	8.5	1241.0	90	112
	9" Masonry Walls, out plane	172.0	5.25	903.0	90	81
	Grand Total =			11081		424

Base shear V_{MP72}= 0.714 W (1972 Construction PC1 Building)
= **303** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x kip	h_x ft	$w_x h_x$ k-ft	Fx kip	Area ft2	fi psf
Roof	424	19	8054	303	11081.0	27.3
Sum =	424		8054	303		

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1
Footnote b for reinforced concrete walls

Wall Forces - Supporting Roof - 1977 Cafeteria Area	Wall Description	Length ft	Width in	Aw in2	Force Vj kips	v avg psi
N-S Direction	Maonry 9"	193.0	9.0	20844	303	3.4
	Maonry 10"	66.0	10.0	7920		
	Maonry 10"	9.0	10.0	1080		
	Maonry 5.625	0.0	5.6	0		
E-W Directioin	Maonry 9"	112.0	9.0	12096	303	6.0
	Maonry 10"	24.0	10.0	2880		
	Maonry 9"	17.0	9.0	1836		

Per ASCE 41-13 check list 16.15LS, if shear stress less than 70 psi in wall, OK
Average wall shear is less than 70 psi, O.K.

Forces-RM1 Cafeteria

Reinforced Concrete Wall, Reinforcing Steel Ratio

9" Brick wall with #5 @ 24" Verti & #4 @ 24" Horizontal at center of wall

Hori ρ=	0.0009	Total V&H reinft not be less than 0.0002; min. not less than 0.0007
Verti ρ=	0.0014	Meeting requirements on reinforcing steel

10" Brick wall with #6 @ 24" Vertical & #4 @ 24" Horizontal Both Face

Hori ρ=	0.0008	Total V&H reinft not be less than 0.0002; min. not less than 0.0007
Verti ρ=	0.0018	Meeting requirements on reinforcing steel

Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

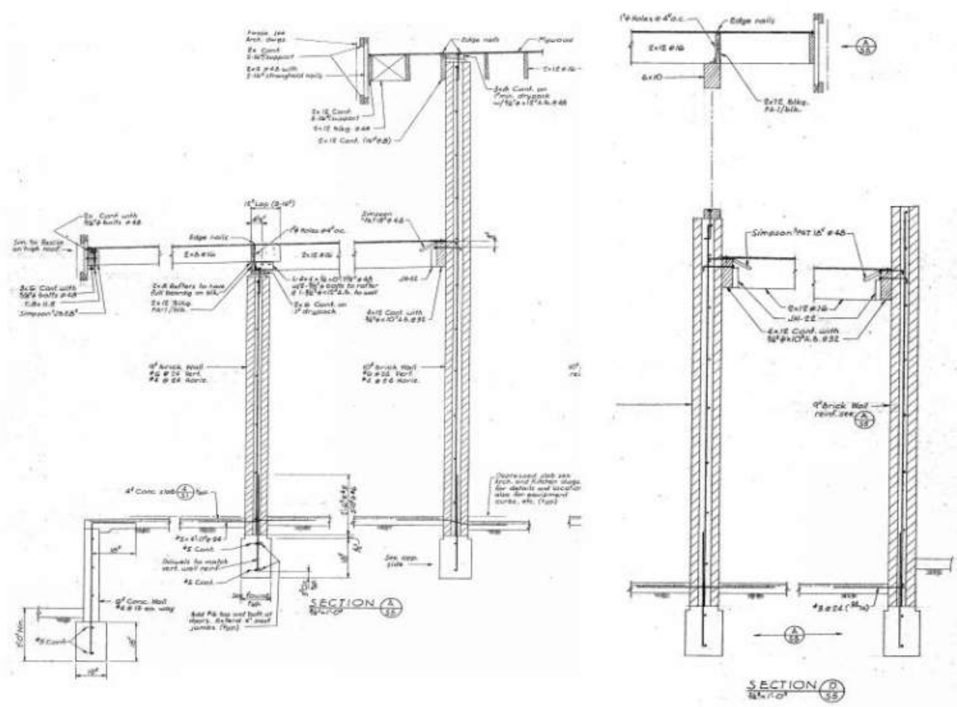
Tc=	$1.2S_{XS}\ w_p\ A_p$ =	77.1	psf	Eqn 4-13
S_{XS} =	0.714			
w_p =	*90*	psf	9" brick wall,	
Ap =	1	ft2		

Evaluate connection for out-of-plane action per Tier 2 procedure
Per Section C7.5.1.2, connections should be evaluated as force-controled procedure.

C_1C_2 =	1.4	From Table 7-3
J=	1	Per Section 7.5.2.1.2
Q_{UF}=	Q_G+/-Q_E/(C_1C_2J)	Eqn 7-35

Q_G =	0.0	lbs	
Q_E=	424.1	lbs	End shear for 1'x5.5' wall (WxH)
Q_{UF}=	302.9	lbs	End shear divided by CJ factor
Per detail A/S-5, wall anchors @ S =	4.00	ft	Typical anchor @ 4'-0" per S-4
Out of plane force T_{UF}=	**1,212**	lbs	Each anchor location
Typical anchor capacity per A/S-5			
Simpso PAT 18 @ 48"=	5685	lbs	
(2) 5/8" bolt in 2x =2*760*3=	4380	lbs	
Ncn=	**4,380**	lbs	>= T_{UF}, Okay
Typical anchor capacity per D/S-5	4.00	ft	Typical anchor @ 4'-0" per D/S-5
Out of plane force T_{UF}=	**1,212**	lbs	Simpson PAT18 @ 48"
Typical anchor capacity per D/S-5			
Simpso PAT 18 @ 48"=	5685	lbs	
Ncn=	**5,685**	lbs	>= T_{UF}, Okay

Therefore, wall out-of-plane anchorage is sufficient.



Note: 1977 Music Room Additon is similar to that of Cafeteria Building, detailed shear stress check and wall connection checks not done. Those of Cafeteria building also applies to music rooom addition.

Diaphragm Shear Capacity for Unblock Wood Panel Diaphragms (Music Room Addition only)

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 7-25
k=1.0

	w_x	h_x	$w_x h_x$	Fx	Area	fi
	kip	ft	k-ft	kip	ft2	psf
Roof	424	19	8054	303	11081.0	27.3
Sum =	424		8054	303		

max shear in diaphragm = 27.3*22' = 600.6 plf
Capacity of 0.5" plywood w/10d@6" = 240.0 plf allowable
expected capacity = 480.0 plf
m factor for wood panel unblocked diaphragm = 2.5 for life safety per Table 12-3, ASCE 41-13
capacity mvexpcted = 1200.0 plf > v_{max}, OK

So, diaphragm shear capacity is sufficient

Forces-RM1 Cafeteria

Table 11B BOLTS: Reference Lateral Design Values (Z) for Single Shear (two member) Connections[1,2]

for sawn lumber or SCL with 1/4" ASTM A 36 steel side plate

Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_{\parallel}$ lbs.	G=0.67 Red Oak $Z_{\perp}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\parallel}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\perp}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\parallel}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\perp}$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_{\parallel}$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_{\perp}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\parallel}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\perp}$ lbs.	G=0.43 Hem-Fir $Z_{\parallel}$ lbs.	G=0.43 Hem-Fir $Z_{\perp}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\parallel}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\perp}$ lbs.	G=0.37 Redwood (open grain) $Z_{\parallel}$ lbs.	G=0.37 Redwood (open grain) $Z_{\perp}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\parallel}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\perp}$ lbs.	G=0.35 Northern Species $Z_{\parallel}$ lbs.	G=0.35 Northern Species $Z_{\perp}$ lbs.
1-1/2	1/4	1/2	730	420	620	350	580	310	580	310	550	290	520	280	510	270	470	240	460	240	450	230
		5/8	910	480	780	400	730	360	720	360	690	340	650	320	640	320	590	290	580	280	560	270
		3/4	1090	550	940	450	870	420	860	410	820	390	780	360	770	360	710	320	690	320	680	310
		7/8	1270	600	1090	510	1020	470	1010	450	960	430	910	410	900	400	820	370	810	360	790	350
		1	1460	660	1250	550	1170	510	1150	500	1100	480	1040	450	1030	450	940	400	930	400	900	390
1-3/4	1/4	1/2	810	460	690	370	640	340	630	330	600	310	570	290	560	280	510	250	500	250	490	240
		5/8	1020	520	870	430	800	390	790	380	750	360	710	340	700	330	640	300	630	290	610	280
		3/4	1220	590	1040	480	960	440	950	430	900	410	860	380	840	370	770	330	750	330	730	320
		7/8	1420	650	1210	540	1130	490	1110	480	1050	450	1000	420	980	420	890	380	880	370	850	360
		1	1630	710	1380	580	1290	540	1270	520	1200	500	1140	470	1120	460	1020	410	1000	410	980	400
2-1/2	1/4	1/2	930	600	860	470	830	410	820	400	780	380	740	350	720	340	650	300	640	290	620	280
		5/8	1370	670	1150	530	1050	470	1040	470	980	430	920	400	910	390	810	340	800	330	770	320
		3/4	1640	750	1370	590	1270	530	1250	520	1180	490	1110	450	1090	440	980	380	960	370	930	360
		7/8	1910	820	1600	650	1480	590	1450	570	1370	530	1290	490	1270	480	1140	420	1120	410	1080	400
		1	2190	880	1830	700	1690	640	1660	620	1570	580	1480	540	1450	530	1300	460	1280	450	1240	440
3-1/2	1/4	1/2	930	620	860	550	830	510	820	510	800	480	770	450	770	430	720	370	720	360	710	350
		5/8	1370	860	1260	690	1210	610	1200	600	1160	550	1130	500	1120	490	1060	420	1050	410	1020	400
		3/4	1900	990	1740	760	1670	680	1660	660	1580	610	1480	560	1450	540	1290	460	1260	450	1220	440
		7/8	2530	1070	2170	840	1990	740	1950	710	1840	660	1720	610	1690	590	1510	510	1480	500	1430	470
		1	2980	1150	2480	890	2270	800	2230	770	2100	730	1970	660	1930	650	1720	560	1690	540	1630	530
5-1/4	1/4	5/8	1370	860	1260	760	1210	710	1200	700	1160	670	1130	640	1120	630	1060	580	1050	560	1030	540
		3/4	1900	1140	1740	1000	1670	940	1660	930	1610	860	1560	770	1550	760	1460	640	1450	620	1420	600
		7/8	2530	1460	2320	1190	2220	1050	2200	1010	2140	920	2070	840	2050	820	1940	700	1920	680	1890	640
		1	3260	1660	2980	1270	2860	1130	2840	1080	2750	1010	2670	920	2640	890	2490	750	2450	730	2360	710
5-1/2	1/4	5/8	1370	860	1260	760	1210	710	1200	700	1160	670	1130	640	1120	630	1060	580	1050	570	1030	560
		3/4	1900	1140	1740	1000	1670	940	1660	930	1610	890	1560	810	1550	790	1460	660	1450	640	1420	620
		7/8	2530	1460	2320	1240	2220	1090	2200	1050	2140	960	2070	880	2050	860	1940	730	1920	710	1890	660
		1	3260	1730	2980	1320	2860	1170	2840	1130	2750	1050	2670	950	2640	930	2490	780	2470	760	2420	740
7-1/2	1/4	5/8	1370	860	1260	760	1210	710	1200	700	1160	670	1130	640	1120	630	1060	580	1050	570	1030	560
		3/4	1900	1140	1740	1000	1670	940	1660	930	1610	890	1560	850	1550	840	1460	760	1450	750	1420	740
		7/8	2530	1460	2320	1280	2220	1210	2200	1180	2140	1130	2070	1080	2050	1070	1940	960	1920	930	1890	870
		1	3260	1820	2980	1590	2860	1500	2840	1470	2750	1400	2670	1270	2640	1230	2490	1030	2470	1000	2420	960
9-1/2	1/4	3/4	1900	1140	1740	1000	1670	940	1660	930	1610	890	1560	850	1550	840	1460	760	1450	750	1420	740
		7/8	2530	1460	2320	1280	2220	1210	2200	1180	2140	1130	2070	1080	2050	1070	1940	980	1920	970	1890	930
		1	3260	1820	2980	1590	2860	1500	2840	1470	2750	1420	2670	1350	2640	1330	2490	1220	2470	1200	2420	1180
11-1/2	1/4	7/8	2530	1460	2320	1280	2220	1210	2200	1180	2140	1130	2070	1080	2050	1070	1940	980	1920	970	1890	930
		1	3260	1820	2980	1590	2860	1500	2840	1470	2750	1420	2670	1350	2640	1330	2490	1220	2470	1200	2420	1180
13-1/2	1/4	1	3260	1820	2980	1590	2860	1500	2840	1470	2750	1420	2670	1350	2640	1330	2490	1220	2470	1200	2420	1180

1. Tabulated lateral design values (Z) for bolted connections shall be multiplied by all applicable adjustment factors (see Table 10.3.1).
2. Tabulated lateral design values (Z) are for "full diameter" bolts (see Appendix L) with bending yield strength (F_{yb}) of 45,000 psi and dowel bearing strength (F_e) of 87,000 psi for ASTM A 36 steel.

Use ASD to LRFD factor = 3

Table 11.3.1B Reduction Term, R_d

Fastener Size	Yield Mode	Reduction Term, R_d
$0.25" \le D \le 1"$	I_m, I_s	$4\ K_\theta$
	II	$3.6\ K_\theta$
	III_m, III_s, IV	$3.2\ K_\theta$
$D < 0.25"$	I_m, I_s, II, III_m, III_s, IV	K_D[1]

Notes:

K_θ = $1 + 0.25(\theta/90)$

θ = maximum angle of load to grain ($0^\circ \le \theta \le 90^\circ$) for any member in a connection

D = diameter, in. (see 11.3.6)

K_D = 2.2 for $D \le 0.17"$

K_D = $10D + 0.5$ for $0.17" < D < 0.25"$

1. For threaded fasteners where nominal diameter (see Appendix L) is greater than or equal to 0.25" and root diameter is less than 0.25", $R_d = K_D\ K_\theta$.

11.3.2 Dowel Bearing Strength

11.3.2.1 Dowel bearing strengths, F_e, for parallel or perpendicular to grain loading are provided for dowel-type fasteners with $1/4" \le D \le 1"$ in Table 11.3.2. When fastener diameter, $D < 1/4"$, a single dowel bearing strength, F_e, is used for both parallel and perpendicular to grain loading.

11.3.2.2 Dowel bearing strengths, F_e, for wood structural panels are provided in Table 11.3.2B.

11.3.2.3 Dowel bearing strengths, F_e, for structural composite lumber shall be obtained from the manufacturer's literature or code evaluation report.

11.3.2.4 When dowel-type fasteners with $D \ge 1/4"$ are inserted into the end grain of the main member, with the fastener axis parallel to the wood fibers, $F_{e\perp}$ shall be used in determination of the dowel bearing strength of the main member, F_{em}.

11.3.3 Dowel Bearing Strength at an Angle to Grain

When a member in a connection is loaded at an angle to grain, the dowel bearing strength, $F_{e\theta}$, for the member shall be determined as follows (see Appendix J):

$$F_{e\theta} = \frac{F_{e\parallel} F_{e\perp}}{F_{e\parallel} \sin^2\theta + F_{e\perp} \cos^2\theta} \qquad (11.3\text{-}11)$$

where:

θ = angle between direction of load and direction of grain (longitudinal axis of member).

Figure 11B Single Shear Bolted Connections

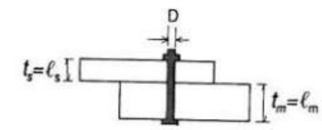
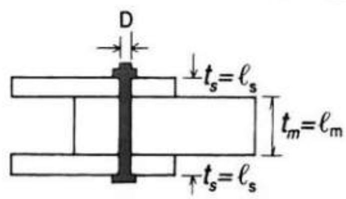


Figure 11C Double Shear Bolted Connections



11.3.4 Dowel Bearing Length

11.3.4.1 Dowel bearing length in the side member(s) and main member, ℓ_s and ℓ_m, represent the length of dowel bearing perpendicular to the application of load. The length of dowel bearing shall not include the tapered tip of a fastener for fastener penetration lengths less than 10D.

11.3.5 Dowel Bending Yield Strength

11.3.5.1 Reference design values for bolts, lag screws, wood screws, nails, and spikes are based on bending yield strengths provided in Tables 11A through 11R.

11.3.5.2 Dowel bending yield strengths, F_{yb}, used in calculation of reference design values shall be based on yield strength derived using methods provided in ASTM F 1575 or the tensile yield strength derived using procedures of ASTM F 606.

11.3.6 Dowel Diameter

11.3.6.1 When used in Tables 11.3-1A and 11.3-1B, the fastener diameter shall be taken as D for unthreaded full-body diameter fasteners and D_r for reduced body diameter fasteners or threaded fasteners except as provided in 11.3.6.2. For bolts meeting the requirements of ANSI/ASME Standard B18.2.1 for full-body diameter bolts, the fastener diameter shall be taken as D (see Appendix L).

Table 11K LAG SCREWS: Reference Lateral Design Values (Z) for Single Shear (two member) Connections[1,2,3]

with 1/4" ASTM A 36 steel side plate, or ASTM A 653, Grade 33 steel side plate (for t_s < 1/4")

Side Member Thickness	Lag Screw Diameter	G=0.67 Red Oak		G=0.55 Mixed Maple Southern Pine		G=0.5 Douglas Fir-Larch		G=0.49 Douglas Fir-Larch (N)		G=0.46 Douglas Fir(S) Hem-Fir(N)		G=0.43 Hem-Fir		G=0.42 Spruce-Pine-Fir		G=0.37 Redwood (open grain)		G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods		G=0.35 Northern Species	
t_s	D	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$
in.	in.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0.075 (14 gage)	1/4	170	130	160	120	150	110	150	110	150	100	140	100	140	100	130	90	130	90	130	90
	5/16	220	160	200	140	190	130	190	130	190	130	180	120	180	120	170	110	170	110	160	100
	3/8	220	160	200	140	200	130	190	130	190	120	180	120	180	120	170	110	170	100	170	100
0.105 (12 gage)	1/4	180	140	170	130	160	120	160	120	160	110	150	110	150	110	140	100	140	100	140	90
	5/16	230	170	210	150	200	140	200	140	190	130	190	130	190	120	180	110	170	110	170	110
	3/8	230	160	210	140	200	140	200	130	200	130	190	120	190	120	180	110	180	110	170	110
0.120 (11 gage)	1/4	190	150	180	130	170	120	170	120	160	120	160	110	160	110	150	100	150	100	140	100
	5/16	230	170	210	150	210	140	200	140	200	140	190	130	190	130	180	120	180	120	180	110
	3/8	240	170	220	150	210	140	210	140	200	130	200	130	190	120	180	110	180	110	180	110
0.134 (10 gage)	1/4	200	150	180	140	180	130	170	130	170	120	160	120	160	110	150	110	150	100	150	100
	5/16	240	180	220	160	210	150	210	140	200	140	200	130	200	130	190	120	180	120	180	120
	3/8	240	170	220	150	220	140	210	140	210	140	200	130	200	130	190	120	190	120	180	110
0.179 (7 gage)	1/4	220	170	210	150	200	150	200	140	190	140	190	130	190	130	180	120	170	120	170	120
	5/16	260	190	240	170	230	160	230	160	230	150	220	150	220	150	210	130	200	130	200	130
	3/8	270	190	250	170	240	160	240	160	230	150	220	140	220	140	210	130	210	130	200	130
0.239 (3 gage)	1/4	240	180	220	160	210	150	210	150	200	140	190	140	190	130	180	120	180	120	180	120
	5/16	300	220	280	190	270	180	260	180	260	170	250	160	250	160	230	150	230	150	230	140
	3/8	310	220	280	190	270	180	270	180	260	170	250	160	250	160	240	140	230	140	230	140
	7/16	420	290	390	260	380	240	370	240	360	230	350	220	350	220	330	200	330	200	320	190
	1/2	510	340	470	300	460	290	450	280	440	270	430	260	420	260	400	240	400	230	390	230
	5/8	770	490	710	430	680	400	680	400	660	380	640	370	630	360	600	330	590	330	580	320
	3/4	1110	670	1020	590	980	560	970	550	950	530	920	500	910	500	860	450	850	450	840	440
	7/8	1510	880	1390	780	1330	730	1320	710	1280	690	1250	650	1230	650	1170	590	1160	590	1140	570
	1	1940	1100	1780	960	1710	910	1700	890	1650	860	1600	820	1590	810	1500	740	1480	730	1460	710
1/4	1/4	240	180	220	160	210	150	210	150	200	140	200	140	190	130	180	120	180	120	180	120
	5/16	310	220	280	200	270	180	270	180	260	170	250	170	250	160	230	150	230	150	230	140
	3/8	320	220	290	190	280	180	270	180	270	170	260	160	250	160	240	150	240	140	230	140
	7/16	480	320	440	280	420	270	420	260	410	250	390	240	390	230	370	220	360	210	360	210
	1/2	580	390	540	340	520	320	510	320	500	310	480	290	480	290	460	270	450	260	440	260
	5/8	850	530	780	470	750	440	740	440	720	420	700	400	690	400	660	370	650	360	640	350
	3/4	1200	730	1100	640	1060	600	1050	590	1020	570	990	540	980	530	930	490	920	480	900	470
	7/8	1600	930	1470	820	1410	770	1400	750	1360	720	1320	690	1310	680	1240	630	1220	620	1200	600
	1	2040	1150	1870	1000	1800	950	1780	930	1730	900	1680	850	1660	840	1570	770	1550	760	1530	740

1. Tabulated lateral design values (Z) shall be multiplied by all applicable adjustment factors (see Table 10.3.1).
2. Tabulated lateral design values (Z) are for "reduced body diameter" lag screws (see Appendix L) inserted in side grain with screw axis perpendicular to wood fibers; minimum screw penetration, p, into the main member equal to 8D; dowel bearing strengths (F_e) of 61,850 psi for ASTM A 653, Grade 33 steel and 87,000 psi for ASTM A 36 steel and screw bending yield strengths (F_{yb}): F_{yb} = 70,000 psi for D = 1/4"; F_{yb} = 60,000 psi for D = 5/16"; F_{yb} = 45,000 psi for D ≥ 3/8"
3. When 4D ≤ p < 8D, tabulated lateral design values (Z) shall be multiplied by p/8D.

www.strongtie.com

PA/HPA Purlin Anchors

PA/HPA purlin anchors offer solutions for wood to concrete and concrete block connections which satisfy code requirements. The PAs dual embedment line allows installation in concrete or concrete block.

Material: PA – 12 gauge; HPA – 10 gauge.

Finish: Galvanized. PA's available HDG or ZMAX® coating .

Load Table
Gallery of images
Code Reports
Drawings
Catalog Page
Related Categories
Technical Bulletins
Help for downloads

Installation:

- Use all specified fasteners; some models have extra fastener holes. See General Notes.
- Purlin Anchor must hook around rebar.
- Allowable loads are for a horizontal installation into the side of a concrete or masonry wall.
- Strap may be bent one full cycle. (Bent vertical 90° then bent horizontal.)

Edge Distance: Minimum concrete edge distance is 5". Minimum concrete block left-to-right edge distance is 20".

Concrete Block Walls: The minimum wall specifications are:

A One # 4 vertical rebar, 32" long, 16" each side of anchor;
B Two courses of grout filled block above and below the anchor (no cold joints allowed);
C A horizontal bond beam with two #4 rebars, 40" long, a maximum of two courses above or below the anchor.
D Minimum masonry compressive strength, f'_m = 1500 psi.

Options: See LTT and HTT Tension Ties for alternate retrofit solutions.

ASCE7-10 12.11.2.2.5 states:
...Diaphragm to structural anchorage using embedded straps shall have the straps attached to or hooked around the reinforcing steel, or otherwise terminated to effectively transfer forces to the reinforcing steel.

Gallery:

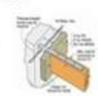
▲top

roll over images below to see larger image

HPA35

PA

PA/HPA Purlin to Concrete Block Wall (Refer to installation notes above)



PA/HPA Purlin to Concrete Wall See I-Joist applications

Load Table: See code report listings below

▲top

These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

Wind and SDC A & B - Allowable Tension Loads

Max. Ledger Size	Model No.	Strap Length, L (in.)	le (in.)	Non-Cracked Concrete		Cracked Concrete		Max. Allowable Strap Tensile Capacity	Masonry Installation
				Required Nails	Tension	Required Nails	Tension		
4x Ledger	PA18	18½	4	12 -10d Common	2430	12 -10d Common	2360	NA	1895
	PA23	23¾	4	16 -10d Common	3220	12 -10d Common	2360	NA	2815
	PA28	29	4	16 -10d Common	3370	12 -10d Common	2360	NA	2815
	PA35	35	4	16 -10d Common	3370	12 -10d Common	2360	NA	2815
	HPA28	32½	6	22 -10d Common	5145	20 -10d Common	4675	NA	—
	HPA35	38½	8¼	22 -10d Common	5145	22 -10d Common	5145	NA	—

SDC C-F - Allowable Tension Loads

Max. Ledger Size	Model No.	Strap Length, L (in.)	le (in.)	Non-Cracked Concrete		Cracked Concrete		Max. Allowable Strap Tensile Capacity	Masonry Installation
				Required Nails	Tension	Required Nails	Tension		
4x Ledger	PA18	18½	4	12 -10d Common	2430	10 -10d Common	1980	3220	1895
	PA23	23¾	4	14 -10d Common	2830	10 -10d Common	1980	3220	2815
	PA28	29	4	14 -10d Common	2830	10 -10d Common	1980	3935	2815
	PA35	35	4	14 -10d Common	2830	10 -10d Common	1980	3935	2815
	HPA28	32½	6	22 -10d Common	5145	18 -10d Common	4090	5145	—
	HPA35	38½	8¼	22 -10d Common	5145	22 -10d Common	5145	5145	—

1. Allowable loads have been increased for earthquake or wind load durations with no further increases allowed.
2. Deflection at highest allowable loads are as follows:
PA18 = 0.087", PA23 = 0.118", PA28 = 0.085", PA35 = 0.085", PA51 & 68 = 0.010", HPA28 = 0.133" and HPA35 = 0.132".
3. Multiply Seismic and Wind ASD load values by 1.4 or 1.6 respectively to obtain LRFD capacities.
4. Minimum center-to-center spacing is 3 times the required embedment. Standard installation is based on minimum 5" end distance.
5. For wall anchorage systems in SDC C-F, the maximum allowable strap tensile capacity shall not be less than 1.4 times the ASD anchor design load per ASCE7-10 12.11.2.2.2.
6. Nail quantities are based on Douglas Fir (DF) and Southern Pine (SP). For use on Spruce Pine-Fir (SPF) or Hem Fir (HF) nail quantities must be increased by 1.15 to achieve allowable loads – alternatively, loads may be decreased by a 1.15 factor.
7. Concrete shall have a minimum concrete strength, f'_c of 3000 psi.
8. For Masonry Installation Loads, see 'Non-Cracked Concrete' for Required Nails.
9. 10dx1 1/2" nails may be substituted for 10d commons with no load reduction and with a 15% increase in deflection. For installation over sheathing use 3" minimum nail lengths.
10. Minimum f'_m = 1500 psi for masonry.
11. NAILS: 10d = 0.148" dia. x 3" long.. See other nail sizes and information.

Code Reports (PDFs):

▾next ▴top

	IAPMO UES ER	ICC-ES ESR	CITY OF LOS ANGELES	STATE OF FLORIDA	LEGACY REPORTS: ICC-ES NER	ICC-ES ER	ICC-ES ES
HPA	See specific model numbers for code listings.						
HPA28		ESR-2920 / ESR-2523 *					
HPA35		ESR-2920 / ESR-2523 *					
PA	See specific model numbers for code listings.						
PA18		ESR-2920 / ESR-2523 *		FL13904			
PA23		ESR-2920 / ESR-2523 *		FL13904			
PA28		ESR-2920 / ESR-2523 *		FL13904			
PA35		ESR-2920 / ESR-2523 *		FL13904			

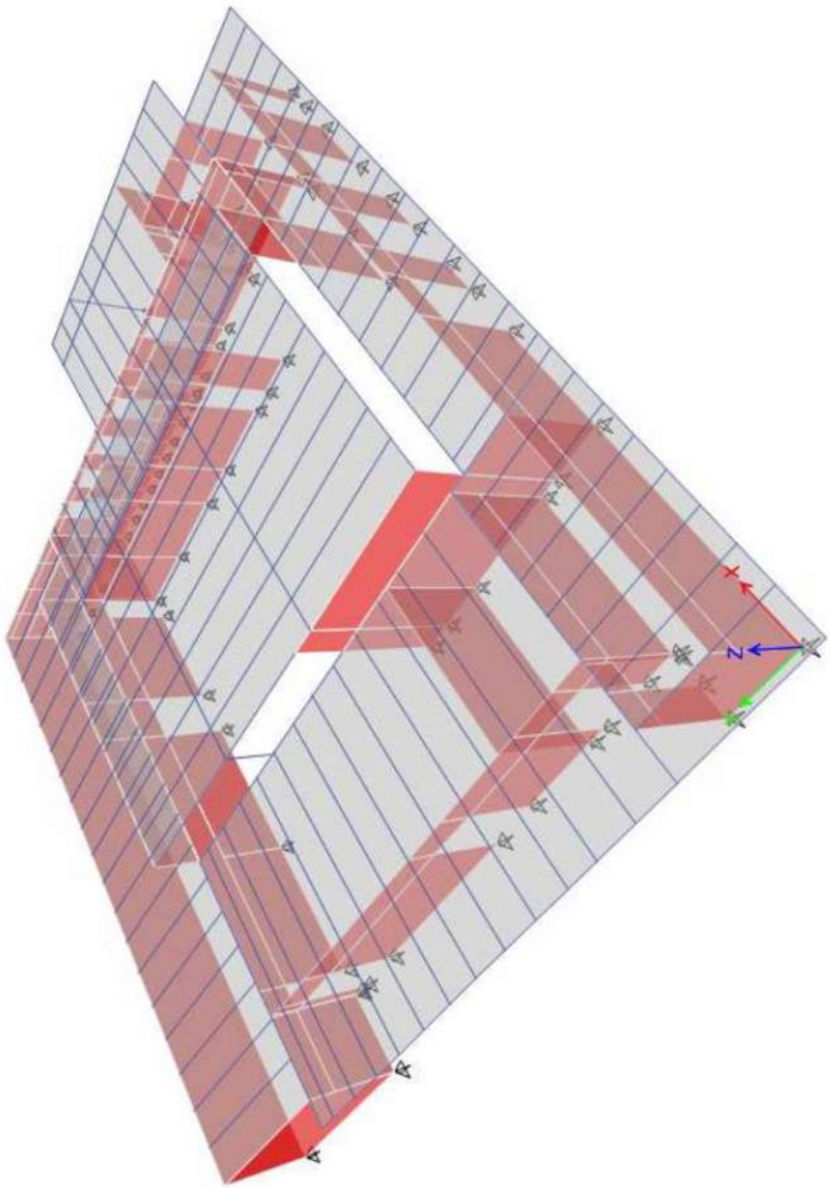
* ESR-2523 is an index of many of Simpson Strong-Tie Stamped and Welded Cold-formed Steel Products for Wood or Cold-formed Steel Construction

Drawings: To download drawings, right-click or Ctrl-click on the link, then choose "Save Target As..."

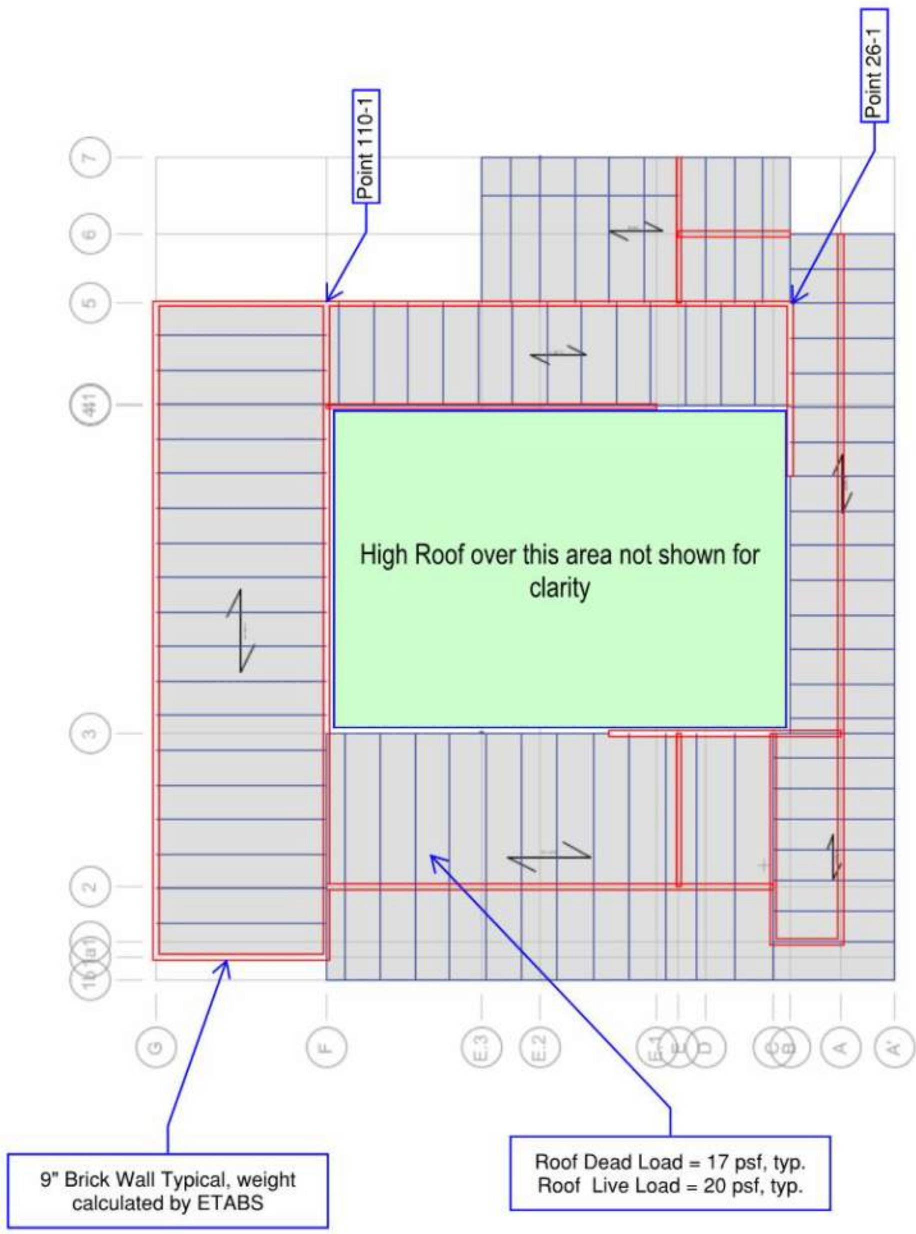
▾next ▴top

Download the Simpson Strong-Tie® AutoCAD® Menu, which allows you to insert Ortho views directly into your AutoCAD drawing.

	ORTHOGRAPHIC	PERSPECTIVE
HPA	None for this model	PA & HPA: DWG | DXF



Multipurpose Building B - Cafeteria Addition, ETABS Model 3D View



Multipurpose Building B - Cafeteria Addition, ETABS Model Low Roof Plan

1 Analysis Results

This chapter provides analysis results.

1.1 Point Results

Table 1.1 - Joint Displacements

Story	Label	Unique Name	Load Case/Combo	UX in	UY in	UZ in	RX rad	RY rad	RZ rad
Roof	26-1	72	QX1E Max	0.00047	0.000182	7.2E-05	4E-06	3E-06	5E-06
Roof	110-1	30	QX1E Max	0.000336	0.000185	5.5E-05	3E-06	4E-06	7E-06

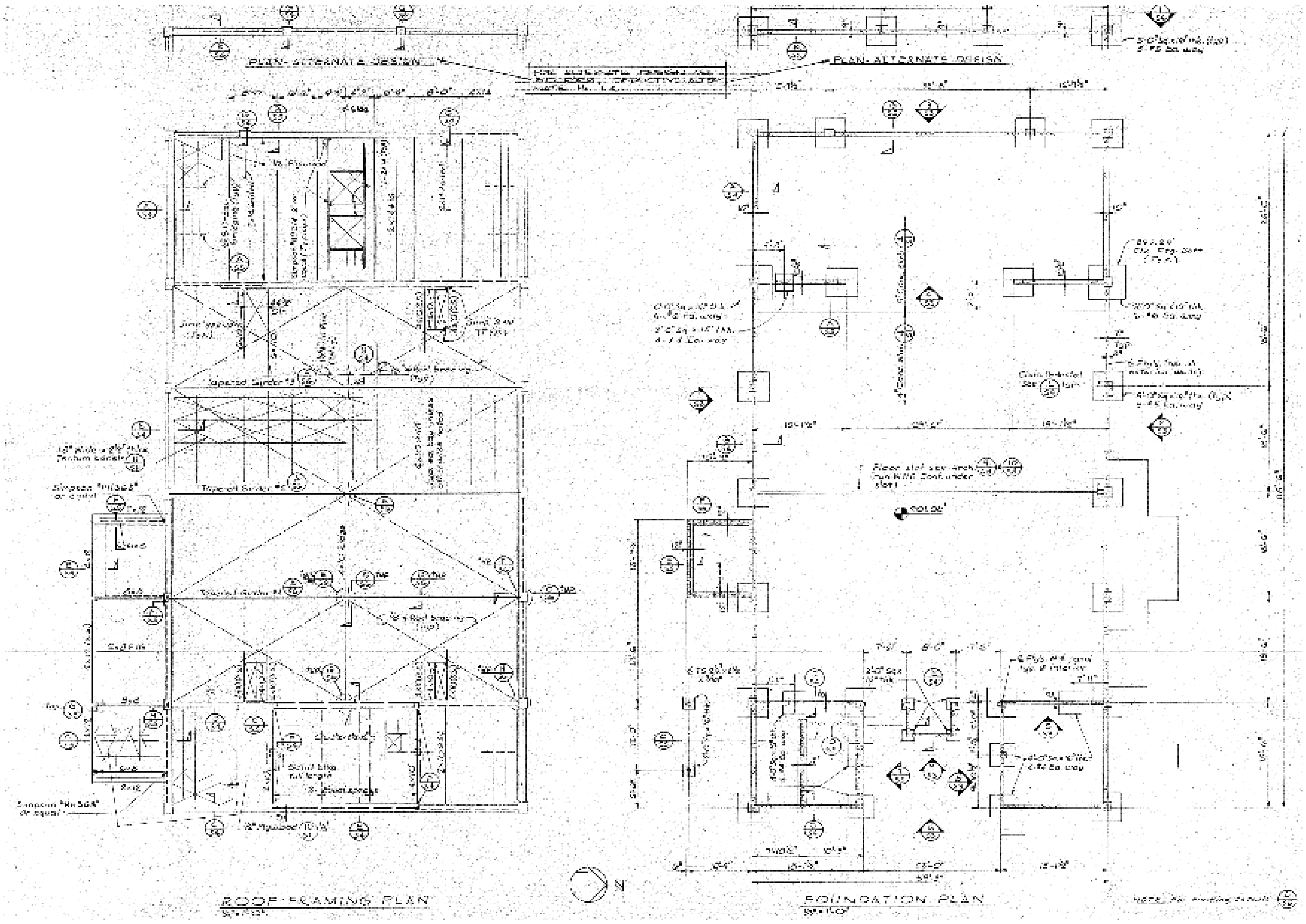
Average Displacement of Point 26-1 & 110-1, D_{avrage} = (0.00047+0.000336)/2=0.0004 inch

For building separation at adjacent Multipurpose PC1 portion, required separation

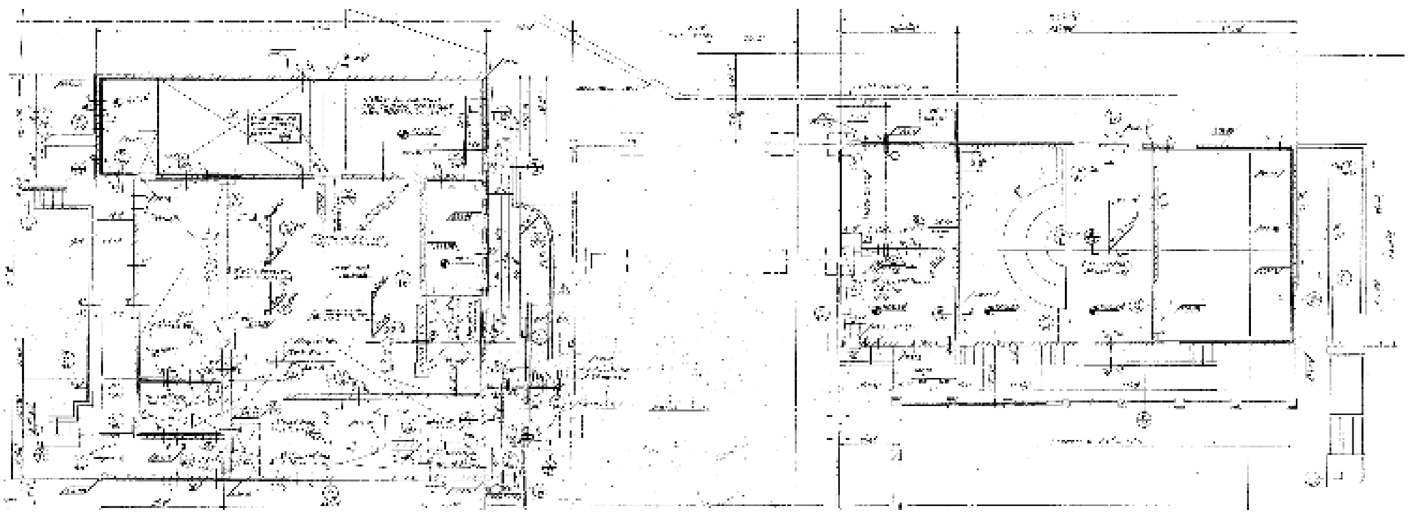
$D_{req} = (0.0004^2+0.004^2)^{0.5} = 0.0005$ inch

Provided building separation is 1.5" > D_{req}, OK

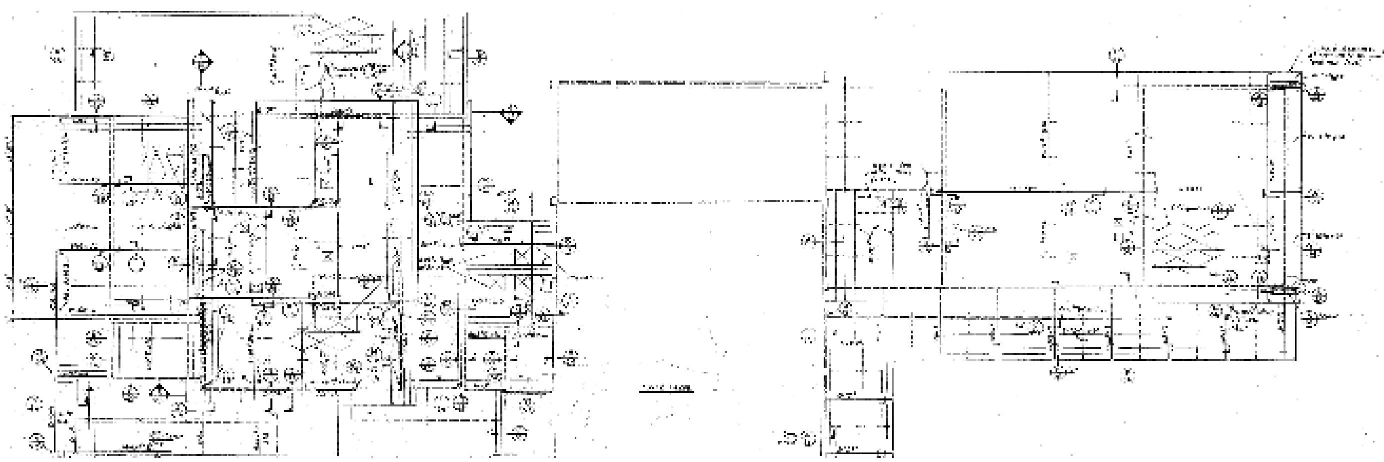
Appendix 1-C: As-Built Plans



Roof and Foundation Plan (1972 Sheet S-2)



Foundation Plan (1977 Addition Sheet S-2)



Roof Plan (1977 Addition Sheet S-3)

Appendix 7A – Images of Existing Conditions

Fig 1. Precast wall panels at front of MP room

Fig 2. Exterior ramp adjacent to wall panels

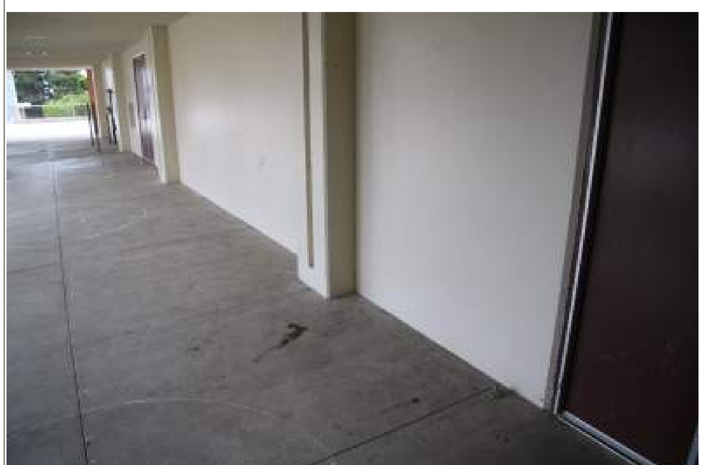


Fig 3. Covered walkway adjacent to wall panels

Fig 4. Stage to adjacent room through wall panel

Fig 5. Electrical equipment mounted to wall panels

Fig 6. Precast wall panels from inside the MP room

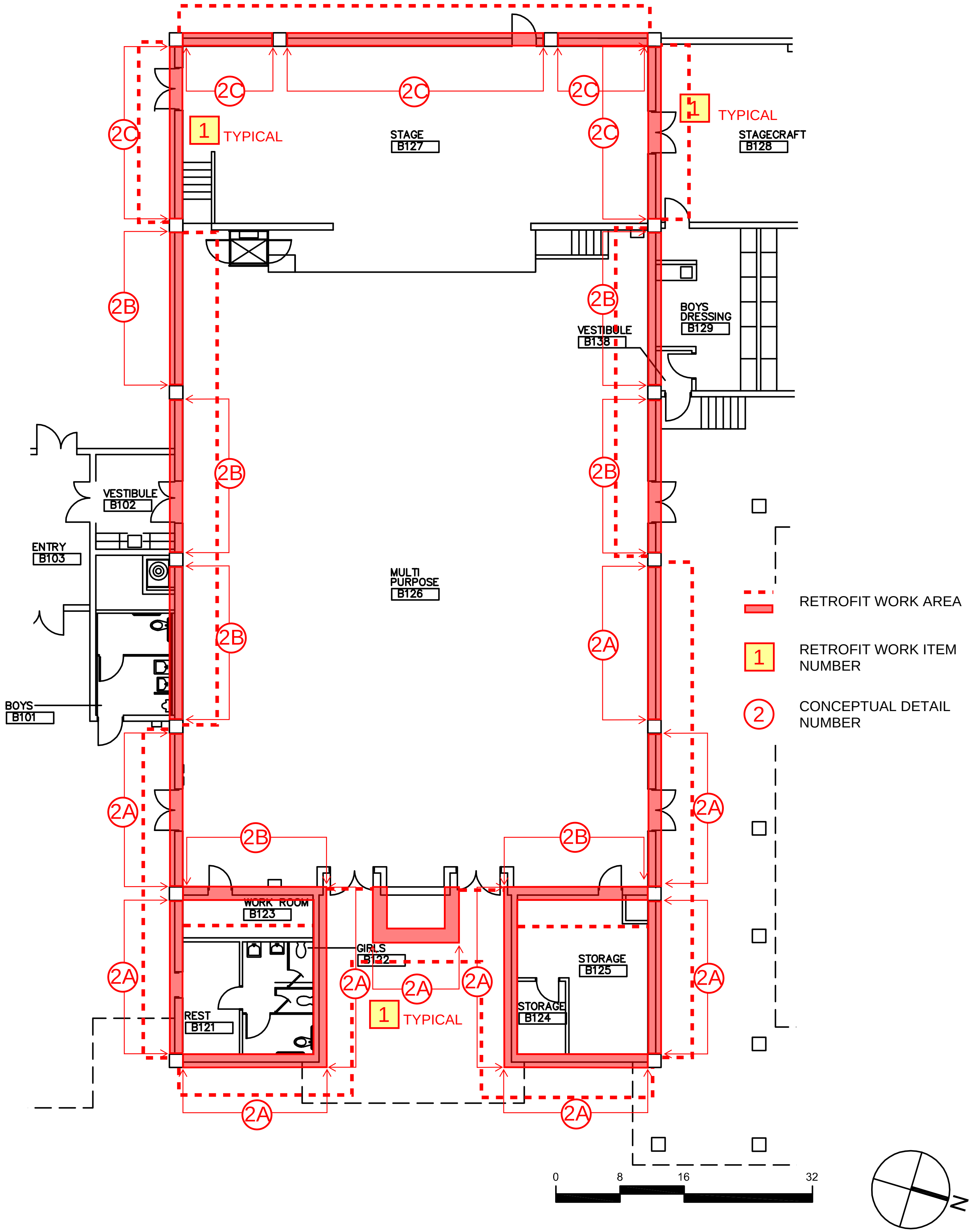
Fig 7. Wall panels at entry ticket booth from exterior

Fig 8. Elevated area at wall panels behind the stage

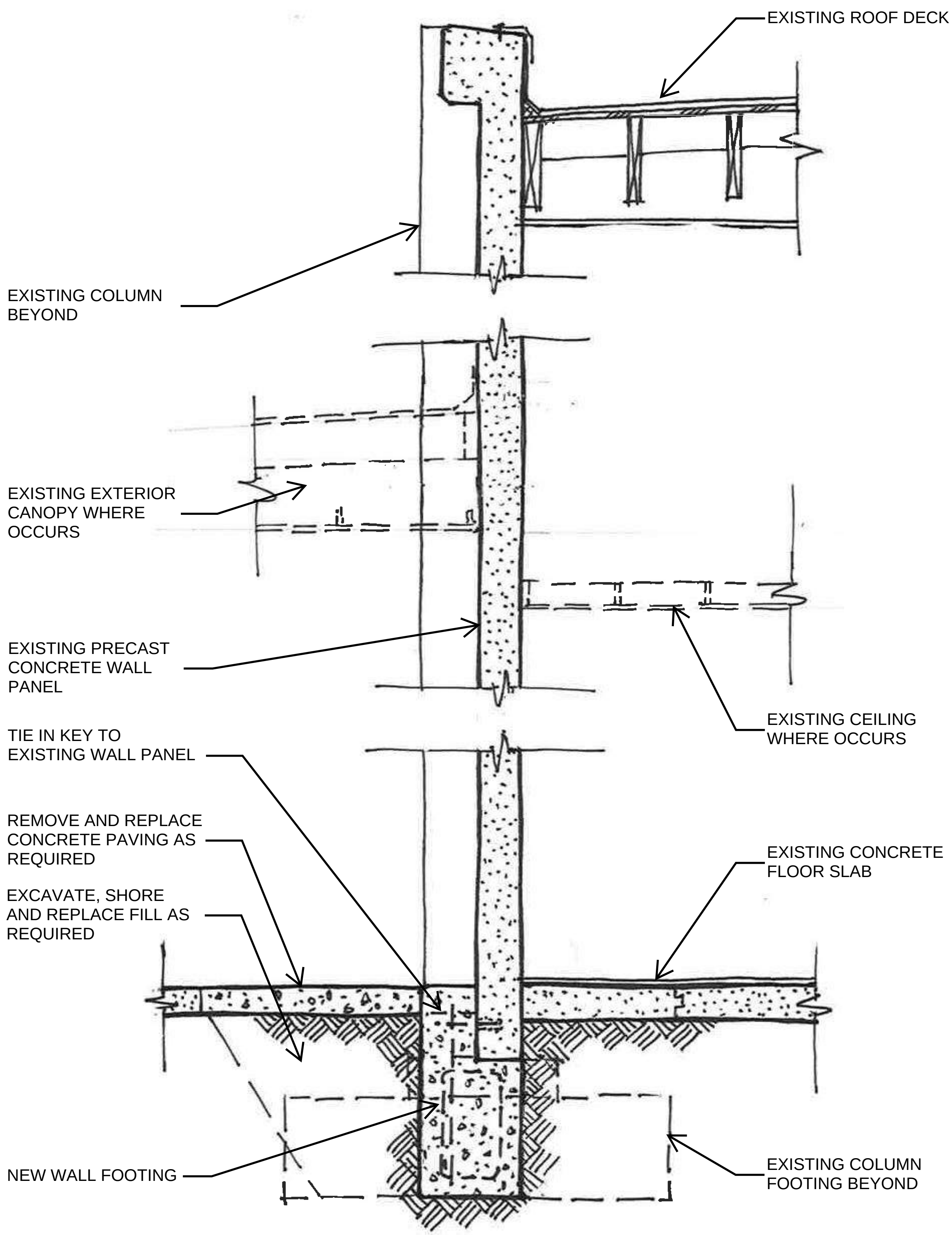
Fig 9. Elevated entry to the stage through wall panel

Fig 10. Exterior stair to elevated room adjacent to wall panels

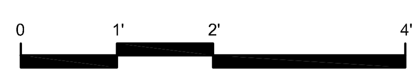
Fig 11. Exterior soffited area at wall panels



MIRALESTE IS - BUILDING B



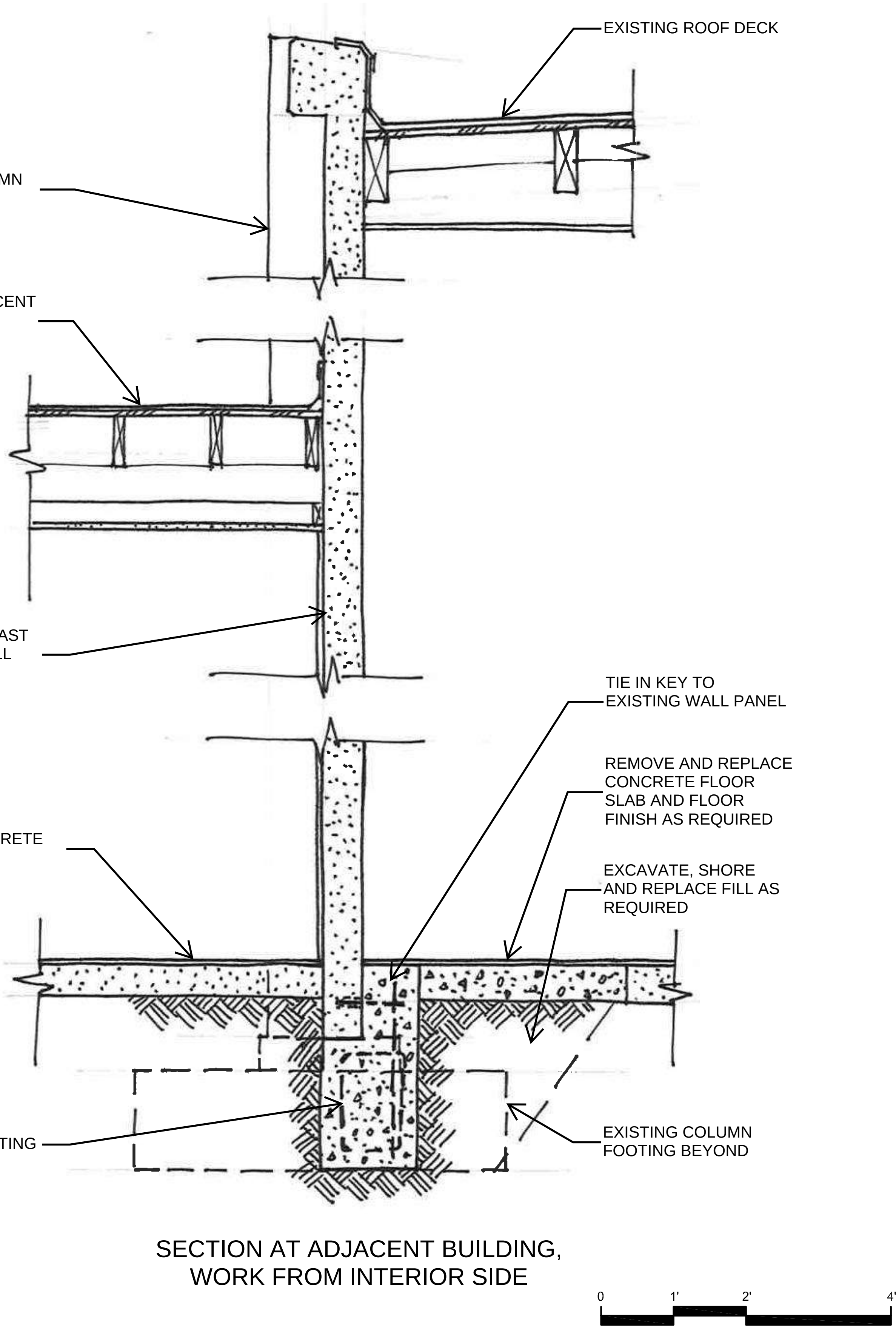
SECTION AT FLUSH EXTERIOR, WORK FROM EXTERIOR SIDE



PBWS

PRECAST WALL PANEL FOOTING ADDITION

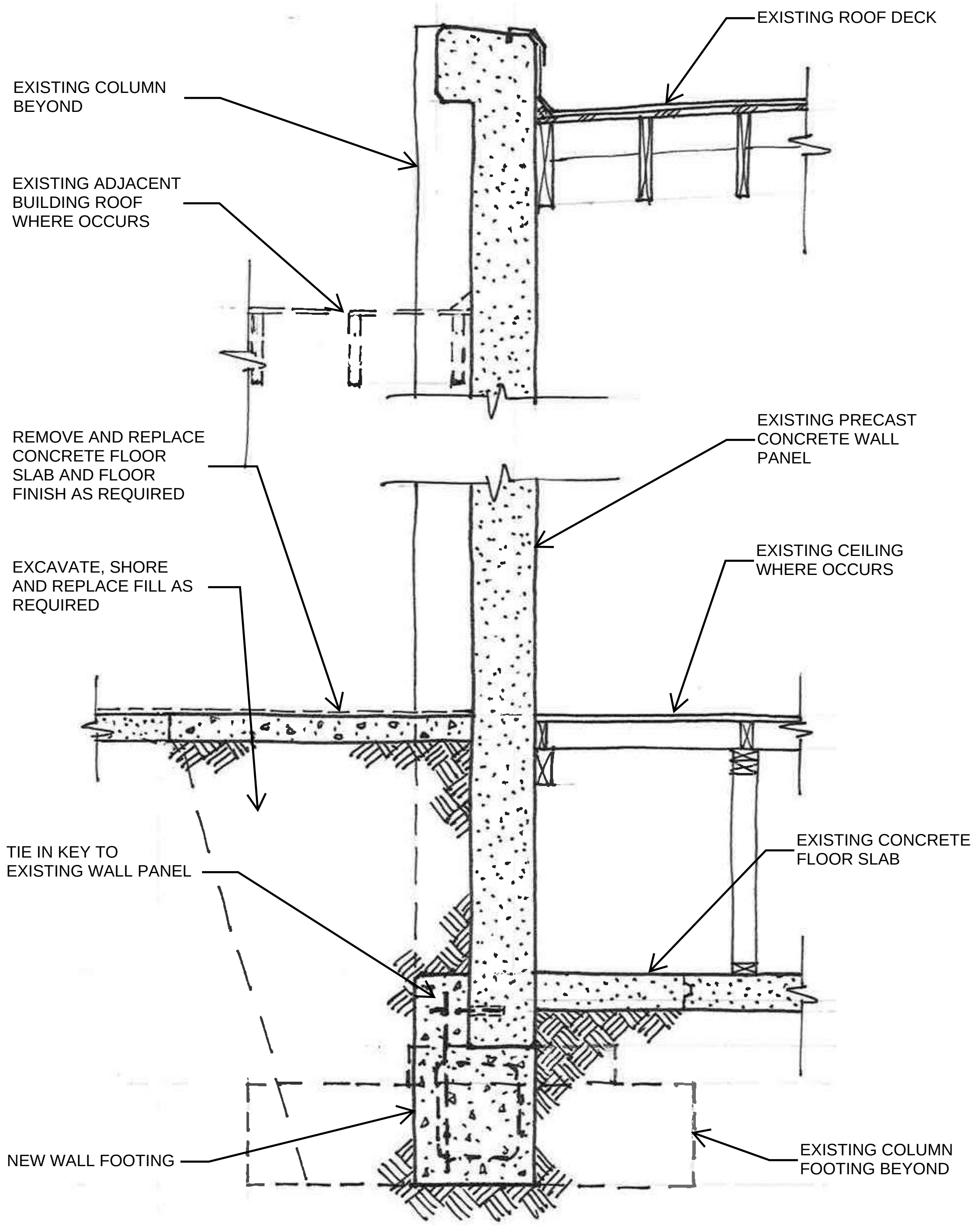
2A



SECTION AT ADJACENT BUILDING,
WORK FROM INTERIOR SIDE

PBWS

PRECAST WALL PANEL
FOOTING ADDITION
2B



SECTION AT ELEVATED EXTERIOR,
WORK FROM EXTERIOR SIDE

0 1' 2' 4'

PBWS

PRECAST WALL PANEL FOOTING ADDITION

2C

TTG

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
CLASSROOM BUILDING (C)

MIRALESTE INTERMEDIATE SCHOOL
29323 Palos Verdes Dr. E,
Rancho Palos Verdes, CA 90275

Terry Tsang, S.E.
Structural Engineer S2992
TTG Job No.: 0215.768.00

JANUARY 2016

300 N. Lake Avenue, 14th Floor, Pasadena, CA 91101 (626) 463-2800 Fax (626) 463-2801 www.ttgcorp.com

Table of Contents

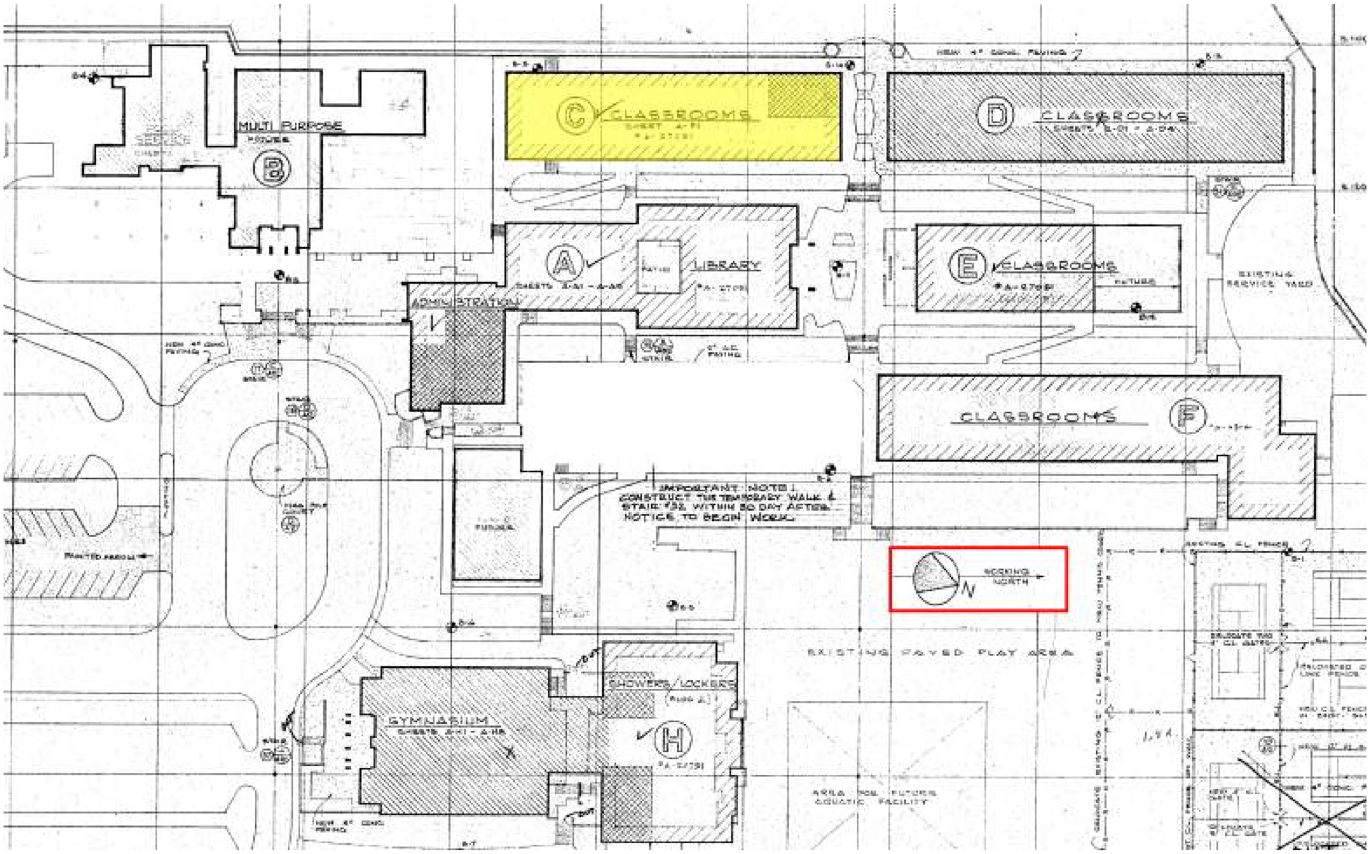
1.0 Introduction

A multiphase seismic vulnerability assessment of ***Classroom Building C*** was conducted, beginning with a site visit on ***12/21/2015***, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Picture of similar bldg.

An overall campus map of Jefferson High School, indicating the buildings under evaluation, is provided below. The highlighted building is ***Classroom Building C.***



Site Map- Classroom Building C

2.0 Classroom Building C

2.1 Site Seismicity

Per ASCE 41-13 (2012 IBC), for Miraleste Intermediate School located at 29323 Palos Verdes Dr. E, Rancho Palos Verdes, CA 90275

Site Coordinates = 33.75222°N, 118.32549°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.514 g; $S_{1,20/50}$ = 0.197 g
Fa = 1.389 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.01 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.714 g
$S_{X1} = F_v S_{1,20/20}$ = 0.396 g

2.2 Building Description

The Classroom Building 'C' is a one-story building in the western part of the school campus. The set of existing drawings is available dated February 1967, which shows the proposed building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of one story of classrooms. The building is rectangular with approximate dimensions of 80' x 250'. Total footprint of the building is estimated to be ±13,800 square feet. About 30 feet of south end of the building has a five feet step down. Roof typical height is about 13'-3".

The building consists of blocked plywood sitting on glulam chord ties with ridge glulam beam at center, which is considered flexible diaphragm. The building has continuous spread footing below the reinforced bearing brick walls and spread footing below gravity columns. The lateral system of the building is mainly formed of reinforced brick wall in both directions. Therefore, based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as "RM1".

The structural risk category for the administration building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Classroom Building C Summary Table	
Year Designed	1967
Drawings	***Original drawings prepared by Donley .Bundy & Associates(Arch.) & Wilson & Wilson Structural Engineers; dated February 1967***
Gravity System	Wood roof diaph. On glulam beams on bearing brick walls w/infill HSS columns
Lateral System	Reinforced Brick Walls
No. of Stories & Height	One Story; Main Roof: h_n=13.25 ft;
Building Period "T"	0.139 Sec
Base Shear "V"	0.714 W = 550 Kips
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	-

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of ***Classroom building C*** is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

No deficiencies were identified post Tier 1 analysis.

3.2 ASCE 41-13 Tier 2 Evaluation

No Tier 2 evaluation required.

4.0 Conclusions

After further review and updating tier 1 checklist as per ASCE 41-13, no major deficiencies were identified which required tier 2 evaluation.

Given the reason above, a voluntary seismic retrofit is not required for this structure.

5.0 Documents Reviewed

The following existing drawings were reviewed:

Date	Architect / Engineer	TTG Comments
February 1967	Donley. Bundy & Associates (Architect) Wilson & Wilson (Structural Engineer)	Title Block states "Building C" (State of California – Department of General Services, Office of Architecture and Construction Project No. 27051)

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Miraleste Intermediate School Building C, Classrooms

Table of Contents

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the

234 E. Colorado Boulevard Suite 700, Pasadena, California 91101 T: 626.432.5000 F: 626.432.5010 www.pbws.com Architecture Planning Interiors

District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Miraleste Intermediate School was originally constructed as a public high school with in the Palos Verdes Peninsula Unified School District. It was constructed in four phases in 1967, 1970, 1973 and 1977. It was originally called Miraleste High School and has been in constant use as a public school since that time. The original campus buildings were designed by the firm of Donley Bundy & Associates and is mostly of reinforced brick and concrete masonry, and wood construction. The building referred to as Building C is part of the 1967 phase.

Building C contains classrooms in a single story rectangular plan with back to back classrooms. There are circulation walkways around the building with overhangs to shade. It is a reinforced brick masonry wall structure with a concrete bond beam around the top of the walls to transfer the roof beam load to the walls. The roof structure is a wood framed with glue laminated beams and secondary joists.

All portions of the building are of Type-5 non-rated construction and appear fit within the current CBC Type-5B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how

the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Work

No Recommended Retrofit
After further tier 2 analysis it was determined that the building does not require any seismic retrofit work for life safety.

Accessibility Upgrades

There are no accessibility upgrades anticipated for this building since no retrofit work is recommended.

Fire & Life Safety

There are no fire & life safety upgrades anticipated for this building since no retrofit work is recommended.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Appendix 1-A: Tier 1 Screening Checklists/Calculation

ASCE 41-13

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path, so compliant.
x				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.3)	No adjacent bldg.
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanine levels in the building, not applicable.
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	One story bldg.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	One story bldg.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	Per review of as-built and site investigation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	One story bldg.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	One story bldg.
		x		TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Flexible diaphragm & more or less equal distribution of walls each side per as built.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
			x	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	No geotech report available but not anticipated per site location.
			x	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	No geotech report available
			x	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	No geotech report available
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					

C	NC	N/A	U	Checklist	Comments
x				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.714=0.43< min(60,230)/13.25=4.5 Compliant per review of existing drawings. Elements of the lateral system can work together, so building dimension is used for this check since all the elements are well connected.
x				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Compliant per review of existing foundation plan.(Ref. sheet S-C1)

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY BEARING WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY BEARING WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. Commentary Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1.	Per as-built dwgs
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in. 2 . Commentary Sec. A.3.2.4.1. Tier 2: Sec. 5.5.3.1.1.	See provided calc at end of checklist
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. Commentary Sec. A.3.2.4.2. Tier 2: Sec. 5.5.3.1.3.	See provided calc at end of checklist
Stiff Diaphragms					

C	NC	N/A	U	Checklist	Comments
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. Commentary Sec. A.4.5.1. Tier 2: Sec. 5.6.4	Wood diaphragm
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. Commentary Sec. A.5.1.1. Tier 2:Sec. 5.7.1.1.	See provided calc at end of checklist
		x		WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. Commentary Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3.	Per S-T2 details, no wood ledger exist.
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. Commentary Sec. A.5.2.1. Tier 2: Sec. 5.7.2.	Per A/S-T2, anchor bolts @ each Glulam beam location and 48" o.c. in between provided
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. Commentary Sec. A.5.2.3. Tier 2: Sec. 5.7.2.	All wood diaphragm
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. Commentary Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4	Per S-T3 details
x				GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. Commentary Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1.	Per H/S-T4
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.					

C	NC	N/A	U	Checklist	Comments
Stiff Diaphragms					
		x		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. Commentary Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3.	Flexible diaphragm
		x		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. Commentary Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3.	Flexible diaphragm
Flexible Diaphragms					
x				CROSS TIES: There are continuous cross ties between diaphragm chords. Commentary Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2.	Glulam beams as cross ties between chords…per S-C1 roof plan
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. Commentary Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3.	No large opening…ref. S-C1 roof plan
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. Commentary Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3.	No large opening…ref. S-C1 roof plan
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. Commentary Sec. A.4.2.1. Tier 2: Sec. 5.6.2	5/8” plywood diaphragm per S-C1 roof plan
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. Commentary Sec. A.4.2.2. Tier 2: Sec. 5.6.2.	5/8” plywood diaphragm per S-C1 roof plan
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. Commentary Sec. A.4.2.3. Tier 2: Sec. 5.6.2.	Blocked plywood diaphragm per S-C1 roof plan
x				OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than	Wood diaphragm

C	NC	N/A	U	Checklist	Comments
				wood, metal deck, concrete, or horizontal bracing. Commentary Sec. A.4.7.1. Tier 2: Sec. 5.6.5.	
Connections					
x				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. Commentary Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2.	

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
Life Safety Systems					
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Hazardous Materials	
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
				Partitions	
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate	No URM partition, so not applicable.

C	NC	N/A	U	Checklist	Comments
				Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
Light Fixtures					
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Proper support was observed
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				Cladding and Glazing	
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	No multi-story panel, so not applicable.
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are	No cladding panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	
				Masonry Veneer	
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	No URM backup, so not applicable.
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
				Parapets, Cornices, Ornamentation, and Appendages	
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported	No URM parapet, so not applicable.

C	NC	N/A	U	Checklist	Comments
				unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	
			X	LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Not accessible during site visit
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No parapets; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	No such appendages were observed; So not applicable
				Masonry Chimneys	
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
				Stairs	
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness	No stairs, so not applicable.

C	NC	N/A	U	Checklist	Comments
				ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
				Contents and Furnishings	
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	
				Mechanical and Electrical Equipment	
	X			LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	Air conditioning units suspended from canopies over existing windows are not properly braced.
			X	LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Not accessible during site visit
X				LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	Proper anchorage was observed
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
				Piping	
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
				Ducts	
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				Elevators	
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW		Bldg Type= **RM1**
$C =$	1	From Table 4-8	
$S_a = \min(S_{XS}, S_{X1}/T)$		From Section 4.5.2.3	
$S_{X1} = F_V S_1$		Eq. 2-2	
$S_{XS} = F_a S_S$		Eq. 2-1	
$S_S =$	0.514	g, mapped spectral acceleration	
$S_1 =$	0.197	g, mapped spectral acceleration	
$S_{X1} =$	0.396	g	
$S_{XS} =$	0.714	g	
$T = C_t h_n^{\beta}$		From Section 4.5.2.4	
$C_t =$	0.02		
$h_n =$	13.25	ft., average height at sloped roof	
$\beta =$	0.75		
$T =$	0.139	sec.	
$S_a =$	0.714	g	
$V =$	0.714	W	

Check Seismic Mass For Shear Stress Check

Roof

Roofing	6	psf
5/8" plywood	2	psf
framing(purlins+sub-purlins)	4	psf
MEP	3	psf
Ceiling	4	psf
Misc	1	psf
DL =	**20**	**psf**
Use	**20**	**psf**

CMU Wall Weight

8 1/2" CMU wall =	96	psf

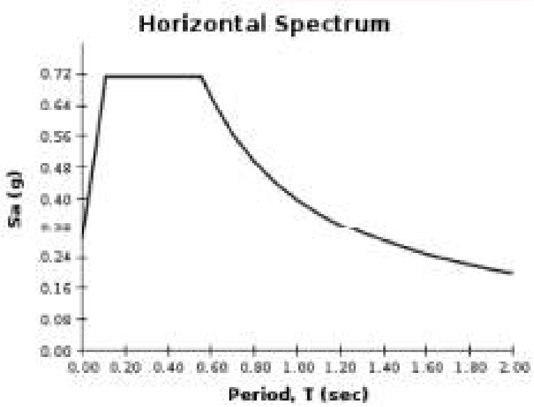
USGS Design Maps Summary Report

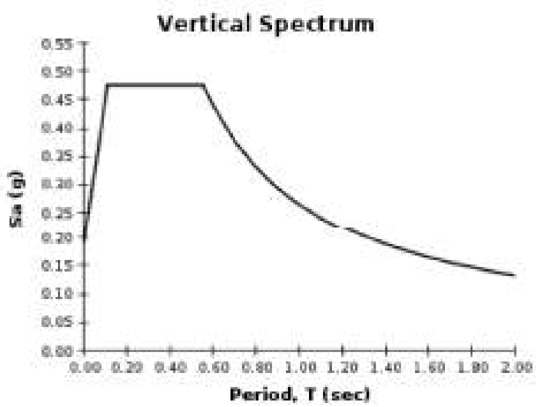
User–Specified Input

Building Code Reference Document	ASCE 41-13 Retrofit Standard, BSE-1E (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.75222°N, 118.32549°W
Site Soil Classification	Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,10/50}$	0.514 g	$S_{XS,BSE-1E}$	0.714 g
$S_{1,10/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g





Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation

	Location	Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Roof	Area 1	250.0	80.0	20000.0	20	400
	Walls, out plane	643.0	6.0	3858.0	96	370
				20000		**770**
	Grand Total =			**20000**		**770**

Base shear V= 0.714 W
Base shear V= 550

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m

m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1 Footnote b for reinforced masonary walls

Wall Forces - 1st Floor (Supporting Roof)

	Wall Description	**Length ft**	**Width in**	**Aw in2**	**Force Vj kips**	**v avg psi**
N-S Direction	8.5" CMU	128.0	8.5	13056	550	14.0
E-W Directioin	8.5" CMU	234.0	8.5	23868	550	7.7

Per ASCE 41-13 check list 16.15LS, shear stress shall be less than **70** psi in CMU wall to be compliant.

Reinforcing Steel Ratio Check:

8.5" CMU wall with #5 @ 24" Hori & Verti

Hori / Vert ρ=	0.0015	>0.0007 OK
Total ρ=	0.0030	>0.002 OK

12" CMU wall with #6 @ 24" Hori & Verti

Hori / Vert ρ=	0.0015	>0.0007 OK
Total ρ=	0.0031	>0.002 OK

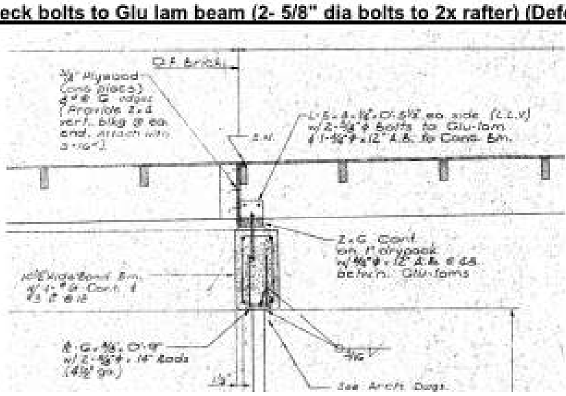
Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

$T_c = 1.2 S_{XS}\, w_p\, A_p =$ 82.3 psf Eqn 4-13

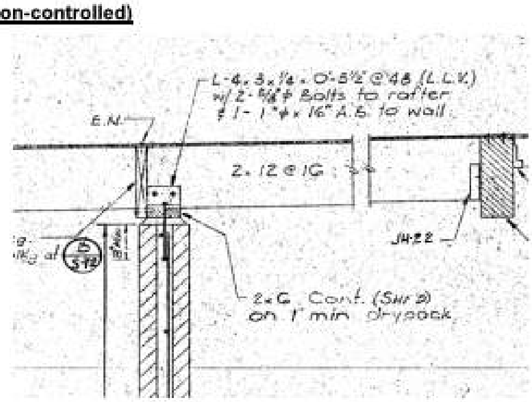
where:

S_{XS} =	0.714		
w_p =	96	psf	8.5" CMU wall
Ap =	1	ft2	
Trib. h =	6	ft	
Q_E=	494	lbs	End shear = W x Trib. H; W = 1 ft

<u>Check bolts to Glu lam beam (2- 5/8" dia bolts to 2x rafter) (Deformation-controlled)</u>



<u>A /ST-2</u> (perpend.)



<u>B /ST-2</u> (parallel)

Per ASCE 41-13 12.3.3.1 demands on wood connectors shall be considered as deformation-controlled actions.

QUD = QE =	494	lbs/ ft		
A) Per Dwg A/ST-2, wall anchors @ S =	10.00	ft	(double shear)	for east & west walls
B) Per Dwg B/ST-2, wall anchors @ S =	4.00	ft	(single shear)	for North & South walls
A) Out of plane force Q_{UD} =	**4935**	lbs	Each anchor location	for east & west walls
B) Out of plane force Q_{UD} =	**1974**	lbs	Each anchor location	for North & South walls

Table 11I BOLTS: Reference Lateral Design Values, Z, for Double Shear (three member) Connections[1,2]

for structural glued laminated timber main member with 1/4" ASTM A 36 steel side plates

Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.55 Southern Pine $Z_\parallel$ lbs.	G=0.55 Southern Pine $Z_\perp$ lbs.	G=0.50 Douglas Fir-Larch $Z_\parallel$ lbs.	G=0.50 Douglas Fir-Larch $Z_\perp$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\parallel$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\perp$ lbs.	G=0.43 Hem-Fir $Z_\parallel$ lbs.	G=0.43 Hem-Fir $Z_\perp$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\parallel$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\perp$ lbs.	G=0.36 Spruce-Pine-Fir(S) Western Woods $Z_\parallel$ lbs.	G=0.36 Spruce-Pine-Fir(S) Western Woods $Z_\perp$ lbs.
2-1/2	1/4	1/2	-	-	1650	790	1590	700	1500	640	1470	610	1270	490
		5/8	-	-	2190	880	2010	780	1880	700	1840	690	1580	550
		3/4	-	-	2630	980	2410	860	2250	770	2200	750	1900	600
		7/8	-	-	3060	1050	2820	920	2630	830	2570	810	2210	660
		1	-	-	3500	1130	3220	1000	3000	900	2940	880	2530	700
3	1/4	1/2	1720	1100	-	-	-	-	-	-	-	-	-	-
		5/8	2510	1220	-	-	-	-	-	-	-	-	-	-
		3/4	3460	1330	-	-	-	-	-	-	-	-	-	-
		7/8	4040	1440	-	-	-	-	-	-	-	-	-	-
		1	4610	1530	-	-	-	-	-	-	-	-	-	-
3-1/8	1/4	1/2	-	-	1650	980	1590	880	1540	800	1530	770	1430	610
		5/8	-	-	2410	1090	2330	980	2260	880	2230	860	1980	680
		3/4	-	-	3280	1220	3020	1080	2810	960	2750	940	2370	750
		7/8	-	-	3830	1310	3520	1150	3280	1040	3210	1010	2770	820
		1	-	-	4380	1410	4020	1250	3750	1130	3670	1090	3160	880
5	1/4	5/8	2510	1510	-	-	-	-	-	-	-	-	-	-
		3/4	3480	2000	-	-	-	-	-	-	-	-	-	-
		7/8	4630	2410	-	-	-	-	-	-	-	-	-	-
		1	5360	2550	-	-	-	-	-	-	-	-	-	-
5-1/8	1/4	5/8	-	-	2410	1420	2330	1340	2260	1280	2230	1270	2090	1120
		3/4	-	-	3340	1890	3220	1770	3120	1580	3090	1540	2890	1230
		7/8	-	-	4440	2150	4280	1880	4150	1700	4110	1650	3840	1350
		1	-	-	5720	2310	5510	2050	5330	1850	5290	1790	4930	1440

BOLTS

Table 11B BOLTS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2]

for sawn lumber or SCL main member with 1/4" ASTM A 36 steel side plate

Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_\parallel$ lbs.	G=0.67 Red Oak $Z_\perp$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_\parallel$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_\perp$ lbs.	G=0.50 Douglas Fir-Larch $Z_\parallel$ lbs.	G=0.50 Douglas Fir-Larch $Z_\perp$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_\parallel$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_\perp$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\parallel$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\perp$ lbs.	G=0.43 Hem-Fir $Z_\parallel$ lbs.	G=0.43 Hem-Fir $Z_\perp$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\parallel$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\perp$ lbs.	G=0.37 Redwood (open grain) $Z_\parallel$ lbs.	G=0.37 Redwood (open grain) $Z_\perp$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_\parallel$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_\perp$ lbs.	G=0.35 Northern Species $Z_\parallel$ lbs.	G=0.35 Northern Species $Z_\perp$ lbs.
1-1/2	1/4	1/2	730	420	620	350	580	310	580	310	550	290	520	280	510	270	470	240	460	240	450	230
		5/8	910	480	780	400	730	360	720	360	690	340	650	320	640	320	590	290	580	280	560	270
		3/4	1090	560	940	450	870	420	860	410	820	390	780	360	770	360	710	320	680	320	680	310
		7/8	1270	600	1090	510	1020	470	1010	430	990	430	910	410	900	400	820	370	810	360	790	350
		1	1460	680	1280	550	1170	510	1150	500	1100	480	1040	450	1030	450	940	430	930	400	900	380
1-3/4	1/4	1/2	810	460	690	370	640	340	630	330	600	310	570	280	560	280	510	250	500	250	480	240
		5/8	1020	520	870	430	800	390	780	380	750	360	710	340	700	330	640	300	630	290	610	280
		3/4	1220	590	1040	480	990	440	950	430	900	410	860	380	840	370	770	330	750	330	730	320
		7/8	1420	650	1210	540	1130	490	1110	480	1050	460	1000	420	980	420	890	380	880	370	860	360
		1	1630	710	1380	580	1200	540	1270	520	1200	500	1140	470	1120	460	1020	410	1000	410	980	400

Z =	2410 lbs/ bolt	NDS Table 11I	for east & west walls
Z =	800 lbs/ bolt	NDS Table 11B	for North & South walls

2012 NDS

λ tied to ASCE 7 Factored Loads: Baseline 10 minutes (ASD uses 10 years)

Table N3 Time Effect Factor, λ (LRFD Only)

Load Combination[2]		λ
1.4D	Permanent	0.6
1.2D + 1.6L + 0.5(L_r or S or R)		0.7 when L is from storage 0.8 when L is from occupancy 1.25 when L is from impact[1]
1.2D + 1.6(L_r or S or R) + (L or 0.8W)	Long term	0.8
1.2D + 1.0W + L + 0.5(L_r or S or R)		1.0
1.2D + 1.0E + L + 0.2S	Short term	1.0
0.9D + 1.0W		1.0
0.9D + 1.0E		1.0

1. Time effect factors, λ, greater than 1.0 shall not apply to connections or to structural members pressure-treated with water-borne preservatives (see Reference 30) or fire-retardant chemicals.
2. Load combinations and load factors consistent with ASCE 7-10 are listed for ease of reference. Nominal loads shall be in accordance with N.1.2. D = dead load; L = live load; L_r = roof live load; S = snow load; R = rain load; W = wind load; and E = earthquake load.

2012 NDS

Table 2.3.5 Format Conversion Factor, K_F (LRFD Only)

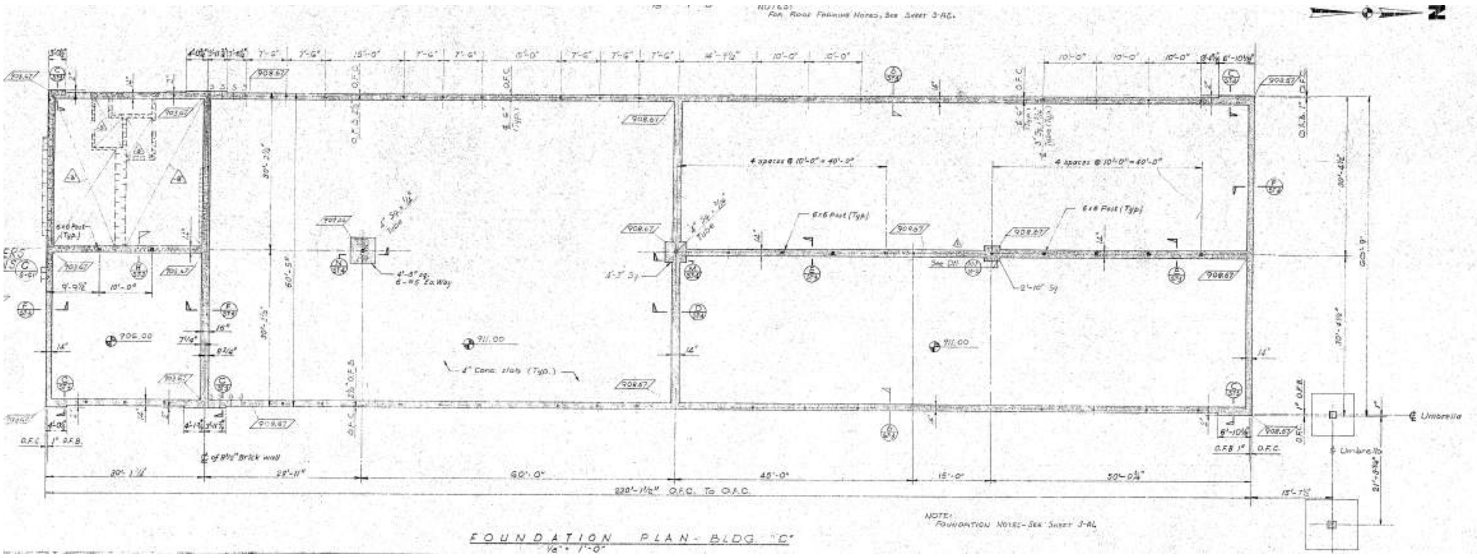
Application	Property	K_F
Member	F_b	2.54
	F_t	2.70
	F_v, F_{rt}, F_s	2.88
	F_c	2.40
	$F_{c\perp}$	1.67
	E_{min}	1.76
All Connections	(all design values)	3.32

$$R_N = \phi\,\lambda\,K_F\,R_{ASD}$$

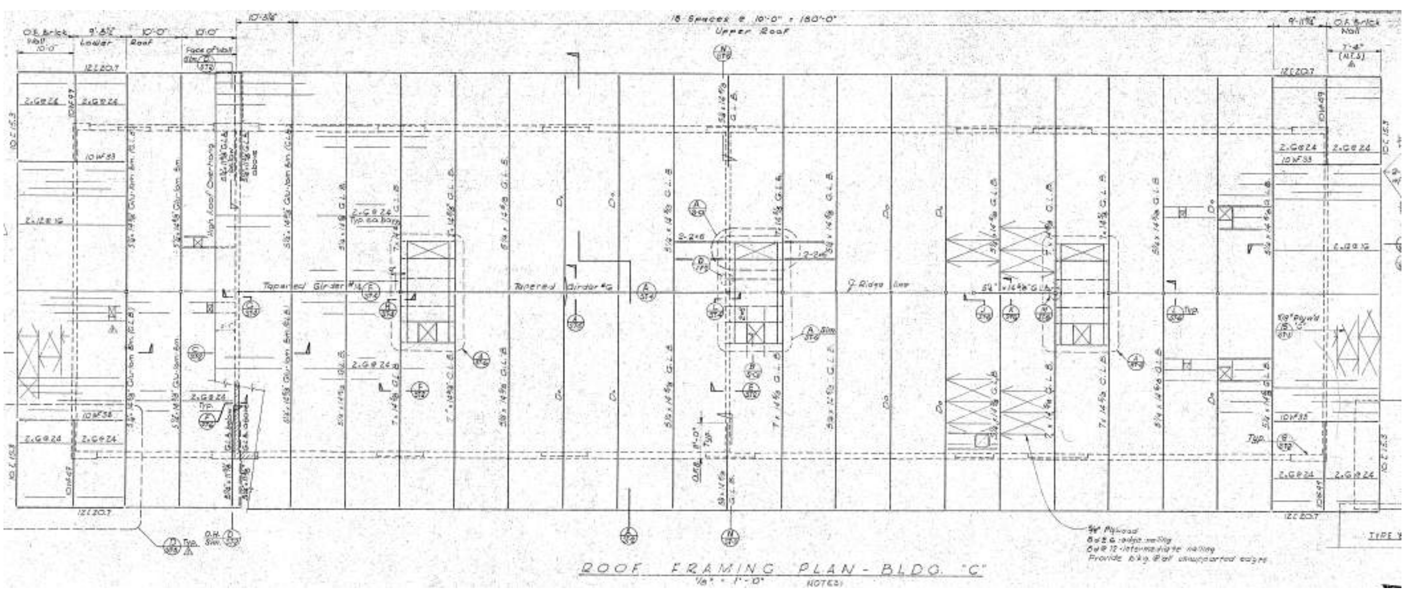
K_F converts reference design values (ASD normal load duration) to LRFD reference resistance

	n =	2	
A)	Z =	2410 lbs/ bolt	for east & west walls
B)	Z =	800 lbs/ bolt	for North & South walls
	φ =	1.0	per ASCE 41-13 12.3.2.2.1
	λ =	1.0	per NDS 2012 table N3
	KF =	3.32	per NDS 2012 Table 2.3.5
	RN = φ*λ*KF =	3.32	
A)	QCL = n x Z x KF =	16002 lbs	
B)	QCL = n x Z x KF =	5312 lbs	
	QCE/ QCL =	1.5	per ASCE 41-13 12.3.2.2.1
	m (IO) =	1.4	Table 12-3, machine bolts, metal to wood
	m (LS) =	2.8	Table 12-3, machine bolts, metal to wood
	m = 1/2*[m(IO) + m(LS)] =	2.1	Table 2-1 Footnote b, for Tier 1, Risk Category III
	k =	0.75	Table 6-1, Usual level of knowledge
	QCE = m*K*(QCE/ QCL)*QCL =	37806 lbs	**QUD = 4935 lbs < QCE, OK** for east & west walls
	QCE = m*K*(QCE/ QCL)*QCL =	12550 lbs	**QUD = 1974 lbs < QCE, OK** for North & South walls

Appendix 1-C: As-Built Plans



Foundation Plan(S-C1)



Roof Plan(S-C1)

Appendix 7A – Images of Existing Conditions

Fig 1. Building C with shade canopies in front

Fig 2. Equipment mount above ceiling

Fig 3. Typical suspended ceiling & lighting

TTG

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

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ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
CLASSROOM BUILDING (D)

MIRALESTE INTERMEDIATE SCHOOL
29323 Palos Verdes Dr. E,
Rancho Palos Verdes, CA 90275

REGISTERED PROFESSIONAL ENGINEER
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No.S2992
Exp. 06/30/2016
STRUCTURAL
STATE OF CALIFORNIA

Terry Tsang, S.E.
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JANUARY 2016

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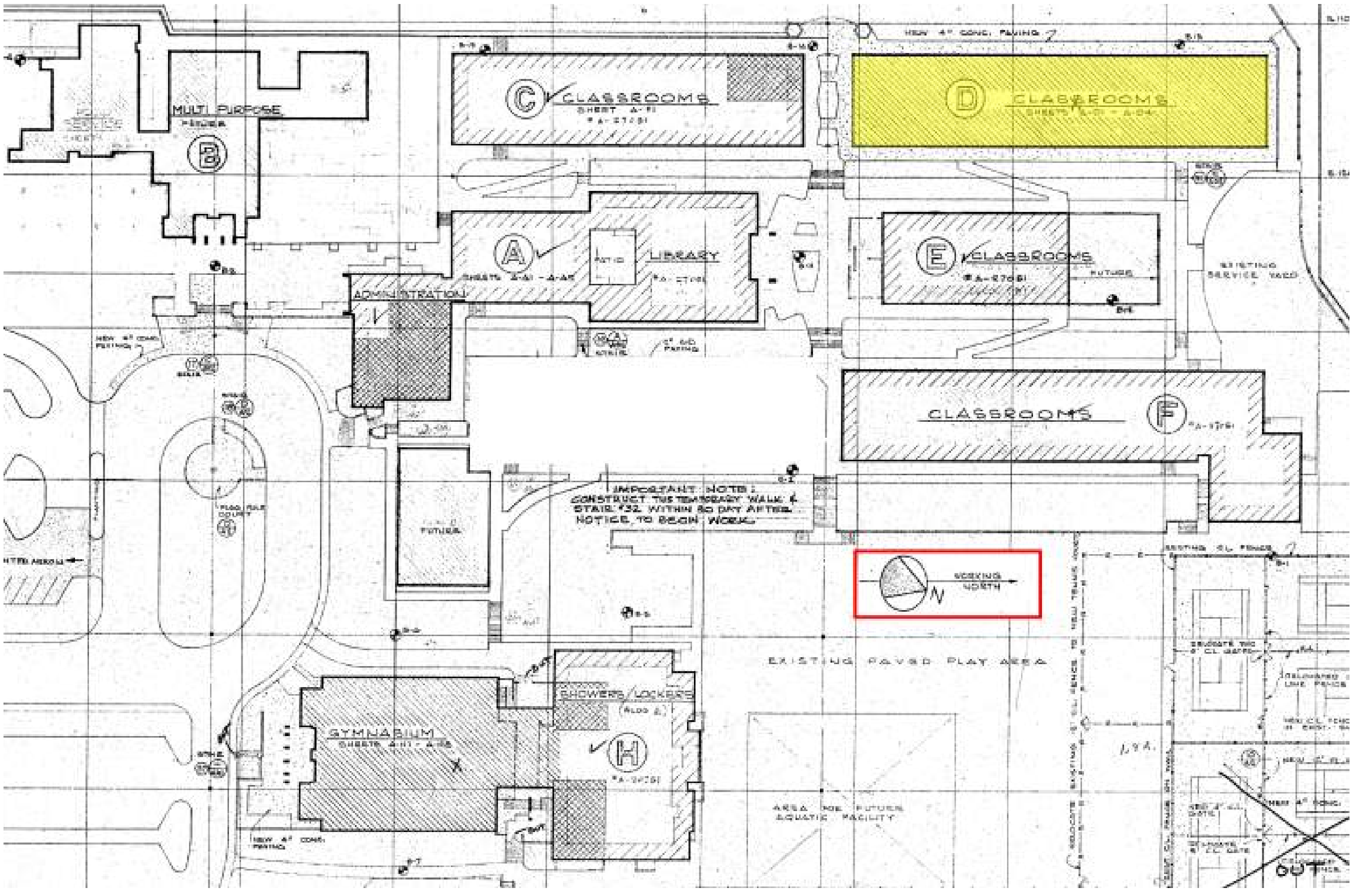
1.0 Introduction

A multiphase seismic vulnerability assessment of ***Classroom Building D*** was conducted, beginning with a site visit on ***12/21/2015***, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Picture of similar bldg.

An overall campus map of Jefferson High School, indicating the buildings under evaluation, is provided below. The highlighted building is ***Classroom Building D.***



Site Map- Classroom Building D

2.0 Classroom Building D

2.1 Site Seismicity

Per ASCE 41-13 (2012 IBC), for Miraleste Intermediate School located at 29323 Palos Verdes Dr. E, Rancho Palos Verdes, CA 90275

Site Coordinates = 33.75222°N, 118.32549°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.514 g; $S_{1,20/50}$ = 0.197 g
Fa = 1.389 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.01 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.714 g
$S_{X1} = F_v S_{1,20/20}$ = 0.396 g

2.2 Building Description

The Classroom Building 'D' is a one-story building in the north-western part of the school campus. The set of existing drawings is available dated December 1969, which shows the proposed building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of one story of classrooms. The building is rectangular with approximate dimensions of 80' x 280'. Total footprint of the building is estimated to be ±16,200 square feet. Roof typical height is about 13'-6".

The building consists of blocked plywood sitting on glulam chord ties with ridge glulam beam at center, which is considered flexible diaphragm. The building has continuous spread footing below the reinforced bearing brick walls and spread footing below gravity columns. The lateral system of the building is mainly formed of reinforced brick wall in both directions. Therefore, based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as “RM1”.

The structural risk category for the administration building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceednce in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Classroom Building D Summary Table	
Year Designed	1968
Drawings	***Original drawings prepared by Donley.Bundy & Associates(Arch.) & Wilson & Wilson Structural Engineers; dated February 1967***
Gravity System	Wood roof diaph. On glulam beams on bearing brick walls w/infill HSS columns
Lateral System	Reinforced Brick Walls
No. of Stories & Height	One Story; Main Roof: h_n=13.5 ft;
Building Period "T"	0.141 Sec
Base Shear "V"	0.714 W = 646 Kips
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	-

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of ***Classroom building D*** is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

No deficiencies were identified post Tier 1 analysis.

3.2 ASCE 41-13 Tier 2 Evaluation

No Tier 2 evaluation required.

4.0 Conclusions

After further review and updating tier 1 checklist as per ASCE 41-13, no major deficiencies were identified which required tier 2 evaluation.

Given the reason above, a voluntary seismic retrofit is not required for this structure.

5.0 Documents Reviewed

The following existing drawings were reviewed:

Date	Architect / Engineer	TTG Comments
December 1968	Donley. Bundy & Associates (Architect) Wilson & Wilson (Structural Engineer)	Title Block states “Building H”-Second increment (State of California – Department of General Services, Office of Architecture and Construction Project No. 29168)

6.0 Limitations

These reports represent ***TTG’s*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Miraleste Intermediate School Building D, Classrooms

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Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the

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District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Miraleste Intermediate School was originally constructed as a public high school with in the Palos Verdes Peninsula Unified School District. It was constructed in four phases in 1967, 1970, 1973 and 1977. It was originally called Miraleste High School and has been in constant use as a public school since that time. The original campus buildings were designed by the firm of Donley Bundy & Associates and is mostly of reinforced brick and concrete masonry, and wood construction. The building referred to as Building D is part of the 1967 phase.

Building D contains classrooms in a single story rectangular plan with back to back classrooms. There are circulation walkways around the building with overhangs to shade. It is a reinforced brick masonry wall structure with a concrete bond beam around the top of the walls to transfer the roof beam load to the walls. The roof structure is a wood framed with glue laminated beams and secondary joists.

All portions of the building are of Type-5 1 hour rated construction and appear fit within the current CBC Type-5A requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the

proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Work

No Recommended Retrofit
After further tier 2 analysis it was determined that the building does not require any seismic retrofit work for life safety.

Accessibility Upgrades

There are no accessibility upgrades anticipated for this building since no retrofit work is recommended.

Fire & Life Safety

There are no fire & life safety upgrades anticipated for this building since no retrofit work is recommended.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Appendix 1-A: Tier 1 Screening Checklists/Calculation

ASCE 41-13

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path, so compliant.
x				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.3)	No adjacent bldg.
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanine levels in the building, not applicable.
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	One story bldg.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	One story bldg.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	Per review of as-built and site investigation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	One story bldg.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	One story bldg.
		x		TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Flexible diaphragm.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
			x	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	No geotech report available but not anticipated per site location.
			x	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	No geotech report available
			x	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	No geotech report available
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					

C	NC	N/A	U	Checklist	Comments
x				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.714=0.43< min(60,250)/13.25=4.5 Compliant per review of existing drawings. Elements of the lateral system can work together, so building dimension is used for this check since all the elements are well connected.
x				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Compliant per review of existing foundation plan.(Ref. sheet S-D1)

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY BEARING WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY BEARING WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. Commentary Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1.	Per as-built dwgs
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in. 2 . Commentary Sec. A.3.2.4.1. Tier 2: Sec. 5.5.3.1.1.	See provided calc at end of checklist
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. Commentary Sec. A.3.2.4.2. Tier 2: Sec. 5.5.3.1.3.	See provided calc at end of checklist
Stiff Diaphragms					

C	NC	N/A	U	Checklist	Comments
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. Commentary Sec. A.4.5.1. Tier 2: Sec. 5.6.4	Wood diaphragm
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. Commentary Sec. A.5.1.1. Tier 2:Sec. 5.7.1.1.	See provided calc at end of checklist
		x		WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. Commentary Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3.	Per S-T2 details, no wood ledger exist.
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. Commentary Sec. A.5.2.1. Tier 2: Sec. 5.7.2.	Per A/S-T2, anchor bolts @ each Glulam beam location and 48" o.c. in between provided
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. Commentary Sec. A.5.2.3. Tier 2: Sec. 5.7.2.	All wood diaphragm
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. Commentary Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4	Per S-T3 details
x				GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. Commentary Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1.	Per H/S-T4
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.					

C	NC	N/A	U	Checklist	Comments
				Stiff Diaphragms	
		x		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. Commentary Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3.	Flexible diaphragm
		x		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. Commentary Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3.	Flexible diaphragm
				Flexible Diaphragms	
x				CROSS TIES: There are continuous cross ties between diaphragm chords. Commentary Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2.	Glulam beams as cross ties between chords…per S-D1 roof plan
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. Commentary Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3.	No large opening…ref. S-D1 roof plan
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. Commentary Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3.	No large opening…ref. S-D1 roof plan
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. Commentary Sec. A.4.2.1. Tier 2: Sec. 5.6.2	5/8” plywood diaphragm per S-D1 roof plan
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. Commentary Sec. A.4.2.2. Tier 2: Sec. 5.6.2.	5/8” plywood diaphragm per S-D1 roof plan
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. Commentary Sec. A.4.2.3. Tier 2: Sec. 5.6.2.	Blocked plywood diaphragm per S-D1 roof plan
x				OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than	Wood diaphragm

C	NC	N/A	U	Checklist	Comments
				wood, metal deck, concrete, or horizontal bracing. Commentary Sec. A.4.7.1. Tier 2: Sec. 5.6.5.	
Connections					
x				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. Commentary Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2.	

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
Life Safety Systems					
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
Hazardous Materials					
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate	No URM partition, so not applicable.

C	NC	N/A	U	Checklist	Comments
				Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
				Light Fixtures	
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Proper support was observed
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
Cladding and Glazing					
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	No multi-story panel, so not applicable.
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are	No cladding panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	
				Masonry Veneer	
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	No URM backup, so not applicable.
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
				Parapets, Cornices, Ornamentation, and Appendages	
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported	No URM parapet, so not applicable.

C	NC	N/A	U	Checklist	Comments
				unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	
			X	LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Not accessible during site visit
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No parapets; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	No such appendages were observed; So not applicable
				Masonry Chimneys	
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
				Stairs	
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness	No stairs, so not applicable.

C	NC	N/A	U	Checklist	Comments
				ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
				Contents and Furnishings	
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	
				Mechanical and Electrical Equipment	
	X			LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	Air conditioning units suspended from canopies over existing windows are not properly braced.
			X	LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Not accessible during site visit
X				LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	Proper anchorage was observed
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
				Piping	
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
				Ducts	
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				Elevators	
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: As-Built Plans

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW		Bldg Type= **RM1**
$C =$	1	From Table 4-8	
$S_a = \min(S_{XS}, S_{X1}/T)$		From Section 4.5.2.3	
$S_{X1} = F_vS_1$		Eq. 2-2	
$S_{XS} = F_aS_S$		Eq. 2-1	
$S_S =$	0.514	g, mapped spectral acceleration	
$S_1 =$	0.197	g, mapped spectral acceleration	
$S_{X1} =$	0.396	g	
$S_{XS} =$	0.714	g	
$T = C_th_n^{\beta}$		From Section 4.5.2.4	
$C_t =$	0.02		
$h_n =$	13.5	ft., average height at sloped roof	
$\beta =$	0.75		
$T =$	0.141	sec.	
$S_a =$	0.714	g	
$V =$	0.714	W	

Check Seismic Mass For Shear Stress Check

Roof

Roofing	6	psf
5/8" plywood	2	psf
framing(purlins+sub-purlins)	4	psf
MEP	3	psf
Ceiling	4	psf
Misc	1	psf
DL =	**20**	**psf**
Use	**20**	**psf**

CMU Wall Weight

8 1/2" CMU wall = 96 psf

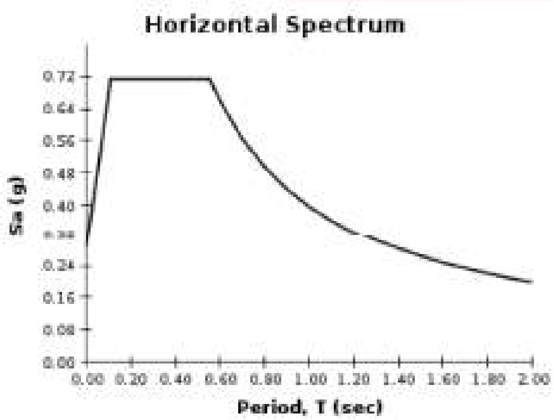
USGS Design Maps Summary Report

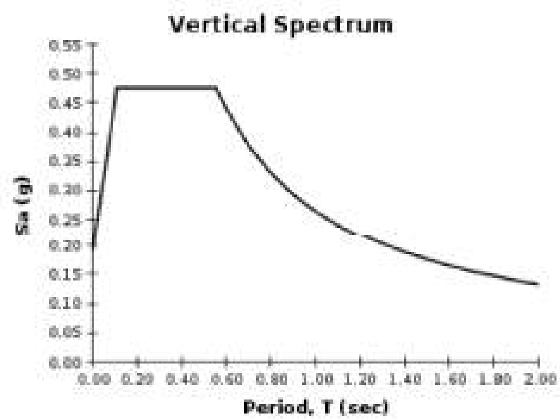
User–Specified Input

Building Code Reference Document	ASCE 41-13 Retrofit Standard, BSE-1E (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.75222°N, 118.32549°W
Site Soil Classification	Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.514 g	$S_{XS,BSE-1E}$	0.714 g
$S_{1,20/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g





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Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation

	Location	Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Roof	Area 1	282.0	80.5	22701.0	20	454
	Walls, out plane	781.4	6.0	4688.4	96	450
				22701		**904**
	Grand Total =			**22701**		**904**

Base shear V= 0.714 W
Base shear V= 646

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1 Footnote b for reinforced masonary walls

Wall Forces - 1st Floor (Supporting Roof)

	Wall Description	**Length ft**	**Width in**	**Aw in2**	**Force Vj kips**	**v avg psi**
N-S Direction	8.5" CMU	164.6	8.5	16791	646	12.8
E-W Directioin	8.5" CMU	234.0	8.5	23868	646	9.0

Per ASCE 41-13 check list 16.15LS, shear stress shall be less than **70** psi in CMU wall to be compliant.

Reinforcing Steel Ratio Check:

8.5" CMU wall with #5 @ 24" Hori & Verti

Hori / Vert ρ=	0.0015	>0.0007 OK
Total ρ=	0.0030	>0.002 OK

12" CMU wall with #6 @ 24" Hori & Verti

Hori / Vert ρ=	0.0015	>0.0007 OK
Total ρ=	0.0031	>0.002 OK

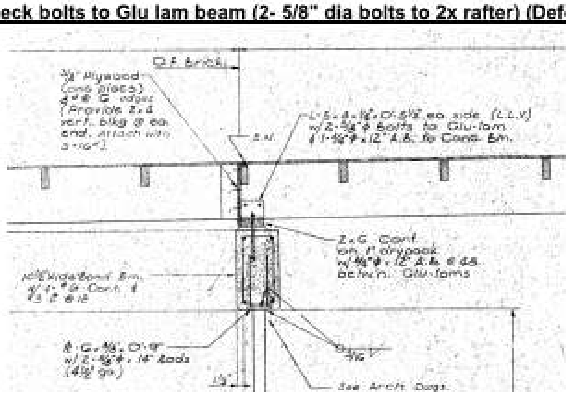
Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

$Tc= 1.2S_{XS}\, w_p\, A_p =$ 82.3 psf Eqn 4-13

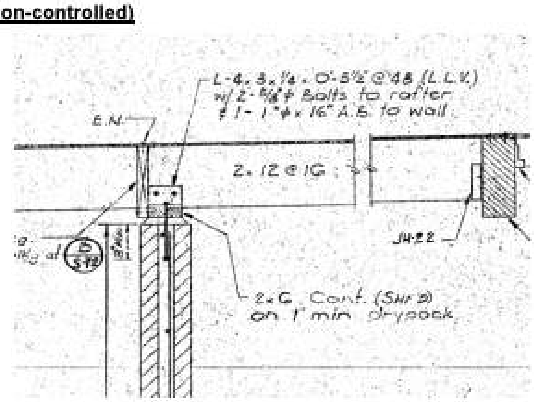
where:

S_{XS} =	0.714		
w_p =	96	psf	8.5" CMU wall
Ap =	1	ft2	
Trib. h =	6	ft	
Q_E=	494	lbs	End shear = W x Trib. H; W = 1 ft

Check bolts to Glu lam beam (2- 5/8" dia bolts to 2x rafter) (Deformation-controlled)



A /ST-2 (perpend.)



B /ST-2 (parallel)

Per ASCE 41-13 12.3.3.1 demands on wood connectors shall be considered as deformation-controlled actions.

QUD = QE =	494	lbs/ ft		
A) Per Dwg A/ST-2, wall anchors @ S =	10.00	ft	(double shear)	for east & west walls
B) Per Dwg B/ST-2, wall anchors @ S =	4.00	ft	(single shear)	for North & South walls
A) Out of plane force Q_{UD} =	**4935**	lbs	Each anchor location	for east & west walls
B) Out of plane force Q_{UD} =	**1974**	lbs	Each anchor location	for North & South walls

Table 11I BOLTS: Reference Lateral Design Values, Z, for Double Shear (three member) Connections[1,2]

for structural glued laminated timber main member with 1/4" ASTM A 36 steel side plates

Main Member t_m in.	Side Member t_s in.	Bolt Diameter D in.	G=0.55 Southern Pine $Z_\parallel$ lbs.	G=0.55 Southern Pine $Z_\perp$ lbs.	G=0.50 Douglas Fir-Larch $Z_\parallel$ lbs.	G=0.50 Douglas Fir-Larch $Z_\perp$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\parallel$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\perp$ lbs.	G=0.43 Hem-Fir $Z_\parallel$ lbs.	G=0.43 Hem-Fir $Z_\perp$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\parallel$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\perp$ lbs.	G=0.36 Spruce-Pine-Fir(S) Western Woods $Z_\parallel$ lbs.	G=0.36 Spruce-Pine-Fir(S) Western Woods $Z_\perp$ lbs.
2-1/2	1/4	1/2	-	-	1650	790	1590	700	1500	640	1470	610	1270	490
		5/8	-	-	2190	880	2010	780	1880	700	1840	680	1580	550
		3/4	-	-	2630	980	2410	860	2250	770	2200	750	1900	600
		7/8	-	-	3060	1050	2820	920	2630	830	2570	810	2210	660
		1	-	-	3500	1130	3220	1000	3000	900	2940	880	2530	700
3	1/4	1/2	1720	1100	-	-	-	-	-	-	-	-	-	-
		5/8	2510	1220	-	-	-	-	-	-	-	-	-	-
		3/4	3460	1330	-	-	-	-	-	-	-	-	-	-
		7/8	4040	1440	-	-	-	-	-	-	-	-	-	-
		1	4610	1530	-	-	-	-	-	-	-	-	-	-
3-1/8	1/4	1/2	-	-	1650	980	1590	880	1540	800	1530	770	1430	610
		5/8	-	-	2410	1090	2330	980	2260	880	2230	860	1980	680
		3/4	-	-	3280	1220	3020	1080	2810	960	2750	940	2370	750
		7/8	-	-	3830	1310	3520	1150	3280	1040	3210	1010	2770	820
		1	-	-	4380	1410	4020	1250	3750	1130	3670	1090	3160	880
5	1/4	5/8	2510	1510	-	-	-	-	-	-	-	-	-	-
		3/4	3480	2000	-	-	-	-	-	-	-	-	-	-
		7/8	4830	2410	-	-	-	-	-	-	-	-	-	-
		1	5360	2550	-	-	-	-	-	-	-	-	-	-
5-1/8	1/4	5/8	-	-	2410	1420	2330	1340	2260	1280	2230	1270	2000	1120
		3/4	-	-	3340	1890	3220	1770	3120	1580	3090	1540	2890	1230
		7/8	-	-	4440	2150	4280	1880	4150	1700	4110	1650	3840	1350
		1	-	-	5720	2310	5510	2050	5330	1850	5290	1790	4930	1440

BOLTS

Table 11B BOLTS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2]

for sawn lumber or SCL main member with 1/4" ASTM A 36 steel side plate

Main Member t_m in.	Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_\parallel$ lbs.	G=0.67 Red Oak $Z_\perp$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_\parallel$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_\perp$ lbs.	G=0.50 Douglas Fir-Larch $Z_\parallel$ lbs.	G=0.50 Douglas Fir-Larch $Z_\perp$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_\parallel$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_\perp$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\parallel$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\perp$ lbs.	G=0.43 Hem-Fir $Z_\parallel$ lbs.	G=0.43 Hem-Fir $Z_\perp$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\parallel$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\perp$ lbs.	G=0.37 Redwood (open grain) $Z_\parallel$ lbs.	G=0.37 Redwood (open grain) $Z_\perp$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_\parallel$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_\perp$ lbs.	G=0.35 Northern Species $Z_\parallel$ lbs.	G=0.35 Northern Species $Z_\perp$ lbs.
1-1/2	1/4	1/2	730	420	620	350	580	310	580	310	550	290	520	280	510	270	470	240	460	240	450	230
		5/8	910	480	780	400	730	360	720	360	690	340	650	320	640	320	590	290	580	280	560	270
		3/4	1090	550	940	450	870	420	860	410	820	390	780	360	770	360	710	320	690	320	680	310
		7/8	1270	600	1090	510	1020	470	1010	430	960	430	910	410	900	400	820	370	810	360	790	350
		1	1460	650	1250	550	1170	510	1150	500	1100	480	1040	450	1030	450	940	400	930	400	900	390
1-3/4	1/4	1/2	810	460	690	370	640	340	630	330	600	310	570	290	560	280	510	250	500	250	480	240
		5/8	1020	520	870	430	800	390	790	380	750	360	710	340	700	330	640	300	630	290	610	280
		3/4	1220	590	1040	480	960	440	950	430	900	410	860	380	840	370	770	330	750	330	730	320
		7/8	1420	650	1210	540	1130	490	1110	480	1050	460	1000	420	980	420	890	380	880	370	850	360
		1	1630	710	1390	590	1200	540	1270	520	1200	500	1140	470	1120	460	1020	410	1000	410	980	400

Z =	2410 lbs/ bolt	NDS Table 11I	for east & west walls
Z =	800 lbs/ bolt	NDS Table 11B	for North & South walls

2012 NDS

λ tied to ASCE 7 Factored Loads: Baseline 10 minutes (ASD uses 10 years)

Table N3 Time Effect Factor, λ (LRFD Only)

Load Combination[2]		λ
1.4D	Permanent	0.6
1.2D + 1.6L + 0.5(L_r or S or R)		0.7 when L is from storage 0.8 when L is from occupancy 1.25 when L is from impact[1]
1.2D + 1.6(L_r or S or R) + (L or 0.8W)	Long term	0.8
1.2D + 1.0W + L + 0.5(L_r or S or R)		1.0
1.2D + 1.0E + L + 0.2S	Short term	1.0
0.9D + 1.0W		1.0
0.9D + 1.0E		1.0

1. Time effect factors, λ, greater than 1.0 shall not apply to connections or to structural members pressure-treated with water-borne preservatives (see Reference 30) or fire-retardant chemicals.
2. Load combinations and load factors consistent with ASCE 7-10 are listed for ease of reference. Nominal loads shall be in accordance with N.1.2. D = dead load; L = live load; L_r = roof live load; S = snow load; R = rain load; W = wind load; and E = earthquake load.

2012 NDS

Table 2.3.5 Format Conversion Factor, K_F (LRFD Only)

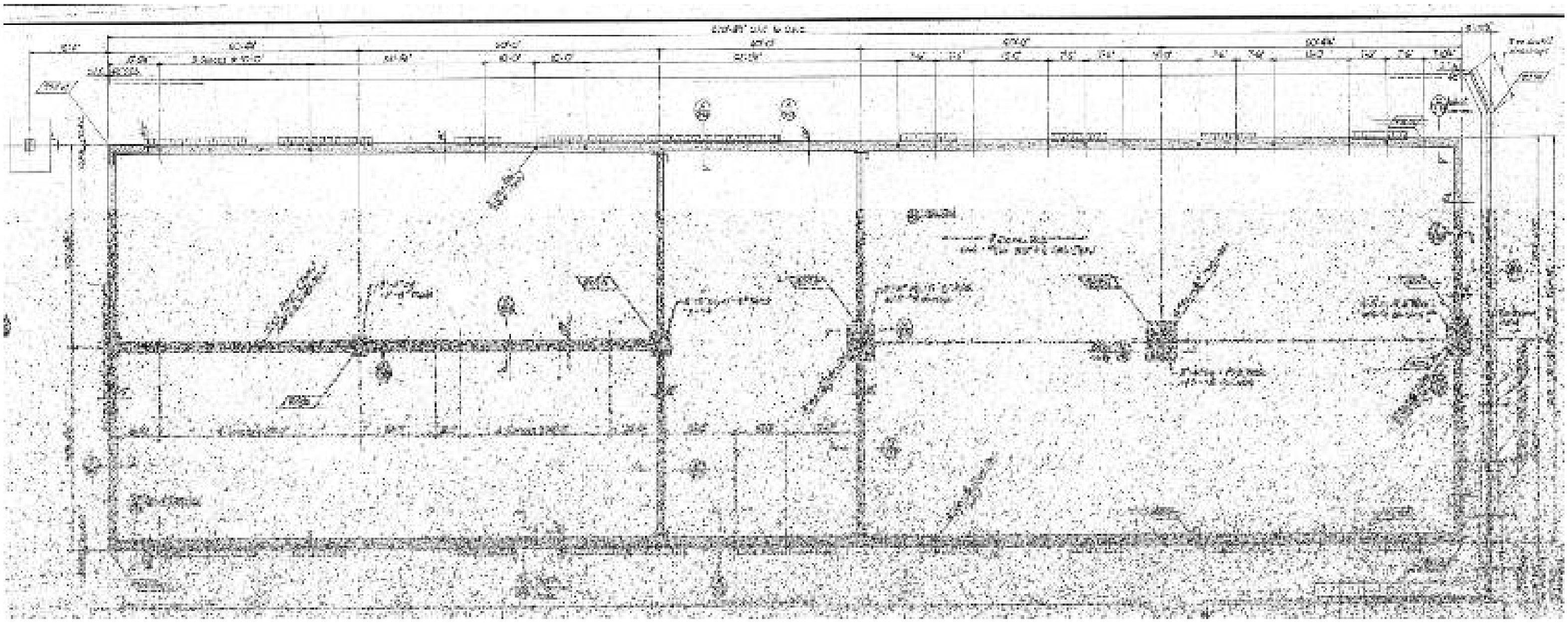
Application	Property	K_F
Member	F_b	2.54
	F_t	2.70
	F_v, F_{rt}, F_s	2.88
	F_c	2.40
	$F_{c\perp}$	1.67
	E_{min}	1.76
All Connections	(all design values)	3.32

$$R_N = \phi\, \lambda\, K_F\, R_{ASD}$$

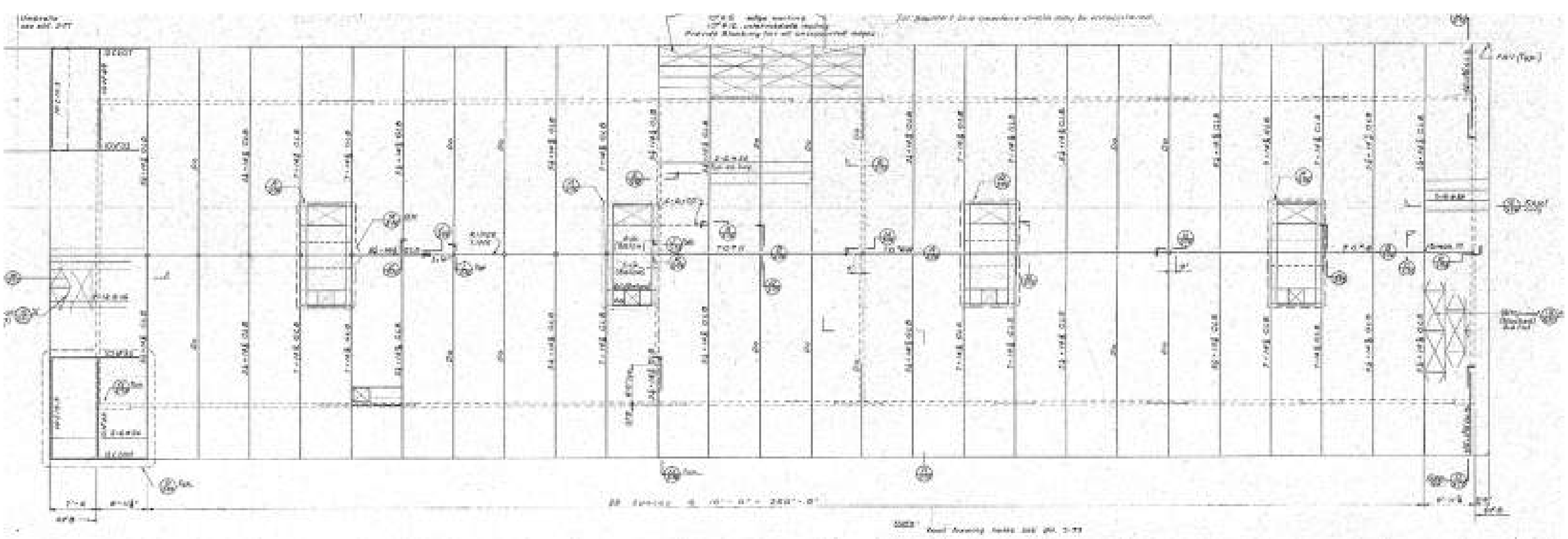
K_F converts reference design values (ASD normal load duration) to LRFD reference resistance

n =	2		
A) Z =	2410 lbs/ bolt	for east & west walls	
B) Z =	800 lbs/ bolt	for North & South walls	
φ =	1.0 per ASCE 41-13 12.3.2.2.1		
λ =	1.0 per NDS 2012 table N3		
KF =	3.32 per NDS 2012 Table 2.3.5		
RN = φ*λ*KF =	3.32		
A) QCL = n x Z x KF =	16002 lbs		
B) QCL = n x Z x KF =	5312 lbs		
QCE/ QCL =	1.5 per ASCE 41-13 12.3.2.2.1		
m (IO) =	1.4 Table 12-3, machine bolts, metal to wood		
m (LS) =	2.8 Table 12-3, machine bolts, metal to wood		
m = 1/2*[m(IO) + m(LS)] =	2.1 Table 2-1 Footnote b, for Tier 1, Risk Category III		
k =	0.75 Table 6-1, Usual level of knowledge		
QCE = m*K*(QCE/ QCL)*QCL =	37806 lbs	**QUD = 4935 lbs < QCE, OK**	for east & west walls
QCE = m*K*(QCE/ QCL)*QCL =	12550 lbs	**QUD = 1974 lbs < QCE, OK**	for North & South walls

Appendix 1-C: As-Built Plans



Foundation Plan (S-D1)



Roof Plan (S-D1)

Appendix 7A – Images of Existing Conditions

Fig 1. Exterior adjacent to slope

Fig 2. South end with large openings

Fig 3. Covered walkway

TTG

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
CLASSROOM BUILDING (E)

MIRALESTE INTERMEDIATE SCHOOL
29323 Palos Verdes Dr. E,
Rancho Palos Verdes, CA 90275

Terry Tsang, S.E.
Structural Engineer S2992
TTG Job No.: 0215.768.00

JANUARY 2016

300 N. Lake Avenue, 14th Floor, Pasadena, CA 91101 (626) 463-2800 Fax (626) 463-2801 www.ttgcorp.com

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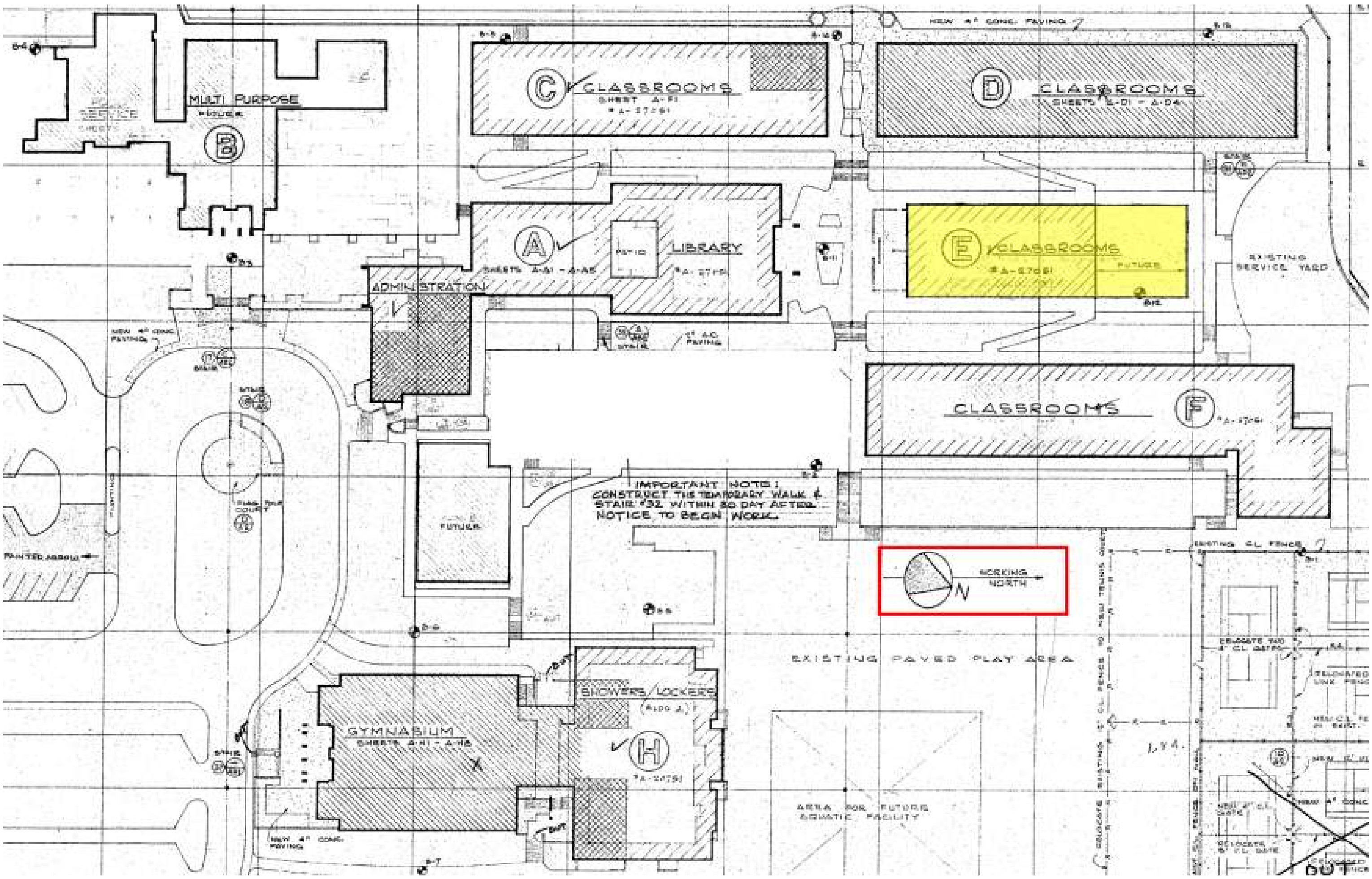
1.0 Introduction

A multiphase seismic vulnerability assessment of ***Classroom Building E*** was conducted, beginning with a site visit on ***12/21/2015***, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

An overall campus map of Jefferson High School, indicating the buildings under evaluation, is provided below. The highlighted building is ***Classroom Building E.***



Site Map- Classroom Building E

2.0 Classroom Building E

2.1 Site Seismicity

Per ASCE 41-13 (2012 IBC), for Miraleste Intermediate School located at 29323 Palos Verdes Dr. E, Rancho Palos Verdes, CA 90275

Site Coordinates = 33.75222°N, 118.32549°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.514 g; $S_{1,20/50}$ = 0.197 g
Fa = 1.389 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.01 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.714 g
$S_{X1} = F_v S_{1,20/20}$ = 0.396 g

2.2 Building Description

The Classroom Building 'E' is a one-story building in the northern part of the school campus. The set of existing drawings is available dated February 1967, which shows the proposed building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of one story of classrooms. The building is rectangular with approximate dimensions of 80' x 125'. Total footprint of the building is estimated to be ±7,200 square feet. Roof typical height is about 13'-6".

The building consists of blocked plywood sitting on glulam chord ties with ridge glulam beam at center, which is considered flexible diaphragm. The building has continuous spread footing below the reinforced bearing brick walls and spread footing below gravity columns. The lateral system of the building is mainly formed of reinforced brick wall in both directions. Therefore, based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as “RM1”.

The structural risk category for the administration building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Classroom Building E Summary Table	
Year Designed	1967
Drawings	***Original drawings prepared by Donley.Bundy & Associates(Arch.) & Wilson & Wilson Structural Engineers; dated February 1967***
Gravity System	Wood roof diaph. On glulam beams on bearing brick walls w/infill HSS columns
Lateral System	Reinforced Brick Walls
No. of Stories & Height	One Story; Main Roof: h_n=13.5 ft;
Building Period "T"	0.141 Sec
Base Shear "V"	0.714 W = 291 Kips
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	-

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of ***Classroom building E*** is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote b for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

No deficiencies were identified post Tier 1 analysis.

3.2 ASCE 41-13 Tier 2 Evaluation

No Tier 2 evaluation required.

4.0 Conclusions

After further review and updating tier 1 checklist as per ASCE 41-13, no major deficiencies were identified which required tier 2 evaluation.

Given the reason above, a voluntary seismic retrofit is not required for this structure.

5.0 Documents Reviewed

The following existing drawings were reviewed:

Date	Architect / Engineer	TTG Comments
February 1967	Donley. Bundy & Associates (Architect) Wilson & Wilson (Structural Engineer)	Title Block states "Building E" (State of California – Department of General Services, Office of Architecture and Construction Project No. 27051)

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Miraleste Intermediate School Building E, Classrooms

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Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the

District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Miraleste Intermediate School was originally constructed as a public high school with in the Palos Verdes Peninsula Unified School District. It was constructed in four phases in 1967, 1970, 1973 and 1977. It was originally called Miraleste High School and has been in constant use as a public school since that time. The original campus buildings were designed by the firm of Donley Bundy & Associates and is mostly of reinforced brick and concrete masonry, and wood construction. The building referred to as Building E is part of the 1967 phase.

Building E contains classrooms in a single story rectangular plan with back to back classrooms. There are circulation walkways around the building with overhangs to shade. It is a reinforced brick masonry wall structure with a concrete bond beam around the top of the walls to transfer the roof beam load to the walls. The roof structure is a wood framed with glue laminated beams and secondary joists.

All portions of the building are of Type-5 1 hour rated construction and appear fit within the current CBC Type-5A requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the

proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Work

No Recommended Retrofit
After further tier 2 analysis it was determined that the building does not require any seismic retrofit work for life safety.

Accessibility Upgrades

There are no accessibility upgrades anticipated for this building since no retrofit work is recommended.

Fire & Life Safety

There are no fire & life safety upgrades anticipated for this building since no retrofit work is recommended.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Appendix 1-A: Tier 1 Screening Checklists/Calculation

ASCE 41-13

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path, so compliant.
x				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.3)	No adjacent bldg.
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanine levels in the building, not applicable.
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	One story bldg.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	One story bldg.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	Per review of as-built and site investigation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	One story bldg.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	One story bldg.
		x		TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Flexible diaphragm.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
			x	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	No geotech report available but not anticipated per site location.
			x	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	No geotech report
			x	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	No geotech report available
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					

C	NC	N/A	U	Checklist	Comments
x				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.714=0.43< min(60,125)/13.25=4.5 Compliant per review of existing drawings. Elements of the lateral system can work together, so building dimension is used for this check since all the elements are well connected.
x				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Compliant per review of existing foundation plan.(Ref. sheet S-E1)

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY BEARING WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY BEARING WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. Commentary Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1.	Per as-built dwgs
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in.^{2} . Commentary Sec. A.3.2.4.1. Tier 2: Sec. 5.5.3.1.1.	See provided calc at end of checklist
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. Commentary Sec. A.3.2.4.2. Tier 2: Sec. 5.5.3.1.3.	See provided calc at end of checklist
Stiff Diaphragms					

C	NC	N/A	U	Checklist	Comments
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. Commentary Sec. A.4.5.1. Tier 2: Sec. 5.6.4	Wood diaphragm
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. Commentary Sec. A.5.1.1. Tier 2:Sec. 5.7.1.1.	See provided calc at end of checklist
		x		WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. Commentary Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3.	Per S-T2 details, no wood ledger exist.
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. Commentary Sec. A.5.2.1. Tier 2: Sec. 5.7.2.	Per A/S-T2, anchor bolts @ each Glulam beam location and 48" o.c. in between provided
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. Commentary Sec. A.5.2.3. Tier 2: Sec. 5.7.2.	All wood diaphragm
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. Commentary Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4	Per B/S-T3 & G/S-T6 details
x				GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. Commentary Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1.	Per L/S-T6
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.					

C	NC	N/A	U	Checklist	Comments
				Stiff Diaphragms	
		x		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. Commentary Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3.	Flexible diaphragm
		x		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. Commentary Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3.	Flexible diaphragm
				Flexible Diaphragms	
x				CROSS TIES: There are continuous cross ties between diaphragm chords. Commentary Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2.	Glulam beams as cross ties between chords…per S-E1 roof plan
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. Commentary Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3.	No large opening…ref. S-E1 roof plan
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. Commentary Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3.	No large opening…ref. S-E1 roof plan
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. Commentary Sec. A.4.2.1. Tier 2: Sec. 5.6.2	5/8” plywood diaphragm per S-E1 roof plan
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. Commentary Sec. A.4.2.2. Tier 2: Sec. 5.6.2.	5/8” plywood diaphragm per S-E1 roof plan
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. Commentary Sec. A.4.2.3. Tier 2: Sec. 5.6.2.	Blocked plywood diaphragm per S-E1 roof plan
x				OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than	Wood diaphragm

C	NC	N/A	U	Checklist	Comments
				wood, metal deck, concrete, or horizontal bracing. Commentary Sec. A.4.7.1. Tier 2: Sec. 5.6.5.	
Connections					
X				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. Commentary Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2.	

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
Life Safety Systems					

C	NC	N/A	U	Checklist	Comments
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
Hazardous Materials					
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
Ceilings					
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	
				Light Fixtures	
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Proper support was observed
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Cladding and Glazing	
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
Masonry Veneer					
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no	No URM backup, so not applicable.

C	NC	N/A	U	Checklist	Comments
				unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
				Parapets, Cornices, Ornamentation, and Appendages	
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
			X	LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Not accessible during site visit
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No parapets; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	
Masonry Chimneys					
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
Stairs					
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
Contents and Furnishings					
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable

C	NC	N/A	U	Checklist	Comments
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
	X			LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	Air conditioning units suspended from canopies over existing windows are not properly braced.
			X	LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Not accessible during site visit
X				LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	Proper anchorage was observed

TTG

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
Piping					
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	
				Ducts	
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
				Elevators	
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

Check Seismic Mass For Shear Stress Check

Roof

Roofing	6	psf
5/8" plywood	2	psf
framing(purlins+sub-purlins)	4	psf
MEP	3	psf
Ceiling	4	psf
Misc	1	psf
DL =	**20**	**psf**
Use	**20**	**psf**

CMU Wall Weight

8 1/2" CMU wall =	96	psf

USGS Design Maps Summary Report

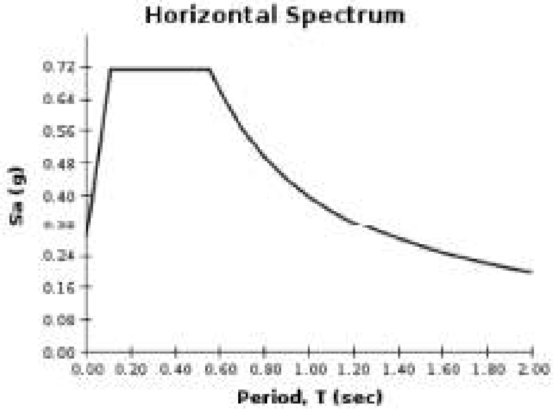
User-Specified Input

Building Code Reference Document	ASCE 41-13 Retrofit Standard, BSE-1E (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.75222°N, 118.32549°W
Site Soil Classification	Site Class D – "Stiff Soil"

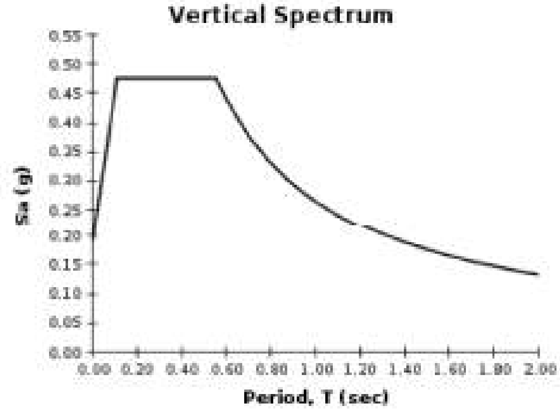
USGS-Provided Output

$S_{S,20/50}$	0.514 g	$S_{XS,BSE-1E}$	0.714 g
$S_{1,20/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g

Horizontal Spectrum



Vertical Spectrum



Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation

	Location	Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Roof	Area 1	125.0	80.0	10000.0	20	200
	Walls, out plane	360.0	6.0	2160.0	96	207
				10000		**407**
	Grand Total =			**10000**		**407**

Base shear V= 0.714 W
Base shear V= 291

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1 Footnote b for reinforced masonary walls

Wall Forces - 1st Floor (Supporting Roof)

	Wall Description	**Length ft**	**Width in**	**Aw in2**	**Force Vj kips**	**v avg psi**
N-S Direction	8.5" CMU	84.5	8.5	8619	291	11.2
E-W Directioin	8.5" CMU	83.0	8.5	8466	291	11.5

Per ASCE 41-13 check list 16.15LS, shear stress shall be less than **70** psi in CMU wall to be compliant.

Reinforcing Steel Ratio Check:

8.5" CMU wall with #5 @ 24" Hori & Verti

Hori / Vert ρ=	0.0015	>0.0007 OK
Total ρ=	0.0030	>0.002 OK

12" CMU wall with #6 @ 24" Hori & Verti

Hori / Vert ρ=	0.0015	>0.0007 OK
Total ρ=	0.0031	>0.002 OK

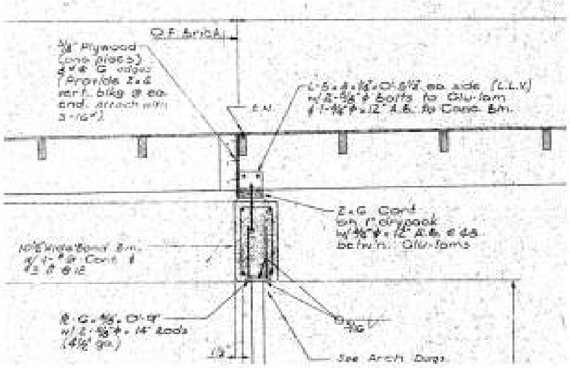
Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

$T_c = 1.2 S_{XS}\, w_p\, A_p =$ 82.3 psf Eqn 4-13

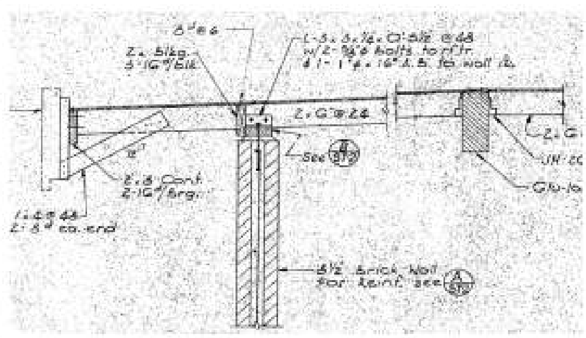
where:

S_{XS} =	0.714		
w_p =	96	psf	8.5" CMU wall
Ap =	1	ft2	
Trib. h =	6.0	ft	
Q_E=	494	lbs	End shear = W x Trib. H; W = 1 ft

Check bolts to Glu lam beam (2- 5/8" dia bolts to 2x rafter) (Deformation-controlled)



A /ST-2 (perpend.)



C /ST-2 (parallel)

Per ASCE 41-13 12.3.3.1 demands on wood connectors shall be considered as deformation-controlled actions.

QUD = QE =	494	lbs/ ft		
A) Per Dwg A/ST-2, wall anchors @ S =	10.00	ft	(double shear)	for east & west walls
B) Per Dwg C/ST-2, wall anchors @ S =	4.00	ft	(single shear)	for North & South walls
A) Out of plane force Q_{UD} =	**4935**	lbs	Each anchor location	for east & west walls
B) Out of plane force Q_{UD} =	**1974**	lbs	Each anchor location	for North & South walls

Table 11I BOLTS: Reference Lateral Design Values, Z, for Double Shear (three member) Connections[1,2]

for structural glued laminated timber main member with 1/4" ASTM A 36 steel side plates

Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.55 Southern Pine $Z_\parallel$ lbs.	G=0.55 Southern Pine $Z_\perp$ lbs.	G=0.50 Douglas Fir-Larch $Z_\parallel$ lbs.	G=0.50 Douglas Fir-Larch $Z_\perp$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\parallel$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\perp$ lbs.	G=0.43 Hem-Fir $Z_\parallel$ lbs.	G=0.43 Hem-Fir $Z_\perp$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\parallel$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\perp$ lbs.	G=0.36 Spruce-Pine-Fir(S) Western Woods $Z_\parallel$ lbs.	G=0.36 Spruce-Pine-Fir(S) Western Woods $Z_\perp$ lbs.
2-1/2	1/4	1/2	-	-	1650	790	1590	700	1500	640	1470	610	1270	490
		5/8	-	-	2190	880	2010	780	1880	700	1840	690	1580	550
		3/4	-	-	2630	980	2410	860	2250	770	2200	750	1900	600
		7/8	-	-	3060	1050	2820	920	2630	830	2570	810	2210	660
		1	-	-	3500	1130	3220	1000	3000	900	2940	880	2530	700
3	1/4	1/2	1720	1100	-	-	-	-	-	-	-	-	-	-
		5/8	2510	1220	-	-	-	-	-	-	-	-	-	-
		3/4	3460	1330	-	-	-	-	-	-	-	-	-	-
		7/8	4040	1440	-	-	-	-	-	-	-	-	-	-
		1	4610	1530	-	-	-	-	-	-	-	-	-	-
3-1/8	1/4	1/2	-	-	1650	980	1590	880	1540	800	1530	770	1430	610
		5/8	-	-	2410	1090	2330	980	2260	880	2230	860	1980	680
		3/4	-	-	3280	1220	3020	1080	2810	960	2750	940	2370	750
		7/8	-	-	3830	1310	3520	1150	3280	1040	3210	1010	2770	820
		1	-	-	4380	1410	4020	1250	3750	1130	3670	1090	3160	860
5	1/4	5/8	2510	1510	-	-	-	-	-	-	-	-	-	-
		3/4	3480	2000	-	-	-	-	-	-	-	-	-	-
		7/8	4630	2410	-	-	-	-	-	-	-	-	-	-
		1	5360	2550	-	-	-	-	-	-	-	-	-	-
5-1/8	1/4	5/8	-	-	2410	1420	2330	1340	2260	1280	2230	1270	2090	1120
		3/4	-	-	3340	1890	3220	1770	3120	1580	3090	1540	2890	1230
		7/8	-	-	4440	2150	4280	1880	4150	1700	4110	1660	3840	1350
		1	-	-	5720	2310	5510	2050	5330	1850	5290	1790	4930	1440

BOLTS

Table 11B BOLTS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2]

for sawn lumber or SCL main member with 1/4" ASTM A 36 steel side plate

Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_\parallel$ lbs.	G=0.67 Red Oak $Z_\perp$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_\parallel$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_\perp$ lbs.	G=0.50 Douglas Fir-Larch $Z_\parallel$ lbs.	G=0.50 Douglas Fir-Larch $Z_\perp$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_\parallel$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_\perp$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\parallel$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\perp$ lbs.	G=0.43 Hem-Fir $Z_\parallel$ lbs.	G=0.43 Hem-Fir $Z_\perp$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\parallel$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\perp$ lbs.	G=0.37 Redwood (open grain) $Z_\parallel$ lbs.	G=0.37 Redwood (open grain) $Z_\perp$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_\parallel$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_\perp$ lbs.	G=0.35 Northern Species $Z_\parallel$ lbs.	G=0.35 Northern Species $Z_\perp$ lbs.
1-1/2	1/4	1/2	730	420	620	350	580	310	580	310	550	290	520	280	510	270	470	240	460	240	450	230
		5/8	910	480	780	400	730	360	720	360	690	340	650	320	640	320	590	290	580	280	560	270
		3/4	1090	550	940	450	870	420	860	410	820	390	780	360	770	360	710	320	690	320	680	310
		7/8	1270	600	1090	510	1020	470	1010	450	960	430	910	410	900	400	820	370	810	360	790	350
		1	1460	660	1250	550	1170	510	1150	500	1100	480	1040	450	1030	450	940	400	930	400	900	390
1-3/4	1/4	1/2	810	460	690	370	640	340	630	330	600	310	570	290	560	280	510	250	500	250	490	240
		5/8	1020	520	870	430	800	390	780	380	750	360	710	340	700	330	640	300	630	290	610	280
		3/4	1220	590	1040	480	960	440	950	430	900	410	860	380	840	370	770	330	750	330	730	320
		7/8	1420	650	1210	540	1130	490	1110	480	1050	460	1000	420	980	420	890	380	880	370	860	360
		1	1630	710	1380	580	1290	540	1270	520	1200	500	1140	470	1120	460	1020	410	1000	410	980	400

Z =	2410 lbs/ bolt	NDS Table 11I	for east & west walls
Z =	800 lbs/ bolt	NDS Table 11B	for North & South walls

2012 NDS

λ tied to ASCE 7 Factored Loads: Baseline 10 minutes (ASD uses 10 years)

Table N3 Time Effect Factor, λ (LRFD Only)

Load Combination[2]		λ
1.4D	Permanent	0.6
1.2D + 1.6L + 0.5(L_r or S or R)		0.7 when L is from storage 0.8 when L is from occupancy 1.25 when L is from impact[1]
1.2D + 1.6(L_r or S or R) + (L or 0.8W)	Long term	0.8
1.2D + 1.0W + L + 0.5(L_r or S or R)		1.0
1.2D + 1.0E + L + 0.2S	Short term	1.0
0.9D + 1.0W		1.0
0.9D + 1.0E		1.0

1. Time effect factors, λ, greater than 1.0 shall not apply to connections or to structural members pressure-treated with water-borne preservatives (see Reference 30) or fire retardant chemicals.
2. Load combinations and load factors consistent with ASCE 7-10 are listed for ease of reference. Nominal loads shall be in accordance with N.1.2. D = dead load; L = live load; L_r = roof live load; S = snow load; R = rain load; W = wind load; and E = earthquake load.

2012 NDS

Table 2.3.5 Format Conversion Factor, K_F (LRFD Only)

Application	Property	K_F
Member	F_b	2.54
	F_t	2.70
	F_v, F_{rt}, F_s	2.88
	F_c	2.40
	$F_{c\perp}$	1.67
	E_{min}	1.76
All Connections	(all design values)	3.32

$$R_N = \phi \lambda K_F R_{ASD}$$

K_F converts reference design values (ASD normal load duration) to LRFD reference resistance

n =	2		
A) Z =	2410	lbs/ bolt	for east & west walls
B) Z =	800	lbs/ bolt	for North & South walls
φ =	1.0	per ASCE 41-13 12.3.2.2.1	
λ =	1.0	per NDS 2012 table N3	
KF =	3.32	per NDS 2012 Table 2.3.5	
RN = φ*λ*KF =	3.32		
A) QCL = n x Z x KF =	16002	lbs	
B) QCL = n x Z x KF =	5312	lbs	
QCE/ QCL =	1.5	per ASCE 41-13 12.3.2.2.1	
m (IO) =	1.4	Table 12-3, machine bolts, metal to wood	
m (LS) =	2.8	Table 12-3, machine bolts, metal to wood	
m = 1/2*[m(IO) + m(LS)] =	2.1	Table 2-1 Footnote b, for Tier 1, Risk Category III	
k =	0.75	Table 6-1, Usual level of knowledge	
QCE = m*K*(QCE/ QCL)*QCL =	37806	lbs	**QUD = 4935 lbs < QCE, OK** for east & west walls
QCE = m*K*(QCE/ QCL)*QCL =	12550	lbs	**QUD = 1974 lbs < QCE, OK** for North & South walls

Appendix 1-C: As-Built Plans

Foundation Plan (S-E1)

Roof Plan (S-E1)

Appendix 7A – Images of Existing Conditions

Fig 1. Exterior adjacent to slope

Fig 2. South end with large openings

Fig 3. Covered walkway

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
CLASSROOM BUILDING (F)

MIRALESTE INTERMEDIATE SCHOOL
29323 Palos Verdes Dr. E,
Rancho Palos Verdes, CA 90275

REGISTERED PROFESSIONAL ENGINEER
TERRY C. TSANG
No.S2992
Exp. 06/30/2016
STRUCTURAL
STATE OF CALIFORNIA

Terry Tsang, S.E.
Structural Engineer S2992

TTG Job No.: 0215.768.00

JANUARY 2016

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Table of Contents

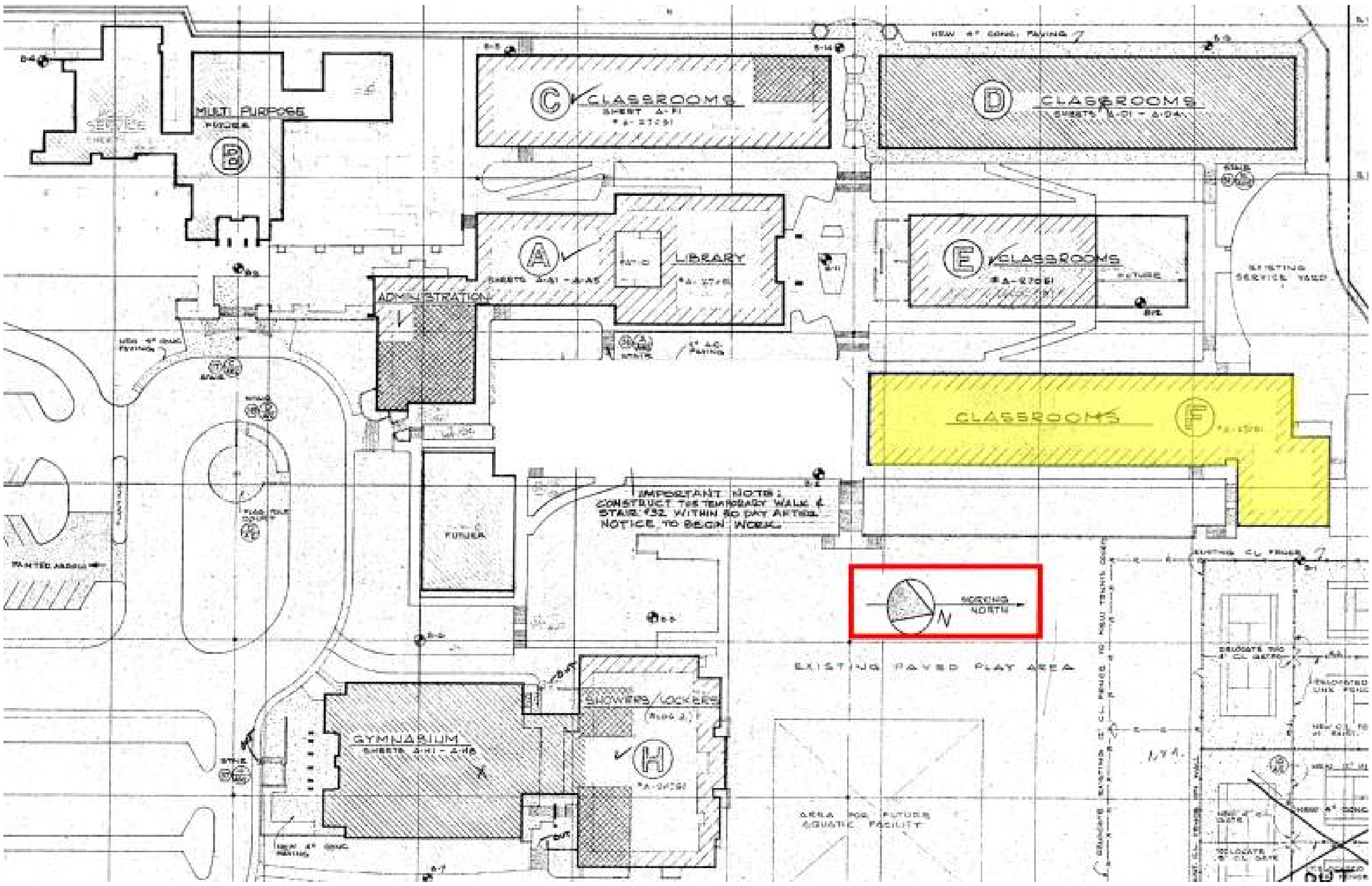
1.0 Introduction

A multiphase seismic vulnerability assessment of Classroom Building F was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.


12/21/2015

An overall campus map of Jefferson High School, indicating the buildings under evaluation, is provided below. The highlighted building is ***Classroom Building F.***



Site Map- Classroom Building F

2.0 Classroom Building F

2.1 Site Seismicity

Per ASCE 41-13 (2012 IBC), for Miraleste Intermediate School located at 29323 Palos Verdes Dr. E, Rancho Palos Verdes, CA 90275

Site Coordinates = 33.75222°N, 118.32549°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.514 g; $S_{1,20/50}$ = 0.197 g
Fa = 1.389 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.01 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.714 g
$S_{X1} = F_v S_{1,20/20}$ = 0.396 g

2.2 Building Description

The Classroom Building ‘F’ is mostly one-story building in the northern part of the school campus. Portion of building at north end is stepping down five feet & then at 90 degree turn, about twenty three feet long is two-story with same roof elevation but lower base(twenty two feet drop) & separated by a 13” concrete retaining wall. The set of existing drawings is available dated February 1967, which shows the proposed building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of classrooms, & two workshops located at depressed area. The building is kind of L-shaped (with relatively short toe) with approximate dimensions of 100’ x 300’. Total footprint of the building is estimated to be ±19,700 square feet. Roof typical height is about 13’-3” @ one story portion, 18’-3” at depressed area and 39’-8” @ small two-story portion (with lower base), but roof elevation stays same all over the building.

The building roof consists of blocked plywood sitting on glulam chord ties with ridge glulam beam at center, which is considered flexible diaphragm. The building has continuous spread footing below the reinforced bearing brick walls and spread footing below gravity columns. The lateral system of the building is mainly formed of reinforced brick wall in both directions & partial concrete walls at two story portion. Therefore, based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as “RM1”.

The structural risk category for the administration building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Classroom Building F Summary Table	
Year Designed	1967
Drawings	***Original drawings prepared by Donley.Bundy & Associates(Arch.) & Wilson & Wilson Structural Engineers; dated February 1967***
Gravity System	Wood roof diaph. On glulam beams on bearing brick walls w/infill HSS columns
Lateral System	Reinforced Brick Walls
No. of Stories & Height	One Story; Typ. Roof: h_n=13.5 ft; depressed area roof=18.5 ft
Building Period "T"	0.141 Sec
Base Shear "V"	0.714 W = 646 Kips
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	-

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of ***Classroom building F*** is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

No deficiencies were identified post Tier 1 analysis.

3.2 ASCE 41-13 Tier 2 Evaluation

No Tier 2 evaluation required.

4.0 Conclusions

After further review and updating tier 1 checklist as per ASCE 41-13, no major deficiencies were identified which required tier 2 evaluation.

Only recommended item which is not specifically a checklist related and might require further study in later phases is the check on adequacy of the retaining wall which is occurring at small two-story portion and storage wall. The study will require further

geotechnical study of soil, obtain required parameters and verify the adequacy of retaining wall in place during seismic event when active pressure pushes on the wall. Given the reason above, a voluntary seismic retrofit is not required for this structure.

5.0 Documents Reviewed

The following existing drawings were reviewed:

Date	Architect / Engineer	TTG Comments
February 1967	Donley. Bundy & Associates (Architect) Wilson & Wilson (Structural Engineer)	Title Block states “Building F” (State of California – Department of General Services, Office of Architecture and Construction Project No. 27051)

6.0 Limitations

These reports represent ***TTG’s*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Miraleste Intermediate School Building F, Classrooms & Shops

Table of Contents

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the

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District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Miraleste Intermediate School was originally constructed as a public high school with in the Palos Verdes Peninsula Unified School District. It was constructed in four phases in 1967, 1970, 1973 and 1977. It was originally called Miraleste High School and has been in constant use as a public school since that time. The original campus buildings were designed by the firm of Donley Bundy & Associates and is mostly of reinforced brick and concrete masonry, and wood construction. The building referred to as Building F is part of the 1967 phase.

Building F contains classrooms and shop classrooms in an L configuration on the north end. It sets above a large terrace slope. It is mostly a single story structure with overhangs to cover the circulation walks. There is an exposed basement level under a portion of the shops on west end that serves as storage space and opens out on to the lower paved area. It is a reinforced brick masonry wall structure with a concrete bond beam around the top of the walls to transfer the roof beam load to the walls. The roof structure is a wood framed with glue laminated beams and secondary joists.

All portions of the building are of Type-5 1 hour rated construction and appear fit within the current CBC Type-5A requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability,

moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Work

No Recommended Retrofit
After further tier 2 analysis it was determined that the building does not require any seismic retrofit work for life safety.

Accessibility Upgrades

There are no accessibility upgrades anticipated for this building since no retrofit work is recommended.

Fire & Life Safety

There are no fire & life safety upgrades anticipated for this building since no retrofit work is recommended.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Appendix 1-A: Tier 1 Screening Checklists/Calculation

ASCE 41-13

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path, so compliant.
x				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.3)	No adjacent bldg.
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanine levels in the building, not applicable.
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	One story bldg.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	One story bldg.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	Per review of as-built and site investigation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	One story bldg.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	One story bldg.
		x		TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Flexible diaphragm.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
			x	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	No geotech report available but not anticipated per site location.
			x	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	No geotech report available
			x	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	No geotech report available
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					

C	NC	N/A	U	Checklist	Comments
x				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.714=0.43< min(60,300)/18.25=3.3 Compliant per review of existing drawings. Elements of the lateral system can work together, so building dimension is used for this check since all the elements are well connected.
x				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Compliant per review of existing foundation plan.(Ref. sheet S-F1)

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY BEARING WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY BEARING WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. Commentary Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1.	Per as-built dwgs
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in.^{2} . Commentary Sec. A.3.2.4.1. Tier 2: Sec. 5.5.3.1.1.	See provided calc at end of checklist
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. Commentary Sec. A.3.2.4.2. Tier 2: Sec. 5.5.3.1.3.	See provided calc at end of checklist
				Stiff Diaphragms	

C	NC	N/A	U	Checklist	Comments
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. Commentary Sec. A.4.5.1. Tier 2: Sec. 5.6.4	Wood diaphragm
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. Commentary Sec. A.5.1.1. Tier 2:Sec. 5.7.1.1.	See provided calc at end of checklist
		x		WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. Commentary Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3.	Per S-T2 details, no wood ledger exist.
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. Commentary Sec. A.5.2.1. Tier 2: Sec. 5.7.2.	Per A/S-T2, anchor bolts @ each Glulam beam location and 48" o.c. in between provided
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. Commentary Sec. A.5.2.3. Tier 2: Sec. 5.7.2.	All wood diaphragm
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. Commentary Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4	Per B/S-T3 detail
x				GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. Commentary Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1.	
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.					

C	NC	N/A	U	Checklist	Comments
Stiff Diaphragms					
		x		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. Commentary Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3.	Flexible diaphragm
		x		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. Commentary Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3.	Flexible diaphragm
Flexible Diaphragms					
x				CROSS TIES: There are continuous cross ties between diaphragm chords. Commentary Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2.	Glulam beams as cross ties between chords…per S-F2 roof plan
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. Commentary Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3.	No large opening…ref. S-F2 roof plan
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. Commentary Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3.	No large opening…ref. S-F2 roof plan
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. Commentary Sec. A.4.2.1. Tier 2: Sec. 5.6.2	5/8" plywood diaphragm per S-F2 roof plan
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. Commentary Sec. A.4.2.2. Tier 2: Sec. 5.6.2.	5/8" plywood diaphragm per S-F2 roof plan
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. Commentary Sec. A.4.2.3. Tier 2: Sec. 5.6.2.	Blocked plywood diaphragm per S-F2 roof plan
x				OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than	Wood diaphragm

C	NC	N/A	U	Checklist	Comments
				wood, metal deck, concrete, or horizontal bracing. Commentary Sec. A.4.7.1. Tier 2: Sec. 5.6.5.	
Connections					
X				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. Commentary Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2.	

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
Life Safety Systems					

C	NC	N/A	U	Checklist	Comments
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
Hazardous Materials					
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	
				Light Fixtures	
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Proper support was observed
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Cladding and Glazing	
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
Masonry Veneer					
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no	No URM backup, so not applicable.

C	NC	N/A	U	Checklist	Comments
				unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
Parapets, Cornices, Ornamentation, and Appendages					
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
			X	LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Not accessible during site visit
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No parapets; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	
				Masonry Chimneys	
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
				Stairs	
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
				Contents and Furnishings	
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable

C	NC	N/A	U	Checklist	Comments
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
	X			LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	Air conditioning units suspended from canopies over existing windows are not properly braced.
			X	LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Not accessible during site visit
X				LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	Proper anchorage was observed

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
Piping					
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	
Ducts					
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
Elevators					
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

DL =	**20**	**psf**
Use	**20**	**psf**

CMU Wall Weight

8 1/2" CMU wall =	96	psf
10" CMU wall =	113	psf
12" CMU wall =	135	psf

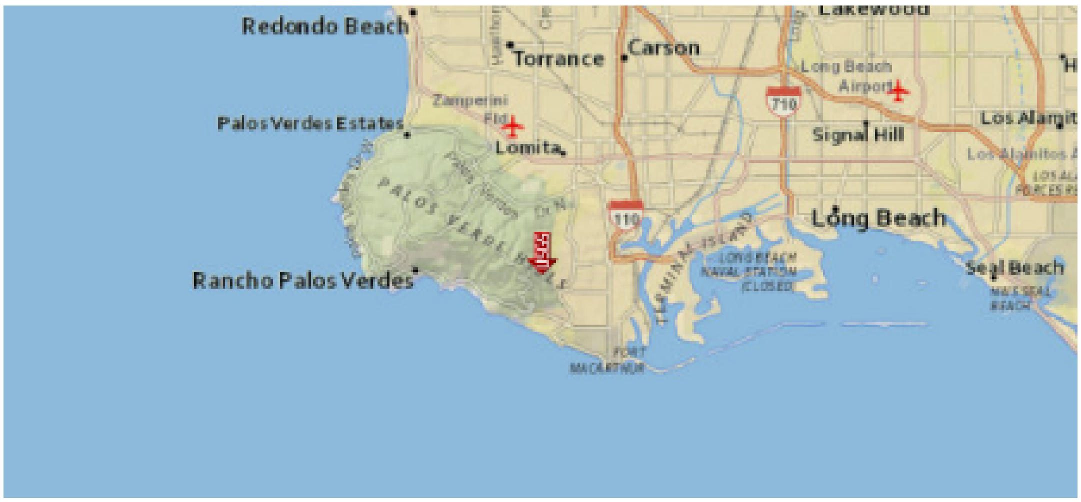
USGS Design Maps Summary Report

User–Specified Input

Building Code Reference Document ASCE 41-13 Retrofit Standard, BSE-1E
(which utilizes USGS hazard data available in 2008)

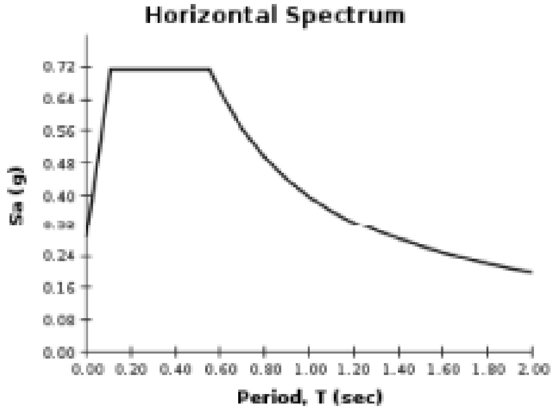
Site Coordinates 33.75222°N, 118.32549°W

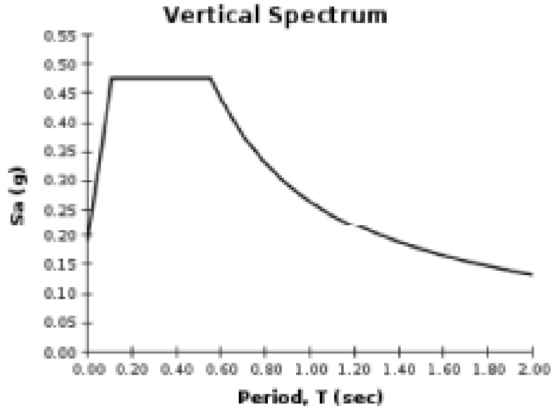
Site Soil Classification Site Class D – "Stiff Soil"



USGS–Provided Output

$S_{S,10/50}$	0.514 g	$S_{XS,BSE-1E}$	0.714 g
$S_{1,10/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g





Mass Weight Calculation

Location		Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Roof	Area 1	-	-	19700.0	20	394
elevated 6" floor	Area 2	60.0	22.0	1320.0	72.5	96
	Walls 1	480.0	6.0	2880.0	96	276
(depressed area)	Walls 2*	319.0	8.5	2711.5	96	260
	Grand Total =		Roof	**19700**		**931**

*Since all openings are conservatively ignored and 8.5" solid wall are considered in weight, therefore minimal lenghts of thicker walls (10" or 12" in depressed area) are assumed 8.5" too.

Base shear V= 0.714 W
Base shear V= 665

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m

m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1 Footnote b for reinforced masonary walls

Reinforcing Steel Ratio Check:

8.5" CMU wall with #5 @ 24" Hori & Verti

Hori / Vert ρ=	0.0015	>0.0007 OK
Total ρ=	0.0030	>0.002 OK

10" CMU wall with #5 @ 20" Hori & Verti

Hori / Vert ρ=	0.0013	>0.0007 OK
Total ρ=	0.0026	>0.002 OK

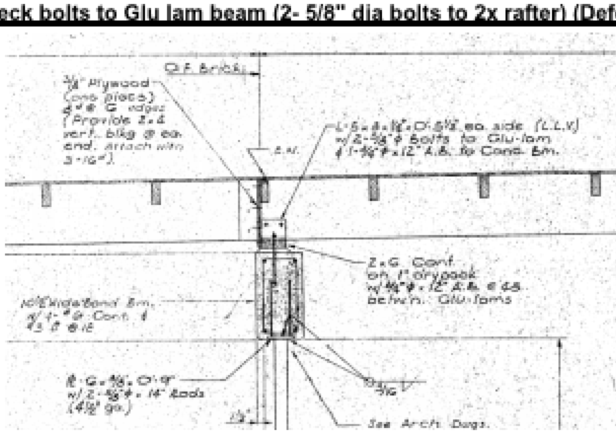
12" CMU wall with #4@ 13" Hori & Verti, ea. face

Hori / Vert ρ=	0.0026	>0.0007 OK
Total ρ=	0.0051	>0.002 OK

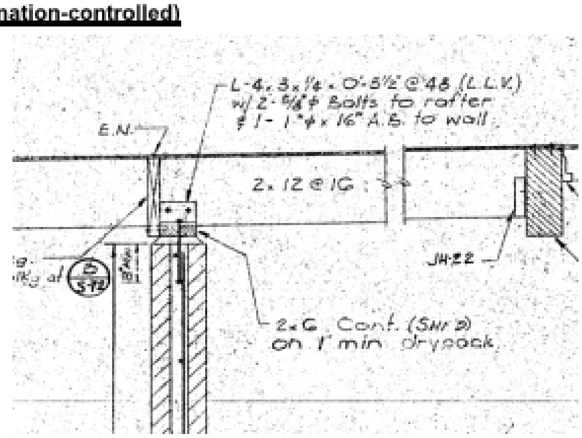
Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

Tc= $1.2S_{XS}\ w_p\ A_p$ =	82.3	psf	Eqn 4-13
where:			
S_{XS} =	0.714		
w_p =	*96*	psf	8.5" CMU wall
Ap =	1	ft2	
Trib. h =	8.5	ft	
Q_E=	699	lbs	End shear = W x Trib. H; W = 1 ft

Check bolts to Glu lam beam (2- 5/8" dia bolts to 2x rafter) (Deformation-controlled)



A /ST-2 (perpend.)



B /ST-2 (parallel)

Per ASCE 41-13 12.3.3.1 demands on wood connectors shall be considered as deformation-controlled actions.

QUD = QE =	699	lbs/ ft		
A) Per Dwg A/ST-2, wall anchors @ S =	10.00	ft	(double shear)	for east & west walls
B) Per Dwg B/ST-2, wall anchors @ S =	4.00	ft	(single shear)	for North & South walls
A) Out of plane force Q_{UD} =	**6991**	lbs	Each anchor location	for east & west walls
B) Out of plane force Q_{UD} =	**2797**	lbs	Each anchor location	for North & South walls

Table 11I BOLTS: Reference Lateral Design Values, Z, for Double Shear (three member) Connections[1,2]

for structural glued laminated timber main member with 1/4" ASTM A 36 steel side plates

Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.55 Southern Pine $Z_{\parallel}$ lbs.	G=0.55 Southern Pine $Z_{\perp}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\parallel}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\perp}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\parallel}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\perp}$ lbs.	G=0.43 Hem-Fir $Z_{\parallel}$ lbs.	G=0.43 Hem-Fir $Z_{\perp}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\parallel}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\perp}$ lbs.	G=0.36 Spruce-Pine-Fir(S) Western Woods $Z_{\parallel}$ lbs.	G=0.36 Spruce-Pine-Fir(S) Western Woods $Z_{\perp}$ lbs.
2-1/2	1/4	1/2	-	-	1660	790	1590	700	1500	640	1470	610	1270	490
		5/8	-	-	2190	880	2010	780	1880	700	1840	690	1580	550
		3/4	-	-	2630	980	2410	860	2250	770	2200	750	1900	600
		7/8	-	-	3060	1050	2820	920	2630	830	2570	810	2210	660
		1	-	-	3500	1130	3220	1000	3000	900	2940	880	2530	700
3	1/4	1/2	1720	1100	-	-	-	-	-	-	-	-	-	-
		5/8	2510	1220	-	-	-	-	-	-	-	-	-	-
		3/4	3460	1330	-	-	-	-	-	-	-	-	-	-
		7/8	4040	1440	-	-	-	-	-	-	-	-	-	-
		1	4610	1530	-	-	-	-	-	-	-	-	-	-
3-1/8	1/4	1/2	-	-	1650	980	1590	880	1540	800	1530	770	1430	610
		5/8	-	-	2410	1090	2330	980	2260	880	2230	860	1980	680
		3/4	-	-	3280	1220	3020	1080	2810	960	2750	940	2370	750
		7/8	-	-	3830	1310	3520	1150	3280	1040	3210	1010	2770	820
		1	-	-	4380	1410	4020	1250	3750	1130	3670	1090	3160	890
5	1/4	5/8	2510	1510	-	-	-	-	-	-	-	-	-	-
		3/4	3480	2000	-	-	-	-	-	-	-	-	-	-
		7/8	4830	2410	-	-	-	-	-	-	-	-	-	-
		1	6360	2550	-	-	-	-	-	-	-	-	-	-
5-1/8	1/4	5/8	-	-	2410	1420	2330	1340	2260	1280	2230	1270	2090	1120
		3/4	-	-	3340	1890	3220	1770	3120	1580	3090	1540	2890	1230
		7/8	-	-	4440	2150	4280	1880	4150	1700	4110	1650	3840	1350
		1	-	-	5720	2310	5510	2050	5330	1850	5290	1790	4930	1440

BOLTS

Table 11B BOLTS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2]

for sawn lumber or SCL main member with 1/4" ASTM A 36 steel side plate

Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_{\parallel}$ lbs.	G=0.67 Red Oak $Z_{\perp}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\parallel}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\perp}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\parallel}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\perp}$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_{\parallel}$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_{\perp}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\parallel}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\perp}$ lbs.	G=0.43 Hem-Fir $Z_{\parallel}$ lbs.	G=0.43 Hem-Fir $Z_{\perp}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\parallel}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\perp}$ lbs.	G=0.37 Redwood (open grain) $Z_{\parallel}$ lbs.	G=0.37 Redwood (open grain) $Z_{\perp}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\parallel}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\perp}$ lbs.	G=0.35 Northern Species $Z_{\parallel}$ lbs.	G=0.35 Northern Species $Z_{\perp}$ lbs.
1-1/2	1/4	1/2	730	420	620	350	580	310	580	310	550	290	520	280	510	270	470	240	460	240	450	230
		5/8	910	480	780	400	730	360	720	360	690	340	650	320	640	320	590	290	580	280	560	270
		3/4	1090	550	940	450	870	420	860	410	820	390	780	360	770	360	710	320	690	320	680	310
		7/8	1270	600	1090	510	1020	470	1010	450	960	430	910	410	900	400	820	370	810	360	790	350
		1	1460	690	1250	550	1170	510	1150	500	1100	480	1040	450	1030	450	940	400	930	400	900	390
1-3/4	1/4	1/2	810	460	690	370	640	340	630	330	600	310	570	290	560	280	510	250	500	250	480	240
		5/8	1020	520	870	430	800	390	790	380	750	360	710	340	700	330	640	300	630	290	610	280
		3/4	1220	590	1040	480	960	440	950	430	900	410	860	380	840	370	770	330	750	330	730	320
		7/8	1420	650	1210	640	1130	490	1110	480	1050	450	1000	420	980	420	880	350	880	370	850	360
		1	1630	710	1380	580	1290	540	1270	520	1200	500	1140	470	1120	460	1020	410	1000	410	980	400

Z =	2410 lbs/ bolt	NDS Table 11I	for east & west walls
Z =	800 lbs/ bolt	NDS Table 11B	for North & South walls

TTG

2012 NDS

λ tied to ASCE 7 Factored Loads: Baseline 10 minutes (ASD uses 10 years)

Table N3 Time Effect Factor, λ (LRFD Only)

Load Combination[2]		λ
1.4D	Permanent	0.6
$1.2D + 1.6L + 0.5(L_r$ or S or R)		0.7 when L is from storage 0.8 when L is from occupancy 1.25 when L is from impact[1]
$1.2D + 1.6(L_r$ or S or R) + (L or 0.8W)	Long term	0.8
$1.2D + 1.0W + L + 0.5(L_r$ or S or R)		1.0
1.2D + 1.0E + L + 0.2S	Short term	1.0
0.9D + 1.0W		1.0
0.9D + 1.0E		1.0

1. Time effect factors, λ, greater than 1.0 shall not apply to connections or to structural members pressure-treated with water-borne preservatives (see Reference 30) or fire retardant chemicals.
2. Load combinations and load factors consistent with ASCE 7-10 are listed for ease of reference. Nominal loads shall be in accordance with N.1.2. D = dead load; L = live load; L_r = roof live load; S = snow load; R = rain load; W = wind load; and E = earthquake load.

2012 NDS

Table 2.3.5 Format Conversion Factor, K_F (LRFD Only)

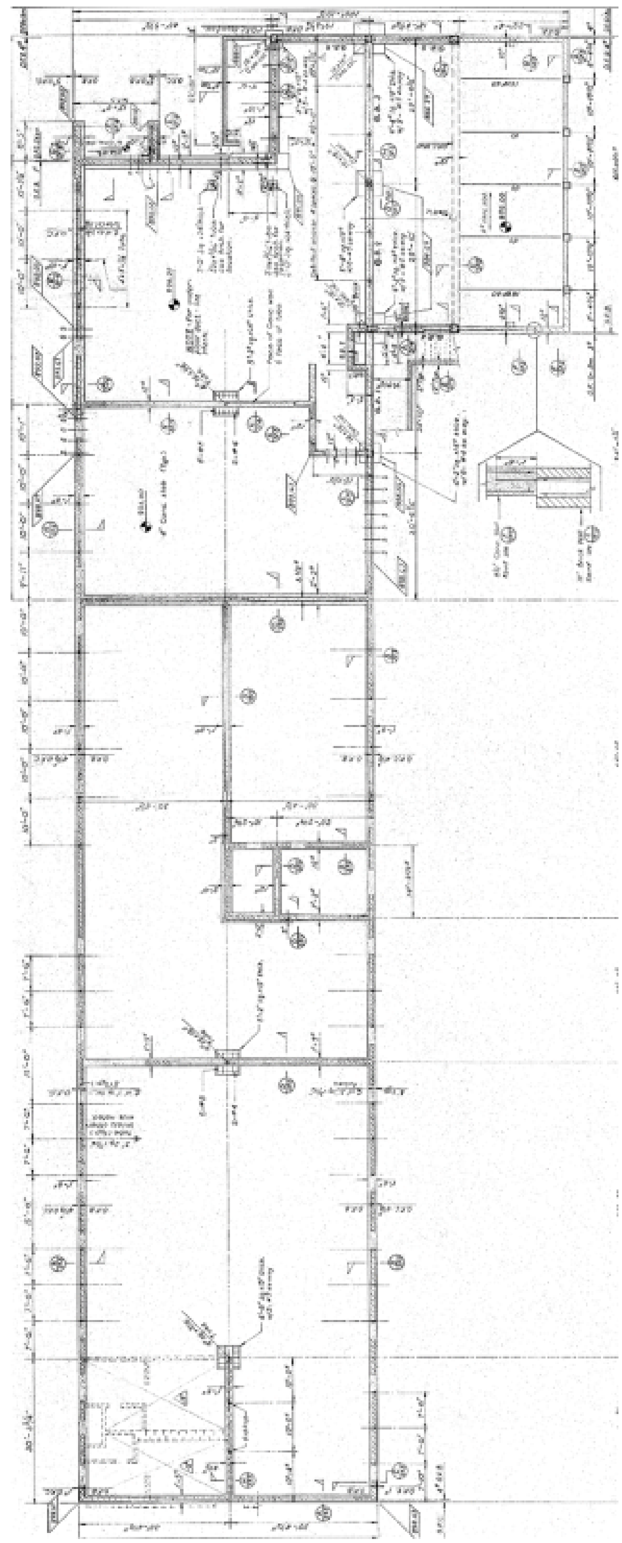
Application	Property	K_F
Member	F_b	2.54
	F_t	2.70
	F_v, F_{rt}, F_s	2.88
	F_c	2.40
	$F_{c\perp}$	1.67
	E_{min}	1.76
All Connections	(all design values)	3.32

$$R_N = \phi \lambda K_F R_{ASD}$$

K_F converts reference design values (ASD normal load duration) to LRFD reference resistance

n =	2		
A) Z =	2410	lbs/ bolt	for east & west walls
B) Z =	800	lbs/ bolt	for North & South walls
ϕ =	1.0	per ASCE 41-13 12.3.2.2.1	
λ =	1.0	per NDS 2012 table N3	
KF =	3.32	per NDS 2012 Table 2.3.5	
RN = ϕ*λ*KF =	3.32		
A) QCL = n x Z x KF =	16002	lbs	
B) QCL = n x Z x KF =	5312	lbs	
QCE/ QCL =	1.5	per ASCE 41-13 12.3.2.2.1	
m (IO) =	1.4	Table 12-3, machine bolts, metal to wood	
m (LS) =	2.8	Table 12-3, machine bolts, metal to wood	
m = 1/2*[m(IO) + m(LS)] =	2.1	Table 2-1 Footnote b, for Tier 1, Risk Category III	
k =	0.75	Table 6-1, Usual level of knowledge	
QCE = m*K*(QCE/ QCL)*QCL =	37806	lbs	**QUD = 6991 lbs < QCE, OK** for east & west walls
QCE = m*K*(QCE/ QCL)*QCL =	12550	lbs	**QUD = 2797 lbs < QCE, OK** for North & South walls

Appendix 1-C: As-Built Plans



Foundation Plan (S-F1)

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Roof Plan (S-F2)

Appendix 7A – Images of Existing Conditions

Fig 1. Terrace slope

Fig 2. Circulation walk with overhang

Fig 3. Exposed basement

Fig 4. Shop ceiling with HVAC unit

Fig 5. Basement storage area

Fig 6. Typical shop equipment

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
GYMNASIUM BUILDING (G)

MIRALESTE INTERMEDIATE SCHOOL
29323 Palos Verdes Dr. E,
Rancho Palos Verdes, CA 90275

Terry Tsang, S.E.
Structural Engineer S2992
TTG Job No.: 0215.768.00

FEBUARY 2016

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1.0 Introduction - Gymnasium Building (G)

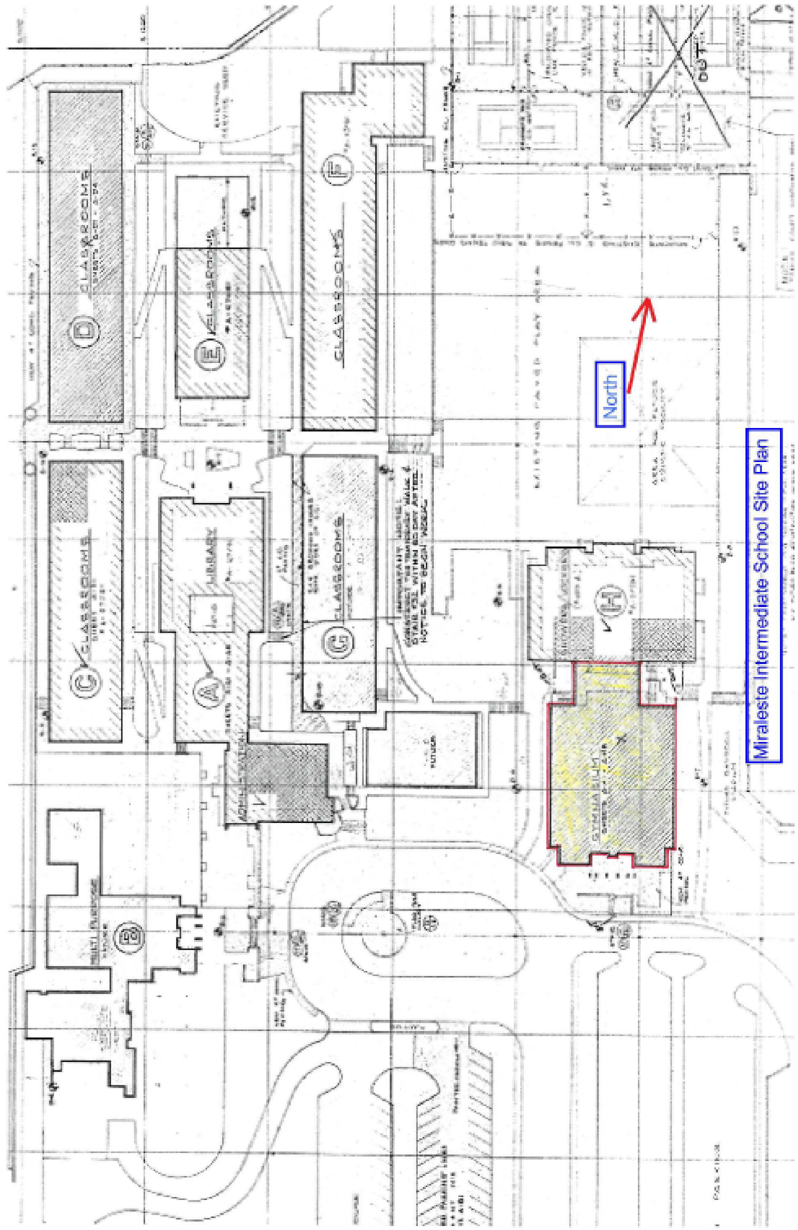
A multiphase seismic vulnerability assessment of ***Gymnasium Building*** was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Photo 1 – Exterior View of Gymnasium Building

Photo 2 – Interior View of Gymnasium Building

An overall campus map of Miraleste Intermediate School, indicating the buildings under evaluation, is provided below. The highlighted building is ***Gymnasium Building (G).***



Partial Site Plan- Gymnasium Building (G)

2.0 Building (G)– Gymnasium Building

2.1 Site Seismicity

Based on 1968 construction drawings, original foundation was based on the allowable soil bearing pressure of 1,800 psf for vertical dead loads plus live loads. There is no geotechnical report available for review.

Per ASCE 41-13 (2012 IBC), for Miraleste Intermediate School located at 29323 Palos Verdes Drive East, Rancho Palos Verdes, CA 90275,

Site Coordinates = 33.75222°N, -118.32549°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.514g; $S_{1,20/50}$ = 0.197 g
Fa = 1.389 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.010 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.714g
$S_{X1} = F_v S_{1,20/20}$ = 0.396g

2.2 Building Description

The Gymnasium Building is a one-story building at the east side of the school campus. The building was constructed circa 1968. The existing drawings for the building are dated November 8, 1968, which shows the proposed gymnasium building construction and implies the building was constructed shortly thereafter.

Functionally, the building consists of one story of gymnasium with entry and restrooms at the south end of the building. At the north end of the gymnasium is a dance room at the second floor that was built over and attached to the adjoining Storage and Locker building. Since the Dance Room is attached to the Storage and Locker Building, it is considered structurally as part of that building for the purposes of evaluation.

The dance room is separated from the Gymnasium building at the second floor and roof levels by a 2 inch gap.

The main gymnasium building is rectangular in shape with approximate dimensions of 100.8’ x 114.8’. Total footprint of the original building is estimated to be ±13,100 square feet. The roof height at the high point of the gymnasium is 30’-0” and 27’-0” at the low point. The average gymnasium roof height is about 28’-6”. The roof height of the entry is 19’-6”. The restrooms roof height at the two ends is 10’-3”. The roof of the building consists of 2-1/2” thick reinforced gypsum deck on steel bulb tees at 2’-0 5/8”over 10 inch deep I-beams at 7’-0” spaces. The wood joists are supported by tapered steel girders 24” – 48” in depth. The tapered steel girders are spaced at spaces varying from 19’-5” to 19’-0”. The tapered steel girders are typically supported by cast-in-place concrete columns along the perimeter of the buildings. The lateral force resistance of the building is provided by reinforced brick walls. The foundation of the building consists of concrete spread footing under the concrete columns and continuous wall footings.

Based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as “RM1”.

The structural risk category for the multipurpose building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse.

For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy.

The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Building (5)– Gymnasium Building Summary Table	
Year Designed	1968
Drawings	Original drawings, dated November 8, 1968, prepared by Donley Bundy & Associates Architects, with Wilson & Wilson Structural Engineers.
Gravity System	Gymnasium Roof: Reinforced Gypsum Deck on steel beam purlins on tapered steel girders supported on columns/walls/foundation (Flexible Diaphragm) Entry and Restrooms Roofs: Plywood on wood joists supported on walls (Flexible Diaphragm)
Lateral System	Reinforced masonry (Brick) bearing walls
No. of Stories & Height	1 Story; Main Roof: h_n=28.5 ft; Entry Roof: h_n= 19.5 ft; Restrooms Roof: 10.3 ft
Building Period "T"	0.247 s
Base Shear "V"	0.714W = 1011 kips (RM1)
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	1. Wood ledgers (cross-grain bending) 2. Other diaphragms (reinforced gypsum concrete)
Retrofit Recommendations	See Section 4.1 (Retrofit required)

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of the Building is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening, if needed. As a Risk Category ***III***, structure the Basic Performance Objective for the building was ***Damage Control Structural***

Performance, per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; some were found to be "Compliant" and others were found to remain "Deficient."

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Adjacent Buildings
- Tier 1 Deficiency No. 2: Wood Ledgers
- Tier 1 Deficiency No. 3: Other Diaphragms

All of the deficiencies listed above were reviewed using a Tier 2 Evaluation, which can be found in ***Appendix 1-B***.

Deficiency No. 1 (Adjacent Buildings) was mitigated with analysis results per ASCE 41-13 section 5.4.1.2 by ensuring that the provided building separation is larger than the expected building displacement at the roof level of the lower building.

Tier 2 analysis was performed using analysis results from the ETABS model developed for the Tier 2 evaluations. Linear static procedure was used for the analysis of the structure using BSE-1E level seismic response spectrum. Output results were exported to Excel spreadsheets and calculations per ASCE 41-13 were performed.

Following are remaining deficient items following the Tier 2 evaluation:

1. Tier 1 Deficiency No. 2: Wood Ledgers. The connections are subject to cross-grain bending. No Tier 2 procedure is available to demonstrate compliance.
2. Tier 1 Deficiency No. 3: Other Diaphragms. The reinforced gypsum concrete diaphragm is inadequate.

3.2 Tier 2 Evaluation and Proposed Retrofit Summary Table

Building	Identified Tier 1 Deficiencies	Tier 2 section number	Tier 2 Evaluation Result	Proposed Retrofit
Building G Target Structural Performance Level: ***S-2 Damage Control***	***16.12 LS Adjacent Buildings***	**5.4.2**	***Adequate***	
	16.15 LS Wood Ledgers	**5.7.1.3**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in Section 4.1.***
	16.15 LS Other Diaphragms	**5.6.5**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in Section 4.1.***

4.0 Conclusions

1. The “wood ledgers” deficiency is due to the fact that the wood ledgers are subject to cross-grain bending. Such failure is sudden and non-ductile and can result in partial collapse of the entry and restroom roofs. Please refer to Fig. A-37 of ASCE 41-13 below to clarify:

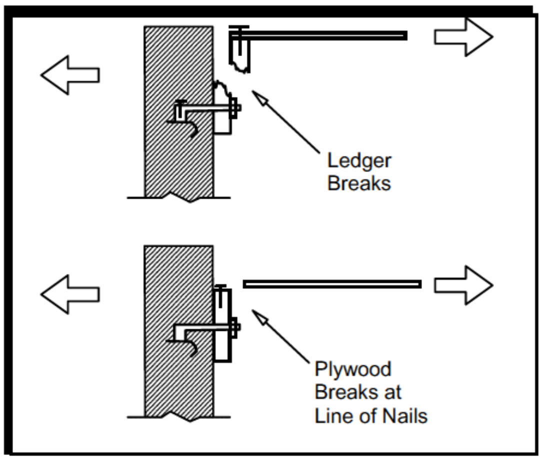


FIG. A-37. Wood Ledgers

2. The “other diaphragms” deficiency is due to the fact that the gymnasium roof diaphragm consists of reinforced gypsum concrete which is a diaphragm other than wood, metal deck, concrete or horizontal bracing. Reinforced gypsum is brittle and has limited strength. The existing reinforced gypsum concrete diaphragm was confirmed to be inadequate.

4.1 Proposed Retrofit Options

Summary of Retrofit options:

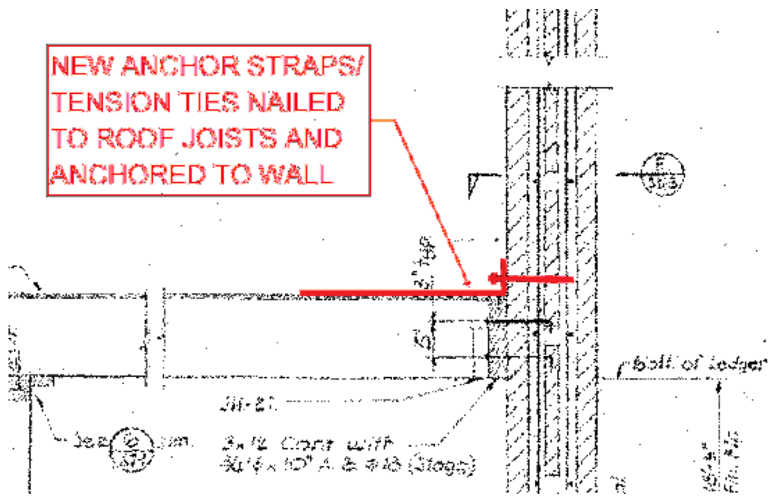
1. Wood ledgers. To eliminate cross-grain bending of the wood ledgers, the following retrofit options are feasible:
    a. Add new steel straps over the roof joists to anchor the wood diaphragms directly to the walls.
    b. Add hold-down anchors to the roof joists to anchor the wood diaphragms directly to the walls.
2. Other diaphragms. To reinforce the existing reinforced gypsum diaphragm, the following options are feasible:
    a. a. Remove all the existing gypsum deck and the supporting steel bulb tee sub-purlins, and replace with new metal deck. Cut off existing ledger stud anchors to allow for the attachment of the new metal deck. Weld new steel angle ties at maximum 4 ft on centers to the underside of the new metal roof deck and anchor to the east and west walls. The new ties would replace the steel bulb tees that are currently supporting the east and west walls in the out-of-plane direction. OR
    b. b. Add horizontal diagonal bracing to the gymnasium roof framing. The bracing may consist of either steel rods or angles.

4.2 Structural Retrofit Selection Recommendations and Conclusions

Based on our analysis of ***Building G***, we recommend implementing the following retrofit options:

1. Wood ledgers. We recommend option (a), the addition of new straps over plywood over the roof joists to anchor the wood diaphragms directly to the walls. This option should be less invasive as it would not require the removal of ceilings as in option (b) in

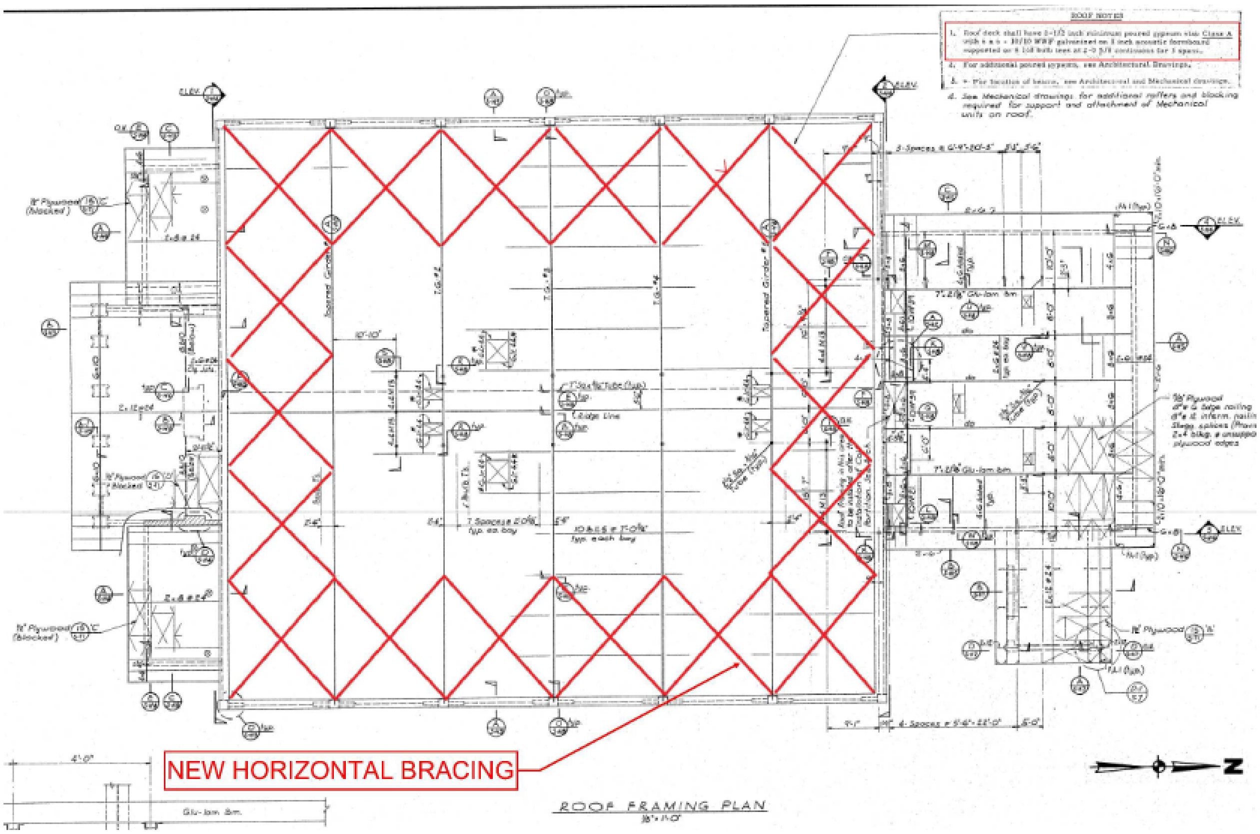
order to install holdown anchors to the joists. Please refer to retrofit sketch (Sketch 1) below.



Sketch 1 – Retrofit to address "wood ledgers" deficiency at Gymnasium entry and restroom roofs

2. Other diaphragms. We recommend option (b), the addition of horizontal diagonal bracing to the gymnasium roof framing. This option is clearly less invasive than

replacing the entire gypsum deck with metal deck per option (a) above. Please see retrofit sketch (Sketch 2) below.



Sketch 2 – Retrofit to address "other diaphragms" deficiency at Gymnasium roof

The above identified deficiencies are major structural deficiencies and pose a serious collapse hazard if they are not mitigated.

Given the reasons above, a voluntary seismic retrofit is recommended for this structure to mitigate these deficiencies.

5.0 Documents Reviewed

The following existing architectural and or structural drawings (and or other documents when available) were reviewed:

Date	Architect / Engineer	TTG Comments
November 8, 1968	Donley . Bundy & Associates Architects, with Wilson & Wilson Structural Engineers.	Title Block states "Miraleste High School Second Increment, Palos Verdes Peninsula Unified School District" Architectural and structural drawings (State of California – Department of Public Works, Division of Architecture, Project No. 29168)

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Miraleste Intermediate School Building G, Gymnasium

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7.0 Architectural Section

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part

234 E. Colorado Boulevard Suite 700, Pasadena, California 91101 T: 626.432.5000 F: 626.432.5010 www.pbws.com Architecture Planning Interiors

of the District's facilities. This resulted in the identification and verification of the District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Miraleste Intermediate School was originally constructed as a public high school with in the Palos Verdes Peninsula Unified School District. It was constructed in four phases in 1967, 1970, 1973 and 1977. It was originally called Miraleste High School and has been in constant use as a public school since that time. The original campus buildings were designed by the firm of Donley Bundy & Associates and is mostly of reinforced brick and concrete masonry, and wood construction. The building referred to as Building G is part of the 1970 phase.

Building G contains the gymnasium and entry lobby. It is a reinforced brick masonry wall structure with a steel roof system. There are engaged concrete columns to support the tapered steel girders that comprise the main structure. The lower adjacent spaces have a wood roof system with a brick colonnade at the front entry. The locker building immediately adjacent to building G and referred to as building H was constructed earlier in the 1967 phase. A link was constructed to connect the two buildings even though they are structurally separated.

All portions of the building are of Type-5 non-rated construction and appear fit within the current CBC Type-5B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Item 1

Low roof connection to high wall enhancement
This work is to enhance connection of the lobby roof diaphragm to the high wall of the gymnasium. The existing roof is a wood roof system connected to the reinforced brick wall of the gymnasium with a wood ledger. The ledger is connected to with anchors through the middle. The enhancement work will consist of providing straps above the plywood roof deck connected through to the roof joists. The straps will be connected by steel angle to the masonry wall with anchors. The work will require removing part of the roof system adjacent to the gym wall and patching it back. See conceptual detail #3.

Retrofit Item 2

Gymnasium roof diaphragm enhancement
This work is to enhance the high roof diaphragm over the gymnasium. The existing roof is metal deck with gypsum concrete fill supported by tapered steel girders and steel

purlins. The enhancement work will consist of providing cross bracing at perimeter bays of the roof. The bracing will likely be steel angles attached to the tapered steel girders and masonry wall with brackets. The extent of the bracing will be completely determined when complete design and engineering is done. This work can be done without disturbing the roofing since the roof structure is open to and can be accessed from below. See conceptual detail #4.

Accessibility Upgrades

The retrofit work has no direct influence on accessibility, however if retrofit work is designed and submitted to DSA there will be some minimum level of access compliance work that will be required as a condition of the obtaining approval. Typically there are requirements for an accessible path of travel to the subject building from parking and accessible restrooms to serve the building. Even though modernization work has been done which on the campus they may be some work required to meet the requirements of the most current codes and regulations at the time of that the retrofit work is being designed. A separate survey for access compliance is recommended for the entire campus that would be of benefit for future project planning.

Fire & Life Safety

The work should have minimal effect on the fire rated assemblies that exist since all the work in the roof plane. Any assembly disturbed in the process will have to be returned to its original rating condition.

The new work will have no impact on the egress system as currently exists and there are no changes to the egress system in this scope. There is no reconfiguration of spaces or changes of use in the scope that would affect the existing fire/life safety code compliance status of the building with regards to building area, construction type or configuration.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

The retrofit work is all within the roof structure and is relatively easy to access. There will be some removal of roofing over the lobby for the retrofit work but there should be no need to disturb the roof for the roof retrofit over the gymnasium. It should cause minimal disturbance to the operation of the school.

8.0 Cost Estimate

PVPUSD Seismic Study
Narrative, Plans and Details by PBWS - Received 8/10/2016

RE: PVPUSD Seismic Study

Please find in the following report the cost estimate for the PVPUSD Seismic Study project. This estimate is prepared in accordance with the Narrative, Plans and Details by PBWS - Received 8/10/2016 with the following:

CLARIFICATIONS:

- Pricing is based on the entire project scope being awarded as one project to a single contractor
- Cost is based on prevailing wage labor rates
- This estimate represents an opinion of the fair construction cost for this project assuming multiple general contractors competitively bidding on the project with all sub-trades covered with 4 to 5 bids per trade. If a different delivery method is used a premium cost should be expected and will vary depending on the method used. This estimated cost should not be construed as a prediction of low bid

EXCLUSIONS:

- All soft costs
- Permits
- Owner's contingency
- Construction or occupancy phasing
- CM fee

Should you have any questions, please call me at 661-367- 5242.

Sincerely:

Walid Shihayed

Walid Shihayed

WM2S, Inc.
14908 Live Oak Springs Canyon Road, Santa Clarita, CA. 91387
P: (661) 367 5242, www.WM2S.com

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
MISG Miraleste Intermediate School Building G, Gymnasium			
0205 Demolition			
02050.000 DEMOLITION			
Remove - Roofing	258.00 SF	5.00 /SF	1,290
DEMOLITION			**1,290**
0205 Demolition			**1,290**
0510 Steel			
05050.000 METAL FASTENING			
Drill & Epoxy Anchor (Hilti)	33.00 EA	75.00 /EA	2,475
METAL FASTENING			**2,475**
05100.100 Structural Steel			
Fabricate Structural Steel	5.14 TON	3,000.00 /TON	15,414
Detail Structural Steel	5.14 TON	2,000.00 /TON	10,276
Structural Steel			**25,690**
05123.803 Steel Angles 3"			
Erect Steel Angles 3"	40.00 EA	875.00 /EA	35,000
Angle 3 x 3 x 1/2 With Plates	1,017.00 LF	50.00 /LF	50,850
Steel Angles 3"			**85,850**
05123.805 Steel Angles 5"			
Angle 5 x 5 x 3/8	86.00 LF	50.00 /LF	4,300
Steel Angles 5"			**4,300**
0510 Steel			**118,315**
0610 Rough Carpentry			
06050.000 FASTENERS AND ADHESIVES			

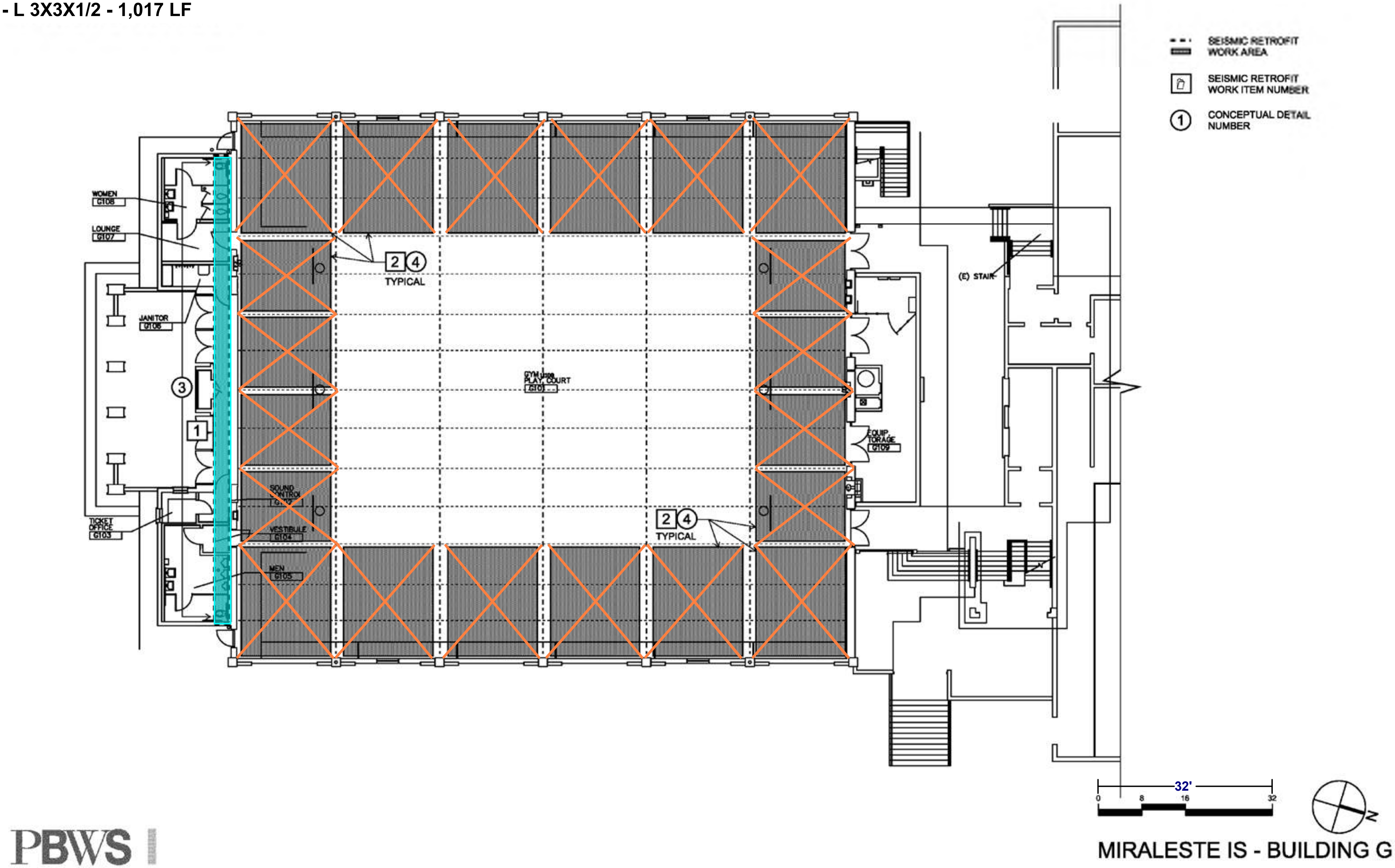
Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
06050.000 FASTENERS AND ADHESIVES			
Strap	99.00 LF	25.00 /LF	2,475
FASTENERS AND ADHESIVES			**2,475**
0610 Rough Carpentry			**2,475**
0750 Roofing			
07500.000 MEMBRANE ROOFING			
Roofing Patch	258.00 SF	35.00 /SF	9,030
MEMBRANE ROOFING			**9,030**
0750 Roofing			**9,030**
0990 Painting			
09900.000 PAINTING			
Painting - Metals - High Performance Coating	1,017.00 SF	4.00 /SF	4,068
PAINTING			**4,068**
0990 Painting			**4,068**
MISG Miraleste Intermediate School Building G, Gymnasium			**135,178**

Partial Totals

Description	Amount	Totals	Rate	
Direct Cost	**135,178**	**135,178**		
General Conditions	13,518		10.00	%
Performance & Payment Bond	1,949			
Liability Insurance	1,352		1.00	%
Overhead & Fee	6,759		5.00	%
Construction Cost	**23,578**	**158,756**		
Design Contingency	31,751		20.00	%
Escalation	6,350		4.00	%
Construction Cost With C&E	**38,101**	**196,857**		
Construction Contingency	19,686		10.00	%
	19,686	**216,543**		
SOFT COSTS:				
Architect & Engineering Fees				
Architect Reimbursables				
Testing & Inspection				
Permits and Fees				
Furniture, Fixtures and Equip.				
Total Project Cost				

9 - Roof Construction - Detail 3 - Add Strap - 86 LF

10 - L 3X3X1/2 - 1,017 LF



MIS_FP_Bldg-G.pdf (64% of Scale); Takeoff in Active Area: All Areas; PVPUSD; WM2S; 8/11/2016 03:17 PM

Appendix 1-A: Tier 1 Screening Checklists

ASCE 41-13 Checklists

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path exists.
	x			ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.2)	Adjacent to Storage and Locker Room Building. Gap = 2" < .04*12.5 ft*12 = 6", NG, check using Tier 2 calculations. See Appendix 1-B for Tier 2 calculations.
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanines
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	It is one story building, so not applicable.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	It is one story building, so not applicable.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	All vertical elements continuous to foundation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	It is one story building, so not applicable.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	It is one story building, so not applicable.
X				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Roof consists of flexible diaphragms with minimum of 2 lines of shear wall support.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
x				LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	
x				SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	
x				SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
X				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.714=0.43 Compliant per review of existing drawings.
X				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Foundation elements are tied together by ties beams and slab on grade.

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY SHEAR WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	At least 2 lines of shear walls present.
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in2. (§A.3.2.4.1. Tier 2: §5.5.3.1.1)	Shear stress is less than 70 psi. See Appendix 1-B for calculations.
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. (§A.3.2.4.2. Tier 2: §5.5.3.1.3)	Reinforcing steel ratios meet requirements. See Appendix 1-B for calculations.
Stiff Diaphragms					
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (§A.4.5.1. Tier 2: §5.6.4)	No precast diaphragm elements.
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Wall to diaphragm anchorage at the gymnasium is sufficient. See Appendix 1-B for calculations.
	x			WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (§A.5.1.2. Tier 2: §5.7.1.3)	Connection induces cross-grain bending or tension (Ref. B/ S-H3, C/ S-H3, A/ S-H4, roof ledger at interior brick walls). No Tier 2 procedure is available to demonstrate compliance (§5.7.1.3)

C	NC	N/A	U	Checklist	Comments
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	Diaphragms are positively connected for transfer of seismic forces to the shear walls at all locations.
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (§A.5.2.3. Tier 2: §5.7.2)	No precast diaphragm elements.
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	Wall reinforcement is dowelled into foundation.
x				GIRDER-COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (§A.5.4.1. Tier 2: §5.7.4.1)	Positive connection present at girder-column connections.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Diaphragms					
Stiff Diaphragms					
		x		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	No stiff diaphragms.
		x		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	No stiff diaphragms.
Flexible Diaphragms					
x				CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Continuous cross ties present.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	Diaphragm openings adjacent to shear walls are less than 25% of the wall length.
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry	Diaphragm openings adjacent to exterior masonry shear walls are

C	NC	N/A	U	Checklist	Comments
				shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	not greater than 8 feet.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	No straight sheathed diaphragms.
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	No straight sheathed or diagonal sheathing used in diaphragms.
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	No diagonally sheathed or unblocked wood panel diaphragms.
	x			OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	Reinforced gypsum concrete diaphragm was used. Check shear capacity per Tier 2.
				Connections	
x				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (§A.5.1.4. Tier 2: §5.7.1.2)	Stiff steel anchors used.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
				Life Safety Systems	
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety	Observed Compliant

C	NC	N/A	U	Checklist	Comments
				systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
Hazardous Materials					
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
Ceilings					
X				LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type present (restrooms) Ref. A/ A-H6. Per detail 24/A-T2 ceiling joists are properly attached to resist seismic force.

C	NC	N/A	U	Checklist	Comments
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
Light Fixtures					
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension	Proper support was observed

C	NC	N/A	U	Checklist	Comments
				system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
Cladding and Glazing					
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	No multi-story panel, so not applicable.
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is	No cladding panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
Masonry Veneer					
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	No URM backup, so not applicable.
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
				Parapets, Cornices, Ornamentation, and Appendages	
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
			X	LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Not accessible during site visit
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No parapets; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	No such appendages were observed; So not applicable
				Masonry Chimneys	
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney.	No URM chimneys, so not applicable.

C	NC	N/A	U	Checklist	Comments
				(§A.7.9.1. Tier 2: §13.6.7)	
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
Stairs					
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
Contents and Furnishings					
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper anchorage was observed

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
				Mechanical and Electrical Equipment	
		X		LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	None observed; so not applicable.
		X		LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	None observed; So not applicable
		X		LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	None observed; So not applicable
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
				Piping	
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
				Ducts	
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
				Elevators	
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

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Miraleste Intermediate School
Gymnasium Building (G)

Job #: 0215.768
Date: Feb-16

Seismic Dead Loads

Gymnasium Roof

Roofing	6.0	psf	
2-1/2" thk gypsum	11.5	psf	55 pcf poured gypsum deck
10B11.5 @ 7'-0"	1.6	psf	W10x11.5 @ 7'
Tapered steel girder	5.0	psf	
MEP	3.0	psf	
Ceiling	5.0	psf	
Misc	1.0	psf	
DL =	33.1	psf	
Use	33.0	psf	

Entry and Restroom Roofs

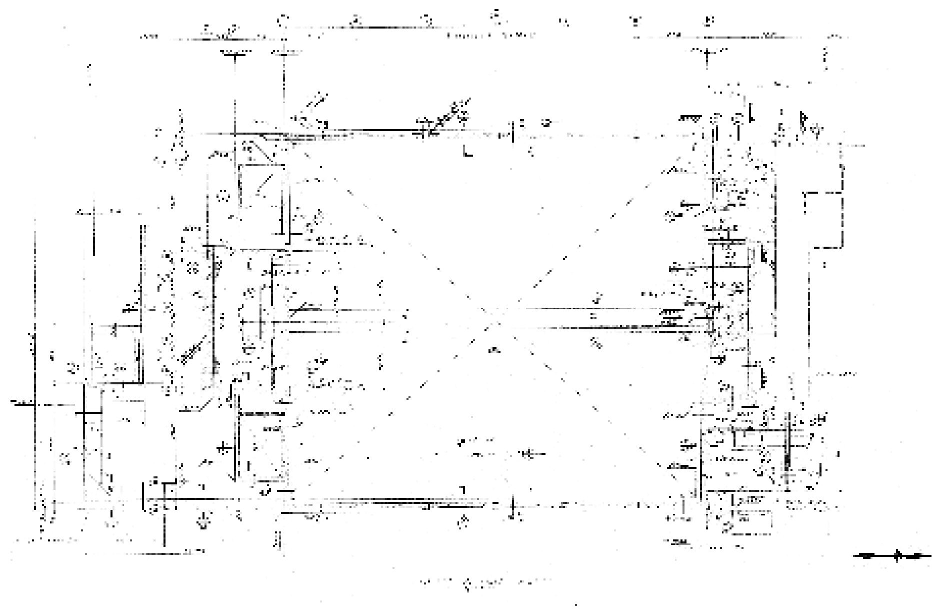
Roofing	6.0	psf
1/2" Plywood	1.5	psf
Wd joist 2x12@24" typ.	3.0	psf
Wd headers	1.0	psf
MEP	3.0	psf
Ceiling	5.0	psf
Misc	1.0	psf
DL =	20.5	psf
Use	21.0	psf

Wall Weight

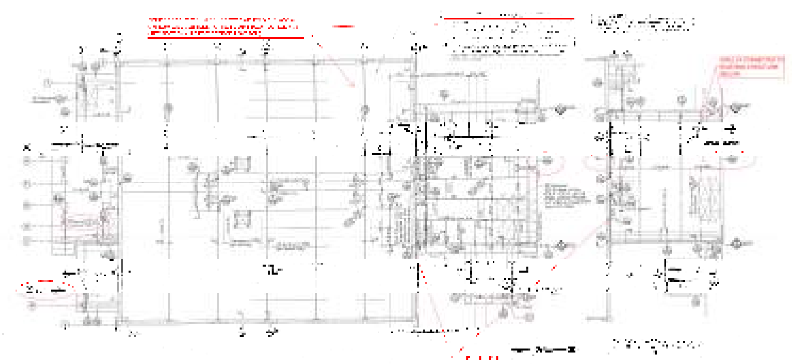
9" brick wall	90	psf
11" brick wall	110	psf
13" brick wall	130	psf
18" brick wall	180	psf

Mass Calculation

Item	Length ft	Wid / Ht ft	Opening Factor	Area sq ft	Mass Wt #/ft2	Weight kip	
Gym roof	115.0	101.0	1.0	11615.0	33	383	
Entry roof	26.0	46.0	1.0	1196.0	21.0	25	
Restroom roofs	16.0	56.0	1.0	896.0	21.0	19	
Grid J wall	115.0	16.0	1.0	1840.0	110.0	202	11" brick wall
Grid A wall	115.0	16.0	1.0	1840.0	110.0	202	11" brick wall
Grid 3 wall	101.0	16.0	1.0	1616.0	130.0	210	13" brick wall
Grid 9 wall	101.0	16.0	1.0	1616.0	180.0	291	13" brick wall
Grid I wall	13.5	5.0	1.0	67.5	90.0	6	9" brick wall
Grid H wall	20.0	18.0	0.6	216.0	90.0	19	9" brick wall
Grid C wall	20.0	18.0	0.6	216.0	90.0	19	9" brick wall
Grid B wall	13.5	5.0	1.0	67.5	90.0	6	9" brick wall
Grid 1 columns	11.0	9.0	1.0	99.0	325.0	32	L = 6*22"/12; Mass wt = (32.5"/12)*120 pcf
					Total	1416	



Foundation Plan with Grid Lines for Calculation Reference



Roof Plan with Grid Lines for Calculation Reference

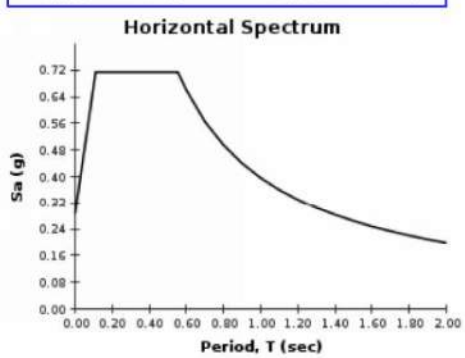
USGS Design Maps Summary Report

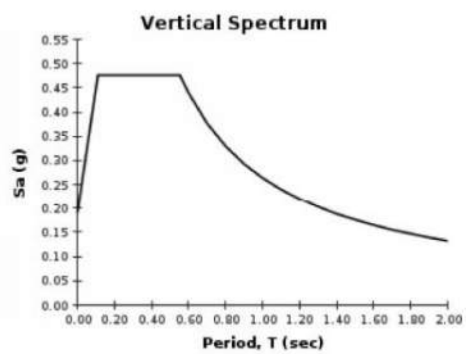
User–Specified Input

Report Title	California Minimum Ss Mon January 4, 2016 22:43:46 UTC
Building Code Reference Document	ASCE 41-13 Retrofit Standard, BSE-1E (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.75222°N, 118.32549°W
Site Soil Classification	Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.514 g	$S_{XS,BSE-1E}$	0.714 g
$S_{1,20/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g





Miraleste Intermediate School
Gymnasium Building (G)

Job #: 0215.768
Date: Feb-16

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW		Bldg Type=	**RM1**
$C =$	1	From Table 4-8		
$S_a =$	$\min(S_{XS}, S_{X1}/T)$	From Section 4.5.2.3		
$S_{X1} =$	F_VS_1	Eq. 2-2		
$S_{XS} =$	F_aS_S	Eq. 2-1		
$S_S =$	0.514	g, mapped spectral acceleration		
$S_1 =$	0.197	g, mapped spectral acceleration		
$S_{X1} =$	0.396	g		
$S_{XS} =$	0.714	g		
$T =$	$C_th_n^{\beta}$	From Section 4.5.2.4		
$C_t =$	0.02			
$h_n =$	28.5	ft., average height at sloped roof		
$\beta =$	0.75			
$T =$	0.247	sec.		
$S_a =$	0.714	g		
$V =$	0.714	W		

Check Vertical Distribution per Section 4.5.2.2

$$Fx = \frac{w_xh_x^k}{\Sigma w_ih_i^k}V$$

	w (kips)	h (ft.)	w*h	Fx (k)	Vx(k)	Area (ft^2)	unit load (ksf)
Roof *	1416	28.5	40361	1011	1011	11615	0.087
Σ =	**1416.192**	Σ =	**40361**	**1011**			

Base shear, V = 0.714 W
= **1011** kips

---

* A/ A-H2 (average of 30' and 27' at gymnasium)

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Miraleste Intermediate School
Gymnasium Building (G)

Job #: **0215.768**
Date: **Feb-16**

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/ Aw)/ m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1 Footnote b for quick check procedures

N-S DIRECTION (Governs B.I.)					
Grid	**Wall Description**	**Total Length ft**	**Width in**	**Aw in2**	Ref.
2	9" brick	51.6	9.0	5573	A-H1
3	13" brick	51.0	13.0	7956	A-H1
9	18" brick	70.0	18.0	15120	A-H1
			Total	28649	

Per ASCE 41-13 check list 16.15LS, if shear stress less than 70 psi

Max wall shear stress = 35.3 psi < max. allowable shear stress, OK

Reinforced Concrete Wall, Reinforcing Steel Ratio (§A.3.2.4.2. Tier 2: §5.5.3.1.3)

9" brick wall with #5 @ 24" E. W. (Ref. C/ S-H3)

Vert. ρ = 0.0014 > **0.0007, OK**
Hor. ρ = 0.0014 > **0.0007, OK**
0.0029 > **0.002, OK**

11" brick wall with #6 @ 24" E. W. (Ref. A/ S-H3)

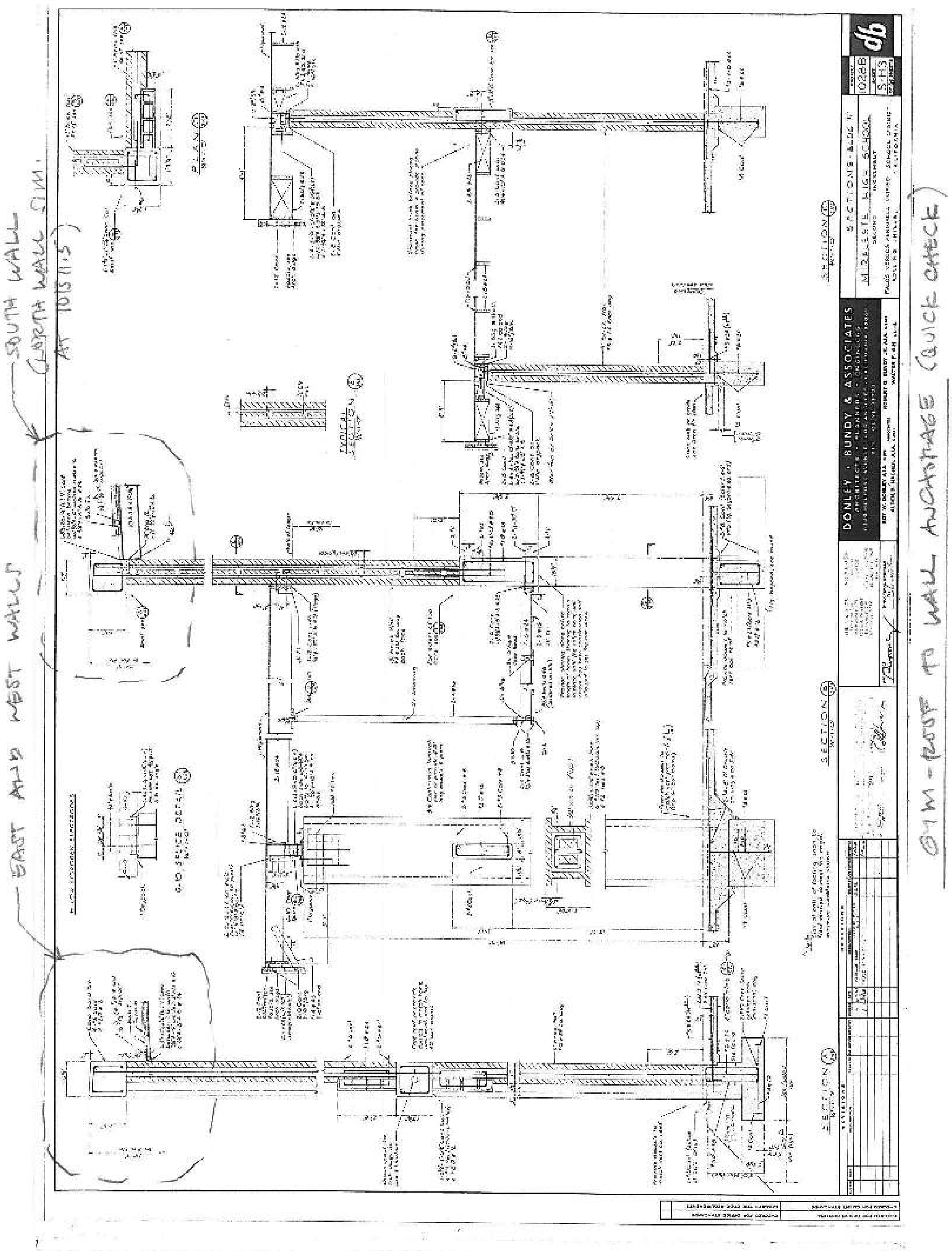
Vert. ρ = 0.0017 > **0.0007, OK**
Hor. ρ = 0.0017 > **0.0007, OK**
0.0033 > **0.002, OK**

13" brick wall with #4 @ 20" E.W.E.F. (Ref. B/ S-H3)

Vert. ρ = 0.0015 > **0.0007, OK**
Hor. ρ = 0.0015 > **0.0007, OK**
0.0031 > **0.002, OK**

18" brick wall with #6 @ 24" (V) E.F., #4@22" (H) E.F. (Ref. A/ S-H5)

Vert. ρ = 0.0020 > **0.0007, OK**
Hor. ρ = 0.0010 > **0.0007, OK**
0.0030 > **0.002, OK**


SOUTH WALL
(NORTH WALL SIM.
AT 10(5 (1.5))
EAST AND WEST WALLS
GYM - ROOF TO WALL ANCHORAGE (QUICK CHECK)
DONLEY · BUNDY & ASSOCIATES
MIRALESTE HIGH SCHOOL

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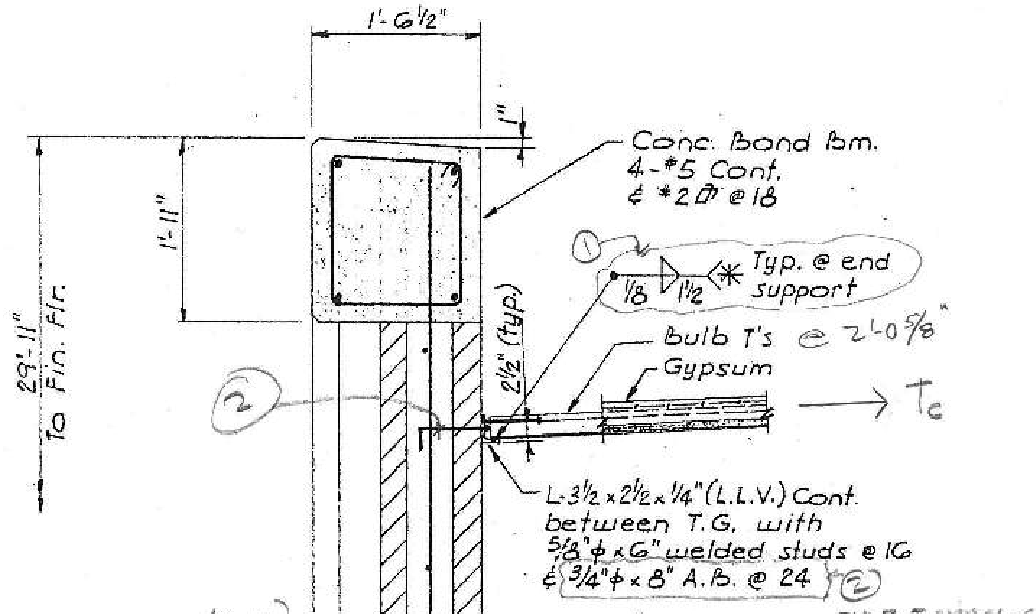
GYM - ROOF TO WALL ANCHORAGE (QUICK CHECK)

EAST AND WEST WALLS (A/S-H3)



(4-13) 11" BRICK BULB T SPACING

$T_c = 1.2 S_{XS} W_p A_p = 1.2(0.714)(110 \times 1.1)(16' \times 2')$

ALLOWANCE

$= 3311\# /$ BULB TEE

① CHECK BULB TEE WELDS TO LEDGER (FORCE-CONTROLLED)

$Q_E = T_c = 3311\#$; $Q_{UF} = Q_G \pm Q_E / [C_1 C_2 J]$

1.4, TABLE 7-3
$2 \le m_{MAX} < 6$

$Q_{UF} = 3311\# / (1.4 \times 1.0)$ 7.5.2.1.2

$= 2365\#$

PER 1/16" WELD

$Q_{CL} = 2 \times (2 \times 1.4\ k/'') \times 1.5$

$= 8400\# > Q_{UF}$, OK

(E) WELDS TO LEDGER OK

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GYM - ROOF TO WALL ANCHORAGE (QUICK CHECK)

sheet ____ of ____
by ____
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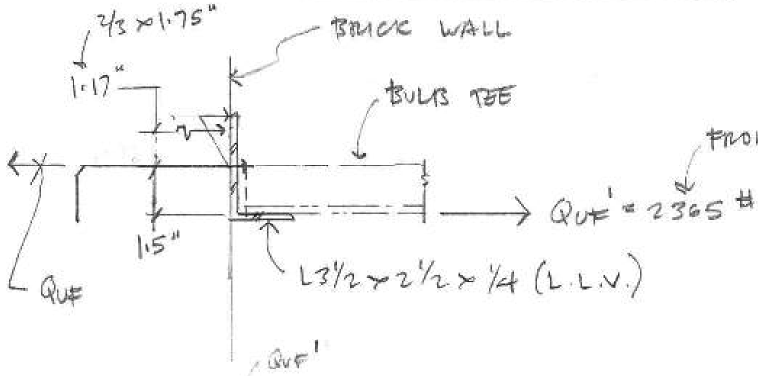
EAST AND WEST WALLS (A/5-H3)

② CHECK LEDGER ANCHORS TO BRICK (FORCE-CONTROLLED)



$Q_{UF} = 2365\# \times 2.67'' / 1.17'' = 5397\#$

$Q_{UF}/Q_{CL} = 0.58 < 1.0$, ok (SEE FF. PAGE FOR CALCS.)

(E) ANCHORS IN BRICK ARE OK

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sheet ______ of ______
by COM
job no. ______
date ______

HOOKED ANCHORS IN MASONRY (ACI 530-08 3.1.6)

Ref.: 3/4 DIA, 8" EMB., 24" SPACING MHS GYM, A/ S-H3, bulb tees @ 2'-0", wall anchorage

Loads on anchors

Tension, baf = 5.4 k
Shear, bvf = 0.2 k QG = D = 26 psf x (7'/ 2 x 2') = 182 lbs. bulb tee span = 7'-0", and 2'-0" spacing

Anchor bolt and concrete properties

fy = 36 ksi
f'm = 1500 psi
Nominal embedment debth, Lbn = 8.00 in. [distance from the edge of masonry to bearing surface of hook]
Hook length, eb = 4.5 in.
Anchor bolt dia, db = 3/4 in.
Effective Embedment depth, Lb = Lbn - db = 7.250 in.
Anchor bolt area, Ab = 0.44 in.^2

Tensile capacities [3.1.6.3.1.2]

Steel tensile capacity, Bans = Ab*fy = 15.9 k (3-5)

Apt = π*Lb^2 = 165.1 in.^2
spacing, s = 24 in.
Lb = 7.25 in.
s/ Lb = 3.3
Spacing reduction factor, RF = 1.00
Breakout capacity, Banb = (RF)*4*Apt*f'm^.5 = 25.6 k (3-3)
Pullout capacity, Banp = 1.5*f'm*eb*db + 300*π*(Lb + eb +db)*db = 16.43 k (3-4)

	Φ	Ban (k)	Φ*Ban
Steel	0.90	15.9	14.3
Breakout	0.50	25.6	12.8
Pullout	0.65	16.4	10.7

Φ*Ban = 10.7 k > baf, OK

Shear capacities [3.1.6.3.2]

Minimum edge distance, Lbe = 12 in.
Effective embedment depth, Lb = 7.250 in.
Embedment depth for shear, Lbv = min (Lbe, Lb) = 7.25 in.
Apv = π*Lbv^2/2 = 82.6 sq.in.

Breakout shear capacity, Bvnb = 4*Apv*f'm^(1/2) = 12.8 k (3-6)
Masonry crushing shear capacity, Bvnc = 1050*(f'm*Ab)^(1/4) = 5.3 k (3-7)
Pryout shear capacity, Bvpry = 2.0*Banb = 8*Apt*(f'm)^(1/2) = 51.2 k (3-8)
Steel shear capacity, Bvns = 0.6*Ab*fy = 9.5 k (3-9)

	Φ	Bvn (k)	Φ*Bvn
Breakout	0.50	12.8	6.4
Crushing	0.50	5.3	2.7
Pryout	0.50	51.2	25.6
Steel	0.90	9.5	8.6

Φ*Bvn = 2.7 k > baf, OK

Anchor bolt unity ratio

baf/ Φ*Ban + bvf/ Φ*Bvn = 0.58 <=1, OK **(3-10)**

2/5/2016 Page 1 of 1

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GYM – ROOF TO WALL ANCHORAGE (QUICK CHECK)

sheet ____ of ____
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job no. 215768
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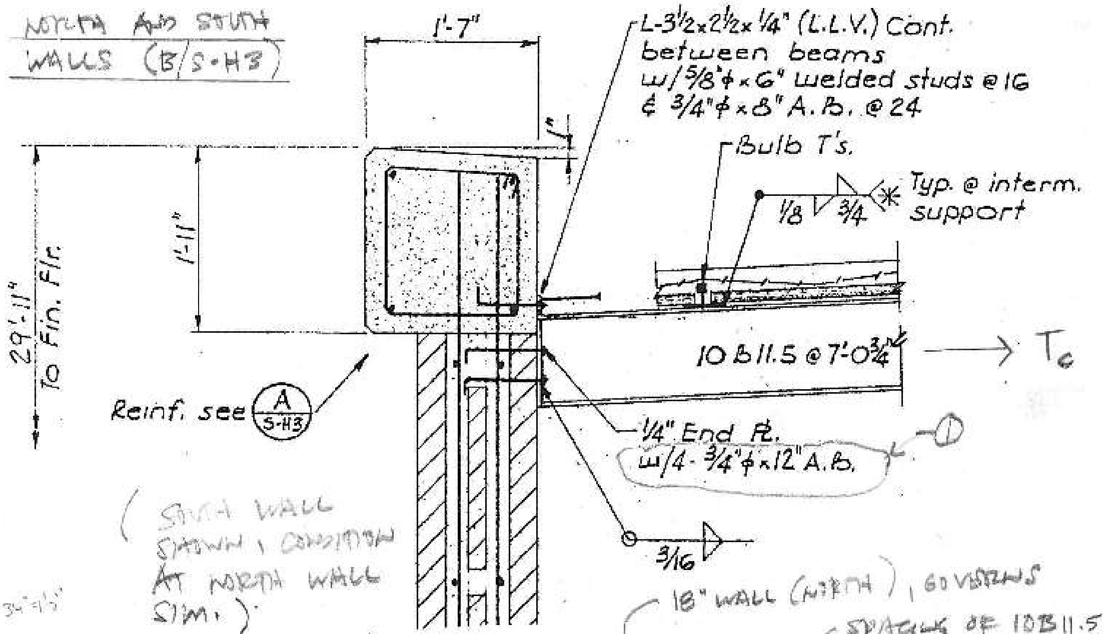

① ANCHORS

$\cdot\ T_c = 1.2\, S_{XS}\, W_p\, A_p = 1.2\,(0.714)(180\text{ psf})(16' \times 7')$ (4-13)

$= 17273\,\#$

$Q_{UF} = Q_G \pm Q_E/(C_1 C_2 J)$

1.4, TABLE 7-3, $2 \le m_{max} < 6$

$= 17273/(1.4 \times 1.0) = 12338\,\#$ (TENSION) 7.5.2.1.2

$Q_{UF}/Q_{CL} = 0.42 < 1.0$, OK (SEE PF PAGE FOR CALCS.)

(E) ANCHORS IN BRICK ARE OK

TTG

TTG

sheet ______ of ______
by
job no. 215768
date

HOOKED ANCHORS IN MASONRY (ACI 530-08 3.1.6)
Ref.: 3/4 DIA, 12" EMB., 4" SPACING   MHS GYM, B/ S-H3 - B10x11.5 @ 7'-0", wall anchorage

Loads on anchors

Tension, baf = 3.1 k   QUF = 12338#/ 4 = 3085#
Shear, bvf = 0.5 k   QG = D = 28 psf x (19'/ 2 x 7')/ 4 = 466 lbs. B10X11.5 span = 19'-0", and 7'-0" spacing

Anchor bolt and concrete properties

fy = 36 ksi
f'm = 1500 psi
Nominal embedment debth, Lbn = 12.00 in.   [distance from the edge of masonry to bearing surface of hook]
Hook length, eb = 4.5 in.
Anchor bolt dia, db = 3/4 in.
Effective Embedment depth, Lb = Lbn - db = 11.250 in.
Anchor bolt area, Ab = 0.44 in.^2

Tensile capacities [3.1.6.3.1.2]

Steel tensile capacity, Bans = Ab*fy = 15.9 k (3-5)

Apt = π*Lb^2 = 397.6 in.^2
spacing, s = 4 in.
Lb = 11.25 in.
s/ Lb = 0.4
Spacing reduction factor, RF = 0.63
Breakout capacity, Banb = (RF)*4*Apt*f'm^.5 = 38.8 k (3-3)
Pullout capacity, Banp = 1.5*f'm*eb*db + 300*π*(Lb + eb +db)*db = 19.28 k (3-4)

	Φ	Ban (k)	Φ*Ban
Steel	0.90	15.9	14.3
Breakout	0.50	38.8	19.4
Pullout	0.65	19.3	12.5

Φ*Ban = 12.5 k > baf, OK

Shear capacities [3.1.6.3.2]

Minimum edge distance, Lbe = 12 in.
Effective embedment depth, Lb = 11.250 in.
Embedment depth for shear, Lbv = min (Lbe, Lb) = 11.25 in.
Apv = π*Lbv^2/2 = 198.8 sq.in.

Breakout shear capacity, Bvnb = 4*Apv*f'm^(1/2) = 30.8 k (3-6)
Masonry crushing shear capacity, Bvnc = 1050*(f'm*Ab)^(1/4) = 5.3 k (3-7)
Pryout shear capacity, Bvpry = 2.0*Banb = 8*Apt*(f'm)^(1/2) = 123.2 k (3-8)
Steel shear capacity, Bvns = 0.6*Ab*fy = 9.5 k (3-9)

	Φ	Bvn (k)	Φ*Bvn
Breakout	0.50	30.8	15.4
Crushing	0.50	5.3	2.7
Pryout	0.50	123.2	61.6
Steel	0.90	9.5	8.6

Φ*Bvn = 2.7 k > baf, OK

Anchor bolt unity ratio

baf/ Φ*Ban + bvf/ Φ*Bvn = 0.42 <=1, OK (3-10)

2/5/2016   Page 1 of 1

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Miraleste Intermediate School
Gymnasium Building (G)

Job #: 0215.768
Date: Feb-16

Seismic Dead Loads (Dance Room)

Roof

Roof	6.0	psf
5/8" Plywood	1.8	psf
4x6 @ 8'	1.0	psf
7" x 2-1/8" GLB @ 8'	0.4	psf
MEP	3.0	psf
Ceiling	3.0	psf
Misc	4.0	psf
DL =	19.2	psf
Use	20.0	psf

Floor

Hardwood flooring	3.0	psf
3/4" plywood	2.2	psf
Wd joist 2x12@16"	4.4	psf
Wd headers	1.0	psf
MEP	3.0	psf
Ceiling	5.0	psf
Misc	1.0	psf
DL =	19.6	psf
Use	20.0	psf

Wall Weight

9" brick wall	90	psf
8" concrete wall	100	psf

Mass Calculation

Roof

Item	Length ft	Wid / Ht ft	Opening Factor	Area sq ft	Mass Wt #/ft2	Weight kip
Roof	48.0	58.0	1.0	2784.0	20.0	56
Concrete walls	139.0	6.5	0.8	722.8	20.0	14
					Total	70

Floor

Item	Length ft	Wid / Ht ft	Opening Factor	Area sq ft	Mass Wt #/ft2	Weight kip
Floor	44.0	51.0	1.0	2244.0	19.6	44
Concrete walls	139.0	12.5	0.6	1042.5	20.0	21
					Total	65

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ADJACENT BUILDINGS

sheet ______ of ______
by ______
job no. 215768
date ______

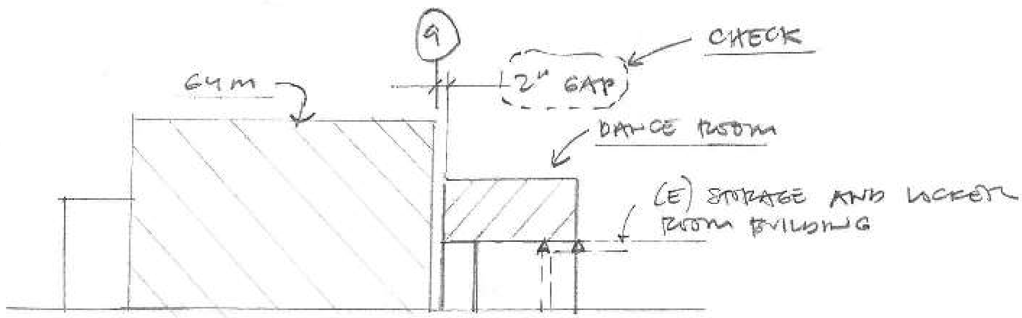
7.4.1 (TIER 2)

TABLE 7-3, $2 \leq m_{MAX} < 6$

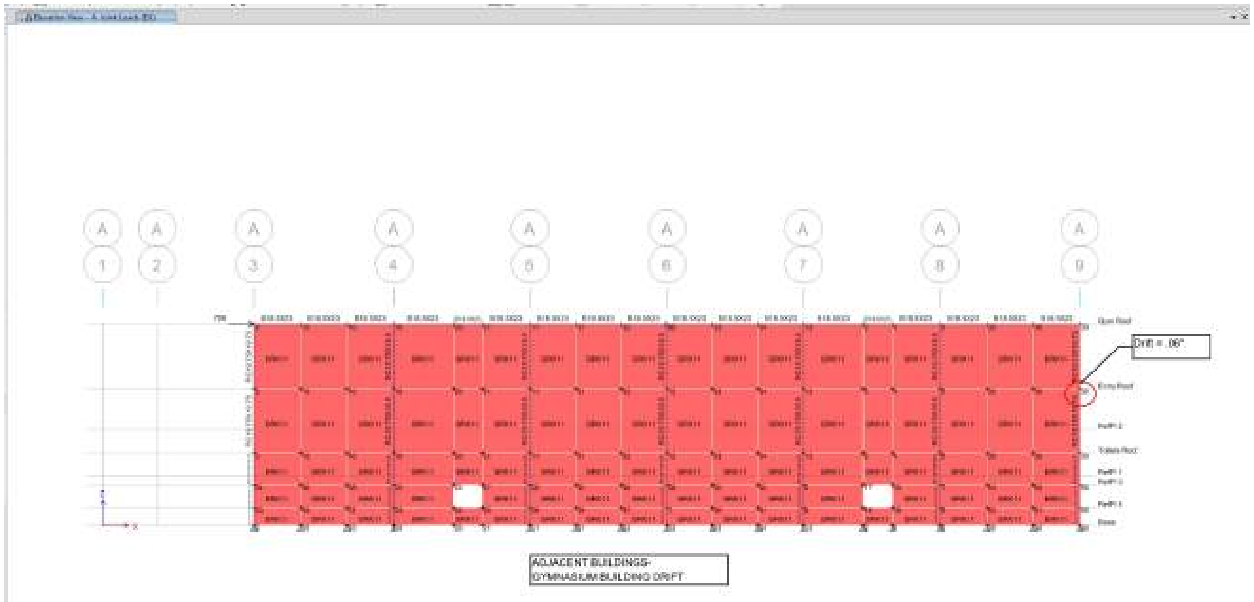
• $V = C_1 C_2 C_m S_a W = 1.4 (1.0)(0.714) W = \boxed{1.0 W}$

TABLE 7-4, 1-2 STORIES

• SEE FOLLOWING PAGES FOR ETABS DISPLACEMENT CALCULATIONS AND CHECKING OF REQUIRED GAP BETWEEN ADJACENT BUILDINGS

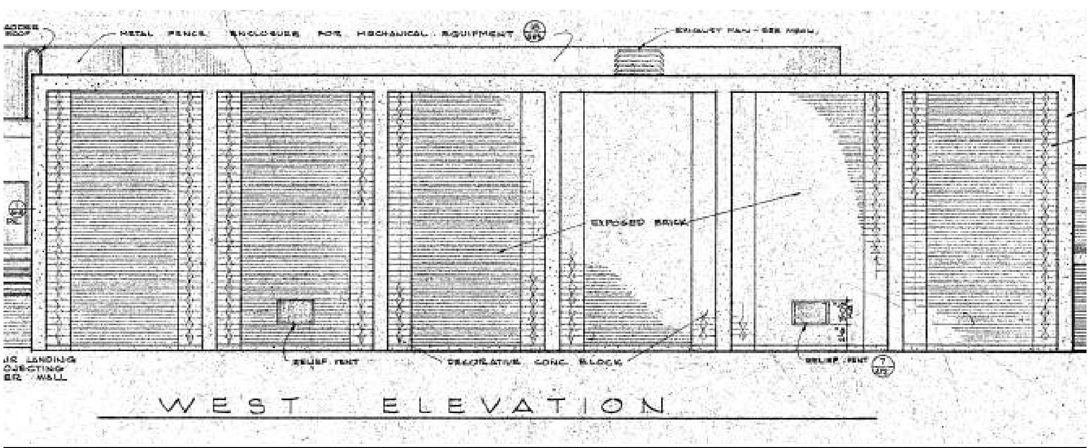


ELEVATION

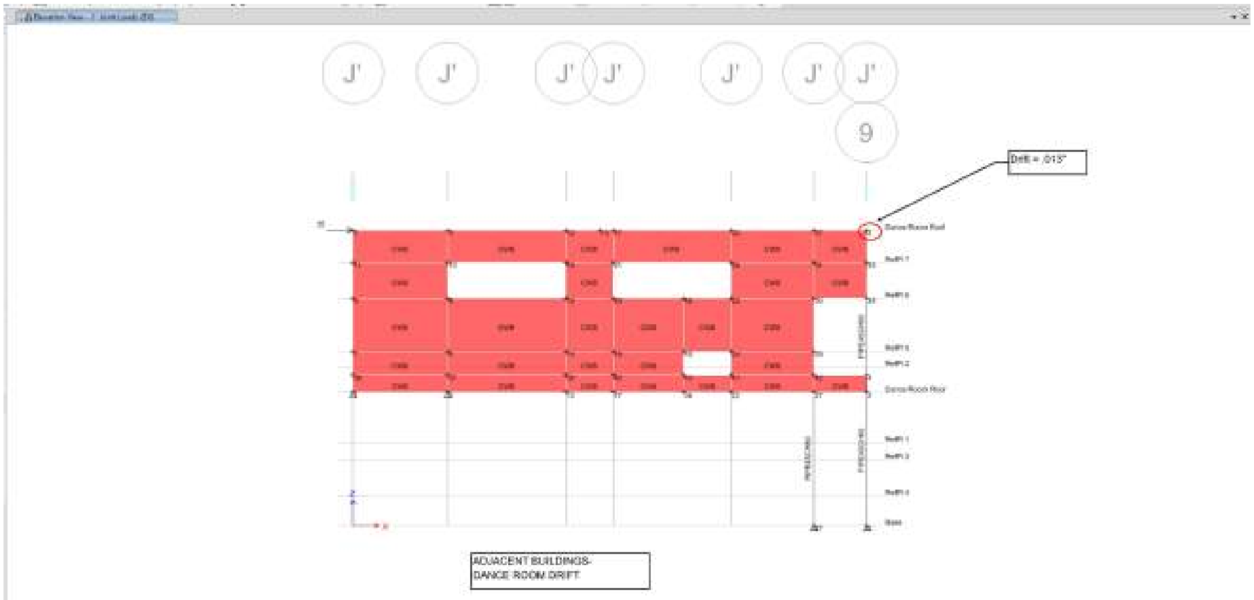


ETABS – Gymnasium west wall 2D model

EX (Tier 2) = 1.0W = 1.0*(1416 k/ 2) = 708 k; Displacement = .060" at Dance Room roof level

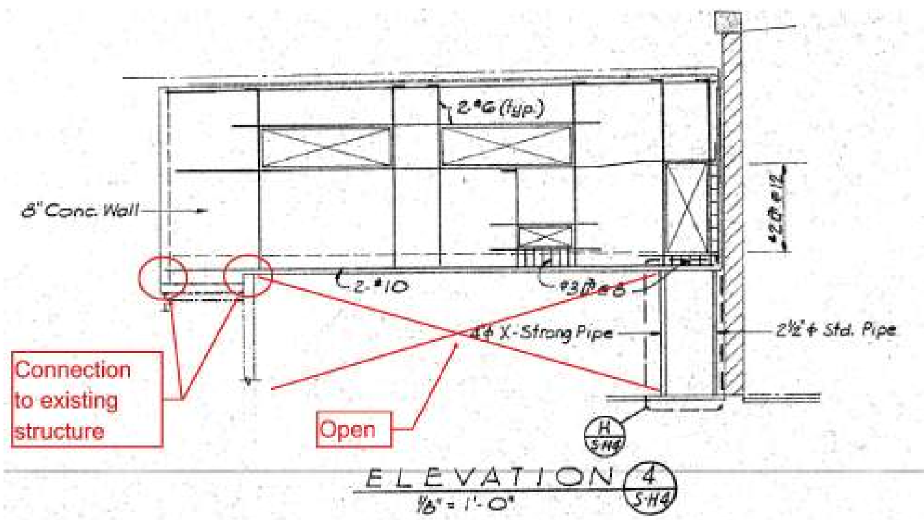


Gymnasium West Elevation (A-H2)



ETABS Dance Room west wall 2D model

EX (Tier 2) = 1.0W = 1.0*(70 k/ 2) = 35 k; Displacement = .013” at roof.



Dance Room west wall (4/ S-H4)

GYMNASIUM DISPLACEMENTS (ETABS)

TABLE: Joint Displacements

Story	Label	Unique Name	Load Case/Combo	UX	UY	UZ	RX	RY	RZ
				in	in	in	rad	rad	rad
Gym Roof	30	103	EX	0.057282	0	-0.013078	0	0.000112	0
Entry Roof	30	105	EX	0.037599	0	-0.011848	0	0.000128	0
Toilets Roof	30	107	EX	0.019339	0	-0.007938	0	0.0001	0
Base	30	109	EX	0	0	0	0	0.000137	0

DANCE ROOM DISPLACEMENTS (ETABS)

TABLE: Joint Displacements

Story	Label	Unique Name	Load Case/Combo	UX	UY	UZ	RX	RY	RZ
				in	in	in	rad	rad	rad
Dance Room Roof	2	47	EX	0.012582	0	-0.008346	0	0.000021	0
Dance Room Floor	2	5	EX	0.00859	0	-0.005114	0	-0.00008	0
Base	2	3	EX	0	0	0	0	0.000067	0

ADJACENT BUILDINGS – CHECK EXISTING GAP BETWEEN GYMNASIUM AND DANCE FLOOR STRUCTURES

Required gap = [(.06)^2 + (.013)^2]^(1/2) = .06” < 2” provided, OK

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"OTHER" DIAPHRAGMS

sheet ____ of ____
by ________
job no. 215768
date 2/5/16

"OTHER" DIAPHRAGMS - A.4.7.1, 5.6.5

DIAPHRAGM IS REINFORCED GYPSUM SLAB ("OTHER" DIAPHRAGM PER A.4.7.1). PER 5.6.5, ANALYZE DIAPHRAGM PER 5.2.4.2, USE LSP PROCEDURE PER 7.4.1

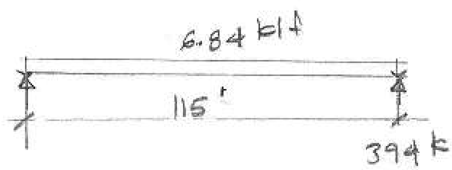
7.4.1

$V = C_1 C_2 C_m S_a W = 1.4(1.0)(0.714)W = 1.0W$

GYM ROOF   GRID A AND GRID J WALLS

$= 1.0[383 + 2(202)] = 787^k$

SHEAR (E-W) - DEFORMATION-CONTROLLED PER 10.10.2.4



$Q_E = V/L = 394^k/110' = 3.58\ klf = Q_{UD}$

FOR CLASS "A" REINFORCED GYPSUM (PER 5-H2 NOTES # 1)

$Q_{ASD} = 0.75[0.16 f_g t C_1 + 1000(k_1 d_1 + k_2 d_2)] C_2$

WHERE:

Q = ALLOWABLE SHEAR PER UBC 94 1927A.4 (COPY ATTACHED FOR REFERENCE), INCLUSIVE OF 1/3 INCREASE FOR SHORT-TIME LOADING

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"OTHER" DIAPHRAGMS

sheet ____ of ____
by ____
job no. 215768
date ____

SHEAR (CONT'D)

f_g = 500 psi FOR CLASS A GYPSUM
C_1 = 1.0 FOR CLASS A GYPSUM
t = 2.5" (S-H2 NOTES # 1)
k_1 = 2 = NUMBER OF MESH WIRES PER FOOT PASSING OVER SUB-PURLINS = 12"/6" ✓ 6x6 MESH
d_1 = 0.135" = DIAMETER OF MESH WIRES OVER SUB-PURLINS
k_2 = 2 = NUMBER OF MESH WIRES PER FOOT PARALLEL TO SUB-PURLINS = 12"/6"
d_2 = 0.135" = DIAMETER OF MESH WIRES PERPENDICULAR TO SUB-PURLINS
C_2 = 1.0 FOR CLASS A GYPSUM (NON-TRUSSED PURLINS)

Q = 555 plf ; Q/1.33 = 417 plf

TABLE 10-1 → Q_{CE}/Q_{CL}

Q_{CE} = 417 × 1.4 × 1.5 = 876 plf

LRFD/ASD (SEISMIC)

$m k Q_{CE}$ = 3.0 (1.0)(876) = 2628 plf < Q_{UD} = 3.58 klf, NG

10.10.2.4 ; TABLE 10-22

(E) REINFORCED GYPSUM CONCRETE DIAPHRAGM IS INADEQUATE

1926A.7.8 Special provisions for other members. For design of deep flexural members, brackets and corbels and walls, the special provisions of Section 1911A shall be used with shear strengths provided by concrete and limiting maximum strengths for shear taken as 55 percent of the values given in Section 1911A. In Section 1911A.10.6, the design axial load shall be multiplied by 1.2 if compression and 2.0 if tension and substituted for N_u.

1926A.7.9 Composite concrete flexural members. For design of composite concrete flexural members, permissible horizontal shear stress v_h shall not exceed 55 percent of the horizontal shear strengths given in Section 1917A.5.2.

SECTION 1927A — REINFORCED GYPSUM CONCRETE

1927A.1 General. Reinforced gypsum concrete shall conform to U.B.C. Standard 19-15.

Reinforced gypsum concrete shall develop the minimum ultimate compressive strength in pounds per square inch (MPa) set forth in Table 19A-F when dried to constant weight, with tests made on cylinders 2 inches (51 mm) in diameter and 4 inches (102 mm) long or on 2-inch (51 mm) cubes.

For special inspection, see Section 1701A.

1927A.2 Design. The minimum thickness of reinforced gypsum concrete shall be 2 inches (51 mm) except the thickness may be reduced to $1^1/_2$ inches (38 mm), provided all of the following conditions are satisfied:

1. *The overall thickness, including the formboard, is not less than 2 inches (51 mm).*
2. *The clear span of the gypsum concrete between supports does not exceed 2 feet 9 inches (838 mm).*
3. *Diaphragm action is not required.*
4. *The design live load does not exceed 40 pounds per square foot (195 kg/m²).*

1927A.3 Stresses. The maximum allowable unit working stresses in reinforced gypsum concrete shall not exceed the values set forth in Table 19A-G except as specified in Chapter 16A. Bolt values shall not exceed those set forth in Table 19A-H.

Allowable shear in poured-in-place reinforced gypsum concrete diaphragms using standard hot-rolled bulb tee subpurlins shall be determined by U.B.C. Standard 19-15. (See Table 19-15-A in the standard for values for commonly used roof systems.)

1927A.4 Diaphragms. Poured-in-place reinforced gypsum concrete slabs may be used as diaphragms to resist horizontal forces. They shall comply with the requirements of this section and Table 16A-Q. Bolts, dowels, lugs or other means approved by the enforcement agency shall be used to transfer the design forces along the margins of the diaphragm into the other structural elements of the building.

The thickness of poured gypsum concrete over form boards shall not be less than 2 inches (51 mm) for open-web subpurlins or $2^1/_2$ inches (64 mm) for standard rolled bulb-tee-subpurlins. The total thickness assumed in the design shall not be more than $3^1/_2$ inches (89 mm). The thickness of the gypsum over the subpurlin shall not be less than $^5/_8$ inch (15.9 mm). The minimum reinforcement in gypsum slabs used as diaphragms shall not be less than $^1/_{10}$ of 1 percent in each direction. Electrically welded mesh reinforcement may be considered as meeting the bond requirements of this section. Mesh shall be lapped a minimum of one wire spacing at splices. Shear in poured gypsum concrete diaphragms shall be determined by the formula:

$Q = 0.75[0.16 f_g t C_1 + 1000(k_1 d_1 + k_2 d_2)]\, C_2$ *where,*

Q = *allowable shear on diaphragm in pounds per linear foot which includes a one-third increase for short-time loading.*

Reinforced Gypsum Concrete Diaphragm – Allowable Shear (ASD, UBC 1994 1927A.3)

f_g = 500 pounds per square inch (3.4 MPa) for Class A gypsum; 1,000 psi (6.9 MPa) for Class B gypsum.

C_1 = 1.0 for Class A gypsum; 1.5 for Class B gypsum.

t = thickness of gypsum concrete between subpurlins in inches. For the purpose of computing diaphragm shear values, t shall not exceed $3^1/_2$ inches (89 mm).

k_1 = number of mesh wires per foot (m) passing over subpurlins.

d_1 = diameter of mesh wires passing over subpurlins in inches, except hexagonal mesh.

k_2 = number of mesh wires per foot parallel to subpurlins, or 0.7 times the number of hexagonal wires. **Note:** k_2 = 8.5 for 2 inches (51 mm) hexagonal mesh woven of No. 19 gage galvanized wire with additional longitudinal No. 16 gage galvanized wires spaced every 3 inches (76 mm) across the width of the mesh.

d_2 = diameter in inches of mesh wires parallel to subpurlins or hexagonal wires.

C_2 = 1.4 for Class A gypsum with trussed purlins, and 1.0 for all other combinations.

1927A.5 Details of Construction.

1927A.5.1 Storage of materials. All materials shall be stored off the ground and shall be kept dry until used. Prolonged storage of gypsum material should be avoided, particularly in humid localities or during humid weather.

1927A.5.2 Water ratio. The water ratio shall not exceed 8.75 gallons (33.2 L) per 80 pounds (36.3 kg) of Class A [500 psi (10.3 MPa)] gypsum concrete and not more than 7.25 gallons (27.5 L) of water per 80 pounds (36.3 kg) of Class B [1,000 psi (6.9 MPa)] gypsum concrete.

1927A.5.3 Mixing gypsum concrete. Gypsum concrete shall be thoroughly mixed with water only in an amount not exceeding that specified in Section 1927A.5.2 added at the site. Proper devices for accurate measurement of water or consistency of mixture shall be used. The concrete shall not be mixed through its setting time. Mixing boxes, tools, mixers, hoses, etc., shall be kept clean and free from set material.

1927A.5.4 Depositing gypsum concrete. Care shall be taken in depositing gypsum concrete to ensure against impact on the form boards to a degree which would cause excessive deflection or cracking. "Double pouring" shall not be used. In all cases, pouring of gypsum concrete shall follow the installation of form boards as promptly as possible. No more form boards shall be laid in one day than will have gypsum concrete poured over them that day. Screed shall be placed as guides to screeding the gypsum concrete to the specified thicknesses. Immediately on pouring, the gypsum concrete shall be spread and screeded. The surface of gypsum concrete shall be left smooth.

1927A.5.5 Weather conditions. Gypsum concrete shall not be mixed or poured during heavy rain, snow or hail, or when the temperature will allow the concrete to freeze before it takes its chemical set.

1927A.5.6 Metal reinforcement. Steel wire and wire fabric used for reinforcing shall be galvanized.

1927A.5.7 Subpurlins. Steel rolled sections used as subpurlins shall conform to ASTM A 499 or U.B.C. Standard 22-1.

Fabricated steel sections used as subpurlins shall be as specifically approved by the enforcement agency.

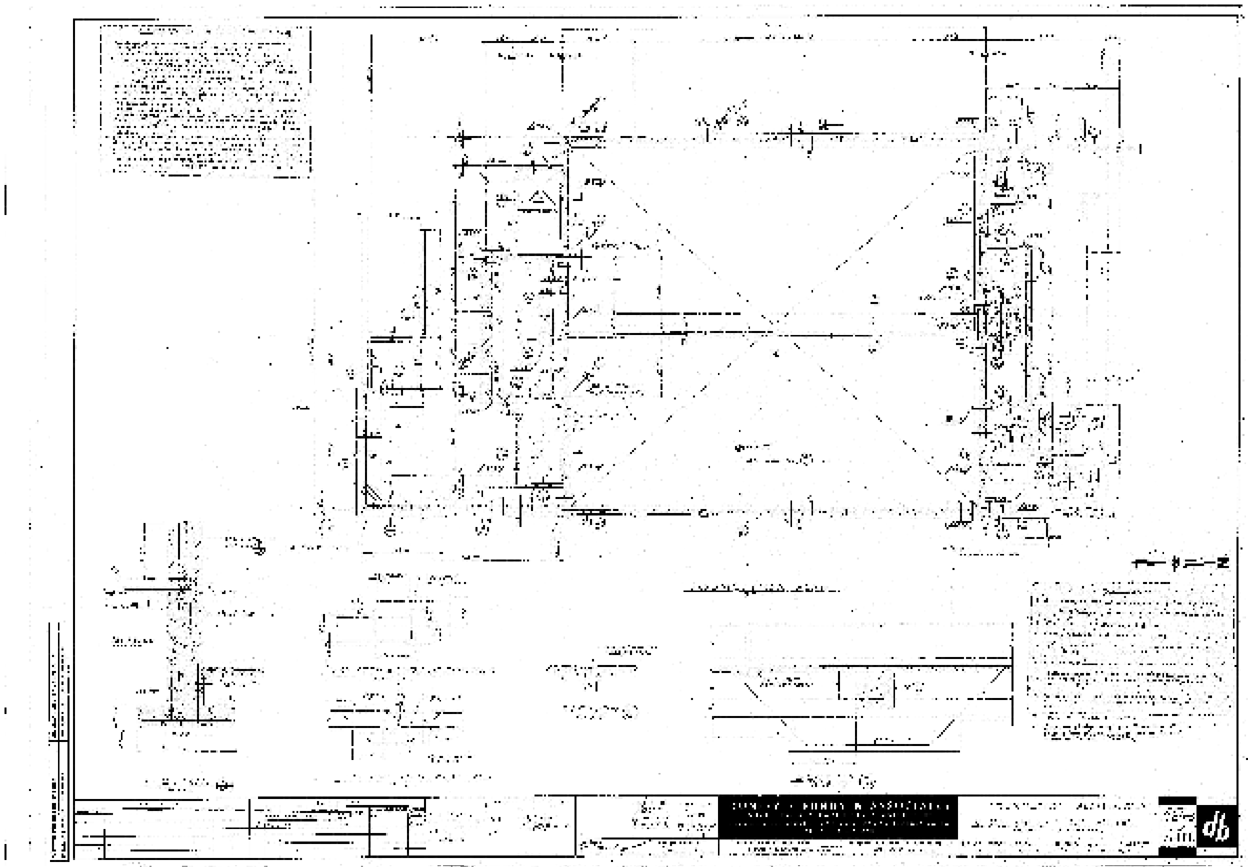
Subpurlins shall be galvanized or shop painted with one coat of rust-inhibitive paint and shall be welded to supports.

SECTION 1928A — TESTING AND INSPECTION

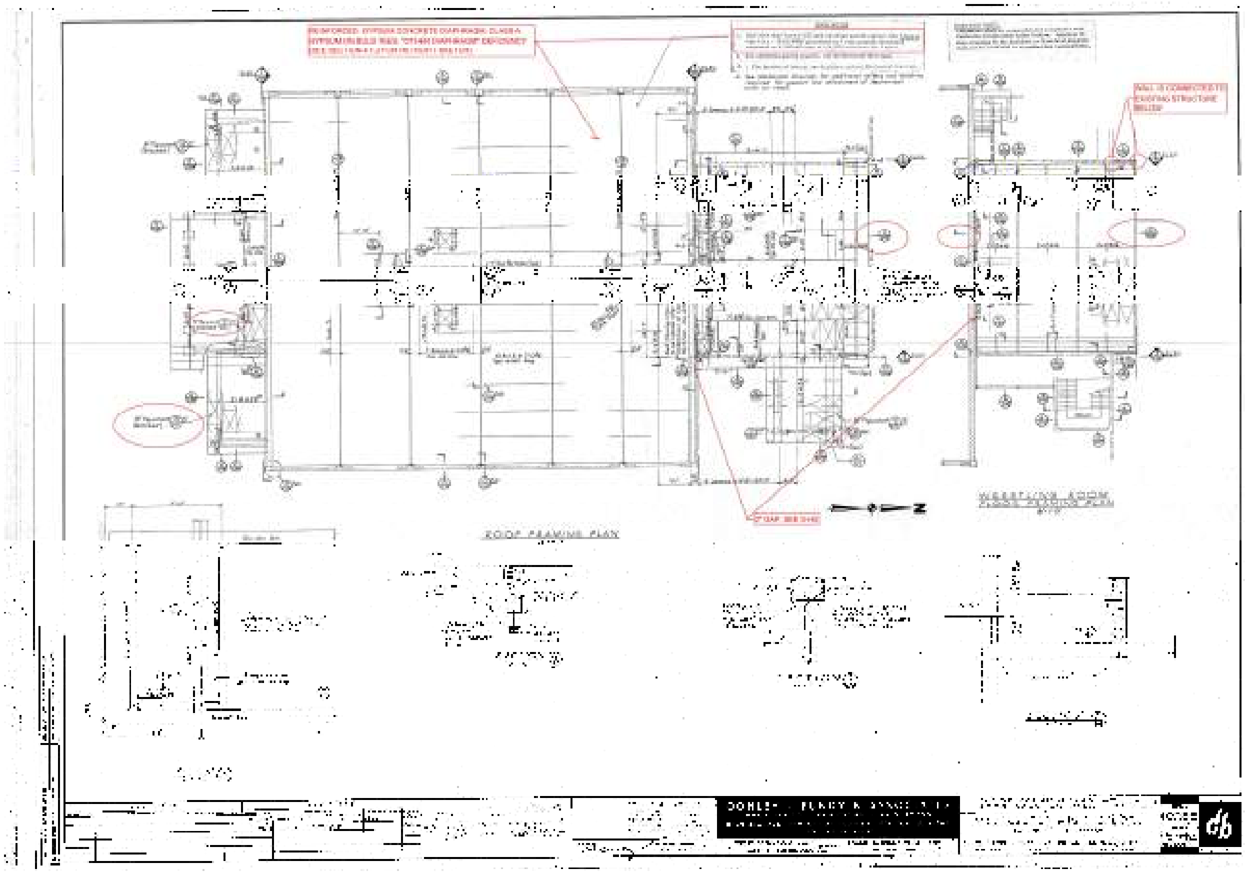
1928A.1 Cementitious Material Test. The concrete supplier shall furnish to the enforcement agency certification from the cement manufacturer that the cement proposed for use on the project

Reinforced Gypsum Concrete Diaphragm – Allowable Shear (ASD, UBC 1994 1927A.3 – Cont'd)

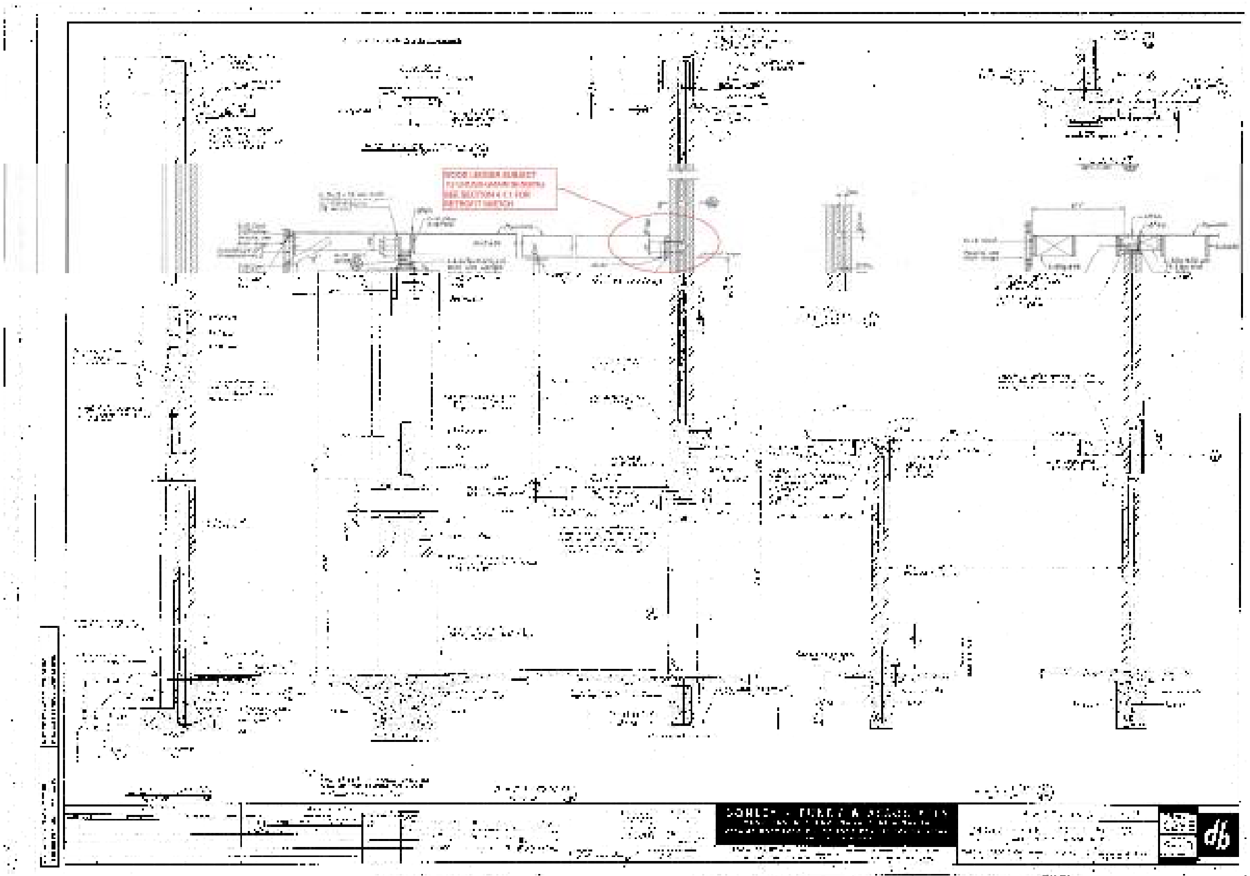
Appendix 1-C: As-Built Plans



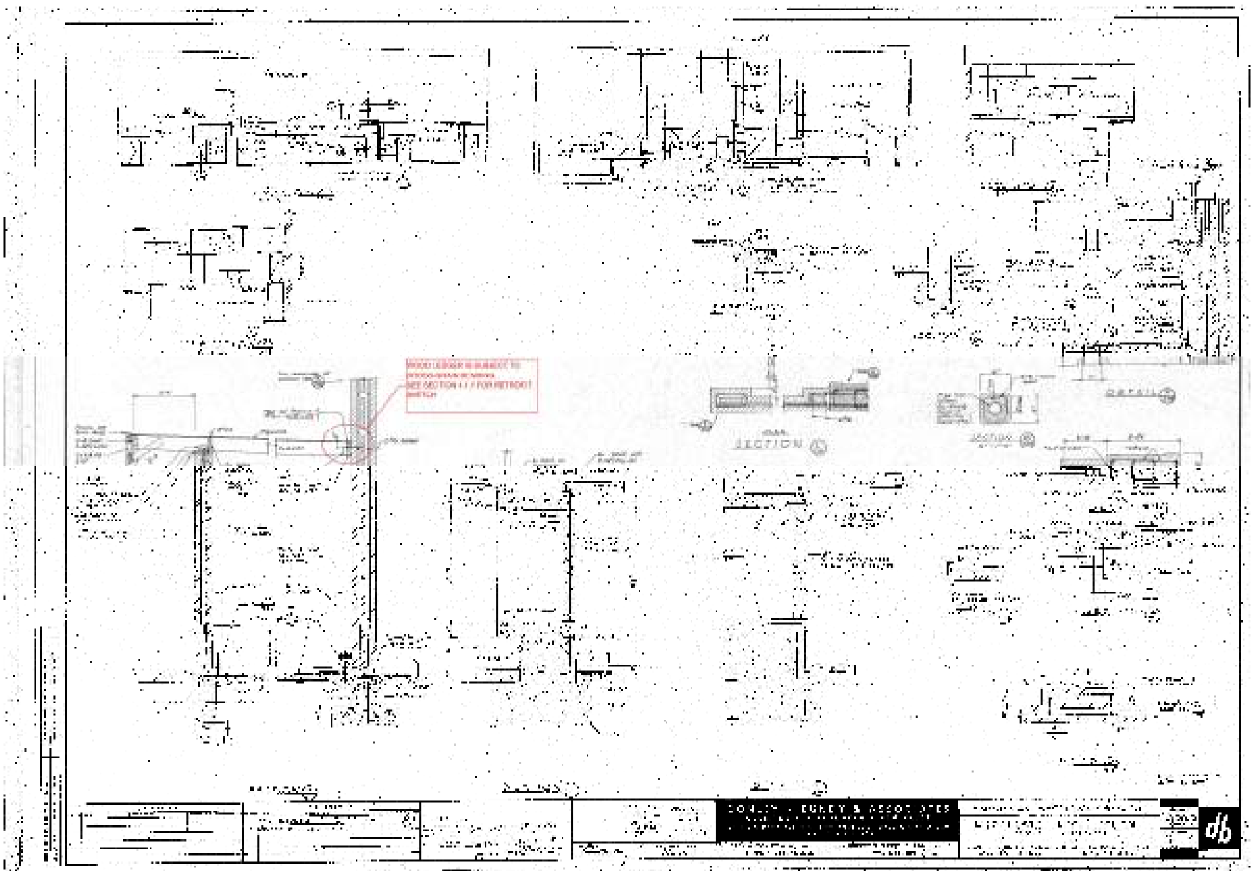
Foundation Plan (1968 Drawing Sheet S-H1)



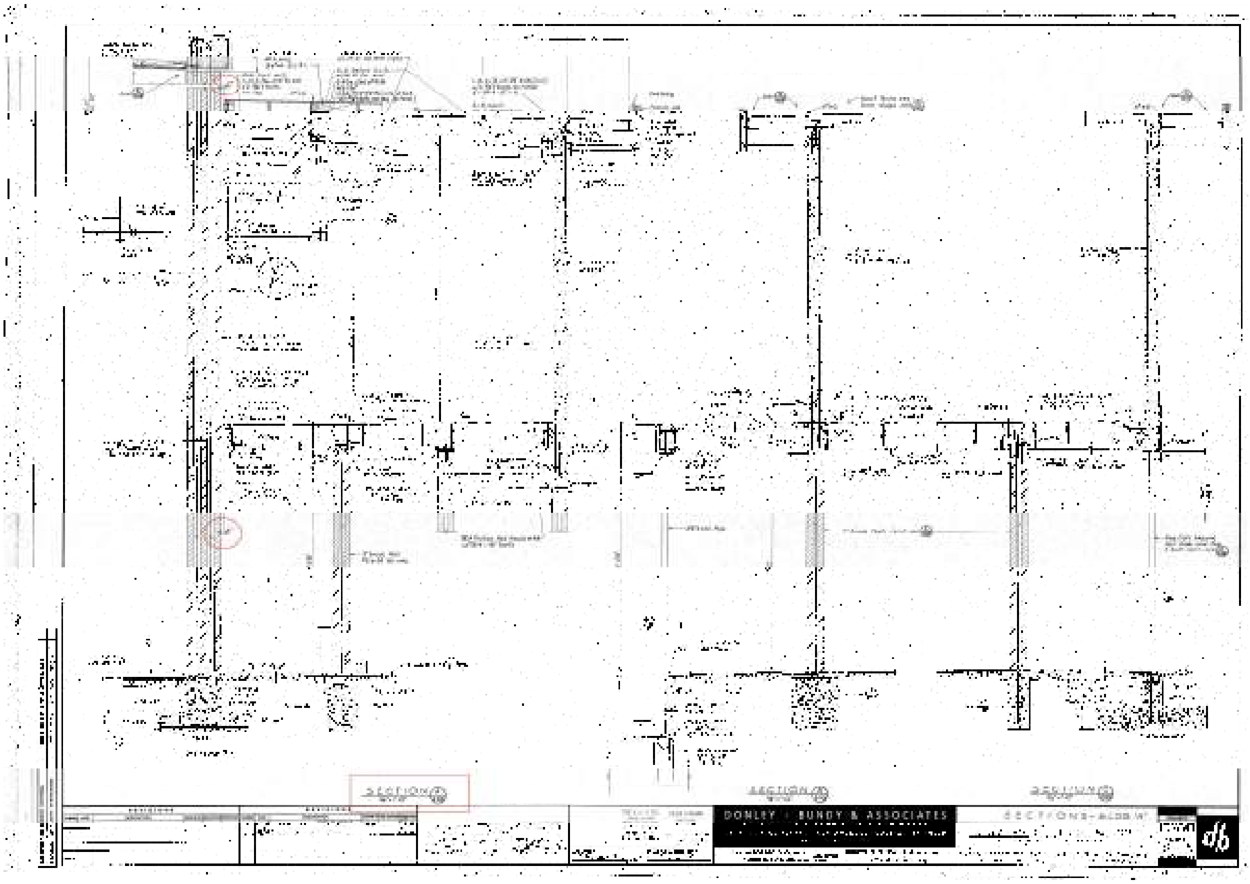
Roof Plan (1968 Drawing Sheet S-H2)



Sections (1968 Drawing Sheet S-H3)



Sections (1968 Drawing Sheet S-H4)



Sections (1968 Drawing Sheet S-H5)

Appendix 7A – Images of Existing Conditions

Fig 1. Gymnasium structure with lobby entry

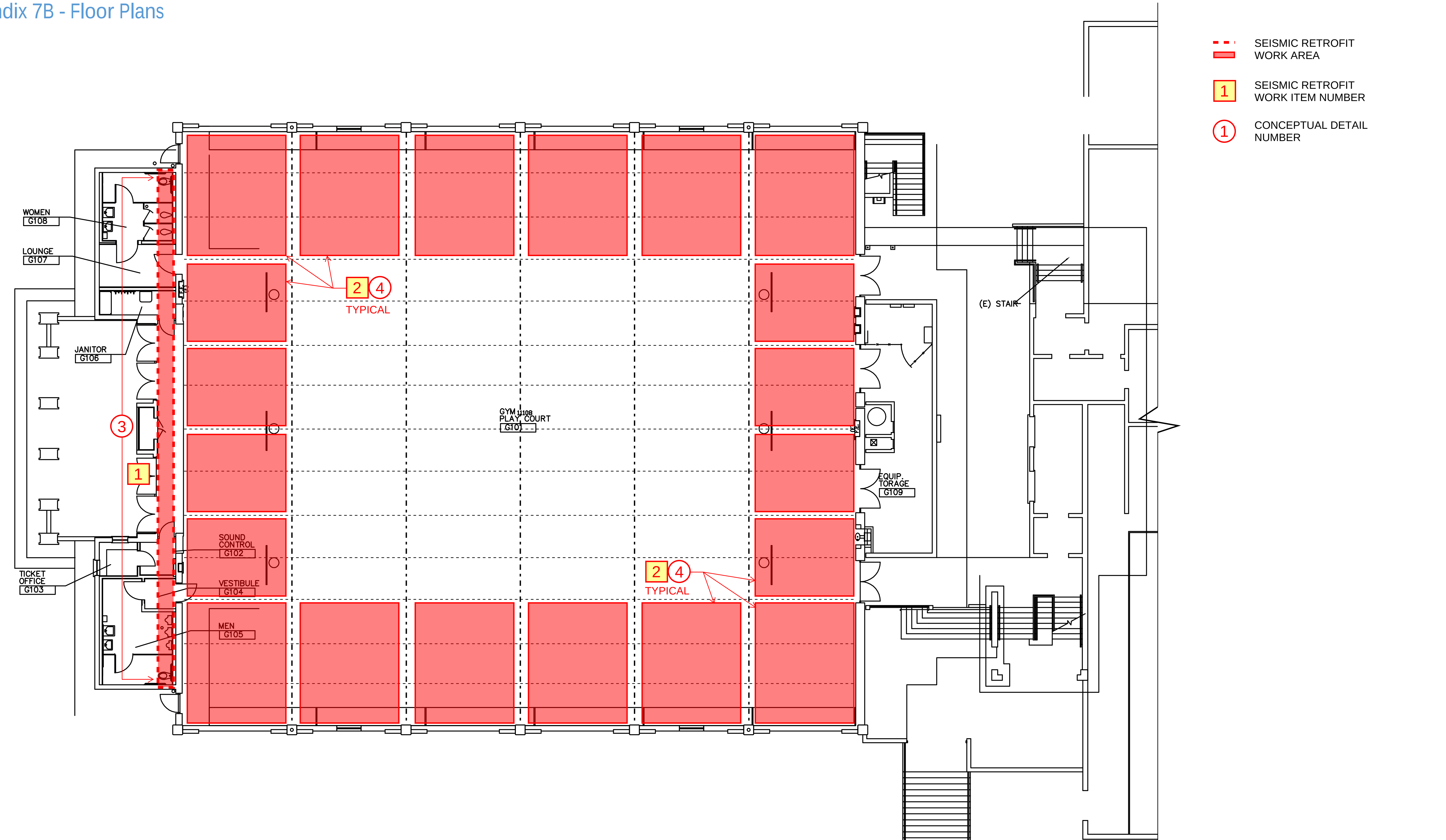
Fig 2. Lower roof at lobby entry

Fig 3. Gymnasium roof structure

Fig 4. Purlins at masonry wall in gym

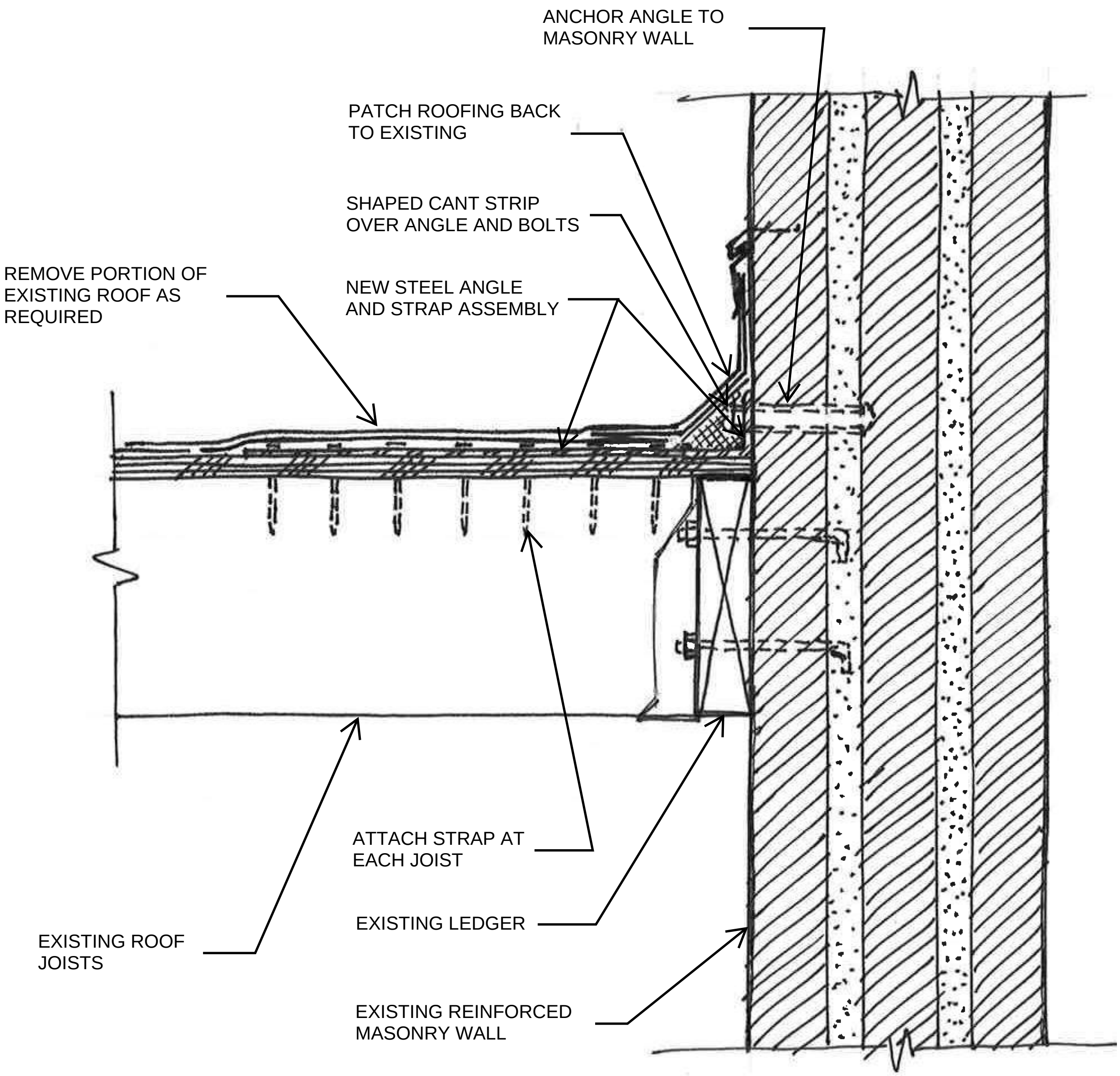
Fig 5. TSG connection at concrete column in gym

Fig 6. Locker building connection to gymnasium

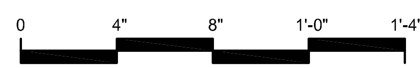


PBWS

MIRALESTE IS - BUILDING G



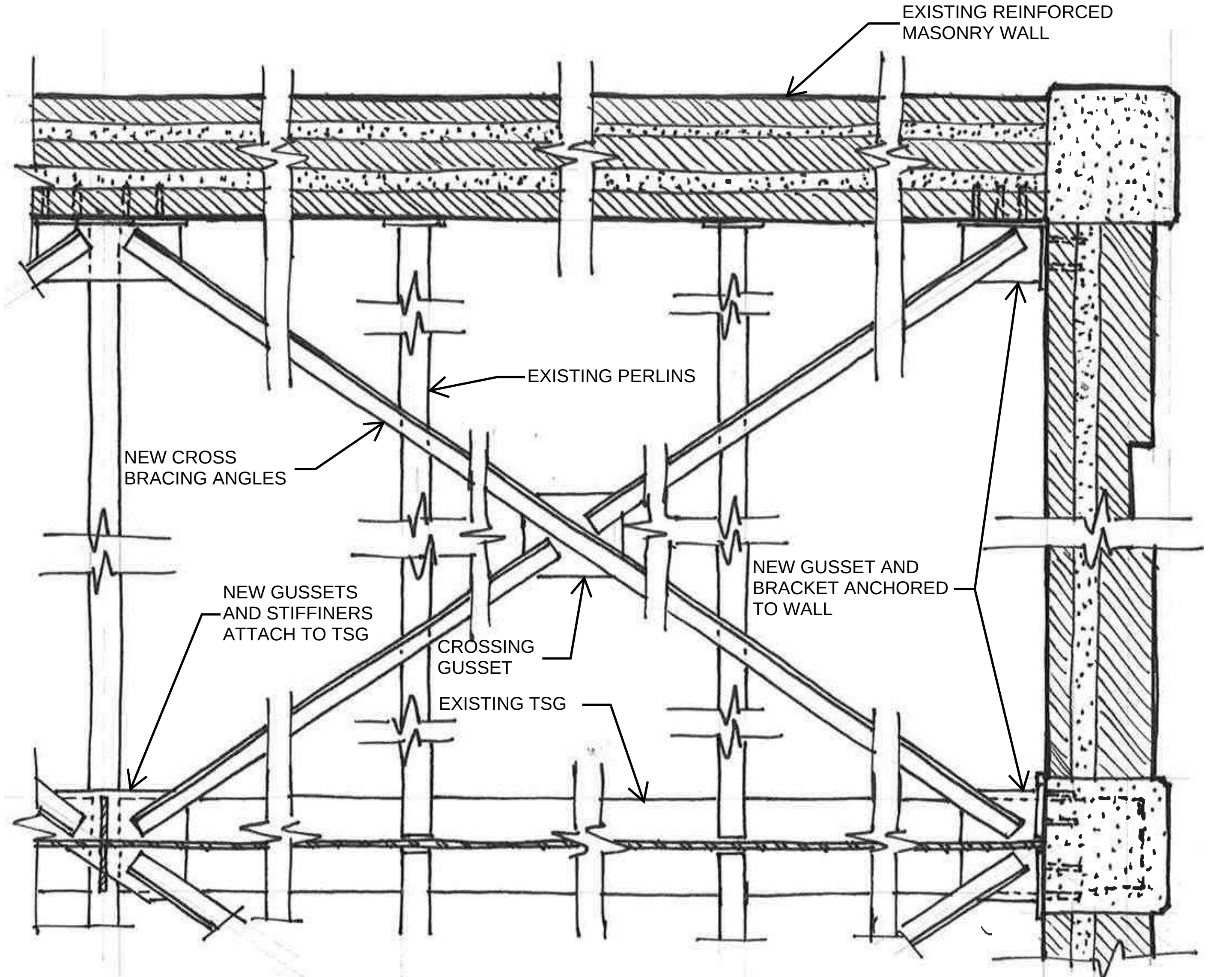
ROOF LEDGER AT MASONRY WALL



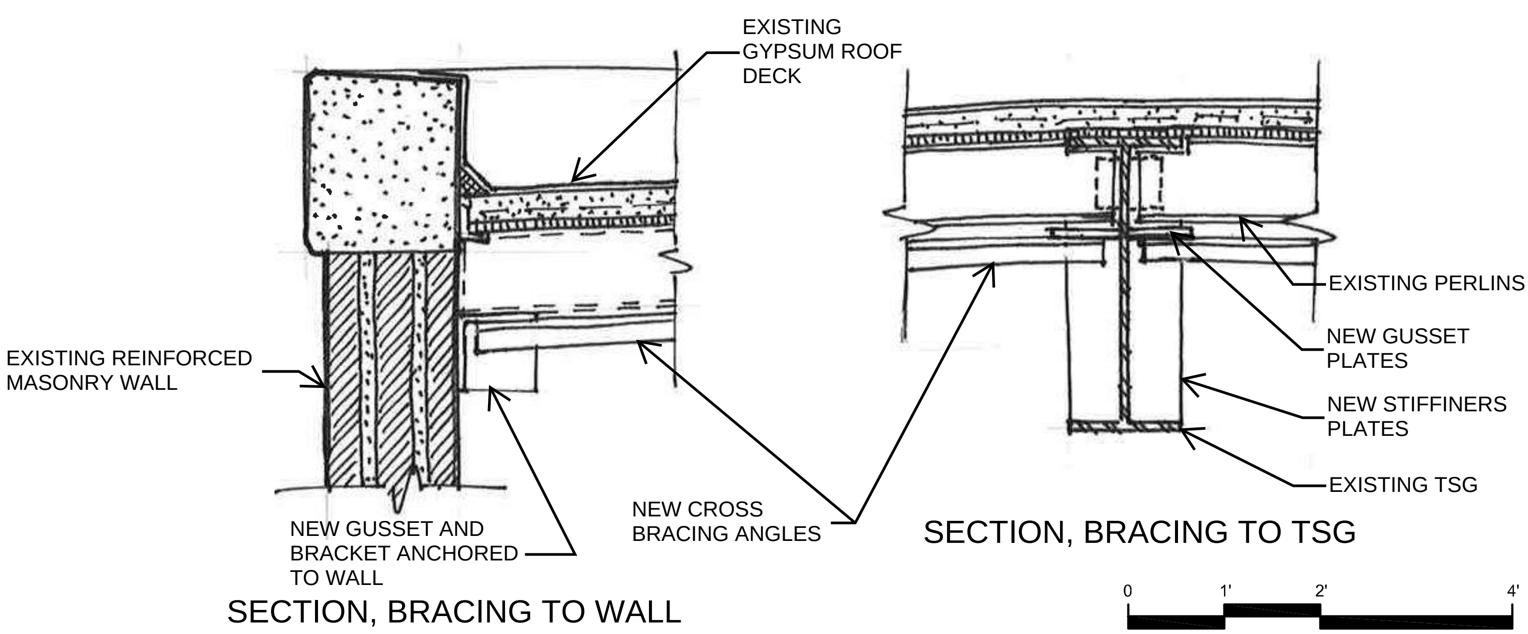
PBWS

ROOF DIAPHRAGM CONNECTION ENHANCEMENT AT MIS BUILDING G GYMNASIUM

3



REFLECTED CEILING PLAN



SECTION, BRACING TO TSG

SECTION, BRACING TO WALL

PBWS

ROOF DIAPHRAGM ENHANCEMENT
AT MIS BUILDING G GYMNASIUM

4

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
SHOWER & LOCKER BUILDING (H)

MIRALESTE INTERMEDIATE SCHOOL
29323 Palos Verdes Dr. E,
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JANUARY 2016

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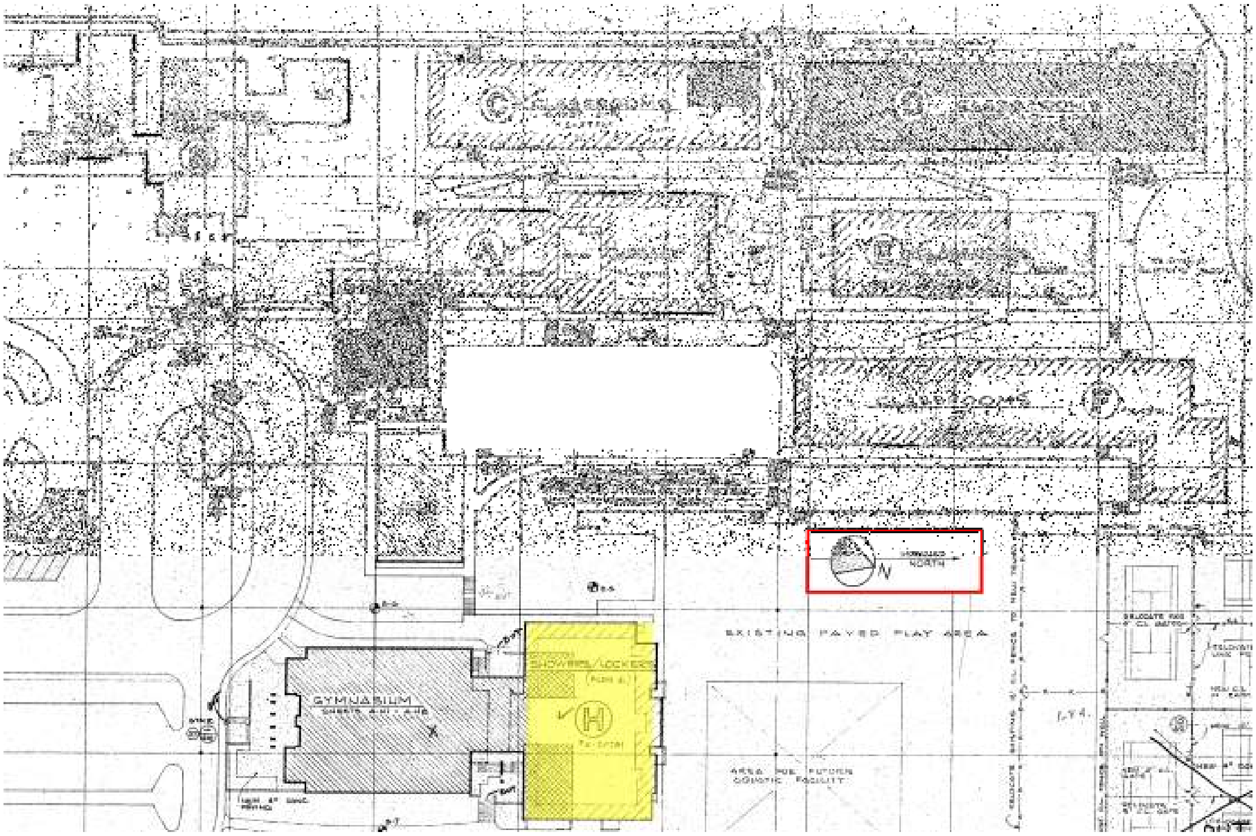
Table of Contents

1.0 Introduction

A multiphase seismic vulnerability assessment of Shower & Locker Building H was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

An overall campus map of Jefferson High School, indicating the buildings under evaluation, is provided below. The highlighted building is ***Shower & Locker Building H.***



Site Map- Shower & Locker Building H

2.0 Shower & Locker Building H

2.1 Site Seismicity

Per ASCE 41-13 (2012 IBC), for Miraleste Intermediate School located at 29323 Palos Verdes Dr. E, Rancho Palos Verdes, CA 90275

Site Coordinates = 33.75222°N, 118.32549°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.514 g; $S_{1,20/50}$ = 0.197 g
Fa = 1.389 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.01 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.714 g
$S_{X1} = F_v S_{1,20/20}$ = 0.396 g

2.2 Building Description

The Shower & Locker Building 'H' is one-story building with varied base and roof elevations in the eastern part of the school campus. The set of existing drawings is available dated February 1967, which shows the proposed building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of shower and locker room for boys and girls. The building is kind of rectangular shaped with dimensions of 104' x 137'. Total footprint of the building is estimated to be ±12,600 square feet. Later is 1969, an elevated wrestling room & stair tower was built connecting to southern part roof of existing shower building and 2" separated from Gym building built same time. Roof height is about 23'-0" @ wrestling room area, & 13'-6" in other areas mostly.

The building roof consists of blocked plywood sitting on glulam chord ties, which is considered flexible diaphragm. The building has continuous spread footing below the reinforced masonry walls and spread footing below gravity columns. The lateral system of the building is mainly formed of reinforced brick wall in both directions & partial concrete walls at two story portion. Therefore, based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as "RM1".

The structural risk category for the administration building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Shower & Locker Building H Summary Table

Year Designed	1967
Drawings	***Original drawings prepared by Donley.Bundy & Associates(Arch.) & Wilson & Wilson Structural Engineers; dated February 1967***
Gravity System	Wood roof diaph. On glulam beams on bearing brick walls w/infill HSS columns
Lateral System	Reinforced Brick Walls
No. of Stories & Height	One Story; Main Roof: h_n=13ft ; Elevated wrestling room Roof: h_n=23ft
Building Period "T"	0.21 Sec
Base Shear "V"	0.714 W = 749 Kips
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	-

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of ***Shower & Locker Building H*** is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

For purpose of evaluation, wrestling room addition done in 1969 was added as seismic mass and considered in calculation.

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Adjacent Buildings

All of the deficiencies listed above were reviewed using a Tier 2 Evaluation, which can be found in ***Appendix 1-B***.

Deficiency No. 1 (Adjacent Buildings) was mitigated with analysis results per ASCE 41-13 section 5.4.1.2 by ensuring that the provided building separation is larger than the expected building displacement at the roof level of the lower building.

Tier 2 analysis was performed using analysis results from the ETABS model developed for the Tier 2 evaluations. Linear static procedure was used for the analysis of the structure using BSE-1E level seismic response spectrum. Output results were exported to Excel spreadsheets and calculations per ASCE 41-13 were performed.

These calculation are reflected and can be found in report prepared for *Gym Building (G).*

3.2 Tier 2 Evaluation and Proposed Retrofit Summary Table

Building	Identified Tier 1 Deficiencies	Tier 2 section number	Tier 2 Evaluation Result	Proposed Retrofit
Building H Target Structural Performance Level: ***S-2 Damage Control***	***16.12 LS Adjacent Buildings***	**5.4.2**	***Adequate***	

4.0 Conclusions

After further review and updating tier 1 checklist as per ASCE 41-13, no major deficiencies were identified which required tier 2 evaluation. The only potential deficiency identified in tier 1 was adjacent building issue which is mitigated by calculation as part of tier 2 evaluation (see Gym Building (G) report).

Given the reason above, a voluntary seismic retrofit is not required for this structure.

5.0 Documents Reviewed

The following existing drawings were reviewed:

Date	Architect / Engineer	TTG Comments
February 1967	Donley. Bundy & Associates (Architect) Wilson & Wilson (Structural Engineer)	Title Block states “Building H” (State of California – Department of General Services, Office of Architecture and Construction Project No. 27051)
December 1968	Donley. Bundy & Associates (Architect) Wilson & Wilson (Structural Engineer)	Title Block states “Building H”-Second increment (State of California – Department of General Services, Office of Architecture and Construction Project No. 29168)

6.0 Limitations

These reports represent ***TTG’s*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Miraleste Intermediate School Building H, Locker Rooms

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Architecture Planning Interiors

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7.0 Architectural Section

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the

District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Miraleste Intermediate School was originally constructed as a public high school with in the Palos Verdes Peninsula Unified School District. It was constructed in four phases in 1967, 1970, 1973 and 1977. It was originally called Miraleste High School and has been in constant use as a public school since that time. The original campus buildings were designed by the firm of Donley Bundy & Associates and is mostly of reinforced brick and concrete masonry, and wood construction. The building referred to as Building H is part of the 1967 phase.

Building H contains the locker rooms. It is a reinforced brick masonry wall structure with a wood framed roof structure. The roof structure is glue laminated beams and joists, and has some steel beams to support changes in roof elevations and clearstory elements. When the adjacent gymnasium building "G" was built later in the 1970 phase it was linked the locker room building with a circulation passage. Even with the two buildings connection the gymnasium remains structurally separate.

All portions of the building are of Type-5 non-rated construction and appear fit within the current CBC Type-5B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how

the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Work

No Recommended Retrofit
After further tier 2 analysis it was determined that the building does not require any seismic retrofit work for life safety.

Accessibility Upgrades

There are no accessibility upgrades anticipated for this building since no retrofit work is recommended.

Fire & Life Safety

There are no fire & life safety upgrades anticipated for this building since no retrofit work is recommended.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Appendix 1-A: Tier 1 Screening Checklists/Calculation

ASCE 41-13

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
General					
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path, so compliant.
	x			ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.3)	Adjacent to Storage and Locker Room Building. Gap = 2” < .04*12.5 ft*12 = 6”, NG, check using Tier 2 calculations. See Gym Building (G) report; Appendix 1-B for Tier 2 calculations.
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanine levels in the building, not applicable.
Building Configuration					
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	One story bldg.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	One story bldg.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	Per review of as-built and site investigation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	One story bldg.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	One story bldg.
		x		TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Flexible diaphragm. Overall equal stiffness distribution by walls
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
			x	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	No geotech report available but not anticipated per site location.
			x	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	No geotech report available
			x	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	No geotech report available
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					

C	NC	N/A	U	Checklist	Comments
x				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.714=0.43< min(104,137)/23=4.5 Compliant per review of existing drawings. Elements of the lateral system can work together, so building dimension is used for this check since all the elements are well connected.
x				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Compliant per review of existing foundation plan.(Ref. sheet S-H1)

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY BEARING WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY BEARING WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. Commentary Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1.	Per as-built dwgs
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in.^{2} . Commentary Sec. A.3.2.4.1. Tier 2: Sec. 5.5.3.1.1.	See provided calc at end of checklist
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. Commentary Sec. A.3.2.4.2. Tier 2: Sec. 5.5.3.1.3.	See provided calc at end of checklist
Stiff Diaphragms					

C	NC	N/A	U	Checklist	Comments
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. Commentary Sec. A.4.5.1. Tier 2: Sec. 5.6.4	Wood diaphragm
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. Commentary Sec. A.5.1.1. Tier 2:Sec. 5.7.1.1.	See provided calc at end of checklist
		x		WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. Commentary Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3.	Per S-H3/ S-H4 details, no wood ledger exist.
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. Commentary Sec. A.5.2.1. Tier 2: Sec. 5.7.2.	Per S-H3 anchor bolts @ each beam location and 48” o.c. in between provided
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. Commentary Sec. A.5.2.3. Tier 2: Sec. 5.7.2.	All wood diaphragm
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. Commentary Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4	Per S-H3/ S-H4 details
x				GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. Commentary Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1.	
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.					

C	NC	N/A	U	Checklist	Comments
Stiff Diaphragms					
		x		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. Commentary Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3.	Flexible diaphragm
		x		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. Commentary Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3.	Flexible diaphragm
Flexible Diaphragms					
x				CROSS TIES: There are continuous cross ties between diaphragm chords. Commentary Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2.	Glulam beams as cross ties between chords…per S-H1 roof plan
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. Commentary Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3.	No large opening…ref. S-H1 roof plan
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. Commentary Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3.	No large opening…ref. S-H1 roof plan
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. Commentary Sec. A.4.2.1. Tier 2: Sec. 5.6.2	5/8” plywood diaphragm per S-H1 roof plan
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. Commentary Sec. A.4.2.2. Tier 2: Sec. 5.6.2.	5/8” plywood diaphragm per S-H1 roof plan
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. Commentary Sec. A.4.2.3. Tier 2: Sec. 5.6.2.	Blocked plywood diaphragm per S-H1 roof plan
x				OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than	Wood diaphragm

C	NC	N/A	U	Checklist	Comments
				wood, metal deck, concrete, or horizontal bracing. Commentary Sec. A.4.7.1. Tier 2: Sec. 5.6.5.	
Connections					
X				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. Commentary Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2.	

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
Life Safety Systems					

C	NC	N/A	U	Checklist	Comments
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Hazardous Materials	
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
Ceilings					
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
			X	LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Not accessible during site visit
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	
Light Fixtures					
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Observed Compliant
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
Cladding and Glazing					
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
				Masonry Veneer	
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no	No URM backup, so not applicable.

C	NC	N/A	U	Checklist	Comments
				unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
Parapets, Cornices, Ornamentation, and Appendages					
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
		X		LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Damage observed on existing outrigger though @ SW corner of bldg.
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No Parapet; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	
				Masonry Chimneys	
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
				Stairs	
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
X				LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	Stairs to structure designed for drift
				Contents and Furnishings	
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable

C	NC	N/A	U	Checklist	Comments
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
				Mechanical and Electrical Equipment	
X				LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	Observed compliant
X				LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Observed compliant
X				LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	Observed compliant

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
				Piping	
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	
Ducts					
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
Elevators					
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW		Bldg Type= **RM1**
$C =$	1	From Table 4-8	
$S_a = \min(S_{XS}, S_{X1}/T)$		From Section 4.5.2.3	
$S_{X1} = F_V S_1$		Eq. 2-2	
$S_{XS} = F_a S_S$		Eq. 2-1	
$S_S =$	0.514	g, mapped spectral acceleration	
$S_1 =$	0.197	g, mapped spectral acceleration	
$S_{X1} =$	0.396	g	
$S_{XS} =$	0.714	g	
$T = C_t h_n^{\beta}$		From Section 4.5.2.4	
$C_t =$	0.02		
$h_n =$	23	ft., average height at sloped roof (Max @ wrestling room)	
$\beta =$	0.75		
$T =$	0.210	sec.	
$S_a =$	0.714	g	
$V =$	0.714	W	different roof heights do not affect base shear coefficient since Sa=Sxs for all roof heights in bldg H

Check Seismic Mass For Shear Stress Check

Roof (all)

Roofing	6	psf
5/8" plywood	2	psf
framing(purlins+sub-purlins)	4	psf
MEP	3	psf
Ceiling	4	psf
Misc	1	psf
DL =	**20**	**psf**
Use	**20**	**psf**

Wrestling room(floor)

Flooring	4	psf
3/4" plywood	2.5	psf
framing(purlins+sub-purl	4	psf
MEP	3	psf
Ceiling	4	psf
Misc	1	psf
DL =	**18.5**	**psf**
Use	**20**	**psf**

Wall Weight

8 1/2" CMU wall =	96	psf
10" CMU wall =	113	psf
8" conc wall=	97	psf

USGS Design Maps Summary Report

User–Specified Input

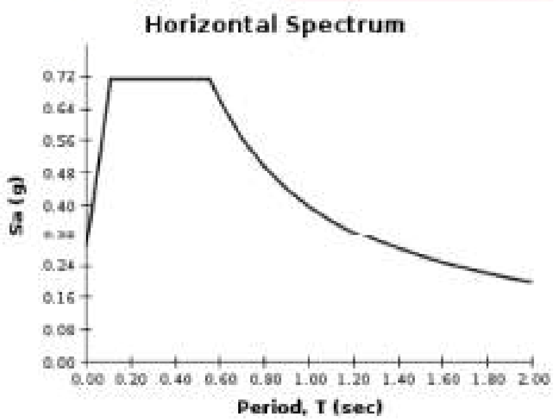
Building Code Reference Document ASCE 41-13 Retrofit Standard, BSE-1E
(which utilizes USGS hazard data available in 2008)

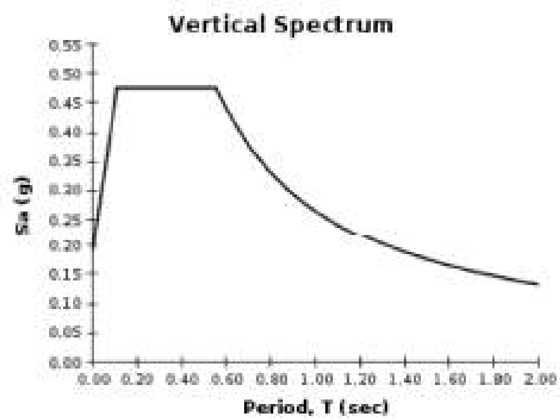
Site Coordinates 33.75222°N, 118.32549°W

Site Soil Classification Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.514 g	$S_{XS,BSE-1E}$	0.714 g
$S_{1,20/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g





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Mass Weight Calculation

Location		Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Roof (all-1967)	Area 1	-	-	13180	20	264
Walls(all-1967)	walls 1*	780.0	6.0	4680	96	449
Wrestling room addition:(1969)						
Roof(wrestling room)	Area 2	-	-	4027	20	81
walls(wresl. Room)	Walls 2*	160.0	12.0	1920	97	186
elev. Floor(wresl. Rm.)	Area 3	53.0	66	3498	20	70
	Grand Total =			**13180**		**1050**

Base shear V=	0.714	W
Base shear V=	749	

*Since all openings are conservatively ignored and 8.5" solid wall are considered in weight, therefore minimal lenghts of thicker walls are assumed 8.5" too.

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m

m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1 Footnote b for reinforced masonary walls

Wall Forces - 1st Floor (Supporting Roof)

	Wall Description	Length ft	Width in	Aw in2	Force Vj kips	v avg psi
N-S Direction	8.5" CMU	147.0	8.5	14994	749	16.7
E-W Directioin	8.5" CMU	244.0	8.5	24888	749	10.0

Per ASCE 41-13 check list 16.15LS, shear stress shall be less than **70** psi in CMU wall to be compliant.

Reinforcing Steel Ratio Check:

8.5" CMU wall with #5 @ 24" Hori & Verti

Hori / Vert ρ=	0.0015	>0.0007 OK
Total ρ=	0.0030	>0.002 OK

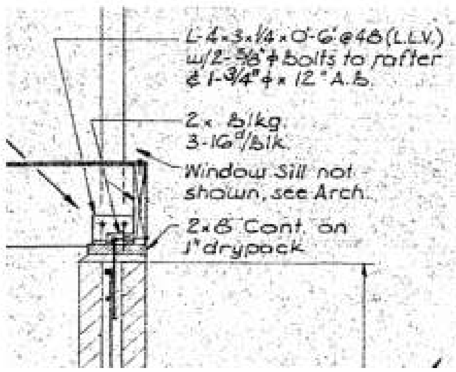
10" CMU wall with #5 @ 20" Hori & Verti

Hori / Vert ρ=	0.0013	>0.0007 OK
Total ρ=	0.0026	>0.002 OK

Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

$T_c = 1.2 S_{XS}\, w_p\, A_p =$	82.3	psf	Eqn 4-13
where:			
$S_{XS} =$	0.714		
$w_p =$	*96*	psf	8.5" CMU wall
Ap =	1	ft2	
Trib. h =	8.5	ft	
$Q_E =$	699	lbs	End shear = W x Trib. H; W = 1 ft

Check bolts to Glu lam beam (2- 5/8" dia bolts to 2x rafter) (Deformation-controlled)



D /SH-3

Per ASCE 41-13 12.3.3.1 demands on wood connectors shall be considered as deformation-controlled actions.

QUD = QE =	699	lbs/ ft	
A) Per Dwg , wall anchors @ S =	4	ft	
A) Out of plane force Q_{UD} =	**2797**	lbs	Each anchor location

BOLTS

Table 11B BOLTS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2]

for sawn lumber or SCL main member with 1/4" ASTM A 36 steel side plate

Thickness Main Member t_m in.	Thickness Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.50 Douglas Fir-Larch $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.43 Hem-Fir $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.42 Spruce-Pine-Fir $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.37 Redwood (open grain) $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_\parallel$ lbs.	$Z_\perp$ lbs.	G=0.35 Northern Species $Z_\parallel$ lbs.	$Z_\perp$ lbs.
1-1/2	1/4	1/2	730	420	620	350	580	310	580	310	550	290	520	280	510	270	470	240	460	240	450	230
		5/8	910	480	780	400	730	360	720	360	690	340	650	320	640	320	590	290	580	280	560	270
		3/4	1090	550	940	450	870	420	860	410	820	390	780	360	770	360	710	320	690	320	680	310
		7/8	1270	600	1090	510	1020	470	1010	450	960	430	910	410	900	400	820	370	810	360	790	360
		1	1460	660	1250	550	1170	510	1150	500	1100	480	1040	450	1030	450	940	400	930	400	900	390
1-3/4	1/4	1/2	810	460	690	370	640	340	630	330	600	310	570	290	560	280	510	250	500	250	490	240
		5/8	1020	520	870	430	800	390	790	380	750	360	710	340	700	330	640	300	630	290	610	280
		3/4	1220	590	1040	480	980	440	950	430	900	410	860	380	840	370	770	330	750	330	730	320
		7/8	1420	650	1210	540	1130	490	1110	480	1050	460	1000	420	980	420	890	380	880	370	850	360
		1	1630	710	1380	580	1290	540	1270	520	1200	500	1140	470	1120	460	1020	410	1000	410	960	400

Z = 800 lbs/ bolt NDS Table 11B

Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

2012 NDS

λ tied to ASCE 7 Factored Loads: Baseline 10 minutes (ASD uses 10 years)

Table N3 Time Effect Factor, λ (LRFD Only)

Load Combination[2]		λ
1.4D	Permanent	0.6
$1.2D + 1.6L + 0.5(L_r \text{ or } S \text{ or } R)$		0.7 when L is from storage 0.8 when L is from occupancy 1.25 when L is from impact[1]
$1.2D + 1.6(L_r \text{ or } S \text{ or } R) + (L \text{ or } 0.8W)$	Long term	0.8
$1.2D + 1.0W + L + 0.5(L_r \text{ or } S \text{ or } R)$		1.0
$1.2D + 1.0E + L + 0.2S$	Short term	1.0
$0.9D + 1.0W$		1.0
$0.9D + 1.0E$		1.0

1. Time effect factors, λ, greater than 1.0 shall not apply to connections or to structural members pressure-treated with water-borne preservatives (see Reference 30) or fire retardant chemicals.
2. Load combinations and load factors consistent with ASCE 7-10 are listed for ease of reference. Nominal loads shall be in accordance with N.1.2. D = dead load; L = live load; L_r = roof live load; S = snow load; R = rain load; W = wind load; and E = earthquake load.

2012 NDS

Table 2.3.5 Format Conversion Factor, K_F (LRFD Only)

Application	Property	K_F
Member	F_b	2.54
	F_t	2.70
	F_v, F_{rt}, F_s	2.88
	F_c	2.40
	$F_{c\perp}$	1.67
	E_{min}	1.76
All Connections	(all design values)	3.32

$$R_N = \phi \lambda K_F R_{ASD}$$

K_F converts reference design values (ASD normal load duration) to LRFD reference resistance

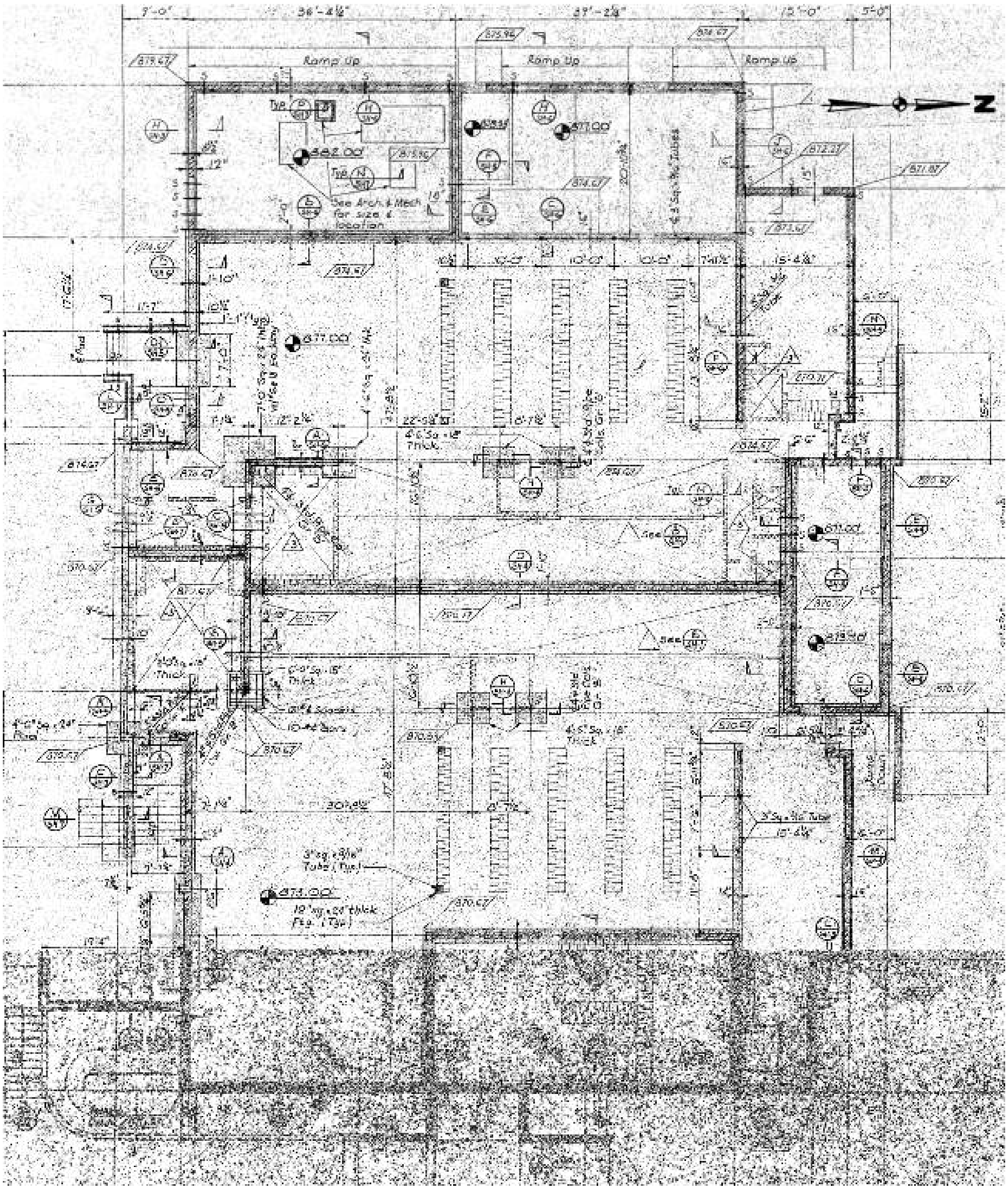
n = 2

Z = 800 lbs/ bolt
Φ = 1.0 per ASCE 41-13 12.3.2.2.1
λ = 1.0 per NDS 2012 table N3
KF = 3.32 per NDS 2012 Table 2.3.5

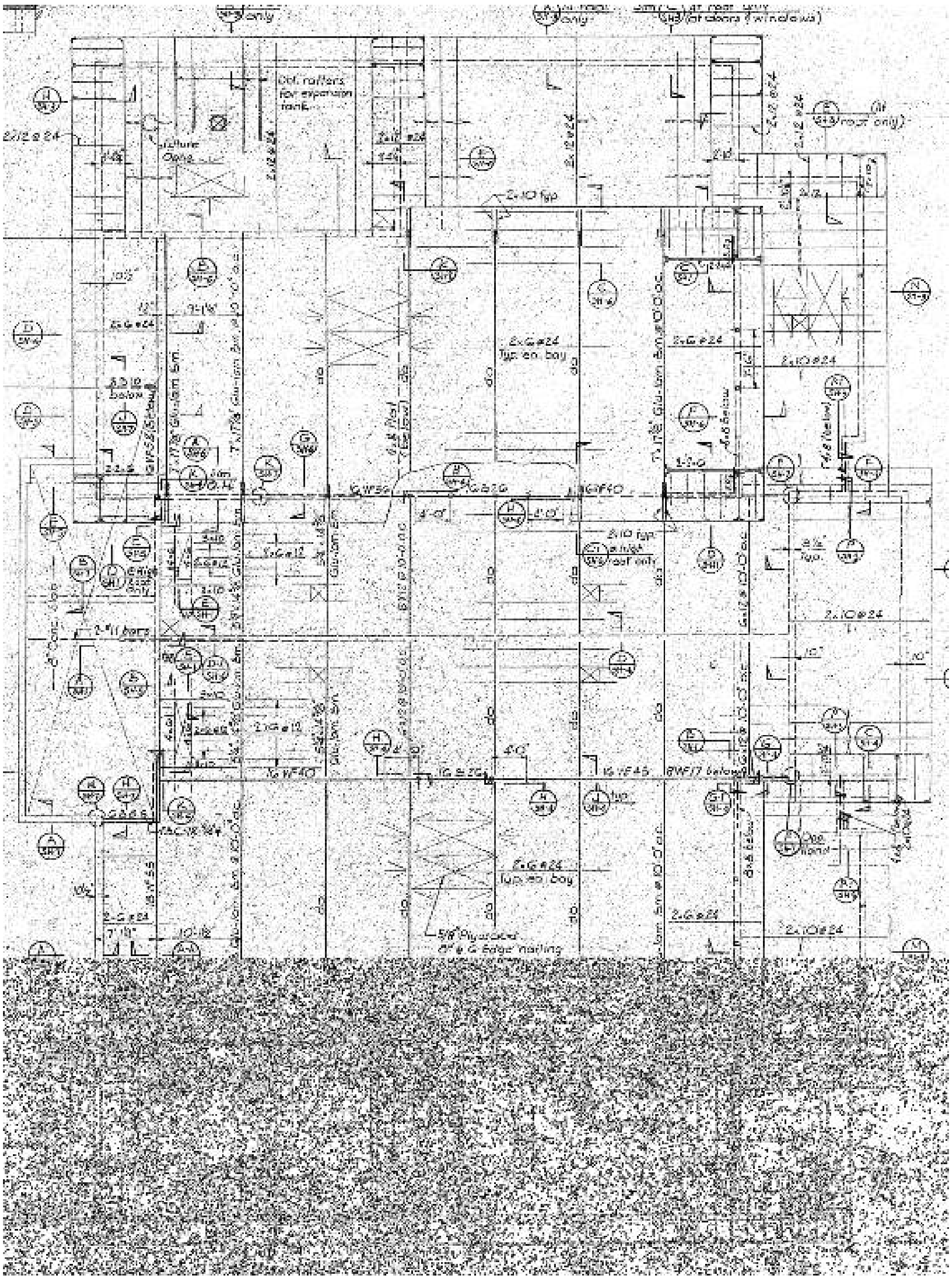
RN = Φ*λ*KF = **3.32**

B) QCL = n x Z x KF = 5312 lbs
QCE/ QCL = 1.5 per ASCE 41-13 12.3.2.2.1
m (IO) = 1.4 Table 12-3, machine bolts, metal to wood
m (LS) = 2.8 Table 12-3, machine bolts, metal to wood
m = 1/2*[m(IO) + m(LS)] = 2.1 Table 2-1 Footnote b, for Tier 1, Risk Category III
k = 0.75 Table 6-1, Usual level of knowledge
QCE = m*K*(QCE/ QCL)*QCL = 12550 lbs **QUD = 2797 lbs < QCE, OK**

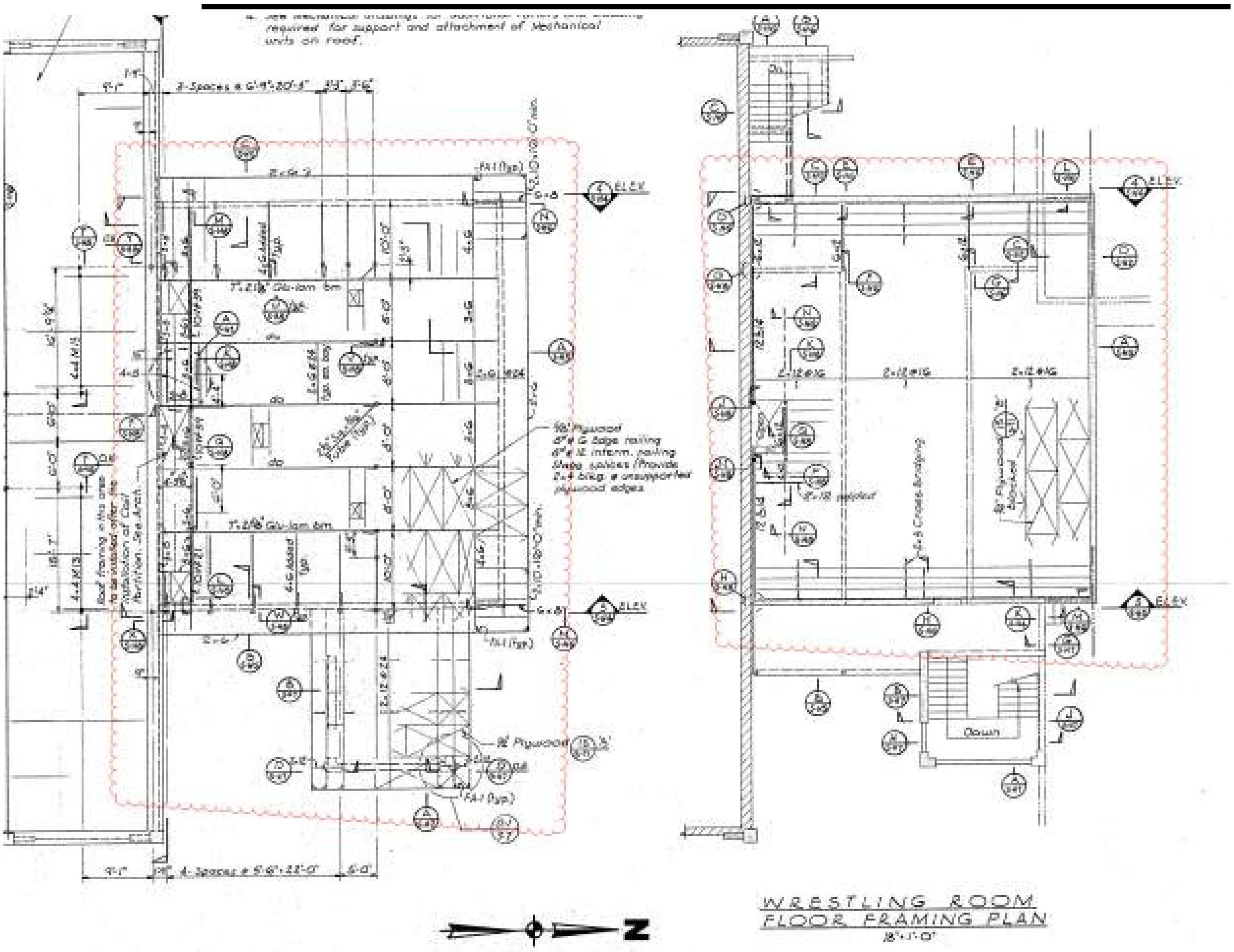
Appendix 1-C: As-Built Plans



Foundation Plan (S-H1)



Roof Plan (S-H2)



Elevated Floor & Roof Plan of Wrestling

Room addition (S-H2 ; 1969 dwg.)

Appendix 7A – Images of Existing Conditions

Fig 1. North end of locker room building

Fig 2. Two story circulation connection to gym.

Fig 3. Circulation from gym to lockers

Fig 4. Structural separation at circulation

Fig 5. Structural separation at gym entry

Fig 6. Locker room interior

TTG

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
CANOPIES

MIRALESTE INTERMEDIATE SCHOOL
29323 Palos Verdes Dr. E,
Rancho Palos Verdes, CA 90275

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1.0 Introduction- Canopies

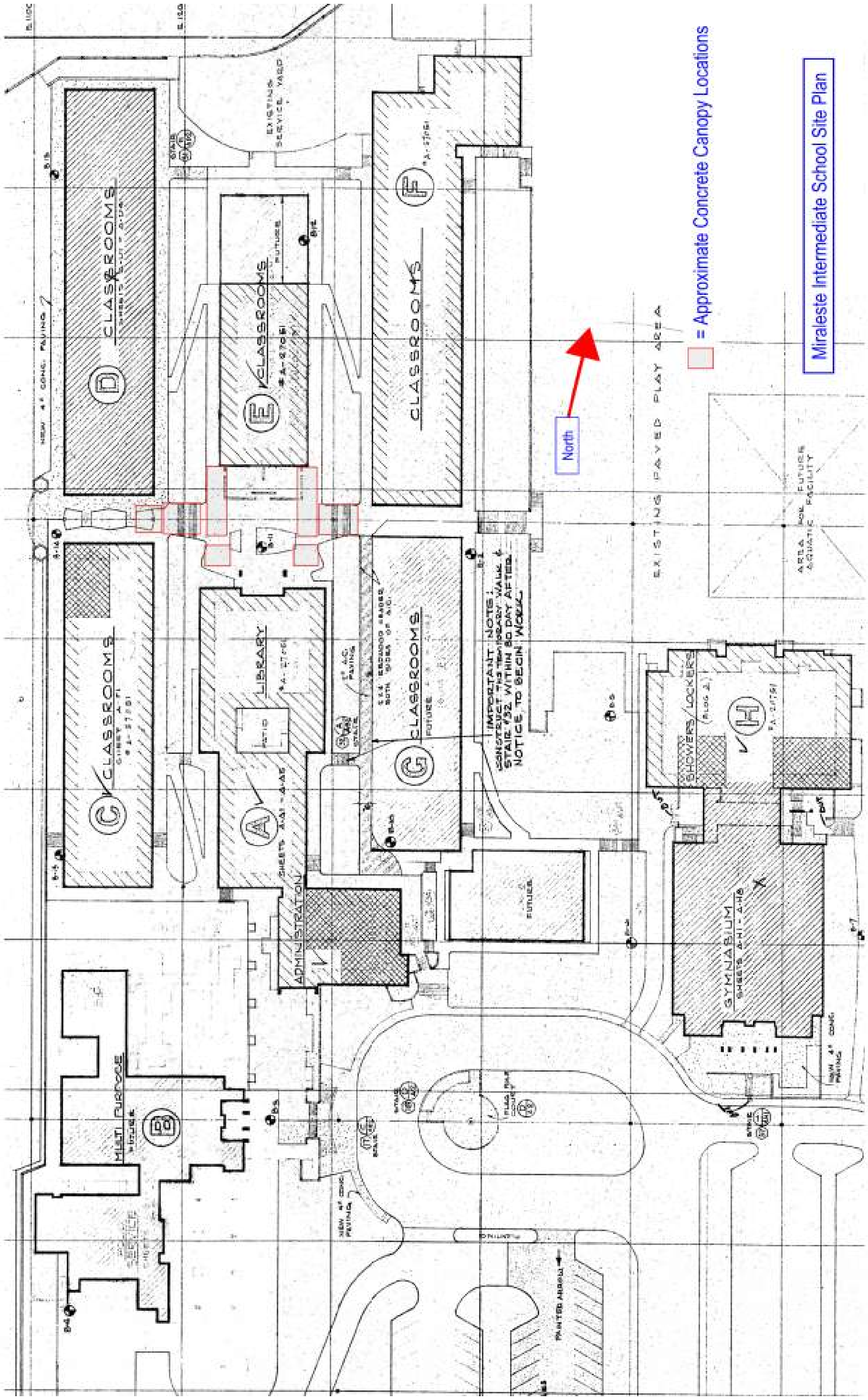
A multiphase seismic vulnerability assessment of ***Canopies*** were conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Photo 1 – View of Concrete Canopy

Photo 2 – View of Concrete Canopy

An overall campus map of Miraleste Intermediate School, indicating the location of the canopies under evaluation, is provided below. The concrete canopies are mainly located between ***Building A and Building E.***



Site Map of Miraleste Intermediate School

2.0 Concrete Canopies

2.1 Site Seismicity

Based on 1967 construction drawings (Sheet ST-1 General Notes 6), foundation was based on the allowable soil bearing pressure of 1,800 psf with width and depth increase to 2,500 psf for vertical dead loads plus live loads. There is no geotechnical report available for review.

Per ASCE 41-13 (2012 IBC), for Miraleste Intermediate School located at 29323 Palos Verdes Drive East, Rancho Palos Verdes, CA 90275,

Site Coordinates = 33.75222°N, -118.32549°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.514g; $S_{1,20/50}$ = 0.197 g
Fa = 1.389 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.010 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.714g
$S_{X1} = F_v S_{1,20/20}$ = 0.396g

2.2 Canopy Description

The concrete canopies are a one-story high structure in the school campus, mainly located between Building A and E. The existing drawings are dated February 8, 1967, which shows the proposed canopy construction and implies the canopies were constructed shortly thereafter. Functionally, the canopies provide shades and acting as walkway covers. The canopies are typically square/rectangular in shape with approximate dimensions of 17’ square, 20’ square, 24’ square and 24’ square umbrella providing shades, supported by cantilevered concrete columns. Typical height of the canopy to the bottom of umbrella varies from 8’-7” to 12’-3”. The roof of the umbrella consists of light weight concrete precast beams and slabs joined together to cast in-place light weight concrete column. The lateral force resistance of the canopy is mainly provided by cantilevered column. The foundation of the canopy consists of normal weight concrete footing under the columns.

Therefore, based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this canopy structure is considered to be Building Type: Concrete Moment Frames denoted as “C1”.

The structural risk category for the canopy structure is III (Actual risk category for the canopies is II; evaluate as risk category III for consistence with other school buildings for now, it is on the conservative side.), per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Building – Canopy Structures Summary Table	
Year Designed	1967
Drawings	Original drawings, dated February 8, 1967, prepared by Donley Bundy & Associates Architects, with Wilson & Thompson Structural Engineers.
Gravity System	Light Weight Concrete Slab/Beam/Column System
Lateral System	Concrete Moment Frame / Cantilevered Columns
No. of Stories & Height	1 Stories; Main Roof: h_n=8.95 ft ~ 12.25ft
Building Period "T"	0.014 Sec
Base Shear "V"	0.928 W = 29 kips for Type B Canopy
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	See Section 4.1 (Retrofit Not Required)

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of ***Canopies*** is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening, if needed. As a Risk Category ***III***, the Basic Performance Objective for the building was ***Damage Control Structural Performance,*** per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; some were found to be "Compliant" and others were found to remain "Deficient."

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Redundancy. The canopy is supported by single cantilevered column system; so no redundancy exists. To perform Tier 2 evaluation to verify the capacity of the columns.

3.2 ASCE 41-13 Tier 2 Evaluation

The deficiency listed above was reviewed using a Tier 2 Evaluation procedure, which can be found in Appendix 1-B. Deficiency No. 1 (Redundancy, single column cantilevered system) is mitigated by analysis results per ASCE 41-13; the column has sufficient capacity for load demands.

3.3 Tier 2 Evaluation and Proposed Retrofit Summary Table

Building	Identified Tier 1 Deficiencies	Tier 2 section number	Tier 2 Evaluation Result	Proposed Retrofit
Canopy Target Structural Performance Level: ***S-2 Damage Control***	***16.1.2 LS Redundancy***	**5.5.1.1**	***Sufficient***	***Retrofit is not required.***

4.0 Conclusions

The redundancy deficiency is due to the fact that there is only one column supporting the canopy. The calculations to verify the capacity of the columns per Tier 2 procedure show that the columns have sufficient capacity for load demand. The above identified deficiency is considered mitigated by calculations. Given the reasons above, a voluntary seismic retrofit is not required.

5.0 Documents Reviewed

The following existing architectural and or structural drawings were reviewed:

Date	Architect / Engineer	TTG Comments
February 8, 1967	Donley, Bundy & Associates (Architect) Wilson & Thompson (Structural Engineer)	Title Block states "Miraleste High School", Plans, Sections and Details Architectural and structural drawings (State of California – Department of General Services, Office of Architecture and Construction Project No. 27051)

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Miraleste Intermediate School Canopies

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7.0 Architectural Section

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the

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District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Miraleste Intermediate School was originally constructed as a public high school with in the Palos Verdes Peninsula Unified School District. It was constructed in four phases in 1967, 1970, 1973 and 1977. It was originally called Miraleste High School and has been in constant use as a public school since that time. The original campus buildings were designed by the firm of Donley Bundy & Associates and is mostly of reinforced brick and concrete masonry, and wood construction. The canopies also referred to as umbrellas were part of the 1967 phase of construction.

The Canopy umbrellas act as shade elements for the walkways between buildings and over the central stair between the three building terraces. They are constructed of a reinforced light weight concrete. The canopy is square shape formed by a hyperbolic paraboloid cantilever in four directions from a central tapered column. In some locations multiple canopies are connected at their edges. The canopy form drains water to the center to a downspout that runs through the central column.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any.

It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Work

No recommended retrofit but surface repair needed.
After further tier 2 analysis it was determined that the building does not require any seismic retrofit work for life safety. There is surface work required to the concrete however to prevent a hazard to occupants and preserve the structures. See Miscellaneous Recommended Work section.

Miscellaneous Recommended Repair

Spalling Concrete Repair
In the course of the seismic analysis of the canopy structures it was determined that they would not require retrofit. Due to this determination it is recommended to get concrete repairs done to keep these structures in serviceable condition and prevent possible injury to occupants. It is also recommended to provide a single ply roof membrane with edge flashing and a concrete sealer on the fascia after repairs. They currently have no moisture protection on top leaving exposed concrete. The single ply membrane can be detailed over the shape of the top surface where support ribs occur. Even though its sloped to drain the rough surface on top can absorb allot of moisture which migrates down to the underside. Most of the spalling damage is on the

edges with some delamination on the undersides. The reason that damage is occurring there is because the rebar is close to the outside of the fascia surface. So that, along with some corrosion expansion is enough to cause the damage. Rebar deeper into the concrete mass doesn't cause damage unless the corrosion is more extreme. The exposed rebar isn't in that bad of condition and can probably be prepped for repair. There doesn't appear to be any compromise of the main structure's integrity. These were cast with a very light weight aggregate which can absorb and hold more moisture. Repair should be done by a firm that has an expertise in this type of work. They should understand the chemistry and moisture issues with this particular concrete mixture so that the appropriate preparation, repair mixes and methods are used. After the repairs the water proofing portion of the work should be done. See the photos in appendix 7A.

Accessibility Upgrades

There are no accessibility upgrades anticipated for this building since no retrofit work is recommended.

Fire & Life Safety

There are no fire & life safety upgrades anticipated for this building since no retrofit work is recommended.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Appendix 1-A: Tier 1 Screening Checklists

ASCE 41-13 Checklists

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path exists.
x				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.2)	Shade umbrella structure is nearby to classroom buildings, but separated from the building and at different height as the roof of the building. 2” separation between the umbrellas having matching height, compliant.
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanines.
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	It is one story structure, so not applicable.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	It is one story structure, so not applicable.
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation.	All vertical elements continuous to foundation.

C	NC	N/A	U	Checklist	Comments
				(§A.2.2.4. Tier 2: §5.4.2.3)	
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	It is one story structure, so not applicable.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	It is one story structure, so not applicable.
X				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Single cantilevered column at center of canopy, compliant.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
			x	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	No geotech report available.
			x	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	No geotech report available.
			x	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	No geotech report available.

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
X				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.714=0.43 Compliant per review of existing drawings.
		X		TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Single column system, so not applicable.

16.9LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES C1: CONCRETE MOMENT FRAMES

Low Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
	x			REDUNDANCY: The number of lines of moment frames in each principal direction is greater than or equal to 2. The number of bays of moment frames in each line is greater than or equal to 2. (§A.3.1.1.1. Tier 2: §5.5.1.1)	Single cantilevered column system; so no redundancy exists. Analysis shows capacity is adequate, see calculations in Appendix 1-B.
x				COLUMN AXIAL STRESS CHECK: The axial stress caused by unfactored gravity loads in columns subjected to overturning forces because of seismic demands is less than $0.20f'_c$. Alternatively, the axial stress caused by overturning forces alone, calculated using the Quick Check procedure of Section 4.5.3.6, is less than $0.3f'_c$. (§A.3.1.4.2. Tier 2: §5.5.2.1.3)	Axial stress is less than 0.2f'c, see calculation in Appendix 1-B.
Connections					
x				CONCRETE COLUMNS: All concrete columns are doweled into the foundation with a minimum of 4 bars. (§A.5.3.2. Tier 2: §5.7.3.1)	Columns are doweled into foundation with at least 4 bars.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Seismic-Force-Resisting System					
		x		INTERFERING WALLS: All concrete and masonry infill walls placed in moment frames are isolated from structural elements (§A.3.1.2.1. Tier 2: §5.5.2.1.1)	No interfering walls.
x				COLUMN SHEAR STRESS CHECK: The shear stress in the concrete columns, calculated using the Quick Check procedure of Section 4.5.3.2, is less than the greater of 100 lb/in^2, or $2\sqrt{f'_c}$. (§A.3.1.4.1. Tier 2: §5.5.2.1.4)	Shear stress is less than $2\sqrt{f'_c}$, see calculation in Appendix 1-B.
		x		FLAT SLAB FRAMES: The seismic-force-resisting system is not a frame consisting of columns and a flat slab or plate without beams. (§A.3.1.4.3. Tier 2: §5.5.2.3.1)	Not a flat slab frame system.

C	NC	N/A	U	Checklist	Comments
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Seismic-Force-Resisting System					
		x		PRESTRESSED FRAME ELEMENTS: The seismic-force-resisting frames do not include any prestressed or posttensioned elements where the average prestress exceeds the lesser of 700 lb/in^2 or $f'_c/6$ at potential hinge locations. The average prestress is calculated in accordance with the Quick Check procedure of Section 4.5.3.8 (§A.3.1.4.4. Tier 2: §5.5.2.3.2)	No prestressed or posttensioned elements.
		x		CAPTIVE COLUMNS: There are no columns at a level with height/depth ratios less than 50% of the nominal height/depth ratio of the typical columns at that level. (§A.3.1.4.5. Tier 2: §5.5.2.3.3)	No captive columns.
				NO SHEAR FAILURES: The shear capacity of frame members is able to develop the moment capacity at the ends of the members. (§A.3.1.4.6. Tier 2: §5.5.2.3.4)	
		x		STRONG COLUMN-WEAK BEAM: The sum of the moment capacity of the columns is 20% greater than that of the beams at frame joints. (§A.3.1.4.7. Tier 2: §5.5.2.1.5)	No moment frame beams; it is a cantilevered column system.
		x		BEAM BARS: At least two longitudinal top and two longitudinal bottom bars extend continuously throughout the length of each frame beam. At least 25% of the longitudinal bars provided at the joints for either positive or negative moment are continuous throughout the length of the members. (§A.3.1.4.8. Tier 2: §5.5.2.3.5)	No moment frame beams; it is a cantilevered column system.
		x		COLUMN-BAR SPLICES: All column-bar lap splice lengths are greater than $35d_b$ and are enclosed by ties spaced at or less than $8d_b$. Alternatively, column bars are spliced with mechanical couplers with a capacity of at least 1.25 times the nominal yield strength of the spliced bar. (§A.3.1.4.9. Tier 2: §5.5.2.3.6)	No splice in column bars.

C	NC	N/A	U	Checklist	Comments
		x		BEAM-BAR SPLICES: The lap splices or mechanical couplers for longitudinal beam reinforcing are not located within $l_b/4$ of the joints and are not located in the vicinity of potential hinge locations. (§A.3.1.4.10. Tier 2: §5.5.2.3.6)	No moment frame beams; it is a cantilevered column system.
	x			COLUMN-TIE SPACING: Frame columns have ties spaced at or less than d/4 throughout their length and at or less than $8d_b$ at all potential plastic hinge locations. (§A.3.1.4.11. Tier 2: §5.5.2.3.7)	Ties not spaced at less than d/4 throughout the length; ties spaced at 6" at potential hinge zone, which is less than $8d_b$.
		x		STIRRUP SPACING: All beams have stirrups spaced at or less than d/2 throughout their length. At potential plastic hinge locations, stirrups are spaced at or less than the minimum of $8d_b$ or d/4. (§A.3.1.4.12. Tier 2: §5.5.2.3.7)	No moment frame beams; it is a cantilevered column system.
		x		JOINT TRANSVERSE REINFORCING: Beam-column joints have ties spaced at or less than $8d_b$. (§A.3.1.4.13. Tier 2: §5.5.2.3.8)	No moment frame joint; it is a cantilevered column system.
		x		DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (§A.3.1.6.2. Tier 2: §5.5.2.5.2)	No secondary components.
		x		FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (§A.3.1.6.3. Tier 2: §5.5.2.5.3)	No flat slab which is not part of the seismic force resisting system.
Diaphragms					
x				DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (§A.4.1.1. Tier 2: §5.6.1.1)	No diaphragm discontinuity.
Connections					
x				UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (§A.5.3.8. Tier 2: §5.7.3.5)	No pile caps.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
				Life Safety Systems	
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Hazardous Materials	
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	No suspended gypsum board.
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2, and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
Light Fixtures					
		X		LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	No light fixtures..
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
Cladding and Glazing					
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
Masonry Veneer					
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.

C	NC	N/A	U	Checklist	Comments
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	No URM backup, so not applicable.
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
Parapets, Cornices, Ornamentation, and Appendages					
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
		X		LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Not applicable.
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No Parapet; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	
				Masonry Chimneys	
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
				Stairs	
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
				Contents and Furnishings	
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2:	No industrial racks observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				§13.8.1)	
		X		LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	No narrow contents.
		X		LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	No fall-prone contents.
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
		X		LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	No equipment.
		X		LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	No equipment.
		X		LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1	None observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				and 13.7.7)	
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
Piping					
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
				Ducts	
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
				Elevators	
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2:	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				§13.8.6)	
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

TTG

Miraleste Intermediate School
Canopy Building

Job #: 0215.769
Date: Mar-16

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW	Bldg Type= **C1**
$C =$	1.3	From Table 4-8 for Moment Frame Building
$S_a = \min(S_{XS}, S_{X1}/T)$		From Section 4.5.2.3
$S_{X1} = F_vS_1$		Eq. 2-2
$S_{XS} = F_aS_S$		Eq. 2-1
$S_S =$	0.514	g, mapped spectral acceleration
$S_1 =$	0.197	g, mapped spectral acceleration
$S_{X1} =$	0.396	g
$S_{XS} =$	0.714	g
$T = C_th_n^{\beta}$		From Section 4.5.2.4
$C_t =$	0.0018	
$h_n =$	10	ft., average height at sloped roof
$\beta =$	0.9	
$T =$	0.014	sec.
$S_a =$	0.714	g
$V_{Canopy} =$	0.928	W

USGS Design Maps Summary Report

User–Specified Input

Report Title California Minimum Ss
Mon January 4, 2016 22:43:46 UTC

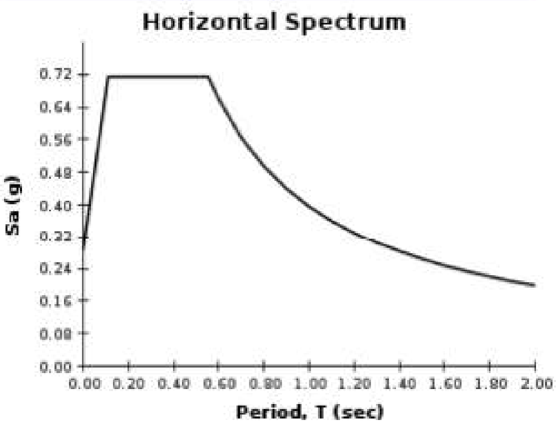
Building Code Reference Document ASCE 41-13 Retrofit Standard, BSE-1E
(which utilizes USGS hazard data available in 2008)

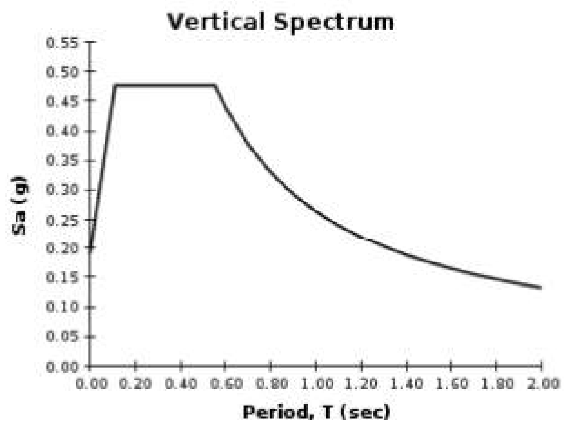
Site Coordinates 33.75222°N, 118.32549°W

Site Soil Classification Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.514 g	$S_{XS,BSE-1E}$	0.714 g
$S_{1,20/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g





TTG

Miraleste Intermediate School
Canopy Building

Job #: 0215.769
Date: Mar-16

Seismic Mass Weight, Concrete Canopy

Roof

(Roof area with 3" Light Weight Concrete Slab Umbrella)

3" LW Slab	25	psf
Concrete Bms	10	psf
Misc	1	psf
DL =	**36**	**psf**
Use	**36**	**psf**

Column Weight

Type A, B Umbrella =	604	plf
Type C Umbrella =	506	plf
Type D Umbrella =	400	plf
Type E, F Umbrella =	352	plf

Check Canopy Column Stress Calculations (per Checklist 16.1.2LS & 16.9LS ; ASCE 41-13)

Mass Weight Calculation **1967 Canopy Structure, Type B**

Location		Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip	Sub-Total ft2	kip
Canopy Umbrella	Type B	26.0	26.0	676	36	24	676	31
	Column	10.8	1.0	11	604	6		
	Grand Total =			**676**		**31**		

Base shear V = 0.928 W
Base shear $V_{Type\ B}$= **29** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x kip	h_x ft	$w_x h_x$ k-ft	Fx kip	Area ft2	fi psf
Roof	31	10.75	331	29	676.0	42.3
Sum =	31		331	29		

Quick Check Column Axial Stress under Gravity Load Only

f'c = 3000 psi
Column Section Area = 400 in^2
Gravity Force P = 30.8 kips
Axial stress p = 77.1 psi < $0.2f'_c$, O.K.
0.2f'c = 600 psi
Per ASCE 41-13 check list 16.9LS, if axial stress less 0.2f'c, OK

Quick Check Column Shear Stress per ASCE 41-13, § 4.5.3.2

$v_{avg} = V/(A_c.M_s)$ = 24 psi < $2\lambda\sqrt{f'_c}$, O.K.
A_c= 400 in^2
M_s = 3.0 from Table 4-9 (average of Life Safety and Immediate Occu.)
Base shear $V_{Type\ B}$= 28.6 kips
$2\lambda\sqrt{f'_c} = 2*0.75*3000^{0.5}$ = 82 psi
λ=0.75, factor for light weight concrete.
Per ASCE 41-13 check list 16.9LS, if shear stress less $2\lambda\sqrt{f'_c}$, OK

Quick Check Column Moment Capacity

Lateral Force F = 29 kips
Height h = 11 ft
M_{demand} = 314.8 for Life Safety
Column M-Capacity M_{ce} = 500.0 kips
m-factor = 2.25 for Life Safety
knowledge factor k= 0.90 Table 6-1 from visual from design drawings.
kmM_{ce} = 1013 k=ft, > M_{demand}, OK
DCR = 0.49
Column has sufficient capacity for load demand

TTG

Check Canopy Column Stress Calculations (per Checklist 16.1.2LS & 16.9LS ; ASCE 41-13)

Mass Weight Calculation — **1967 Canopy Structure, Type E**

Location		Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip	Sub-Total ft2	kip
Canopy Umbrella	Type E	17.0	17.0	289	36	10	289	14
	Column	9.5	1.0	10	352	3		
	Grand Total =			**289**		**13.7**		

Base shear V = 0.928 W

Base shear $V_{Type\ B}$= **12.8** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x kip	h_x ft	$w_x h_x$ k-ft	Fx kip	Area ft2	fi psf
Roof	14	10.75	148	13	289.0	44.2
Sum =	14		148	13		

Quick Check Column Axial Stress under Gravity Load Only

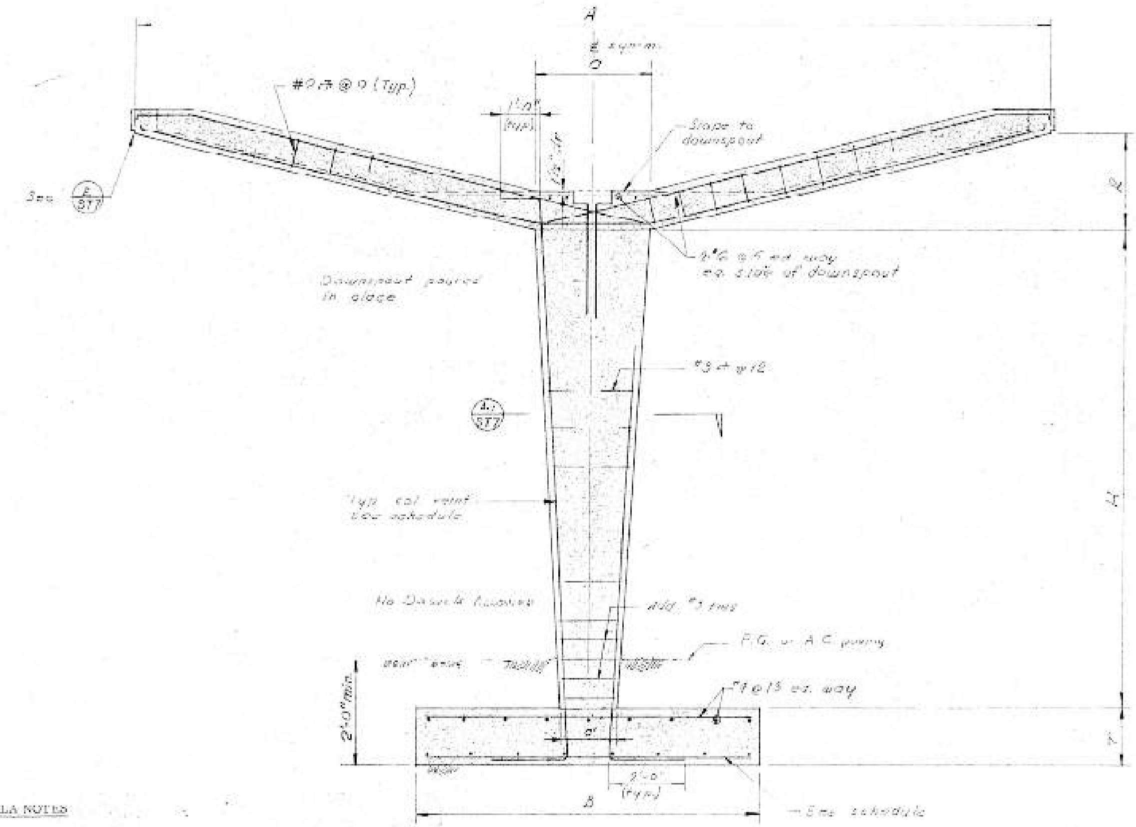
f'c = 3000 psi
Column Section Area = 225 in^2
Gravity Force P = 13.7 kips
Axial stress p = 61.1 psi < $0.2f'_c$, O.K.
0.2f'c = 600 psi
Per ASCE 41-13 check list 16.9LS, if axial stress less 0.2f'c, OK

Quick Check Column Shear Stress per ASCE 41-13, § 4.5.3.2

$v_{avg} = V/(A_c.M_s)$ = 19 psi < $2\lambda\sqrt{f'_c}$, O.K.
A_c= 225 in^2
M_s = 3.0 from Table 4-9 (average of Life Safety and Immediate Occu.)
Base shear $V_{Type\ B}$= 12.8 kips
$2\lambda\sqrt{f'_c}$ = 2*0.75*3000^0.5 = 82 psi
λ=0.75, factor for light weight concrete.
Per ASCE 41-13 check list 16.9LS, if shear stress less $2\lambda\sqrt{f'_c}$, OK

Quick Check Column Moment Capacity

Lateral Force F = 12.8 kips
Height h = 10 ft
M_{demand} = 127.6 for Life Safety
Column M-Capacity M_{ce} = 500.0 kips
m-factor = 2.25 for Life Safety
knowledge factor k= 0.90 Table 6-1 from visual from design drawings.
kmM_{ce} = 1013 k=ft, > M_{demand}, OK
DCR = 0.49
Column has sufficient capacity for load demand



UMBRELLA NOTES

1. All concrete shall have a minimum compressive strength of 3000 p.s.i. in 28 days.
2. All concrete shall be 100 p.c.f. Light Weight concrete, except footing slabs shall be regular weight concrete.
3. Four-unit umbrellas shall be formed and placed at one time.
4. For size and location of overflow, see Architectural Drawings.

SECTION (A/ST7)
1/2" = 1'-0"

UMBRELLA SCHEDULE

DESIGNATIONS				SLAB		EDGE BEAM			COMMON BEAM			CENTER STRUT			COLUMN			FOOTING				REMARKS
TYPE	A	H	R	t	REINF. EA. WAY	SIZE W	SIZE D	REINF.	SIZE W	SIZE D	REINF.	SIZE W	SIZE D	REINF.	a	a'	REINF.	B	T	REINF.	Assumed Bott. Elev.	
A	28' sq.	10'-0"	3'-2"	3"	#3 @ 12	7"	7"	4 - #6	—			1'-3"	1'-0"	4 - #3	3'-2" Sq.	1'-8" Sq.	12 - #10	9'-6" Sq.	1'-6"	9 - #7	900.333	
B	26' Sq.	10'-9"	3'-3"	3"	#3 @ 12	7"	9"	4 - #6	—	—	———	1'-3"	1'-0"	4 - #8	3'-6" Sq.	1'-8" Sq.	12 - #10	7'-6" Sq.	1'-6"	9 - #7	903.333	
C	24' Sq.	12'-3"	3'-0"	3"	#3 @ 9	7"	9"	4 - #6	—	—	———	1'-3"	1'-0"	4 - #7	3'-0" Sq.	1'-6" Sq.	12 - #11	9'-6" Sq.	1'-6"	9 - #7	899.834	
D	20' Sq.	8'-7	2'-6"	3"	#3 @ 10	7"	7"	4 - #5	—	—	———	1'-3"	10"	4 - #6	2'-0" Sq.	1'-4" Sq.	12 - #7	8'-0" Sq.	1'-3"	9 - #6	908.333	
E	17' Sq.	9'-6"	2'-2"	3"	#3 @ 12	7"	9"	4 - #5	7	8½"	4 - #5	1'-0"	9"	4 - #6	2'-6"	1'-3"	12 - #7	7'-0" Sq.	1'-3"	6 - #5	902.667	
F	17' Sq.	9'-6"	2'-2"	3"	#3 @ 12	7"	9"	4 - #5	7	8½"	4 - #5	1'-0"	9"	4 - #6	2'-6"	1'-3	12 - #7	7'-0" Sq.	1'-3"	6 - #5	902.667	

Miraleste Intermediate School, Canopy Type B

```
General Information:
====================
  File Name: \\SANDFS\TTG Data\ENGR\41ENGR\4115 PROJECTS\0215768.00 - PVPUSD ...\TypeB-20x20b-3ksi.col
  Project:  Miraleste Intermediate School
  Column:   CanopyB20x20                       Engineer:
  Code:     ACI 318-08                         Units: English

  Run Option: Investigation                    Slenderness: Not considered
  Run Axis:   X-axis                           Column Type: Structural

Material Properties:
====================
  f'c    = 4.5 ksi                             fy    = 50 ksi
  Ec     = 3823.68 ksi                         Es    = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.85

Section:
========
  Rectangular: Width = 20 in                   Depth = 20 in

  Gross section area, Ag =  400 in^2
  Ix =  13333.3 in^4                           Iy =  13333.3 in^4
  rx =  5.7735 in                              ry =  5.7735 in
  Xo =  0 in                                   Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  #  3     0.38        0.11    #  4     0.50        0.20    #  5     0.63        0.31
  #  6     0.75        0.44    #  7     0.88        0.60    #  8     1.00        0.79
  #  9     1.13        1.00    # 10     1.27        1.27    # 11     1.41        1.56
  # 14     1.69        2.25    # 18     2.26        4.00

  Confinement: Other; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 1,  phi(b) = 1,  phi(c) = 1

  Layout: Rectangular
  Pattern: All Sides Equal  (Cover to transverse reinforcement)
  Total steel area: As = 15.24 in^2 at rho = 3.81%
  Minimum clear spacing = 3.72 in

  12 #10    Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities:
=========================================================
            Pu          Mux       PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
  No.       kip         k-ft        k-ft               in       in
  --- ------------ ------------ ------------ -------- -------- -------- -------- ------
    1        27.90       314.80       497.97    1.582     4.96    17.49  0.00757  1.000
    2        34.10       314.80       500.54    1.590     5.00    17.49  0.00749  1.000
```

3ksi Light Wt weight concrete f'ce=3*1.5=4.5 ksi
fy=40*1.25=50 ksi

Note: Col Type B 20x20, symmetrical about X and Y direction.
Column clear height/span h=10.75', (1) (3) #3 ties @12" typical, @6" at hinge zone.
Max force demand; Pu=0.9*31=27.9 kips min. / 1.1*31=34.1 kips max, Vu=29 kips, Mu=314.8 k-ft

Column shear is forced controlled action, use lower bound capacity/material strength;
Column section shear capacity Vo=Vcl=Vc + Vs =20x18x(2x0.75x3000^0.5+6*0.11/(20*12)*40000)= 29.6+39.6= 69.2 kips --- column controlled by flexture
Column shear capacity at reaching bending capacity Vp=Vcl,b = M/h=498/10.75'=46.3 kips at min. axial force
Vp=Vcl,b = M/h=500.5/10.75'=46.6 kips at max. axial force

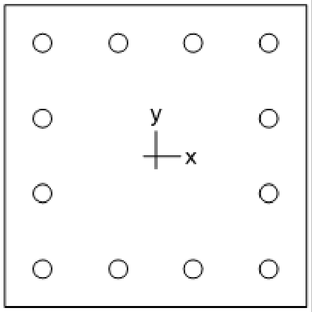
Vp/Vo=46.3/69.2=0.67 <1.0 at P min. Condition ii per Table 10-11
Vp/Vo=46.6/69.2=0.67 <1.0 at P max. Condition ii per Table 10-11; use Condition ii.

P/Ag.fc'=27900/(20*20*4500)=0.016 at Pmin. ; P/Ag.fc'=31400/(20*20*4500)=0.017 at Pmax.
rho=Av/bs=6*0.11/(20*6)=0.0055=0.006
Vu/(bdfc'^0.5) = 29000/(20*18**0.75*(3000)^0.5)=4.4 < 6.0

m = 2.25 for Life Safety from Table 10-9 of ASCE 41-13
k=0.9 used for BSE1E level force check (from visual & drawings; may use 1.0 if material test will be done and expected to meet the 3 ksi concrete strength)
mkMce=2.25*0.9*498=1008 k-ft > Mud=314.8 k-ft, O.K. (DCR=314.8/1008=0.31) at Pmin.
mkMce=2.25*0.9*500=1013 k-ft > Mud=314.8 k-ft, O.K. (DCR=314.8/1013=0.31) at Pmax.
So, Column does have sufficient bending capacity at for bending demand.

kVcl=0.9x46.3=41.7 kips > Quf=Qe/(C1*C2*J)=Vu/1.3=29/1.3=22.3 kips, C1*C2=1.3, J=1.0 (DCR=22.3/41.7=0.53)

Therefore, Column for Type B Canopy 20"x20" does have sufficient capacity for seismic demand.



20 x 20 in

Code: ACI 318-08

Units: English

Run axis: About X-axis

Run option: Investigation

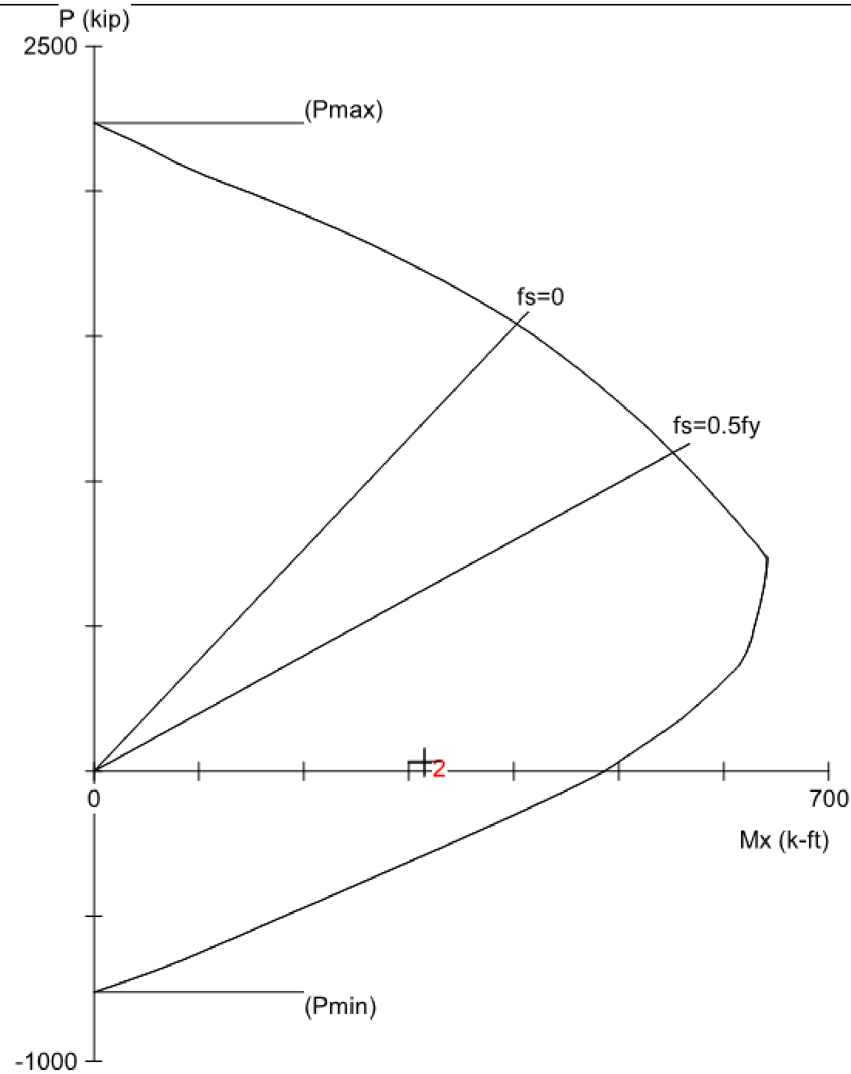
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 03/23/16

Time: 08:42:50



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File: \\SANDFS\TTG_Data\ENGR\41ENGR\4115 PROJECTS\0215768.00 - PVPUSD TIER 2-GROUP...\TypeB-20x20b-3ksi.col

Project: Miraleste Intermediate School

Column: CanopyB20x20		Engineer:	
f'c = 4.5 ksi	fy = 50 ksi	Ag = 400 in^2	12 #10 bars
Ec = 3824 ksi	Es = 29000 ksi	As = 15.24 in^2	rho = 3.81%
fc = 3.825 ksi		Xo = 0.00 in	Ix = 13333.3 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 13333.3 in^4
Beta1 = 0.85		Min clear spacing = 3.72 in	Clear cover = 1.88 in
Confinement: Other			
phi(a) = 1, phi(b) = 1, phi(c) = 1			

Miraleste Intermediate School, Canopy Type E

```
General Information:
====================
  File Name: \\SANDFS\TTG Data\ENGR\41ENGR\4115 PROJECTS\0215768.00 - PVPUSD T...\TypeE-15x15-3ksi.col
  Project:   Miraleste Intermediate School
  Column:    CanopyE15x15                        Engineer:
  Code:      ACI 318-08                          Units: English

  Run Option: Investigation                      Slenderness: Not considered
  Run Axis:   X-axis                             Column Type: Structural

Material Properties:
====================
  f'c     = 4.5 ksi                              fy     = 50 ksi
  Ec      = 3823.68 ksi                          Es     = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.85
```

3ksi Light Wt weight
concrete f'ce=3*1.5=4.5 ksi
fy=40*1.25=50 ksi

```
Section:
========
  Rectangular: Width = 15 in                     Depth = 15 in

  Gross section area, Ag =  225 in^2
  Ix =  4218.75 in^4                             Iy =  4218.75 in^4
  rx =  4.33013 in                               ry =  4.33013 in
  Xo =  0 in                                     Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  #  3      0.38        0.11   #  4      0.50        0.20   #  5      0.63        0.31
  #  6      0.75        0.44   #  7      0.88        0.60   #  8      1.00        0.79
  #  9      1.13        1.00   # 10      1.27        1.27   # 11      1.41        1.56
  # 14      1.69        2.25   # 18      2.26        4.00

  Confinement: Other; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 1,  phi(b) = 1,  phi(c) = 1

  Layout: Rectangular
  Pattern: All Sides Equal  (Cover to transverse reinforcement)
  Total steel area: As = 7.20 in^2 at rho = 3.20%
  Minimum clear spacing = 2.58 in

  12 #7    Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities:
=========================================================
               Pu           Mux       PhiMnx  PhiMn/Mu  NA depth  Dt depth    eps_t    Phi
  No.         kip          k-ft         k-ft                  in        in
  --- ------------ ------------ ------------  --------  --------  --------  -------  ------
    1        12.30       127.60       171.47     1.344      3.71     12.69  0.00726  1.000
    2        15.10       127.60       172.33     1.351      3.73     12.69  0.00720  1.000
```

Note: Col Type E 15x15, symmetrical about X and Y direction.
Column clear height/span h=10', (3) #3 ties @12" typical, @6" at hinge zone.
Max force demand; Pu=0.9*13.7=12.3 kips min. / 1.1*13.7=15.1 kips max, Vu=12.8 kips, Mu=127.6 k-ft

Column shear is forced controlled action, use lower bound capacity/material strength;
Column section shear capacity Vo=Vcl=Vc + Vs =15x13x(2x0.75x3000^0.5+6*0.11/(15*12)*40000)= 16.0+28.6= 44.6 kips --- column controlled by flexture
Column shear capacity at reaching bending capacity Vp=Vcl,b = M/h=171/10'=17.1 kips at min. axial force
Vp=Vcl,b = M/h=172/10'=17.2 kips at max. axial force

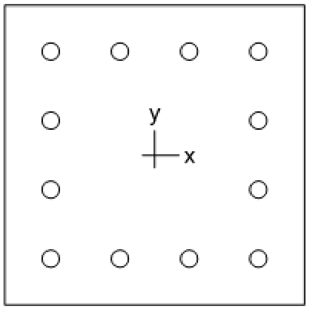
Vp/Vo=17.1/44.6=0.38 <1.0 at P min. Condition ii per Table 10-11
Vp/Vo=17.2/44.6=0.38 <1.0 at P max. Condition ii per Table 10-11; use Condition ii.

P/Ag.fc'=12300/(15*15*4500)=0.012 at Pmin. ; P/Ag.fc'=15100/(15*15*4500)=0.015 at Pmax.
rho=Av/bs=6*0.11/(15*6)=0.0055=0.0073
Vu/(bdfc'^0.5) = 12800/(15*13*0.75*(3000)^0.5)=1.6 < 6.0

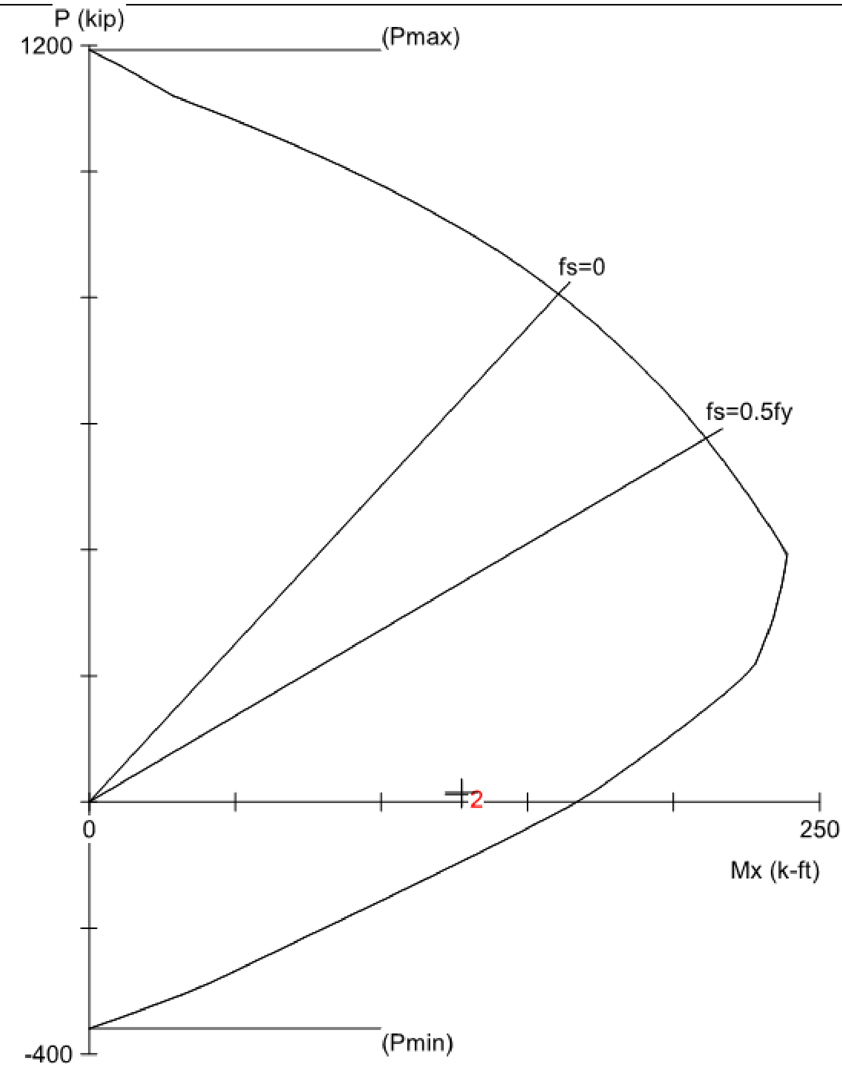
m = 2.25 for Damage Control from Table 10-9 of ASCE 41-13
k=0.9 used for BSE1E level force check (material from drawings specified 3 ksi concrete strength)
mkMce=2.25*0.9*171=346 k-ft > Mud=127.6 k-ft, O.K. (DCR=127.6/346=0.37) at Pmin.
mkMce=2.25*0.9*172=348 k-ft > Mud=127.6 k-ft, O.K. (DCR=127.6/348=0.37) at Pmax.
So, Column does have sufficient bending capacity at for bending demand.

kVcl=0.9x17.1=15.4 kips > Quf=Qe/(C1*C2*J)=Vu/1.3=12.8/1.3=9.8 kips, C1*C2=1.3, J=1.0 (DCR=9.8/15.4=0.64)

Therefore, Column for Type E Canopy 15"x15" does have sufficient capacity for seismic demand.



15 x 15 in



Code: ACI 318-08

Units: English

Run axis: About X-axis

Run option: Investigation

Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 03/23/16

Time: 10:41:26

spColumn v4.80. 15 day trial license. Locking Code: 4-24DE6. User: admin, TTG

File: \\SANDFS\TTG_Data\ENGR\41ENGR\4115 PROJECTS\0215768.00 - PVPUSD TIER 2-GROUP ...\TypeE-15x15-3ksi.col

Project: Miraleste Intermediate School

Column: CanopyE15x15		Engineer:	
f'c = 4.5 ksi	fy = 50 ksi	Ag = 225 in^2	12 #7 bars
Ec = 3824 ksi	Es = 29000 ksi	As = 7.20 in^2	rho = 3.20%
fc = 3.825 ksi		Xo = 0.00 in	Ix = 4218.75 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 4218.75 in^4
Beta1 = 0.85		Min clear spacing = 2.58 in	Clear cover = 1.88 in

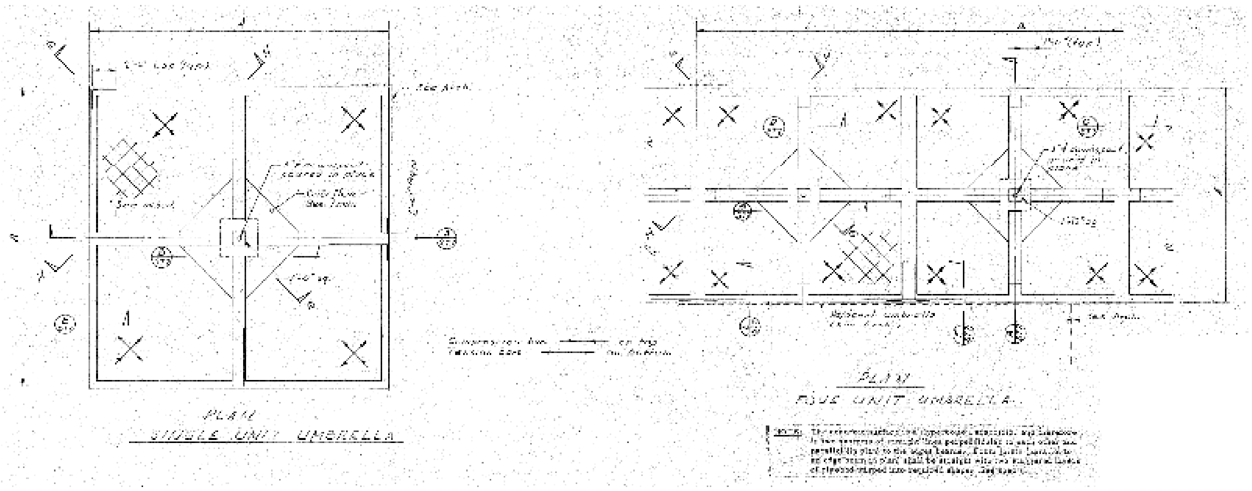
Confinement: Other

phi(a) = 1, phi(b) = 1, phi(c) = 1

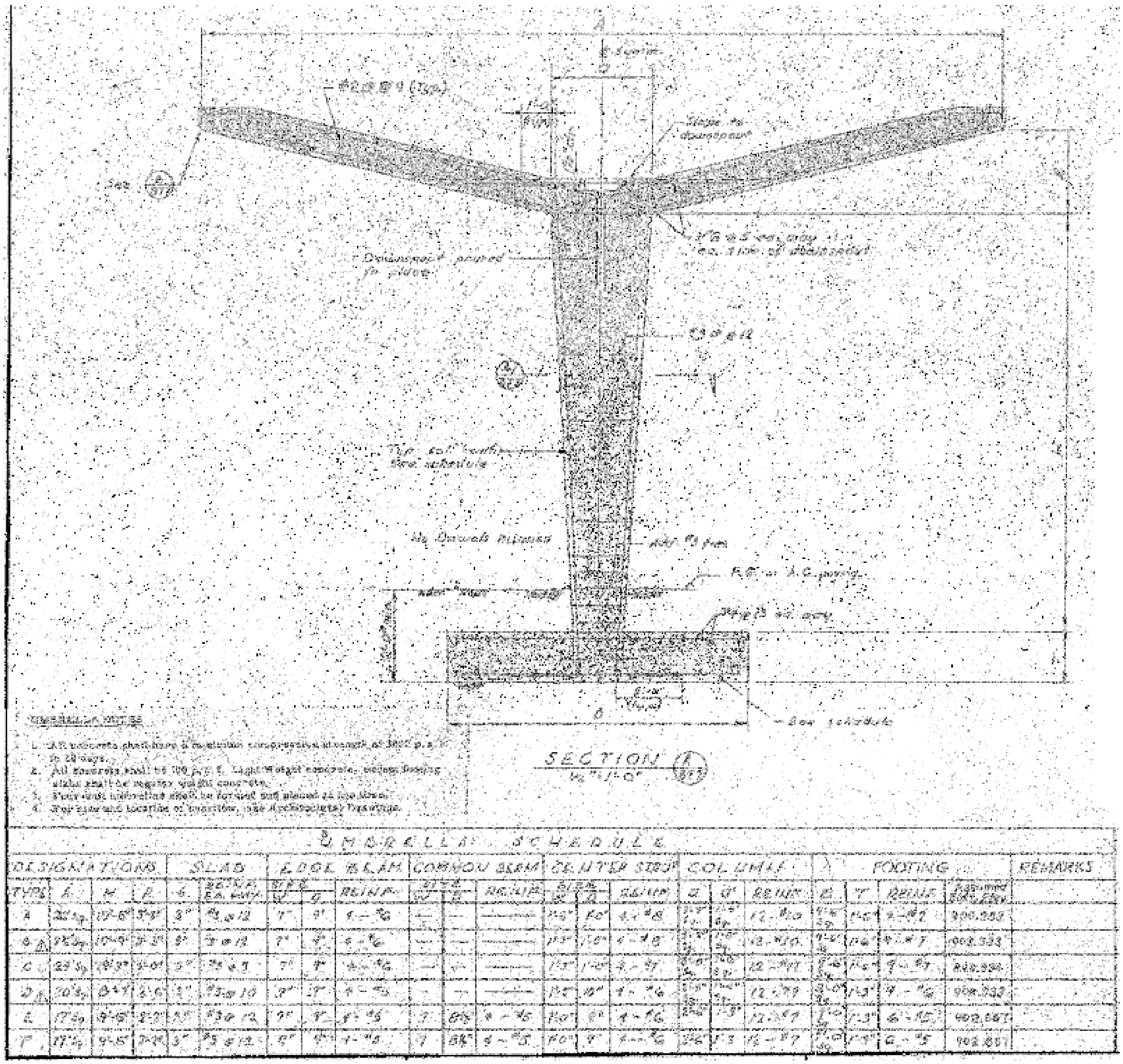
Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	$= C_1 C_2 C_m S_a W$	.... *(Table 7-3 , ASCE 41-13, $2 \le m_{max} < 6$* Bldg Type= C1			
$S_a = \min(S_{XS}, S_{X1}/T)$		From Section 4.5.2.3			
$S_{X1} = F_v S_1$		Eq. 2-2			
$S_{XS} = F_a S_S$		Eq. 2-1			
$S_S =$	0.514	g, mapped spectral acceleration			
$S_1 =$	0.197	g, mapped spectral acceleration			
$S_{X1} =$	0.396	g			
$S_{XS} =$	0.714	g			
$T = C_t h_n^{\beta}$		From Section 7.4.1.2.2		Fv=Sx1/S1=	2.010
$C_t =$	0.018			Fa=Sxs/Ss=	1.389
$h_n =$	10	ft., average height at roof			
$\beta =$	0.9				
$T =$	0.143	sec.			
$S_a =$	0.714	g			
Site Class:	**D**				
$DCR_{max} =$	**2.0**		*. . . (§7.3.1.1 , ASCE 41-13)*		
$\mu_{strength} =$	**1.355**	$= DCR_{max}/1.5\ C_m \ge 1.0$	*. . .(Eqn C7-3 , ASCE 41-13)*		
$a =$	**60**		*. . . (§7.4.1.3.1 , ASCE 41-13; site class D)*		
$C_1 =$	**1.2897**	$= 1 + (\mu_{strength} - 1) / aT^2$	*. . . (Eqn 7-22 , ASCE 41-13)*		
$C_2 =$	**1.0077**	$= 1 + 1 / 800\ ((\mu_{strength} - 1) / T)^2$	*. . .(Eqn 7-23 , ASCE 41-13)*		
$C_1.C_2 =$	**1.30**		*. . . (§7.4.2.3, ASCE 41-13)*		
$C_1.C_2 =$	**1.400**		*. . . (Table 7-3 , ASCE 41-13, $2 \le m_{max} < 6$, $T \le 0.3$, Alternate Value)*		
$C_m =$	**1.000**		*. . . (Table 7-4 , ASCE 41-13, 1-2 stories, Concrete Moment Frame)*		
$V_{STATIC} =$	**0.928 W**	$= C_1 C_2 C_m S_a W$	*. . . (Eqn 7-21 , ASCE 41-13, BSE-1E)*		

Appendix 1-C: As-Built Plans



Canopy Roof Plan (1967 Sheet S-T7)



Canopy Section (1967 Sheet S-T7)

Appendix 7A – Images of Existing Conditions

THESE EDGE BARS WERE TOO CLOSE TO THE FACE OF THE CONCRETE. SHOULD BE AT LEAST 1 1/2".

FIG. 1

CONCRETE READY TO SPALL FROM REBAR CLOSE BEHIND DUE TO WATER MIGRATING FROM THE TOP

CONCRETE DE-LAMINATING FROM THE UNDERSIDE OF THE CANOPY. LOOSE MATERIAL SHOULD BE REMOVED.

FIG. 2

FIG. 3

COSMETIC SURFACE DE-LAMINATION ON THE UNDERSIDE FROM MOISTURE MIGRATING BY GRAVITY THROUGH THE DECK.

FLAT SURFACE FOR WATER TO STAND AND ABSORB IN

REBAR CORROSION ISN'T THAT EXTREME

FIG. 4

ROUGH SURFACE ALLOWS ALLOT OF ABSORPTION BEFORE DRAINING OFF. SHOULD HAVE A WATERPROOF MEMBRANE

FIG. 5

MORE CRACKING THAT WILL SPALL IN TIME. LOOSE MATERIAL SHOULD BE REMOVED

PRIMARY DRAINS APPEAR TO FUNCTIONING ADEQUATELY AS LONG AS CLEANED

OVER FLOW DRAIN

FIG. 6

PBWS
ARCHITECTS

PALOS VERDES PENINSULA HIGH SCHOOL

Building A Administration
Building B Library
Building C Gymnasium
Building D Boys Locker
Building E Girls Locker
Buildings H & S Classroom Wings

SEISMIC STRUCTURAL EVALUATION AND RECOMMENDATIONS

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PALOS VERDES PENINSULA HIGH SCHOOL

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
ADMINISTRATION BUILDING (1)

PALOS VERDES PENINSULA HIGH SCHOOL
27118 Silver Spur Rd.
Rolling Hills Estates, CA 90274

Terry Tsang, S.E.
Structural Engineer S2992
TTG Job No.: 0215.768.00

FEBRUARY 2016

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Table of Contents

1.0 Introduction

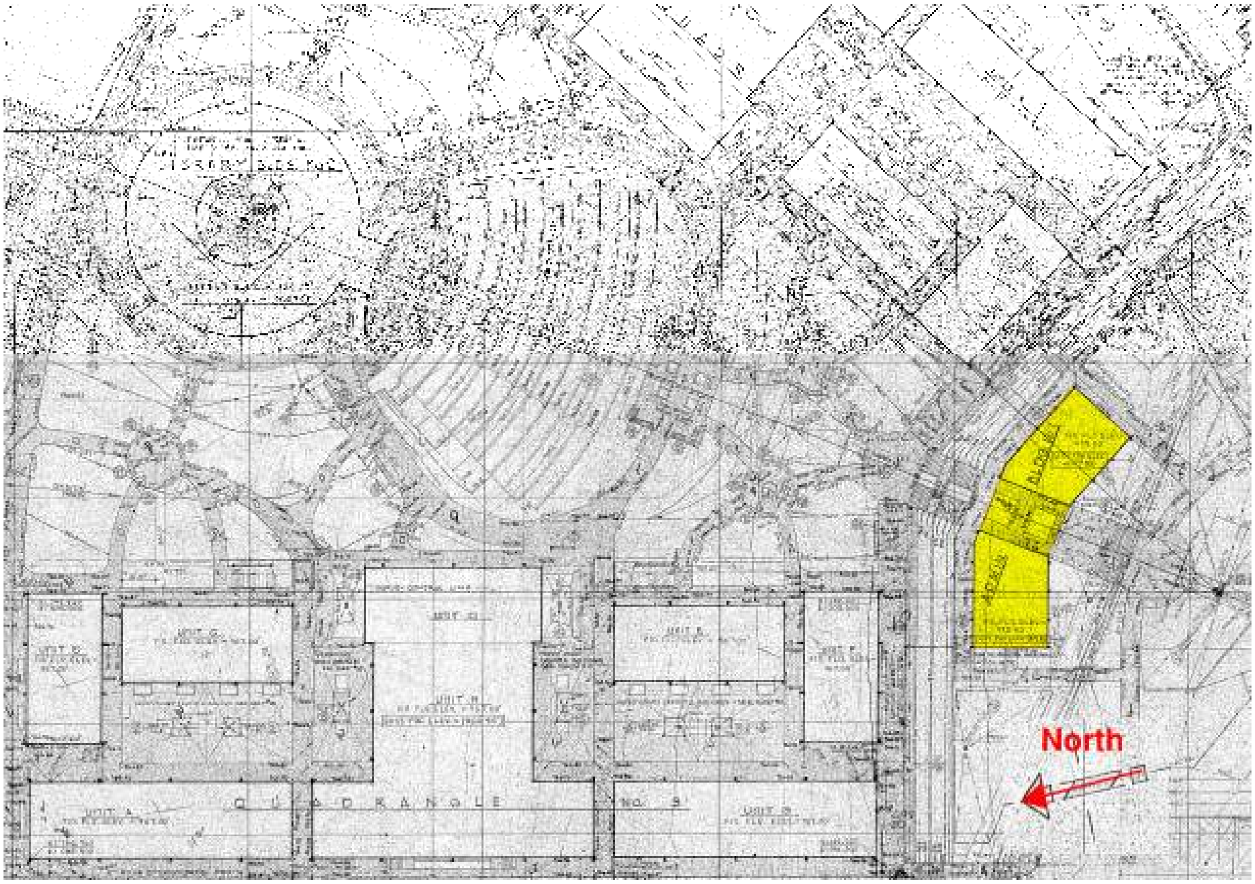
A multiphase seismic vulnerability assessment of ***Administration Building (1)*** was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Photo 1 – Northern Elevation of Administration Building

Photo 2 – Underpass between two buildings of Admin. Building

A partial campus site plan of Palos Verdes Peninsula High School, indicating the building under evaluation, is provided below. The highlighted building is ***Administration Building (1).***



Partial Site Plan- Administration Building (1)

2.0 Building (1)– Administration Building

2.1 Site Seismicity

Based on 1963 construction drawings, original foundation was based on the allowable soil bearing pressure of 2,000 psf for vertical dead loads plus live loads. There is a geotechnical report dated December 21, 2012 by Geo-Advantec Inc. for a proposed 6 Classroom Buildings located at same site as Administration building.

Per ASCE 41-13 (2012 IBC), for Palos Verdes Peninsula High School located at 27118 Silver Spur Road, Rolling Hills Estates, CA 90274,

Site Coordinates = 33.7706°N, -118.3691°W

Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)

$S_{S,20/50}$ = 0.512g; $S_{1,20/50}$ = 0.196 g

F_a = 1.391 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)

F_v = 2.015 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)

$S_{XS} = F_a S_{S,20/50}$ = 0.712g

$S_{X1} = F_v S_{1,20/20}$ = 0.395g

2.2 Building Description

The Administration Building is a one-story building in the southern portion of the school campus, as main entrance building to campus. The building was constructed circa 1963. The existing drawings for the building are dated April 19, 1963, which shows the proposed administration building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of two one-story administration space buildings with single roof connection two, and underpass at middle. The building is close to arc in shape with approximate dimensions of 148’x 50’. Total footprint of the original building is estimated to be ±5,500 square feet. The typical roof height is 10’-6. The roof consists of cast-in-place one-way concrete joist system, which is considered a stiff diaphragm. The perimeter overhang 4” (and 4.5” at ends) concrete roof is supported by tapered precast concrete posts. The lateral force resistance of the building is provided by reinforced concrete walls in combination of concrete precast walls connecting to cast in place wall columns which have very minor contribution and not considered in lateral system for this evaluation purpose. The foundation of the building consists of concrete spread footing under the concrete columns and continuous wall footings.

Based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Concrete Shear Walls with Stiff Diaphragms denoted as “C2”.

The structural risk category for the multipurpose building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Building (1)– Administration Building Summary Table	
Year Designed	1963
Drawings	Original drawings, dated April 19, 1963, prepared by Flewelling, Moody & Horn Architects, and Engineers.
Gravity System	Pan Joist Concrete Slab (Stiff Diaphragm)
Lateral System	Concrete shear wall
No. of Stories & Height	One story Roof: h_n=10.5 ft
Building Period “T”	0.117 Sec
Base Shear “V”	0.997 W = 908 kips
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	See Section 4.1 (Retrofit not required)

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of the Building is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the “Life Safety” performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the “Life Safety” or “Immediate Occupancy” levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening, if needed. As a Risk Category ***III***, the Basic Performance Objective for the building was ***Damage Control Structural Performance,*** per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; some were found to be "Compliant" and others were found to remain "Deficient."

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Coupling Beams

3.2 ASCE 41-13 Tier 2 Evaluation

The deficiency listed above was reviewed using a Tier 2 Evaluation. The deficiency was mitigated base on results of Tier 2 evaluation, which can be found in Appendix 1-B. Deficiency No. 1 (Coupling Beams) was mitigated with analysis results per ASCE 41-13 section 5.5.3.2.1 by insuring that the coupling beam has sufficient capacity for the load demands. The Tier 2 analysis was performed using analysis results from the ETABS model developed for the Tier 2 evaluations. Linear dynamic procedure was used for the analysis of the structure using BSE-1E level seismic response spectrum. Output forces are exported into excel spreadsheet and series of calculation per ASCE 41-13 are performed to verify the components have sufficient capacity for load demands.

4.0 Conclusions

The coupling beam deficiency identified by Tier 1 checklist is mitigated by Tier 2 analysis results. After further review and updating Tier 1 checklist as per ASCE 41-13, no other deficiencies were identified which required tier 2 evaluation.

Given the reason above, a voluntary seismic retrofit is not required for this structure.

5.0 Documents Reviewed

The following existing architectural and or structural drawings (and or other documents when available) were reviewed:

Date	Architect / Engineer	TTG Comments

April 19, 1963	Flewelling, Moody & Horn Architects and Engineers	Title Block states "Gymnasium Bldg. No. 5, Rolling Hills High School, Palos Verdes Peninsula Unified School District" Architectural and structural drawings (State of California – Department of Public Works, Division of Architecture, Project No. 23166)
December 12, 2012	Geo-Advantec, Inc.	Geotechnical Engineering Evaluation Report "Proposed 6 Classroom Buildings & Weight Room Palos Verdes Peninsula High School

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Peninsula High School Building A, Administration

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Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the

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District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Palos Verdes Peninsula High School is a public high school with in the Palos Verdes Peninsula Unified School District. The original buildings were completed in 1963 and includes all the buildings of concern for this analysis. It was originally called Rolling Hills High School and has been in constant use as a high school since that time. The original campus buildings were designed by the firms of Flewelling, Moody, and Horn Architects and is mostly of concrete construction. The building referred to as A is part of the original campus buildings.

Building A is at the south end of the campus and elevated above the rest of the site. It is a one story building with a small open court between two sides. It contains the main administration office on one side and the health office on the other. The building structure is cast-in-place concrete with precast concrete plank infill for non-structural walls. The floor and roof systems are a cast-in-place concrete joist system. The exterior covered portion is cast in place concrete as well.

All portions of the building are of Type-2 non-combustible construction and appear fit within the current CBC Type-2B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how

the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Work

No Recommended Retrofit
After further tier 2 analysis it was determined that the building does not require any seismic retrofit work for life safety.

Miscellaneous Recommended Work

Spalling Concrete Repair
There have been locations on the other concrete building constructed at the time this building was constructed that are experiencing cracking and spalling concrete. Even though these are not effecting the buildings mains structure they present a hazard and will allow the further deterioration of construction if not addressed. At edges and corners. This repair would consist of appropriate preparation of the existing concrete and an appropriate formulated epoxy system with reinforcing where required to fill and hold cracking areas. These areas are generally exposed for easy access.

Accessibility Upgrades

There are no accessibility upgrades anticipated for this building since no retrofit work is recommended.

Fire & Life Safety

There are no fire & life safety upgrades anticipated for this building since no retrofit work is recommended.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Appendix 1-A: Tier 1 Screening Checklists

ASCE 41-13 Checklists

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
General					
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path exists.
x				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.2)	No other buildings within 10 feet of this building
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanines
Building Configuration					
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	It is one story building, so not applicable.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	It is one story building, so not applicable.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	All vertical elements continuous to foundation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	It is one story building, so not applicable.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	It is one story building, so not applicable.
x				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Torsion doesn't exist. See calculation in appendix 1-B.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
x				LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), the building site is not in liquefaction susceptible zone.
x				SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), the building site is not susceptible to slope failure.
x				SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), surface fault rupture not anticipated.

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
x				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.712=0.43 Compliant per review of existing drawings.
x				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Foundation elements are tied together by ties beams and slab on grade.

16.10LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES C2: CONCRETE SHEAR WALLS WITH STIFF DIAPHRAGMS AND C2A: CONCRETE SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (§A.3.1.6.1. Tier 2: §5.5.2.5.1)	Meets the requirement per review of the gravity framing, so compliant.
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	Meets the requirement per review of the as-built drawings.
x				SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in^2 or $2\sqrt{f'c}$. (§A.3.2.2.1. Tier 2: §5.5.3.1.1)	Compliant. See calculations in Appendix 1-B.
x				REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (§A.3.2.2.2. Tier 2: §5.5.3.1.3)	Compliant. See calculations in Appendix 1-B.
				Connections	
		x		WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Rigid diaphragms present, so N/A.

C	NC	N/A	U	Checklist	Comments
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	Dowels into wall per details on S-2
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	CIP shear walls meet requirements, so compliant.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Diaphragms					
x				DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (§A.3.1.6.2. Tier 2: §5.5.2.5.2)	Minimal deflection, so compliant.
		x		FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (§A.3.1.6.3. Tier 2: §5.5.2.5.3)	Concrete pan joist and one-way slab with beams are the gravity systems present, so N/A.
	x			COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than d/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (§A.3.2.2.3. Tier 2: §5.5.3.2.1)	No 135 degree hook. See Tier 2 calculation in appendix 1-B.
Connections					
		x		UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (§A.5.3.8. Tier 2: §5.7.3.5)	No pile caps, so not applicable.
Diaphragms (Flexible or Stiff)					
x				DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (§A.4.1.1. Tier 2: §5.6.1.1)	Meet requirements, so compliant.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear	Meet requirements, so compliant.

C	NC	N/A	U	Checklist	Comments
				walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	
				Flexible Diaphragms	
		X		CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Rigid diaphragm present, so N/A.
		X		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	Rigid diaphragm present, so N/A.
		X		SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	Rigid diaphragm present, so N/A.
		X		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	Rigid diaphragm present, so N/A.
		X		OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	Meet requirements, so N/A.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
				Life Safety Systems	
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Hazardous Materials	
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4.	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				Tier 2: §13.7.3 and 13.7.5)	
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
				Light Fixtures	
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Proper support was observed
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Cladding and Glazing	
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
Masonry Veneer					
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no	No URM backup, so not applicable.

C	NC	N/A	U	Checklist	Comments
				unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
Parapets, Cornices, Ornamentation, and Appendages					
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
X				LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Observed compliant
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No parapets; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	
				Masonry Chimneys	
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
				Stairs	
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
				Contents and Furnishings	
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable

C	NC	N/A	U	Checklist	Comments
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
		X		LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	None observed; So not applicable
		X		LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	None observed; So not applicable
X				LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	Proper anchorage was observed
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
				Piping	
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	
				Ducts	
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
				Elevators	
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2:	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				§13.8.6)	
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

Tier 1 Calculation:

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW		Bldg Type= **C2**
$C =$	1.4	From Table 4-8 for 1963 Admin Building	
$S_a =$	$\min(S_{XS}, S_{X1}/T)$	From Section 4.5.2.3	
$S_{X1} =$	F_vS_1	Eq. 2-2	
$S_{XS} =$	F_aS_S	Eq. 2-1	
$S_S =$	0.512	g, mapped spectral acceleration	
$S_1 =$	0.196	g, mapped spectral acceleration	
$S_{X1} =$	0.395	g	
$S_{XS} =$	0.712	g	
$T =$	$C_th_n^{\beta}$	From Section 4.5.2.4	
$C_t =$	0.02		
$h_n =$	10.5	ft., average height at sloped roof	
$\beta =$	0.75		
$T =$	0.117	sec.	
$S_a =$	0.712	g	
$V =$	0.997	W	
$V =$	908	kips	

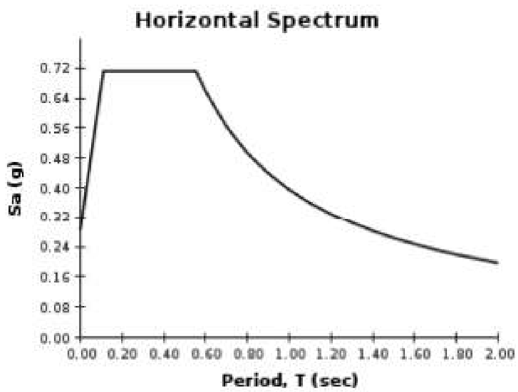
USGS Design Maps Summary Report

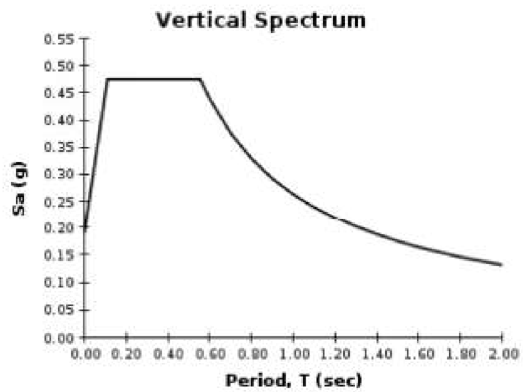
User–Specified Input

Report Title	California Minimum Ss Sat January 23, 2016 03:52:06 UTC
Building Code Reference Document	ASCE 41-13 Retrofit Standard, BSE-1E (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.77058°N, 118.3691°W
Site Soil Classification	Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.512 g	$S_{XS,BSE-1E}$	0.712 g
$S_{1,20/50}$	0.196 g	$S_{X1,BSE-1E}$	0.395 g





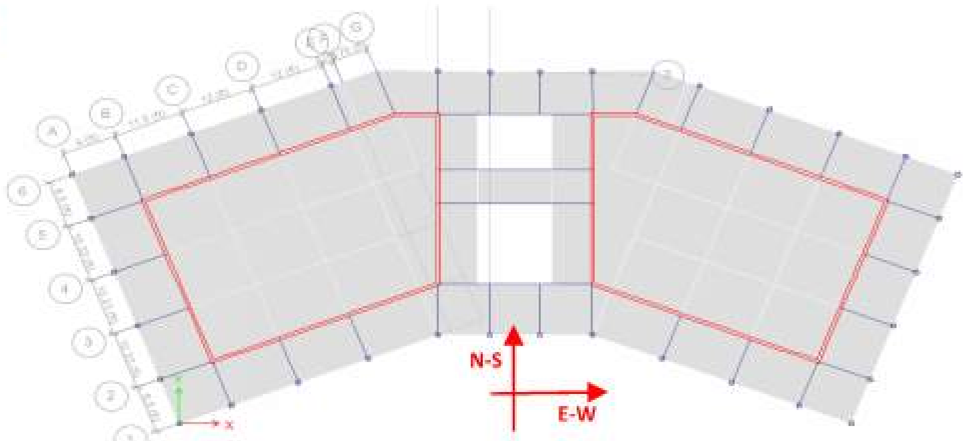
Seismic Mass Weight - 1963 Construction

Roof - concrete pan joist

Roofing	5	psf
Conc. joist @ 3'-0" o.c.	25	psf
Conc. Bridging	2.5	psf
4.5" max slab	54	psf
Partitions	5	psf
MEP	5	psf
Ceiling	5	psf
Misc	5	psf
DL =	**106.875**	**psf**
SDL (for model)=	**52.5**	**psf**
MASS =	1.63	(applied to ETABS model roof)

From ETABS:

Story	UX	UY	Weight
	lb-s²/ft	lb-s²/ft	Kips
Roof	28279.66	28279.66	**911**
Base	4993.81	4993.81	-



Concrete Walls in E-W Direction - Roof					
Wall Pier Label	Wall Length (in)	Angle (deg.)	Projected wall Lx (in)	Wall Thick. (in)	Wall Area (in2)
P-GL5-2	83.0	0.0	83.0	10	829.7
P-GL5'-2	83.0	0.0	83.0	10	829.7
P-GLB-1	175.0	-69.0	62.7	10	627.2
P-GLB-2	156.9	-69.0	56.2	10	562.4
P-GL5-1	111.4	21.0	104.0	10	1040.4
P-GL5'-1	111.4	-21.0	104.0	10	1040.4
P-GLB'-1	33.5	69.0	12.0	10	120.0
P-GLB'-2	41.7	69.0	15.0	10	149.5
P-GLB'-3	97.0	69.0	34.8	10	347.5
P-GL2'-1	150.6	-21.0	140.6	10	1405.9
P-GL2-1	96.7	21.0	90.3	10	902.8

Σ concrete wall= **7855.3**
Σ concrete wall length= **65.5** ft

Concrete Walls in N-S Direction - Roof					
Wall Pier Label	Wall Length (in)	Angle (deg.)	Projected wall Ly (in)	Wall Thick. (in)	Wall Area (in2)
P-GL1-1	162.4	90.0	162.4	10	1623.7
P-GL1'-1	162.4	90.0	162.4	10	1623.7
P-GLB-1	175.0	-69.0	163.4	10	1633.8
P-GLB-2	156.9	-69.0	146.5	10	1465.1
P-GL5-1	111.4	21.0	39.9	10	399.4
P-GL5'-1	111.4	-21.0	39.9	10	399.4
P-GLB'-1	33.5	69.0	31.3	10	312.6
P-GLB'-2	41.7	69.0	39.0	10	389.5
P-GLB'-3	97.0	69.0	90.5	10	905.4
P-GL2'-1	150.6	-21.0	54.0	10	539.7
P-GL2-1	96.7	21.0	34.7	10	346.5

Σ concrete wall area= **9638.8**
Σ concrete wall length= **80.3** ft

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

			Limit (psi)	level	f'c(psi)
Check:	v < max(100, 2√f'c)	=	110	Roof	3000

(conservatively only cast in place concrete wall piers considered)

Level	Vx (k)	Ms-value (Table 4-8)	N-S direction wall area (in^2)	N-S direction *v* (psi)	E-W direction wall area (in^2)	E-W direction *v* (psi)
Roof	908	3	9639	31	7855	39

Reinforced Concrete Wall, Reinforcing Steel Ratio

8" Concrete wall with #4 @ 16" Verti & #4 @ 10" Horizontal at center of wall

Hori ρ=	0.00250	Shall not be less than 0.0012 verti., 0.0020 in hori direction
Verti ρ=	0.00156	Meeting requirements on reinforcing steel

TORSION CHECK (per §A.2.2.7; ASCE 41-13)

From ETABS model

Story	XCM (ft)	YCM (ft)	XCR (ft)	YCR (ft)
Roof	53.8	34.3	41.4	38.3

Check for X-DIR (East-West) Loading

Story	| YCR - YCM |	L_y (ft)	$0.2 \times L_Y$	Torsion (Y/N)
Roof	4.0	50.0	10.0	N

Check for Y-DIR (North-South) Loading

Story	| XCR - XCM |	L_x (ft)	$0.2 \times L_X$	Torsion (Y/N)
Roof	12.4	100.0	20.0	N

Tier 2 Calculation:

Base Shear Calculation - ASCE 41-13 - Linear Static Procedure (LSP) & Linear Dynamic Procedure (LDP)

Seismic Parameters

Address:	27118 Silver Spur Rd, Rolling Hills Estates, CA 90274			
Latitude:	33.77058	Longitude:	-118.369100	
Site Class:	D			
S_{XS} =	0.712 g	S_{X1} =	0.395 g	.... *(per USGS Map, BSE-1E)*

Characteristic Periods of the Response Spectrum

T_S =	0.555 sec			.... *(Eqn 2-9, ASCE 41-13)*
T_0 =	0.111 sec			.... *(Eqn 2-10, ASCE 41-13)*
T_L =	8.000 sec			.... *(Obtained from Fig 22-12, ASCE 7-10)*
B_1 =	1.002	Damping Ratio =	0.05	.... *(Eqn 2-11, ASCE 41-13)*

Static Base Shear Calculation for Linear Static Procedure (LSP)

h_n =	10.50 ft			
C_t =	0.020	β =	0.75	.... *(§7.4.1.2.2, ASCE 41-13, Concrete Shear Wall Systems)*
$T = C_t h_n^{\beta}$ =	0.117 sec			.... *(Eqn 7-18, ASCE 41-13)*
C_m =	1.000			.... *(Table 7-4, ASCE 41-13)*
S_a =	0.710			.... *(Eqn 2-6 to 2-8, ASCE 41-13, BSE-1E)*
DCR_{max} =	3			.... *(§7.3.1.1, ASCE 41-13)*
$\mu_{strength}$ =	1.0	$= [S_a/(V_y/W)].C_m \geq 1.0$		.... *(Eqn 7-31, ASCE 41-13)*
a =	60			.... *(§7.4.1.3.1, ASCE 41-13; site class D)*
C_1 =	1.0	$= 1 + (\mu_{strength} - 1) / aT^2$		.... *(Eqn 7-22, ASCE 41-13)*
C_2 =	1.0	$= 1 + 1 / 800 ((\mu_{strength} - 1) / T)^2$		.... *(Eqn 7-23, ASCE 41-13)*
$C_1.C_2$ =	1.0			.... *(§7.4.2.3, ASCE 41-13)*
V_{STATIC} =	0.710 W	$= C_1 C_2 C_m S_a W$		.... *(Eqn 7-21, ASCE 41-13, BSE-1E)*

General Response Spectrum (§2.4.1.7) for Linear Dynamic Procedure (LDP)

$$
\begin{cases}
S_a = S_{XS}\,[(5/B_1 - 2)T/T_S + 0.4] & \text{for } 0 < T < T_0 \\
S_a = S_{XS} / B_1 & \text{for } T_0 < T < T_S \\
S_a = S_{X1} / (B_1 T) & \text{for } T_S < T < T_L \\
S_a = T_L S_{X1} / (B_1 T^2) & \text{for } T_L < T
\end{cases}
$$

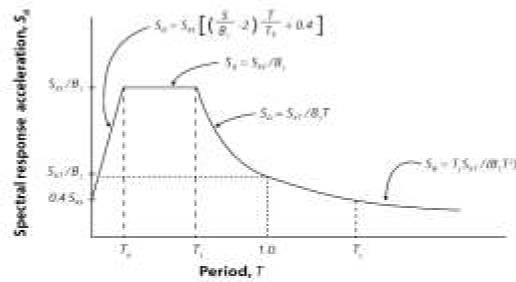
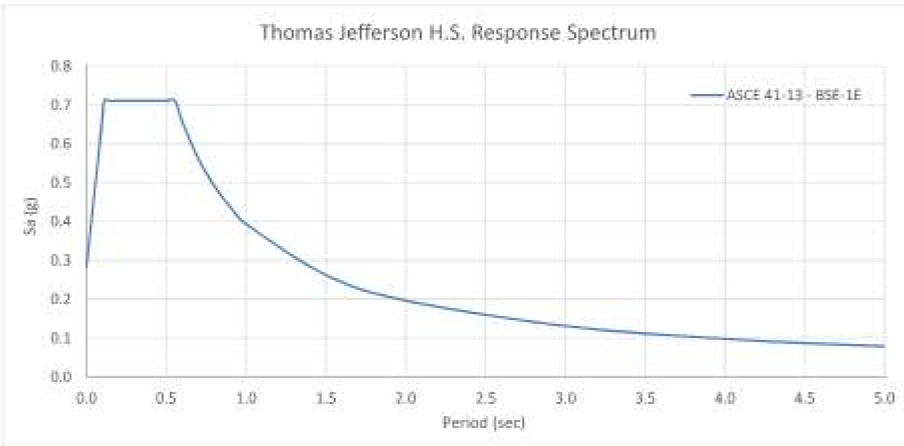


FIG. 2-1. General Horizontal Response Spectrum



$\mu_{strength}$ = Ratio of elastic strength demand to yield strength coefficient calculated in accordance with Eqn (7-31) with the elastic base shear capacity substituted for shear yield strength, Vy

C_m = 1 . . . . *(Table 7-4, ASCE 41-13, 1 o 2 stories)*

$\mu_{strength}$ = Sa.W/Vy. Cm = 0.221 ≥ 1.0

use $\mu_{strength}$ = 1

Sa=	0.710	
W=	911	kips
V demand=	647	kips
Vcapacity =	2927	kips

8" Concrete wall with #4 @ 16" Verti & #4 @ 10" Horizontal at center of wall

Hori ρ= 0.00250 Shall not be less than 0.0012 vertic, 0.0020 in hori direction

Verti ρ= 0.00156 Meeting requirements on reinforcing steel

Vn= Ac(2*∫f'c + ρfy)

Vn= 12*8*(2*3000^0.5+0.0025*40,000)= 20116.27 lb/ft

total length of conc wall in Y-Direction

L=	145.5	feet
Sum Vn=	2927	kips

Check Spandrel (Coupling Beams) Capacity (per §10.7; ASCE 41-13)

Concrete Shear Wall is deformation controlled actions for shear and flexure

$mkQ_{CE} > Q_{UD}$		(Acceptance criteria for shear and bending, Eqn 7-36)
$V_n = A_{cv}(2\lambda\sqrt{f'_c} + \rho f_y)$		(Wall nominal shear capacity ACI 318-08, Equ 21-7)
fc'=	3000	psi, Normal Weight Concrete
λ=	1	Lt. Wt Conc use 0.75; normal Wt use 1.0
fy=	40000	psi
Expected, fce'=	4500	psi (fc' x1.5 per Table 10-1)
Expected, fy=	50000	psi (fy x1.25 per Table 10-1)
Average m=	2	(Min. 1.5 ~ Max. 3 per Table 10-22)
k=	0.75	Table 6-1, material test will be done

BSE1E Level Seismic Force

Load Combo QXENV — **Shear Capacity**

Level	Pier Label	Spandrel Depth h_w (in)	Pier Width t_w (in)	wall area (in²)	Reinft ρ (0 if no 135 hook or spaced more than d/2)	$Q_{CE}=V_n$ (Kips)	L spandrel (ft)	$Q_{CE, at M}$ (Kips)	Demand V_{UD} (kips)	m factor Damage Control (S-2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{V}{t_w l_w \lambda\sqrt{f'_c}}$
Roof	S1-1	27	10	270	0	36	3.5	96	18	2.00	3.02	1.0
Roof	S1-2	27	10	270	0	36	3.5	96	10	2.00	5.56	0.5
Roof	S1-3	27	10	270	0	36	3.5	96	22	2.00	2.47	1.2
Roof	S1'-1	27	10	270	0	36	3.5	96	27	2.00	2.04	1.5

Load Combo QYENV — **Shear Capacity**

Level	Pier Label	Spandrel Depth h_w (in)	Pier Width t_w (in)	wall area (in²)	Reinft ρ (0 if no 135 hook or spaced more than d/2)	$Q_{CE}=V_n$ (Kips)	L spandrel (ft)	$Q_{CE, at M}$ (Kips)	Demand V_{UD} (kips)	m factor Damage Control (S-2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{V}{t_w l_w \lambda\sqrt{f'_c}}$
Roof	S1-1	27	10	270	0	36	3.5	96	39	2.00	1.41	2.1
Roof	S1-2	27	10	270	0	36	3.5	96	21	2.00	2.60	1.2
Roof	S1-3	27	10	270	0	36	3.5	96	45	2.00	1.22	2.5
Roof	S1'-1	27	10	270	0	36	3.5	96	37	2.00	1.48	2.0

Note: 8" thick wall with #4@16" (V), #4@10" (H) 3000 psi normal weight concrete.
Shear Capacity is the smallest of Vn or Vn at Reaching Bending Moment Capacity; RED Vn indicate shear control (m-factor from Table 10-22)

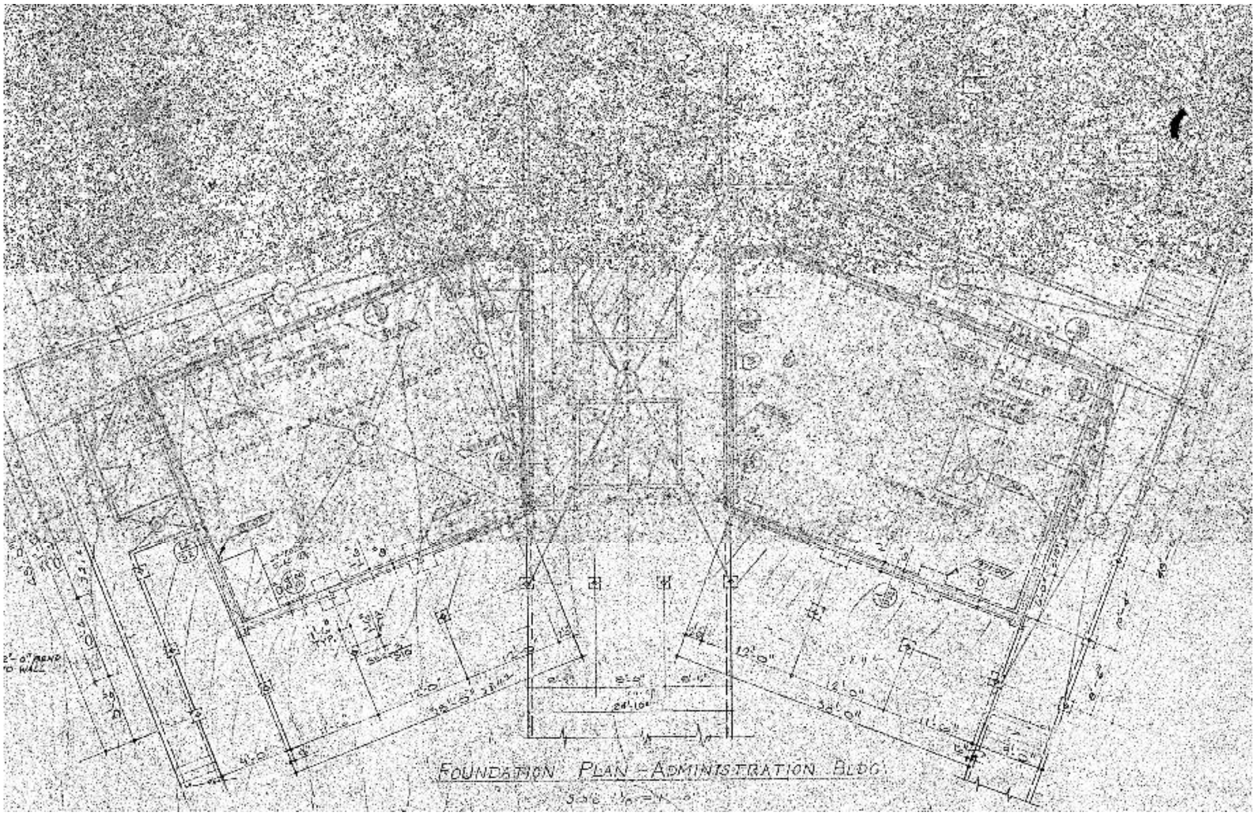
Load Combo QXENV — **X-Direction Force (East-West)** — **Check Spandrel (Coupling Beam) Bending Capacity -** — **Damage Control (S-2)**

Level	Pier Label	Value	Location	Axial P_{UD} (kips)	Demand M_{UD} (k-ft)	Capacity M_{CE} (k-ft)	A (in2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{(A_S - A'_S)f_y + P}{t_w l_w f'_c}$	$\frac{V}{t_w l_w \sqrt{f'_c}}$	m-factor for M (Table 10-21)	m-factor for V (Table 10-22)
Roof	S1-1	Max	right	8	20	168	270	12.91	-0.007	1.0		2
Roof	S1-1	Min	right	-10	-29	168	270	8.78	0.008	1.0		2
Roof	S1-2	Max	right	2	15	168	270	16.68	-0.002	0.5		2
Roof	S1-2	Min	right	-2	-15	168	270	16.77	0.002	0.5		2
Roof	S1-3	Max	right	9	25	168	270	10.03	-0.007	1.2		2
Roof	S1-3	Min	right	-9	-25	168	270	10.25	0.008	1.2		2
Roof	S1'-1	Max	right	-6	36	168	270	7.03	0.005	1.5		2
Roof	S1'-1	Min	right	-13	-48	168	270	5.20	0.010	1.5		2

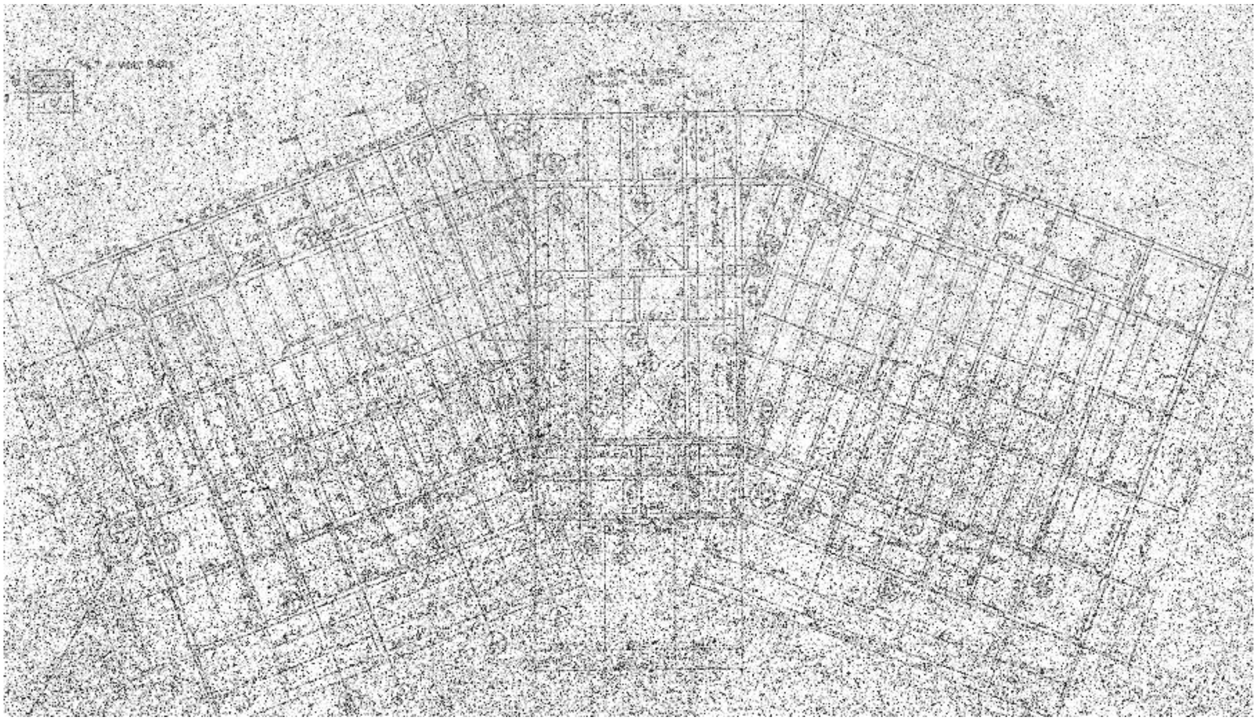
Load Combo QYENV — **Y-Direction Force (North-South)** — **Check Spandrel (Coupling Beam) Bending Capacity -** — **Damage Control (S-2)**

Level	Pier Label	Value	Location	Axial P_{UD} (kips)	Demand MUD (k-ft)	Capacity M_{CE} (k-ft)	A (in2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{(A_S - A'_S)f_y + P}{t_w l_w f'_c}$	$\frac{V}{t_w l_w \sqrt{f'_c}}$	m-factor for M (Table 10-21)	m-factor for V (Table 10-22)
Roof	S1-1	Max	right	18	49	168	270	5.18	-0.015	1.0		2
Roof	S1-1	Min	right	-21	-58	168	270	4.36	0.017	1.0		2
Roof	S1-2	Max	right	5	33	168	270	7.57	-0.004	0.5		2
Roof	S1-2	Min	right	-5	-33	168	270	7.59	0.004	0.5		2
Roof	S1-3	Max	right	20	54	168	270	4.64	-0.016	1.2		2
Roof	S1-3	Min	right	-20	-54	168	270	4.68	0.017	1.2		2
Roof	S1'-1	Max	right	-7	54	168	270	4.69	0.005	1.5		2
Roof	S1'-1	Min	right	-12	-66	168	270	3.80	0.010	1.5		2

Appendix 1-C: As-Built Plans



Foundation Plan (1963 Drawing Sheet S-1)



Roof Plan (1963 Drawing Sheet S-1)

Appendix 7A – Images of Existing Conditions

Fig 1. Covered open area in the middle

Fig 2. Perimeter walkway

Fig 3. Interior corridor with newer ceilings

Fig 4. Typical above ceiling condition

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STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
LIBRARY BUILDING (2)

PALOS VERDES PENINSULA HIGH SCHOOL
27118 Silver Spur Rd.
Rolling Hills Estates, CA 90274

REGISTERED PROFESSIONAL ENGINEER
TERRY C. TSANG
No.S2992
Exp. 06/30/2016
STRUCTURAL
STATE OF CALIFORNIA

Terry Tsang, S.E.
Structural Engineer S2992
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FEBRUARY 2016

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Table of Contents

1.0 Introduction

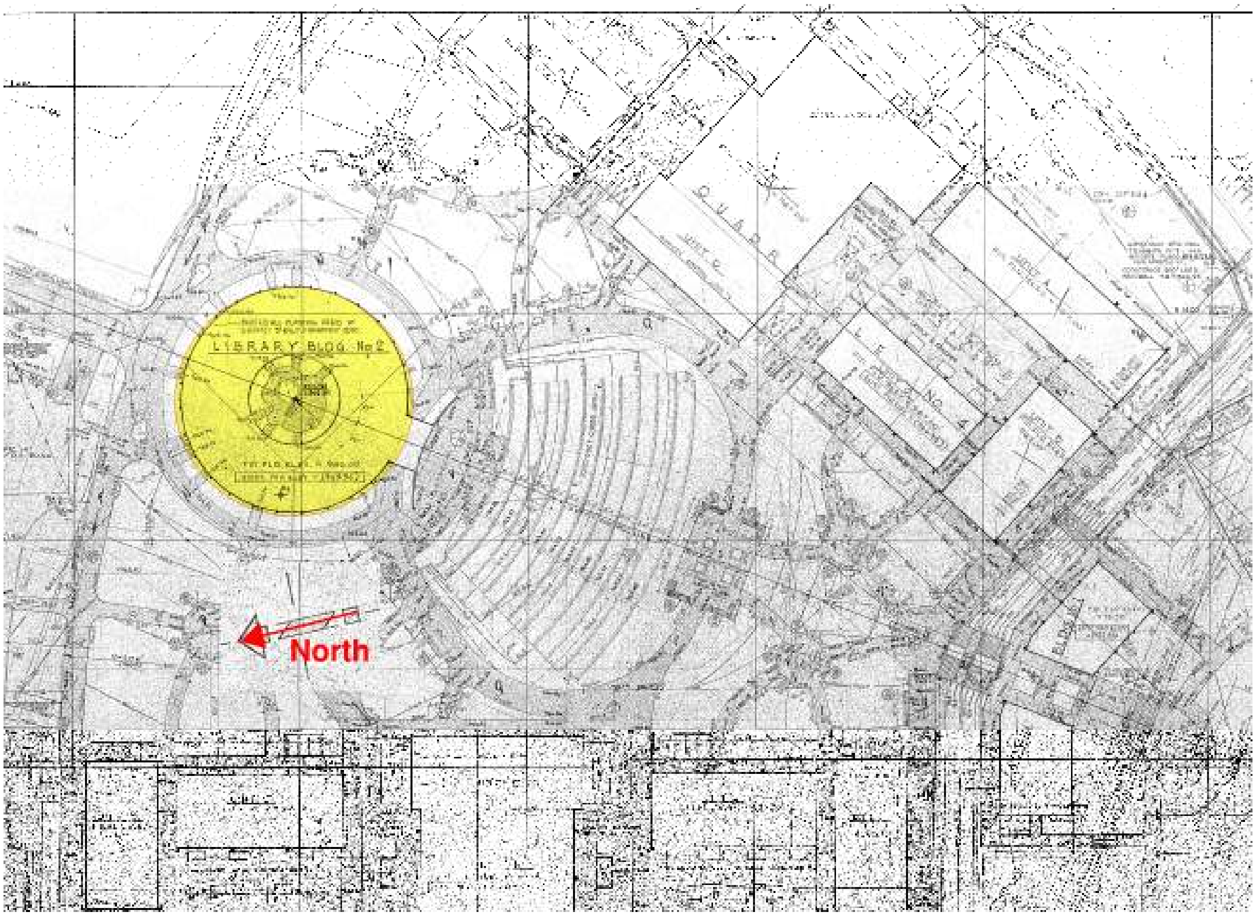
A multiphase seismic vulnerability assessment of ***Library Building (2)*** was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 5.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Photo 1 – Exterior view of Library Building

Photo 2 – Interior view of Library Building

A partial campus site plan of Palos Verdes Peninsula High School, indicating the building under evaluation, is provided below. The highlighted building is ***Library Building (2).***



Partial Site Plan- Library Building (2)

2.0 Building (2)– Library Building

2.1 Site Seismicity

Based on 1963 construction drawings, original foundation was based on the allowable soil bearing pressure of 2,000 psf for vertical dead loads plus live loads. There is a geotechnical report dated December 21, 2012 by Geo-Advantec Inc. for a proposed 6 Classroom Buildings located close to Library building.

Per ASCE 41-13 (2012 IBC), for Palos Verdes Peninsula High School located at 27118 Silver Spur Road, Rolling Hills Estates, CA 90274,

Site Coordinates = 33.7706°N, -118.3691°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.512g; $S_{1,20/50}$ = 0.196 g
F_a = 1.391 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.015 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.712g
$S_{X1} = F_v S_{1,20/20}$ = 0.395g

2.2 Building Description

The Library Building is a one-story circular shape building almost at center of the school campus. The building was constructed circa 1963. The existing drawings for the building are dated April 19, 1963, which shows the proposed administration building construction and implies the building was constructed shortly thereafter. Functionally, the building has large open area serving different library sections. Total footprint of the original building is estimated to be ±8,100 square feet. The typical roof height is about 13'. The roof consists of 4" concrete slab sitting on frame beams, which is considered a stiff diaphragm. The lateral force resistance of the building is provided by reinforced concrete moment frames radially starting from inner ring(radius of 19.5') of column lines to outer ring of columns(radius of 50.8'). In between columns, concentric inner and outer rings of arc-shaped precast walls are filling the space and have some contribution in lateral system due to the stiffness they have. The foundation of the building consists of concrete caissons under the concrete columns, and all tied together with tie beams.

Based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Concrete Moment Frames denoted as "C1".

The structural risk category for the multipurpose building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Building (2)– Library Building Summary Table	
Year Designed	1963
Drawings	Original drawings, dated April 19, 1963, prepared by Flewelling, Moody & Horn Architects, and Engineers.
Gravity System	Concrete Slab (Stiff Diaphragm)
Lateral System	Concrete moment frame
No. of Stories & Height	One story Roof: h_n=13 ft
Building Period “T”	0.487 Sec (from ETABS model)
Base Shear “V”	0.926 W = 642 kips (tier 1)
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	See Section 4.1

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of the Building is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the “Life Safety” performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the “Life Safety” or “Immediate Occupancy” levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening, if needed. As a Risk Category ***III***, the Basic Performance Objective for the building was ***Damage Control Structural Performance,*** per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; some were found to be "Compliant" and others were found to remain "Deficient."

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Strong column-weak beam
- Tier 1 Deficiency No. 2: Beam bars
- Tier 1 Deficiency No. 3: Column-bar splices
- Tier 1 Deficiency No. 4: Beam-bar splices
- Tier 1 Deficiency No. 5: Column-tie spacing
- Tier 1 Deficiency No. 6: Stirrup spacing
- Tier 1 Deficiency No. 7: Joint transverse reinforcing

3.2 ASCE 41-13 Tier 2 Evaluation

The deficiencies listed above was reviewed using a Tier 2 Evaluation. The deficiencies No. 2, 4 & 7 were mitigated based on results of Tier 2 evaluation, which can be found in Appendix 1-B. The Tier 2 analysis was performed using analysis results from the ETABS model developed for the Tier 2 evaluations. Linear dynamic procedure was used for the analysis of the structure using BSE-1E level seismic response spectrum. Output forces are exported into excel spreadsheet and series of calculation per ASCE 41-13 are performed to verify the components have sufficient capacity for load demands.

3.3 Tier 2 Evaluation and Proposed Retrofit Summary Table

Building	Identified Tier 1 Deficiencies	Tier 2 section number	Tier 2 Evaluation Result	Proposed Retrofit
Library Building (#2) Target Structural Performance Level: ***S-2 Damage Control***	***16.9 LS Strong column-weak beam***	**5.5.2.1.5**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in section 4.1.***
	16.9 LS Beam Bars	**5.5.2.3.5**	***Mitigated***	**-**
	16.9 LS Column-bar splices	**5.5.2.3.6**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in section 4.1.***
	16.9 LS Beam-bar splices	**5.5.2.3.6**	***Mitigated***	**-**
	16.9 LS Column-tie spacing	**5.5.2.3.7**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in section 4.1.***
	16.9 LS Stirrup spacing	**5.5.2.3.7**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in section 4.1.***
	16.9 LS Joint transverse reinforcing	**5.5.2.3.8**	***Mitigated***	**-**

4.0 Conclusions

The beam bars, beam-bar splices & joint transverse reinforcing deficiencies identified by Tier 1 checklist were mitigated by Tier 2 analysis results.

Remaining four deficiencies which were all related to frame columns and tier 2 analysis results didn't mitigate the deficiencies. The identified deficiencies are major structural irregularities and pose a serious collapse hazard if they are not mitigated.

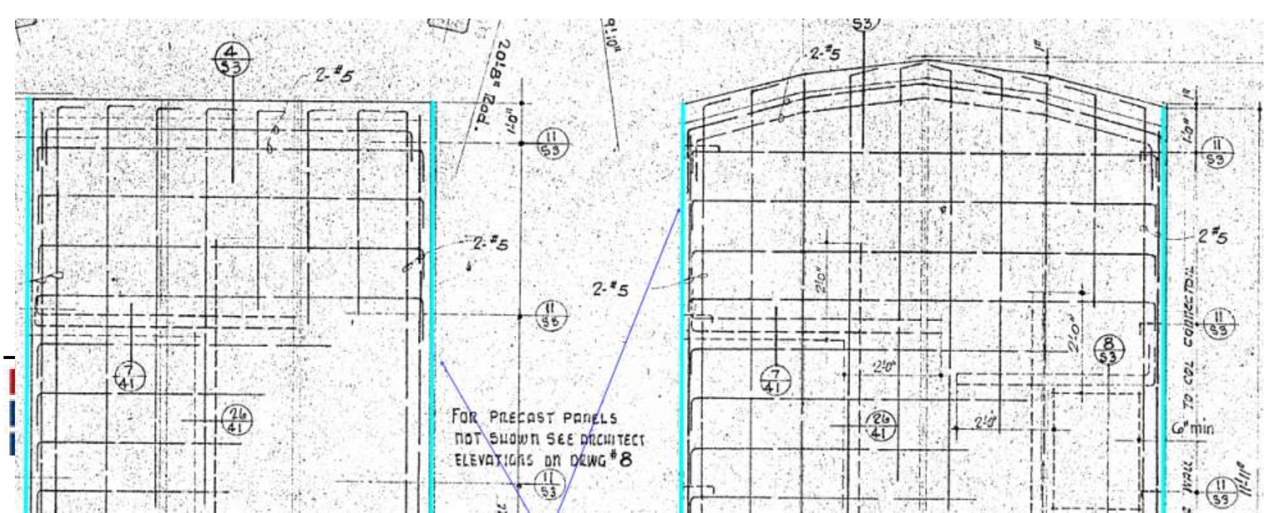
Instead of dealing with frame columns, the preferred retrofit options better to focus on brining precast shear wall panels into play and make sure they will be part of lateral system & contribute as a primary lateral force resisting system.

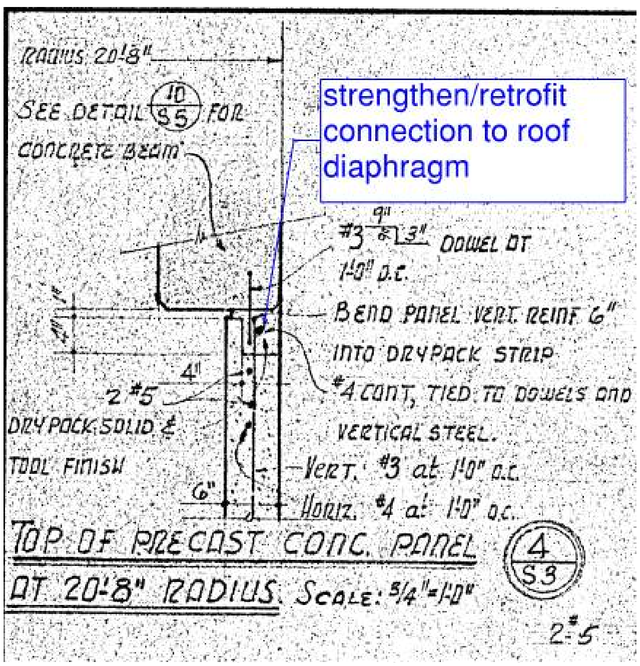
Given the reason above, a voluntary seismic retrofit is required for this structure.

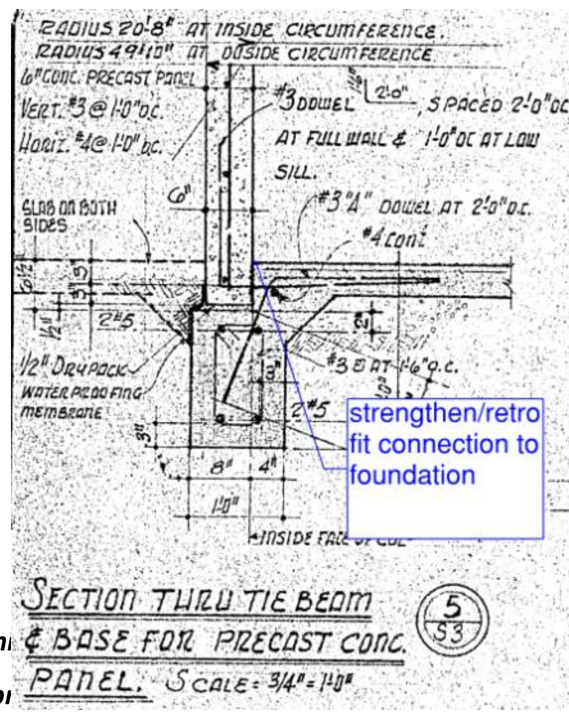
4.1 Proposed Retrofit Options

Summary of Retrofit options:

1. ***Strengthen existing precast panels' connections to have proper load path for lateral force transfer at sides and top and bottom.***







openi... v

shear wall/panel system OR adding bı...

5.0 Documents Reviewed

The following existing architectural and or structural drawings (and or other documents when available) were reviewed:

Date	Architect / Engineer	TTG Comments

April 19, 1963	Flewelling, Moody & Horn Architects and Engineers	Title Block states "Library Bldg. No. 2, Rolling Hills High School, Palos Verdes Peninsula Unified School District" Architectural and structural drawings (State of California – Department of Public Works, Division of Architecture, Project No. 23166)
December 12, 2012	Geo-Advantec, Inc.	Geotechnical Engineering Evaluation Report "Proposed 6 Classroom Buildings & Weight Room Palos Verdes Peninsula High School

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Peninsula High School Building B, Library

Table of Contents

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be

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removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Palos Verdes Peninsula High School is a public high school with in the Palos Verdes Peninsula Unified School District. The original buildings were completed in 1963 and includes all the buildings of concern for this analysis. It was originally called Rolling Hills High School and has been in constant use as a high school since that time. The original campus buildings were designed by the firms of Flewelling, Moody, and Horn Architects and is mostly of concrete construction. The building referred to as B is part of the original campus buildings.

Building B is at the middle of the campus at the north end of the main quad. It is a one story building with a circular plan. It contains the library and some additional support spaces. The building structure is cast-in-place concrete with precast concrete plank infill for non-structural walls. The roof systems is a cast in place concrete folded plate system that spans from the inner core to the exterior concrete piers. The inner core was originally a courtyard open to the sky which has been covered with a wood roof system.

All portions of the building were originally of Type-2 non-combustible construction which would fit within the current CBC Type-2B requirements except for the later courtyard roof which converts to CBC Type 5B with combustible construction.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Item 1

Strengthen wall panel connections to concrete frame
This will entail enhancing the connection of the concrete wall panels an all sides to the foundation, concrete piers and beam overhead. This could be done with steel angles epoxy bolted to the concrete elements. I can also be done by adding thickness to the existing wall panels with rebar dowelled to the surrounding concrete foundation and frame. There may be some enhancement to the foundation itself which would require some excavation and extension to the existing footing. See conceptual detail #5

Retrofit Item 2

Infill to Create Addition Shear Wall
This will consist of adding new concrete wall panels to in some areas of the exterior ring of the building to provide additional shear on the south side between the main space and the back room. This will require excavation for footings under the new wall panels. See conceptual detail #6

Miscellaneous Recommended Work

Spalling Concrete Repair
There are numerous locations throughout both buildings where concrete edges are cracking and spalling. Even though these are not effecting the buildings mains structure they present a hazard and will allow the further deterioration of construction if not addressed. This is mostly concentrated around the stair areas. This would consist of appropriate preparation of the existing concrete and an appropriate formulated epoxy system with reinforcing where required to fill and hold cracking areas. These areas are generally exposed for easy access.

Accessibility Upgrades

If Retrofit work is designed and submitted to DSA there will be some minimum level of access compliance work that will be required as a condition of the obtaining approval. Typically, there are requirements for an accessible path of travel to the subject building from parking and accessible restrooms to serve the building. Even though modernization work has been done which on the campus they may be some work required to meet the requirements of the most current codes and regulations at the time of that the retrofit work is being designed. A separate survey for access compliance is recommended for the entire campus that would be of benefit for future project planning.

Fire & Life Safety

The work should have minimal effect on the fire rated assemblies that exist since all the work is concrete enhancement to exterior wall elements and floor/roof beams. Any assembly disturbed in the process will have to be returned to its original rating condition.

The new work will have no impact on the egress system as currently exists and there are no changes to the egress system in this scope. There is no reconfiguration of spaces or changes of use in the scope that would affect the existing fire/life safety code compliance status of the building with regards to building area, construction type or configuration.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

It should be possible to construct these retrofit elements without major impact to the function and appearance of the building. Most of the work is involve retrofitting the concrete structure which is generally exposed. There is also work within the inner core which can be accessed within the reading room which is mostly clear space. The cost of this seismic mitigation work would be significantly less then structure replacement.

8.0 Cost Estimate

PVPUSD Seismic Study
Narrative, Plans and Details by PBWS - Received 8/10/2016

RE: PVPUSD Seismic Study

Please find in the following report the cost estimate for the PVPUSD Seismic Study project. This estimate is prepared in accordance with the Narrative, Plans and Details by PBWS - Received 8/10/2016 with the following:

CLARIFICATIONS:

- Pricing is based on the entire project scope being awarded as one project to a single contractor
- Cost is based on prevailing wage labor rates
- This estimate represents an opinion of the fair construction cost for this project assuming multiple general contractors competitively bidding on the project with all sub-trades covered with 4 to 5 bids per trade. If a different delivery method is used a premium cost should be expected and will vary depending on the method used. This estimated cost should not be construed as a prediction of low bid

EXCLUSIONS:

- All soft costs
- Permits
- Owner's contingency
- Construction or occupancy phasing
- CM fee

Should you have any questions, please call me at 661-367- 5242.

Sincerely:

Walid Shihayed

WM2S, Inc.
14908 Live Oak Springs Canyon Road, Santa Clarita, CA. 91387
P: (661) 367 5242, www.WM2S.com

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
PENB Peninsula High School Building B, Library			
0205 Demolition			
02050.000 DEMOLITION			
Remove Concrete Slab	358.00 SF	15.00 /SF	5,370
Remove Concrete Slab	51.00 SF	15.00 /SF	765
Demo Window And Frame	1.00 EA	300.00 /EA	300
DEMOLITION			**6,435**
0205 Demolition			**6,435**
0220 Earthwork			
02200.000 EARTHWORK			
Excavate For Footing - Hand	11.34 CY	65.00 /CY	737
Backfill Walls - Hand	5.67 CY	50.00 /CY	284
EARTHWORK			**1,021**
0220 Earthwork			**1,021**
0252 Site Concrete			
02520.000 SITE CONCRETE			
Cast-in-Place Concrete Paving 4"	358.00 SF	35.00 /SF	12,530
Cast-in-Place Concrete Paving 4"	51.00 SF	35.00 /SF	1,785
SITE CONCRETE			**14,315**
0252 Site Concrete			**14,315**
0320 Reinforcing Steel			
03200.000 CONCRETE REINFORCEMENT			
Concrete Wall Reinforcing	340.00 SF	7.00 /SF	2,380

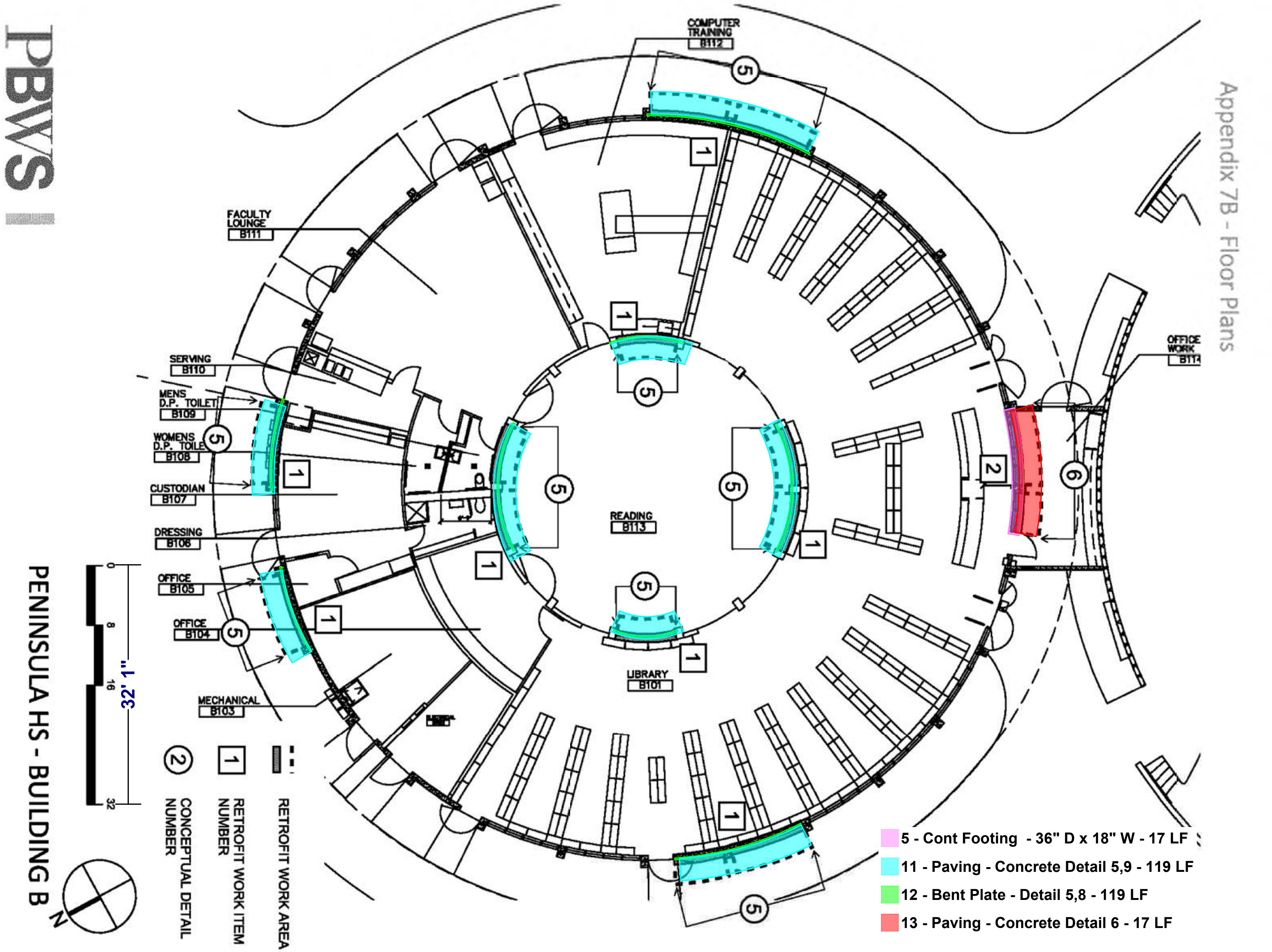
Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
CONCRETE REINFORCEMENT			**2,380**
0320 Reinforcing Steel			**2,380**
0330 Concrete			
03300.000 CAST-IN-PLACE CONCRETE			
Drill & Epoxy Reinforcing Dowel	74.00 EA	35.00 /EA	2,590
Continuous Footings - Underpinning	5.67 CY	800.00 /CY	4,536
Slab On Grade	51.00 SF	50.00 /SF	2,550
Concrete Walls - Poured In Place - 10" thick	340.00 SF	80.00 /SF	27,200
CAST-IN-PLACE CONCRETE			**36,876**
0330 Concrete			**36,876**
0370 Concrete Restoration			
03700.000 CONCRETE RESTORATION			
Concrete Restoration & Repair	1.00 LS	15,000.00 /LS	15,000
CONCRETE RESTORATION			**15,000**
0370 Concrete Restoration			**15,000**
0510 Steel			
05050.000 METAL FASTENING			
Drill & Epoxy Anchor (Hilti)	464.00 EA	75.00 /EA	34,800
METAL FASTENING			**34,800**
05100.100 Structural Steel			
Fabricate Structural Steel	2.68 TON	3,000.00 /TON	8,040
Detail Structural Steel	2.68 TON	2,000.00 /TON	5,360
Structural Steel			**13,400**
05123.803 Steel Angles 3"			
Erect Steel Plates	167.00 EA	87.50 /EA	14,613

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
Steel Angles 3"			**14,613**
05124.005 Steel Plate < 1"			
Steel Plate 1/2"	524.00 SF	51.05 /SF	26,750
Steel Plate < 1"			**26,750**
0510 Steel			**89,563**
0640 Cabinets			
06400.000 ARCH WOODWORK & CABINETS			
Cabinets - Remove& Reinstall	1.00 LS	2,500.00 /LS	2,500
ARCH WOODWORK & CABINETS			**2,500**
0640 Cabinets		**/SF**	**2,500**
0950 Ceiling			
09500.000 ACOUSTICAL TREATMENT			
Acoustical Ceilings - 12x12 Glued On	119.00 SF	15.00 /SF	1,785
ACOUSTICAL TREATMENT			**1,785**
0950 Ceiling			**1,785**
0960 Flooring			
09650.000 RESILIENT FLOORING			
Remove & Replace Flooring	51.00 SF	40.00 /SF	2,040
RESILIENT FLOORING			**2,040**
0960 Flooring			**2,040**
0990 Painting			
09900.000 PAINTING			
Painting - Metals - High Performance Coating	524.00 SF	4.00 /SF	2,096
Painting - Concrete Wall	680.00 SF	2.50 /SF	1,700

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
PAINTING			**3,796**
0990 Painting			3,796
PENB Peninsula High School Building B, Library			**175,710**

Partial Totals

Description	Amount	Totals	Rate	
Direct Cost	**175,711**	**175,711**		
General Conditions	17,571		10.00	%
Performance & Payment Bond	2,533			
Liability Insurance	1,757		1.00	%
Overhead & Fee	8,786		5.00	%
Construction Cost	**30,647**	**206,358**		
Design Contingency	41,271		20.00	%
Escalation	8,254		4.00	%
Construction Cost With C&E	**49,525**	**255,883**		
Construction Contingency	25,588		10.00	%
	25,588	**281,471**		
SOFT COSTS:				
Architect & Engineering Fees				
Architect Reimbursables				
Testing & Inspection				
Permits and Fees				
Furniture, Fixtures and Equip.				
Total Project Cost				


PBWS
PENINSULA HS - BUILDING B
COMPUTER TRAINING B112
FACULTY LOUNGE B111
SERVING B110
MENS D.P. TOILET B109
WOMENS D.P. TOILE B108
CUSTODIAN B107
DRESSING B106
OFFICE B105
OFFICE B104
MECHANICAL B103
READING B113
LIBRARY B101
OFFICE WORK B114
32' 1"
0
8
16
32
2 CONCEPTUAL DETAIL NUMBER
1 RETROFIT WORK ITEM NUMBER
RETROFIT WORK AREA
N
5 - Cont Footing - 36" D x 18" W - 17 LF
11 - Paving - Concrete Detail 5,9 - 119 LF
12 - Bent Plate - Detail 5,8 - 119 LF
13 - Paving - Concrete Detail 6 - 17 LF

Appendix 1-A: Tier 1 Screening Checklists

ASCE 41-13 Checklists

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path exists.
x				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.2)	No other buildings within 10 feet of this building
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanines
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	It is one story building, so not applicable.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	It is one story building, so not applicable.
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation.	All vertical elements continuous to foundation.

C	NC	N/A	U	Checklist	Comments
				(§A.2.2.4. Tier 2: §5.4.2.3)	
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	It is one story building, so not applicable.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	It is one story building, so not applicable.
x				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Symmetric bldg. torsion deficiency not anticipated by observation.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
x				LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), the building site is not in liquefaction susceptible zone.
x				SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), the building site is not susceptible to slope failure.
x				SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), surface fault rupture not anticipated.

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
X				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.712=0.43 Compliant per review of existing drawings.
X				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Foundation elements are tied together by ties beams (1 & 5/S3) and slab on grade.

16.9LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES C1: CONCRETE MOMENT FRAMES

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of moment frames in each principal direction is greater than or equal to 2. The number of bays of moment frames in each line is greater than or equal to 2. (§A.3.1.1.1. Tier 2: §5.5.1.1)	Adequate frame lines al around per as built
x				COLUMN AXIAL STRESS CHECK: The axial stress caused by unfactored gravity loads in columns subjected to overturning forces because of seismic demands is less than 0.20f'_c. Alternatively, the axial stress caused by overturning forces alone, calculated using the Quick Check procedure of Section 4.5.3.6, is less than 0.3f'_c. (§A.3.1.4.2. Tier 2: §5.5.2.1.3)	Axial stress is less than 0.2f'c, see calculation in Appendix 1-B.
Connections					
x				CONCRETE COLUMNS: All concrete columns are doweled into the foundation with a minimum of 4 bars. (§A.5.3.2. Tier 2: §5.7.3.1)	Columns are doweled into foundation with at least 4 bars.(7/S3)
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Seismic-Force-Resisting System					
		x		INTERFERING WALLS: All concrete and masonry infill walls placed in moment frames are isolated from structural elements (§A.3.1.2.1. Tier 2: §5.5.2.1.1)	No interfering walls.
x				COLUMN SHEAR STRESS CHECK: The shear stress in the concrete columns, calculated using the Quick Check procedure of Section 4.5.3.2, is less than the greater of 100 lb/in^2, or $2\sqrt{f'_c}$. (§A.3.1.4.1. Tier 2: §5.5.2.1.4)	Shear stress is less than $2\sqrt{f'_c}$, see calculation in Appendix 1-B.
		x		FLAT SLAB FRAMES: The seismic-force-resisting system is not a frame consisting of columns and a flat slab or plate without beams. (§A.3.1.4.3. Tier 2: §5.5.2.3.1)	Not a flat slab frame system.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Seismic-Force-Resisting System					

C	NC	N/A	U	Checklist	Comments
		x		PRESTRESSED FRAME ELEMENTS: The seismic-force-resisting frames do not include any prestressed or posttensioned elements where the average prestress exceeds the lesser of 700 lb/in^2 or $f'_c/6$ at potential hinge locations. The average prestress is calculated in accordance with the Quick Check procedure of Section 4.5.3.8 (§A.3.1.4.4. Tier 2: §5.5.2.3.2)	No pre-stressed or post tensioned elements.
		x		CAPTIVE COLUMNS: There are no columns at a level with height/depth ratios less than 50% of the nominal height/depth ratio of the typical columns at that level. (§A.3.1.4.5. Tier 2: §5.5.2.3.3)	No captive columns.
x				NO SHEAR FAILURES: The shear capacity of frame members is able to develop the moment capacity at the ends of the members. (§A.3.1.4.6. Tier 2: §5.5.2.3.4)	see calculation in Appendix 1-B.
	x			STRONG COLUMN-WEAK BEAM: The sum of the moment capacity of the columns is 20% greater than that of the beams at frame joints. (§A.3.1.4.7. Tier 2: §5.5.2.1.5)	Interior circumference column doesn't satisfy the requirement per quick check. see calculation in Appendix 1-B.
	x			BEAM BARS: At least two longitudinal top and two longitudinal bottom bars extend continuously throughout the length of each frame beam. At least 25% of the longitudinal bars provided at the joints for either positive or negative moment are continuous throughout the length of the members. (§A.3.1.4.8. Tier 2: §5.5.2.3.5)	Top two bars not continuous. see tier 2 calculation in Appendix 1-B.
	x			COLUMN-BAR SPLICES: All column-bar lap splice lengths are greater than $35d_b$ and are enclosed by ties spaced at or less than $8d_b$. Alternatively, column bars are spliced with mechanical couplers with a capacity of at least 1.25 times the nominal yield strength of the spliced bar. (§A.3.1.4.9. Tier 2: §5.5.2.3.6)	Provided bar splice is 24db & tie spaced at 8", less than required. see tier 2 calculation in Appendix 1-B.
	x			BEAM-BAR SPLICES: The lap splices or mechanical couplers for longitudinal beam reinforcing are not located within $L_b/4$ of the joints and are not located in the vicinity of potential hinge locations. (§A.3.1.4.10. Tier 2: §5.5.2.3.6)	$L_b/4$=30'/4=7.5'…top bar splice is at 7'-0". see tier 2 calculation in Appendix 1-B.

C	NC	N/A	U	Checklist	Comments
	X			COLUMN-TIE SPACING: Frame columns have ties spaced at or less than d/4 throughout their length and at or less than $8d_b$ at all potential plastic hinge locations. (§A.3.1.4.11. Tier 2: §5.5.2.3.7)	d/4=12"/4=3"<8"…Ties not spaced at less than d/4 throughout the length; ties spaced at 4" at potential hinge zone, which is more than $8d_b$=8(3/8")=3". see tier 2 calculation in Appendix 1-B.
	X			STIRRUP SPACING: All beams have stirrups spaced at or less than d/2 throughout their length. At potential plastic hinge locations, stirrups are spaced at or less than the minimum of $8d_b$ or d/4. (§A.3.1.4.12. Tier 2: §5.5.2.3.7)	d/2=16"/2=8"<12"… min($8d_b$,d/4)=[8(3/8"),16"/4]=3"<4". see tier 2 calculation in Appendix 1-B.
	X			JOINT TRANSVERSE REINFORCING: Beam-column joints have ties spaced at or less than $8d_b$. (§A.3.1.4.13. Tier 2: §5.5.2.3.8)	No ties at joint. see tier 2 calculation in Appendix 1-B.
		X		DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (§A.3.1.6.2. Tier 2: §5.5.2.5.2)	No secondary components.
		X		FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (§A.3.1.6.3. Tier 2: §5.5.2.5.3)	No flat slab which is not part of the seismic force resisting system.
Diaphragms					
X				DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (§A.4.1.1. Tier 2: §5.6.1.1)	No diaphragm discontinuity.
Connections					
		X		UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (§A.5.3.8. Tier 2: §5.7.3.5)	No pile caps.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
				Life Safety Systems	
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Hazardous Materials	
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4.	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				Tier 2. §13.6.2)	
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7.	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
				Tier 2: §13.6.4)	
Light Fixtures					
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Observed Compliant
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
Cladding and Glazing					
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	No multi-story panel, so not applicable.
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in	No cladding panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
Masonry Veneer					
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	No URM backup, so not applicable.
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the	No masonry veneer, so not applicable.

C	NC	N/A	U	Checklist	Comments
				backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
Parapets, Cornices, Ornamentation, and Appendages					
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
X				LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Observed Compliant
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No Parapet; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	No such appendages were observed; So not applicable
Masonry Chimneys					
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity	No URM chimneys, so not applicable.

C	NC	N/A	U	Checklist	Comments
				and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
Stairs					
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
Contents and Furnishings					
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
		X		LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	None observed; So not applicable
			X	LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Not accessible during site visit
X				LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	Observed Compliant
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
Piping					
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
Ducts					
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	
				Elevators	
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

Tier 1 Calculation:

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW	Bldg Type= **C1**
$C =$	1.3	From Table 4-8 for Moment Frame Building
$S_a =$	$\min(S_{XS}, S_{X1}/T)$	From Section 4.5.2.3
$S_{X1} =$	F_VS_1	Eq. 2-2
$S_{XS} =$	F_aS_S	Eq. 2-1
$S_S =$	0.512	g, mapped spectral acceleration
$S_1 =$	0.196	g, mapped spectral acceleration
$S_{X1} =$	0.395	g
$S_{XS} =$	0.712	g
$T =$	$C_th_n^{\beta}$	From Section 4.5.2.4
$C_t =$	0.018	
$h_n =$	13	ft., average height at sloped roof
$\beta =$	0.9	
$T =$	0.181	sec.
$S_a =$	0.712	g
$V_{Canopy} =$	0.926	W

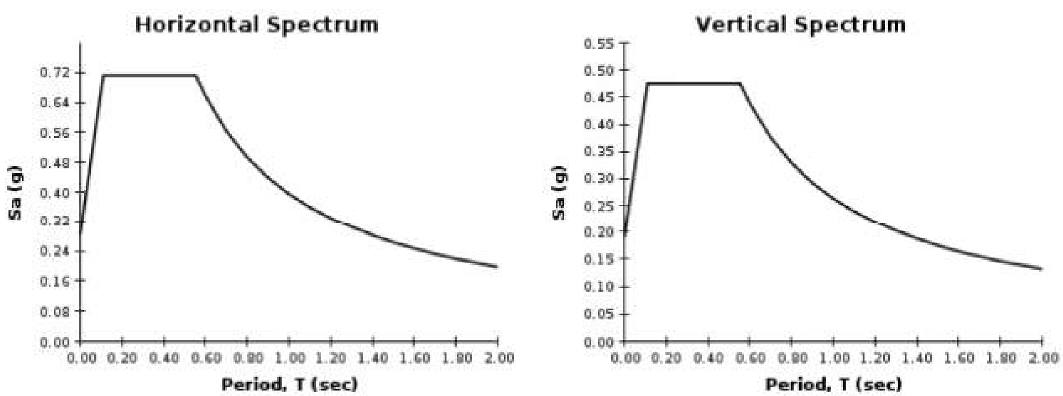
USGS Design Maps Summary Report

User–Specified Input

Report Title	California Minimum Ss Sat January 23, 2016 03:52:06 UTC
Building Code Reference Document	ASCE 41-13 Retrofit Standard, BSE-1E (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.77058°N, 118.3691°W
Site Soil Classification	Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.512 g	$S_{XS,BSE-1E}$	0.712 g
$S_{1,20/50}$	0.196 g	$S_{X1,BSE-1E}$	0.395 g



Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

Seismic Mass Weight, Concrete Canopy

Roof

Roof area with 4" Light Weight Concrete Slab Roof

4" LW Slab	37	psf
Concrete Bms	12.7	psf
roofing	5	psf
MEP & Misc	6	psf
DL =	**60**	**psf**

Roof area covered at center

steel framing	10	psf
Ceiling	5	psf
Mep & Misc	5	psf
DL =	**20**	**psf**

Column Weight

Col @ exterior circum.(frame 2) =	165	plf
Col @ exterior circum. (frame 1) =	165	plf
Col @ interior circum. (frame 1) =	107	plf

Panel Weight

6" precast conc panel= 55 psf

Check Column Stress Calculations (per Checklist 16.1.2LS & 16.9LS ; ASCE 41-13)

Mass Weight Calculation

	Location	Length ft	Wid / Ht ft	Area sq ft	Mass Wt psf or plf	Weight kip
R=0 ~ 17')	Roof (conc)	-	-	9935	60	596
R=17' ~ 58')	Roof (steel)	-	$A = \pi r^2$	908	20	18
(50% opening)	precast panels	218.3	6.5	710	55	39
	Columns ext	182.0	-	-	165	30
	Columns int	91.0	-	-	107	10
	Grand Total =			**9935**		**693**

Base shear V = 0.926 W

V= **642** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x	h_x	$w_x h_x$	Fx	Area	fi
	kip	ft	k-ft	kip	ft2	psf
Roof	693	13	9010	642	9935	64.6
	trib area(sq.ft)	**P_{DL}(k)**	**P_{LL}(k)**		**$P(k)=P_{DL}+0.25P_{LL}$**	
TYP ext column	235	14.1	4.7		15.3	
TYP Int column	270	10.8	5.4		12.2	

where : R_{LL}= 20 psf $R_{DL,ext}$= 60 psf $R_{DL,int\ (avg)}$= 40 psf

Quick Check Column Axial Stress under Gravity Load Only

Column Axial Stress Check (§A3.1.4.2 of ASCE 41-13):

P/Ag< 0.20f'c for Life Safety

P/Ag < 0.13f'c for Immediate Occupancy

P/Ag < f'c(0.2+0.13)/2=0.165f'c for Damage Control

0.165f'c =	**495**	psi	where f'c =	3000	psi
Ext. Column Section Area =	216	in^2	Int. Column Section Area =	140	in^2
Gravity Force P =	15.3	kips	Gravity Force P =	12.2	kips
Axial stress p =P/Ag=	**70.7**	psi	p =P/Ag=	**86.8**	psi
CHECK:	OK		**CHECK:**	OK	

Column Shear Stress Check (§A.3.1.4.1. Tier 2: §5.5.2.1.4):

			Limit (psi)	level	f'c(psi)
Check:	v < max(100, 2√f'c)	=	110	1st	3000

Shear corresponding to tirbutary area of a typical type "B1" frame is considered to calculated the stress. Whole area divided by 14 will result in tributary needed for typ. frame "B1" .

Level	M^*_s	$V_{j,frame\ 'B1'}$ (kips)	$A_{c,frame\ 'B1'}$ (in^2)	v_j^{avg} (psi)	Shear?
1st Flr	1.65	46	356	78	OK

*Ms = 2.0 for Life Safety
Ms = 1.3 for Immediate Occupancy

Strong-Column Weak-Beam Check(§A.3.1.4.7. Tier 2: §5.5.2.1.5)

Moment Capacity of a Typ. Column in frame "B1":
(from spColumn)

location	Mn +ve (k-ft)	Mn -ve (k-ft)
interior	79	64
exterior	170	139

Moment Capacity of the Beams in frame "B1":
(from spColumn)

Loc.	Mn +ve (k-ft)	Mn -ve (k-ft)
Interior	72	72
exterior	72	72

At a typical Frame "B1":

location	Mn col (k-ft)	Mn Beam (k-ft)	No. of Columns @ a Typ. Joint	No. of Beams @ a Typ. Joint	ΣMn Col @ Joint	ΣMn Bm @ Joint	SCWB Status
Interior	64	72	1	1	64	72	NG
exterior	139	72	1	1	139	72	OK

No Shear Failure Check:(§A.3.1.4.6. Tier 2: §5.5.2.3.4)

$V_u = 2M_n/h$, Vn=Vc+Vs --> Vu<Vn
(Flexural conrolled)

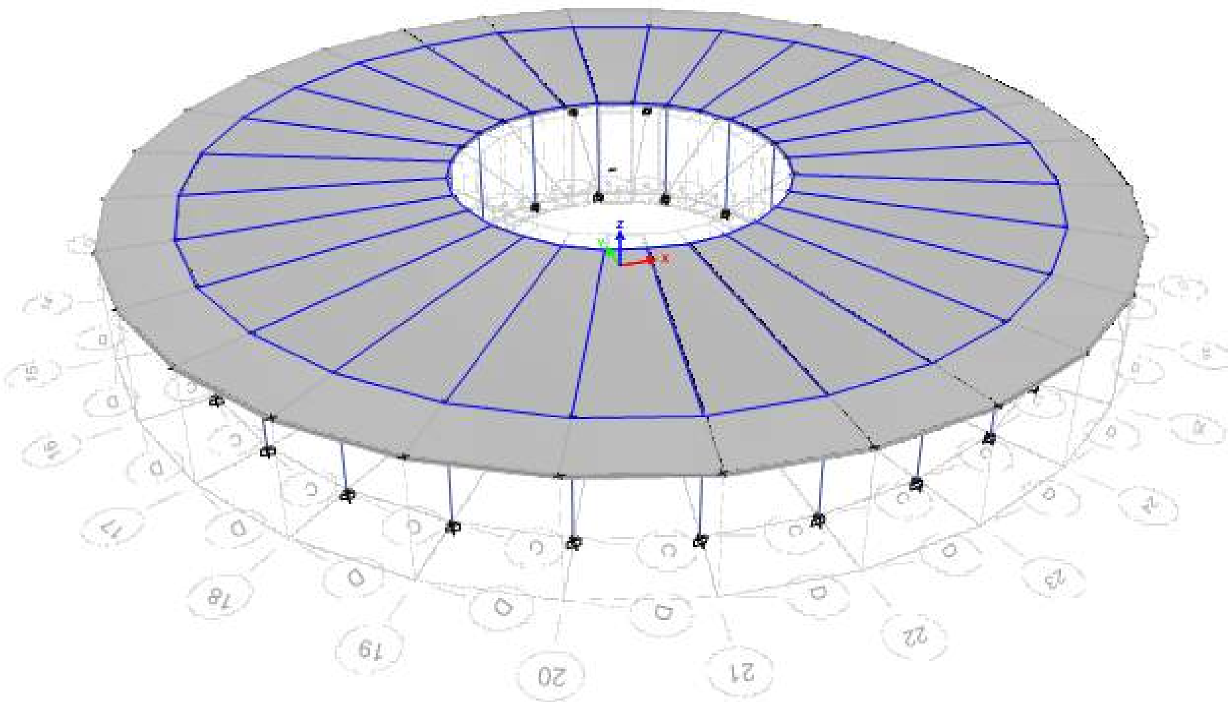
level	*h(ft)*
1st floor	*13*

Note: If tie spacing s < d/2, Vs is calculated; Otherwise, it is ignored.

Material props: **f'c=** 4500 psi **(expected values per table 10-1)**
fy= 50000 psi

Story	Frame Member location	COL SIZE b(in)	COL SIZE h(in)	Vertical Reinf. (No. of Bars) #Bar No./Size	Transverse Reinf. tie ϕ (in)	Transverse Reinf. spacing (in)	CAPACITY Mn (k-ft) [P=0] (per sPcol)	CAPACITY Vn (k)	CHECK Vu (k)	CHECK Status?
First	interior Col.	10	14	(2) #7 & (2)#8	3/8	8	74.0	18.8	11.4	OK
	exterior Col.	12	18	(2) #10 & (2)#9	3/8	8	163.0	29.0	25.1	OK
	Beam	12	16	(2) #7 T & B	3/8	8	72.0	25.8	4.8	OK

Tier 2 Calculation:



Seismic Mass Weight:

Roof

Roof area with 4" Light Weight Concrete Slab Roof

4" LW Slab *	37	psf
Concrete Bms*	13	psf
roofing	5	psf
MEP & Misc	6	psf
DL =	**60**	**psf**
RLL =	**20**	**psf**

Roof area covered at center

steel framing	10	psf
Ceiling	5	psf
Mep & Misc	5	psf
DL =	**20**	**psf**
RLL =	**20**	**psf**

* weight of concrete slab , beam and columns are being calculated by ETABS...only superimposed DL is added to model.

ETABS mass:

TABLE: Mass Summary by Story				
Story	**UX**	**UY**		**Weight**
	lb-s²/ft	lb-s²/ft		Kips
Roof	**22737.85**	**22737.85**		**732**
Base	1685.23	1685.23		

Base Shear Calculation - ASCE 41-13 - Linear Dynamic Procedure (LDP)

Seismic Parameters

Address:	27118 Silver Spur Rd, Rolling Hills Estates, CA 90274			
Latitude:	33.77058	**Longitude:**	-118.36910	
Site Class:	D			.... *(per default value)*
$S_{XS,BSE-1E}$ =	**0.712 g**	$S_{X1,BSE-1E}$ =	**0.395 g**	.... *(per USGS Map, BSE-1E)*

Characteristic Periods of the Response Spectrum

T_S =	0.555	Sec.			.... *(Eqn 2-9, ASCE 41-13)*
T_0 =	0.111	Sec.			.... *(Eqn 2-10, ASCE 41-13)*
T_L =	8	Sec.			.... *(Obtained from Fig 22-12, ASCE 7-10)*
B_1 =	1.00		Damping Ratio =	**0.05**	.... *(Eqn 2-11, ASCE 41-13)*

Base Shear Parameters

h_n =	13.00 ft				
C_t =	0.018		β =	**0.90**	.... *(§7.4.1.2.2, ASCE 41-13, Concrete moment frame System)*
$T = C_t h_n^{\beta}$ =	0.181	Sec.			.... *(Eqn 7-18, ASCE 41-13)*
W =	732	kips			.... *(Seismic Weight per ETABS Output)*
a =	60				.... *(§7.4.1.3.1, ASCE 41-13; site class D)*

	X-Dir	Y-Dir		
C_m =	1.000	1.000		.... *(Table 7-4, ASCE 41-13, 1 or 2 stories, Concrete Moment Frame)*
T_{ETABS} =	**0.487**	**0.487**		.... *(Eqn 2-6 to 2-8, ASCE 41-13, BSE-1E)*
S_a =	0.712	0.712		
DCR_{max} =	3.0	3.0		.... *(Max DCR per Eqn 7-16, ASCE 41-13)*
$\mu_{strength}$ =	2.000	2.000	$= DCR_{max}/1.5\ C_m \geq 1.0$	.... *(Eqn C7-3, ASCE 41-13)*
C_1 =	1.070	1.070	$= 1 + (\mu_{strength} - 1) / aT^2$	.... *(Eqn 7-22, ASCE 41-13)*
C_2 =	1.005	1.005	$= 1 + 1 / 800 ((\mu_{strength} - 1) / T)^2$	.... *(Eqn 7-23, ASCE 41-13)*
$C_1.C_2$ =	**1.076**	**1.076**	→ Used	.... *(§7.4.2.3, ASCE 41-13)*
$C_1.C_2$ =	1.400	1.400		.... *(Table 7-3, ASCE 41-13, $2 \leq m_{max} < 6$, $T \leq 0.3$, Alternate Value)*
V_{STATIC} =	**0.766 W**	**0.766 W**	$= C_1\ C_2\ C_m\ S_a\ W$	.... *(Eqn 7-21, ASCE 41-13, BSE-1E)*
V_{STATIC} =	**561**	**561**	kips	
$V_{DYN\ UNSCLD}$ =	393	389	kips	
V_{DYN} =	**0.578 W**	**0.572 W**	$= C_1\ C_2\ V_{DYN\ UNSCLD}$	
V_{DYN} =	**423**	**418**	kips	

Beam-column joint Check (Per 10.4.2.3.2 ;ASCE41-13, Tier 2)

Col ID	$f'c_{nominal}$ (psi)	ϒ (table 10-12)	λ	Joint depth (in)	Joint width (in)	Aj (in^2)	Vn=λϒ√f'c Aj (k)	V_{UF} (k)	DCR	Status
C1	3000	4	0.75	18	12	216	35.5	20.6	0.58	OK
C2	3000	4	0.75	14	10	140	23.0	18.4	0.80	OK
C3	3000	4	0.75	18	12	216	35.5	21.4	0.60	OK
C4	3000	4	0.75	14	10	140	23.0	19.1	0.83	OK
C5	3000	4	0.75	18	12	216	35.5	21.1	0.59	OK
C6	3000	4	0.75	14	10	140	23.0	18.9	0.82	OK
C7	3000	4	0.75	18	12	216	35.5	20.1	0.57	OK
C8	3000	4	0.75	14	10	140	23.0	18.0	0.78	OK
C9	3000	4	0.75	18	12	216	35.5	20.8	0.59	OK
C10	3000	4	0.75	14	10	140	23.0	18.6	0.81	OK
C11	3000	4	0.75	18	12	216	35.5	21.2	0.60	OK
C12	3000	4	0.75	14	10	140	23.0	18.9	0.82	OK
C13	3000	4	0.75	18	12	216	35.5	20.6	0.58	OK
C14	3000	4	0.75	14	10	140	23.0	18.4	0.80	OK
C15	3000	4	0.75	18	12	216	35.5	20.7	0.58	OK
C16	3000	4	0.75	14	10	140	23.0	18.4	0.80	OK
C17	3000	4	0.75	18	12	216	35.5	21.5	0.61	OK
C18	3000	4	0.75	14	10	140	23.0	19.1	0.83	OK
C19	3000	4	0.75	18	12	216	35.5	21.3	0.60	OK
C20	3000	4	0.75	14	10	140	23.0	18.9	0.82	OK
C21	3000	4	0.75	18	12	216	35.5	20.0	0.56	OK
C22	3000	4	0.75	14	10	140	23.0	17.9	0.78	OK
C23	3000	4	0.75	18	12	216	35.5	21.1	0.59	OK
C24	3000	4	0.75	14	10	140	23.0	18.6	0.81	OK
C25	3000	4	0.75	18	12	216	35.5	21.1	0.59	OK
C26	3000	4	0.75	14	10	140	23.0	18.9	0.82	OK
C27	3000	4	0.75	18	12	216	35.5	20.6	0.58	OK
C28	3000	4	0.75	14	10	140	23.0	18.4	0.80	OK
C29	3000	4	0.75	18	12	216	35.5	21.1	0.59	OK
C30	3000	4	0.75	18	12	216	35.5	21.4	0.60	OK
C31	3000	4	0.75	18	12	216	35.5	20.7	0.58	OK
C32	3000	4	0.75	18	12	216	35.5	20.4	0.58	OK
C33	3000	4	0.75	18	12	216	35.5	21.1	0.59	OK
C34	3000	4	0.75	18	12	216	35.5	20.9	0.59	OK
C35	3000	4	0.75	18	12	216	35.5	20.2	0.57	OK
C36	3000	4	0.75	18	12	216	35.5	21.2	0.60	OK
C37	3000	4	0.75	18	12	216	35.5	21.4	0.60	OK
C38	3000	4	0.75	18	12	216	35.5	20.8	0.59	OK
C39	3000	4	0.75	18	12	216	35.5	20.5	0.58	OK
C40	3000	4	0.75	18	12	216	35.5	21.1	0.59	OK
C41	3000	4	0.75	18	12	216	35.5	21.0	0.59	OK
C42	3000	4	0.75	18	12	216	35.5	19.9	0.56	OK

Reinforced Concrete Beams Flexure/Shear Check (Per ASCE41-13, Tier 2)

PVPUSD_PVP HS
Bldg # 2
Job number: 0215.768

for shear check: J= 1 ...per 7.1.2.1.2 (force controlled; applied in model load combo)
for Moment check: m= 1.375 ...per table 10-13(deformation controlled)

C_1 = **1.070** ... Eqn. 7-22
C_2 = **1.005** ... Eqn. 7-23

Knowledge Factor, κ = **0.75** ... §6.2.4

DCR up to max 5% over... considered acceptable

Level	ETABS Member ID	Length (ft)	Moment Demand Qud (ft-kips) $Q_{UD-BSE1}$	Shear Demand Quf (kips) $Q_{UF-BSE1}$	Width b_w (in)	Depth d (in)	nominal f'_c (psi)	nominal f_y (psi)	Top Reinforcement Reinf.	Top Reinforcement Area (in²)	Bottom Reinforcement Reinf.	Bottom Reinforcement Area (in²)	Moment Capacity a (in)	Moment Capacity j (-)	Moment Capacity c (in)	Moment Capacity ε_t (-)	Moment Capacity ϕ (-)	Moment Capacity ϕM_n (ft-kips)	Shear Capacity, ϕVn (ϕ=1.0) V_c (kips)	Shear Capacity, ϕVn (ϕ=1.0) Horizontal Reinforcement	Shear Capacity, ϕVn (ϕ=1.0) V_s (kips)	Shear Capacity, ϕVn (ϕ=1.0) ϕV_n (kips)	Moment Check BSE1 deformation controlled DCR ≤ 3.0?	Moment Check BSE1 deformation controlled Acceptance ≤ 1.0?	Moment Check BSE1 deformation controlled STATUS	Shear Check BSE1 Force controlled DCR ≤ 3.0?	Shear Check BSE1 Force controlled Acceptance ≤ 1.0?	Shear Check BSE1 Force controlled STATUS
ROOF	B1	30	80.2	22.9	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.04	1.01	NG	0.45	0.60	OK
ROOF	B2	30	81.4	12.3	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.06	1.03	NG	0.24	0.32	OK
ROOF	B3	30	81.2	10.2	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.06	1.02	NG	0.20	0.27	OK
ROOF	B4	30	76.4	10.8	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	0.99	0.96	OK	0.21	0.28	OK
ROOF	B5	30	80.4	10.8	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.05	1.01	NG	0.21	0.28	OK
ROOF	B6	30	81.3	10.1	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.06	1.03	NG	0.20	0.26	OK
ROOF	B7	30	78.3	11.8	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.02	0.99	OK	0.23	0.31	OK
ROOF	B8	30	80.0	22.8	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.04	1.01	NG	0.45	0.60	OK
ROOF	B9	30	82.6	12.3	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.07	1.04	NG	0.24	0.32	OK
ROOF	B10	30	82.0	10.5	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.07	1.03	NG	0.20	0.27	OK
ROOF	B11	30	76.3	10.5	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	0.99	0.96	OK	0.21	0.27	OK
ROOF	B12	30	81.0	11.2	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.05	1.02	NG	0.22	0.29	OK
ROOF	B13	30	81.7	10.2	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.06	1.03	NG	0.20	0.27	OK
ROOF	B14	30	77.8	11.8	12	16	3,000	40,000	2#7	1.20	2#7	1.20	1.31	0.96	1.59	0.03	1.00	76.9	19.1	#3 @ 4" (2)	32.0	51.1	1.01	0.98	OK	0.23	0.31	OK
ROOF	B15	30	81.6	12.1	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.80	0.78	OK	0.24	0.32	OK
ROOF	B16	30	81.9	10.1	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.81	0.78	OK	0.20	0.26	OK
ROOF	B17	30	77.9	10.2	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.77	0.74	OK	0.20	0.27	OK
ROOF	B18	30	79.0	22.4	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.78	0.75	OK	0.44	0.58	OK
ROOF	B19	30	80.6	10.5	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.79	0.77	OK	0.21	0.27	OK
ROOF	B20	30	80.7	10.2	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.79	0.77	OK	0.20	0.26	OK
ROOF	B21	30	75.7	10.6	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.75	0.72	OK	0.21	0.28	OK
ROOF	B22	30	81.8	11.3	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.81	0.78	OK	0.22	0.30	OK
ROOF	B23	30	83.1	10.5	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.82	0.79	OK	0.21	0.28	OK
ROOF	B24	30	78.6	10.5	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.77	0.75	OK	0.21	0.28	OK
ROOF	B25	30	79.1	22.4	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.78	0.75	OK	0.44	0.58	OK
ROOF	B26	30	81.3	10.8	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.80	0.78	OK	0.21	0.28	OK
ROOF	B27	30	80.6	10.2	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.79	0.77	OK	0.20	0.27	OK
ROOF	B28	30	76.3	10.8	12	16	3,000	40,000	2#6	0.88	2#8	1.57	0.96	0.97	1.17	0.04	1.00	101.6	19.1	#3 @ 4" (2)	32.0	51.1	0.75	0.73	OK	0.21	0.28	OK

Reinforced Concrete Columns Flexure/Shear Check (Per ASCE41-13, Tier 2)

PVPUSD_PVP HS
Bldg # 2
Job number: 0215.768

C_1 = **1.070** ... Eqn. 7-22
C_2 = **1.005** ... Eqn. 7-23

Knowledge Factor, κ = **0.750** ... §6.2.4

Load Combo: 1.1D+0.275L+E

Column	Level	Story	ETABS	Length	Axial Demand - P (kips)					Moment Demand - M3 (ft-kips)					Moment Demand - M2 (ft-kips)					Shear Demand - V2 (kips)					Shear Demand - V3 (kips)					Column Size		f'_c	f_y	M3-ϕM_n
GRID			Member ID	(ft)	Q_E Max	Q_{G1}	Q_{G2}	Q_G	Q_{UD}	Q_E Max	Q_{G1}	Q_{G2}	Q_G	$Q_{UD-BSE1}$	Q_E Max	Q_{G1}	Q_{G2}	Q_G	Q_{UD}	Q_E Max	Q_{G1}	Q_{G2}	Q_G	$Q_{UD-BSE1}$	Q_E Max	Q_{G1}	Q_{G2}	Q_G	$Q_{UD-BSE1}$	a_x (in)	a_y (in)	(psi)	(psi)	(ft-kips)
-	Roof	First	C1	13	3.8	20.4	15.6	20.4	24.2	165.5	25.8	19.8	25.8	191.3	108.5	0	0	0	108.8	17.1	3.5	2.7	3.5	20.6	12.2	0.0	0.0	0.0	12.2	12	18	4,500	50,000	129.4
-	Roof	First	C2	13	1.7	18.7	14.5	18.7	20.4	95.8	33.2	25.0	33.2	129.1	65.3	0	0	0	65.6	13.9	4.5	3.4	4.5	18.4	10.3	0.0	0.0	0.0	10.3	10	14	4,500	50,000	74.2
-	Roof	First	C3	13	4.0	15.8	11.9	15.8	19.9	173.1	26.0	19.8	26.0	199.1	112.7	1	0	1	113.4	17.9	3.5	2.7	3.5	21.4	12.7	0.1	0.0	0.1	12.8	12	18	4,500	50,000	127.2
-	Roof	First	C4	13	1.8	20.5	16.0	20.5	22.3	100.4	33.1	24.9	33.1	133.4	67.8	0	0	0	67.9	14.6	4.5	3.4	4.5	19.1	10.7	0.0	0.0	0.0	10.7	10	14	4,500	50,000	74.9
-	Roof	First	C5	13	4.3	15.5	11.6	15.5	19.8	171.2	25.2	19.3	25.2	196.4	113.5	1	1	1	114.4	17.7	3.4	2.6	3.4	21.1	13.1	0.1	0.1	0.1	13.3	12	18	4,500	50,000	127.2
-	Roof	First	C6	13	1.9	20.3	15.8	20.3	22.2	99.3	33.1	24.9	33.1	132.3	67.0	0	0	0	67.2	14.4	4.5	3.4	4.5	18.9	10.6	0.0	0.0	0.0	10.6	10	14	4,500	50,000	74.9
-	Roof	First	C7	13	4.1	19.8	15.2	19.8	23.9	159.6	26.9	20.6	26.9	186.6	105.3	2	1	2	106.8	16.5	3.6	2.8	3.6	20.1	12.0	0.2	0.1	0.2	12.2	12	18	4,500	50,000	129.3
-	Roof	First	C8	13	1.8	20.5	16.0	20.5	22.4	92.7	33.2	25.0	33.2	125.8	62.9	0	0	0	63.0	13.5	4.5	3.4	4.5	18.0	9.9	0.0	0.0	0.0	9.9	10	14	4,500	50,000	74.9
-	Roof	First	C9	13	3.7	16.0	12.0	16.0	19.7	168.2	25.1	19.1	25.1	193.2	102.3	1	1	1	103.0	17.4	3.4	2.6	3.4	20.8	11.6	0.1	0.1	0.1	11.7	12	18	4,500	50,000	127.2
-	Roof	First	C10	13	1.7	20.3	15.9	20.3	22.1	97.5	33.1	24.9	33.1	130.5	64.7	0	0	0	64.9	14.2	4.5	3.4	4.5	18.6	10.2	0.0	0.0	0.0	10.2	10	14	4,500	50,000	74.8
-	Roof	First	C11	13	3.9	15.9	11.9	15.9	19.7	170.6	26.2	20.0	26.2	196.9	100.1	1	0	1	100.8	17.6	3.5	2.7	3.5	21.2	11.3	0.0	0.0	0.0	11.4	12	18	4,500	50,000	127.2
-	Roof	First	C12	13	1.8	20.4	15.9	20.4	22.1	99.0	33.0	24.9	33.0	132.0	64.6	0	0	0	64.8	14.4	4.5	3.4	4.5	18.9	10.2	0.0	0.0	0.0	10.2	10	14	4,500	50,000	74.9
-	Roof	First	C13	13	3.7	18.2	13.8	18.2	21.9	165.1	25.7	19.6	25.7	190.8	93.2	1	1	1	94.4	17.1	3.5	2.7	3.5	20.6	10.5	0.1	0.1	0.1	10.7	12	18	4,500	50,000	128.3
-	Roof	First	C14	13	1.8	20.3	15.8	20.3	22.1	95.8	33.0	24.8	33.0	128.7	61.3	0	0	0	61.6	13.9	4.5	3.4	4.5	18.4	9.7	0.0	0.0	0.0	9.7	10	14	4,500	50,000	74.8
-	Roof	First	C15	13	4.1	20.0	15.3	20.0	24.1	165.4	26.2	20.0	26.2	191.6	87.8	0	0	0	88.2	17.1	3.6	2.7	3.6	20.7	9.9	0.0	0.0	0.0	10.0	12	18	4,500	50,000	129.4
-	Roof	First	C16	13	1.8	20.4	15.9	20.4	22.2	95.9	33.1	24.9	33.1	129.0	59.0	0	0	0	59.3	13.9	4.5	3.4	4.5	18.4	9.3	0.0	0.0	0.0	9.4	10	14	4,500	50,000	74.9
-	Roof	First	C17	13	4.2	20.0	15.3	20.0	24.2	173.0	26.8	20.5	26.8	199.8	90.2	1	0	1	90.9	17.9	3.6	2.8	3.6	21.5	10.2	0.1	0.0	0.1	10.3	12	18	4,500	50,000	129.4
-	Roof	First	C18	13	1.8	20.6	16.1	20.6	22.4	100.4	33.0	24.9	33.0	133.4	61.2	0	0	0	61.3	14.6	4.5	3.4	4.5	19.1	9.7	0.0	0.0	0.0	9.7	10	14	4,500	50,000	75.0
-	Roof	First	C19	13	3.9	20.4	15.6	20.4	24.2	171.2	26.4	20.2	26.4	197.6	90.7	1	1	1	91.8	17.7	3.6	2.7	3.6	21.3	10.3	0.2	0.1	0.2	10.4	12	18	4,500	50,000	129.5
-	Roof	First	C20	13	1.8	18.7	14.5	18.7	20.5	99.2	33.1	24.9	33.1	132.3	61.0	1	0	1	61.5	14.4	4.5	3.4	4.5	18.9	9.6	0.1	0.1	0.1	9.7	10	14	4,500	50,000	74.3
-	Roof	First	C21	13	3.6	15.9	11.9	15.9	19.5	159.9	25.1	19.2	25.1	185.0	91.3	0	0	0	91.5	16.6	3.4	2.6	3.4	20.0	10.3	0.0	0.0	0.0	10.3	12	18	4,500	50,000	127.0
-	Roof	First	C22	13	1.7	16.5	12.7	16.5	18.2	92.6	33.1	24.9	33.1	125.7	59.0	0	0	0	59.1	13.4	4.5	3.4	4.5	17.9	9.3	0.0	0.0	0.0	9.3	10	14	4,500	50,000	73.4
-	Roof	First	C23	13	3.7	20.5	15.7	20.5	24.3	168.0	27.1	20.7	27.1	195.1	100.9	1	1	1	101.8	17.4	3.7	2.8	3.7	21.1	11.4	0.2	0.1	0.2	11.6	12	18	4,500	50,000	129.5
-	Roof	First	C24	13	1.8	16.9	13.1	16.9	18.7	97.5	33.2	25.0	33.2	130.6	64.3	0	0	0	64.4	14.2	4.5	3.4	4.5	18.6	10.2	0.0	0.0	0.0	10.2	10	14	4,500	50,000	73.6
-	Roof	First	C25	13	3.9	15.9	11.9	15.9	19.8	170.8	25.0	19.1	25.0	195.9	106.0	0	0	0	106.5	17.7	3.4	2.6	3.4	21.1	12.0	0.0	0.0	0.0	12.0	12	18	4,500	50,000	127.2
-	Roof	First	C26	13	1.8	16.8	13.0	16.8	18.6	99.0	33.1	24.9	33.1	132.1	66.4	0	0	0	66.4	14.4	4.5	3.4	4.5	18.9	10.5	0.0	0.0	0.0	10.5	10	14	4,500	50,000	73.6
-	Roof	First	C27	13	3.7	16.0	12.0	16.0	19.6	165.1	26.2	20.0	26.2	191.3	105.1	1	1	1	105.8	17.1	3.5	2.7	3.5	20.6	11.8	0.1	0.1	0.1	11.9	12	18	4,500	50,000	127.1
-	Roof	First	C28	13	1.7	16.6	12.8	16.6	18.3	95.8	33.1	24.9	33.1	128.9	65.0	0	0	0	65.1	13.9	4.5	3.4	4.5	18.4	10.3	0.0	0.0	0.0	10.3	10	14	4,500	50,000	73.5
-	Roof	First	C29	13	3.9	18.4	13.9	18.4	22.3	170.3	25.7	19.7	25.7	196.0	114.9	1	1	1	116.2	17.6	3.5	2.6	3.5	21.1	13.4	0.2	0.2	0.2	13.6	12	18	4,500	50,000	89.1
-	Roof	First	C30	13	3.9	15.9	11.9	15.9	19.8	173.0	26.5	20.2	26.5	199.5	113.7	1	0	1	114.4	17.8	3.6	2.7	3.6	21.4	13.0	0.1	0.0	0.1	13.0	12	18	4,500	50,000	87.8
-	Roof	First	C31	13	4.0	19.2	14.6	19.2	23.2	166.4	26.3	20.1	26.3	192.6	119.0	3	3	3	122.1	17.2	3.5	2.7	3.5	20.7	14.7	0.4	0.3	0.4	15.1	12	18	4,500	50,000	89.6
-	Roof	First	C32	13	3.7	18.2	13.8	18.2	21.9	163.5	26.0	19.9	26.0	189.5	101.9	2	1	2	103.7	16.9	3.5	2.7	3.5	20.4	11.6	0.3	0.2	0.3	11.8	12	18	4,500	50,000	88.9
-	Roof	First	C33	13	3.8	16.0	12.0	16.0	19.8	170.1	26.3	20.0	26.3	196.4	102.3	0	0	0	102.7	17.6	3.5	2.7	3.5	21.1	11.6	0.0	0.0	0.0	11.6	12	18	4,500	50,000	87.9
-	Roof	First	C34	13	3.8	15.9	11.9	15.9	19.7	168.8	25.3	19.3	25.3	194.1	98.3	1	1	1	99.2	17.4	3.4	2.6	3.4	20.9	11.3	0.1	0.1	0.1	11.4	12	18	4,500	50,000	87.8
-	Roof	First	C35	13	3.9	20.9	16.0	20.9	24.7	159.1	27.6	21.1	27.6	186.7	92.2	3	2	3	95.3	16.4	3.7	2.9	3.7	20.2	10.9	0.4	0.3	0.4	11.2	12	18	4,500	50,000	90.3
-	Roof	First	C36	13	4.0	20.9	16.0	20.9	24.9	170.2	26.8	20.5	26.8	197.1	93.3	2	2	2	95.7	17.6	3.6	2.8	3.6	21.2	11.0	0.3	0.2	0.3	11.3	12	18	4,500	50,000	90.4
-	Roof	First	C37	13	3.9	20.4	15.6	20.4	24.3	173.1	25.9	19.8	25.9	199.0	91.5	1	0	1	92.2	17.9	3.5	2.7	3.5	21.4	10.5	0.1	0.0	0.1	10.5	12	18	4,500	50,000	90.1
-	Roof	First	C38	13	3.7	18.2	13.8	18.2	21.9	166.3	26.8	20.4	26.8	193.0	90.9	2	2	2	93.3	17.2	3.6	2.8	3.6	20.8	10.4	0.4	0.3	0.4	10.7	12	18	4,500	50,000	88.9
-	Roof	First	C39	13	3.7	18.1	13.8	18.1	21.9	163.5	26.2	20.0	26.2	189.7	96.8	1	1	1	98.3	16.9	3.6	2.7	3.6	20.5	11.0	0.2	0.1	0.2	11.2	12	18	4,500	50,000	88.9
-	Roof	First	C40	13	3.8	18.3	13.8	18.3	22.0	170.2	26.1	19.9	26.1	196.2	104.5	2	1	2	106.0	17.6	3.5	2.7	3.5	21.1	11.9	0.2	0.2	0.2	12.1	12	18	4,500	50,000	89.0
-	Roof	First	C41	13	3.8	15.9	11.9	15.9	19.7	168.7	26.2	20.0	26.2	194.9	107.7	1	1	1	108.4	17.4	3.5	2.7	3.5	21.0	12.3	0.1	0.1	0.1	12.5	12	18	4,500	50,000	87.8
-	Roof	First	C42	13	3.6	18.2	13.8	18.2	21.8	159.1	25.5	19.5	25.5	184.7	106.4	2	2	2	108.4	16.5	3.4	2.6	3.4	19.9	12.2	0.3	0.2	0.3	12.4	12	18	4,500	50,000	88.8

M2-ϕM_n	Shear Capacity, V2 - φVn (φ=1)				Shear Capacity, V3 - φVn (φ=1)				$P/A_g f'_c$	Shear Reinf. Ratio $\rho = A_v/b_w s$		s/d at Plastic Hinge		Hook Angle	Plastic Shear Demand $V_p = 2*M_p/L$ (kips)		$V_o = V_n/k$ (kips), Eq. 10-3 - BSE1						V_p/V_o BSE1		Column Condition, Table 10-11 BSE1		$V/b_w d\sqrt{f'_c}$ BSE1		m-Factor BSE1								
	V_c	Horizontal	V_s	ϕV_n	V_c	Horizontal	V_s	ϕV_n									V2			V3									3-3 Axis				2-2 Axis				
(ft-kips)	(kips)	Reinforcement	(kips)	(kips)	(kips)	Reinforcement	(kips)	(kips)	BSE1	V2	V3	V2	V3	90 or 135	V2	V3	λ	M/Vd	V_o	λ	M/Vd	V_o	3-3 axis	2-2 axis	3-3 axis	2-2 axis	3-3	2-2	IO	LS	CP	DC	IO	LS	CP	DC	DCR ≤ 3.0?
87.2	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.913	13.415	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.55	0.96	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.48
45.2	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.03	0.003	0.002	0.640	0.941	135 Deg.	11.423	6.955	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.20	1.30	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.74
86.0	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.576	13.233	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.61	1.01	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.56
45.6	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.04	0.003	0.002	0.640	0.941	135 Deg.	11.528	7.016	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.27	1.34	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.78
86.0	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.572	13.230	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.59	1.05	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.54
45.6	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.04	0.003	0.002	0.640	0.941	135 Deg.	11.521	7.012	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.25	1.33	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.77
87.1	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.896	13.406	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.52	0.96	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.44
45.6	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.04	0.003	0.002	0.640	0.941	135 Deg.	11.530	7.017	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.14	1.25	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.68
86.0	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.562	13.225	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.57	0.92	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.52
45.6	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.04	0.003	0.002	0.640	0.941	135 Deg.	11.514	7.008	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.22	1.28	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.74
86.0	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.565	13.227	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.59	0.90	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.55
45.6	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.04	0.003	0.002	0.640	0.941	135 Deg.	11.518	7.010	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.25	1.28	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.76
86.6	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.734	13.318	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.55	0.84	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.49
45.6	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.04	0.003	0.002	0.640	0.941	135 Deg.	11.514	7.008	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.19	1.22	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.72
87.2	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.908	13.412	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.56	0.79	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.48
45.6	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.04	0.003	0.002	0.640	0.941	135 Deg.	11.521	7.012	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.20	1.17	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.72
87.2	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.913	13.415	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.62	0.81	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.54
45.6	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.04	0.003	0.002	0.640	0.941	135 Deg.	11.535	7.020	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.27	1.21	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.78
87.2	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.919	13.418	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.60	0.82	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.53
45.2	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.03	0.003	0.002	0.640	0.941	135 Deg.	11.425	6.956	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.25	1.22	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.78
85.9	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.545	13.216	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.50	0.82	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.46
44.7	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.03	0.003	0.002	0.640	0.941	135 Deg.	11.297	6.883	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.14	1.17	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.71
87.2	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.921	13.419	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.59	0.91	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.51
44.8	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.03	0.003	0.002	0.640	0.941	135 Deg.	11.326	6.899	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.22	1.27	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.77
86.0	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.568	13.229	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.59	0.95	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.54
44.8	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.03	0.003	0.002	0.640	0.941	135 Deg.	11.318	6.895	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.25	1.31	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.80
85.9	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	19.557	13.222	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.55	0.94	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.50
44.8	16.8	#3 @ 8" (2)	17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.03	0.003	0.002	0.640	0.941	135 Deg.	11.303	6.886	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	2.19	1.29	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.75
83.7	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.704	12.872	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.59	1.07	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.20
83.0	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.515	12.767	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.61	1.03	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.27
83.9	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.778	12.912	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.56	1.19	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.15
83.6	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.674	12.855	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.54	0.93	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.13
83.0	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.517	12.768	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.59	0.92	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.24
83.0	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.508	12.763	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.57	0.90	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.21
84.3	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.03	0.002	0.002	0.485	0.762	135 Deg.	13.893	12.976	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.52	0.89	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.07
84.4	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.03	0.002	0.002	0.485	0.762	135 Deg.	13.906	12.983	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.60	0.89	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.18
84.2	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.03	0.002	0.002	0.485	0.762	135 Deg.	13.862	12.959	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.61	0.83	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.21
83.6	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.680	12.858	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.57	0.85	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.17
83.6	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.673	12.855	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.54	0.88	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.13
83.6	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.687	12.862	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.59	0.96	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.21
83.0	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.508	12.763	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.58	0.98	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.22
83.5	26.6	#3 @ 8" (2)	22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.02	0.002	0.002	0.485	0.762	135 Deg.	13.668	12.852	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.50	0.98	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	2.08

Moment Check BSE1					Shear Check BSE1					
3-3 Axis		2-2 Axis			3-3 Axis			2-2 Axis		
Acceptance ≤ 1.0?	STATUS	DCR ≤ 3.0?	Acceptance ≤ 1.0?	STATUS	DCR ≤ 3.0?	Acceptance ≤ 1.0?	STATUS	DCR ≤ 3.0?	Acceptance ≤ 1.0?	STATUS
0.98	OK	1.25	1.16	NG	0.42	0.56	OK	0.31	0.41	OK
1.40	NG	1.45	1.28	NG	0.54	0.72	OK	0.37	0.50	OK
1.03	NG	1.32	1.22	NG	0.43	0.58	OK	0.32	0.43	OK
1.43	NG	1.49	1.31	NG	0.56	0.75	OK	0.39	0.52	OK
1.02	NG	1.33	1.23	NG	0.43	0.57	OK	0.33	0.44	OK
1.42	NG	1.47	1.29	NG	0.56	0.74	OK	0.38	0.51	OK
0.95	OK	1.23	1.14	NG	0.41	0.54	OK	0.31	0.41	OK
1.35	NG	1.38	1.21	NG	0.53	0.70	OK	0.36	0.48	OK
1.00	NG	1.20	1.11	NG	0.42	0.56	OK	0.29	0.39	OK
1.40	NG	1.43	1.25	NG	0.55	0.73	OK	0.37	0.49	OK
1.02	NG	1.17	1.09	NG	0.43	0.57	OK	0.29	0.38	OK
1.42	NG	1.42	1.25	NG	0.55	0.74	OK	0.37	0.49	OK
0.98	OK	1.09	1.01	NG	0.42	0.56	OK	0.27	0.36	OK
1.38	NG	1.35	1.19	NG	0.54	0.72	OK	0.35	0.47	OK
0.98	OK	1.01	0.94	OK	0.42	0.56	OK	0.25	0.33	OK
1.38	NG	1.30	1.14	NG	0.54	0.72	OK	0.34	0.45	OK
1.02	NG	1.04	0.97	OK	0.44	0.58	OK	0.26	0.34	OK
1.43	NG	1.34	1.18	NG	0.56	0.75	OK	0.35	0.47	OK
1.01	NG	1.05	0.98	OK	0.43	0.58	OK	0.26	0.35	OK
1.43	NG	1.36	1.20	NG	0.55	0.74	OK	0.35	0.47	OK
0.96	OK	1.07	0.99	OK	0.40	0.54	OK	0.26	0.35	OK
1.37	NG	1.32	1.16	NG	0.53	0.70	OK	0.34	0.45	OK
1.00	OK	1.17	1.08	NG	0.43	0.57	OK	0.29	0.39	OK
1.42	NG	1.44	1.26	NG	0.55	0.73	OK	0.37	0.49	OK
1.02	NG	1.24	1.15	NG	0.43	0.57	OK	0.30	0.40	OK
1.44	NG	1.48	1.30	NG	0.55	0.74	OK	0.38	0.50	OK
0.99	OK	1.23	1.14	NG	0.42	0.56	OK	0.30	0.40	OK
1.41	NG	1.45	1.28	NG	0.54	0.72	OK	0.37	0.49	OK
1.45	NG	1.39	1.29	NG	0.43	0.57	OK	0.34	0.45	OK
1.50	NG	1.38	1.28	NG	0.43	0.58	OK	0.33	0.44	OK
1.42	NG	1.46	1.35	NG	0.42	0.56	OK	0.38	0.51	OK
1.41	NG	1.24	1.15	NG	0.41	0.55	OK	0.30	0.40	OK
1.48	NG	1.24	1.15	NG	0.43	0.57	OK	0.29	0.39	OK
1.46	NG	1.20	1.11	NG	0.42	0.56	OK	0.29	0.38	OK
1.37	NG	1.13	1.05	NG	0.41	0.55	OK	0.28	0.38	OK
1.44	NG	1.13	1.05	NG	0.43	0.57	OK	0.28	0.38	OK
1.46	NG	1.09	1.01	NG	0.43	0.58	OK	0.26	0.35	OK
1.43	NG	1.12	1.03	NG	0.42	0.56	OK	0.27	0.36	OK
1.41	NG	1.18	1.09	NG	0.41	0.55	OK	0.28	0.37	OK
1.46	NG	1.27	1.18	NG	0.43	0.57	OK	0.30	0.41	OK
1.47	NG	1.31	1.21	NG	0.42	0.57	OK	0.31	0.42	OK
1.37	NG	1.30	1.20	NG	0.40	0.54	OK	0.31	0.42	OK

Reinforced Concrete Columns Flexure/Shear Check (Per ASCE41-13, Tier 2)

PVPUSD_PVP HS
Bldg # 2
Job number: 0215.768

C_1 = 1.070 ... Eqn. 7-22
C_2 = 1.005 ... Eqn. 7-23

Knowledge Factor, κ = 0.750 ... §6.2.4

Load Combo: 0.9D-E

																																		Shear Capacity, V2 -	
Column	Level	Story	ETABS	Length	Axial Demand - P (kips)					Moment Demand - M3 (ft-kips)					Moment Demand - M2 (ft-kips)					Shear Demand - V2 (kips)					Shear Demand - V3 (kips)					Column Size		f'_c	f_y	M3-ϕM_n	M2-ϕM_n	V_c	Horizontal
GRID			Member ID	(ft)	Q_E Max	Q_{G1}	Q_{G2}	Q_G	Q_{UD}	Q_E Max	Q_{G1}	Q_{G2}	Q_G	$Q_{UD\text{-}BSE1}$	Q_E Max	Q_{G1}	Q_{G2}	Q_G	Q_{UD}	Q_E Max	Q_{G1}	Q_{G2}	Q_G	$Q_{UD\text{-}BSE1}$	Q_E Max	Q_{G1}	Q_{G2}	Q_G	$Q_{UD\text{-}BSE1}$	a_x (in)	a_y (in)	(psi)	(psi)	(ft-kips)	(ft-kips)	(kips)	Reinforcement
-	Roof	First	C1	13	3.8	20.4	15.6	15.6	11.9	165.5	25.8	19.8	19.8	145.7	108.5	0	0	0	108.3	17.1	3.5	2.7	2.7	14.5	12.2	0.0	0.0	0.0	12.2	12	18	4,500	50,000	123.1	83.8	26.6	#3 @ 8" (2)
-	Roof	First	C2	13	1.7	18.7	14.5	14.5	12.8	95.8	33.2	25.0	25.0	70.8	65.3	0	0	0	65.0	13.9	4.5	3.4	3.4	10.5	10.3	0.0	0.0	0.0	10.3	10	14	4,500	50,000	71.5	43.6	16.8	#3 @ 8" (2)
-	Roof	First	C3	13	4.0	15.8	11.9	11.9	7.8	173.1	26.0	19.8	19.8	153.3	112.7	1	0	0	112.2	17.9	3.5	2.7	2.7	15.2	12.7	0.1	0.0	0.0	12.7	12	18	4,500	50,000	121.0	82.7	26.6	#3 @ 8" (2)
-	Roof	First	C4	13	1.8	20.5	16.0	16.0	14.2	100.4	33.1	24.9	24.9	75.5	67.8	0	0	0	67.8	14.6	4.5	3.4	3.4	11.2	10.7	0.0	0.0	0.0	10.7	10	14	4,500	50,000	72.0	43.9	16.8	#3 @ 8" (2)
-	Roof	First	C5	13	4.3	15.5	11.6	11.6	7.3	171.2	25.2	19.3	19.3	151.9	113.5	1	1	1	112.9	17.7	3.4	2.6	2.6	15.1	13.1	0.1	0.1	0.1	13.0	12	18	4,500	50,000	120.8	82.5	26.6	#3 @ 8" (2)
-	Roof	First	C6	13	1.9	20.3	15.8	15.8	13.9	99.3	33.1	24.9	24.9	74.3	67.0	0	0	0	66.9	14.4	4.5	3.4	3.4	11.0	10.6	0.0	0.0	0.0	10.6	10	14	4,500	50,000	71.9	43.8	16.8	#3 @ 8" (2)
-	Roof	First	C7	13	4.1	19.8	15.2	15.2	11.0	159.6	26.9	20.6	20.6	139.1	105.3	2	1	1	104.2	16.5	3.6	2.8	2.8	13.7	12.0	0.2	0.1	0.1	11.9	12	18	4,500	50,000	122.7	83.5	26.6	#3 @ 8" (2)
-	Roof	First	C8	13	1.8	20.5	16.0	16.0	14.2	92.7	33.2	25.0	25.0	67.7	62.9	0	0	0	62.8	13.5	4.5	3.4	3.4	10.1	9.9	0.0	0.0	0.0	9.9	10	14	4,500	50,000	72.0	43.9	16.8	#3 @ 8" (2)
-	Roof	First	C9	13	3.7	16.0	12.0	12.0	8.2	168.2	25.1	19.1	19.1	149.0	102.3	1	1	1	101.8	17.4	3.4	2.6	2.6	14.8	11.6	0.1	0.1	0.1	11.5	12	18	4,500	50,000	121.2	82.8	26.6	#3 @ 8" (2)
-	Roof	First	C10	13	1.7	20.3	15.9	15.9	14.1	97.5	33.1	24.9	24.9	72.6	64.7	0	0	0	64.6	14.2	4.5	3.4	3.4	10.8	10.2	0.0	0.0	0.0	10.2	10	14	4,500	50,000	71.9	43.9	16.8	#3 @ 8" (2)
-	Roof	First	C11	13	3.9	15.9	11.9	11.9	8.0	170.6	26.2	20.0	20.0	150.7	100.1	1	0	0	99.7	17.6	3.5	2.7	2.7	14.9	11.3	0.0	0.0	0.0	11.3	12	18	4,500	50,000	121.1	82.7	26.6	#3 @ 8" (2)
-	Roof	First	C12	13	1.8	20.4	15.9	15.9	14.1	99.0	33.0	24.9	24.9	74.2	64.6	0	0	0	64.5	14.4	4.5	3.4	3.4	11.0	10.2	0.0	0.0	0.0	10.2	10	14	4,500	50,000	72.0	43.9	16.8	#3 @ 8" (2)
-	Roof	First	C13	13	3.7	18.2	13.8	13.8	10.2	165.1	25.7	19.6	19.6	145.5	93.2	1	1	1	92.1	17.1	3.5	2.7	2.7	14.4	10.5	0.1	0.1	0.1	10.4	12	18	4,500	50,000	122.2	83.3	26.6	#3 @ 8" (2)
-	Roof	First	C14	13	1.8	20.3	15.8	15.8	14.1	95.8	33.0	24.8	24.8	70.9	61.3	0	0	0	61.2	13.9	4.5	3.4	3.4	10.5	9.7	0.0	0.0	0.0	9.7	10	14	4,500	50,000	71.9	43.9	16.8	#3 @ 8" (2)
-	Roof	First	C15	13	4.1	20.0	15.3	15.3	11.2	165.4	26.2	20.0	20.0	145.4	87.8	0	0	0	87.4	17.1	3.6	2.7	2.7	14.4	9.9	0.0	0.0	0.0	9.9	12	18	4,500	50,000	122.7	83.6	26.6	#3 @ 8" (2)
-	Roof	First	C16	13	1.8	20.4	15.9	15.9	14.1	95.9	33.1	24.9	24.9	70.9	59.0	0	0	0	58.9	13.9	4.5	3.4	3.4	10.6	9.3	0.0	0.0	0.0	9.3	10	14	4,500	50,000	72.0	43.9	16.8	#3 @ 8" (2)
-	Roof	First	C17	13	4.2	20.0	15.3	15.3	11.1	173.0	26.8	20.5	20.5	152.5	90.2	1	0	0	89.7	17.9	3.6	2.8	2.8	15.1	10.2	0.1	0.0	0.0	10.2	12	18	4,500	50,000	122.7	83.6	26.6	#3 @ 8" (2)
-	Roof	First	C18	13	1.8	20.6	16.1	16.1	14.2	100.4	33.0	24.9	24.9	75.5	61.2	0	0	0	61.1	14.6	4.5	3.4	3.4	11.2	9.7	0.0	0.0	0.0	9.6	10	14	4,500	50,000	72.0	43.9	16.8	#3 @ 8" (2)
-	Roof	First	C19	13	3.9	20.4	15.6	15.6	11.7	171.2	26.4	20.2	20.2	151.0	90.7	1	1	1	90.0	17.7	3.6	2.7	2.7	15.0	10.3	0.2	0.1	0.1	10.1	12	18	4,500	50,000	123.0	83.7	26.6	#3 @ 8" (2)
-	Roof	First	C20	13	1.8	18.7	14.5	14.5	12.7	99.2	33.1	24.9	24.9	74.3	61.0	1	0	0	60.6	14.4	4.5	3.4	3.4	11.0	9.6	0.1	0.1	0.1	9.6	10	14	4,500	50,000	71.4	43.6	16.8	#3 @ 8" (2)
-	Roof	First	C21	13	3.6	15.9	11.9	11.9	8.4	159.9	25.1	19.2	19.2	140.7	91.3	0	0	0	91.1	16.6	3.4	2.6	2.6	14.0	10.3	0.0	0.0	0.0	10.3	12	18	4,500	50,000	121.3	82.8	26.6	#3 @ 8" (2)
-	Roof	First	C22	13	1.7	16.5	12.7	12.7	11.1	92.6	33.1	24.9	24.9	67.7	59.0	0	0	0	59.0	13.4	4.5	3.4	3.4	10.1	9.3	0.0	0.0	0.0	9.3	10	14	4,500	50,000	70.8	43.2	16.8	#3 @ 8" (2)
-	Roof	First	C23	13	3.7	20.5	15.7	15.7	12.0	168.0	27.1	20.7	20.7	147.3	100.9	1	1	1	100.2	17.4	3.7	2.8	2.8	14.6	11.4	0.2	0.1	0.1	11.3	12	18	4,500	50,000	123.2	83.8	26.6	#3 @ 8" (2)
-	Roof	First	C24	13	1.8	16.9	13.1	13.1	11.3	97.5	33.2	25.0	25.0	72.5	64.3	0	0	0	64.3	14.2	4.5	3.4	3.4	10.8	10.2	0.0	0.0	0.0	10.1	10	14	4,500	50,000	70.9	43.3	16.8	#3 @ 8" (2)
-	Roof	First	C25	13	3.9	15.9	11.9	11.9	8.0	170.8	25.0	19.1	19.1	151.7	106.0	0	0	0	105.7	17.7	3.4	2.6	2.6	15.1	12.0	0.0	0.0	0.0	12.0	12	18	4,500	50,000	121.1	82.7	26.6	#3 @ 8" (2)
-	Roof	First	C26	13	1.8	16.8	13.0	13.0	11.2	99.0	33.1	24.9	24.9	74.1	66.4	0	0	0	66.4	14.4	4.5	3.4	3.4	11.0	10.5	0.0	0.0	0.0	10.5	10	14	4,500	50,000	70.9	43.3	16.8	#3 @ 8" (2)
-	Roof	First	C27	13	3.7	16.0	12.0	12.0	8.3	165.1	26.2	20.0	20.0	145.1	105.1	1	1	1	104.6	17.1	3.5	2.7	2.7	14.4	11.8	0.1	0.1	0.1	11.7	12	18	4,500	50,000	121.3	82.8	26.6	#3 @ 8" (2)
-	Roof	First	C28	13	1.7	16.6	12.8	12.8	11.1	95.8	33.1	24.9	24.9	70.8	65.0	0	0	0	64.9	13.9	4.5	3.4	3.4	10.5	10.3	0.0	0.0	0.0	10.2	10	14	4,500	50,000	70.8	43.2	16.8	#3 @ 8" (2)
-	Roof	First	C29	13	3.9	18.4	13.9	13.9	10.1	170.3	25.7	19.7	19.7	150.6	114.9	1	1	1	113.8	17.6	3.5	2.6	2.6	15.0	13.4	0.2	0.2	0.2	13.2	12	18	4,500	50,000	82.9	80.3	26.6	#3 @ 8" (2)
-	Roof	First	C30	13	3.9	15.9	11.9	11.9	8.0	173.0	26.5	20.2	20.2	152.7	113.7	1	0	0	113.2	17.8	3.6	2.7	2.7	15.1	13.0	0.1	0.0	0.0	12.9	12	18	4,500	50,000	81.9	79.7	26.6	#3 @ 8" (2)
-	Roof	First	C31	13	4.0	19.2	14.6	14.6	10.6	166.4	26.3	20.1	20.1	146.3	119.0	3	3	3	116.4	17.2	3.5	2.7	2.7	14.5	14.7	0.4	0.3	0.3	14.4	12	18	4,500	50,000	83.2	80.4	26.6	#3 @ 8" (2)
-	Roof	First	C32	13	3.7	18.2	13.8	13.8	10.1	163.5	26.0	19.9	19.9	143.6	101.9	2	1	1	100.4	16.9	3.5	2.7	2.7	14.2	11.6	0.3	0.2	0.2	11.3	12	18	4,500	50,000	83.0	80.3	26.6	#3 @ 8" (2)
-	Roof	First	C33	13	3.8	16.0	12.0	12.0	8.2	170.1	26.3	20.0	20.0	150.1	102.3	0	0	0	102.0	17.6	3.5	2.7	2.7	14.9	11.6	0.0	0.0	0.0	11.6	12	18	4,500	50,000	82.0	79.8	26.6	#3 @ 8" (2)
-	Roof	First	C34	13	3.8	15.9	11.9	11.9	8.1	168.8	25.3	19.3	19.3	149.5	98.3	1	1	1	97.6	17.4	3.4	2.6	2.6	14.8	11.3	0.1	0.1	0.1	11.2	12	18	4,500	50,000	81.9	79.7	26.6	#3 @ 8" (2)
-	Roof	First	C35	13	3.9	20.9	16.0	16.0	12.1	159.1	27.6	21.1	21.1	138.0	92.2	3	2	2	89.9	16.4	3.7	2.9	2.9	13.6	10.9	0.4	0.3	0.3	10.6	12	18	4,500	50,000	84.0	80.8	26.6	#3 @ 8" (2)
-	Roof	First	C36	13	4.0	20.9	16.0	16.0	12.0	170.2	26.8	20.5	20.5	149.7	93.3	2	2	2	91.4	17.6	3.6	2.8	2.8	14.8	11.0	0.3	0.2	0.2	10.8	12	18	4,500	50,000	83.9	80.8	26.6	#3 @ 8" (2)
-	Roof	First	C37	13	3.9	20.4	15.6	15.6	11.6	173.1	25.9	19.8	19.8	153.2	91.5	1	0	0	91.1	17.9	3.5	2.7	2.7	15.2	10.5	0.1	0.0	0.0	10.4	12	18	4,500	50,000	83.7	80.7	26.6	#3 @ 8" (2)
-	Roof	First	C38	13	3.7	18.2	13.8	13.8	10.1	166.3	26.8	20.4	20.4	145.8	90.9	2	2	2	89.0	17.2	3.6	2.8	2.8	14.4	10.4	0.4	0.3	0.3	10.1	12	18	4,500	50,000	83.0	80.3	26.6	#3 @ 8" (2)
-	Roof	First	C39	13	3.7	18.1	13.8	13.8	10.0	163.5	26.2	20.0	20.0	143.5	96.8	1	1	1	95.7	16.9	3.6	2.7	2.7	14.2	11.0	0.2	0.1	0.1	10.9	12	18	4,500	50,000	82.9	80.3	26.6	#3 @ 8" (2)
-	Roof	First	C40	13	3.8	18.3	13.8	13.8	10.1	170.2	26.1	19.9	19.9	150.3	104.5	2	1	1	103.3	17.6	3.5	2.7	2.7	14.9	11.9	0.2	0.2	0.2	11.7	12	18	4,500	50,000	82.9	80.3	26.6	#3 @ 8" (2)
-	Roof	First	C41	13	3.8	15.9	11.9	11.9	8.1	168.7	26.2	20.0	20.0	148.7	107.7	1	1	1	107.2	17.4	3.5	2.7	2.7	14.7	12.3	0.1	0.1	0.1	12.2	12	18	4,500	50,000	82.0	79.7	26.6	#3 @ 8" (2)
-	Roof	First	C42	13	3.6	18.2	13.8	13.8	10.3	159.1	25.5	19.5	19.5	139.6	106.4	2	2	2	104.7	16.5	3.4	2.6	2.6	13.8	12.2	0.3	0.2	0.2	11.9	12	18	4,500	50,000	83.0	80.3	26.6	#3 @ 8" (2)

ϕV_n (ϕ=1)		Shear Capacity, V3 - ϕV_n (ϕ=1)					Shear Reinf. Ratio					Plastic Shear Demand		$V_o = V_n/k$ (kips), Eq. 10-3 - BSE1						V_p/V_o		Column Condition, Table 10-11		$V/b_w d\sqrt{f'_c}$		m-Factor BSE1								Moment Check BSE1					
V_s	ϕV_n	V_c	Horizontal	V_s	ϕV_n	$P/A_g f'_c$	$\rho = A_v/b_w s$		s/d at Plastic Hinge		Hook Angle	$V_p = 2{*}M_p/L$ (kips)		V2			V3			BSE1		BSE1		BSE1		3-3 Axis				2-2 Axis				3-3 Axis			2-2 Axis		
(kips)	(kips)	(kips)	Reinforcement	(kips)	(kips)	BSE1	V2	V3	V2	V3	90 or 135	V2	V3	λ	M/Vd	V_o	λ	M/Vd	V_o	3-3 axis	2-2 axis	3-3 axis	2-2 axis	3-3	2-2	IO	LS	CP	DC	IO	LS	CP	DC	DCR ≤ 3.0?	Acceptance ≤ 1.0?	STATUS	DCR ≤ 3.0?	Acceptance ≤ 1.0?	STATUS
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.939	12.889	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.09	0.96	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.18	0.78	OK	1.29	1.20	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	10.994	6.708	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.26	1.29	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	0.99	0.80	OK	1.49	1.31	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.620	12.716	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.15	1.00	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.27	0.84	OK	1.36	1.26	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	11.072	6.753	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.34	1.34	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.05	0.84	OK	1.54	1.36	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.578	12.693	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.14	1.03	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.26	0.83	OK	1.37	1.27	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	11.058	6.745	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.32	1.32	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.03	0.83	OK	1.53	1.34	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.873	12.853	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.03	0.94	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.13	0.75	OK	1.25	1.16	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	11.072	6.753	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.20	1.24	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	0.94	0.75	OK	1.43	1.26	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.650	12.733	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.12	0.91	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.23	0.81	OK	1.23	1.14	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	11.069	6.751	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.29	1.28	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.01	0.81	OK	1.47	1.29	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.636	12.725	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.13	0.89	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.24	0.82	OK	1.20	1.12	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	11.070	6.752	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.31	1.27	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.03	0.83	OK	1.47	1.29	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.804	12.816	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.09	0.82	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.19	0.79	OK	1.11	1.03	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	11.068	6.751	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.26	1.21	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	0.99	0.79	OK	1.39	1.23	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.884	12.859	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.09	0.78	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.18	0.78	OK	1.05	0.97	OK
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	11.070	6.752	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.26	1.16	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	0.99	0.79	OK	1.34	1.18	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.878	12.856	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.14	0.80	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.24	0.82	OK	1.07	1.00	OK
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	11.076	6.755	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.34	1.21	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.05	0.84	OK	1.39	1.22	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.927	12.882	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.13	0.80	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.23	0.81	OK	1.07	1.00	OK
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	10.991	6.707	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.32	1.20	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.04	0.84	OK	1.39	1.22	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.664	12.740	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.05	0.81	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.16	0.77	OK	1.10	1.02	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	10.897	6.653	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.20	1.17	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	0.96	0.77	OK	1.36	1.20	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.947	12.893	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.10	0.89	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.20	0.79	OK	1.20	1.11	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	10.912	6.661	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.28	1.27	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.02	0.82	OK	1.48	1.30	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.629	12.721	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.14	0.94	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.25	0.83	OK	1.28	1.18	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	10.904	6.657	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.31	1.31	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.04	0.84	OK	1.53	1.35	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	18.655	12.735	0.75	2.000	48.9	0.75	4.000	27.5	0.4	0.5	i	ii	1.08	0.93	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.20	0.79	OK	1.26	1.17	NG
17.3	34.0	16.0	#3 @ 8" (2)	11.7	27.7	0.02	0.003	0.002	0.640	0.941	135 Deg.	10.897	6.653	0.75	2.000	34.2	0.75	4.000	20.2	0.3	0.3	ii	ii	1.26	1.28	1.53	1.79	2.06	1.66	1.41	1.62	1.83	1.52	1.00	0.80	OK	1.50	1.32	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.760	12.349	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.13	1.04	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.82	1.20	NG	1.42	1.31	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.604	12.263	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.14	1.02	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.86	1.23	NG	1.42	1.32	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.801	12.372	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.09	1.14	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.76	1.16	NG	1.45	1.34	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.762	12.350	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.07	0.89	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.73	1.14	NG	1.25	1.16	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.619	12.271	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.12	0.92	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.83	1.21	NG	1.28	1.19	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.606	12.264	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.12	0.88	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.82	1.21	NG	1.22	1.14	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.917	12.436	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.02	0.83	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.64	1.09	NG	1.11	1.03	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.911	12.433	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.12	0.85	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.78	1.18	NG	1.13	1.05	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.883	12.418	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.5	i	ii	1.14	0.82	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.83	1.21	NG	1.13	1.05	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.765	12.352	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.08	0.80	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.76	1.16	NG	1.11	1.03	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.759	12.349	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.07	0.86	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.73	1.14	NG	1.19	1.11	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.761	12.350	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.12	0.92	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.81	1.20	NG	1.29	1.19	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.612	12.268	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.11	0.97	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.81	1.20	NG	1.34	1.25	NG
22.8	49.3	25.4	#3 @ 8" (2)	14.5	39.9	0.01	0.002	0.002	0.485	0.762	135 Deg.	12.777	12.359	0.75	2.000	48.9	0.75	4.000	27.5	0.3	0.4	i	ii	1.04	0.94	2.00	2.04	2.63	2.02	1.35	1.53	1.70	1.44	1.68	1.11	NG	1.30	1.21	NG

Shear Check BSE1					
3-3 Axis			2-2 Axis		
DCR ≤ 3.0?	Acceptance ≤ 1.0?	STATUS	DCR ≤ 3.0?	Acceptance ≤ 1.0?	STATUS
0.29	0.39	OK	0.31	0.41	OK
0.31	0.41	OK	0.37	0.49	OK
0.31	0.41	OK	0.32	0.42	OK
0.33	0.44	OK	0.39	0.51	OK
0.31	0.41	OK	0.33	0.43	OK
0.32	0.43	OK	0.38	0.51	OK
0.28	0.37	OK	0.30	0.40	OK
0.30	0.39	OK	0.36	0.48	OK
0.30	0.40	OK	0.29	0.38	OK
0.32	0.42	OK	0.37	0.49	OK
0.30	0.40	OK	0.28	0.38	OK
0.32	0.43	OK	0.37	0.49	OK
0.29	0.39	OK	0.26	0.35	OK
0.31	0.41	OK	0.35	0.46	OK
0.29	0.39	OK	0.25	0.33	OK
0.31	0.41	OK	0.34	0.45	OK
0.31	0.41	OK	0.26	0.34	OK
0.33	0.44	OK	0.35	0.46	OK
0.30	0.40	OK	0.25	0.34	OK
0.32	0.43	OK	0.35	0.46	OK
0.28	0.38	OK	0.26	0.35	OK
0.30	0.40	OK	0.34	0.45	OK
0.30	0.39	OK	0.28	0.38	OK
0.32	0.42	OK	0.37	0.49	OK
0.31	0.41	OK	0.30	0.40	OK
0.32	0.43	OK	0.38	0.50	OK
0.29	0.39	OK	0.29	0.39	OK
0.31	0.41	OK	0.37	0.49	OK
0.30	0.40	OK	0.33	0.44	OK
0.31	0.41	OK	0.32	0.43	OK
0.29	0.39	OK	0.36	0.48	OK
0.29	0.38	OK	0.28	0.38	OK
0.30	0.40	OK	0.29	0.39	OK
0.30	0.40	OK	0.28	0.37	OK
0.28	0.37	OK	0.27	0.35	OK
0.30	0.40	OK	0.27	0.36	OK
0.31	0.41	OK	0.26	0.35	OK
0.29	0.39	OK	0.25	0.34	OK
0.29	0.38	OK	0.27	0.36	OK
0.30	0.40	OK	0.29	0.39	OK
0.30	0.40	OK	0.31	0.41	OK
0.28	0.37	OK	0.30	0.40	OK

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

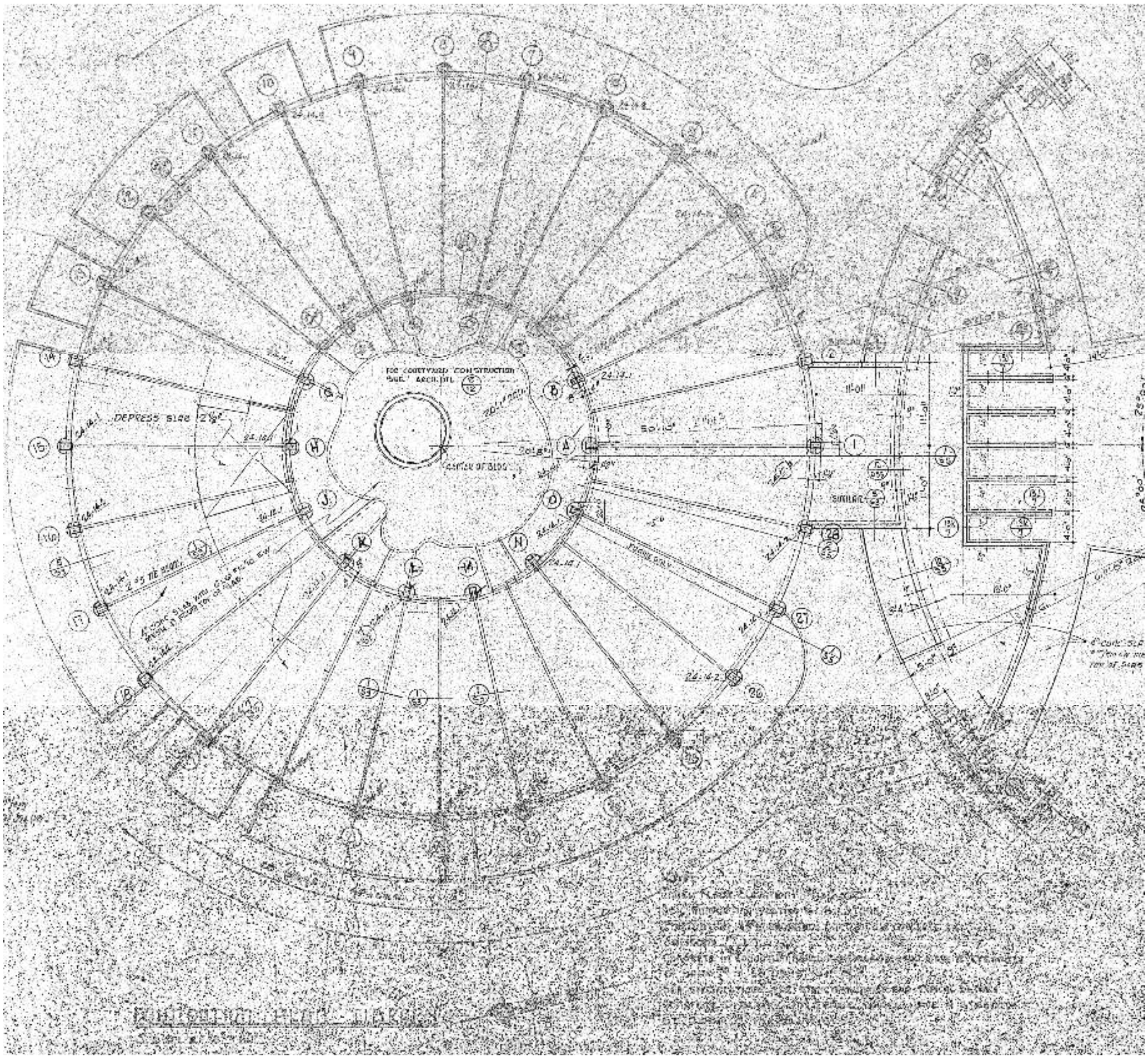
Just a quick check of concrete panels

			Limit (psi)	level	f'c(psi)
Check:	$v < \max(100, 2\sqrt{f'c})$	=	110	Roof	3000

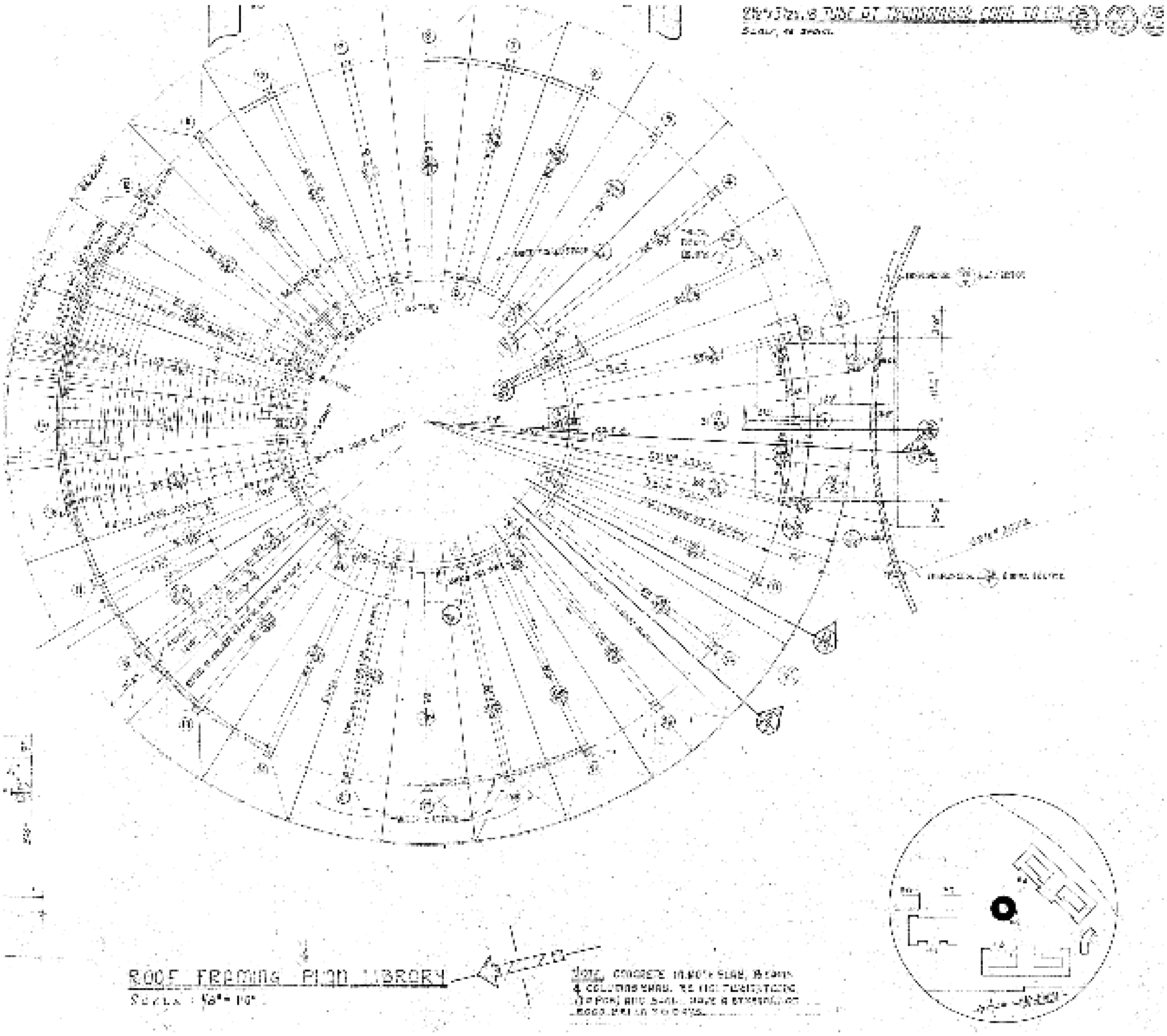
			N-S direction		E-W direction	
Level	Vx (k)	Ms-value (Table 4-8)	wall area (in^2)	*v* (psi)	wall area (in^2)	*v* (psi)
Roof	561	3	2000	94	2000	94

there is about 130' of 6" precast panel overall in inner and outer radius. Approx. 30' wall, per calc above, in any direction will suffice to satisfy shear stress check.

Appendix 1-C: As-Built Plans



Foundation Plan (1963 Drawing Sheet S-3)



Roof Plan (1963 Drawing Sheet S-4)

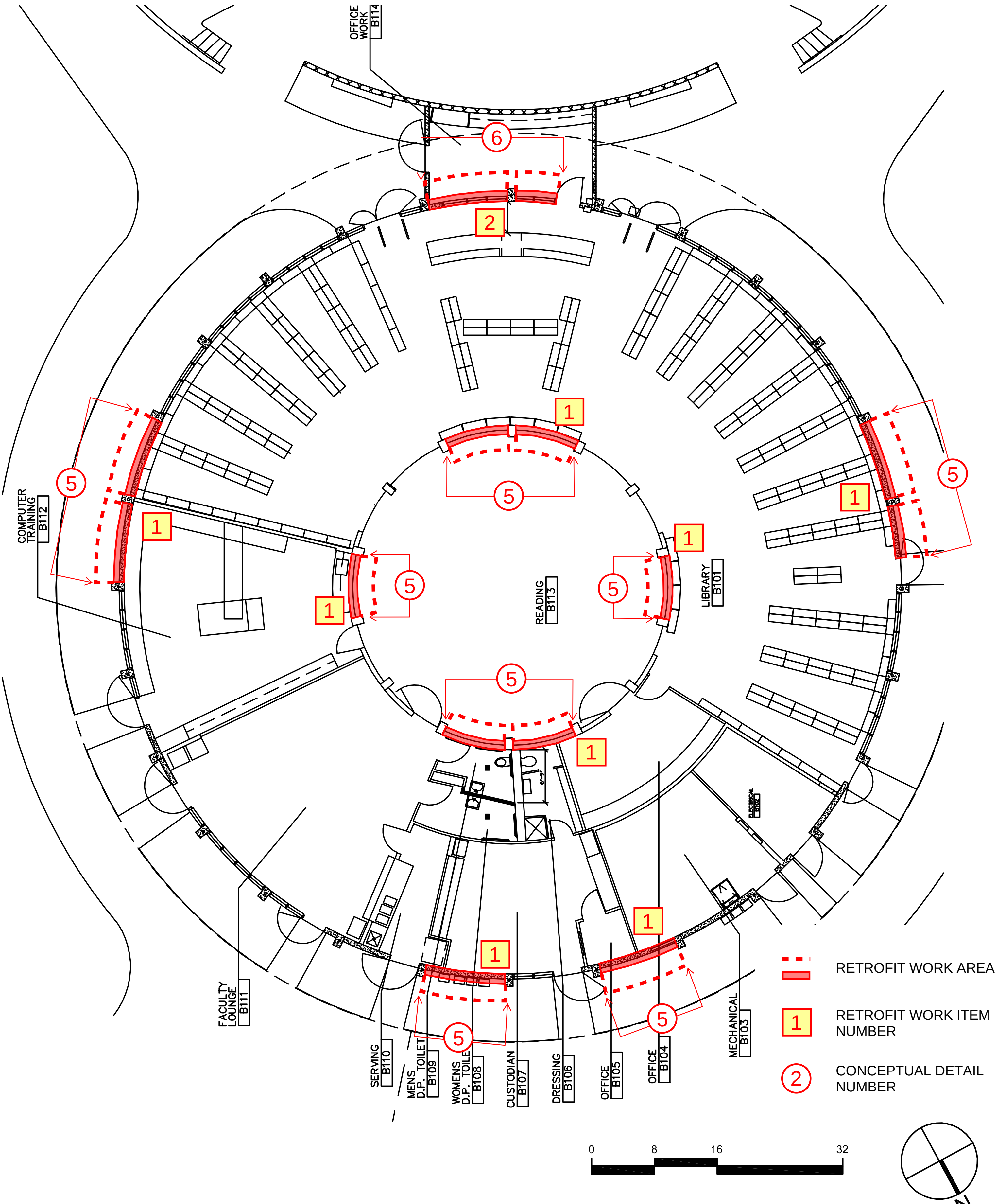
Appendix 7A – Images of Existing Conditions

Fig 1. Folded plate roof and support piers from exterior

Fig 2. Folded plate roof from interior

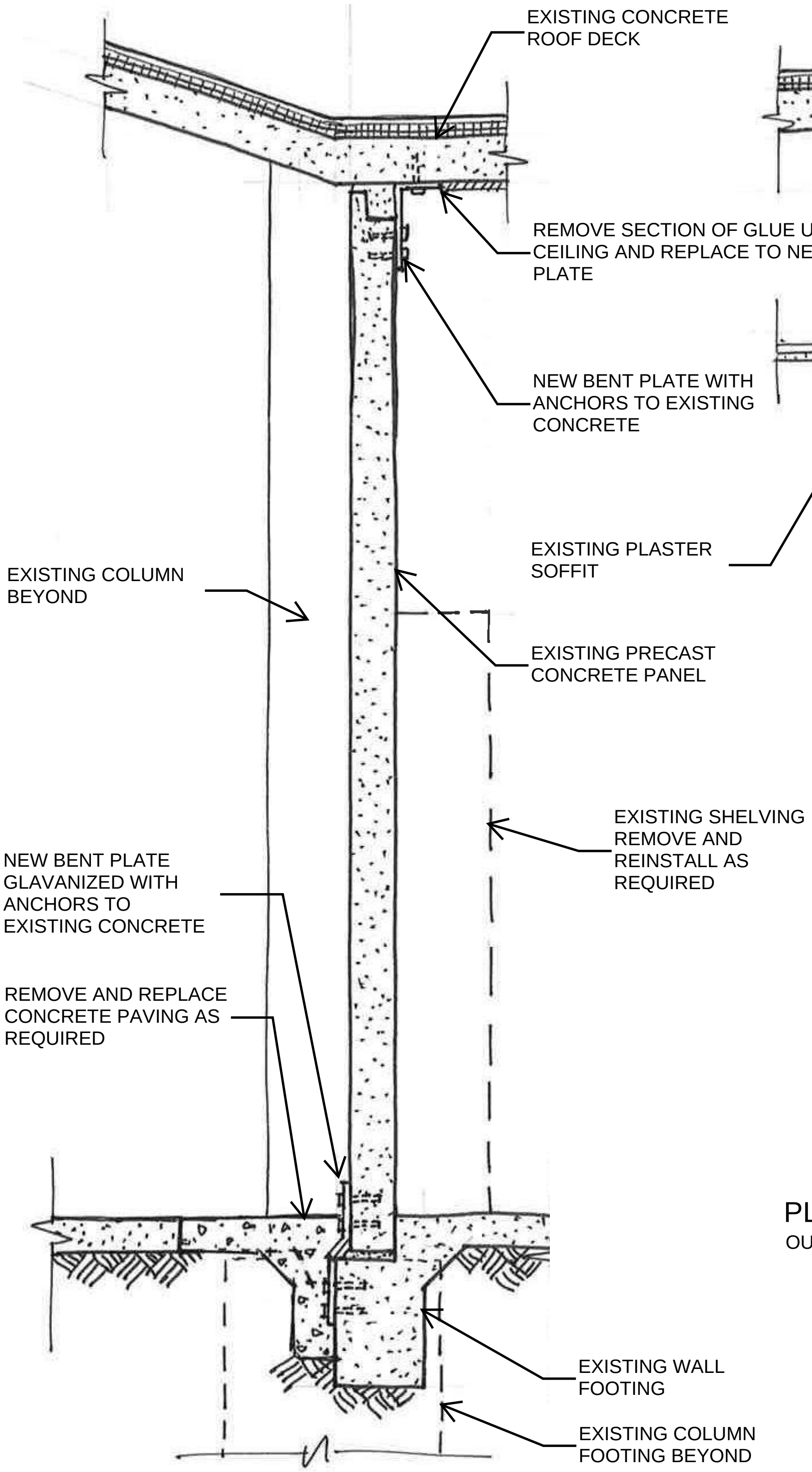
Fig 3. Interior core walls from inside

Fig 4. Interior core walls from outside with folded plate roof and beams



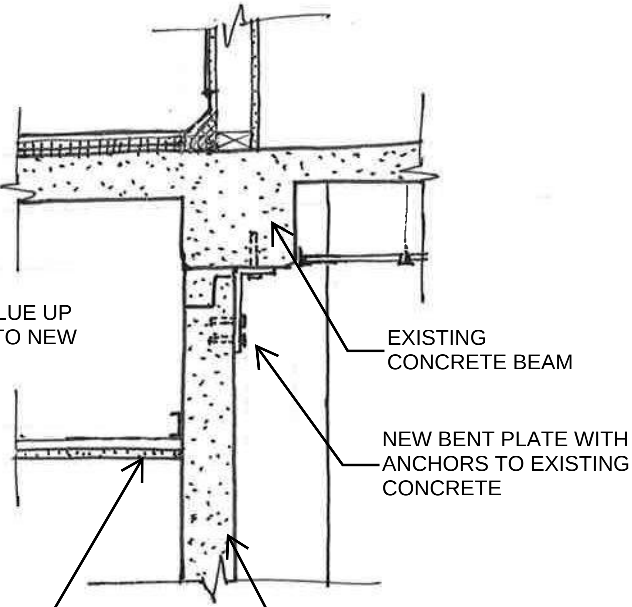
PBWS

PENINSULA HS - BUILDING B

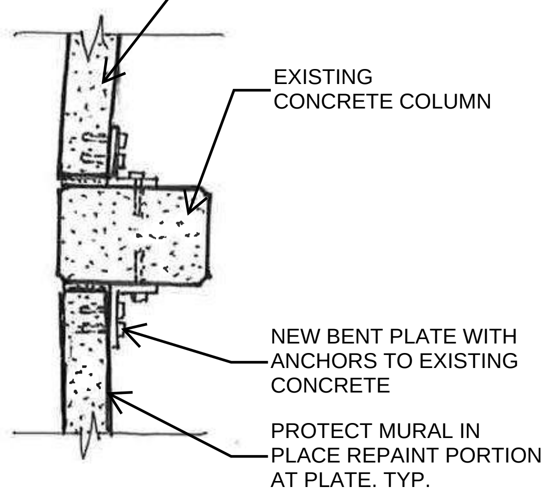


SECTION AT OUTER RING

FOOTING AT INNER RING SIMILAR



SECTION AT INNER RING



PLAN AT INNER RING COLUMN

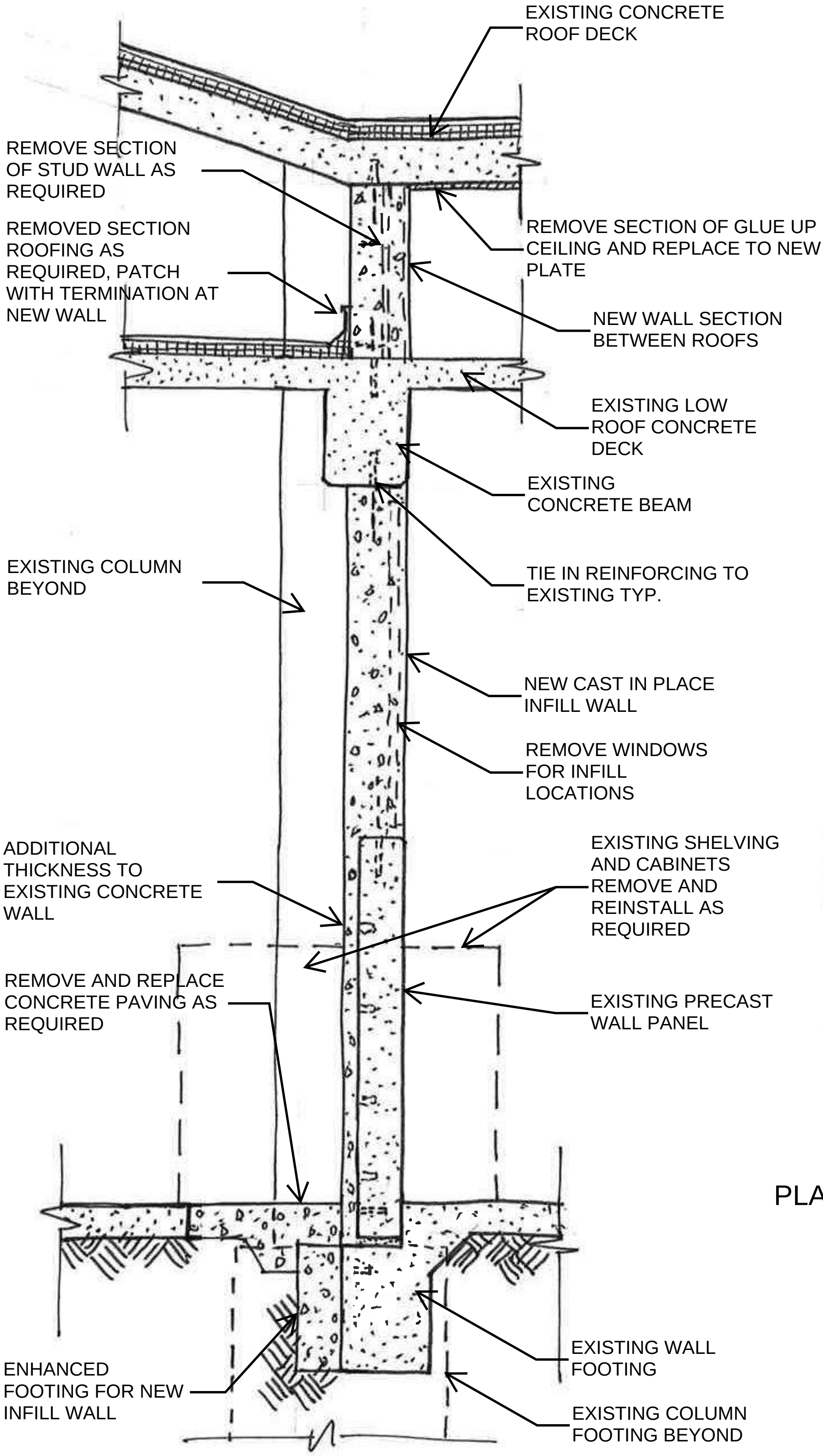
OUTER RING SIMILAR

0 1' 2' 4'

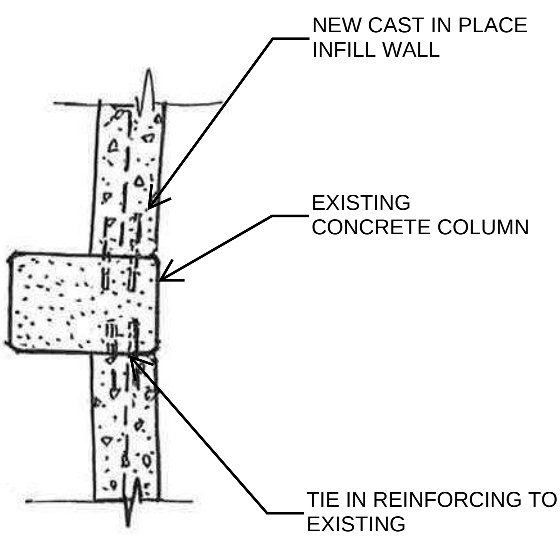
PBWS

SHEAR WALL CONNECTION ENHANCEMENT AT PENHS BUILDING B

5



SECTION AT OUTER RING



PLAN AT OUTER RING COLUMN

0 1' 2' 4'

PBWS

SHEAR WALL INFILL AT PENHS
BUILDING B

6

TTG

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
GYMNASIUM BUILDING (5)

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FEBUARY 2016

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Table of Contents

1.0 Introduction

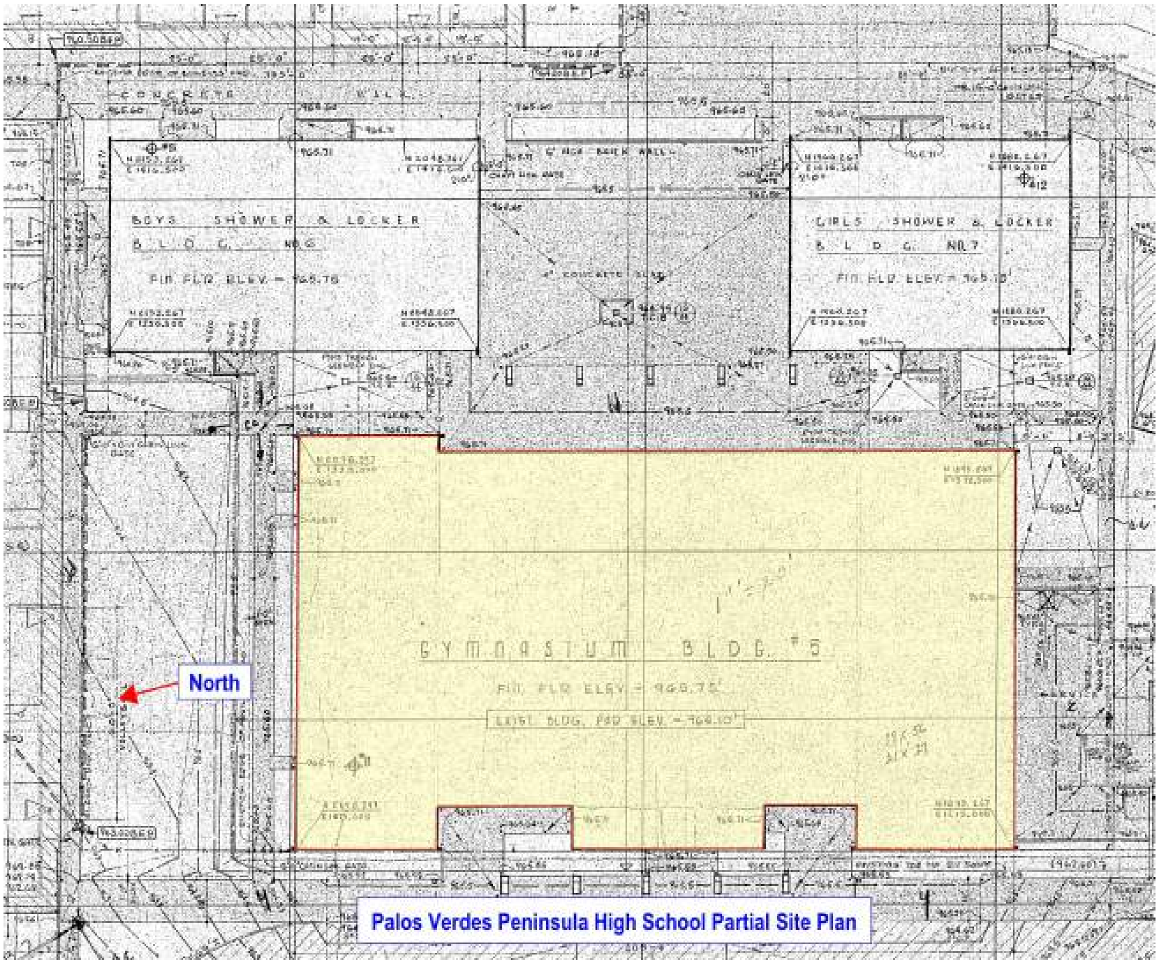
A multiphase seismic vulnerability assessment of ***Gymnasium Building (5)*** was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 6.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Photo 1 – Exterior View of Gymnasium Building

Photo 2 – Interior View of Gymnasium Building

A partial campus site plan of Palos Verdes Peninsula High School, indicating the building under evaluation, is provided below. The highlighted building is ***Gymnasium Building (5).***



Partial Site Plan- Gymnasium Building (5)

2.0 Building (5)– Gymnasium Building

2.1 Site Seismicity

Based on 1963 construction drawings, original foundation was based on the allowable soil bearing pressure of 2,000 psf for vertical dead loads plus live loads. There is a geotechnical report dated December 21, 2012 by Geo-Advantec Inc. for a proposed 6 Classroom Buildings located about 150 feet to the North-East of the Gymnasium Building available for review.

Per ASCE 41-13 (2012 IBC), for Palos Verdes Peninsula High School located at 27118 Silver Spur Road, Rolling Hills Estates, CA 90274,

Site Coordinates = 33.7706°N, -118.3691°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.512g; $S_{1,20/50}$ = 0.196 g
F_a = 1.391 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.015 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.712g
$S_{X1} = F_v S_{1,20/20}$ = 0.395g

2.2 Building Description

The Gymnasium Building is a one-story building in the middle portion of the school campus. The building was constructed circa 1963. The existing drawings for the building are dated April 19, 1963, which shows the proposed gymnasium building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of one story of gymnasium in the central portion and supporting facility rooms at the two ends of the building. The building is rectangular in shape with approximate dimensions of 203.3'x 113.5'. Total footprint of the original building is estimated to be ±23,100 square feet. The clear roof height at the high point of the gymnasium is 28'-0" and at the low point is 17'-0" with an average roof height of about 22'-6". The roof height of the supporting rooms at the two ends is about 15'-0". The roof of the building consists of plywood panel over wood joists. The wood joists are supported by Glulam girders spanning about 40'~44' at 16' spacing at the two ends and by arched Glulam girders spanning about 100' at 20' spacing at the gymnasium. The Glulam girders are typically supported by cast-in-place concrete columns along the perimeter of the buildings and brick walls. The arched Glulam girders of the gymnasium are supported on concrete footings directly. The lateral force resistance of the building is provided by reinforced brick walls in combination of concrete walls. The foundation of the building consists of concrete spread footing under the concrete columns and continuous wall footings.

Based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as “RM1” in combination with Concrete Shear Walls with Flexible Diaphragms denoted as “C2A”.

The structural risk category for the multipurpose building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Building (5)– Gymnasium Building Summary Table	
Year Designed	1963
Drawings	Original drawings, dated April 19, 1963, prepared by Flewelling, Moody & Horn Architects, and Engineers.
Gravity System	Wood joists on Glulam beams/girders supported on columns/walls/foundation (Flexible Diaphragm)
Lateral System	Reinforced masonry (Brick) bearing walls and reinforced concrete bearing walls
No. of Stories & Height	1 Stories; Main Roof: h_n=22.5 ft; Supporting Room Roof: h_n=15 ft
Building Period "T"	0.20 Sec
Base Shear "V"	0.712 W = 550 kips Gymnasium (RM1 & C2A)
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	See Section 4.1 (Retrofit not required)

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of the Building is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening, if needed. As a Risk Category ***III***, the Basic Performance Objective for the building was ***Damage Control Structural Performance,*** per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; some were found to be "Compliant" and others were found to remain "Deficient."

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

No deficiencies were identified post Tier 1 analysis.

3.2 ASCE 41-13 Tier 2 Evaluation

No Tier 2 evaluation required.

4.0 Conclusions

After further review and updating tier 1 checklist as per ASCE 41-13, no major deficiencies were identified which required tier 2 evaluation.

Given the reason above, a voluntary seismic retrofit is not required for this structure.

5.0 Documents Reviewed

The following existing architectural and or structural drawings (and or other documents when available) were reviewed:

Date	Architect / Engineer	TTG Comments
April 19, 1963	Flewelling, Moody & Horn Architects and Engineers	Title Block states "Gymnasium Bldg. No. 5, Rolling Hills High School, Palos Verdes Peninsula Unified School District" Architectural and structural drawings (State of California – Department of Public Works, Division of Architecture, Project No. 23166)
December 12, 2012	Geo-Advantec, Inc.	Geotechnical Engineering Evaluation Report "Proposed 6 Classroom Buildings & Weight Room Palos Verdes Peninsula High School

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Peninsula High School Building C, Gymnasium

Table of Contents

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the

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District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Palos Verdes Peninsula High School is a public high school with in the Palos Verdes Peninsula Unified School District. The original buildings were completed in 1963 and includes all the buildings of concern for this analysis. It was originally called Rolling Hills High School and has been in constant use as a high school since that time. The original campus buildings were designed by the firms of Flewelling, Moody, and Horn Architects and is mostly of concrete construction. The building referred to as C is part of the original campus buildings.

Building C is at the middle of the campus adjacent to the behind the main parking lot and the entry is visible to Silver Spur Road. It is a long span building with some adjacent connected spaces. The main space is the gymnasium classroom spaces on the north and kitchen and serving on the south. There is a metal shade structure connected on the south end. The building structure consists of reinforced brick masonry exterior walls and glue laminated arches to create the roof structure. The arches are supported by thrust blocks outside the building walls on the east and west side with joists and plywood deck over the interior space.

The exterior walls of the building are non-combustible construction. It has combustible roof framing and the glue laminated beams protrude beyond the exterior walls on the east and west. The building appears to fit within the current CBC Type-5B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Work

No Recommended Retrofit

After further tier 2 analysis it was determined that the building does not require any seismic retrofit work for life safety.

Miscellaneous Recommended Work

Roofing & Arches

It is recommended to maintain the roof system in good repair to minimize any deterioration of the wood roof framing system. It is also recommended to maintain the glue laminated wood arches and the sheet metal protective enclosure in good repair to minimize deterioration of those structural members. The elements appear to be in good condition.

Accessibility Upgrades

There are no accessibility upgrades anticipated for this building since no retrofit work is recommended.

Fire & Life Safety

There are no fire & life safety upgrades anticipated for this building since no retrofit work is recommended.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Appendix 1-A: Tier 1 Screening Checklists

ASCE 41-13 Checklists

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path exists.
x				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.2)	No other buildings within 10 feet of this building
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanines
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	It is one story building, so not applicable.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	It is one story building, so not applicable.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	All vertical elements continuous to foundation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	It is one story building, so not applicable.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	It is one story building, so not applicable.
X				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Roof consists of flexible wood diaphragms with minimum of 2 lines of shear wall support. Torsion appears not exist.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
x				LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), the building site is not in liquefaction susceptible zone.
x				SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), the building site is not susceptible to slope failure.
x				SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), surface fault rupture not anticipated.

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
X				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.712=0.43 Compliant per review of existing drawings.
X				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Foundation elements are tied together by ties beams and slab on grade.

16.10LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES C2: CONCRETE SHEAR WALLS WITH STIFF DIAPHRAGMS AND C2A: CONCRETE SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (§A.3.1.6.1. Tier 2: §5.5.2.5.1)	Complete vertical-load carrying system exists.
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	There are at least 2 lines of shear walls in each direction.
x				SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in^2 or $2\sqrt{f'c}$. (§A.3.2.2.1. Tier 2: §5.5.3.1.1)	Average shear stress is less than max {100,$2\sqrt{f'c}$} =100 psi. See calculations in Appendix 1-B.
x				REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (§A.3.2.2.2. Tier 2: §5.5.3.1.3)	Reinforcing steel ratios meet requirements; see calculations in Appendix 1-B.
				Connections	
x				WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Wall anchorage is sufficient. See calculations in Appendix 1-B.
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	Diaphragms are connected to shear walls.

C	NC	N/A	U	Checklist	Comments
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	Wall reinforcement is doweled into foundation.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Seismic-Force-Resisting System					
x				DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (§A.3.1.6.2. Tier 2: §5.5.2.5.2)	Meet requirements.
		x		FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (§A.3.1.6.3. Tier 2: §5.5.2.5.3)	Not applicable. There is no slab which is not part of the seismic force resisting system.
		x		COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than d/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (§A.3.2.2.3. Tier 2: §5.5.3.2.1)	No coupling beams.
Connections					
		x		UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (§A.5.3.8. Tier 2: §5.7.3.5)	No pile caps, so not applicable.
Diaphragms (Flexible or Stiff)					
x				DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (§A.4.1.1. Tier 2: §5.6.1.1)	There is no diaphragm discontinuity in the building, so compliant.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	Meet requirements, so compliant.
Flexible Diaphragms					

C	NC	N/A	U	Checklist	Comments
x				CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Cross ties exist.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	Straight sheathing diaphragms not used.
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	Wood structural panels exist.
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	No diagonally sheathed diaphragms. Structural panel diaphragms are blocked.
		x		OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	No other diaphragms.

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY SHEAR WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	At least 2 lines of shear walls present.
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in^2. (§A.3.2.4.1. Tier 2: §5.5.3.1.1)	Shear stress is less than 70 psi.
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. (§A.3.2.4.2. Tier 2: §5.5.3.1.3)	Reinforcing steel ratios meet requirements.
Stiff Diaphragms					
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (§A.4.5.1. Tier 2: §5.6.4)	No precast diaphragm elements.
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Wall anchorage is sufficient.
x				WOOD LEDGERS: The connection between the wall panels and the diaphragm does not	Connection does not induce cross-grain bending or tension.

C	NC	N/A	U	Checklist	Comments
				induce cross-grain bending or tension in the wood ledgers. (§A.5.1.2. Tier 2: §5.7.1.3)	
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	There is positive connection for shear transfer between diaphragm and shear wall in all locations
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (§A.5.2.3. Tier 2: §5.7.2)	No precast diaphragm elements.
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	Wall reinforcement is dowelled into foundation.
x				GIRDER-COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (§A.5.4.1. Tier 2: §5.7.4.1)	Positive connection present at girder-column connections.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity					
Stiff Diaphragms					
		x		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	No stiff diaphragms.
		x		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	No stiff diaphragms.
Flexible Diaphragms					
x				CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Continuous cross ties present.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear	Diaphragm openings adjacent to shear walls are less than 25% of

C	NC	N/A	U	Checklist	Comments
				walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	the wall length.
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	Diaphragm openings adjacent to exterior masonry shear walls are not greater than 8 feet.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	Straight sheathing diaphragms not used.
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	Structural panel over straight sheathing on gymnasium roof.
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	No diagonally sheathed or unblocked diaphragms.
		x		OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	No other diaphragms used.
Connections					
x				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (§A.5.1.4. Tier 2: §5.7.1.2)	Stiff steel anchors used.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
				Life Safety Systems	
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Hazardous Materials	
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4.	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				Tier 2: §13.7.3 and 13.7.5)	
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
				Light Fixtures	
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Proper support was observed
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Cladding and Glazing	
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
				Masonry Veneer	
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no	No URM backup, so not applicable.

C	NC	N/A	U	Checklist	Comments
				unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
Parapets, Cornices, Ornamentation, and Appendages					
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
		X		LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	None Observed; so not applicable
		X		LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	No parapets; So not applicable
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	
				Masonry Chimneys	
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
				Stairs	
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
				Contents and Furnishings	
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable

C	NC	N/A	U	Checklist	Comments
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	Proper bracing was observed
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
				Mechanical and Electrical Equipment	
X				LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	Observed Compliant
		X		LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	None observed; So not applicable
		X		LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	None observed; So not applicable
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
				Piping	
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	
Ducts					
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
Elevators					
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2:	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				§13.8.6)	
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW		Bldg Type= **RM1 & C2A**
$C =$	1	From Table 4-8 for 1963 Gymnasium Building	
$S_a =$	$\min(S_{XS}, S_{X1}/T)$	From Section 4.5.2.3	
$S_{X1} = F_V S_1$		Eq. 2-2	
$S_{XS} = F_a S_S$		Eq. 2-1	
$S_S =$	0.512	g, mapped spectral acceleration	
$S_1 =$	0.196	g, mapped spectral acceleration	
$S_{X1} =$	0.395	g	
$S_{XS} =$	0.712	g	
$T = C_t h_n^{\beta}$		From Section 4.5.2.4	
$C_t =$	0.02		
$h_n =$	22.5	ft., average height at sloped roof	
$\beta =$	0.75		
$T =$	0.207	sec.	
$S_a =$	0.712	g	
$V_{MP\ 1972} =$	0.712	W	

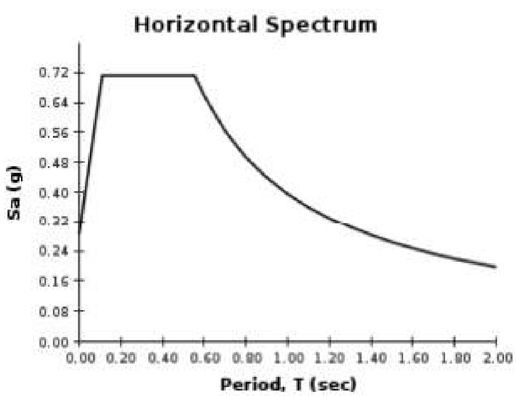
USGS Design Maps Summary Report

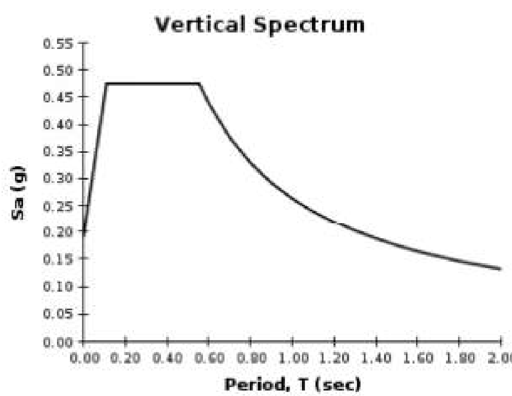
User–Specified Input

Report Title	California Minimum Ss Sat January 23, 2016 03:52:06 UTC
Building Code Reference Document	ASCE 41-13 Retrofit Standard, BSE-1E (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.77058°N, 118.3691°W
Site Soil Classification	Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.512 g	$S_{XS,BSE-1E}$	0.712 g
$S_{1,20/50}$	0.196 g	$S_{X1,BSE-1E}$	0.395 g





Seismic Mass Weight - 1963 Construction

Roof

(Roof Gym area with 1/2" Plywood sheathing)

Roofing	6	psf
1/2" Plywood	1.5	psf
Wd joist 4x10@48" typ.	1.5	psf
Roof Glulam beams	4	psf
MEP	3	psf
Ceiling	0	psf
Misc	1	psf
DL =	**17**	**psf**
Use	**17**	**psf**

(Roof Supporting Rooms)

Roofing	6	
1/2" Plywd	1.5	psf
Wood joist	1.5	psf
Glulam Bm	4	psf
MEP	3	psf
Ceiling	3	psf
Misc	1	psf
DL =	**20**	**psf**
Use	**20**	**psf**

(Roof Canopy with metal decking)

Roofing	6	psf
Insulation	0.5	psf
Metal Decking	2.5	psf
Steel angle beams	2	psf
MEP	0	psf
Ceiling	0	psf
Misc	1	psf
DL =	**12**	**psf**
Use	**12**	**psf**

Wall Weight

9" brick wall =	90	psf
10" brick wall =	100	psf
8" concrete wall =	100	psf
Wood/metal stud wall =	15	psf

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation

Location		Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Roof	Gym roof	120.0	116.0	13920.0	17	237
	Support area 1	118.0	39.0	4602.0	20	92
	Support area 2	113.5	44.0	4994.0	20	100
	Canopy 1	120.0	30.0	3600.0	12	43
	Canopy 2	62.0	9.0	558.0	12	7
	9" Brick Walls, out plane	200.0	8.5	1700.0	90	153
	8" Conc Walls, out plane	166.0	8.5	1411.0	100	141
	Grand Total =			**27674**		**773**

Base shear V_{Gym}= 0.712 W
V = **550** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x	h_x	$w_x h_x$	Fx	Area	fi
	kip	ft	k-ft	kip	ft2	psf
Roof	773	22.75	17576	550	27674.0	19.9
Sum =	773		17576	550		

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1
Footnote b for reinforced concrete walls

Wall Forces - Supporting Roof

	Wall Description	Length ft	Width in	Aw in2	Force Vj kips	v avg psi
N-S Direction	Wall thick 8"	144.5	8.0	13872	550	5.1
	Wall thick 9"	205.0	9.0	22140		
E-W Directioin	Wall thick 9"	208.0	9.0	22464	550	4.0
	Wall thick 10"	198.8	10.0	23850		

Per ASCE 41-13 check list 16.10LS, if shear stress less than max(100, 2f'c^0.5)=109 psi in concrete wall, OK
fc'=3 ksi Average wall shear is less than 109 psi, O.K.
For RM1 wall per checklist 16.15 LS, if shear stress is less than 70 psi, O.K.

Reinforced Concrete Wall, Reinforcing Steel Ratio

8" Concrete wall with #4 @ 15" Verti & #4 @ 10" Horizontal at center of wall

Hori ρ=	0.0025	Shall not be less than 0.0012 vertic, 0.0020 in hori direction
Verti ρ=	0.0017	Meeting requirements on reinforcing steel

Reinforced Masonry Wall, Reinforcing Steel Ratio

9" Brick wall with #4 @ 15" Verti & Horizontal at center of wall

Hori ρ=	0.0015	Total V&H reinft not be less than 0.0002; min. not less than 0.0007
Verti ρ=	0.0015	Meeting requirements on reinforcing steel
Total ρ=	0.0030	

10" Brick wall with #5 @ 18" Vertical & Horizontal center of wall

Hori ρ=	0.0017	Total V&H reinft not be less than 0.0002; min. not less than 0.0007
Verti ρ=	0.0017	Meeting requirements on reinforcing steel
Total ρ=	0.0034	

Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

Tc=	$1.2S_{XS}\ w_p\ A_p$ =	76.9	psf	Eqn 4-13
S_{XS} =	0.712			
w_p =	90	psf	9" brick wall,	
Ap =	1	ft2		

Evaluate connection for out-of-plane action per Tier 2 procedure
Per Section C7.5.1.2, connections should be evaluated as force-controled procedure.

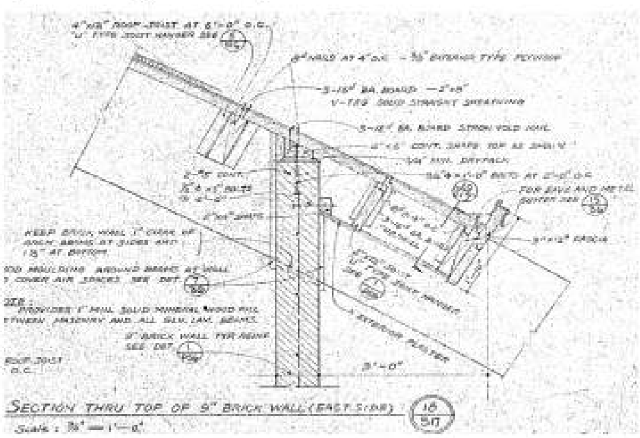
C_1C_2 =	1.4	From Table 7-3		
J=	1	Per Section 7.5.2.1.2		
Q_{UF}=	Q_G+/-Q_E/(C_1C_2J)	Eqn 7-35		
Q_G =	0.0	lbs		
Q_E=	653.6	lbs	End shear for 1'x8.5' wall (WxH)	
Q_{UF}=	466.9	lbs	End shear divided by CJ factor	

Per detail 18/S-17, wall anchors @ S =	2.00	ft	**Typical anchor @ 2'-0"**
Out of plane force T_{UF}=	**934**	lbs	Each anchor location

Typical anchor capacity per 18/S-17

3/4" Dia Bolt =	19.8	kips	
Ncn=	**19.8**	kips	>= T_{UF}, Okay
(3) 16d nails @ each 2x8 board =	423.00	lbs	each nail
(9) nails each 24", capacity =	3807	lbs	
Ncn=min(19800, 3807)=	**3,267**	lbs	>= T_{UF}, Okay

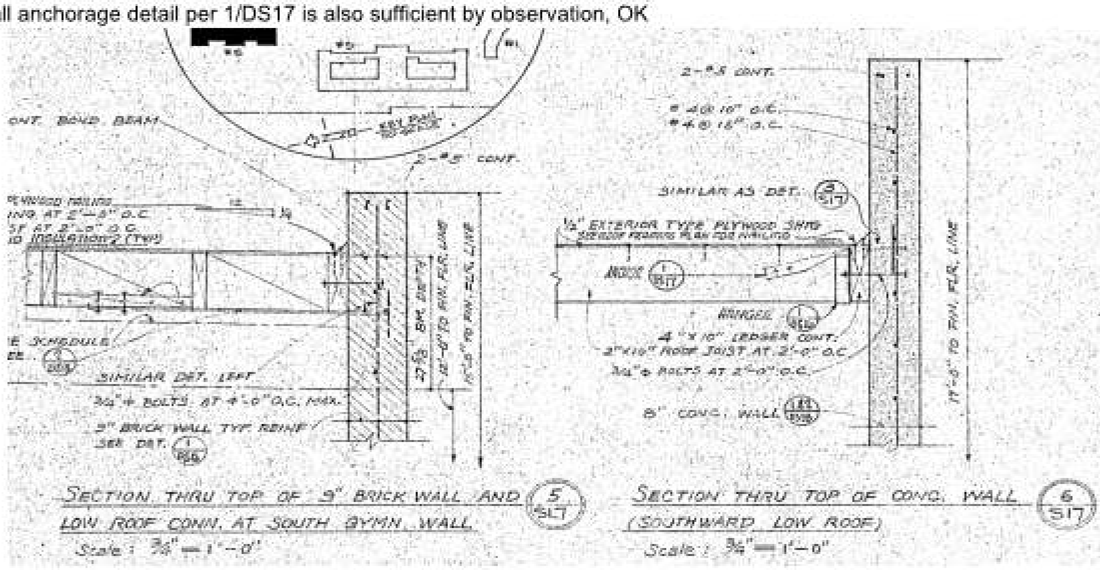
Therefore, wall out-of-plane anchorage issufficient, per detail 18/S17

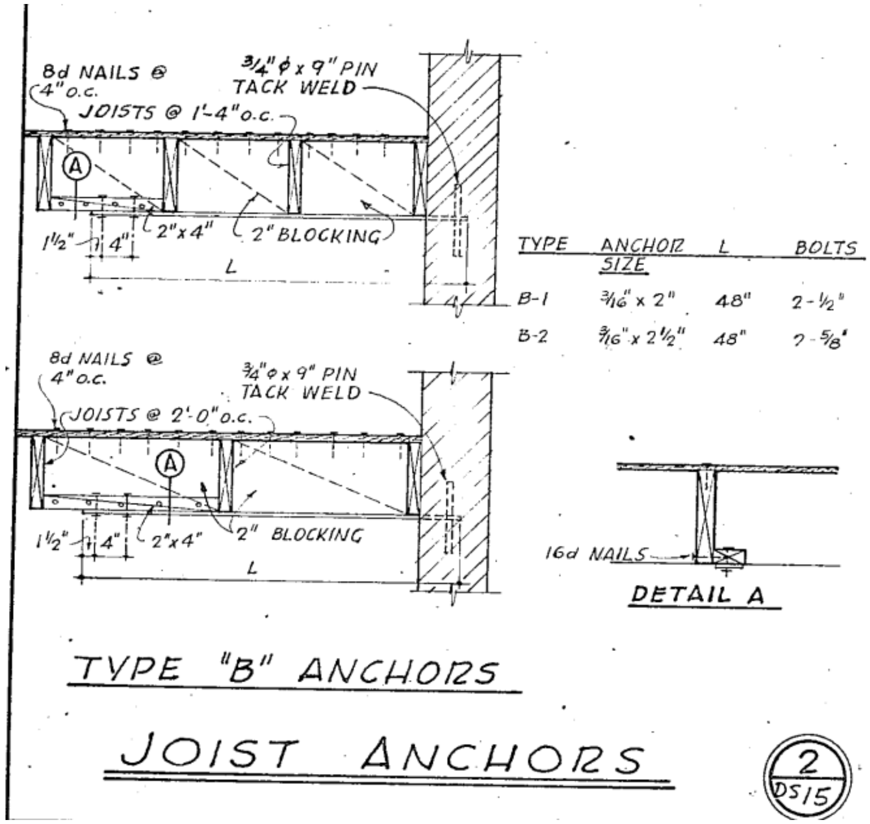


Wall anchor capacity per 2/DS15 (Note: Allowable to Capacity factor = 3)

3/16"x2" strap =	16.8	kips	
(2) 1/2" bolts=	3480	lbs	
16d nails =	423	lbs	each nail
(5) nails each 24", capacity =	2115	lbs	<<< Control
Ncn=min(16800, 3480,2115)=	**2,115**	lbs	>= T_{UF}, Okay

Therefore, wall out-of-plane anchorage is sufficient, per detail 2/DS15
Wall anchorage detail per 1/DS17 is also sufficient by observation, OK




8d NAILS @ 4" o.c.
3/4" ϕ x 9" PIN TACK WELD
JOISTS @ 1'-4" o.c.
A
1 1/2"
4"
2"x4"
2" BLOCKING
L
TYPE ANCHOR SIZE L BOLTS
B-1 3/16" x 2" 48" 2-1/2"
B-2 3/16" x 2 1/2" 48" 2-5/8"
8d NAILS @ 4" o.c.
3/4" ϕ x 9" PIN TACK WELD
JOISTS @ 2'-0" o.c.
A
1 1/2"
4"
2"x4"
2" BLOCKING
L
16d NAILS
DETAIL A
TYPE "B" ANCHORS
JOIST ANCHORS
2
DS15

BOLTS

Table 11B BOLTS: Reference Lateral Design Values (Z) for Single Shear (two member) Connections[1,2]

for sawn lumber or SCL with 1/4" ASTM A 36 steel side plate

Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_{\parallel}$ lbs.	G=0.67 Red Oak $Z_{\perp}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\parallel}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\perp}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\parallel}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\perp}$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_{\parallel}$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_{\perp}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\parallel}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\perp}$ lbs.	G=0.43 Hem-Fir $Z_{\parallel}$ lbs.	G=0.43 Hem-Fir $Z_{\perp}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\parallel}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\perp}$ lbs.	G=0.37 Redwood (open grain) $Z_{\parallel}$ lbs.	G=0.37 Redwood (open grain) $Z_{\perp}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\parallel}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\perp}$ lbs.	G=0.35 Northern Species $Z_{\parallel}$ lbs.	G=0.35 Northern Species $Z_{\perp}$ lbs.
1-1/2	1/4	1/2	730	420	620	350	580	310	580	310	550	290	520	280	510	270	470	240	460	240	450	230
		5/8	910	480	780	400	730	360	720	360	690	340	650	320	640	320	590	290	580	280	560	270
		3/4	1090	550	940	450	870	420	860	410	820	390	780	360	770	360	710	320	690	320	680	310
		7/8	1270	600	1090	510	1020	470	1010	450	960	430	910	410	900	400	820	370	810	360	790	350
		1	1460	660	1250	550	1170	510	1150	500	1100	480	1040	450	1030	450	940	400	930	400	900	390
1-3/4	1/4	1/2	810	460	690	370	640	340	630	330	600	310	570	290	560	280	510	250	500	250	490	240
		5/8	1020	520	870	430	800	390	790	380	750	360	710	340	700	330	640	300	630	290	610	280
		3/4	1220	590	1040	480	960	440	950	430	900	410	860	380	840	370	770	330	750	330	730	320
		7/8	1420	650	1210	540	1130	490	1110	480	1050	450	1000	420	980	420	890	380	880	370	850	360
		1	1630	710	1380	580	1290	540	1270	520	1200	500	1140	470	1120	460	1020	410	1000	410	980	400
2-1/2	1/4	1/2	930	600	860	470	830	410	820	400	780	380	740	350	720	340	650	300	640	290	620	280
		5/8	1370	670	1150	530	1050	470	1040	470	980	430	920	400	910	390	810	340	800	330	770	320
		3/4	1640	750	1370	590	1270	530	1250	520	1180	490	1110	450	1090	440	980	380	960	370	930	360
		7/8	1910	820	1600	650	1480	590	1450	570	1370	530	1290	490	1270	480	1140	420	1120	410	1080	400
		1	2190	880	1830	700	1690	640	1660	620	1570	580	1480	540	1450	530	1300	460	1280	450	1240	440
3-1/2	1/4	1/2	930	620	860	550	830	510	820	510	800	480	770	450	770	430	720	370	720	360	710	350
		5/8	1370	860	1260	690	1210	610	1200	600	1160	550	1130	500	1120	490	1060	420	1050	410	1020	400
		3/4	1900	990	1740	760	1670	680	1660	660	1580	610	1480	560	1450	540	1290	460	1260	450	1220	440
		7/8	2530	1070	2170	840	1990	740	1950	710	1840	660	1720	610	1690	590	1510	510	1480	500	1430	470
		1	2980	1150	2480	890	2270	800	2230	770	2100	730	1970	660	1930	650	1720	560	1690	540	1630	530
		5/8	1370	860	1260	760	1210	710	1200	700	1160	670	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Use ASD to LRFD factor = 3

Table 11.3.1B Reduction Term, R_d

Fastener Size	Yield Mode	Reduction Term, R_d
$0.25" \le D \le 1"$	I_m, I_s II III_m, III_s, IV	$4\ K_\theta$ $3.6\ K_\theta$ $3.2\ K_\theta$
$D < 0.25"$	I_m, I_s, II, III_m, III_s, IV	K_D[1]

Notes:
K_θ = $1 + 0.25(\theta/90)$
θ = maximum angle of load to grain ($0^\circ \le \theta \le 90^\circ$) for any member in a connection
D = diameter, in. (see 11.3.6)
K_D = 2.2 for $D \le 0.17"$
K_D = $10D + 0.5$ for $0.17" < D < 0.25"$

1. For threaded fasteners where nominal diameter (see Appendix L) is greater than or equal to 0.25" and root diameter is less than 0.25", $R_d = K_D\ K_\theta$

11.3.2 Dowel Bearing Strength

11.3.2.1 Dowel bearing strengths, F_e, for parallel or perpendicular to grain loading are provided for dowel-type fasteners with $1/4" \le D \le 1"$ in Table 11.3.2. When fastener diameter, $D < 1/4"$, a single dowel bearing strength, F_e, is used for both parallel and perpendicular to grain loading.

11.3.2.2 Dowel bearing strengths, F_e, for wood structural panels are provided in Table 11.3.2B.

11.3.2.3 Dowel bearing strengths, F_e, for structural composite lumber shall be obtained from the manufacturer's literature or code evaluation report.

11.3.2.4 When dowel-type fasteners with $D \ge 1/4"$ are inserted into the end grain of the main member, with the fastener axis parallel to the wood fibers, $F_{e\perp}$ shall be used in determination of the dowel bearing strength of the main member, F_{em}.

11.3.3 Dowel Bearing Strength at an Angle to Grain

When a member in a connection is loaded at an angle to grain, the dowel bearing strength, $F_{e\theta}$, for the member shall be determined as follows (see Appendix J):

$$F_{e\theta} = \frac{F_{e\parallel} F_{e\perp}}{F_{e\parallel} \sin^2\theta + F_{e\perp} \cos^2\theta} \qquad (11.3\text{-}11)$$

where:

θ = angle between direction of load and direction of grain (longitudinal axis of member).

Figure 11B Single Shear Bolted Connections

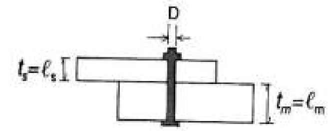
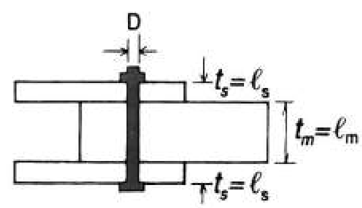


Figure 11C Double Shear Bolted Connections



11.3.4 Dowel Bearing Length

11.3.4.1 Dowel bearing length in the side member(s) and main member, ℓ_s and ℓ_m, represent the length of dowel bearing perpendicular to the application of load. The length of dowel bearing shall not include the tapered tip of a fastener for fastener penetration lengths less than 10D.

11.3.5 Dowel Bending Yield Strength

11.3.5.1 Reference design values for bolts, lag screws, wood screws, nails, and spikes are based on bending yield strengths provided in Tables 11A through 11R.

11.3.5.2 Dowel bending yield strengths, F_{yb}, used in calculation of reference design values shall be based on yield strength derived using methods provided in ASTM F 1575 or the tensile yield strength derived using procedures of ASTM F 606.

11.3.6 Dowel Diameter

11.3.6.1 When used in Tables 11.3-1A and 11.3-1B, the fastener diameter shall be taken as D for unthreaded full-body diameter fasteners and D_r for reduced body diameter fasteners or threaded fasteners except as provided in 11.3.6.2. For bolts meeting the requirements of ANSI/ASME Standard B18.2.1 for full-body diameter bolts, the fastener diameter shall be taken as D (see Appendix L).

Table 11K LAG SCREWS: Reference Lateral Design Values (Z) for Single Shear (two member) Connections[1,2,3]

with 1/4" ASTM A 36 steel side plate, or ASTM A 653, Grade 33 steel side plate (for t_s < 1/4")

Side Member Thickness	Lag Screw Diameter	G=0.67 Red Oak		G=0.55 Mixed Maple Southern Pine		G=0.5 Douglas Fir-Larch		G=0.49 Douglas Fir-Larch (N)		G=0.46 Douglas Fir(S) Hem-Fir(N)		G=0.43 Hem-Fir		G=0.42 Spruce-Pine-Fir		G=0.37 Redwood (open grain)		G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods		G=0.35 Northern Species	
t_s	D	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$	$Z_\parallel$	$Z_\perp$
in.	in.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0.075	1/4	170	130	160	120	150	110	150	110	150	100	140	100	140	100	130	90	130	90	130	90
(14 gage)	5/16	220	160	200	140	190	130	190	130	190	130	180	120	180	120	170	110	170	110	160	100
	3/8	220	160	200	140	200	130	190	130	190	120	180	120	180	120	170	110	170	100	170	100
0.105	1/4	180	140	170	130	160	120	160	120	160	110	150	110	150	110	140	100	140	100	140	90
(12 gage)	5/16	230	170	210	150	200	140	200	140	190	130	190	130	190	120	180	110	170	110	170	110
	3/8	230	160	210	140	200	140	200	130	200	130	190	120	190	120	180	110	180	110	170	110
0.120	1/4	190	150	180	130	170	120	170	120	160	120	160	110	160	110	150	100	150	100	140	100
(11 gage)	5/16	230	170	210	150	210	140	200	140	200	140	190	130	190	130	180	120	180	120	180	110
	3/8	240	170	220	150	210	140	210	140	200	130	200	130	190	120	180	110	180	110	180	110
0.134	1/4	200	150	180	140	180	130	170	130	170	120	160	120	160	110	150	110	150	100	150	100
(10 gage)	5/16	240	180	220	160	210	150	210	140	200	140	200	130	200	130	190	120	180	120	180	120
	3/8	240	170	220	150	220	140	210	140	210	140	200	130	200	130	190	120	190	120	180	110
0.179	1/4	220	170	210	150	200	150	200	140	190	140	190	130	190	130	180	120	170	120	170	120
(7 gage)	5/16	260	190	240	170	230	160	230	160	230	150	220	150	220	150	210	130	200	130	200	130
	3/8	270	190	250	170	240	160	240	160	230	150	220	140	220	140	210	130	210	130	200	130
0.239	1/4	240	180	220	160	210	150	210	150	200	140	190	140	190	130	180	120	180	120	180	120
(3 gage)	5/16	300	220	280	190	270	180	260	180	260	170	250	160	250	160	230	150	230	150	230	140
	3/8	310	220	280	190	270	180	270	180	260	170	250	160	250	160	240	140	230	140	230	140
	7/16	420	290	390	260	380	240	370	240	360	230	350	220	350	220	330	200	330	200	320	190
	1/2	510	340	470	300	460	290	450	280	440	270	430	260	420	260	400	240	400	230	390	230
	5/8	770	490	710	430	680	400	680	400	660	380	640	370	630	360	600	330	590	330	580	320
	3/4	1110	670	1020	590	980	560	970	550	950	530	920	500	910	500	860	450	850	450	840	440
	7/8	1510	880	1390	780	1330	730	1320	710	1280	690	1250	650	1230	650	1170	590	1160	590	1140	570
	1	1940	1100	1780	960	1710	910	1700	890	1650	860	1600	820	1590	810	1500	740	1480	730	1460	710
1/4	1/4	240	180	220	160	210	150	210	150	200	140	200	140	190	130	180	120	180	120	180	120
	5/16	310	220	280	200	270	180	270	180	260	170	250	170	250	160	230	150	230	150	230	140
	3/8	320	220	290	190	280	180	270	180	270	170	260	160	250	160	240	150	240	140	230	140
	7/16	480	320	440	280	420	270	420	260	410	250	390	240	390	230	370	220	360	210	360	210
	1/2	580	390	540	340	520	320	510	320	500	310	480	290	480	290	460	270	450	260	440	260
	5/8	850	530	780	470	750	440	740	440	720	420	700	400	690	400	660	370	650	380	640	350
	3/4	1200	730	1100	640	1060	600	1050	590	1020	570	990	540	980	530	930	490	920	480	900	470
	7/8	1600	930	1470	820	1410	770	1400	750	1360	720	1320	690	1310	680	1240	630	1220	620	1200	600
	1	2040	1150	1870	1000	1800	950	1780	930	1730	900	1680	850	1660	840	1570	770	1550	760	1530	740

1. Tabulated lateral design values (Z) shall be multiplied by all applicable adjustment factors (see Table 10.3.1).
2. Tabulated lateral design values (Z) are for "reduced body diameter" lag screws (see Appendix L) inserted in side grain with screw axis perpendicular to wood fibers; minimum screw penetration, p, into the main member equal to 8D; dowel bearing strengths (F_e) of 61,850 psi for ASTM A 653, Grade 33 steel and 87,000 psi for ASTM A 36 steel and screw bending yield strengths (F_{yb}): F_{yb} = 70,000 psi for D = 1/4"; F_{yb} = 60,000 psi for D = 5/16"; F_{yb} = 45,000 psi for D ≥ 3/8"
3. When 4D ≤ p < 8D, tabulated lateral design values (Z) shall be multiplied by p/8D.

Table 11N COMMON WIRE, BOX, or SINKER NAILS: Reference Lateral Design Values (Z) for Single Shear (two member) Connections[1,2,3,4]

for sawn lumber or SCL with both members of identical specific gravity

Side Member Thickness t_s in.	Nail Diameter D in.	Common Wire Nail (Pennyweight)	Box Nail (Pennyweight)	Sinker Nail (Pennyweight)	G=0.67 Red Oak lbs.	G=0.55 Mixed Maple Southern Pine lbs.	G=0.5 Douglas Fir-Larch lbs.	G=0.49 Douglas Fir-Larch (N) lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) lbs.	G=0.43 Hem-Fir lbs.	G=0.42 Spruce-Pine-Fir lbs.	G=0.37 Redwood (open grain) lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods lbs.	G=0.35 Northern Species lbs.
3/4	0.099		6d	7d	73	61	55	54	51	48	47	39	38	36
	0.113	6d	8d	8d	94	79	72	71	65	58	57	47	46	44
	0.120			10d	107	89	80	77	71	64	62	52	50	48
	0.128		10d		121	101	87	84	78	70	68	57	56	54
	0.131	8d			127	104	90	87	80	73	70	60	58	56
	0.135		16d	12d	135	108	94	91	84	76	74	63	61	58
	0.148	10d	20d	16d	154	121	105	102	94	85	83	70	69	66
	0.162	16d	40d		183	138	121	117	108	99	96	82	80	77
	0.177			20d	200	153	134	130	121	111	107	92	90	87
	0.192	20d		30d	206	157	138	134	125	114	111	96	93	90
	0.207	30d		40d	216	166	147	143	133	122	119	103	101	97
	0.225	40d			229	178	158	154	144	132	129	112	110	106
	0.244	50d		60d	234	182	162	158	147	136	132	115	113	109
1	0.099		6d	7d	73	61	55	54	51	48	47	42	41	40
	0.113	6d[4]	8d	8d	94	79	72	71	67	63	61	55	54	51
	0.120			10d	107	89	81	80	76	71	69	60	59	56
	0.128		10d		121	101	93	91	86	80	79	66	64	61
	0.131	8d			127	106	97	95	90	84	82	68	66	63
	0.135		16d	12d	135	113	103	101	96	89	86	71	69	66
	0.148	10d	20d	16d	154	128	118	115	109	99	96	80	77	74
	0.162	16d	40d		184	154	141	137	125	113	109	91	89	85
	0.177			20d	213	178	155	150	138	125	121	102	99	95
	0.192	20d		30d	222	183	159	154	142	128	124	105	102	98
	0.207	30d		40d	243	192	167	162	149	135	131	111	109	104
	0.225	40d			268	202	177	171	159	144	140	120	117	112
	0.244	50d		60d	274	207	181	175	162	148	143	123	120	115
1-1/4	0.099		6d[4]	7d[4]	73	61	55	54	51	48	47	42	41	40
	0.113	6d[4]	8d	8d[4]	94	79	72	71	67	63	61	55	54	52
	0.120			10d	107	89	81	80	76	71	69	62	60	59
	0.128		10d		121	101	93	91	86	80	79	70	69	67
	0.131	8d[4]			127	106	97	95	90	84	82	73	72	70
	0.135		16d	12d	135	113	103	101	96	89	88	78	76	74
	0.148	10d	20d	16d	154	128	118	115	109	102	100	89	87	84
	0.162	16d	40d		184	154	141	138	131	122	120	103	100	95
	0.177			20d	213	178	163	159	151	141	136	113	110	105
	0.192	20d		30d	222	185	170	166	157	145	140	116	113	108
	0.207	30d		40d	243	203	186	182	169	152	147	123	119	114
	0.225	40d			268	224	200	193	177	160	155	130	127	121
	0.244	50d		60d	276	230	204	197	181	163	158	133	129	124
1-1/2	0.099			7d[4]	73	61	55	54	51	48	47	42	41	40
	0.113		8d[4]	8d[4]	94	79	72	71	67	63	61	55	54	52
	0.120			10d	107	89	81	80	76	71	69	62	60	59
	0.128		10d		121	101	93	91	86	80	79	70	69	67
	0.131	8d[4]			127	106	97	95	90	84	82	73	72	70
	0.135		16d	12d	135	113	103	101	96	89	88	78	76	74
	0.148	10d	20d	16d	154	128	118	115	109	102	100	89	87	84
	0.162	16d	40d		184	154	141	138	131	122	120	106	104	101
	0.177			20d	213	178	163	159	151	141	138	123	121	117
	0.192	20d		30d	222	185	170	166	157	147	144	128	126	120
	0.207	30d		40d	243	203	186	182	172	161	158	135	131	125
	0.225	40d			268	224	205	201	190	178	172	143	138	132
	0.244	50d		60d	276	230	211	206	196	181	175	146	141	135

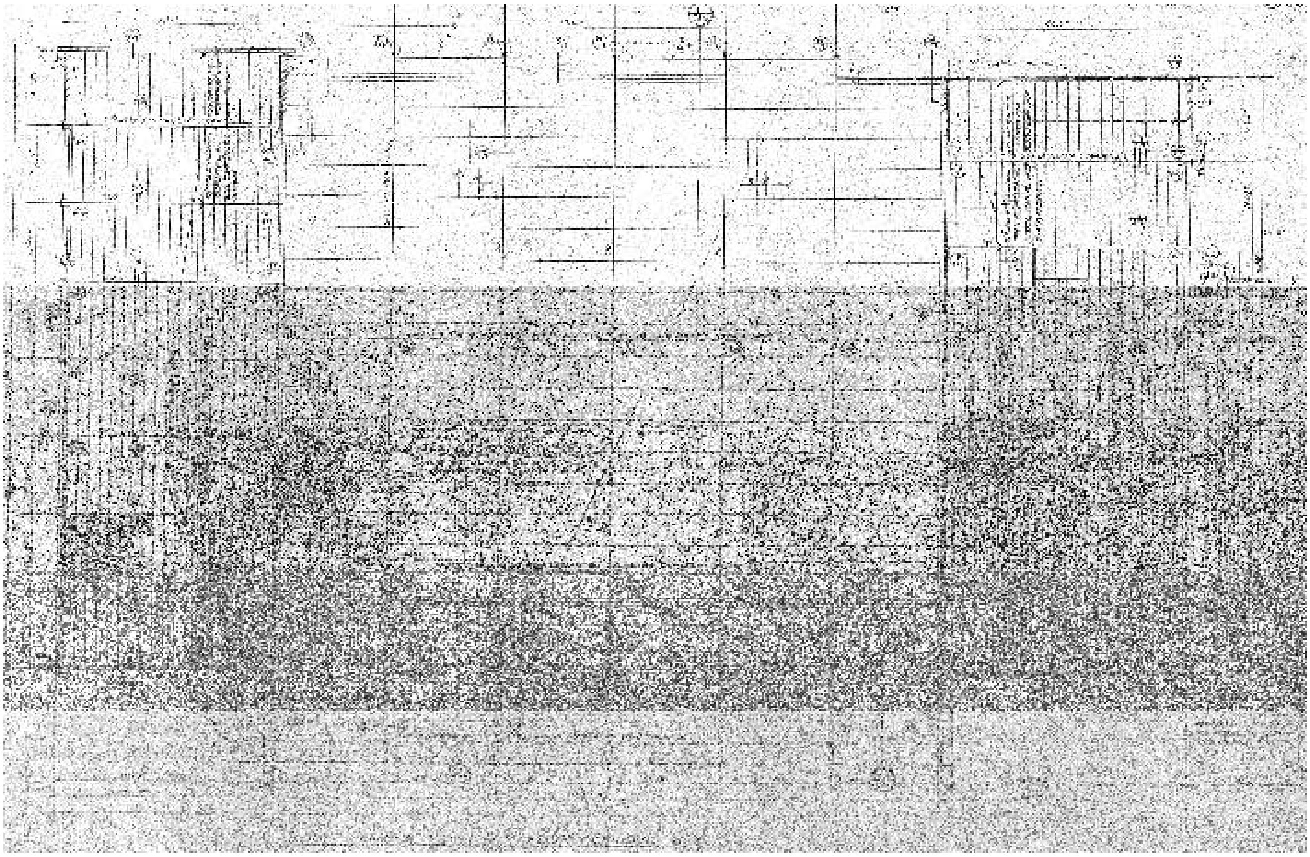
NAILS

DOWEL-TYPE FASTENERS

11

Appendix 1-C: As-Built Plans

Foundation Plan (1963 Drawing Sheet S-14)



Roof Plan (1963 Drawing Sheet S-15)

Appendix 7A – Images of Existing Conditions

Fig 1. Glue lam roof support arches

Fig 2. Masonry side wall & glue lam arch with sheet metal protection

Fig 3. Glue lam roof support arches inside the gym

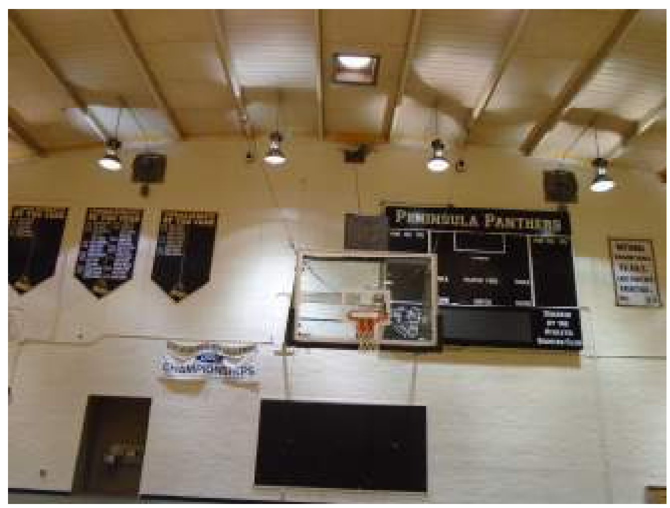


Fig 4. Masonry end wall inside the gym

TTG

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
BOYS SHOWER & LOCKER BUILDING (6)

PALOS VERDES PENINSULA HIGH SCHOOL
27118 Silver Spur Rd.
Rolling Hills Estates, CA 90274

Terry Tsang, S.E.
Structural Engineer S2992
TTG Job No.: 0215.768.00

MARCH 2016

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1.0 Introduction – Boys Shower & Locker Building (6)

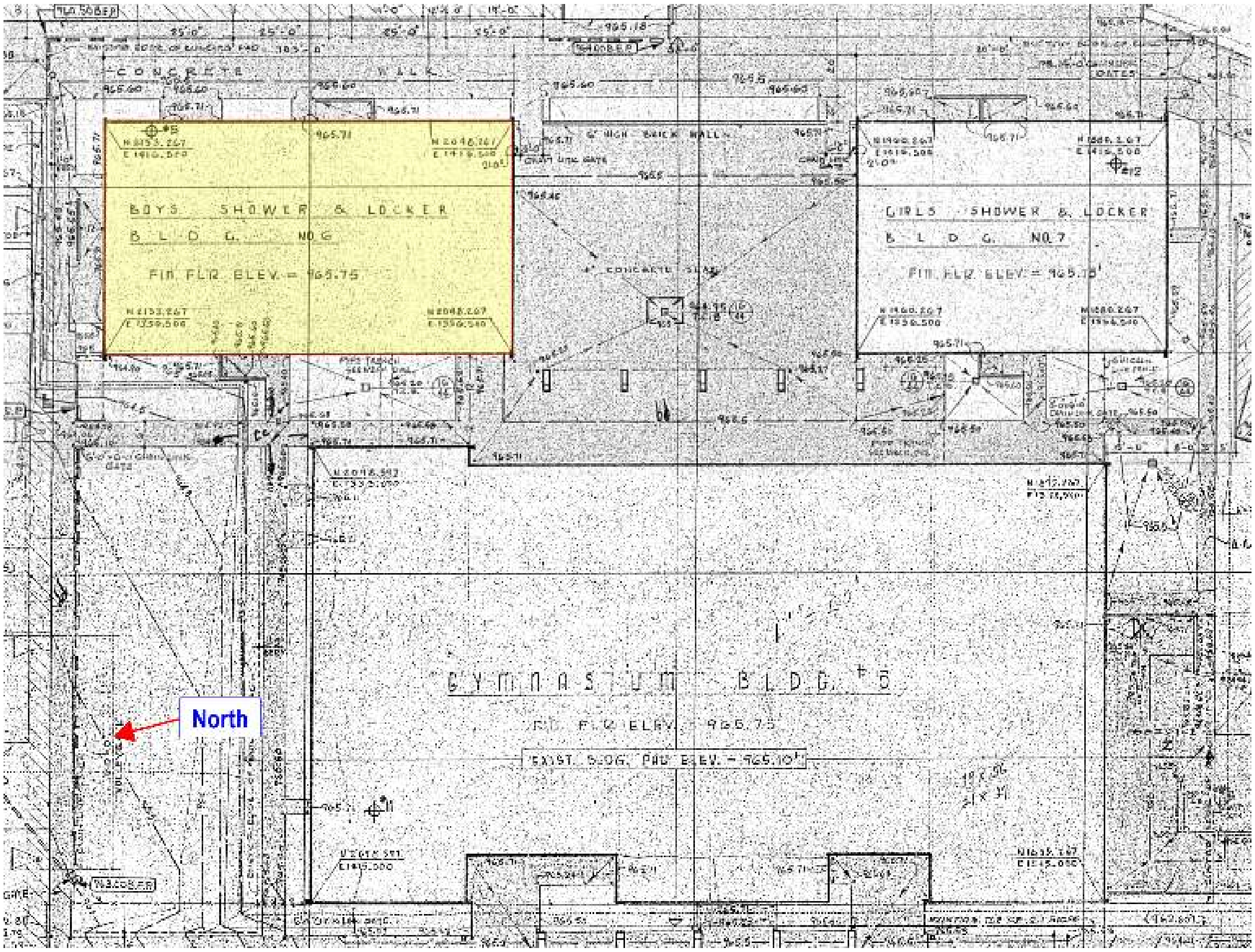
A multiphase seismic vulnerability assessment of ***Boys Shower & Locker Building (6)*** was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 6.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

Photo 1 – Exterior View of Boys Shower & Locker Building

Photo 2 – Interior View of the Building

A partial campus site plan of Palos Verdes Peninsula High School, indicating the building under evaluation, is provided below. The highlighted building is ***Boys Shower & Locker Building (6).***



Partial Site Plan- Boys Shower & Locker Building (6)

2.0 Building (6)– Boys Shower & Locker Building

2.1 Site Seismicity

Based on 1963 construction drawings, original foundation was based on the allowable soil bearing pressure of 2,000 psf for vertical dead loads plus live loads. There is a geotechnical report dated December 21, 2012 by Geo-Advantec Inc. for a proposed 6 Classroom Buildings located about 150 feet to the North-East of the Gymnasium Building available for review.

Per ASCE 41-13 (2012 IBC), for Palos Verdes Peninsula High School located at 27118 Silver Spur Road, Rolling Hills Estates, CA 90274,

Site Coordinates = 33.7706°N, -118.3691°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.512g; $S_{1,20/50}$ = 0.196 g
F_a = 1.391 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.015 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.712g
$S_{X1} = F_v S_{1,20/20}$ = 0.395g

2.2 Building Description

The Boys Shower & Locker Building is a one-story structure in the middle portion of the school campus. The building was constructed circa 1963. The existing drawings for the building are dated April 19, 1963, which shows the proposed Boys Shower & Locker building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of shower and locker rooms, storage rooms and offices. The building is rectangular in shape with approximate dimensions of 105'x 60'. Total footprint of the building is estimated to be ±6,300 square feet. The roof height at the high point of the building is about 14'-0" and at the low point is about 13'-6". The roof of the building consists of plywood panel over wood joists. The wood joists are supported by Glulam girders spanning about 60' at 15' spacing. The Glulam girders are typically supported by cast-in-place concrete columns along the perimeter of the building. The lateral force resistance of the building is provided by reinforced brick walls in combination of concrete walls. The foundation of the building consists of concrete continuous footings.

Based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as "RM1" in combination with Concrete Shear Walls with Flexible Diaphragms denoted as "C2A".

The structural risk category for the Boys Shower & Locker building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Building (6)– Boys Shower & Locker Building Summary Table	
Year Designed	1963
Drawings	Original drawings, dated April 19, 1963, prepared by Flewelling, Moody & Horn Architects, and Engineers.
Gravity System	Wood joists on Glulam beams/girders supported on columns/walls/foundation (Flexible Diaphragm)
Lateral System	Reinforced masonry (Brick) bearing walls and reinforced concrete bearing walls
No. of Stories & Height	1 Stories; Main Roof: h_n=14 ft
Building Period "T"	0.15 Sec
Base Shear "V"	0.712 W = 165 kips Boys Shower & Locker (RM1 & C2A)
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	See Section 4.1 (Retrofit not required)

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of the building is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening, if needed. As a Risk Category ***III***, the Basic Performance Objective for the building was ***Damage Control Structural Performance,*** per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; some were found to be "Compliant" and others were found to remain "Deficient."

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Coupling Beams

3.2 ASCE 41-13 Tier 2 Evaluation

The deficiency listed above was reviewed using a Tier 2 Evaluation. The deficiency was mitigated base on results of Tier 2 evaluation, which can be found in Appendix 1-B. Deficiency No. 1 (Coupling Beams) was mitigated with analysis results per ASCE 41-13 section 5.5.3.2.1 by insuring that the coupling beam has sufficient capacity for the load demands. The Tier 2 analysis was performed using analysis results from the ETABS model developed for the Tier 2 evaluations. Linear dynamic procedure was used for the analysis of the structure using BSE-1E level seismic response spectrum. Output forces are exported into excel spreadsheet and series of calculation per ASCE 41-13 are performed to verify the components have sufficient capacity for load demands.

4.0 Conclusions

The coupling beam deficiency identified by Tier 1 checklist is mitigated by Tier 2 analysis results. After further review and updating Tier 1 checklist as per ASCE 41-13, no other deficiencies were identified which required tier 2 evaluation.

Given the reason above, a voluntary seismic retrofit is not required for this structure.

5.0 Documents Reviewed

The following existing architectural and or structural drawings (and or other documents when available) were reviewed:

Date	Architect / Engineer	TTG Comments
April 19, 1963	Flewelling, Moody & Horn Architects and Engineers	Title Block states “Boys’ Shower and Locker Bldg. No. 6, Rolling Hills High School, Palos Verdes Peninsula Unified School District” Architectural and structural drawings (State of California – Department of Public Works, Division of Architecture, Project No. 23166)
December 12, 2012	Geo-Advantec, Inc.	Geotechnical Engineering Evaluation Report “Proposed 6 Classroom Buildings & Weight Room”, Palos Verdes Peninsula High School

6.0 Limitations

These reports represent ***TTG’s*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Peninsula High School Building D, Boys Locker

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7.0 Architectural Section

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the

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District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Palos Verdes Peninsula High School is a public high school with in the Palos Verdes Peninsula Unified School District. The original buildings were completed in 1963 and includes all the buildings of concern for this analysis. It was originally called Rolling Hills High School and has been in constant use as a high school since that time. The original campus buildings were designed by the firms of Flewelling, Moody, and Horn Architects and is mostly of concrete construction. The building referred to as D is part of the original campus buildings.

Building D is at the middle of the campus adjacent to the gym and pool. It is a one story building. It contains the boys' lockers and showers. The building structure consists of reinforced brick masonry exterior walls on the east and west and cast in place concrete walls on the north and south. The roof structure is glue laminated beams with joists and plywood deck. The glue laminated beams are supported on concrete piers within the masonry walls.

The exterior walls of the building are non-combustible construction. It has combustible roof framing and the glue laminated beams protrude beyond the exterior walls on the east and west. The building appears to fit within the current CBC Type-5B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability,

moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Work

No Recommended Retrofit
After further tier 2 analysis it was determined that the building does not require any seismic retrofit work for life safety.

Miscellaneous Recommended Work

Roofing
It is recommended to maintain the roof system in good repair to minimize any deterioration of the wood roof framing system. It is also recommended to maintain the exposed ends of the glue laminated beams that support the roof.

Accessibility Upgrades

There are no accessibility upgrades anticipated for this building since no retrofit work is recommended.

Fire & Life Safety

There are no fire & life safety upgrades anticipated for this building since no retrofit work is recommended.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Appendix 1-A: Tier 1 Screening Checklists

ASCE 41-13 Checklists

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path exists.
x				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.2)	No other buildings within 10 feet of this building
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanines
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	It is one story building, so not applicable.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	It is one story building, so not applicable.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	All vertical elements continuous to foundation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	It is one story building, so not applicable.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	It is one story building, so not applicable.
X				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Roof consists of flexible wood diaphragms with minimum of 2 lines of shear wall support. Torsion appears not exist.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
x				LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), the building site is not in liquefaction susceptible zone.
x				SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), the building site is not susceptible to slope failure.
x				SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), surface fault rupture not anticipated.

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
x				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.712=0.43 Compliant per review of existing drawings.
x				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Foundation elements are tied together by continuous footings and slab on grade.

16.10LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES C2: CONCRETE SHEAR WALLS WITH STIFF DIAPHRAGMS AND C2A: CONCRETE SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (§A.3.1.6.1. Tier 2: §5.5.2.5.1)	Complete vertical-load carrying system exists.
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	There are at least 2 lines of shear walls in each direction.
x				SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in² or 2√f'c. (§A.3.2.2.1. Tier 2: §5.5.3.1.1)	Average shear stress is less than max {100,2√f'c} =100 psi. See calculations in Appendix 1-B.
x				REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (§A.3.2.2.2. Tier 2: §5.5.3.1.3)	Reinforcing steel ratios meet requirements; see calculations in Appendix 1-B.
Connections					
x				WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Wall anchorage is sufficient. See calculations in Appendix 1-B.
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	Diaphragms are connected to shear walls.

C	NC	N/A	U	Checklist	Comments
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	Wall reinforcement is doweled into foundation.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Seismic-Force-Resisting System					
x				DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (§A.3.1.6.2. Tier 2: §5.5.2.5.2)	Meet requirements.
		x		FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (§A.3.1.6.3. Tier 2: §5.5.2.5.3)	Not applicable. There is no slab which is not part of the seismic force resisting system.
x				COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than d/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (§A.3.2.2.3. Tier 2: §5.5.3.2.1)	Concrete coupling beam on the North wall not-compliant per Tier 1 checklist requirements (Tier 2 calculation to verify). Mitigated by Tier 2 calculation.
Connections					
		x		UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (§A.5.3.8. Tier 2: §5.7.3.5)	No pile caps, so not applicable.
Diaphragms (Flexible or Stiff)					
x				DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (§A.4.1.1. Tier 2: §5.6.1.1)	There is no diaphragm discontinuity in the building, so compliant.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	Meet requirements, so compliant.
Flexible Diaphragms					

C	NC	N/A	U	Checklist	Comments
x				CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Cross ties exist.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	Straight sheathing diaphragms not used.
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	Wood structural panels exist.
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	No diagonally sheathed diaphragms. Structural panel diaphragms are blocked.
		x		OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	No other diaphragms.

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY SHEAR WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	At least 2 lines of shear walls present.
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in^2. (§A.3.2.4.1. Tier 2: §5.5.3.1.1)	Shear stress is less than 70 psi.
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. (§A.3.2.4.2. Tier 2: §5.5.3.1.3)	Reinforcing steel ratios meet requirements.
Stiff Diaphragms					
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (§A.4.5.1. Tier 2: §5.6.4)	No precast diaphragm elements.
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Wall anchorage is sufficient.
x				WOOD LEDGERS: The connection between the wall panels and the diaphragm does not	Connection does not induce cross-grain bending or tension.

C	NC	N/A	U	Checklist	Comments
				induce cross-grain bending or tension in the wood ledgers. (§A.5.1.2. Tier 2: §5.7.1.3)	
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	There is positive connection for shear transfer between diaphragm and shear wall in all locations
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (§A.5.2.3. Tier 2: §5.7.2)	No precast diaphragm elements.
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	Wall reinforcement is dowelled into foundation.
x				GIRDER-COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (§A.5.4.1. Tier 2: §5.7.4.1)	Positive connection present at girder-column connections.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity					
Stiff Diaphragms					
		x		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	No stiff diaphragms.
		x		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	No stiff diaphragms.
Flexible Diaphragms					
x				CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Continuous cross ties present.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear	Diaphragm openings adjacent to shear walls are less than 25% of

C	NC	N/A	U	Checklist	Comments
				walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	the wall length.
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	Diaphragm openings adjacent to exterior masonry shear walls are not greater than 8 feet.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	Straight sheathing diaphragms not used.
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	Structural panel over straight sheathing on gymnasium roof.
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	No diagonally sheathed or unblocked diaphragms.
		x		OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	No other diaphragms used.
				Connections	
x				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (§A.5.1.4. Tier 2: §5.7.1.2)	Stiff steel anchors used.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
				Life Safety Systems	
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Hazardous Materials	
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4.	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				Tier 2: §13.7.3 and 13.7.5)	
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
				Partitions	
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
			X	LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Not accessible during site visit
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
				Light Fixtures	
			X	LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Not accessible during site visit
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Cladding and Glazing	
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
				Masonry Veneer	
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no	No URM backup, so not applicable.

C	NC	N/A	U	Checklist	Comments
				unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
				Parapets, Cornices, Ornamentation, and Appendages	
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
		X		LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	None Observed; so not applicable
X				LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	Observed compliant
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	
Masonry Chimneys					
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
Stairs					
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
Contents and Furnishings					
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable

C	NC	N/A	U	Checklist	Comments
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
		X		LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	None observed; So non applicable
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
		X		LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	None observed; So not applicable
			X	LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Not accessible during site visit
		X		LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	None observed; So not applicable
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
				Piping	
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	
Ducts					
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
Elevators					
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2:	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				§13.8.6)	
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW		Bldg Type= **RM1 & C2A**
$C =$	1	From Table 4-8 for 1963 Shower/Locker Building	
$S_a =$	$\min(S_{XS}, S_{X1}/T)$	From Section 4.5.2.3	
$S_{X1} =$	F_VS_1	Eq. 2-2	
$S_{XS} =$	F_aS_S	Eq. 2-1	
$S_S =$	0.512	g, mapped spectral acceleration	
$S_1 =$	0.196	g, mapped spectral acceleration	
$S_{X1} =$	0.395	g	
$S_{XS} =$	0.712	g	
$T =$	$C_th_n^{\beta}$	From Section 4.5.2.4	
$C_t =$	0.02		
$h_n =$	14	ft., average height at sloped roof	
$\beta =$	0.75		
$T =$	0.145	sec.	
$S_a =$	0.712	g	
$V_{MP\ 1972} =$	0.712	W	

TTG

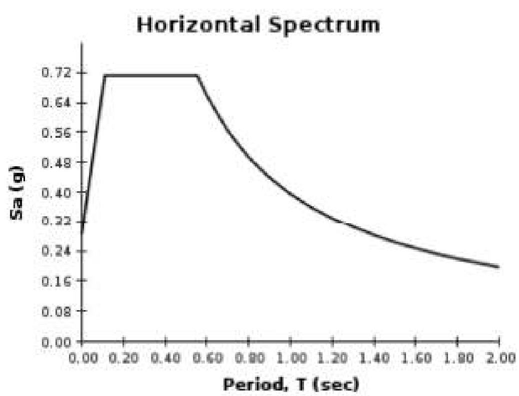
USGS Design Maps Summary Report

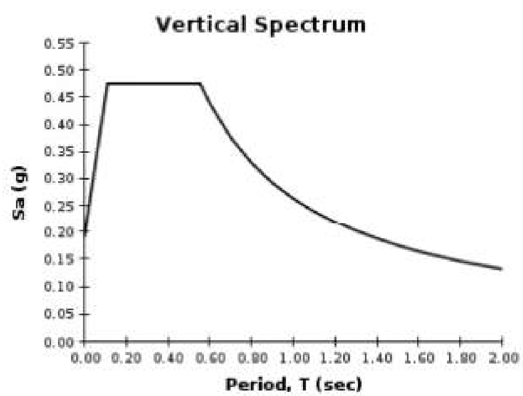
User–Specified Input

Report Title	California Minimum Ss Sat January 23, 2016 03:52:06 UTC
Building Code Reference Document	ASCE 41-13 Retrofit Standard, BSE-1E (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.77058°N, 118.3691°W
Site Soil Classification	Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.512 g	$S_{XS,BSE-1E}$	0.712 g
$S_{1,20/50}$	0.196 g	$S_{X1,BSE-1E}$	0.395 g





Seismic Mass Weight - 1963 Construction

Roof

(Roof area with 1/2" Plywood sheathing)

Roofing	6	psf
1/2" Plywood	1.5	psf
Wd joist 4x10@48" typ.	1.5	psf
Roof Glulam beams	4	psf
MEP	3	psf
Ceiling	3	psf
Misc	1	psf
DL =	**20**	**psf**
Use	**20**	**psf**

Wall Weight

9" brick wall =	90	psf
10" brick wall =	100	psf
8" concrete wall =	100	psf
Wood/metal stud wall =	15	psf

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation

Location		Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Roof	Roof	105.0	60.0	6300.0	17	107
	9" Brick Walls, out plane	105.0	7.0	735.0	90	66
	9" Brick Walls, out plane	105.0	6.25	656.3	90	59
	Grand Total =			**6300**		**232**

Base shear V_{Gym}= 0.712 W
V = **165** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x	h_x	$w_x h_x$	Fx	Area	fi
	kip	ft	k-ft	kip	ft2	psf
Roof	232	22.75	5285	165	6300.0	26.3
Sum =	232		5285	165		

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1 Footnote b for reinforced concrete walls

Wall Forces - Supporting Roof						
	Wall Description	Length ft	Width in	Aw in2	Force Vj kips	v avg psi
N-S Direction	Wall thick 9"	105.0	9.0	11340	165	2.4
	Wall thick 9"	105.0	9.0	11340		
E-W Directioin	Wall thick 8"	60.0	8.0	5760	165	4.8
	Wall thick 8"	60.0	8.0	5760		

Per ASCE 41-13 check list 16.10LS, if shear stress less than max(100, 2f'c^0.5)=109 psi in concrete wall, OK
fc'=3 ksi Average wall shear is less than 109 psi, O.K.
For RM1 wall per checklist 16.15 LS, if shear stress is less than 70 psi, O.K.

Reinforced Concrete Wall, Reinforcing Steel Ratio

8" Concrete wall with #4 @ 16" Verti & #4 @ 10" Horizontal at center of wall

Hori ρ= 0.0025 Shall not be less than 0.0012 vertic, 0.0020 in hori direction
Verti ρ= 0.0016 Meeting requirements on reinforcing steel

Reinforced Masonry Wall, Reinforcing Steel Ratio

9" Brick wall with #4 @ 15" Verti & Horizontal at center of wall

Hori ρ=	0.0015	Total V&H reinft not be less than 0.0002; min. not less than 0.0007
Verti ρ=	0.0015	Meeting requirements on reinforcing steel
Total ρ=	0.0030	

Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

Tc=	$1.2S_{XS}\ w_p\ A_p$ =	82.0	psf	Eqn 4-13
S_{XS} =	0.712			
w_p =	96	psf	9" brick wall; or 8" concrete wall	
Ap =	1	ft2		

Evaluate connection for out-of-plane action per Tier 2 procedure
Per Section C7.5.1.2, connections should be evaluated as force-controled procedure.

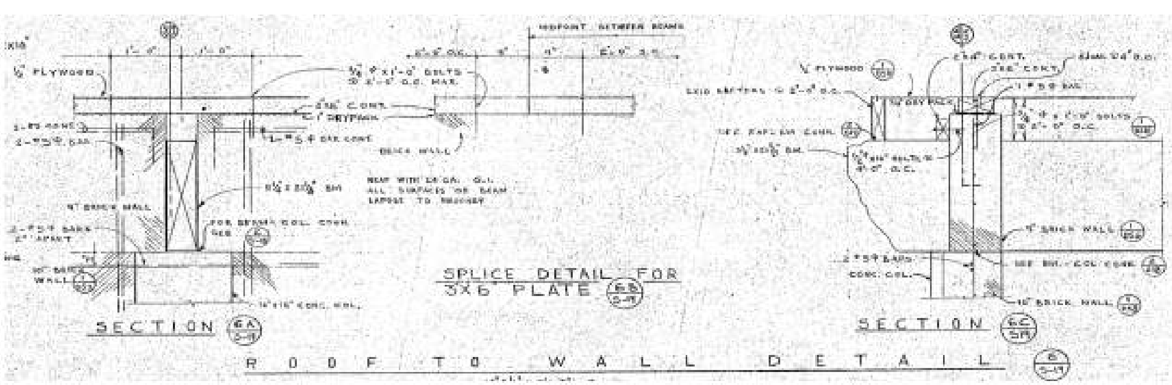
C_1C_2 =	1.4	From Table 7-3		
J=	1	Per Section 7.5.2.1.2		
Q_{UF}=	Q_G+/-Q_E/(C_1C_2J)	Eqn 7-35		
	Q_G =	0.0	lbs	
	Q_E=	512.6	lbs	End shear for 1'x6.25' wall (WxH)
	Q_{UF}=	366.2	lbs	End shear divided by CJ factor

Per detail 18/S-17, wall anchors @ S =	2.00	ft	**Typical anchor @ 2'-0"**
Out of plane force T_{UF}=	**732**	lbs	Each anchor location

Typical anchor capacity per 6/S-19 (3/4" Dia Bolt @ 24" and 8d nails @4")

$B_{vn}=4A_{pv}\sqrt{f'm}$	7153	lbs	(ACI 530-05, Equation 3-8)
f'm=	1000	psi	
$A_{pv} = \pi\ l^2_{be}\ /2$	56.55	in^2	
B_{vn}= $0.6A_bf_y$=	**11,880**	lbs	(ACI 530-05, Equation 3-9)
$B_{vn\ (smallest)}$ =	7153	lbs	
8d nails @ 4" =	222.0	lbs	each nail
(7) nails each 24", capacity =	1554	lbs	
Ncn=min(7153, 1554)=	**1,554**	lbs	>= T_{UF}, Okay

Therefore, wall out-of-plane anchorage issufficient, per detail 6/S-19



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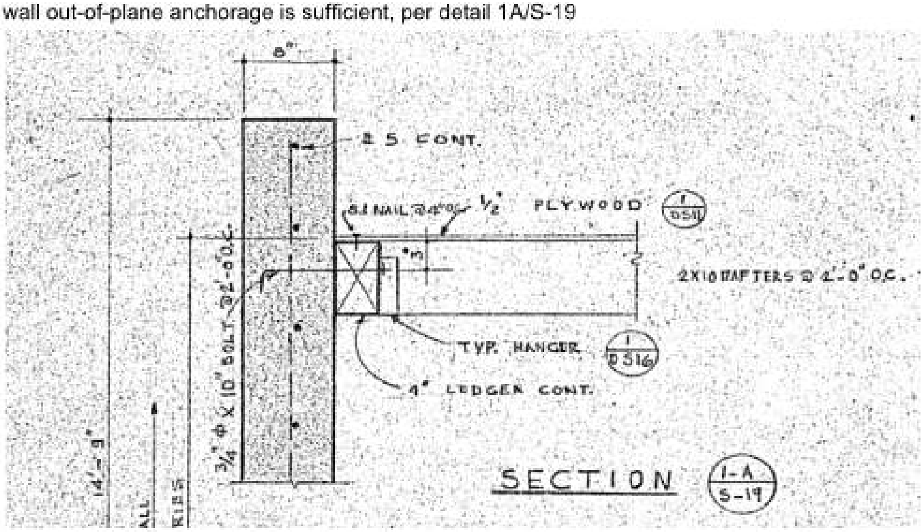
Wall anchor capacity per 1A/S-19 (Note: Allowable to Capacity factor = 3)

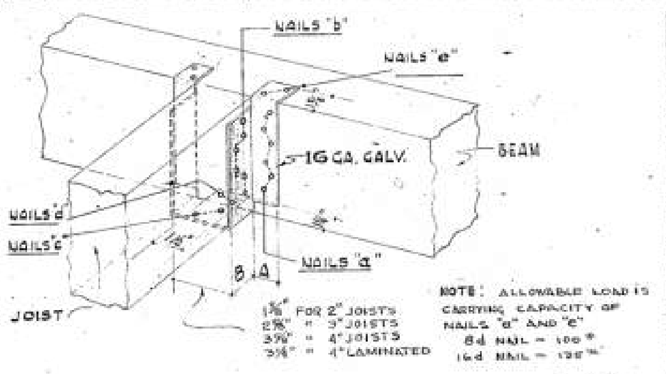
$B_{an}=4A_{pt}\surd f'm$ =	14305	lbs	(ACI 530-05, Equation 3-1; conservative estimate)
f'm=	1000	psi	
$A_{pv} = \pi\ l^2_{be}$	113.09	in^2	
$B_{an}= A_b f_y$=	**19,800**	lbs	(ACI 530-05, Equation 3-2)
$B_{an\ (smallest)}$ =	14305	lbs	

Hanger capacity = 6480 lbs, per detail 1/DS16

Ncn=min(14305, 6480)= **6,480** lbs >= T_{UF}, Okay

Therefore, wall out-of-plane anchorage is sufficient, per detail 1A/S-19



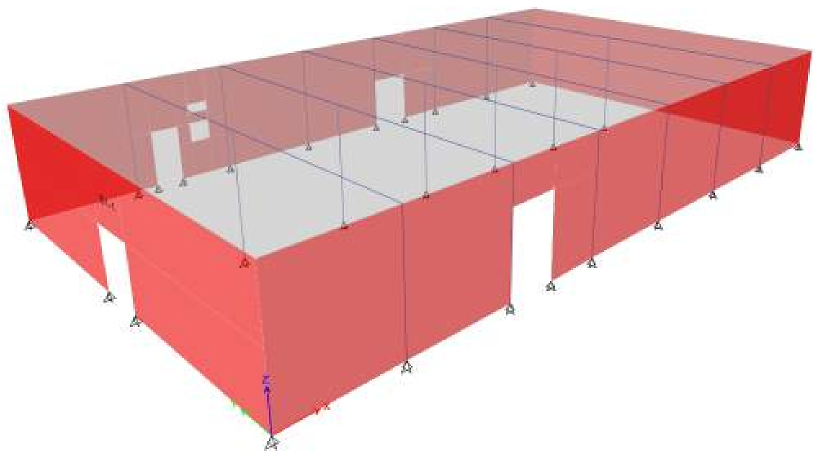


"U" TYPE JOIST HANGER

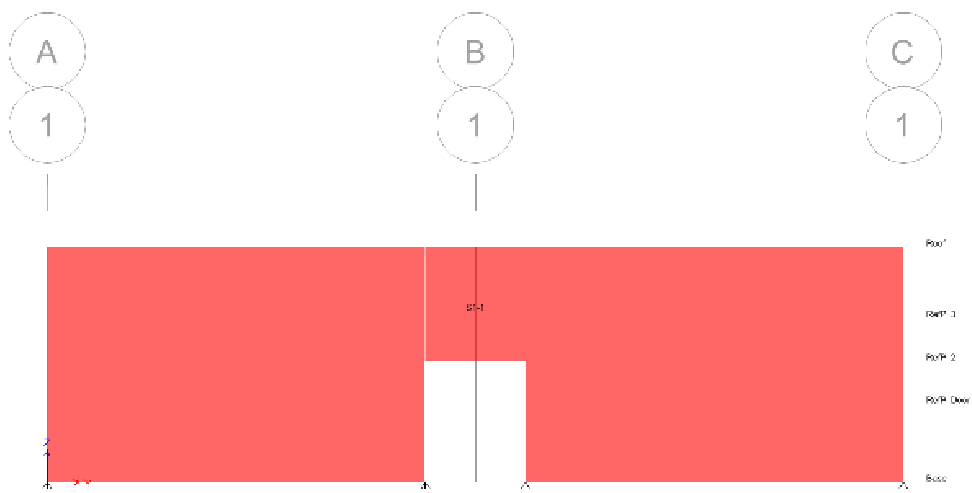
JOIST HANGER SHOWN IS "YET" TYPE OR APPROVED EQUAL.

JOIST SIZE.	DIMEN. A	DIMEN. B	NAILS a EA. SIDE	b EA. SIDE	c	d	e EA. SIDE	ALLOWABLE LOAD ON NAILS "a" AND "e"
2 x 4	1 1/4"	2"	2 - 8d	1 - 8d	2 - 8d	2 - 8d	2 - 8d	500 #
2 x 6			4 - 8d	2 - 8d		2 - 8d	2 - 8d	1200
2 x 8			4 - 16d	2 - 8d		2 - 8d	2 - 16d	1620
2 x 10			6 - 16d	3 - 8d		2 - 8d	2 - 16d	2160
2 x 12			6 - 16d	3 - 8d		2 - 8d	2 - 16d	2160
2 x 14			6 - 16d	3 - 8d		2 - 8d	2 - 16d	2160
2 x 16			6 - 16d	3 - 8d		2 - 8d	2 - 16d	2160

<<< Detail 1/DS16



ETABS Model 3D View - Boys's Shower & Locker Building (6)



ETABS Model Elevation View - Boys's Shower & Locker Building (6), Spandrel S1-1

1 Analysis Results

This chapter provides analysis results.

1.1 Line Results

Table 1.1 - Spandrel Forces

Story	Spandrel	Load Case/Combo	Step Type	Location	P kip	V2 kip	V3 kip	T kip-ft	M2 kip-ft	M3 kip-ft
Roof	S1-1	QfuX1Env	Max	Left	-0.479	-2.539	0.123	0.494	0.3366	11.504
Roof	S1-1	QfuX1Env	Max	Right	-0.554	3.873	0.108	0.4323	0.3208	11.6228
Roof	S1-1	QfuX1Env	Min	Left	-9.148	-3.884	-0.121	-0.4872	-0.3366	-12.1061
Roof	S1-1	QfuX1Env	Min	Right	-9.064	2.532	-0.106	-0.4247	-0.3242	-12.1985
Roof	S1-1	QfuY1Env	Max	Left	7.376	7.734	0.944	3.806	0.9488	30.6014
Roof	S1-1	QfuY1Env	Max	Right	7.771	14.146	0.945	3.8124	0.9859	29.0873
Roof	S1-1	QfuY1Env	Min	Left	-17.004	-14.157	-0.942	-3.7993	-0.9487	-31.2036
Roof	S1-1	QfuY1Env	Min	Right	-17.389	-7.741	-0.943	-3.8049	-0.9893	-29.663

Check Spandrel (Coupling Beams) Capacity (per §10.7; ASCE 41-13)

Concrete Shear Wall is deformation controlled actions for shear and flexure

$mkQ_{CE} > Q_{UD}$		(Acceptance criteria for shear and bending, Eqn 7-36)
Vn= Acv(2λ√fc' + ρ fy)		(Wall nominal shear capacity ACI 318-08, Equ 21-7)
fc'=	3000	psi, Normal Weight Concrete
λ=	1	Lt. Wt Conc use 0.75; normal Wt use 1.0
fy=	40000	psi
Expected, fce'=	4500	psi (fc' x1.5 per Table 10-1)
Expected, fy=	50000	psi (fy x1.25 per Table 10-1)
Average m=	3	(Min. 1.5 ~ Max. 3 per Table 10-22 for Collapse Prevention)
k=	1	Table 6-1, material test will be done

BSE1E Level Seismic Force

Load Combo QfuX1Env Max Left **Shear Capacity**

Level	Pier Label	Spandrel Depth h_w (in)	Pier Width t_w (in)	wall area (in^2)	Reinft ρ	$Q_{CE}=V_n$ (Kips)	$Q_{CE,\ at\ M}$ (Kips)	Demand V_{UD} (kips)	m factor Damage Control (S-2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{V}{t_w l_w \lambda\sqrt{f_c'}}$
Roof	S1-1	96	8	768	0.0016	163	193	-3	2.00	128.43	0.0

Load Combo QfuY1Env Max Left **Shear Capacity**

Level	Pier Label	Spandrel Depth h_w (in)	Pier Width t_w (in)	wall area (in^2)	Reinft ρ	$Q_{CE}=V_n$ (Kips)	$Q_{CE,\ at\ M}$ (Kips)	Demand V_{UD} (kips)	m factor Damage Control (S-2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{V}{t_w l_w \lambda\sqrt{f_c'}}$
Roof	S1-1	96	8	768	0.0016	163	193	8	2.00	42.16	0.2

Note: 8" thick wall with #4@16" (V), #4@10" (H) 3000 psi normal weight concrete.
Shear Capacity is the smallest of Vn or Vn at Reaching Bending Moment Capacity; RED Vn indicate shear control (m-factor from Table 10-22)

Load Combo QfuX1Env **X-Direction Force (East-West)** **Check Spandrel (Coupling Beam) Bending Capacity - Damage Control (S-2)**

Level	Pier Label	Value	Location	Axial P_{UD} (kips)	Demand M_{UD} (k-ft)	Capacity M_{CE} (k-ft)	A (in2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{(A_S - A_S')f_y + P}{t_w l_w f_c'}$	$\frac{V}{t_w l_w \sqrt{f_c'}}$	m-factor for M (Table 10-21)	m-factor for V (Table 10-22)
Roof	S1-1	Max	Left	0	12	676	768	117.52	0.000	0.0		2
Roof	S1-1	Min	Left	-9	-12	676	768	111.68	0.003	0.0		2

Load Combo QfuY1Env **Y-Direction Force (North-South)** **Check Spandrel (Coupling Beam) Bending Capacity - Damage Control (S-2)**

Level	Pier Label	Value	Location	Axial P_{UD} (kips)	Demand M_{UD} (k-ft)	Capacity M_{CE} (k-ft)	A (in2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{(A_S - A_S')f_y + P}{t_w l_w f_c'}$	$\frac{V}{t_w l_w \sqrt{f_c'}}$	m-factor for M (Table 10-21)	m-factor for V (Table 10-22)
Roof	S1-1	Max	Left	7	31	676	768	44.18	-0.002	0.0		2
Roof	S1-1	Min	Left	-17	-31	676	768	43.33	0.005	0.0		2

```
15 day trial license. Locking Code: 4-24DE6. User: admin, TTG                                01/28/16
C:\Users\azheng\Documents\Palos Verdes Peninsula HS Boys-Girls Shower Bldgs 6...\Spandrel S1-1.col      02:44 PM


General Information:
====================
  File Name: C:\Users\azheng\Documents\Palos Verdes Peninsula HS Boys-Girls Showe...\Spandrel S1-1.col
  Project:  PVPHS Bldg 6 Boys Locker
  Column:   S1-1                          Engineer:
  Code:     ACI 318-08                    Units: English

  Run Option: Investigation               Slenderness: Not considered
  Run Axis:   X-axis                      Column Type: Structural

Material Properties:
====================
  f'c   = 4.5 ksi                         fy   = 50 ksi
  Ec    = 3823.68 ksi                     Es   = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.825

Section:
========
  Rectangular: Width = 8 in               Depth = 96 in

  Gross section area, Ag =  768 in^2
  Ix =  589824 in^4                       Iy =  4096 in^4
  rx =  27.7128 in                        ry =  2.3094 in
  Xo =  0 in                              Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  #  3      0.38        0.11   #  4      0.50        0.20   #  5      0.63        0.31
  #  6      0.75        0.44   #  7      0.88        0.60   #  8      1.00        0.79
  #  9      1.13        1.00   # 10      1.27        1.27   # 11      1.41        1.56
  # 14      1.69        2.25   # 18      2.26        4.00

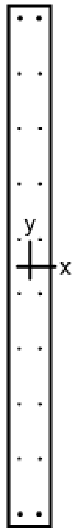
  Confinement: Other; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 1,  phi(b) = 1,  phi(c) = 0.7

  Layout: Rectangular
  Pattern: Sides Different  (Cover to transverse reinforcement)
  Total steel area: As = 3.52 in^2 at rho = 0.46% (Note: rho < 0.50%)
  Minimum clear spacing = 2.75 in

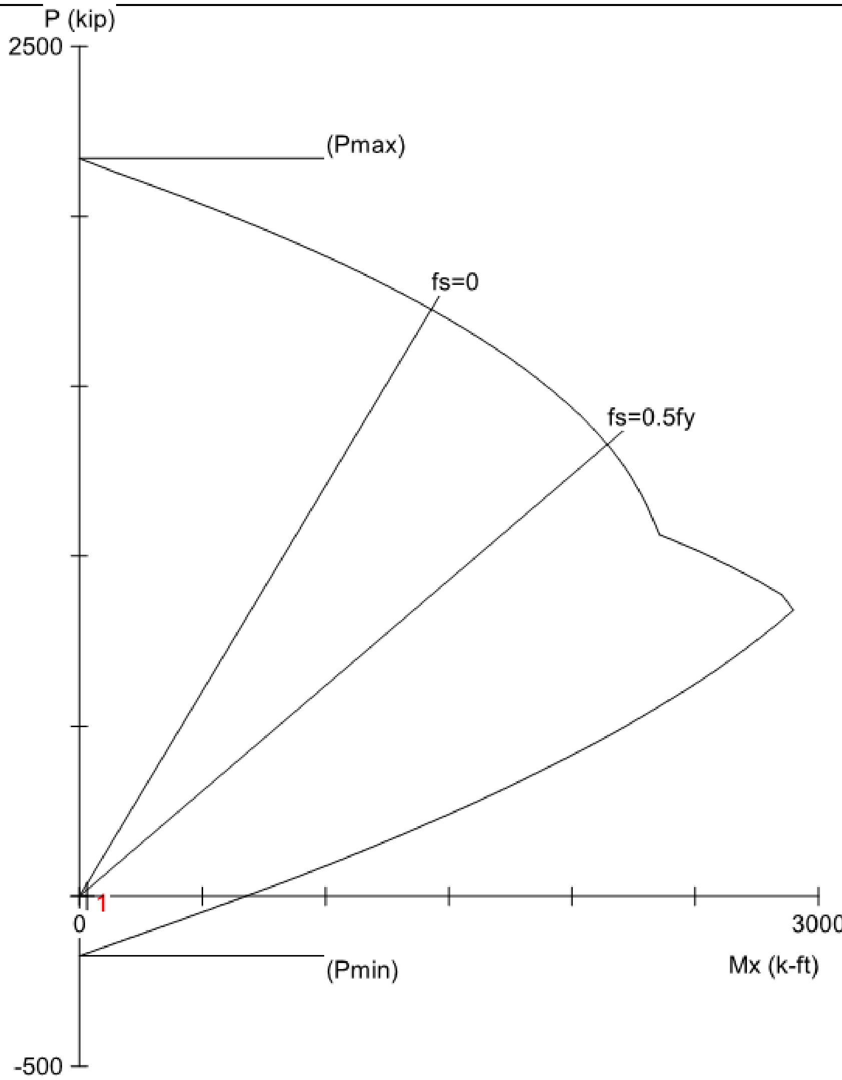
                    Top       Bottom         Left        Right
                 --------    --------     --------     --------
    Bars           2  # 6      2  # 6       8  # 3       8  # 3
    Cover(in)        1.5         1.5          1.5          1.5

Factored Loads and Moments with Corresponding Capacities:
=========================================================
               Pu          Mux        PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
  No.         kip         k-ft          k-ft                in       in
  --- ------------ ------------ ------------ -------- -------- -------- -------- ------
    1        0.00        31.00        675.99   21.806     4.02    93.75  0.06688  1.000

  *** End of output ***
```



8 x 96 in



Code: ACI 318-08

Units: English

Run axis: About X-axis

Run option: Investigation

Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 01/28/16

Time: 14:45:59

spColumn v4.80. 15 day trial license. Locking Code: 4-24DE6. User: admin, TTG

File: C:\Users\azheng\Documents\Palos Verdes Peninsula HS Boys-Girls Shower Bldgs 6 & 7\Spandrel S1-1.col

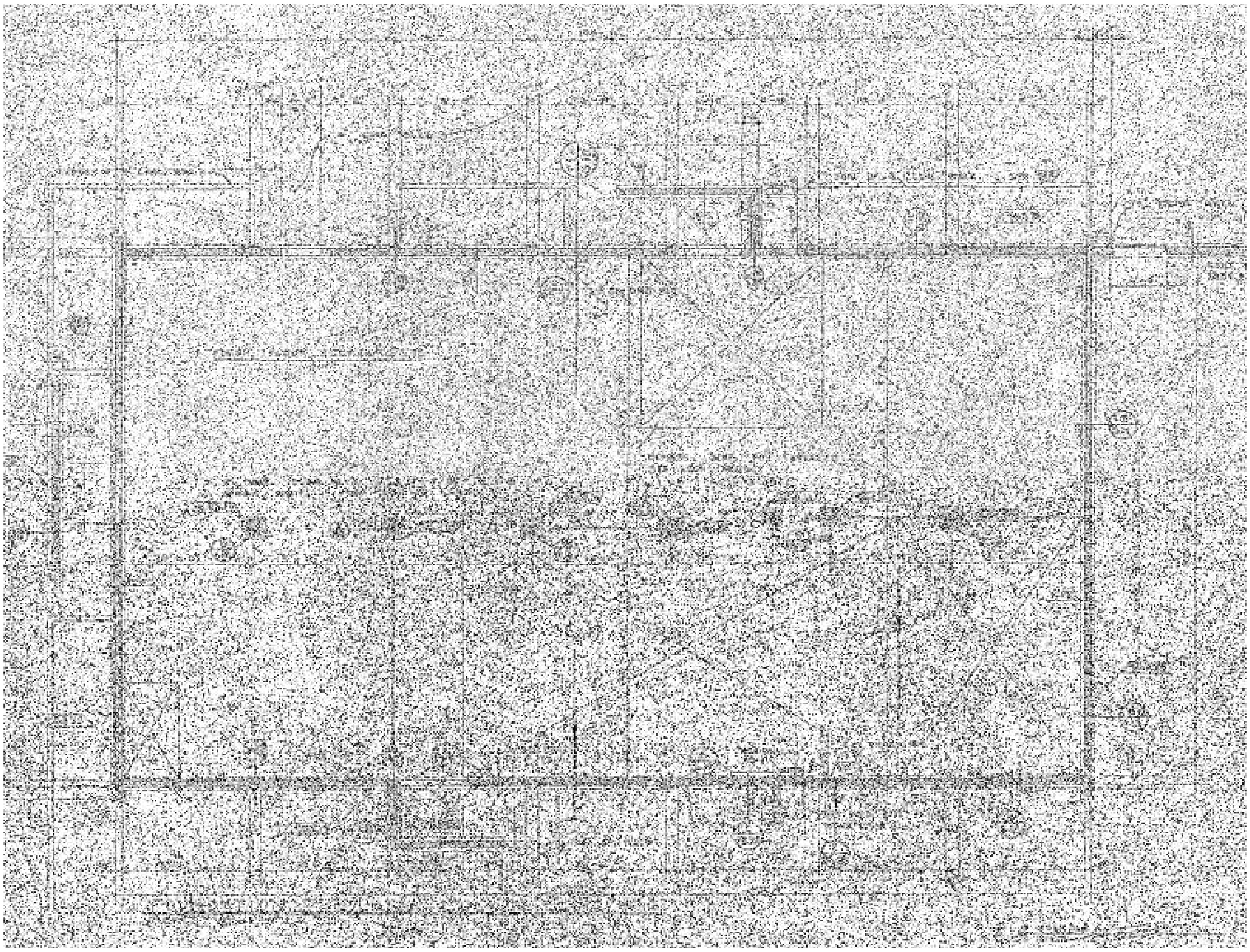
Project: PVPHS Bldg 6 Boys Locker

Column: S1-1		Engineer:	
f'c = 4.5 ksi	fy = 50 ksi	Ag = 768 in^2	20 bars
Ec = 3824 ksi	Es = 29000 ksi	As = 3.52 in^2	rho = 0.46%
fc = 3.825 ksi		Xo = 0.00 in	Ix = 589824 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 4096 in^4
Beta1 = 0.825		Min clear spacing = 2.75 in	Clear cover = 1.88 in

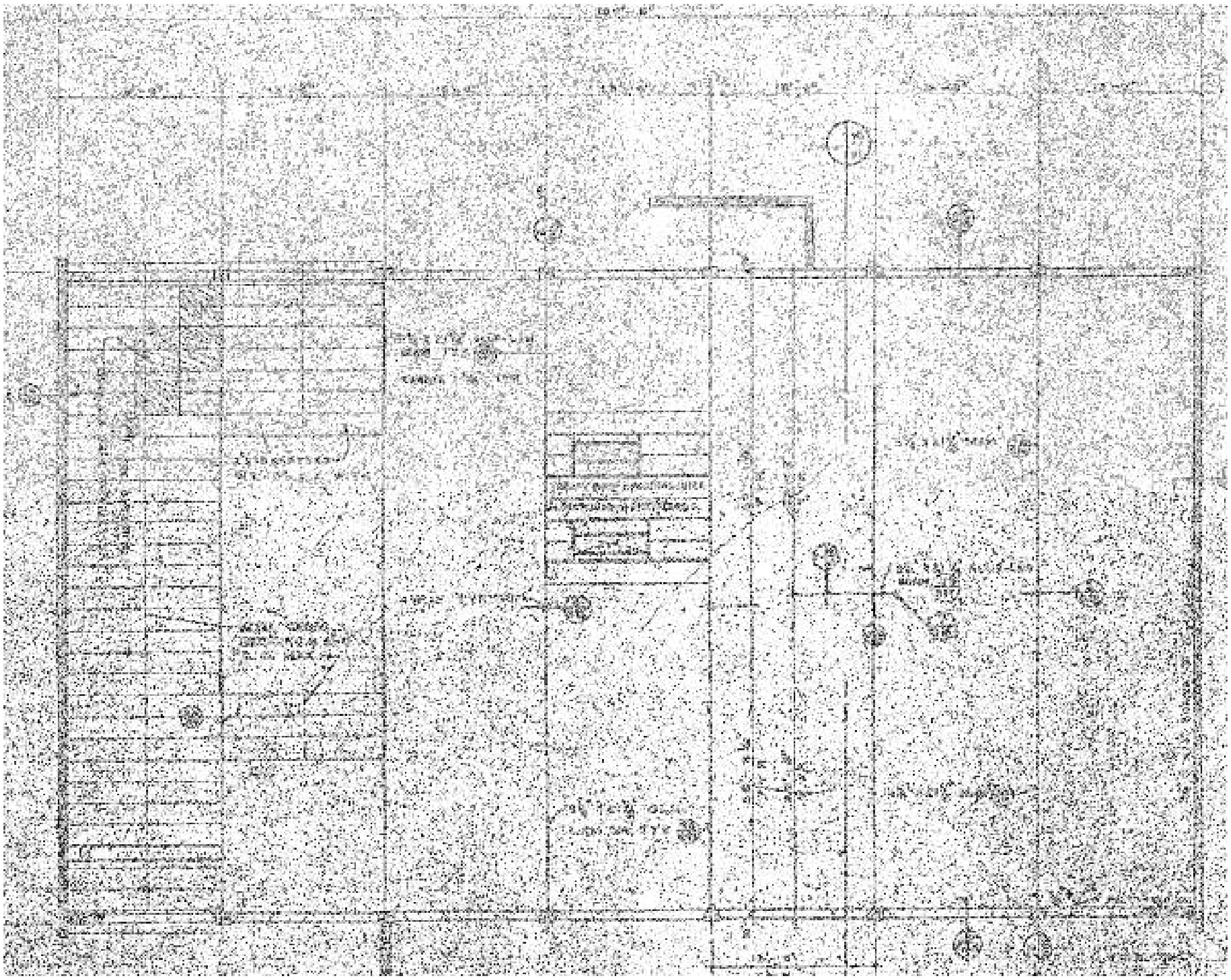
Confinement: Other

phi(a) = 1, phi(b) = 1, phi(c) = 0.7

Appendix 1-C: As-Built Plans



Foundation Plan (1963 Drawing Sheet S-18)



Roof Plan (1963 Drawing Sheet S-18)

Appendix 7A – Images of Existing Conditions

Fig 1. Exterior masonry wall with concrete piers

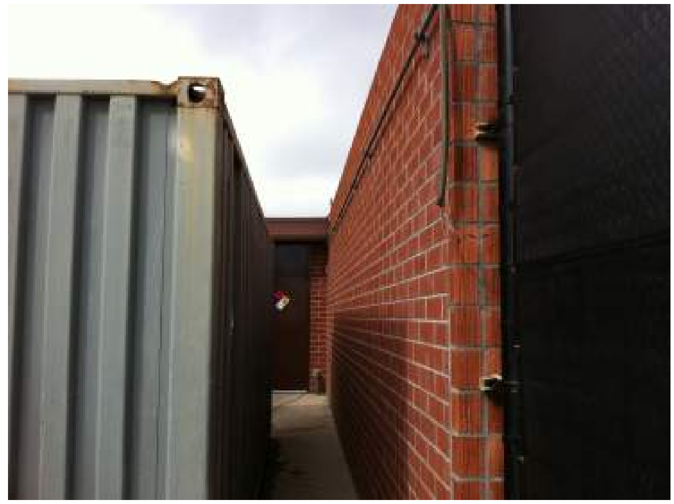


Fig 2. Perimeter masonry wall

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
GIRLS SHOWER & LOCKER BUILDING (7)

PALOS VERDES PENINSULA HIGH SCHOOL
27118 Silver Spur Rd.
Rolling Hills Estates, CA 90274

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1.0 Introduction – Girls Shower & Locker Building (7)

A multiphase seismic vulnerability assessment of ***Girls Shower & Locker Building (7)*** was conducted, beginning with a site visit on 12/21/2015, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation, if needed.

All of the evaluations and studies were based on existing documents provided by the District (see Section 6.0), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

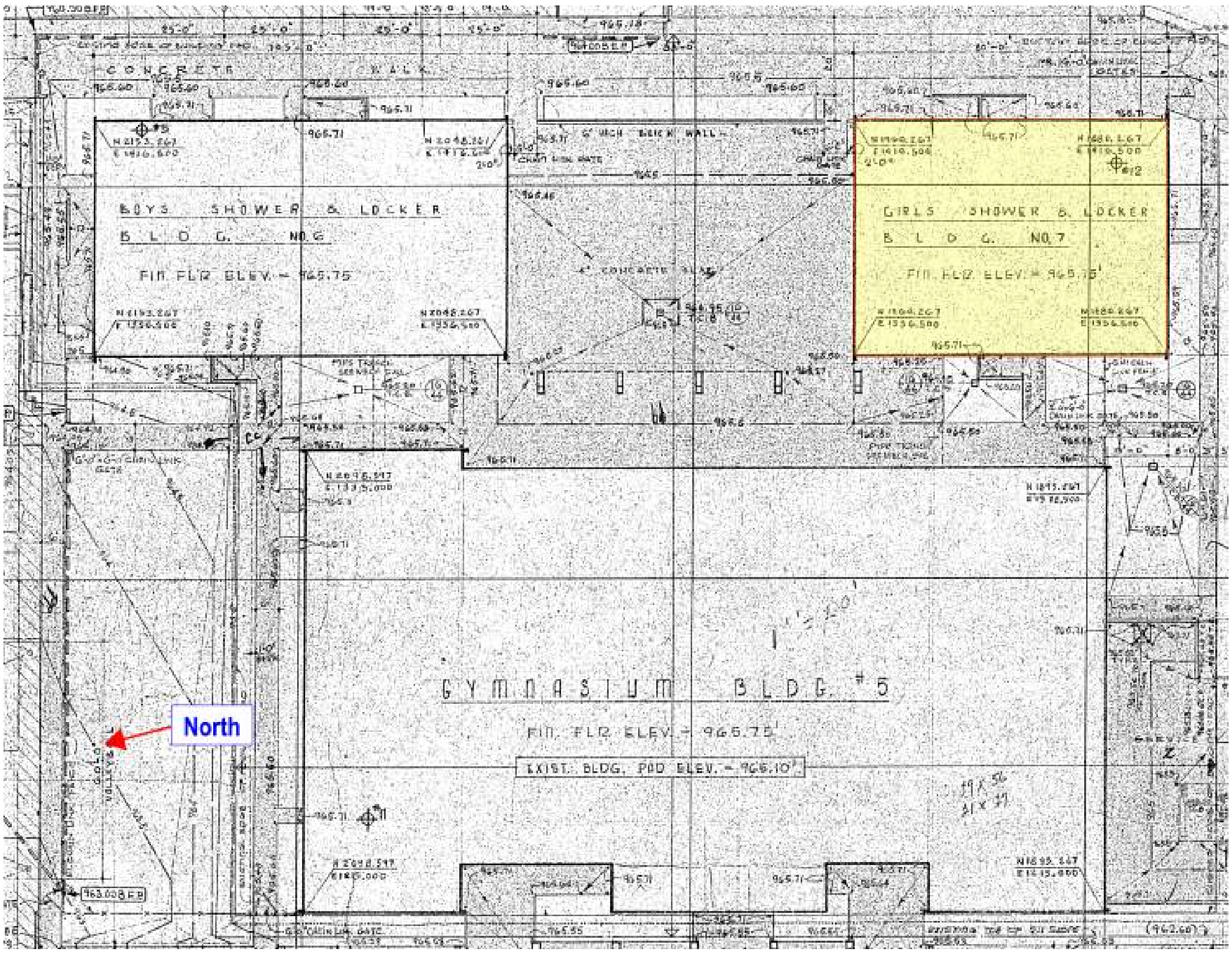
Photo 1 – Exterior View of Boys Shower & Locker Building

(Girls Shower & Locker is Similar)

Photo 2 – Interior View of the Building

(Girls Shower & Locker is Similar)

A partial campus site plan of Palos Verdes Peninsula High School, indicating the building under evaluation, is provided below. The highlighted building is ***Girls Shower & Locker Building (7).***



Partial Site Plan- Girls Shower & Locker Building (7)

2.0 Building (7)– Girls Shower & Locker Building

2.1 Site Seismicity

Based on 1963 construction drawings, original foundation was based on the allowable soil bearing pressure of 2,000 psf for vertical dead loads plus live loads. There is a geotechnical report dated December 21, 2012 by Geo-Advantec Inc. for a proposed 6 Classroom Buildings located about 150 feet to the North-East of the Gymnasium Building available for review.

Per ASCE 41-13 (2012 IBC), for Palos Verdes Peninsula High School located at 27118 Silver Spur Road, Rolling Hills Estates, CA 90274,

Site Coordinates = 33.7706°N, -118.3691°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.512g; $S_{1,20/50}$ = 0.196 g
F_a = 1.391 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.015 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.712g
$S_{X1} = F_v S_{1,20/20}$ = 0.395g

2.2 Building Description

The Girls Shower & Locker Building is a one-story structure in the middle portion of the school campus. The building was constructed circa 1963. The existing drawings for the building are dated April 19, 1963, which shows the proposed Girls Shower & Locker building construction and implies the building was constructed shortly thereafter. Functionally, the building consists of shower and locker rooms, storage rooms and offices. The building is rectangular in shape with approximate dimensions of 80'x 60'. Total footprint of the building is estimated to be ±4,800 square feet. The roof height at the high point of the building is about 14'-0" and at the low point is about 13'-6". The roof of the building consists of plywood panel over wood joists. The wood joists are supported by Glulam girders spanning about 60' at 15' spacing. The Glulam girders are typically supported by cast-in-place concrete columns along the perimeter of the building. The lateral force resistance of the building is provided by reinforced brick walls in combination of concrete walls. The foundation of the building consists of concrete continuous footings.

Based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Reinforced Masonry Bearing Walls with Flexible Diaphragms denoted as "RM1" in combination with Concrete Shear Walls with Flexible Diaphragms denoted as "C2A".

The structural risk category for the Girls Shower & Locker building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Building (7)– Girls Shower & Locker Building Summary Table	
Year Designed	1963
Drawings	Original drawings, dated April 19, 1963, prepared by Flewelling, Moody & Horn Architects, and Engineers.
Gravity System	Wood joists on Glulam beams/girders supported on columns/walls/foundation (Flexible Diaphragm)
Lateral System	Reinforced masonry (Brick) bearing walls and reinforced concrete bearing walls
No. of Stories & Height	1 Stories; Main Roof: h_n=14 ft
Building Period "T"	0.15 Sec
Base Shear "V"	0.712 W = 122 kips Girls Shower & Locker (RM1 & C2A)
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	None
Retrofit Recommendations	See Section 4.1 (Retrofit not required)

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of the building is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the “Life Safety” performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the “Life Safety” or “Immediate Occupancy” levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening, if needed. As a Risk Category ***III***, the Basic Performance Objective for the building was ***Damage Control Structural Performance,*** per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; some were found to be “Compliant” and others were found to remain “Deficient.”

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Coupling Beams

3.2 ASCE 41-13 Tier 2 Evaluation

The deficiency listed above was reviewed using a Tier 2 Evaluation. The deficiency was mitigated base on results of Tier 2 evaluation, which can be found in Appendix 1-B. Deficiency No. 1 (Coupling Beams) was mitigated with analysis results per ASCE 41-13 section 5.5.3.2.1 by insuring that the coupling beam has sufficient capacity for the load demands. The Tier 2 analysis was performed using analysis results from the ETABS model developed for the Tier 2 evaluations. Linear dynamic procedure was used for the analysis of the structure using BSE-1E level seismic response spectrum. Output forces are exported into excel spreadsheet and series of calculation per ASCE 41-13 are performed to verify the components have sufficient capacity for load demands.

4.0 Conclusions

The coupling beam deficiency identified by Tier 1 checklist is mitigated by Tier 2 analysis results. After further review and updating Tier 1 checklist as per ASCE 41-13, no other deficiencies were identified which required tier 2 evaluation.

Given the reason above, a voluntary seismic retrofit is not required for this structure.

5.0 Documents Reviewed

The following existing architectural and or structural drawings (and or other documents when available) were reviewed:

Date	Architect / Engineer	TTG Comments
April 19, 1963	Flewelling, Moody & Horn Architects and Engineers	Title Block states "Girls Shower & Locker Bldg. No. 7, Rolling Hills High School, Palos Verdes Peninsula Unified School District" Architectural and structural drawings (State of California – Department of Public Works, Division of Architecture, Project No. 23166)
December 12, 2012	Geo-Advantec, Inc.	Geotechnical Engineering Evaluation Report "Proposed 6 Classroom Buildings & Weight Room", Palos Verdes Peninsula High School

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Peninsula High School Building E, Girls Locker

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7.0 Architectural Section

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the

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District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Palos Verdes Peninsula High School is a public high school with in the Palos Verdes Peninsula Unified School District. The original buildings were completed in 1963 and includes all the buildings of concern for this analysis. It was originally called Rolling Hills High School and has been in constant use as a high school since that time. The original campus buildings were designed by the firms of Flewelling, Moody, and Horn Architects and is mostly of concrete construction. The building referred to as E is part of the original campus buildings.

Building E is at the middle of the campus adjacent to the gym and pool. It is a one story building. It contains the Girls' lockers and showers. The building structure consists of reinforced brick masonry exterior walls on the east and west and cast in place concrete walls on the north and south. The roof structure is glue laminated beams with joists and plywood deck. The glue laminated beams are supported on concrete piers within the masonry walls.

The exterior walls of the building are non-combustible construction. It has combustible roof framing and the glue laminated beams protrude beyond the exterior walls on the east and west. The building appears to fit within the current CBC Type-5B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability,

moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Work

No Recommended Retrofit
After further tier 2 analysis it was determined that the building does not require any seismic retrofit work for life safety.

Miscellaneous Recommended Work

Roofing
It is recommended to maintain the roof system in good repair to minimize any deterioration of the wood roof framing system. It is also recommended to maintain the exposed ends of the glue laminated beams that support the roof.

Accessibility Upgrades

There are no accessibility upgrades anticipated for this building since no retrofit work is recommended.

Fire & Life Safety

There are no fire & life safety upgrades anticipated for this building since no retrofit work is recommended.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

Appendix 1-A: Tier 1 Screening Checklists

ASCE 41-13 Checklists

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
x				LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Complete load path exists.
x				ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.2)	No other buildings within 10 feet of this building
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanines
				Building Configuration	
		x		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	It is one story building, so not applicable.
		x		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	It is one story building, so not applicable.

C	NC	N/A	U	Checklist	Comments
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	All vertical elements continuous to foundation.
		x		GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	It is one story building, so not applicable.
		x		MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	It is one story building, so not applicable.
X				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Roof consists of flexible wood diaphragms with minimum of 2 lines of shear wall support. Torsion appears not exist.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
x				LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), the building site is not in liquefaction susceptible zone.
x				SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), the building site is not susceptible to slope failure.
x				SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	Based on available geotechnical report (see Section 5.0), surface fault rupture not anticipated.

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
X				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.712=0.43 Compliant per review of existing drawings.
X				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Foundation elements are tied together by continuous footings and slab on grade.

16.10LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES C2: CONCRETE SHEAR WALLS WITH STIFF DIAPHRAGMS AND C2A: CONCRETE SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (§A.3.1.6.1. Tier 2: §5.5.2.5.1)	Complete vertical-load carrying system exists.
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	There are at least 2 lines of shear walls in each direction.
x				SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in^2 or $2\sqrt{f'c}$. (§A.3.2.2.1. Tier 2: §5.5.3.1.1)	Average shear stress is less than max $\{100, 2\sqrt{f'c}\}$ =100 psi. See calculations in Appendix 1-B.
x				REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (§A.3.2.2.2. Tier 2: §5.5.3.1.3)	Reinforcing steel ratios meet requirements; see calculations in Appendix 1-B.
				Connections	
x				WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Wall anchorage is sufficient. See calculations in Appendix 1-B.
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	Diaphragms are connected to shear walls.

C	NC	N/A	U	Checklist	Comments
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	Wall reinforcement is doweled into foundation.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Seismic-Force-Resisting System					
x				DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (§A.3.1.6.2. Tier 2: §5.5.2.5.2)	Meet requirements.
		x		FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (§A.3.1.6.3. Tier 2: §5.5.2.5.3)	Not applicable. There is no slab which is not part of the seismic force resisting system.
	x			COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than d/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (§A.3.2.2.3. Tier 2: §5.5.3.2.1)	Concrete coupling beams on the North and South walls not-compliant per Tier 1 checklist requirements (Tier 2 calculation to verify). Mitigated by Tier 2 calculation.
Connections					
		x		UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (§A.5.3.8. Tier 2: §5.7.3.5)	No pile caps, so not applicable.
Diaphragms (Flexible or Stiff)					
x				DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (§A.4.1.1. Tier 2: §5.6.1.1)	There is no diaphragm discontinuity in the building, so compliant.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	Meet requirements, so compliant.
Flexible Diaphragms					

C	NC	N/A	U	Checklist	Comments
x				CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Cross ties exist.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	Straight sheathing diaphragms not used.
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	Wood structural panels exist.
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	No diagonally sheathed diaphragms. Structural panel diaphragms are blocked.
		x		OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	No other diaphragms.

16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY SHEAR WALLS WITH STIFF DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	At least 2 lines of shear walls present.
x				SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in^2. (§A.3.2.4.1. Tier 2: §5.5.3.1.1)	Shear stress is less than 70 psi.
x				REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. (§A.3.2.4.2. Tier 2: §5.5.3.1.3)	Reinforcing steel ratios meet requirements.
Stiff Diaphragms					
		x		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (§A.4.5.1. Tier 2: §5.6.4)	No precast diaphragm elements.
Connections					
x				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Wall anchorage is sufficient.
x				WOOD LEDGERS: The connection between the wall panels and the diaphragm does not	Connection does not induce cross-grain bending or tension.

C	NC	N/A	U	Checklist	Comments
				induce cross-grain bending or tension in the wood ledgers. (§A.5.1.2. Tier 2: §5.7.1.3)	
x				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	There is positive connection for shear transfer between diaphragm and shear wall in all locations
		x		TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (§A.5.2.3. Tier 2: §5.7.2)	No precast diaphragm elements.
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	Wall reinforcement is dowelled into foundation.
x				GIRDER-COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (§A.5.4.1. Tier 2: §5.7.4.1)	Positive connection present at girder-column connections.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity					
Stiff Diaphragms					
		x		OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	No stiff diaphragms.
		x		OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	No stiff diaphragms.
Flexible Diaphragms					
x				CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Continuous cross ties present.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear	Diaphragm openings adjacent to shear walls are less than 25% of

C	NC	N/A	U	Checklist	Comments
				walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	the wall length.
x				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (§A.4.1.6. Tier 2: §5.6.1.3)	Diaphragm openings adjacent to exterior masonry shear walls are not greater than 8 feet.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	Straight sheathing diaphragms not used.
x				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	Structural panel over straight sheathing on gymnasium roof.
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	No diagonally sheathed or unblocked diaphragms.
		x		OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	No other diaphragms used.
				Connections	
x				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (§A.5.1.4. Tier 2: §5.7.1.2)	Stiff steel anchors used.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
Life Safety Systems					
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	Not present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	Observed Compliant
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	Not present; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	Not present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
Hazardous Materials					
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4.	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				Tier 2: §13.7.3 and 13.7.5)	
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	No hazardous materials; So not applicable
				Partitions	
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
				Ceilings	
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
			X	LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Not accessible during site visit
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
				Light Fixtures	
			X	LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	Not accessible during site visit
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
				Cladding and Glazing	
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate	No multi-story panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
				Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
Masonry Veneer					
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no	No URM backup, so not applicable.

C	NC	N/A	U	Checklist	Comments
				unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
Parapets, Cornices, Ornamentation, and Appendages					
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
		X		LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	None Observed; so not applicable
X				LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	Observed compliant
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This	No such appendages were observed; So not applicable

C	NC	N/A	U	Checklist	Comments
				checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	
Masonry Chimneys					
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	No URM chimneys, so not applicable.
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
Stairs					
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
		X		LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	No stairs, so not applicable.
Contents and Furnishings					
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable

C	NC	N/A	U	Checklist	Comments
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
		X		LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	None observed; So non applicable
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
		X		LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	None observed; So not applicable
			X	LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Not accessible during site visit
		X		LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	None observed; So not applicable
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
				Piping	
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	
Ducts					
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
Elevators					
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2:	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				§13.8.6)	
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Evaluation Calculations

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW		Bldg Type= **RM1 & C2A**
$C =$	1	From Table 4-8 for 1963 Shower/Locker Building	
$S_a = \min(S_{XS}, S_{X1}/T)$		From Section 4.5.2.3	
$S_{X1} = F_VS_1$		Eq. 2-2	
$S_{XS} = F_aS_S$		Eq. 2-1	
$S_S =$	0.512	g, mapped spectral acceleration	
$S_1 =$	0.196	g, mapped spectral acceleration	
$S_{X1} =$	0.395	g	
$S_{XS} =$	0.712	g	
$T = C_th_n^{\beta}$		From Section 4.5.2.4	
$C_t =$	0.02		
$h_n =$	14	ft., average height at sloped roof	
$\beta =$	0.75		
$T =$	0.145	sec.	
$S_a =$	0.712	g	
$V_{MP\ 1972} =$	0.712	W	

USGS Design Maps Summary Report

User–Specified Input

Report Title California Minimum Ss
Sat January 23, 2016 03:52:06 UTC

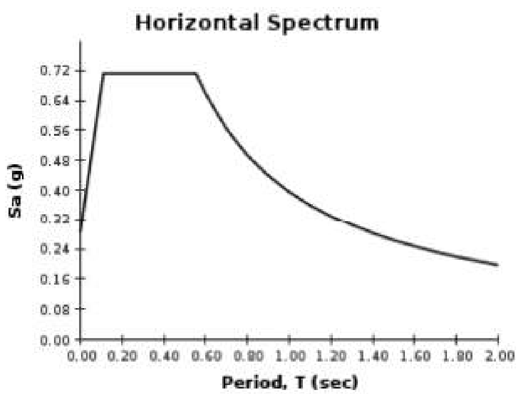
Building Code Reference Document ASCE 41-13 Retrofit Standard, BSE-1E
(which utilizes USGS hazard data available in 2008)

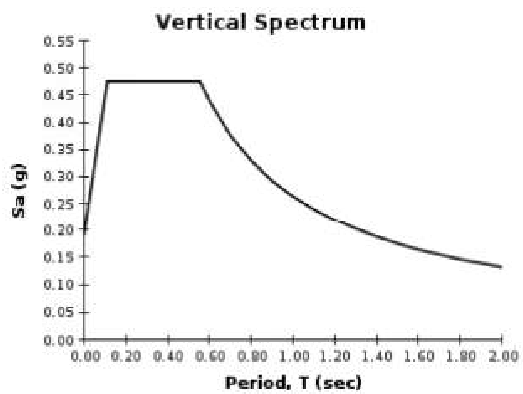
Site Coordinates 33.77058°N, 118.3691°W

Site Soil Classification Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.512 g	$S_{XS,BSE-1E}$	0.712 g
$S_{1,20/50}$	0.196 g	$S_{X1,BSE-1E}$	0.395 g





Seismic Mass Weight - 1963 Construction

Roof

(Roof area with 1/2" Plywood sheathing)

Roofing	6	psf
1/2" Plywood	1.5	psf
Wd joist 4x10@48" typ.	1.5	psf
Roof Glulam beams	4	psf
MEP	3	psf
Ceiling	3	psf
Misc	1	psf
DL =	**20**	**psf**
Use	**20**	**psf**

Wall Weight

9" brick wall =	90	psf
10" brick wall =	100	psf
8" concrete wall =	100	psf
Wood/metal stud wall =	15	psf

Check Wall Shear Stress Calculations (per §4.5.3.3; ASCE 41-13)

Mass Weight Calculation

	Location	Length ft	Wid / Ht ft	Area sq ft	Mass Wt #/ft2	Weight kip
Roof	Roof	80.0	60.0	4800.0	17	82
	9" Brick Walls, out plane	80.0	6.25	500.0	90	45
	9" Brick Walls, out plane	80.0	6.25	500.0	90	45
	Grand Total =			**4800**		**172**

Base shear V = 0.712 W
V = **122** kips

Vertical Distribution of Story Shear per ASCE 41-13, § 4.5.2.2

$$F_x = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k} V$$

Equation 4-3a
k=1.0

	w_x	h_x	$w_x h_x$	Fx	Area	fi
	kip	ft	k-ft	kip	ft2	psf
Roof	172	22.75	3904	122	4800.0	25.5
Sum =	172		3904	122		

Quick Check Wall Shear Stress per ASCE 41-13, § 4.5.3.3

v avg= (Vj/Aw)/m
m= 3.0 Tabel 4-9 ASCE 41-13, use average of LS & IO per Table 2-1 Footnote b for reinforced concrete walls

Wall Forces - Supporting Roof

	Wall Description	Length ft	Width in	Aw in2	Force Vj kips	v avg psi
N-S Direction	Wall thick 9"	80.0	9.0	8640	122	2.4
	Wall thick 9"	80.0	9.0	8640		
E-W Directioin	Wall thick 8"	60.0	8.0	5760	122	3.5
	Wall thick 8"	60.0	8.0	5760		

Per ASCE 41-13 check list 16.10LS, if shear stress less than max(100, 2f'c^0.5)=109 psi in concrete wall, OK
fc'=3 ksi Average wall shear is less than 109 psi, O.K.
For RM1 wall per checklist 16.15 LS, if shear stress is less than 70 psi, O.K.

Reinforced Concrete Wall, Reinforcing Steel Ratio

8" Concrete wall with #4 @ 16" Verti & #4 @ 10" Horizontal at center of wall

Hori ρ= 0.0025 Shall not be less than 0.0012 vertic, 0.0020 in hori direction
Verti ρ= 0.0016 Meeting requirements on reinforcing steel

Reinforced Masonry Wall, Reinforcing Steel Ratio

9" Brick wall with #4 @ 15" Verti & Horizontal at center of wall

Hori ρ=	0.0015	Total V&H reinft not be less than 0.0002; min. not less than 0.0007
Verti ρ=	0.0015	Meeting requirements on reinforcing steel
Total ρ=	0.0030	

Wall Out-of-plane Anchorage (Tier 1 Procedure, Section 4.5.3.7)

Tc=	$1.2S_{XS}\,w_p\,A_p$ =	82.0	psf	Eqn 4-13
S_{XS} =	0.712			
w_p =	*96*	psf	9" brick wall; or 8" concrete wall	
Ap =	1	ft2		

Evaluate connection for out-of-plane action per Tier 2 procedure
Per Section C7.5.1.2, connections should be evaluated as force-controled procedure.

C_1C_2 =	1.4	From Table 7-3
J=	1	Per Section 7.5.2.1.2
Q_{UF}=	Q_G+/-$Q_E/(C_1C_2J)$	Eqn 7-35

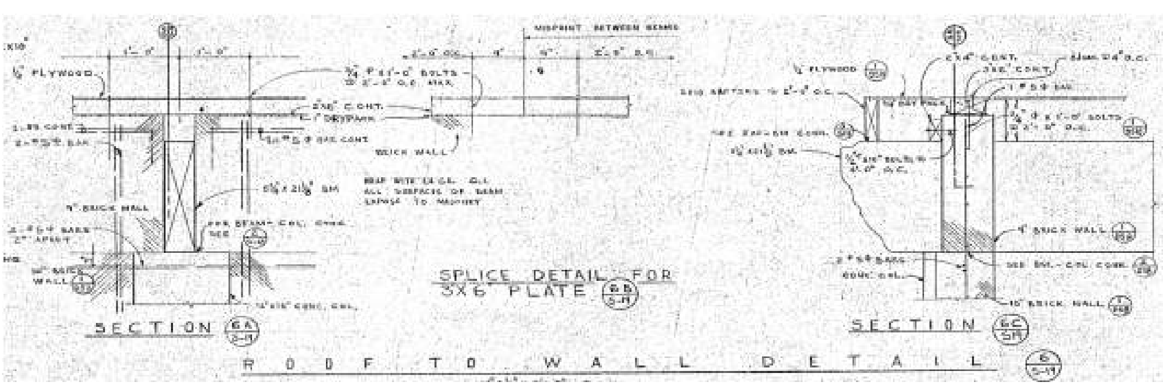
Q_G =	0.0	lbs	
Q_E=	512.6	lbs	End shear for 1'x6.25' wall (WxH)
Q_{UF}=	366.2	lbs	End shear divided by CJ factor

Per detail 18/S-17, wall anchors @ S =	2.00	ft	**Typical anchor @ 2'-0"**
Out of plane force T_{UF}=	**732**	lbs	Each anchor location

Typical anchor capacity per 6/S-19 (3/4" Dia Bolt @ 24" and 8d nails @4")

$B_{vn}=4A_{pv}\sqrt{f'm}$	7153	lbs	(ACI 530-05, Equation 3-8)
f'm=	1000	psi	
$A_{pv} = \pi\ l^2_{be}\ /2$	56.55	in^2	
$B_{vn}=0.6A_bf_y$=	**11,880**	lbs	(ACI 530-05, Equation 3-9)
$B_{vn\ (smallest)}$ =	7153	lbs	
8d nails @ 4" =	222.0	lbs	each nail
(7) nails each 24", capacity =	1554	lbs	
Ncn=min(7153, 1554)=	**1,554**	lbs	>= T_{UF}, Okay

Therefore, wall out-of-plane anchorage issufficient, per detail 6/S-19



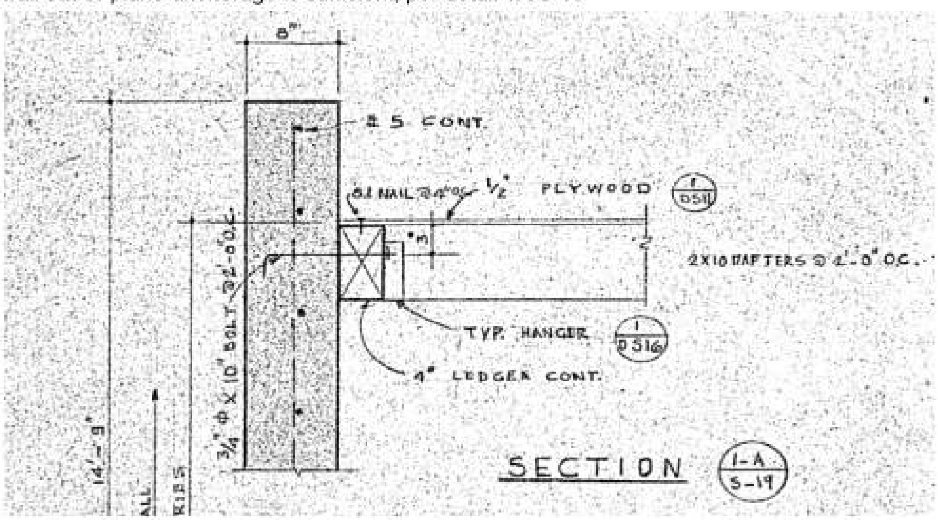
Wall anchor capacity per 1A/S-19 (Note: Allowable to Capacity factor = 3)

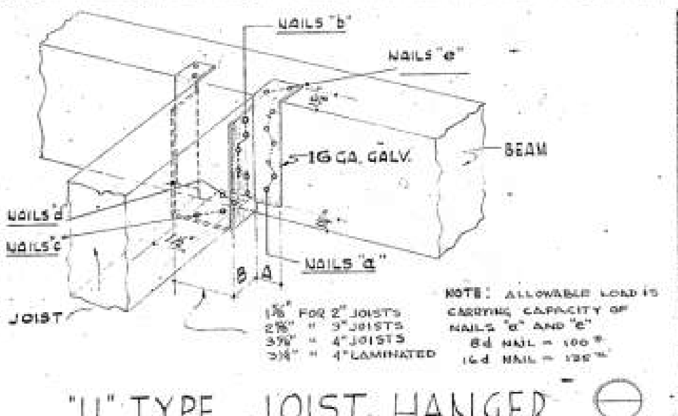
$B_{an}=4A_{pt}\sqrt{f'm}$ =	14305	lbs	(ACI 530-05, Equation 3-1; conservative estimate)
f'm=	1000	psi	
$A_{pv} = \pi\ l^2_{be}$ =	113.09	in^2	
$B_{an}= A_b f_y$=	**19,800**	lbs	(ACI 530-05, Equation 3-2)
$B_{an\ (smallest)}$ =	14305	lbs	

Hanger capacity = 6480 lbs, per detail 1/DS16

Ncn=min(14305, 6480)= **6,480** lbs >= T_{UF}, Okay

Therefore, wall out-of-plane anchorage is sufficient, per detail 1A/S-19



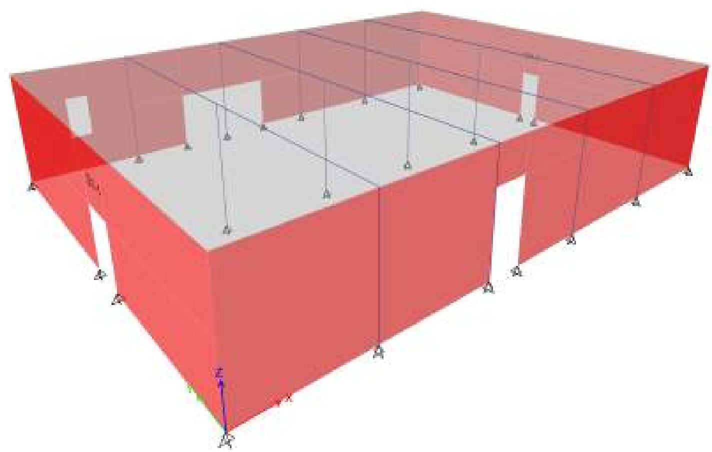


"U" TYPE JOIST HANGER

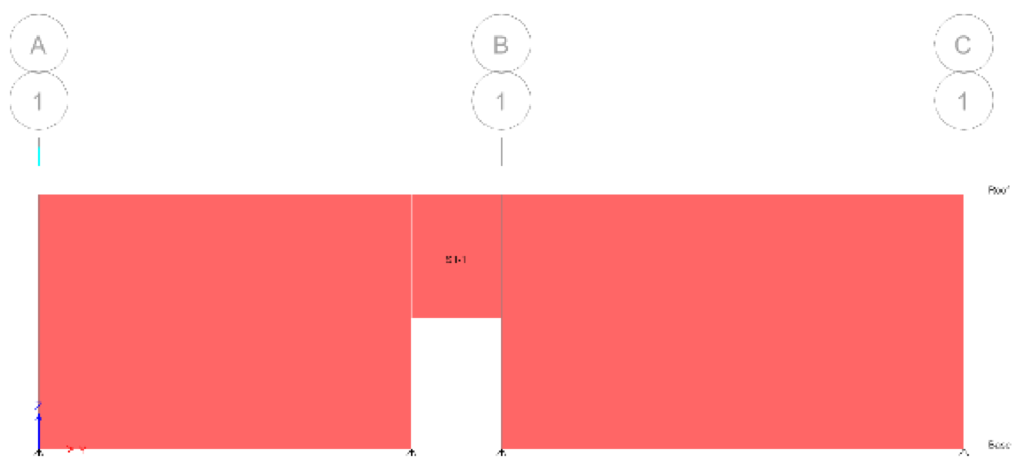
JOIST HANGER SHOWN IS "YET" TYPE OR APPROVED EQUAL.

JOIST SIZE	DIMEN. A	DIMEN. B	NAILS a EA. SIDE	NAILS b EA. SIDE	NAILS c	NAILS d	NAILS e EA. SIDE	ALLOWABLE LOAD ON NAILS "a" AND "e"
2 x 4	1¼"	2"	2-8d	1-8d	2-8d	2-8d	2-8d	800#
2 x 6			4-8d	2-8d		2-8d	2-8d	1200
2 x 8			4-16d	2-8d		2-8d	2-16d	1620
2 x 10			6-16d	3-8d		2-8d	2-16d	2160
2 x 12			6-16d	3-8d		2-8d	2-16d	2160
2 x 14			6-16d	3-8d		2-8d	2-16d	2160
2 x 16			6-16d	3-8d		2-8d	2-16d	2160

<<< Detail 1/DS16



ETABS Model 3D View - Girls Shower & Locker Building (7)



ETABS Model Elevation View - Girls Shower & Locker Building (7), Spandrel S1-1

(Spandrel S6-1 along Line 6 elevation is similar)

1 Analysis Results

This chapter provides analysis results.

1.1 Line Results

Table 1.1 - Spandrel Forces

Story	Spandrel	Load Case/Combo	Step Type	Location	P kip	V2 kip	V3 kip	T kip-ft	M2 kip-ft	M3 kip-ft
Roof	S1-1	QfuX1Env	Max	Left	-0.838	-0.781	0.024	0.1019	0.2642	10.6159
Roof	S1-1	QfuX1Env	Max	Right	-0.838	4.076	0.024	0.1019	0.129	6.7109
Roof	S1-1	QfuX1Env	Min	Left	-8.59	-2.756	-0.024	-0.1011	-0.2665	-8.8731
Roof	S1-1	QfuX1Env	Min	Right	-8.59	1.722	-0.024	-0.1011	-0.1274	-11.5636
Roof	S1-1	QfuY1Env	Max	Left	1.694	7.714	0.014	0.0353	0.0778	22.5309
Roof	S1-1	QfuY1Env	Max	Right	1.694	12.571	0.014	0.0353	0.0358	34.6058
Roof	S1-1	QfuY1Env	Min	Left	-11.122	-11.251	-0.015	-0.0345	-0.0801	-20.7881
Roof	S1-1	QfuY1Env	Min	Right	-11.122	-6.773	-0.015	-0.0345	-0.0342	-39.4585
Roof	S6-1	QfuX1Env	Max	Left	-1.978	-0.769	0.468	1.8725	0.1366	13.2325
Roof	S6-1	QfuX1Env	Max	Right	-1.88	2.275	0.313	1.2539	0.0985	11.6269
Roof	S6-1	QfuX1Env	Min	Left	-7.939	-2.27	-0.467	-1.8688	-0.1356	-15.687
Roof	S6-1	QfuX1Env	Min	Right	-8.098	0.847	-0.313	-1.2533	-0.0978	-14.5256
Roof	S6-1	QfuY1Env	Max	Left	5.853	9.297	1.142	4.6028	0.3135	31.5259
Roof	S6-1	QfuY1Env	Max	Right	3.366	12.341	1.141	4.5965	0.9324	18.4606
Roof	S6-1	QfuY1Env	Min	Left	-15.77	-12.336	-1.142	-4.599	-0.3125	-33.9804
Roof	S6-1	QfuY1Env	Min	Right	-13.344	-9.219	-1.141	-4.5959	-0.9317	-21.3592

Check Spandrel (Coupling Beams) Capacity (per §10.7: ASCE 41-13)

Concrete Shear Wall is deformation controlled actions for shear and flexure

$mkQ_{CE} > Q_{UD}$		(Acceptance criteria for shear and bending, Eqn 7-36)
$V_n = A_{cv}(2\lambda\sqrt{f'_c} + \rho f_y)$		(Wall nominal shear capacity ACI 318-08, Equ 21-7)
fc'=	3000	psi, Normal Weight Concrete
λ=	1	Lt. Wt Conc use 0.75; normal Wt use 1.0
fy=	40000	psi
Expected, fce'=	4500	psi (fc' x1.5 per Table 10-1)
Expected, fy=	50000	psi (fy x1.25 per Table 10-1)
Average m=	3	(Min. 1.5 ~ Max. 3 per Table 10-22 for Collapse Prevention)
k=	1	Table 6-1, material test will be done

BSE1E Level Seismic Force

Load Combo QfuX1Env Max Left **Shear Capacity**

Level	Pier Label	Spandrel Depth h_w (in)	Pier Width t_w (in)	wall area (in^2)	Reinft ρ	$Q_{CE}=V_n$ (Kips)	$Q_{CE,\ at\ M}$ (Kips)	Demand V_{UD} (kips)	m factor Damage Control (S-2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{V}{t_w l_w \lambda\sqrt{f'_c}}$
Roof	S1-1	96	8	768	0.0016	163	193	-1	2.00	417.52	0.0
Roof	S6-1	96	8	768	0.0016	163	416	-1	2.00	424.04	0.0

Load Combo QfuY1Env Max Left **Shear Capacity**

Level	Pier Label	Spandrel Depth h_w (in)	Pier Width t_w (in)	wall area (in^2)	Reinft ρ	$Q_{CE}=V_n$ (Kips)	$Q_{CE,\ at\ M}$ (Kips)	Demand V_{UD} (kips)	m factor Damage Control (S-2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{V}{t_w l_w \lambda\sqrt{f'_c}}$
Roof	S1-1	96	8	768	0.0016	163	193	8	2.00	42.27	0.1
Roof	S6-1	96	8	768	0.0016	163	416	9	2.00	35.07	0.2

Note: 8" thick wall with #4@16" (V), #4@10" (H) 3000 psi normal weight concrete.
Shear Capacity is the smallest of Vn or Vn at Reaching Bending Moment Capacity; RED Vn indicate shear control (m-factor from Table 10-22)

Load Combo QfuX1Env **X-Direction Force (East-West)** **Check Spandrel (Coupling Beam) Bending Capacity - Damage Control (S-2)**

Level	Pier Label	Value	Location	Axial P_{UD} (kips)	Demand M_{UD} (k-ft)	Capacity M_{CE} (k-ft)	A (in2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{(A_S - A'_S)f_y + P}{t_w l_w f'_c}$	$\frac{V}{t_w l_w \sqrt{f'_c}}$	m-factor for M (Table 10-21)	m-factor for V (Table 10-22)
Roof	S1-1	Max	Left	-1	11	676	768	127.36	0.000	0.0		2
Roof	S1-1	Min	Left	-9	-9	676	768	152.37	0.002	0.0		2
Roof	S6-1	Max	Left	-2	13	676	768	102.17	0.001	0.0		2
Roof	S6-1	Min	Left	-8	-16	676	768	86.19	0.002	0.0		2

Load Combo QfuY1Env **Y-Direction Force (North-South)** **Check Spandrel (Coupling Beam) Bending Capacity - Damage Control (S-2)**

Level	Pier Label	Value	Location	Axial P_{UD} (kips)	Demand M_{UD} (k-ft)	Capacity M_{CE} (k-ft)	A (in2)	mkQ_{CE}/Q_{UD} >1.0 ?	$\frac{(A_S - A'_S)f_y + P}{t_w l_w f'_c}$	$\frac{V}{t_w l_w \sqrt{f'_c}}$	m-factor for M (Table 10-21)	m-factor for V (Table 10-22)
Roof	S1-1	Max	Left	2	23	676	768	60.01	0.000	0.0		2
Roof	S1-1	Min	Left	-11	-21	676	768	65.04	0.003	0.0		2
Roof	S6-1	Max	Left	6	32	676	768	42.89	-0.002	0.0		2
Roof	S6-1	Min	Left	-16	-34	676	768	39.79	0.005	0.0		2

```
15 day trial license. Locking Code: 4-24DE6. User: admin, TTG                              01/28/16
C:\Users\azheng\Documents\Palos Verdes Peninsula HS Boys-Girls Shower Bldgs 6...\Spandrel S1-1.col       02:44 PM

General Information:
====================
  File Name: C:\Users\azheng\Documents\Palos Verdes Peninsula HS Boys-Girls Showe...\Spandrel S1-1.col
  Project:  PVPHS Bldg 6 Boys Locker
  Column:   S1-1                              Engineer:
  Code:     ACI 318-08                        Units: English

  Run Option: Investigation                   Slenderness: Not considered
  Run Axis:   X-axis                          Column Type: Structural

Material Properties:
====================
  f'c   = 4.5 ksi                             fy   = 50 ksi
  Ec    = 3823.68 ksi                         Es   = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.825

Section:
========
  Rectangular: Width = 8 in                   Depth = 96 in

  Gross section area, Ag =  768 in^2
  Ix =  589824 in^4                           Iy =  4096 in^4
  rx =  27.7128 in                            ry =  2.3094 in
  Xo =  0 in                                  Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  #  3     0.38        0.11    #  4     0.50        0.20    #  5     0.63        0.31
  #  6     0.75        0.44    #  7     0.88        0.60    #  8     1.00        0.79
  #  9     1.13        1.00    # 10     1.27        1.27    # 11     1.41        1.56
  # 14     1.69        2.25    # 18     2.26        4.00

  Confinement: Other; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 1,  phi(b) = 1,  phi(c) = 0.7

  Layout: Rectangular
  Pattern: Sides Different  (Cover to transverse reinforcement)
  Total steel area: As = 3.52 in^2 at rho = 0.46% (Note: rho < 0.50%)
  Minimum clear spacing = 2.75 in

                    Top       Bottom        Left       Right
                 --------    --------    --------    --------
    Bars            2  # 6     2  # 6      8  # 3      8  # 3
    Cover(in)         1.5        1.5         1.5         1.5

Factored Loads and Moments with Corresponding Capacities:
=========================================================
              Pu          Mux        PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
  No.        kip         k-ft          k-ft               in       in
  --- ------------ ------------ ------------ -------- -------- -------- -------- ------
    1        0.00        31.00       675.99   21.806     4.02    93.75  0.06688  1.000

  *** End of output ***
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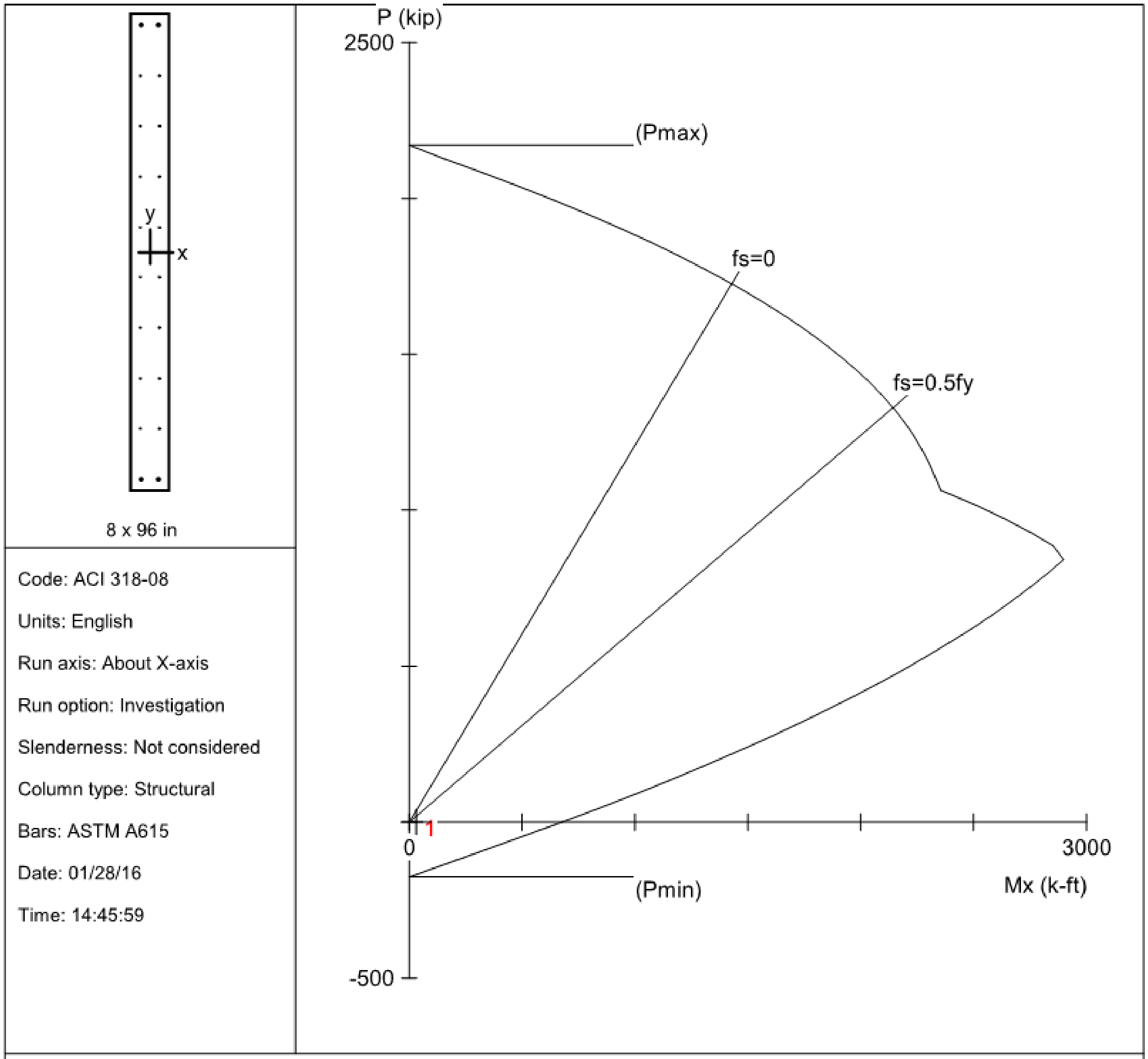


Code: ACI 318-08

Units: English

Run axis: About X-axis

Run option: Investigation

Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 01/28/16

Time: 14:45:59

spColumn v4.80. 15 day trial license. Locking Code: 4-24DE6. User: admin, TTG

File: C:\Users\azheng\Documents\Palos Verdes Peninsula HS Boys-Girls Shower Bldgs 6 & 7\Spandrel S1-1.col

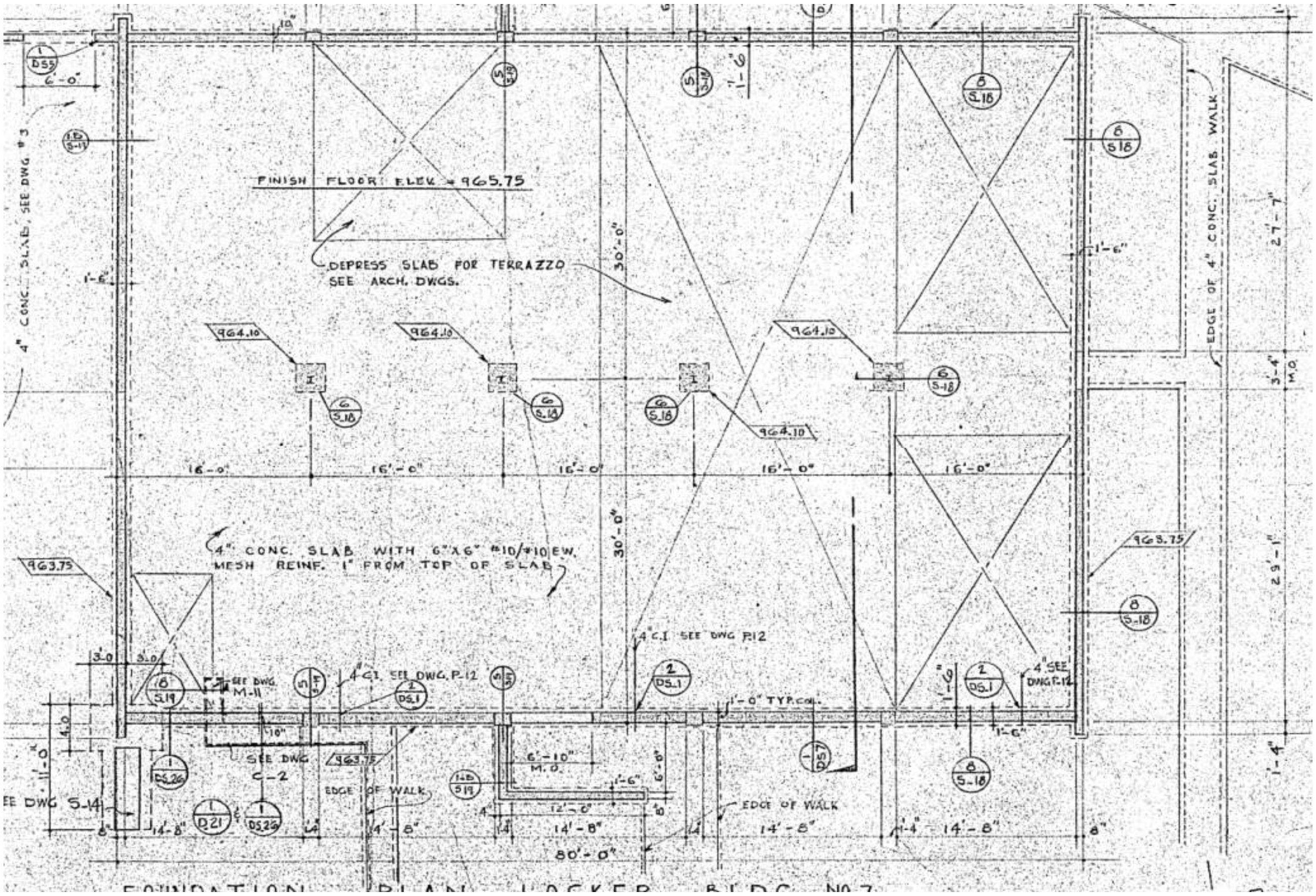
Project: PVPHS Bldg 6 Boys Locker

Column: S1-1		Engineer:	
f'c = 4.5 ksi	fy = 50 ksi	Ag = 768 in^2	20 bars
Ec = 3824 ksi	Es = 29000 ksi	As = 3.52 in^2	rho = 0.46%
fc = 3.825 ksi		Xo = 0.00 in	Ix = 589824 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 4096 in^4
Beta1 = 0.825		Min clear spacing = 2.75 in	Clear cover = 1.88 in

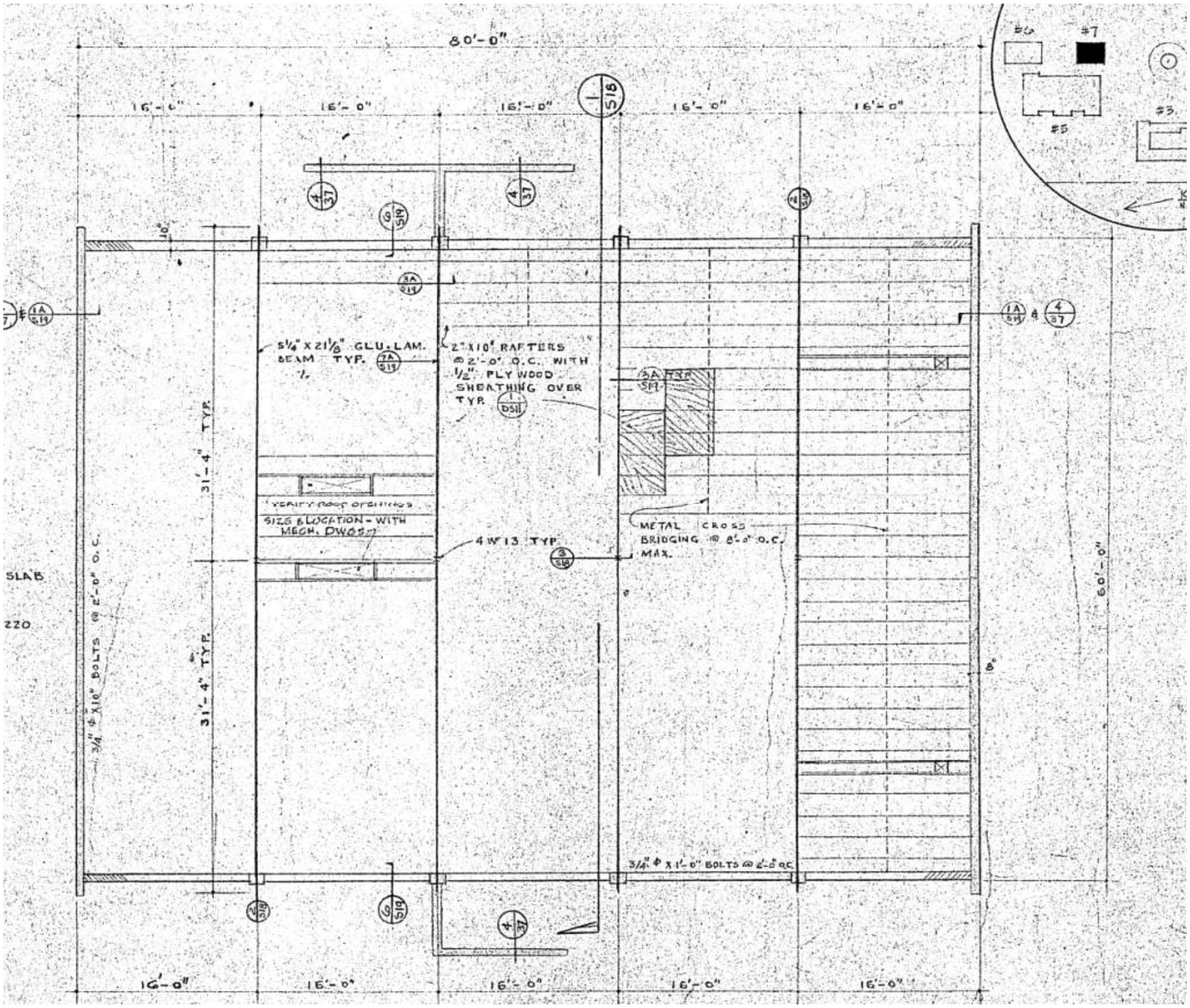
Confinement: Other

phi(a) = 1, phi(b) = 1, phi(c) = 0.7

Appendix 1-C: As-Built Plans



Foundation Plan (1963 Drawing Sheet S-19)



Roof Plan (1963 Drawing Sheet S-19)

Appendix 7A – Images of Existing Conditions

Fig 1. Concrete exterior end walls

Fig 2. Locker rooms and gym context

TTG

STRUCTURAL, MEP, CIVIL ENGINEERING & CONSTRUCTION SERVICES

Arizona California Colorado Florida Texas Lebanon Saudi Arabia U.A.E.

ASCE 41-13
TIER-2 EVALUATION REPORT
FOR
CLASSROOM BUILDINGS (H&S)

PALOS VERDES PENINSULA HIGH SCHOOL
27118 Silver Spur Rd,
Rolling Hills Estates, CA 90274

REGISTERED PROFESSIONAL ENGINEER
TERRY C. TSANG
No.S2992
Exp. 06/30/2016
STRUCTURAL
STATE OF CALIFORNIA

Terry Tsang, S.E.
Structural Engineer S2992
TTG Job No.: 0215.766.00

JANUARY 2016

300 N. Lake Avenue, 14th Floor, Pasadena, CA 91101 (626) 463-2800 Fax (626) 463-2801 www.ttgcorp.com

Table of Contents

1.0 Introduction

A multiphase seismic vulnerability assessment of ***Classroom Buildings H*** was conducted, beginning with a site visit on ***12/21/2015***, an ASCE 41-13 Tier 1 Screening, and concluding with an ASCE 41-13 Tier 2 Evaluation. The Tier 1 screening identified potential deficiencies for the building, which have been further investigated in the Tier 2 Evaluation. ***Classroom Building H*** is nearly identical to the adjacent ***Classroom Building S***, therefore the findings in this report apply equally to both buildings.

Please note that the original (1963) construction documents refer to ***Classroom Building H*** and ***Classroom Building S*** as ***Quadrangle 3*** and ***Quadrangle 4***, respectively.

All of the evaluations and studies were based on existing documents provided by the District (see Appendix 1-C), site walks through the building, and structural calculations performed using the guidelines outlined in ASCE 41-13.

An overall campus map of Palos Verdes Peninsula High School, indicating the buildings under evaluation, is provided below. The highlighted buildings are ***Classroom Building H and Classroom Building S***.

Site Map- Classroom Building H and Classroom Building S

2.0 Classroom Building H & Classroom Building S

2.1 Site Seismicity

Based on 1963 construction drawings, the original foundation design was based on the allowable soil bearing pressure of 2000psf for ***Classroom Building H*** (controlled compacted fill) and 3000psf for ***Classroom Building S*** (silt stone). There was no increase noted for lateral loads given in the 1963 construction drawings. However, the Geotechnical report by Geo-Advantec Inc. titled 'Proposed 6 Classroom Buildings and Weight Room Palos Verdes Peninsula High School' dated December 21, 2012 has indicated an allowable soil bearing 2000psf for vertical loads and 2660psf including lateral loads.

Per ASCE 41-13 (2012 IBC), for Palos Verdes High School located at 27118 Silver Spur Rd., Rolling Hills Estates, CA.

Site Coordinates = 33.7776°N, -118.3746°W
Occupancy Category = III

BSE-1E spectral accelerations for evaluation of existing building (§2.4.1.4 ASCE 41-13)
$S_{S,20/50}$ = 0.516g; $S_{1,20/50}$ = 0.197g
Fa = 1.387 (ASCE 41-13 Table 2-3 by interpolation for Site Class D and $S_{S,20/50}$)
F_v = 2.012 (ASCE 41-13 Table 2-4 by interpolation for Site Class D and $S_{1,20/50}$)
$S_{XS} = F_a S_{S,20/50}$ = 0.716g
$S_{X1} = F_v S_{1,20/20}$ = 0.396g

2.2 Building Description

Classroom Buildings H&S are primarily two-story buildings (with a split level low roof) in the south part of the school campus. The set of available existing drawings is dated April 1963, which shows the proposed classroom buildings construction and implies the buildings were constructed shortly thereafter. Functionally, the building consists of two story of classroom wings and a one story mixed classroom/lecture room central portion. The buildings are rectangular with approximate dimensions of130' x 361'. The total footprint of each building is estimated to be ±71,000 square feet, about 5,700 square feet of which is combined classroom/lecture area (with the split level low roof) with the remainder of the floor areas are split between the 1st and 2nd floor classrooms. The split level low roof forms about 20% of the floor area and has higher ceiling and roof compared to the rest of the 2nd level floor. Typical 1st and 2nd floor heights are both 12'-6". The split level low roof is 7'-2" higher than the 2nd floor.

The classroom buildings have 1"and 1-1/4" expansion gaps in the corridors at the 2nd and roof levels, respectively. These expansion gaps are located between Grids D.7-E and I-I.3 (see attached plans in Appendix 1-C). The presence of these expansion gaps causes the portion of two story structure located between grids E-I and 5-9, to act independently from the remainder of the two story classroom structure. There is a common shear wall located along Grid 5 which is shared with the split level low roof.

The classroom buildings consists of cast-in-place one-way concrete joist system, which is considered a stiff diaphragm. The building has continuous wall footings below the concrete bearing walls and spread footings below gravity columns. The lateral system of the building is formed of cast-in-place reinforced concrete shear wall in both directions. Therefore, based on the information in the existing drawings and according to building type definition in Table 3-1 of ASCE 41-13, this building is considered to be Building Type: Concrete Shear Walls with Stiff Diaphragms denoted as "C2".

The structural risk category for the administration building is III, per Table 2-1 of ASCE 41-13. For Tier 1 evaluation, the structural performance target used for this building was Life Safety (S-3), meaning the post-earthquake damage state of the structure would contain damaged components but retain a margin against the onset of partial or total collapse. For Tier 2 evaluation, the structural performance target used for this building was Damage Control (S-2), meaning the structure would have a greater reliability of resisting collapse and sustain less post-earthquake damage than a typical structure but still not to the extent required for immediate occupancy. The seismic hazard level used for both the Tier 1 and 2 evaluation of this building by ASCE 41-13 is BSE-1E, Basic Safety Earthquake-1, taken as a seismic hazard with a 20% probability of exceedance in 50 years. It is from this seismic hazard level that spectral response acceleration parameters are obtained for analysis.

2.3 Building Description Summary Table

Classroom Buildings H and Classroom Building S Summary Table	
Year Designed	1963
Drawings	***Original drawings prepared by Flewelling Moody and Horn Architecture-Engineering-Industrial Planning , dated April 1963***
Gravity System	Pan Joist Concrete Slab (Stiff Diaphragm)
Lateral System	Concrete Shear Walls
No. of Stories & Height	Two main stories with a split level low roof High Roof: h_n= 25'-0" Split Level Low Roof: h_n= 19'-8" Second Level: h_n= 12'-6"
Building Period "T"	0.13 Sec (per ETABS model)
Base Shear "V"	0.98 W = 9790 Kips
ASCE 41-13 Risk Category	***III***
Major Seismic Deficiencies	Load Path Redundancy Transfer to shear walls Coupling Beams
Retrofit Recommendations	***See Section 4.2***

3.0 Evaluation Methodology and Findings

The evaluation methodology for the initial screening of ***Classroom Buildings H&S*** is based on ASCE 41-13 Tier 1 Screening. This screening consists of checklists, which allow for a rapid evaluation of the existing structure and non-structural conditions to the "Life Safety" performance level, per Section 4.1.1. It should be noted that in general the Tier 1 Screening is only performed to the "Life Safety" or "Immediate Occupancy" levels per Section 4.1.1. These checklists have been completed and can be found in ***Appendix 1-A.***

After the Tier 1 Screening was performed, a Tier 2 Evaluation was implemented for the deficiencies that were found during the Tier 1 Screening. As a Risk Category ***III***, the Basic Performance Objective for the building was ***Damage Control Structural Performance,*** per Table 2-1 of ASCE 41-13, shown below. Deficiencies that were identified in the Tier 1 Screening were then analyzed using a BSE-1E seismic event; all deficiencies noted were found to remain "Deficient."

Table 2-1. Basic Performance Objective for Existing Buildings (BPOE)

	Tier 1[a]	Tier 2[a]	Tier 3	
Risk Category	BSE-1E	BSE-1E	BSE-1E	BSE-2E
I & II	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Life Safety Structural Performance Life Safety Nonstructural Performance (3-C)	Collapse Prevention Structural Performance Nonstructural Performance Not Considered (5-D)
III	See footnote *b* for Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Damage Control Structural Performance Position Retention Nonstructural Performance (2-B)	Limited Safety Structural Performance Nonstructural Performance Not Considered (4-D)
IV	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Immediate Occupancy Structural Performance Position Retention Nonstructural Performance (1-B)	Life Safety Structural Performance Nonstructural Performance Not Considered (3-D)

[a]For Tier 1 and 2 assessments, seismic performance for the BSE-2E is not explicitly evaluated.
[b]For Risk Category III, the Tier 1 screening checklists shall be based on the Life Safety Performance Level (S-3), except that checklist statements using the Quick Check procedures of Section 4.5.3 shall be based on MS-factors and other limits that are an average of the values for Life Safety and Immediate Occupancy.

3.1 ASCE 41-13 Tier 1 Evaluation Summary

The following deficiencies were identified in the Tier 1 analysis:

- Tier 1 Deficiency No. 1: Load Path

- Tier 1 Deficiency No. 2: Redundancy
- Tier 1 Deficiency No. 3: Transfer to Shear Walls
- Tier 1 Deficiency No. 4: Coupling Beams

3.2 ASCE 41-13 Tier 2 Evaluation

All of the deficiencies listed above were reviewed using a Tier 2 Evaluation and none of the deficiencies were mitigated. The deficient items following Tier 2 evaluation include:

1. Tier 2 Deficiency 1 (Load Path) per Section ***5.4.1.1***
   The Low Roof diaphragms do not have a sufficient load path to transfer seismic forces into the lateral force resisting system.
2. Tier 2 Deficiency 2 (Redundancy) per Section ***5.5.1.1***
   Due to lack of isolated short shear walls to meet the compliance criteria along Grid 8.
3. Tier 2 Deficiency 3 (Transfer to Shear Walls) per Section ***5.7.2***
   Due to lack of or insufficient positive connection of Low Roof diaphragms to lateral force resisting system (shear walls).
4. Tier 2 Deficiency 4 (Coupling Beams) per Section ***5.5.3.2.1***
   Due to non-compliant detailing causing the inability of the coupling beams to control falling debris at egress paths due to spalling of inadequately confined concrete. Some coupling beams/piers were found to meet the acceptance criteria while others were not and will require retrofit.

Linear static procedure was used for the analysis of the structure using the BSE-1E seismic hazard level. This analysis was performed by creating a 3-D ETABS model of the structure. Output forces were used to perform a series of calculations (per ASCE 41-13) in order to verify the DCR for various elements that were previously identified as deficient in the Tier 1 review. All elements checked meet the acceptance criteria, with the exception of the elements singled out for retrofit in the following section.

3.3 Tier 2 Evaluation and Proposed Retrofit Summary Table

Building	Identified Tier 1 Deficiencies	Tier 2 section number	Tier 2 Evaluation Result	Proposed Retrofit
Classroom Buildings (H&S) Target Structural Performance Level: ***S-2 Damage Control***	***16.1.2 LS Load Path***	**5.4.1.1**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in section 4.1.***
	16.1.2 LS Redundancy	**5.5.1.1**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in section4.1.***
	16.1.2 LS Transfer to Shear Walls	**5.7.2**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in section 4.1.***
	16.10 LS – Coupling Beams	**5.5.3.2.1**	***Deficient***	***Retrofit is proposed. See structural retrofit options for Building in section 4.1.***

4.0 Conclusions

The load path and transfer to shear wall deficiencies are the result of lack of sufficient positive connection between the Low Roof diaphragms and the shear walls along Grids F and H. This deficiency causes the seismic loads to be transferred to the

foundation through undesirable (non-ductile) load paths which could result in a sudden brittle loss of strength and stiffness when these elements are overcome by seismic forces which they were never designed to take in the first place. Examples of these undesirable load paths are seismic forces being transferred through the concrete girders (along Grids E.9 & H.1) to precast cladding panels below and seismic forces being taken by out-of-pane bending of the shear wall along Grid 5, at the split level Low Roof elevation.

The redundancy deficiency is a result of insufficient length of shear wall along Grid 8, the two isolated piers do not have sufficient shear strength to develop the flexural capacity of the piers which could lead to a sudden brittle loss of strength and stiffness during a major seismic event. This type of failure can lead to a partial collapse of the structure and cause other elements of the lateral force resisting system to be overcome as well.

The coupling beam deficiency is due to an inability of the coupling beams to control falling debris at egress paths due to spalling of inadequately confined concrete.

In addition some of the coupling beams/piers do not meet the acceptance criteria for shear and/or flexural demands. The ability of the coupling beams to effectively transfer seismic forces between adjacent shear wall piers plays an important role in the overall seismic behavior of the structure.

The deficiencies listed above indicate that the existing shear walls do not have enough shear and overturning resistance to meet the seismic load demand on the structure. Thus, all the identified deficiencies are major structural irregularities and pose a serious collapse hazard if they are not mitigated.

Given the reasons above, a voluntary seismic retrofit is recommended for this structure.

4.1 Proposed Retrofit Options

Summary of Retrofit options:

1. ***Provide new steel member collectors at concrete over metal deck Low Roof diaphragm to drag seismic forces into the existing shear walls along Grids F & H.***
2. ***Provide new positive connection at concrete pan joist Low Roof to transfer seismic forces into the existing shear walls along Grids F & H.***
3. ***Provide shotcrete retrofit of the existing piers located at Grids G/8 & H/8. The existing piers are 8" wide x 6'-4" long and have an integral 10" x 24" column at the centerline of the pier. The column strong axis is orientated perpendicular to the plane of the wall giving a 16" protrusion from the face of the shear wall. This 16" pocket can have shotcrete applied from the exterior of the structure with minimal impact of the function of the structure.***
4. ***Either FRP retrofit or extend the existing 10" wide x 24" long piers located at Grids E/8 & I/8. Along the same lines of resistance the existing 10" wide x approximately 9'-6" long piers either need FRP or shotcrete retrofit. When the actual retrofit scheme is developed the interplay between the different piers along the same line of resistance will be taken into account in order to provide the best solution possible.***
5. ***All coupling beams over egress paths require FRP jacketing in order to control the falling debris hazard during a moderate to severe seismic event.***

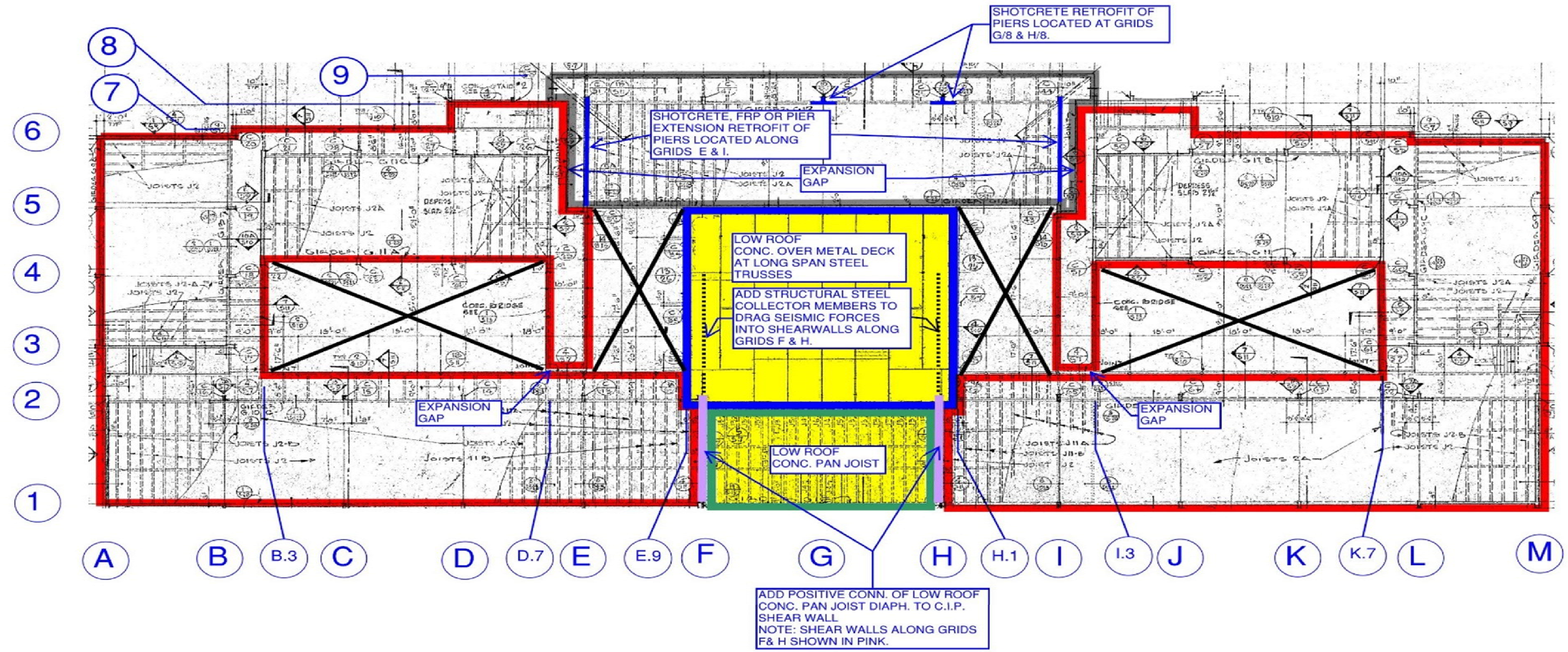
4.2 Structural Retrofit Selection Recommendations and Conclusions

Based on our analysis of ***Classroom Buildings (H&S)***, we strongly recommend implementing the following retrofit options:

Recommended options:

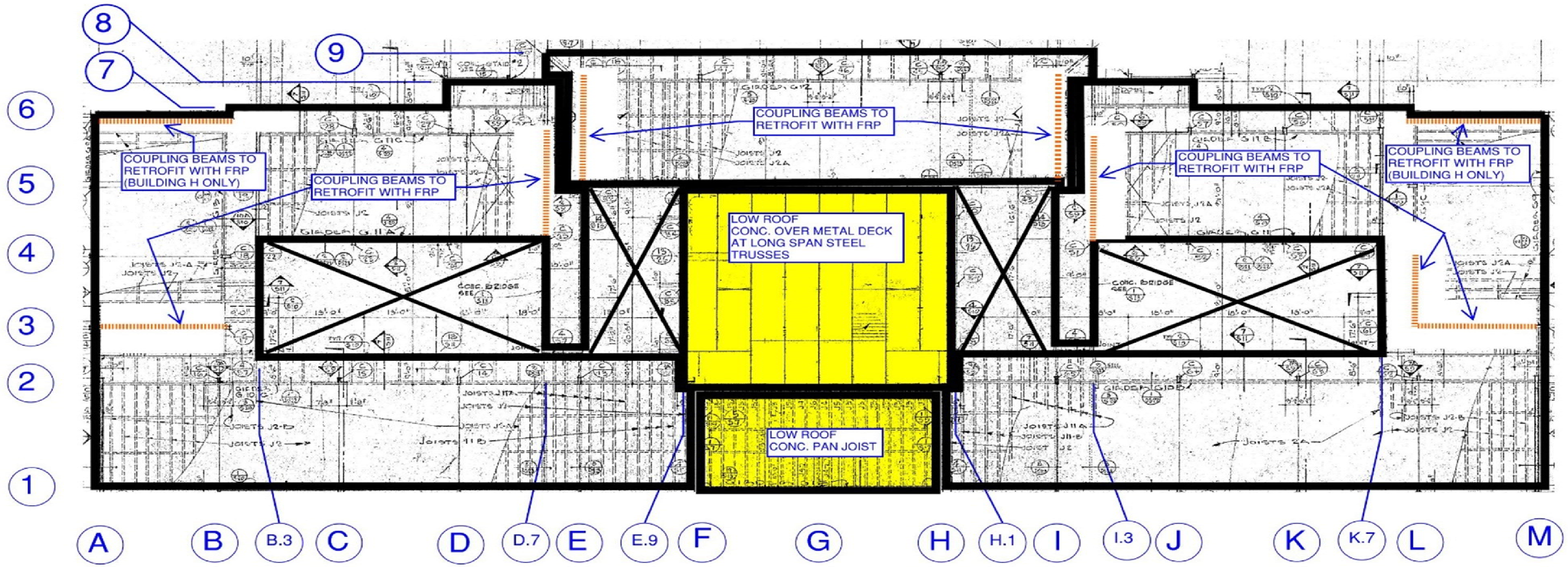
- ***Adding collectors and in plane shear connections at the Low Roof diaphragms in order to obtain a well-defined seismic load path and prevent undesirable and potentially dangerous alternate load paths.***
- ***Shotcreting the piers located Grids G/8 & H/8 in order to meet the shear wall acceptance criteria and obtain much better seismic behavior of these elements.***

- *A combination of FRP, shotcrete and/or extending piers along Grids E & I, in order to meet the shear wall acceptance criteria and obtain much better seismic behavior of this line of resistance.*
- *FRP application at all coupling beams over egress paths in order to control falling debris in a moderate to severe seismic event.*



PROPOSED RETROFIT MEASURES

NOTE: SEE FOLOWING PAGE FOR COUPLING BEAM FRP RETROFIT LOCATIONS AT EGRESS PATHS.



PROPOSED FRP RETROFIT
OF COUPLING BEAMS AT EGRESS PATHS

5.0 Documents Reviewed

The following existing structural drawings were reviewed:

Date	Architect / Engineer	TTG Comments
April 1963	Flewelling Moody and Horn Architecture-Engineering-Industrial Planning	Title Block states “Quadrangle 3” and “Quadrangle 4” for Classroom Building H and Classroom Building S respectively. (DSA Approval No. 23166)
Dec. 2015	Geo-Anvantec Inc.	Titled: Geotechnical Engineering Evaluation Report Proposed 6 Classroom Buildings & Weight Room Palos, Palos Verdes Peninsula High School

6.0 Limitations

These reports represent ***TTG's*** professional engineering judgment as to the deficiencies which would be vulnerable in a moderate to severe seismic event. It must be acknowledged that deficiencies may exist in the structure that were not observed in this evaluation. The information and opinions provided in this report have been prepared in accordance with recognized engineering principles. These findings and opinions are not intended as a warranty by ***TTG*** for the condition of the existing building and its performance in a major seismic event.

7.0 Architectural Section - Peninsula High School Buildings H & S, Classroom Wings

Table of Contents

Introduction and Background

In 1999 Assembly Bill 300 was passed which directed the Department of General Services (DGS), parent agency of DSA to prepare an inventory of all the public school sites in California from information they have regarding possible seismic risk based on when a school was constructed and the construction method used. Essentially all non-wood buildings constructed before 1976 were listed. This report and the funding availability was brought to light in the press a few years ago and DGS notified the Districts by letter to the superintendent recommending that further analysis be done to address seismically deficient facilities. They recommended a Structural Engineer should be consulted to take the next steps of review. The state allocated 200 million dollars for seismic mitigation work of which approximately 100 million is still available. Only two school districts in the state have proceeded far enough to apply for this funding. Very few school districts have done any steps in in addressing the recommendations of this report. It was estimated that there could be potentially over 4 billion dollars' worth of mitigation work across the state. A district is required to do complete construction

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documents for the identified seismic upgrades and obtain DSA approval before funding can be applied for.

In 2012 PVPUSD contracted with PBWS along with TTG to perform the next step which is called the seismic screening. This is starts with the DSA prepared list that is vetted by the District's consultants. From this review it is was determined that some campuses be removed from the list and some added based on the consultant's research and familiarity with the District's facilities. In some cases, campuses may no longer be part of the District's facilities. This resulted in the identification and verification of the District's campuses and individual buildings that are recommended for further analysis known as tier 2 analysis.

The purpose of tier 2 analysis and report is to review the capacity of the existing individual building or building complex to resist the effects of anticipated seismic activity and to assign a performance level based on the research. These performance level criteria would be based on national recognized ASCE standard. See the Structural Section for more information. Recommendations are provided to upgrade the structural system to the life safety performance level as is the desired result of the AB300 program. This analysis and general structural upgrade recommendations are contained in the structural portion of this report. The impacts and specifics of construction of that structural upgrades with regard to constructability, aesthetics, finishes, fire/life safety, accessibility, and effects on building program and function are addressed in the architectural portion of this report.

History, Description and Use of the Facility

Palos Verdes Peninsula High School is a public high school with in the Palos Verdes Peninsula Unified School District. The original buildings were completed in 1963 and includes all the buildings of concern for this analysis. It was originally called Rolling Hills High School and has been in constant use as a high school since that time. The original campus buildings were designed by the firms of Flewelling, Moody, and Horn Architects and is mostly of concrete construction. The buildings referred to as H & S are part of the original campus buildings.

The buildings H & S are essentially mirrors of one another on each side of the central courtyard. They are mostly 2 story buildings each with two inner courtyards. They contain classrooms, some administration office space, and some multipurpose spaces in and a single story middle element. The buildings structure is mostly cast-in-place concrete with precast concrete plank infill for non-structural walls. The floor and roof systems are a cast-in-place concrete joist system. The single story central portion has a steel truss roof.

All portions of the building are of Type-2 non-combustible construction and appear fit within the current CBC Type-2B requirements.

Retrofit Recommendations Arrangement and Goals

The Goal of the Architectural portion of the recommendations is to minimize the retrofit's effect on building function, systems and interruption to existing spaces as much as possible. It is also to minimize the impact on the existing construction and to return construction to its original state. This portion reviews the finish, weather ability, moisture control, utility systems and esthetics of the retrofit work by determining how the work affects all element of the construction. It examines the effects of the proposed retrofit work on the building use, function, accessibility, and fire safety if any. It considers the feasibility to construct the work and what might have to be removed and restored.

The retrofit recommendations are arranged by number that corresponds to the numbering in the structural section. Each item is keyed on the floor plans in Appendix 7B for reference. There are conceptual details called out from the floor plans that show the anticipated construction for the various conditions and they are included in Appendix 7C.

The ultimate goal is to retrofit the building for the protection of life and allow for the evacuation of the buildings after a significant seismic event and damage control of the structure per ASCE S-2 classification. This is referred to as structural damage control performance. There are higher levels of retrofit that can be met which is commonly used for essential facilities such as hospitals and fire stations. This consideration is based on the State's overall goals for the projection of life at all public school campuses. The size maximum of the Earthquake event anticipated in this analysis is clarified in the structural portion of this report.

It should be noted that even though the target retrofit is to the S-2 performance level the structures could still suffer significant damage and might require significant repair before being serviceable and occupiable again.

Retrofit Item 1

Collectors at Low Roof Diaphragms on Grids F and H
This will entail adding steel members under the metal roof deck of the lower roof over the high multipurpose space in Building H and the counseling center in Building S along grid line F and H. These will be in line with the concrete shear walls at the side of the raised platform. The will require removal and replacement of a portion of the ceiling in

these rooms and may require removal and replacement of strips of roofing over this area to allow for welding work. See conceptual detail #7

Retrofit Item 2

Connection of Roof to Shear Wall on Grids F and H
This consists of providing a connection from the low concrete roof over the stage area to the concrete shear walls on each side along grid line F & H. This can most likely be done with steel angles anchored into both the roof and wall. This area above the stage where the work would take place is mostly exposed in Building H but some ceiling areas may need to be removed and reinstalled in Building S. See conceptual detail #8

Retrofit Item 3

Pier Reinforcing at Grids G8 and H8
This consists of providing additional thickness to the existing pier walls that provide shear along grid line 8. This will be accomplished by adding concrete doweled to the existing walls from the foundation up through the roof deck. This will include enhancement to the width of the existing foundation. This will most likely be installed on the outside facing surface so as to avoid disturbing the interior space. The face of the concrete is exposed but there will be some excavation to perform the foundation portion of the work. See conceptual detail #9.

Retrofit Item 4

Pier Reinforcing at Grids E8 and I8
This consists of providing additional thickness to the existing pier walls that provide shear along grid lines E and I. This will be accomplished by adding concrete doweled to the existing walls from the foundation up through the 2nd floor deck. This will include enhancement to the width of the existing foundation. This will most likely be installed on the side facing central office space so as to avoid disturbing passage width. The face of the concrete is exposed but there will be some excavation to perform the foundation portion of the work. A section of lockers would need to be relocated. See conceptual detail #10.

Retrofit Item 5

Jacket Coupling Beams Over Egress Path
This consists of providing a carbon fiber overlay around the sides and bottom of concrete beams that are part of the lateral force resisting system. These are generally over concrete shear wall. This material is adhered to the existing concrete and painted to match adjacent color. Since these beams have a high likelihood of spalling during a

seismic event and they are over or adjacent to exit paths from the building there would be a hazard of falling concrete fragments. The beams to be wrapped in the carbon fiber overlay are exposed and relatively easy to access for work on the exterior side which is the side of the egress path. If it desired to wrap the opposite side which is toward the interior of classrooms access will have to be obtained above the ceilings that exist. A portion of the ceiling will have to be removed and reinstalled. See conception detail #11.

Miscellaneous Recommended Work

Spalling Concrete Repair
There are numerous locations throughout both buildings where concrete edges are cracking and spalling. Even though these are not effecting the buildings mains structure they present a hazard and will allow the further deterioration of construction if not addressed. This is mostly concentrated around the stair areas. This would consist of appropriate preparation of the existing concrete and an appropriate formulated epoxy system with reinforcing where required to fill and hold cracking areas. These areas are generally exposed for easy access.

Accessibility Upgrades

If Retrofit work is designed and submitted to DSA there will be some minimum level of access compliance work that will be required as a condition of the obtaining approval. Typically, there are requirements for an accessible path of travel to the subject building from parking and accessible restrooms to serve the building. Even though modernization work has been done which on the campus they may be some work required to meet the requirements of the most current codes and regulations at the time of that the retrofit work is being designed. A separate survey for access compliance is recommended for the entire campus that would be of benefit for future project planning.

Fire & Life Safety

The work should have minimal effect on the fire rated assemblies that exist since all the work is concrete enhancement to exterior wall elements and floor/roof beams. Any assembly disturbed in the process will have to be returned to its original rating condition.

The new work will have no impact on the egress system as currently exists and there are no changes to the egress system in this scope. There is no reconfiguration of spaces or changes of use in the scope that would affect the existing fire/life safety code compliance status of the building with regards to building area, construction type or configuration.

Conclusion

It should be noted that this report addresses the building's structure in regards to seismic safety and does not take into account non-structural seismic hazards such as ceiling systems, cabinetry, or overhead equipment. Most of which has been addressed in previous modernization work. It also does not consider other deficiencies that may exist such as program function, utility systems condition, building envelope weather ability, energy efficiency, or other differed maintenance items.

It should be possible to construct these retrofit elements with relatively small impact to the function and appearance of the building. Most of the work is involve retrofitting the concrete structure which is generally exposed. There is also work within the steel frame lower roof which will require some roof and ceiling repair. The cost of this seismic mitigation work would be significantly less then structure replacement.

PVPUSD Seismic Study
Narrative, Plans and Details by PBWS - Received 8/10/2016

RE: PVPUSD Seismic Study

Please find in the following report the cost estimate for the PVPUSD Seismic Study project. This estimate is prepared in accordance with the Narrative, Plans and Details by PBWS - Received 8/10/2016 with the following:

CLARIFICATIONS:

- Pricing is based on the entire project scope being awarded as one project to a single contractor
- Cost is based on prevailing wage labor rates
- This estimate represents an opinion of the fair construction cost for this project assuming multiple general contractors competitively bidding on the project with all sub-trades covered with 4 to 5 bids per trade. If a different delivery method is used a premium cost should be expected and will vary depending on the method used. This estimated cost should not be construed as a prediction of low bid

EXCLUSIONS:

- All soft costs
- Permits
- Owner's contingency
- Construction or occupancy phasing
- CM fee

Should you have any questions, please call me at 661-367- 5242.

Sincerely:

Walid Shihayed

Walid Shihayed

WM2S, Inc.
14908 Live Oak Springs Canyon Road, Santa Clarita, CA. 91387
P: (661) 367 5242, www.WM2S.com

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
PENH Peninsula High School Buildings H & S, Classroom Wings			
0205 Demolition			
02050.000 DEMOLITION			
Remove Concrete Slab	57.00 SF	15.00 /SF	855
Remove Concrete Slab	60.00 SF	15.00 /SF	900
Demo Ceiling	360.00 SF	4.00 /SF	1,440
Demo Ceiling	2,695.00 SF	4.00 /SF	10,780
Remove - Roofing	180.00 SF	5.00 /SF	900
DEMOLITION			**14,875**
0205 Demolition			**14,875**
0220 Earthwork			
02200.000 EARTHWORK			
Excavate For Footing - Hand	4.00 CY	65.00 /CY	260
Backfill Walls - Hand	2.00 CY	50.00 /CY	100
Excavate For Footing - Hand	4.00 CY	65.00 /CY	260
Backfill Walls - Hand	2.00 CY	50.00 /CY	100
EARTHWORK			**720**
0220 Earthwork			**720**
0252 Site Concrete			
02520.000 SITE CONCRETE			
Cast-in-Place Concrete Paving 4"	57.00 SF	35.00 /SF	1,995
Cast-in-Place Concrete Paving 4"	60.00 SF	35.00 /SF	2,100
SITE CONCRETE			**4,095**
0252 Site Concrete			**4,095**
0320 Reinforcing Steel			

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
03200.000 CONCRETE REINFORCEMENT			
Concrete Wall Reinforcing	294.00 SF	7.00 /SF	2,058
Concrete Wall Reinforcing	500.00 SF	7.00 /SF	3,500
CONCRETE REINFORCEMENT			**5,558**
0320 Reinforcing Steel			**5,558**
0330 Concrete			
03300.000 CAST-IN-PLACE CONCRETE			
Drill & Epoxy Reinforcing Dowel	294.00 EA	35.00 /EA	10,290
Drill & Epoxy Reinforcing Dowel	500.00 EA	35.00 /EA	17,500
Lightweight Concrete on Metal Decks	180.00 SF	15.00 /SF	2,700
CAST-IN-PLACE CONCRETE			**30,490**
0330 Concrete			**30,490**
0335 Shotcrete			
03360.000 SHOTCRETE			
Concrete Walls - Shotcrete - Per cuyd - 12 " Thick	294.00 SF	37.04 /SF	10,889
Concrete Walls - Shotcrete - Per cuyd - 12 " Thick	500.00 SF	37.04 /SF	18,519
SHOTCRETE			**29,407**
0335 Shotcrete			**29,407**
0370 Concrete Restoration			
03700.000 CONCRETE RESTORATION			
Concrete Restoration & Repair	1.00 LS	15,000.00 /LS	15,000
Fiberwrap Concrete - Exterior Tyfo System	6,200.00 SF	9.50 /SF	58,900
Fiberwrap Concrete - Add For Angles and Anchors	6,200.00 SF	3.20 /SF	19,840
Fiberwrap Concrete - Add For Smooth Coat	6,200.00 SF	0.20 /SF	1,240

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
CONCRETE RESTORATION			**94,980**
0370 Concrete Restoration			**94,980**
0510 Steel			
05050.000 METAL FASTENING			
Drill & Epoxy Anchor (Hilti)	136.00 EA	75.00 /EA	10,200
Drill & Epoxy Anchor (Hilti)	8.00 EA	75.00 /EA	600
METAL FASTENING			**10,800**
05100.100 Structural Steel			
Fabricate Structural Steel	1.39 TON	3,000.00 /TON	4,170
Fabricate Structural Steel	5.70 TON	3,000.00 /TON	17,100
Detail Structural Steel	1.39 TON	2,000.00 /TON	2,780
Detail Structural Steel	5.70 TON	2,000.00 /TON	11,400
Structural Steel			**35,450**
05120.014 Steel Beam W 14			
Buy W 14 x 90	60.00 LF	96.30 /LF	5,778
Steel Beam W 14			**5,778**
05123.803 Steel Angles 3"			
Erect Steel Plates	2.00 EA	3,500.00 /EA	7,000
Erect Steel	34.00 EA	875.00 /EA	29,750
Steel Angles 3"			**36,750**
05123.805 Steel Angles 5"			
Angle 5 x 5 x 3/8 - Bracing	150.00 LF	50.00 /LF	7,500
Steel Angles 5"			**7,500**
05124.005 Steel Plate < 1"			
Steel Plate 1/2"	136.00 SF	51.05 /SF	6,943

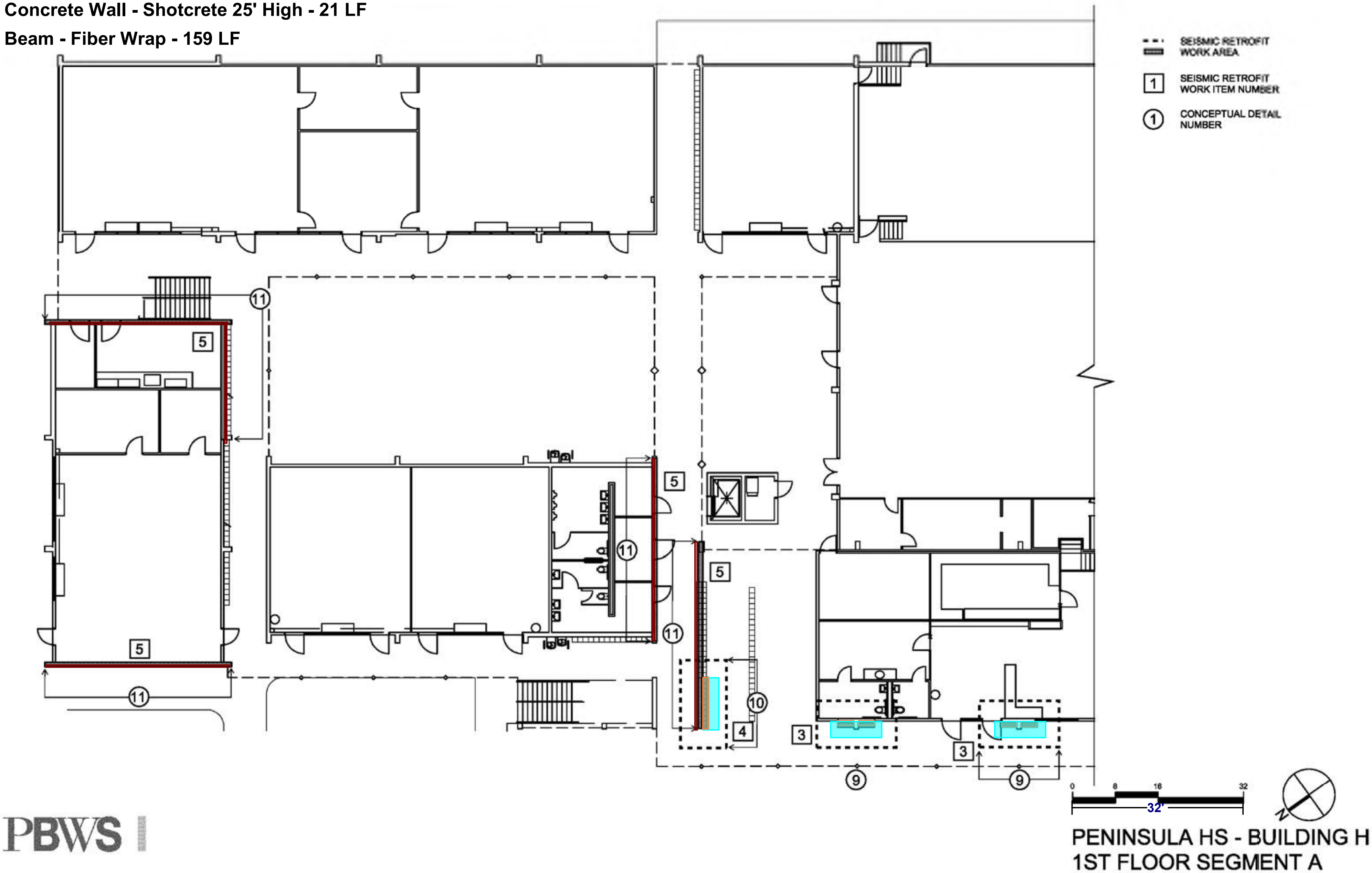
Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
05124.005 Steel Plate < 1"			
Steel Plate 1/2"	180.00 SF	51.05 /SF	9,189
Steel Plate < 1"			**16,132**
0510 Steel			**112,410**
0750 Roofing			
07500.000 MEMBRANE ROOFING			
Roofing Patch	136.00 SF	35.00 /SF	4,760
Roofing Patch	180.00 SF	35.00 /SF	6,300
MEMBRANE ROOFING			**11,060**
0750 Roofing			**11,060**
0925 Plaster And Drywall			
09250.000 GYPSUM BOARD			
Replace Ceiling & Suspension	360.00 SF	25.00 /SF	9,000
Replace Ceiling & Suspension	2,695.00 SF	15.00 /SF	40,425
GYPSUM BOARD			**49,425**
0925 Plaster And Drywall			**49,425**
0950 Ceiling			
09500.000 ACOUSTICAL TREATMENT			
Acoustical Ceilings - 12x12 Glued On	119.00 SF	15.00 /SF	1,785
ACOUSTICAL TREATMENT			**1,785**
0950 Ceiling			**1,785**
0990 Painting			
09900.000 PAINTING			
Painting - Metals - High Performance Coating	136.00 SF	4.00 /SF	544

Spreadsheet Level	Takeoff Quantity	Total Cost/Unit	Total Amount
09900.000 PAINTING			
Painting - Concrete Wall	600.00 SF	2.50 /SF	1,500
Painting - Concrete Wall	1,000.00 SF	2.50 /SF	2,500
Painting - Interior Ceiling	1,440.00 SF	3.00 /SF	4,320
PAINTING			**8,864**
0990 Painting			**8,864**
1000 Specialties			
10500.000 LOCKERS			
Lockers - Remove& Reinstall	1.00 LS	5,000.00 /LS	5,000
LOCKERS			**5,000**
1000 Specialties			**5,000**
PENH Peninsula High School Buildings H & S, Classroom Wings			**368,669**

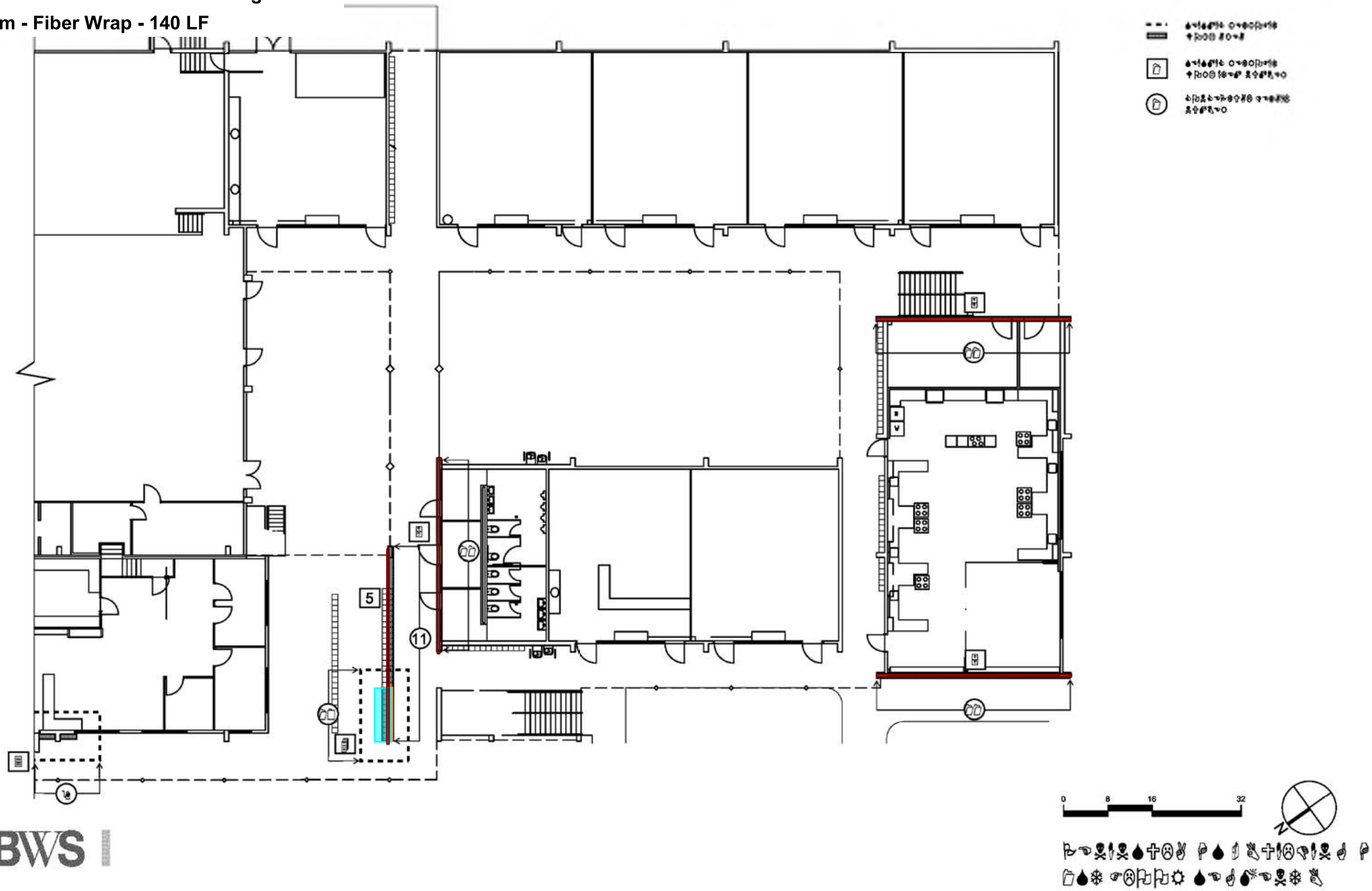
Partial Totals

Description	Amount	Totals	Rate	
Direct Cost	**368,669**	**368,669**		
General Conditions	36,867		10.00	%
Performance & Payment Bond	5,251			
Liability Insurance	3,687		1.00	%
Overhead & Fee	18,433		5.00	%
Construction Cost	**64,238**	**432,907**		
Design Contingency	86,581		20.00	%
Escalation	17,316		4.00	%
Construction Cost With C&E	**103,897**	**536,804**		
Construction Contingency	53,681		10.00	%
	53,681	**590,485**		
SOFT COSTS:				
Architect & Engineering Fees				
Architect Reimbursables				
Testing & Inspection				
Permits and Fees				
Furniture, Fixtures and Equip.				
Total Project Cost				

11 - Paving - Concrete Detail 5,9 - 29 LF
14 - Concrete Wall - Shotcrete 25' High - 21 LF
16 - Beam - Fiber Wrap - 159 LF



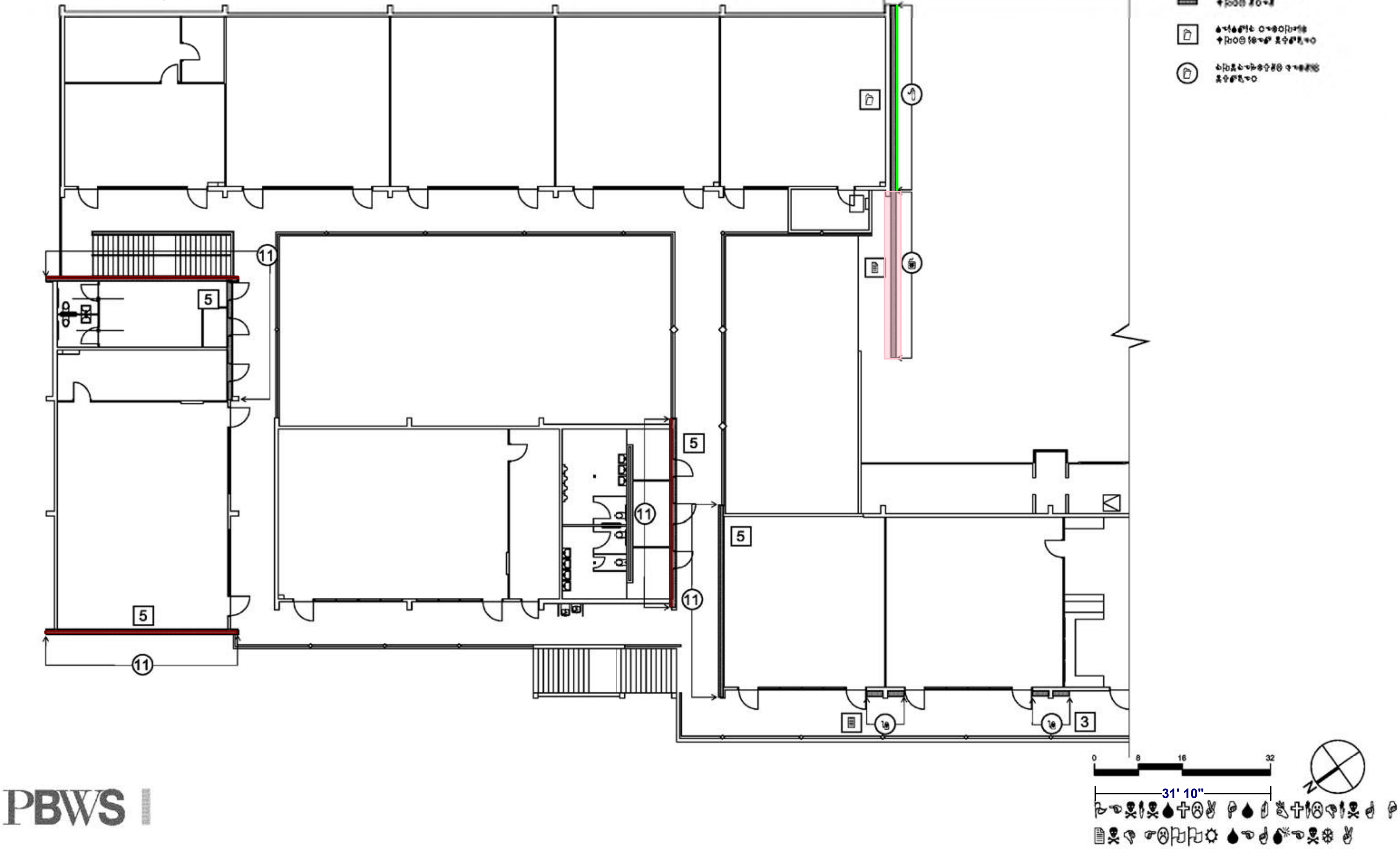
11 - Paving - Concrete Detail 5,9 - 10 LF
14 - Concrete Wall - Shotcrete 25' High - 10 LF
16 - Beam - Fiber Wrap - 140 LF



12 - Bent Plate - Detail 5,8 - 34 LF

15 - Roof Construction - Detail 7 - Add Drag Strut - 30 LF

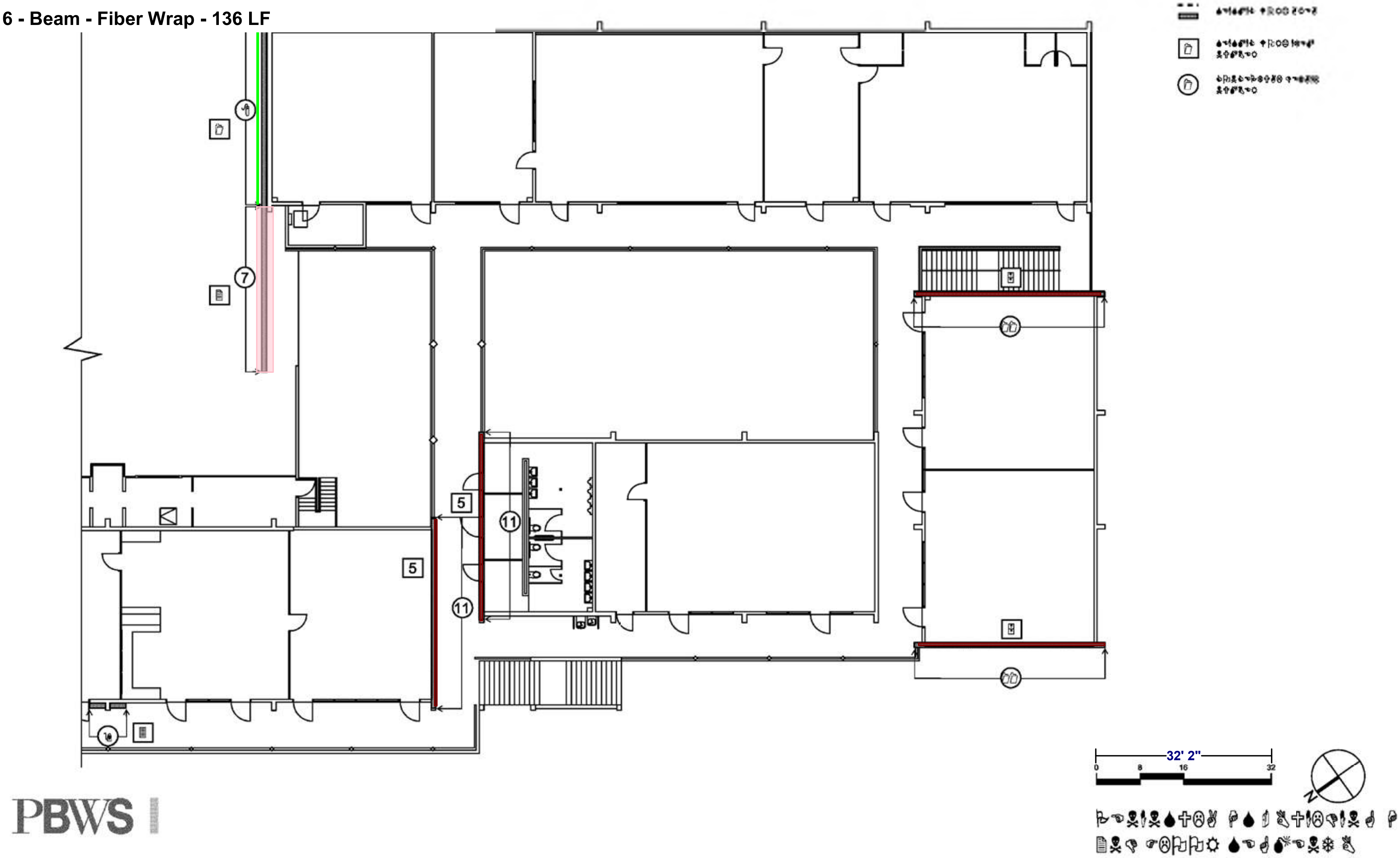
16 - Beam - Fiber Wrap - 104 LF



12 - Bent Plate - Detail 5,8 - 34 LF

15 - Roof Construction - Detail 7 - Add Drag Strut - 30 LF

16 - Beam - Fiber Wrap - 136 LF



PEN_FP_Bldg-H-2-B.pdf (64% of Scale); Takeoff in Active Area: All Areas; PVPUSD; WM2S; 8/11/2016 03:17 PM

Appendix 1-A: Tier 1 Screening Checklists/Calculation

§16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

Low Seismicity

Building system

C	NC	N/A	U	Checklist	Comments
				General	
	x			LOAD PATH: The structure shall contain a complete, well defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (§A.2.1.1. Tier 2: §5.4.1.1)	Load path incomplete, so non-compliant. The low roofs do not have a clearly defined load path to the LFRS. The pan joist low roof is disengaged from the CIP shear wall along grids F&H (between grids 1&2) in the North-South direction and the conc. over metal deck diaphragm at the long span steel trusses has only a small portion of diaphragm with potential connection to the LFRS. The remainder of this roof diaphragm is connected to concrete girders/precast cladding panels along grids E.9&H.1 (between grids 2.5&4.5).
		x		ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (§A.2.1.2. Tier 2: §5.4.1.3)	No adjacent buildings, so N/A.
		x		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (§A.2.1.3. Tier 2: §5.4.1.3)	No mezzanine levels in the building, N/A.
				Building Configuration	
x				WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (§A2.2.2. Tier 2: §5.4.2.1)	Meets the requirement by observation since there is an increase in shear wall length → story strength in the Base – 2nd level compared to the 2nd – Roof level, so complaint.

C	NC	N/A	U	Checklist	Comments
x				SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (§A.2.2.3. Tier 2: §5.4.2.2)	Meets the requirement by observation since there is an increase in shear wall length → story stiffness in the Base – 2nd level compared to the 2nd – Roof level, so complaint.
x				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (§A.2.2.4. Tier 2: §5.4.2.3)	Compliant by visual observation.
x				GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (§A.2.2.5. Tier 2: §5.4.2.4)	Compliant by visual observation.
x				MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (§A.2.2.6. Tier 2: §5.4.2.5)	Compliant by visual observation.
x				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (§A.2.2.7. Tier 2: §5.4.2.6)	Structural analysis was performed with 3-D model using ETABS software, which demonstrated that torsion is compliant.
Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity. Geologic Site Hazards					
x				LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (§A.6.1.1. Tier 2: §5.4.3.1)	Compliant per soils report by Geo-Advantec Inc. titled 'Proposed 6 Classroom Buildings and Weight Room Palos Verdes Peninsula High School' dated December 21, 2012.
x				SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or	Compliant, per soils report listed above.

C	NC	N/A	U	Checklist	Comments
				is capable of accommodating any predicted movements without failure. (§A.6.1.2. Tier 2: §5.4.3.1)	
x				SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (§A.6.1.3. Tier 2: §5.4.3.1)	Compliant, per soils report listed above.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Foundation Configuration					
x				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (§A.6.2.1. Tier 2: §5.4.3.3)	0.6Sa=0.6x0.716=0.43 Compliant per review of existing drawings. Elements of the lateral system can work together, so building dimension is used for this check since all the elements are well connected.
x				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (§A.6.2.2. Tier 2: §5.4.3.4)	Slab-on-grade ties foundation elements together, so compliant.

16.10LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES C2: CONCRETE SHEAR WALLS WITH STIFF DIAPHRAGMS AND C2A: CONCRETE SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Checklist	Comments
x				COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (§A.3.1.6.1. Tier 2: §5.5.2.5.1)	Meets the requirement per review of the gravity framing, so compliant.

C	NC	N/A	U	Checklist	Comments
	x			REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (§A.3.2.1.1. Tier 2: §5.5.1.1)	Shear wall piers along Grid 8 do not meet the minimum length requirement, so non-compliant.
x				SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in^2 or $2\sqrt{f'c}$. (§A.3.2.2.1. Tier 2: §5.5.3.1.1)	See attachments for calculations. Average shear stress is less than max $\{100, 2\sqrt{f'c}\}$ =110 psi. See calculations in Appendix A.
x				REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (§A.3.2.2.2. Tier 2: §5.5.3.1.3)	8” wall typical reinforcement: #4@10” horiz. → ρ_h = 0.0025 #4@12” vert. → ρ_v = 0.0021 10” wall reinforcement: #5@12” horiz. → ρ_h = 0.0026 #4@12” vert. → ρ_v = 0.0017 Ratios are more than minimum, so compliant.
Connections					
		x		WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (§A.5.1.1. Tier 2: §5.7.1.1)	Rigid diaphragms present, so N/A.
	x			TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of	According to the as-built drawings, there are positive connections for shear transfer between

C	NC	N/A	U	Checklist	Comments
				seismic forces to the shear walls. (§A.5.2.1. Tier 2: §5.7.2)	diaphragms and shear walls in all locations except for the low roofs. (Grids F-H & 1-4.5) At the conc. pan joist low roof the diaphragm was purposely detailed without a positive connection (See As-Built detail 1/S7), so non-compliant.
x				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (§A.5.3.5. Tier 2: §5.7.3.4)	CIP shear walls meet requirements, so compliant.
High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity. Diaphragms					
x				DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (§A.3.1.6.2. Tier 2: §5.5.2.5.2)	See calculations in Appendix, compliant.
		x		FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (§A.3.1.6.3. Tier 2: §5.5.2.5.3)	Concrete pan joist and one-way slab with beams are the gravity systems present, so N/A.
	x			COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than d/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (§A.3.2.2.3. Tier 2: §5.5.3.2.1)	Coupling beams are non-compliant. (See As-Built elevation 2/S9) No additional vertical reinforcement is present in coupling beams. Only typical distributed wall reinforcement is present.
Connections					
		x		UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (§A.5.3.8. Tier 2: §5.7.3.5)	No pile caps, so not applicable.
Diaphragms (Flexible or Stiff)					

C	NC	N/A	U	Checklist	Comments
x				DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (§A.4.1.1. Tier 2: §5.6.1.1)	Seismic force resisting elements are provided each side of the expansion gap, so compliant.
x				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (§A.4.1.4. Tier 2: §5.6.1.3)	Meet requirements, so compliant.
Flexible Diaphragms					
		x		CROSS TIES: There are continuous cross ties between diaphragm chords. (§A.4.1.2. Tier 2: §5.6.1.2)	Rigid diaphragm present, so N/A.
		x		STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (§A.4.2.1. Tier 2: §5.6.2)	Rigid diaphragm present, so N/A.
		x		SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (§A.4.2.2. Tier 2: §5.6.2)	Rigid diaphragm present, so N/A.
		x		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (§A.4.2.3. Tier 2: §5.6.2)	Rigid diaphragm present, so N/A.
		x		OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (§A.4.7.1. Tier 2: §5.6.5)	Meet requirements, so N/A.

16.17 NONSTRUCTURAL CHECKLIST

C	NC	N/A	U	Checklist	Comments
Life Safety Systems					
		X		LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (§A.7.13.1. Tier 2: §13.7.4)	No fire sprinklers or suppression piping present; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (§A.7.13.2. Tier 2: §13.7.4)	No fire sprinklers or suppression piping present; So not applicable
X				LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life	Proper anchorage and bracing was observed

C	NC	N/A	U	Checklist	Comments
				safety systems is anchored or braced. (§A.7.12.1. Tier 2: §13.7.7)	
		X		LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (§A.7.14.1. Tier 2: §13.7.6)	None observed at site; So not applicable
		X		LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (§A.7.13.3. Tier 2: §13.7.4)	No fire sprinklers or suppression piping present; So not applicable
		X		LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (§A.7.3.1. Tier 2: §13.7.9)	Not applicable to Life Safety.
Hazardous Materials					
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (§A.7.12.2. Tier 2: §13.7.1)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (§A.7.15.1. Tier 2: §13.8.4)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (§A.7.13.3. Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (§A.7.15.4, Tier 2: §13.7.3 and 13.7.5)	No hazardous materials; So not applicable
		X		LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that	No hazardous materials; So not applicable

C	NC	N/A	U	Checklist	Comments
				either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A.7.13.6. Tier 2: §13.7.3, 13.7.5, and 13.7.6)	
Partitions					
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (§A.7.1.1. Tier 2: §13.6.2)	No URM partition, so not applicable.
		X		LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	No masonry or hollow-clay partitions, so not applicable.
		X		LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (§A.7.1.2 Tier 2: §13.6.2)	No rigid cementitious partitions, so not applicable.
		X		LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (§A.7.2.1. Tier 2: §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (§A.7.1.3. Tier 2. §13.6.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (§A.7.1.4. Tier 2. §13.6.2)	Not applicable to Life Safety.
Ceilings					
		X		LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	Ceiling type not present; So not applicable
		X		LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces	Ceiling type not present; So not applicable

C	NC	N/A	U	Checklist	Comments
				for every 12 ft^2 of area. (§A.7.2.3. Tier 2: §13.6.4)	
		X		LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (§A.7.2.2. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (§A.7.2.4. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (§A.7.2.5. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 are supported by closure angles or channels not less than 2 in. wide. (§A.7.2.6. Tier 2: §13.6.4)	Not applicable to Life Safety.
		X		LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft^2 and has a ratio of long-to-short dimension no more than 4-to-1. (§A.7.2.7. Tier 2: §13.6.4)	Not applicable to Life Safety.
Light Fixtures					
X				LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite	Proper support was observed

C	NC	N/A	U	Checklist	Comments
				corners of each fixture. (§A.7.3.2. Tier 2: §13.6.4 and 13.7.9)	
		X		LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (§A.7.3.3. Tier 2: §13.7.9)	Not applicable to Life Safety.
		X		LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (§A.7.3.4. Tier 2: §13.7.9)	Not applicable to Life Safety.
Cladding and Glazing					
		X		LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (§A.7.4.1. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.3. Tier 2: §13.6.1)	No cladding or glazing, so not applicable.
		X		LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (§A.7.4.4. Tier 2: §13.6.1)	No multi-story panel, so not applicable.
		X		LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (§A.7.4.5. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.

C	NC	N/A	U	Checklist	Comments
		X		LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (§A.7.4.6. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (§A.7.4.7. Tier 2: §13.6.1.4)	No cladding panel, so not applicable.
		X		LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft^2 in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (§A.7.4.8: Tier 2: §13.6.1.5)	No cladding panel, so not applicable.
Masonry Veneer					
		X		LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (§A.7.5.1. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (§A.7.5.2. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (§A.7.5.3. Tier 2: §13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (§A.7.7.2. Tier 2: §13.6.1.1 and 13.6.1.2)	No URM backup, so not applicable.
		X		LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (§A.7.6.1. Tier 2: §13.6.1.1 and 13.6.1.2)	No masonry veneer, so not applicable.
		X		LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or	No masonry veneer, so not applicable.

C	NC	N/A	U	Checklist	Comments
				less than 4 ft along the floors and roof. (§A.7.7.1. Tier 2: §13.6.1.1 and 13.6.1.2)	
		X		LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (§A.7.5.6. Tier 2: §13.6.1.2)	Not applicable to Life Safety.
		X		LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (§A.7.6.2. Tier 2: §13.6.1.1 and 13.6.1.2)	Not applicable to Life Safety.
Parapets, Cornices, Ornamentation, and Appendages					
		X		LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (§A.7.8.1. Tier 2: §13.6.5)	No URM parapet, so not applicable.
X				LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (§A.7.8.2. Tier 2: §13.6.6)	Meet requirements, so complaint.
X				LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (§A.7.8.3. Tier 2: §13.6.5)	Meet requirements, so complaint.
		X		LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (§A.7.8.4. Tier 2: §13.6.6)	No such appendages were observed; So not applicable
Masonry Chimneys					
		X		LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of	No URM chimneys, so not applicable.

C	NC	N/A	U	Checklist	Comments
				the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (§A.7.9.1. Tier 2: §13.6.7)	
		X		LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (§A.7.9.2. Tier 2: §13.6.7)	No masonry chimneys, so not applicable.
Stairs					
		X		LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (§A.7.10.1. Tier 2: §13.6.2 and 13.6.8)	No stairs, so not applicable.
	X			LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (§A.7.10.2. Tier 2: §13.6.8)	Damage and attempted patching observed on outdoor stairs at site indicates stairs were not detailed properly for drift; So Non-Compliant
Contents and Furnishings					
		X		LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (§A.7.11.1. Tier 2: §13.8.1)	No industrial racks observed; So not applicable
X				LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (§A.7.11.2. Tier 2: §13.8.2)	Proper anchorage was observed
X				LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or	Proper bracing was observed

C	NC	N/A	U	Checklist	Comments
				otherwise restrained. (§A.7.11.3. Tier 2: §13.8.2)	
		X		LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (§A.7.11.4. Tier 2: §13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (§A.7.11.5. Tier 2: §13.7.7 and 13.8.3)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (§A.7.11.6. Tier 2: §13.8.2)	Not applicable for Life Safety.
Mechanical and Electrical Equipment					
			X	LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (§A.7.12.4. Tier 2: §13.7.1 and 13.7.7)	Not accessible during site visit
			X	LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (§A.7.12.5. Tier 2: §13.7.1)	Not accessible during site visit
			X	LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (§A.7.12.6. Tier 2: §13.7.1 and 13.7.7)	Not accessible during site visit
		X		LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (§A.7.12.7. Tier 2: §13.6.9)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (§A.7.12.8. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
		X		LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (§A.7.12.9. Tier 2: §13.7.1)	Not applicable for Life Safety.
		X		LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (§A.7.12.10. Tier 2: §13.7.1 and 13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (§A.7.12.11. Tier 2: §13.7.7)	Not applicable for Life Safety.
		X		LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (§A.7.12.12. Tier 2: §13.7.8)	Not applicable for Life Safety.
Piping					
		X		LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (§A.7.13.2. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (§A.7.13.4. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (§A.7.13.5. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
		X		LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (§A7.13.6. Tier 2: §13.7.3 and 13.7.5)	Not applicable for Life Safety.
Ducts					
		X		LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (§A.7.14.2. Tier 2: §13.7.6)	
		X		LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (§A.7.14.3. Tier 2: §13.7.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (§A.7.14.5. Tier 2: §13.7.6)	Not applicable for Life Safety.
Elevators					
		X		LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (§A.7.16.1. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (§A.7.16.2. Tier 2: §13.8.6)	No elevators, not applicable.
		X		LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (§A.7.16.3. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (§A.7.16.4. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (§A.7.16.5. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (§A.7.16.6. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the	Not applicable for Life Safety.

C	NC	N/A	U	Checklist	Comments
				counterweight rail to the structure are sized in accordance with ASME A17.1. (§A.7.16.7. Tier 2: §13.8.6)	
		X		LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (§A.7.16.8. Tier 2: §13.8.6)	Not applicable for Life Safety.
		X		LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (§A.7.16.9. Tier 2: §13.8.6)	Not applicable for Life Safety.

Appendix 1-B: Tier 2 Evaluation Calculations

USGS Design Maps Summary Report

User–Specified Input

Building Code Reference Document ASCE 41-13 Retrofit Standard, BSE-1E
(which utilizes USGS hazard data available in 2008)

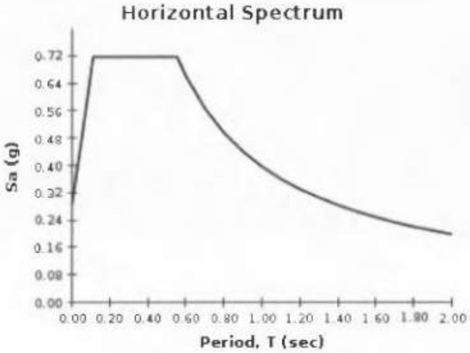
Site Coordinates 33.77761°N, 118.37467°W

Site Soil Classification Site Class D – "Stiff Soil"

USGS–Provided Output

$S_{S,20/50}$	0.516 g	$S_{XS,BSE-1E}$	0.716 g
$S_{1,20/50}$	0.197 g	$S_{X1,BSE-1E}$	0.396 g

Horizontal Spectrum



Vertical Spectrum

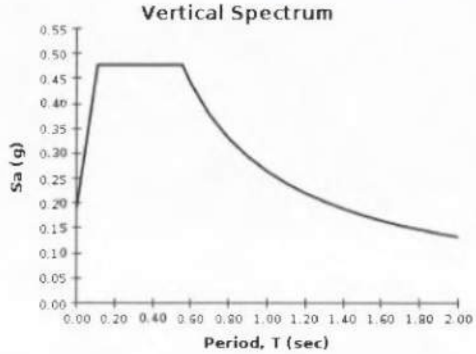


Table 2-3. Values of F_a as a Function of Site Class and Mapped Short-Period Spectral Response Acceleration S_s

Site Class	Mapped Spectral Acceleration at Short-Period S_s				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	Site-specific geotechnical and dynamic site response analyses shall be performed				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_s = 0.516 g, F_a = 1.387

Table 2-4. Values of F_v as a Function of Site Class and Mapped Spectral Response Acceleration at 1 s Period S_1

Site Class	Mapped Spectral Acceleration at 1 s Period S_1				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	Site-specific geotechnical and dynamic site response analyses shall be performed				

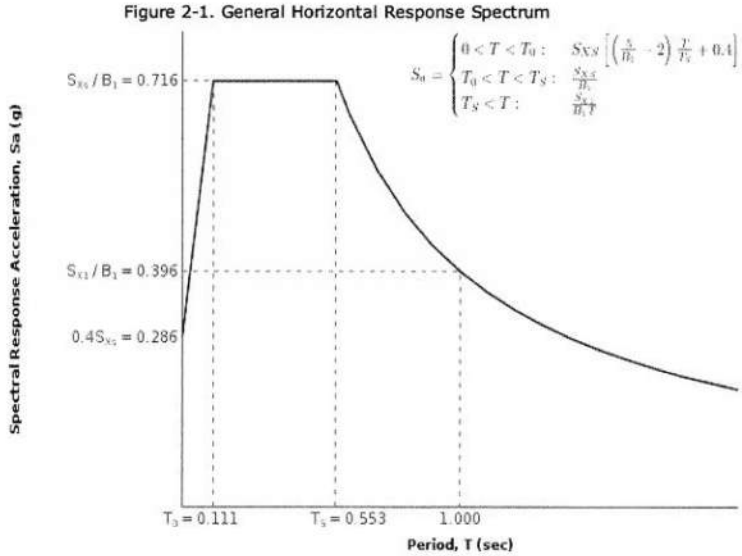
Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.197 g, F_v = 2.013

Provided as a reference for Equation (2-4):	$F_a S_{S,20/50}$ = 1.387 x 0.516 g = 0.716 g
Provided as a reference for Equation (2-5):	$F_v S_{1,20/50}$ = 2.013 x 0.197 g = 0.396 g
Provided as a reference for Equation (2-4):	$S_{XS,BSE\text{-}1N}$ = ⅔ x $S_{XS,BSE\text{-}2N}$ = ⅔ x $F_a S_{S,BSE\text{-}2N}$ = 1.044 g
Provided as a reference for Equation (2-5):	$S_{X1,BSE\text{-}1N}$ = ⅔ x $S_{X1,BSE\text{-}2N}$ = ⅔ x $F_v S_{1,BSE\text{-}2N}$ = 0.603 g
Equation (2–4):	$S_{XS,BSE\text{-}1E}$ = MIN[$F_a S_{S,20/50}$, $S_{XS,BSE\text{-}1N}$] = MIN[0.716g, 1.044g] = 0.716g
Equation (2–5):	$S_{X1,BSE\text{-}1E}$ = MIN[$F_v S_{S,20/50}$, $S_{X1,BSE\text{-}1N}$] = MIN[0.396g, 0.603g] = 0.396g

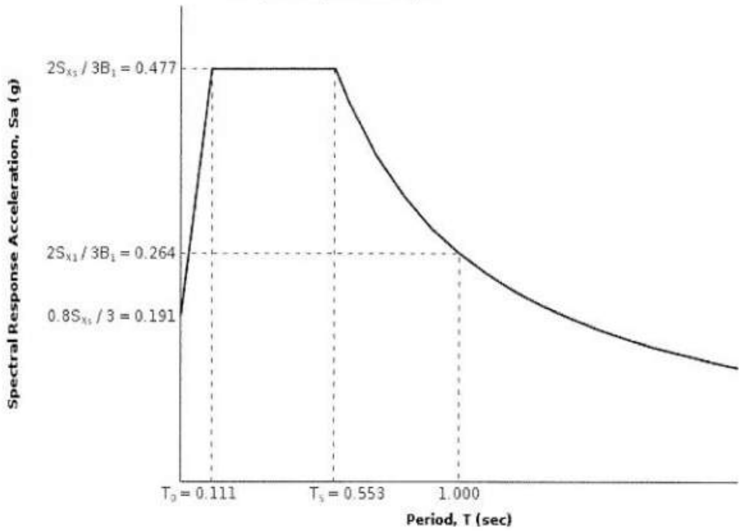
Section 2.4.1.7.1 — General Horizontal Response Spectrum

Figure 2-1. General Horizontal Response Spectrum



Section 2.4.1.7.2 — General Vertical Response Spectrum

The General Vertical Response Spectrum is determined by multiplying the General Horizontal Response Spectrum by ⅔.



TTG

Palos Verdes H.S.
Building H - (Building S is identical)

Job #: 0215766
Date: 1/27/2016

Check Seismic Mass for Shear Stress Check

Note: Concrete slabs (2nd Floor and RoofLevel are light weight concrete: 110 pcf
Concrete over metal deck at long span steel trusses is Vermiculite concrete: 90 pcf

High Roof - concrete pan joist

Roofing	5	psf
Conc. joist @ 3'-0" o.c.	25	psf
Conc. Bridging	2.5	psf
3" slab	27.5	psf
Partitions	5	psf
MEP	10	psf
Ceiling	5	psf
Misc	5	psf
DL =	**85.0**	**psf**
SDL (for model)=	**57.5**	**psf**
MASS =	**1.8**	

Low Roof 1: concrete pan joist

Roofing	5	psf
Conc. joist @ 3'-0" o.c.	25	psf
Conc. Bridging	2.5	psf
3" slab	27.5	psf
Partitions	5	psf
MEP	10	psf
Ceiling	5	psf
Misc	5	psf
DL =	**85.0**	**psf**
SDL (for model)=	**57.5**	**psf**
MASS =	**1.8**	

2nd Floor - concrete pan joist

Flooring	5	psf
Conc. joist @ 3'-0" o.c.	25	psf
Conc. Bridging	2.5	psf
3" slab	27.5	psf
Partitions	10	psf
MEP	10	psf
Ceiling	5	psf
Misc	5	psf
DL =	**90.0**	**psf**
SDL (for model)=	**62.5**	**psf**
MASS =	**1.9**	

Low Roof 2: concrete over metal deck

Roofing	5	psf
2-1/2" Vermic. conc. over	28	psf
18 GA. 1-1/2" metal deck		psf
Long Span Steel Trusses	5	psf
Partitions	5	psf
MEP	10	psf
Ceiling	5	psf
Misc	5	psf
DL =	**63.0**	**psf**
SDL (for model)=	**63.0**	**psf**
MASS =	**2.0**	

Griders

3'-0" Deep x 12" Wide Girders (SDL of Girder alone):	303 plf	Mass: 9.4
3'-0" Deep x 12" Wide Girders (SDL in additon to 6" precast panel):	152 plf	Mass: 4.7

Wall Weight

6" conc. precast wall = 75 psf

	trib. Height (ft)	6" Wall (plf)
High Roof	6.25	469
Low Roof	10.00	750
2nd	12.50	938
1st (Base)	6.25	469

Building Dimensions:

LX = 361'-0"
LY = 122'-0"

TTG **Palos Verdes H.S.**
Buildings H&S

Job #: 0215766
Date: 1/27/2016

Check Base Shear Per ASCE 41-13 Section 4.5.2.1

$V =$	CS_aW	Bldg Type= **C2 --> Risk Category III**	
$C =$	1.2	From Table 4-8 (Building Type C2 for 2 story)	
$S_a = \min(S_{XS}, S_{X1}/T)$		From § 4.5.2.3	
$S_{X1} = F_V S_1$		Eq. 2-2	
$S_{XS} = F_a S_S$		Eq. 2-1	
$S_S =$	0.516	g, mapped spectral acceleration	
$S_1 =$	0.197	g, mapped spectral acceleration	
$S_{X1} =$	0.396	g	
$S_{XS} =$	0.716	g	
$T = C_t h_n^{\beta}$		From Section 4.5.2.4	
$C_t =$	0.02		
$h_n =$	25.0	ft., average height at sloped roof	
$\beta =$	0.75		
$T =$	0.224	sec.	
$S_a =$	0.716	g	
$W=$	9990	k	
$V =$	0.859	W =	**8583** kips

TTG PVHS BLDG (H&S) TIER 1

sheet ____ of ____
by GC
job no. 215766
date 1/25/16

STRUCTURAL MECHANICAL ELECTRICAL AND CIVIL ENGINEERS

SHEAR STRESS CHECK PER §4.5.3.3

GLOBAL X-DIRECTION

- LENGTH OF WALL (EXCLUDING OPENINGS)

→ $L_w = 79' + 13.5' + 26' + 43' + 49' + 60' + 49' + 60' + 12.6' = 392'$

- GRID 1: $L = 30' + 30' + 9.5' + 9.5' = 79'$
- GRID 1.9: $L = 4.5' + 9' = 13.5'$
- GRID 2: $L = 6.4' + 6.8' + 6.4' + 6.4' = 26'$
- GRID 3: $L = 34' - [4' + 4' + 3.5'] + 34' - [4' + 4' + 3.5'] = 45'$
- GRID 4.2: $L = 24.5' + 24.5' = 49'$
- GRID 5: $L = 60'$
- GRID 5.1: $L = 24.5' + 24.5' = 49'$
- GRID 6: $L = 30' + 30' = 60'$
- GRID 8: $L = 6.3' + 6.3' = 12.6'$

GLOBAL Y-DIRECTION

→ $L_w = 53' + 34.5' + 31' + 11.5' + 31' + 31' + 11.5' + 31' + 34.5' + 23.6' + 53' = 345'$

- GRID A: $L = 31' + 22' = 53'$
- GRID B.3: $L = 34.5'$
- GRID D.7: $L = 8.5' + 34.5' - [4' - 4' - 4'] = 31'$
- GRID E: $L = 9.5' + 2' = 11.5'$
- GRID F: $L = 31'$
- GRID H: $L = 31'$
- GRID I: $L = 9.5' + 2' = 11.5'$
- GRID I.3: $L = 31'$
- GRID K.7: $L = 34.5'$
- GRID L: $L = 23.6'$
- GRID M: $L = 22' + 31' = 53'$

TTG PVHS BLDG. (H&S) TIER I

sheet ____ of ____
by GC
job no. 215766
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STRUCTURAL MECHANICAL ELECTRICAL AND CIVIL ENGINEERS

AVERAGE SHEAR STRESS IN SHEAR WALLS

$$v_j^{AVG} = \frac{1}{M_S}\left(\frac{V_j}{A_w}\right)$$

$$M_S = \frac{4.0+2.0}{2} = 3.0$$ (REINFORCED CONCRETE SHEARWALLS USING DEM AND CRITICAL PERFORMANCE LEVEL.)

$V_j = 8591\ k$ (STORY SHEAR BASE - 2ND LEVEL)

[WHERE $V = CS_aW = 0.86W$]

$$v_j^{AVG} = \frac{8591\ k}{(3.0 \times 392' \times 12'' \times 8'')} = 76\ psi\ [< 110\ psi\ \ ok]$$ X-DIR

$$= \frac{8591\ k}{(3.0 \times 345' \times 12'' \times 8'')} = 87\ psi\ [< 110\ psi\ \ ok]$$ Y-DIR

TTG TIER 1 - DEFLECTION COMPATIBILITY CHECK

sheet ____ of ____
by GG
job no. 215766
date 1/25/16

STRUCTURAL MECHANICAL ELECTRICAL AND CIVIL ENGINEERS

DEFLECTION COMPATIBILITY

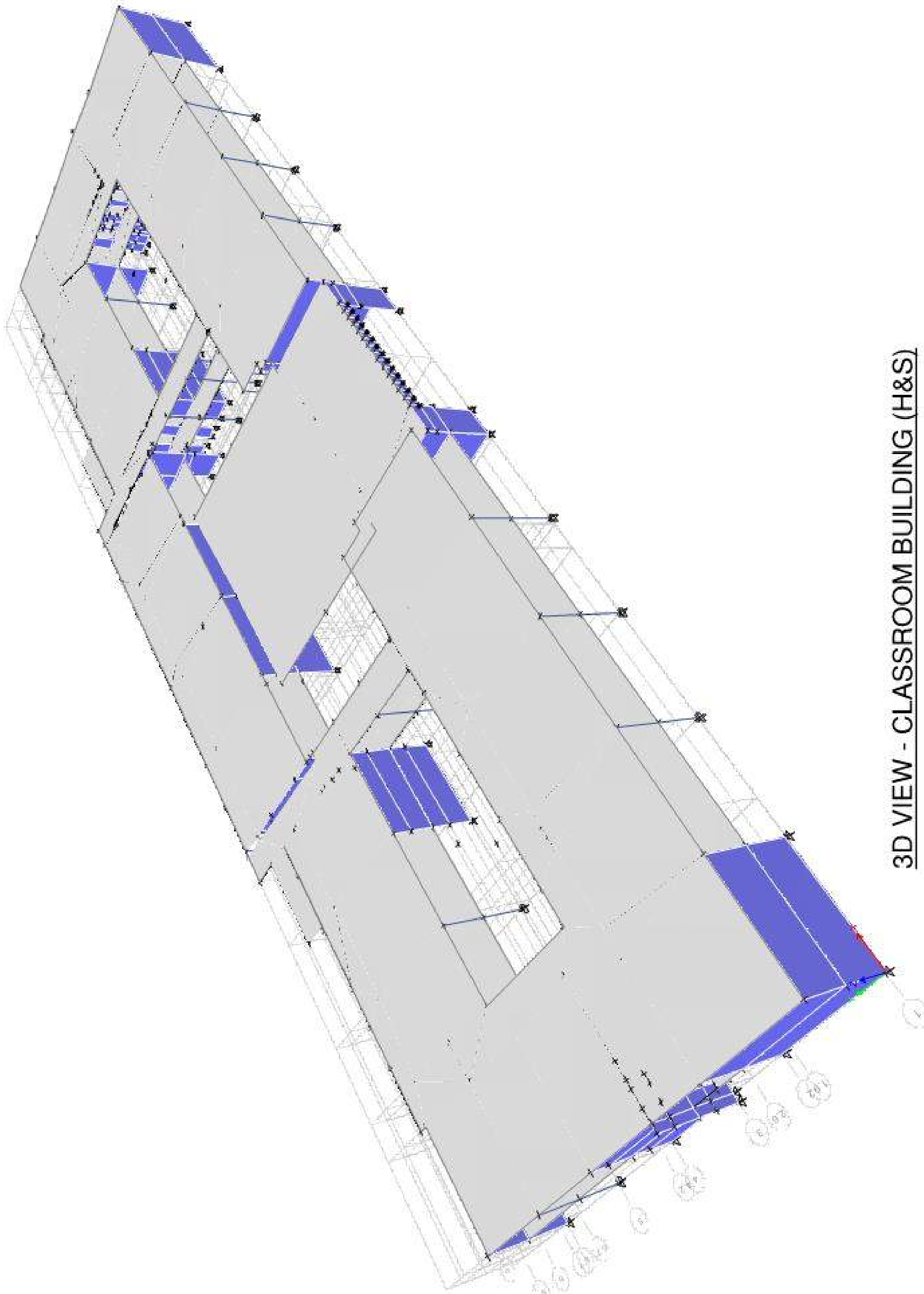
- ONLY COL. TO BE UNRESTRAINED ARE ALONG GRIDS E&I.
- $F_c' = 3\,ksi$ (PER GENERAL NOTES) → EXPECTED MULTIPLY BY 1.5
- $F_y = 40\,ksi$ (DEFAULT TABLE 4-3) → " " BY 1.25
- COL. 10" × 24" w/ (6) #7 VERT & #3 @ 4" (BOTTOM 3'-0")
  #3 @ 10" (REMAINDER)

- PER PCACOL OUTPUT. COL 32 & 43
- $M_n = \frac{139\,(k\text{-}ft)}{0.9} = 154\,(k\text{-}ft)$
- $V_u = \frac{154\,(k\text{-}ft) \times 2}{9.5'} = 32.4\,k$
- $V_n = \left[2 \times \frac{\sqrt{4500} \times 10" \times 20.9"}{1000}\right] + \left[0.2 \times \frac{40\,ksi \times 20.9"}{10"}\right]$

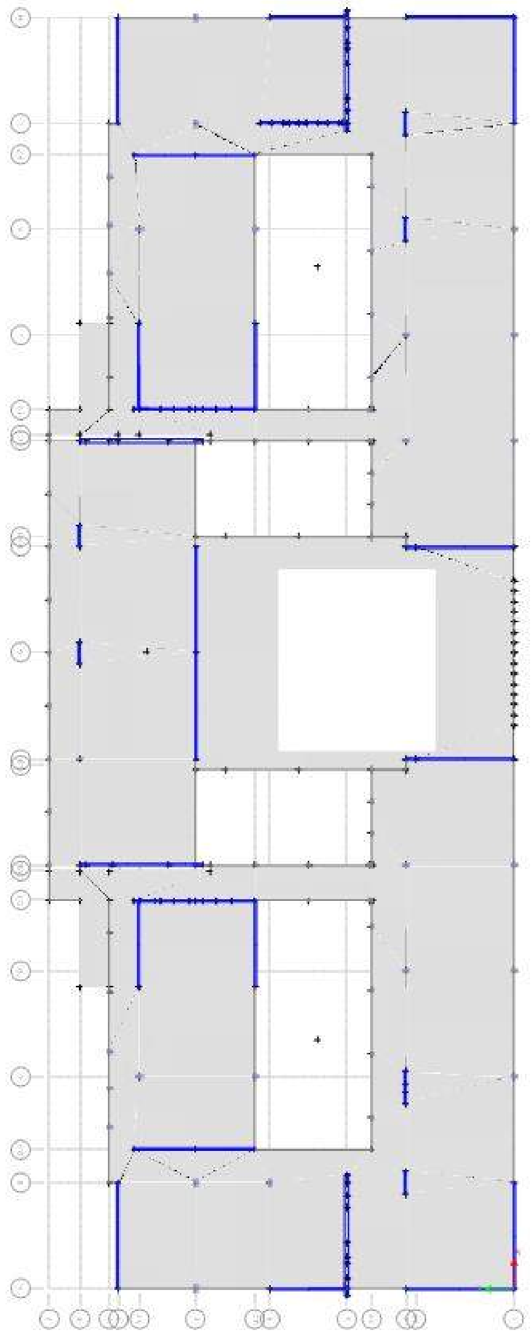
  $= (28 + 16.7)\,k$

  $= 44.7\,k > V_u$ OK

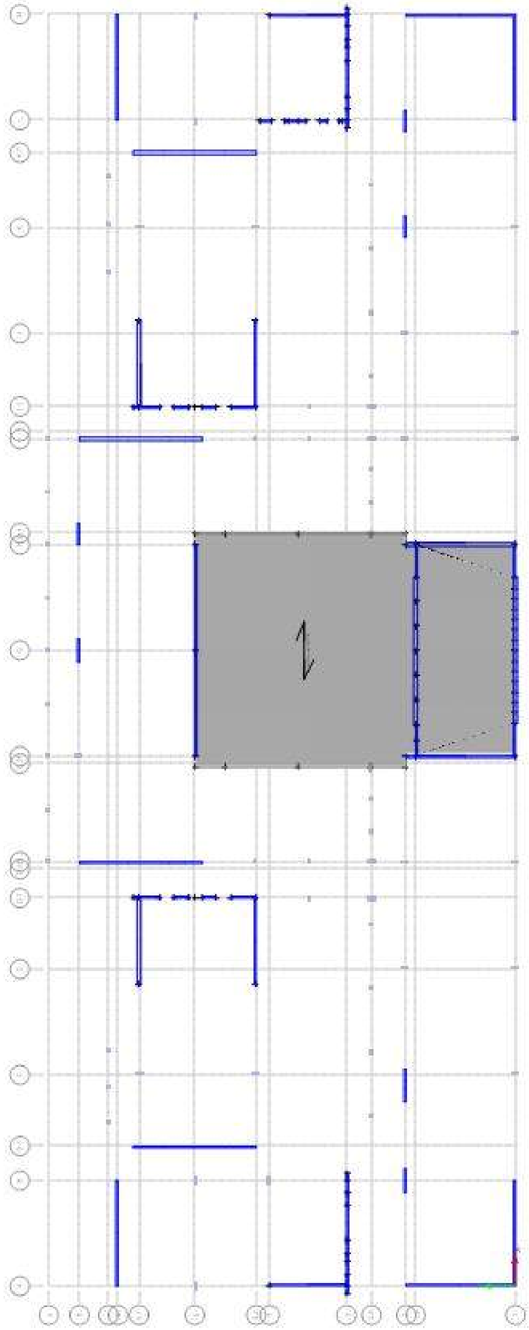
TTG



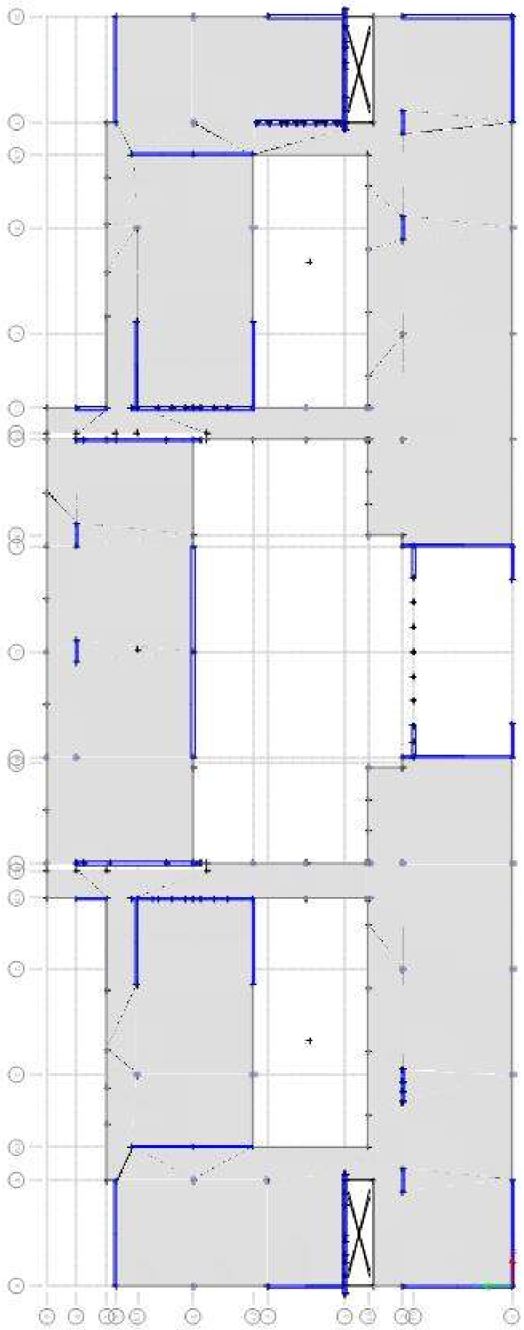
3D VIEW - CLASSROOM BUILDING (H&S)



HIGH ROOF PLAN



LOW ROOF PLAN



SECOND FLOOR PLAN

TTG

Palos Verdes H.S.
Buildings H&S
Job number: 0215.766
1/28/2016

Base Shear Calculation - ASCE 41-13 - Linear Static Procedure (LSP) & Linear Dynamic Procedure (LDP)

Seismic Parameters

Address: 27118 Silver Spur Rd, Rolling Hills Estates, CA 90274
Latitude: 33.77761 **Longitude:** -118.37467
Site Class: D
S_{XS} = **0.716 g** S_{X1} = **0.396 g** .... *(per USGS Map, BSE-1E)*

Characteristic Periods of the Response Spectrum

T_S = **0.553 sec** .... *(Eqn 2-9, ASCE 41-13)*
T_0 = **0.111 sec** .... *(Eqn 2-10, ASCE 41-13)*
T_L = **8.000 sec** .... *(Obtained from Fig 22-12, ASCE 7-10)*
B_1 = **1.002** Damping Ratio = **0.05** .... *(Eqn 2-11, ASCE 41-13)*

Static Base Shear Calculation for Linear Static Procedure (LSP)

h_n = **25.00 ft**
C_t = **0.020** β = **0.75** .... *(§7.4.1.2.2, ASCE 41-13, Concrete Shear Wall Systems)*
$T = C_t\, h_n^{\beta}$ = **0.224 sec** .... *(Eqn 7-18, ASCE 41-13)*

C_m = **1.000** .... *(Table 7-4, ASCE 41-13 --> 1-2 stories, Concrete Shear Wall)*
S_a = **0.714** .... *(Eqn 2-6 to 2-8, ASCE 41-13, BSE-1E)*

DCR_{max} = **3** .... *(§7.3.1.1, ASCE 41-13)*
$\mu_{strength}$ = **2.000** $= DCR_{max}/1.5\, C_m \geq 1.0$ .... *(Eqn C7-3, ASCE 41-13)*
a = **60** .... *(§7.4.1.3.1, ASCE 41-13; site class D)*
C_1 = **1.3333** $= 1 + (\mu_{strength} - 1) / aT^2$ .... *(Eqn 7-22, ASCE 41-13)*
C_2 = **1.0250** $= 1 + 1 / 800\, ((\mu_{strength} - 1) / T)^2$ .... *(Eqn 7-23, ASCE 41-13)*
$C_1.C_2$ = **1.3667** .... *(§7.4.2.3, ASCE 41-13)*

V_{STATIC} = **0.976 W** $= C_1\, C_2\, C_m\, S_a\, W$ .... *(Eqn 7-21, ASCE 41-13, BSE-1E)*

General Response Spectrum (§2.4.1.7) for Linear Dynamic Procedure (LDP)

$$
\begin{cases}
S_a = S_{XS}\,[(5/B_1 - 2)T/T_S + 0.4] & \text{for } 0 < T < T_0 \\
S_a = S_{XS} / B_1 & \text{for } T_0 < T < T_S \\
S_a = S_{X1} / (B_1 T) & \text{for } T_S < T < T_L \\
S_a = T_L S_{X1} / (B_1 T^2) & \text{for } T_L < T
\end{cases}
$$

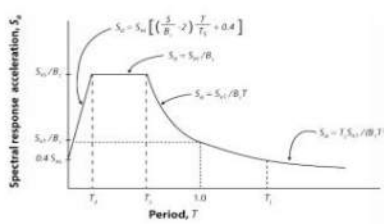
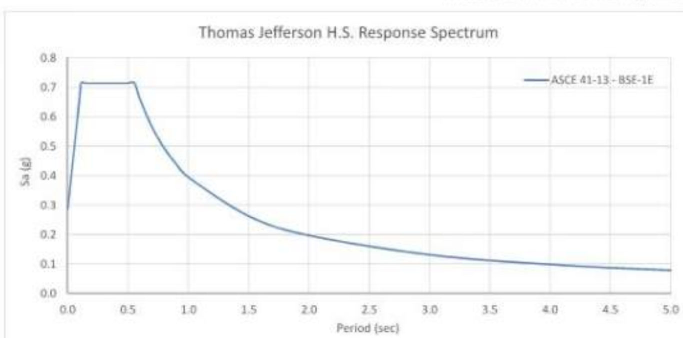


FIG. 2-1. General Horizontal Response Spectrum



TTG PVHS BLDG (H&S) TIER 2

sheet ____ of ____
by GC
job no. 215766
date 1/25/16

STRUCTURAL MECHANICAL ELECTRICAL AND CIVIL ENGINEERS

REDUNDANCY

PIERS 56 & 57 (EACH 6'-4" LONG) LOCATED ALONG GRID 9
[P56 AT GRID 9/G & P57 AT GRID 9/H]

$A_T = 30' \times [15.5' + 4.5'] = 600\,SF$

$P_{DL} = 600\,SF \times [90\,psf + 85\,psf] = 105\,k$

$P_{LL} = 600\,SF \times [40\,psf + 20\,psf] = 36\,k$

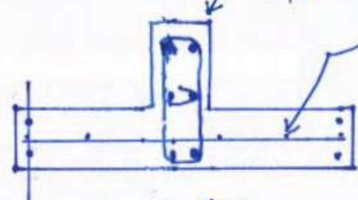
HIGH ROOF ↑ ↑ 2ND LEVEL

$Q_G = 1.1\,(Q_D + Q_L) = (1.1 \times 105\,k) + (1.1 \times 0.25 \times 36\,k) = 125.4\,k$

$Q_G = 0.9\,Q_D = 94.5\,k$

BSE-1E DEMAND FROM ETABS MODEL → P56 GOVERNS

DEMAND	P56	P57
M (k-ft)	501	473
V (k)	58	55
DETAIL	10/S9	1B/S9



- COLUMNS C46 & C45 BOTH ARE IDENTICAL w/ (6)#11 VERT. [10"x24"]
- SEE ATTACHED PCA COL. OUTPUT FOR FLEXURAL CAPACITY:

TTG

STRUCTURAL MECHANICAL ELECTRICAL AND CIVIL ENGINEERS

sheet ___ of ___
by GC
job no. 215766
date 1/25/16

FROM PCA COL OUTPUT.

$\phi M_n = 2025$ (K-FT) (PIER 57) $\rightarrow d = 76'' - 24'' = 52''$

$M_n = \frac{2025}{0.9} = 2250$ (K-FT)

$Q_{UD} = V_u = \frac{2250 \text{(K-FT)}}{12.5'} = 180K$

$Q_{CE} = V_n = A_{cv}(\alpha_c \sqrt{f'_c} + \rho_t f_y)$
$= 8'' \times 52'' (2\sqrt{4500} + [0.0021 \times 50000]) = 99\ k$

$\left(\frac{h_w}{l_w} = \frac{25'}{6.3'} = 4.0 \rightarrow \alpha_c = 2.0 \right)$

$V_n < V_u \rightarrow$ SHEAR CONTROLLED BEHAVIOR

M-FACTORS PER TABLE 10-22

$\frac{(A_s - A'_s) f_y + P}{t_w l_w f'_c} > 0.05 \rightarrow m = \frac{1.5+2}{2} = 1.75$ (DEMAND CRITICAL PERFORMANCE LEVEL)

$m K Q_{CE} > Q_{UD} \rightarrow \frac{Q_{UD}}{Q_{CE}} < [mK = 0.75 \times 1.75 = 1.31]$

$\frac{D}{C} = \frac{180}{99} = 1.82 > 1.31$ N.G.

PIERS 56 & 57 DO NOT MEET THE SHEAR CRITERIA FOR DEF. CONT. AND THEREFORE NEED TO BE RETROFITTED. SHOTCRETE WOULD BE BEST OPTION FOR THESE PIERS.

```
STRUCTUREPOINT - spColumn v4.80 (TM)                                                            Page   2
Licensed to: TTG. License ID: 63029-1044865-4-227F3-24DE6                                       01/25/16
\\Ontfs\ontengr$\40.Engr\4015_Projects\0215.766.00.0...\Palos Verdes H.S. - Pier 57 - Grid 9-H.col   04:14 PM

General Information:
====================
  File Name: \\Ontfs\ontengr$\40.Engr\4015_Projects\0215...\Palos Verdes H.S. - Pier 57 - Grid 9-H.col
  Project:  Palos Verdes H.S.
  Column:   C19                             Engineer: GC
  Code:     ACI 318-11                      Units: English

  Run Option: Investigation                 Slenderness: Not considered
  Run Axis:   X-axis                        Column Type: Structural

Material Properties:
====================
  f'c   = 4.5 ksi                           fy    = 50 ksi
  Ec    = 3823.68 ksi                       Es    = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.825

Section:
========
  Exterior Points
   No.    X (in)     Y (in)    No.    X (in)     Y (in)    No.    X (in)     Y (in)
  ----- ---------- ---------- ----- ---------- ---------- ----- ---------- ----------
     1       4.0       38.0      2       4.0        5.0      3      20.0        5.0
     4      20.0       -5.0      5       4.0       -5.0      6       4.0      -38.0
     7      -4.0      -38.0      8      -4.0       38.0

  Gross section area, Ag =  768 in^2
  Ix =  293984 in^4                         Iy =  24896 in^4
  rx =  19.5651 in                          ry =  5.69356 in
  Xo =  2.5 in                              Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  # 3     0.38        0.11     # 4     0.50        0.20     # 5     0.63        0.31
  # 6     0.75        0.44     # 7     0.88        0.60     # 8     1.00        0.79
  # 9     1.13        1.00     # 10    1.27        1.27     # 11    1.41        1.56
  # 14    1.69        2.25     # 18    2.26        4.00

  Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

  Pattern: Irregular
  Total steel area: As = 15.84 in^2 at rho = 2.06%
  Minimum clear spacing = 0.78 in

  Area in^2   X (in)   Y (in)  Area in^2   X (in)   Y (in)  Area in^2   X (in)   Y (in)
  --------- -------- -------- --------- -------- -------- --------- -------- --------
       1.27     -1.6     35.6      1.27      1.6     35.6      1.27     -1.6    -35.6
       1.27      1.6    -35.6      1.56     17.5     -2.5      1.56      8.0     -2.5
       1.56      8.0      2.5      1.56     -1.5      2.5      1.56     -1.5     -2.5
       1.56     17.5      2.5      0.20      0.0     12.0      0.20      0.0     24.0
       0.20      0.0     36.0      0.20      0.0    -12.0      0.20      0.0    -24.0
       0.20      0.0    -36.0      0.20      0.0      0.0

Factored Loads and Moments with Corresponding Capacities:
=========================================================
                  Pu          Mux      PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
 No.              kip         k-ft       k-ft                in       in
 --- ------------ ------------ -------- -------- -------- -------- -------- ------
   1        125.40         0.00   2024.61  999.999    23.96    74.00  0.00626  0.900
   2         94.50         0.00   1997.47  999.999    23.31    74.00  0.00653  0.900

*** End of output ***
```

$M_n = \dfrac{2025\ \text{kft}}{0.9} = 2250\ (\text{kft})$

$V_u = \dfrac{2250\ (\text{kFt})}{12.5'} = 180\ \text{k}$

```
STRUCTUREPOINT - spColumn v4.80 (TM)                                                          Page   2
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\\ontfs\ontengr$\40.Engr\4015_Projects\0215.766.00.0...\Palos Verdes H.S. - Pier 57 - Grid 9-H.col   03:39 PM

General Information:
====================
  File Name: \\Ontfs\ontengr$\40.Engr\4015_Projects\0215...\Palos Verdes H.S. - Pier 57 - Grid 9-H.col
  Project:  Palos Verdes H.S.
  Column:   C19                              Engineer: GC
  Code:     ACI 318-11                       Units: English

  Run Option: Investigation                  Slenderness: Not considered
  Run Axis:   X-axis                         Column Type: Structural

Material Properties:
====================
  f'c   = 4.5 ksi                            fy   = 50 ksi
  Ec    = 3823.68 ksi                        Es   = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.825

Section:
========
  Exterior Points
   No.     X (in)     Y (in)    No.     X (in)     Y (in)    No.     X (in)     Y (in)
  ----- ---------- ---------- ----- ---------- ---------- ----- ---------- ----------
     1        4.0       38.0     2        4.0        5.0     3       20.0        5.0
     4       20.0       -5.0     5        4.0       -5.0     6        4.0      -38.0
     7       -4.0      -38.0     8       -4.0       38.0

  Gross section area, Ag =  768 in^2
  Ix =  293984 in^4                          Iy =  24896 in^4
  rx =  19.5651 in                           ry =  5.69356 in
  Xo =  2.5 in                               Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  #  3     0.38         0.11   #  4     0.50         0.20   #  5     0.63         0.31
  #  6     0.75         0.44   #  7     0.88         0.60   #  8     1.00         0.79
  #  9     1.13         1.00   # 10     1.27         1.27   # 11     1.41         1.56
  # 14     1.69         2.25   # 18     2.26         4.00

  Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

  Pattern: Irregular
  Total steel area: As = 13.92 in^2 at rho = 1.81%
  Minimum clear spacing = 0.91 in

  Area in^2   X (in)   Y (in)  Area in^2   X (in)   Y (in)  Area in^2   X (in)   Y (in)
  --------- -------- --------  --------- -------- --------  --------- -------- --------
       0.79     -1.6     35.6       0.79      1.6     35.6       0.79     -1.6    -35.6
       0.79      1.6    -35.6       1.56     17.5     -2.5       1.56      8.0     -2.5
       1.56      8.0      2.5       1.56     -1.5      2.5       1.56     -1.5     -2.5
       1.56     17.5      2.5       0.20      0.0     12.0       0.20      0.0     24.0
       0.20      0.0     36.0       0.20      0.0    -12.0       0.20      0.0    -24.0
       0.20      0.0    -36.0       0.20      0.0      0.0

Factored Loads and Moments with Corresponding Capacities:
=========================================================
                 Pu          Mux      PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
  No.           kip         k-ft        k-ft                in       in
  --- ------------ ------------ ------------ -------- -------- -------- -------- ------
    1       125.40         0.00      1775.02  999.999    23.89    74.00  0.00629  0.900
    2        94.50         0.00      1747.87  999.999    23.24    74.00  0.00655  0.900

  *** End of output ***
```

PIER 57 GOVERNS

TTG

STRUCTURAL MECHANICAL ELECTRICAL AND CIVIL ENGINEERS

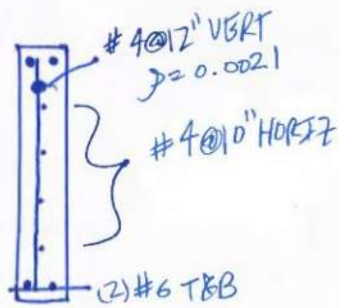
sheet ____ of ____
by GC
job no. 215766
date 1/25/16

COUPLING BEAMS

CHECK TYP. COUPLING BEAM ALONG GRID I.3.

2ND LEVEL [8"W × 5'-6" D × 4'-0" LONG] #4 @ 10" HORIZ → (2) #6 T&B (TRIM BARS)
#4 @ 12" VERT

$F_c' = 1.5 F_c'$ } DEF. CONT.
$F_y = 1.25 F_y$



$M_n = \frac{348 (K\text{-}FT)}{0.9} = 387\ K$

$Q_{UD} = V_u = \frac{2 \times 387}{4'} (K\text{-}FT) = 193\ k$

$Q_{CE} = V_n = 8" \times 62.8" \left[\left(2 \times \sqrt{4500} \right) + \left(0.0021 \times 50000 psi \right) \right] = 120\ k$

SHEAR CONTROLLED

ETABS MODEL DEMAND $M = 613\ k(FT)$ MOMENT

MFACTOR = 1.2 (NON-CONFORMING REINF.)

$\frac{D}{C} = \frac{193}{120} = 1.6 < \left[(0.75 \times 1.2) = 0.9 \right]$ N.G.

(COUPLING BEAMS WILL BE IGNORED AND THE PIERS CHECKED WITH REVISED DEMAND.)

- REVISED DEMAND TO DE-COUPLED PIERS IS LOW DUE TO THE PRESENCE OF MULTIPLE SOLID/STIFF S.W. IN THE SAME DIRECTION. THEREFORE THE COUPLING BEAM DEFICIENCY IS MITIGATED FOR GRIDS I.3 & D.7.

```
STRUCTUREPOINT - spColumn v4.80 (TM)                                                                     Page   2
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\\Ontfs\ontengr$\40.Engr\4015_Projec...\Palos Verdes H.S. - Coupling Beam Grid I.3 - 2nd Level.col      04:11 PM


General Information:
====================
  File Name: \\Ontfs\ontengr$\40.Engr\40...\Palos Verdes H.S. - Coupling Beam Grid I.3 - 2nd Level.col
  Project:  PVHS - Coup. Beam 2nd Level
  Column:   Grid I.3                          Engineer: GC
  Code:     ACI 318-11                        Units: English

  Run Option: Investigation                   Slenderness: Not considered
  Run Axis:   X-axis                          Column Type: Structural

Material Properties:
====================
  f'c    = 4.5 ksi                            fy    = 50 ksi
  Ec     = 3823.68 ksi                        Es    = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.825

Section:
========
  Rectangular: Width = 8 in                   Depth = 66 in

  Gross section area, Ag =  528 in^2
  Ix =  191664 in^4                           Iy =  2816 in^4
  rx =  19.0526 in                            ry =  2.3094 in
  Xo =  0 in                                  Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  #  3     0.38         0.11   #  4     0.50         0.20   #  5     0.63         0.31
  #  6     0.75         0.44   #  7     0.88         0.60   #  8     1.00         0.79
  #  9     1.13         1.00   # 10     1.27         1.27   # 11     1.41         1.56
  # 14     1.69         2.25   # 18     2.26         4.00

  Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

  Pattern: Irregular
  Total steel area: As = 2.96 in^2 at rho = 0.56% (Note: rho < 1.0%)
  Minimum clear spacing = 5.22 in

  Area in^2  X (in)   Y (in)  Area in^2  X (in)   Y (in)  Area in^2  X (in)   Y (in)
  --------- -------- -------- --------- -------- -------- --------- -------- --------
       0.20     0.0      5.0       0.20     0.0     15.0       0.20     0.0     25.0
       0.20     0.0     -5.0       0.20     0.0    -15.0       0.20     0.0    -25.0
       0.88     0.0    -31.0       0.88     0.0     31.0

Factored Loads and Moments with Corresponding Capacities:
=========================================================
                 Pu          Mux       PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
  No.           kip         k-ft         k-ft                in       in
  --- ------------ ------------ ------------ -------- -------- -------- -------- ------
    1         0.00       613.00       348.29    0.568     3.15    64.00  0.05800  0.900 #

  # Section capacity exceeded. Revise design!

  *** End of output ***
```

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STRUCTURAL MECHANICAL ELECTRICAL AND CIVIL ENGINEERS

sheet ___ of ___
by GC
job no. 215766
date 1/26/16

COUPLING BEAM AT GRID L (ROOF LEVEL)
SAME AS GRID I.3 (2ND LEVEL) W/ (2)#6 BOTTOM ONLY.

$$M_n = \frac{323(\text{k-ft})}{0.9} = 359(\text{k-ft})$$

$$Q_{UD} = V_u = \frac{359 \times 2}{3.3'} = 217\text{ k}$$

$$V_n = 120\text{k}$$

$$\frac{D}{C} = \frac{217}{120} = 1.8 < [(0.75 \times 1.2) = 0.9] \quad \text{N.G.}$$

(COUPLING BEAMS WILL BE IGNORED AND THE PIERS CHECKED WITH REVISED DEMAND.)

- REVISED DEMAND TO DE-COUPLED PIERS IS VERY LOW, DUE TO THE PRESENCE OF MULTIPLE SOLID/STIFF S.W. IN THE SAME DIRECTION. THEREFORE THE COUPLING BEAM DEFICIENCY IS MITIGATED FOR GRID L.

```
STRUCTUREPOINT - spColumn v4.80 (TM)                                                      Page   2
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\\Ontfs\ontengr$\40.Engr\4015_Project...\Palos Verdes H.S. - Coupling Beam Grid L - Roof Level.col     04:52 PM

General Information:
====================
  File Name: \\Ontfs\ontengr$\40.Engr\401...\Palos Verdes H.S. - Coupling Beam Grid L - Roof Level.col
  Project:  PVHS - Coup. Beam 2nd Level
  Column:   Grid L                            Engineer: GC
  Code:     ACI 318-11                        Units: English

  Run Option: Investigation                   Slenderness: Not considered
  Run Axis:   X-axis                          Column Type: Structural

Material Properties:
====================
  f'c    = 4.5 ksi                            fy    = 50 ksi
  Ec     = 3823.68 ksi                        Es    = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.825

Section:
========
  Rectangular: Width = 8 in                   Depth = 66 in

  Gross section area, Ag =  528 in^2
  Ix =  191664 in^4                           Iy =  2816 in^4
  rx =  19.0526 in                            ry =  2.3094 in
  Xo =  0 in                                  Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)  Size Diam (in) Area (in^2)  Size Diam (in) Area (in^2)
  ---- --------- -----------  ---- --------- -----------  ---- --------- -----------
  #  3    0.38        0.11    #  4    0.50        0.20    #  5    0.63        0.31
  #  6    0.75        0.44    #  7    0.88        0.60    #  8    1.00        0.79
  #  9    1.13        1.00    # 10    1.27        1.27    # 11    1.41        1.56
  # 14    1.69        2.25    # 18    2.26        4.00

  Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

  Pattern: Irregular
  Total steel area: As = 2.08 in^2 at rho = 0.39% (Note: rho < 0.50%)
  Minimum clear spacing = 9.22 in

  Area in^2   X (in)   Y (in)  Area in^2   X (in)   Y (in)  Area in^2   X (in)   Y (in)
  --------- -------- -------- --------- -------- -------- --------- -------- --------
       0.20      0.0      0.0      0.20      0.0     10.0      0.20      0.0     20.0
       0.20      0.0     30.0      0.20      0.0    -10.0      0.20      0.0    -20.0
       0.88      0.0    -30.0

Factored Loads and Moments with Corresponding Capacities:
=========================================================
              Pu          Mux        PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
  No.        kip         k-ft          k-ft                in       in
  --- ------------ ------------ ------------ -------- -------- -------- --------- ------
    1         1.00       -78.00      -323.33    4.145     3.67    63.00  0.04847  0.900

  *** End of output ***
```

TTG

STRUCTURAL MECHANICAL ELECTRICAL AND CIVIL ENGINEERS

sheet ______ of ______
by GL
job no. 215766
date 1/25/16

CHECK PIER P12 (9.5'x10") (w/ #5@12" HORIZ. / #4@12" VERT.) TYP. DIST. REINF.

$Q_G = 77.3k \; [1.1(Q_D+Q_L)]$
$= 64.1k \; [0.9 Q_D]$ (GRID I)

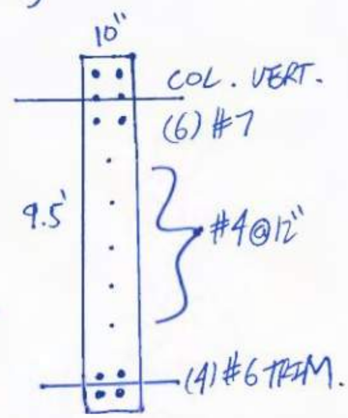
$M_n = \frac{2005}{0.9} = 2229 (kft)$

$Q_{UD} = V_u = \frac{2229 \times 2}{9.5'} = 469\,k$

$Q_{CE} = V_n = 287\,k$ (SHEAR CONT.)

$\left[\frac{(A_s - A_s')F_y + P}{t_w l_w f_c'} = 0.049 < 0.05 \right] \rightarrow m = 2.25$

$\frac{D}{C} = \frac{469}{287} = 1.63 < (mk = 1.69)$ OK



FLEXURE $M = 4351 (kFt)$ FROM ETABS ANALYSIS $\rightarrow Q_{UD}$

$M_n = \frac{2005}{0.9}(kft) = 2229 (kft) \longrightarrow Q_{CE}$

$\frac{D}{C} = \frac{4351}{2229} = 1.95 > (km = 1.56)$ N.G.

```
STRUCTUREPOINT - spColumn v4.80 (TM)                                                        Page    2
Licensed to: TTG. License ID: 63029-1044865-4-227F3-24DE6                                   01/27/16
\\Ontfs\ontengr$\40.Engr\4015_Projects\0215.766.00.040...\Palos Verdes H.S. - Grid I - Pier 12.col      06:27 AM

General Information:
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  Project:   PVHS - Coup. Beam 2nd Level
  Column:    Grid I.3                            Engineer: GC
  Code:      ACI 318-11                          Units: English

  Run Option: Investigation                      Slenderness: Not considered
  Run Axis:   X-axis                             Column Type: Structural

Material Properties:
====================
  f'c    = 4.5 ksi                               fy    = 50 ksi
  Ec     = 3823.68 ksi                           Es    = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.825

Section:
========
  Rectangular: Width = 10 in                     Depth = 114 in

  Gross section area, Ag =  1140 in^2
  Ix =  1.23462e+006 in^4                        Iy =  9500 in^4
  rx =  32.909 in                                ry =  2.88675 in
  Xo =  0 in                                     Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  # 3     0.38        0.11     # 4     0.50        0.20     # 5     0.63        0.31
  # 6     0.75        0.44     # 7     0.88        0.60     # 8     1.00        0.79
  # 9     1.13        1.00     # 10    1.27        1.27     # 11    1.41        1.56
  # 14    1.69        2.25     # 18    2.26        4.00

  Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

  Pattern: Irregular
  Total steel area: As = 6.96 in^2 at rho = 0.61% (Note: rho < 1.0%)
  Minimum clear spacing = 10.65 in

  Area in^2   X (in)    Y (in)   Area in^2   X (in)    Y (in)   Area in^2   X (in)    Y (in)
  --------- -------- ---------   --------- -------- --------   --------- -------- ---------
       0.20      0.0       0.0        0.20      0.0     12.0        0.20      0.0      24.0
       0.20      0.0      36.0        3.80      0.0     48.0        0.20      0.0     -12.0
       0.20      0.0     -24.0        0.20      0.0    -36.0        1.76      0.0     -52.0

Factored Loads and Moments with Corresponding Capacities:
=========================================================
                Pu          Mux        PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
  No.          kip         k-ft          k-ft               in       in
  --- ------------ ------------ ------------ -------- -------- -------- -------- ------
    1        77.30         0.00      2060.36  999.999     9.01   109.00  0.03195  0.900
    2        64.10         0.00      2005.06  999.999     8.66   109.00  0.03338  0.900

  *** End of output ***
```

```
STRUCTUREPOINT - spColumn v4.80 (TM)                                                              Page   2
Licensed to: TTG. License ID: 63029-1044865-4-227F3-24DE6                                         01/27/16
\\Ontfs\ontengr$\40.Engr\4015_Projects\0215....\Palos Verdes H.S. - Grid I - Pier 12 - Flexure.col 06:10 PM

General Information:
====================
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  Project:  PVHS - Coup. Beam 2nd Level
  Column:   Grid I.3                          Engineer: GC
  Code:     ACI 318-11                        Units: English

  Run Option: Investigation                   Slenderness: Not considered
  Run Axis:   X-axis                          Column Type: Structural

Material Properties:
====================
  f'c   = 4.5 ksi                             fy   = 50 ksi
  Ec    = 3823.68 ksi                         Es   = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.825

Section:
========
  Rectangular: Width = 10 in                  Depth = 114 in

  Gross section area, Ag =  1140 in^2
  Ix =  1.23462e+006 in^4                     Iy =  9500 in^4
  rx =  32.909 in                             ry =  2.88675 in
  Xo =  0 in                                  Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  # 3      0.38        0.11   # 4      0.50        0.20   # 5      0.63        0.31
  # 6      0.75        0.44   # 7      0.88        0.60   # 8      1.00        0.79
  # 9      1.13        1.00   # 10     1.27        1.27   # 11     1.41        1.56
  # 14     1.69        2.25   # 18     2.26        4.00

  Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

  Pattern: Irregular
  Total steel area: As = 6.96 in^2 at rho = 0.61% (Note: rho < 1.0%)
  Minimum clear spacing = 10.65 in

  Area in^2   X (in)   Y (in)  Area in^2   X (in)   Y (in)  Area in^2   X (in)   Y (in)
  --------- -------- --------  --------- -------- --------  --------- -------- --------
       0.20      0.0      0.0       0.20      0.0     12.0       0.20      0.0     24.0
       0.20      0.0     36.0       3.80      0.0     48.0       0.20      0.0    -12.0
       0.20      0.0    -24.0       0.20      0.0    -36.0       1.76      0.0    -52.0

Factored Loads and Moments with Corresponding Capacities:
=========================================================
               Pu           Mux        PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
  No.         kip          k-ft          k-ft                in       in
  --- ------------ ------------ ------------ -------- -------- -------- -------- ------
    1        77.30      4351.00      2060.36    0.474     9.01   109.00  0.03195  0.900 #
    2        64.10      4351.00      2005.06    0.461     8.66   109.00  0.03338  0.900 #

  # Section capacity exceeded. Revise design!

  *** End of output ***
```

TTG

STRUCTURAL MECHANICAL ELECTRICAL AND CIVIL ENGINEERS

sheet ____ of ____
by GK
job no. 215766
date 1/25/16

SHEARWALLS ALONG GRIDS E & I

CHECK 2'-0"x10" PIER P9A → GRID E (GOVERNS)

C31 COLUMN TYPE PER SCHEDULE → (6)#7 VERT.

$A_T = 370$ sf → $Q_G = 77.3$ k $[1.1(Q_D+Q_L)]$
$= 64.1$ k $[0.9 Q_D]$

$M_n = \frac{197 (kFt)}{0.9} = 219$ kFt (SEE ATTACHED PCA COLUMN OUTPUT)

$Q_{UD} = V_u = \frac{219 (kFt) \times 2}{9.5'} = 46$ k

$Q_{CE} = V_n = 65.4$ k

SECTION IS CONTROLLED BY FLEXURE. (TABLE 10-21 - m FACTOR)

$\left[\frac{V}{t_w l_w \sqrt{f_c'}} = 2.9\right]$ & $\left[\frac{(A_s - A_s')f_y + P}{t_w l_w f_c'}\right] = 0.18$

INTERPOLATING $\left(m = \frac{1.375 + 1.75}{2} = 1.56\right)$

$\frac{D}{C} = \frac{46}{65.4} = 0.70 < [km = 0.75 \times 1.56 = 1.17]$ ok

FLEXURE $M = 641$ (kFt) FROM ETABS ANALYSIS → Q_{UD}
$M_n = \frac{187 (kFt)}{0.9} = 208$ (kFt) FROM PCA COL. OUTPUT → Q_{CE}

$\frac{D}{C} = \frac{641}{208} = 3.1 > [1.56]$ N.G.

SUMMARY: BOTH WALL SEGMENTS ALONG GRIDS E & I ARE NON-COMPLIANT FOR FLEXURE. RETROFIT METHOD WILL BE RECCOMENDED IN REPORT.

```
STRUCTUREPOINT - spColumn v4.80 (TM)                                                            Page    2
Licensed to: TTG. License ID: 63029-1044865-4-227F3-24DE6                                      01/27/16
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General Information:
====================
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  Project:  Palos Verdes H.S.
  Column:   C31                          Engineer: GC
  Code:     ACI 318-11                   Units: English

  Run Option: Investigation              Slenderness: Not considered
  Run Axis:   X-axis                     Column Type: Structural

Material Properties:
====================
  f'c    = 4.5 ksi                       fy    = 50 ksi
  Ec     = 3823.68 ksi                   Es    = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.825

Section:
========
  Rectangular: Width = 10 in             Depth = 24 in

  Gross section area, Ag =  240 in^2
  Ix =  11520 in^4                       Iy =  2000 in^4
  rx =  6.9282 in                        ry =  2.88675 in
  Xo =  0 in                             Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  # 3     0.38         0.11    # 4     0.50         0.20    # 5     0.63         0.31
  # 6     0.75         0.44    # 7     0.88         0.60    # 8     1.00         0.79
  # 9     1.13         1.00    # 10    1.27         1.27    # 11    1.41         1.56
  # 14    1.69         2.25    # 18    2.26         4.00

  Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 0.8,   phi(b) = 0.9,   phi(c) = 0.65

  Layout: Rectangular
  Pattern: Sides Different  (Cover to longitudinal reinforcement)
  Total steel area: As = 3.60 in^2 at rho = 1.50%
  Minimum clear spacing = 4.50 in

                    Top       Bottom        Left        Right
                 --------    --------    --------    --------
    Bars          2  # 7      2  # 7      1  # 7      1  # 7
    Cover(in)      1.875       1.875       1.875       1.875

Factored Loads and Moments with Corresponding Capacities:
=========================================================
              Pu          Mux        PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
  No.        kip         k-ft          k-ft               in       in
  --- ------------ ------------ ------------ -------- -------- -------- -------- ------
    1        77.30         0.00       196.50  999.999     4.92    21.69  0.01023  0.900
    2        64.10         0.00       187.18  999.999     4.57    21.69  0.01123  0.900

  *** End of output ***
```

```
STRUCTUREPOINT - spColumn v4.80 (TM)                                                    Page   2
Licensed to: TTG. License ID: 63029-1044865-4-227F3-24DE6                              01/27/16
\\Ontfs\ontengr$\40.Engr\4015_Projects...\Palos Verdes H.S. - C31 - Grid E - Pier 9A - Flexure.col    06:11 PM

General Information:
====================
  File Name: \\Ontfs\ontengr$\40.Engr\4015...\Palos Verdes H.S. - C31 - Grid E - Pier 9A - Flexure.col
  Project:  Palos Verdes H.S.
  Column:   C31                              Engineer: GC
  Code:     ACI 318-11                       Units: English

  Run Option: Investigation                  Slenderness: Not considered
  Run Axis:   X-axis                         Column Type: Structural

Material Properties:
====================
  f'c    = 4.5 ksi                           fy    = 50 ksi
  Ec     = 3823.68 ksi                       Es    = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.825

Section:
========
  Rectangular: Width = 10 in                 Depth = 24 in

  Gross section area, Ag =  240 in^2
  Ix =  11520 in^4                           Iy =  2000 in^4
  rx =  6.9282 in                            ry =  2.88675 in
  Xo =  0 in                                 Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  #  3      0.38        0.11   #  4      0.50        0.20   #  5      0.63        0.31
  #  6      0.75        0.44   #  7      0.88        0.60   #  8      1.00        0.79
  #  9      1.13        1.00   # 10      1.27        1.27   # 11      1.41        1.56
  # 14      1.69        2.25   # 18      2.26        4.00

  Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
  phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

  Layout: Rectangular
  Pattern: Sides Different  (Cover to longitudinal reinforcement)
  Total steel area: As = 3.60 in^2 at rho = 1.50%
  Minimum clear spacing = 4.50 in

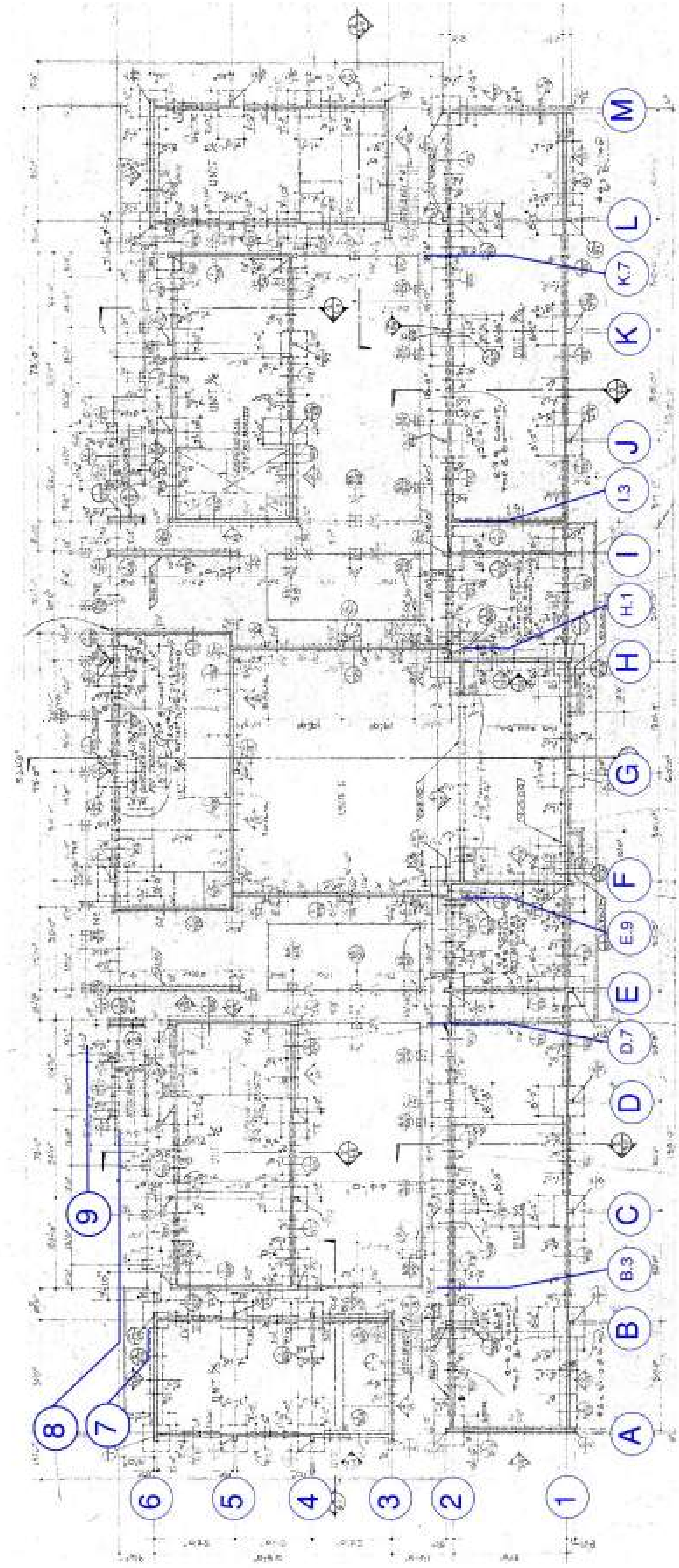
                     Top         Bottom        Left        Right
                  --------     --------     --------     --------
    Bars           2  # 7       2  # 7       1  # 7       1  # 7
    Cover(in)       1.875        1.875        1.875        1.875

Factored Loads and Moments with Corresponding Capacities:
=========================================================
                Pu          Mux        PhiMnx PhiMn/Mu NA depth Dt depth    eps_t    Phi
  No.          kip         k-ft         k-ft                 in       in
  --- ------------ ------------ ------------ -------- -------- -------- --------- ------
    1        77.30       647.00       196.50    0.304     4.92    21.69  0.01023  0.900 #
    2        64.10       647.00       187.18    0.289     4.57    21.69  0.01123  0.900 #

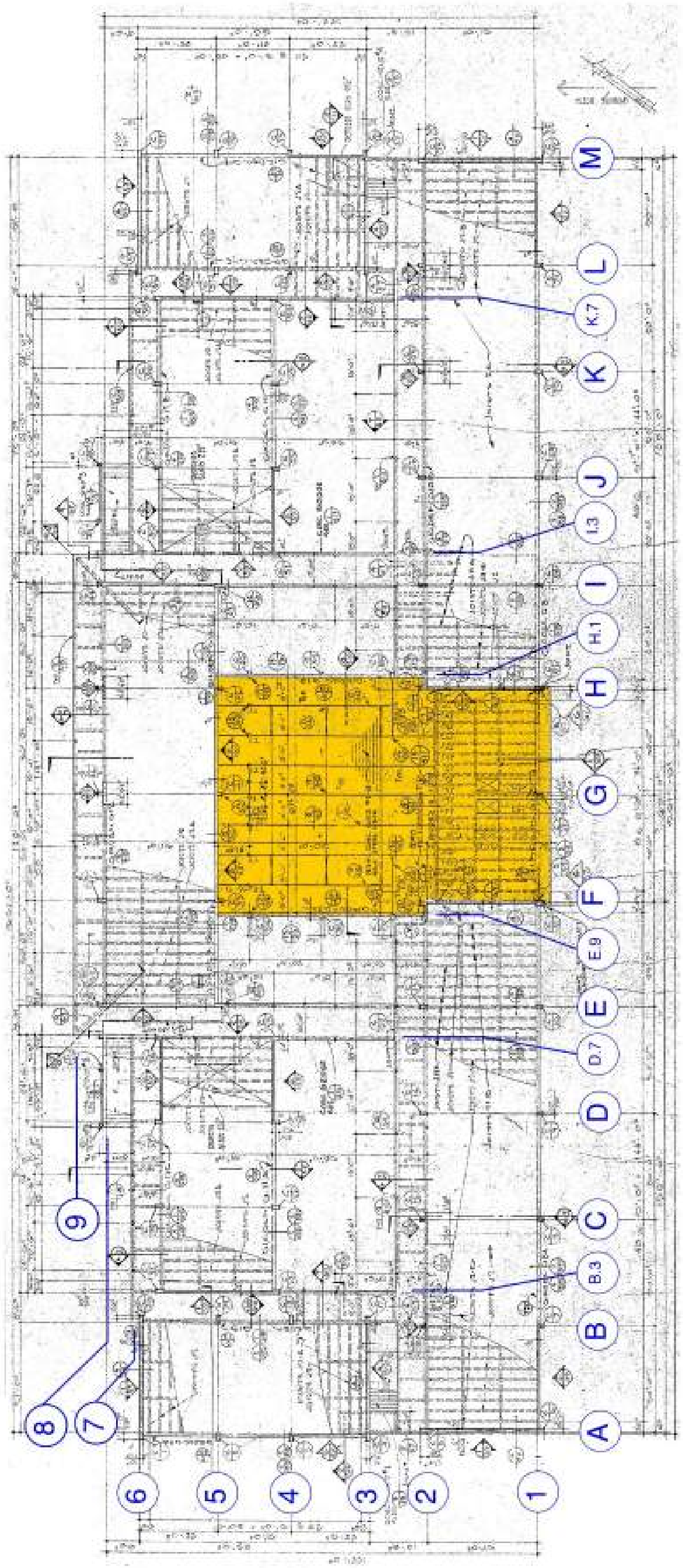
  # Section capacity exceeded. Revise design!

  *** End of output ***
```

Appendix 1-C: As-Built Plans

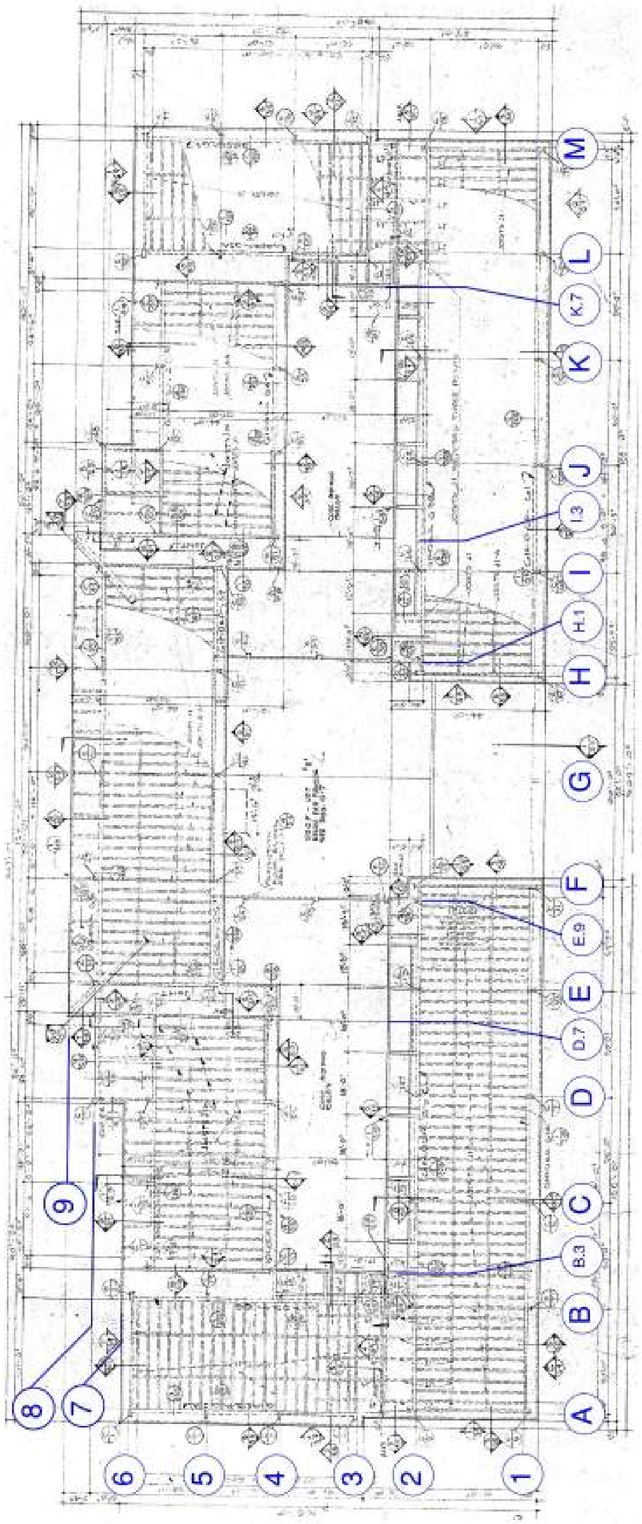


PLAN - FOUNDATION LEVEL



PLAN - SECOND LEVEL AND LOW ROOF (COMBINED)

NOTE: THE LOW ROOF IS SHOWN HIGHLIGHTED IN YELLOW.



PLAN - HIGH ROOF

Appendix 7A – Images of Existing Conditions

Fig 1. pier wall along grid 8

Fig 2. Lower steel roof at grid F

Fig 3. Ceiling in area below steel roof at grid F

Fig 4. Walls along grid E & D.7 at 2nd floor

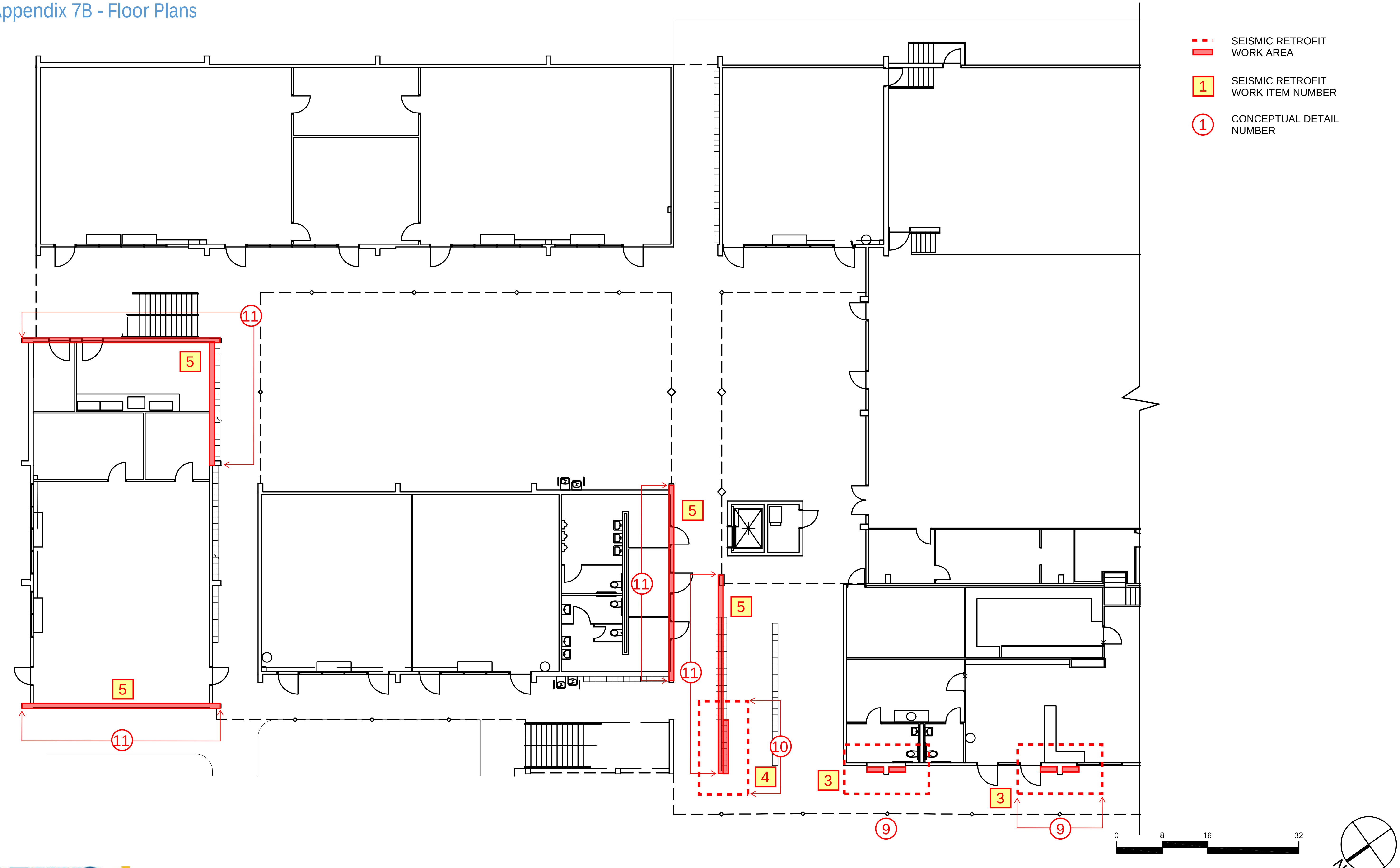
Fig 5. Wall/coupling beam along grid line E 1st floor

Fig 6. Typical above ceiling near coupling

Fig 7. Typical courtyard

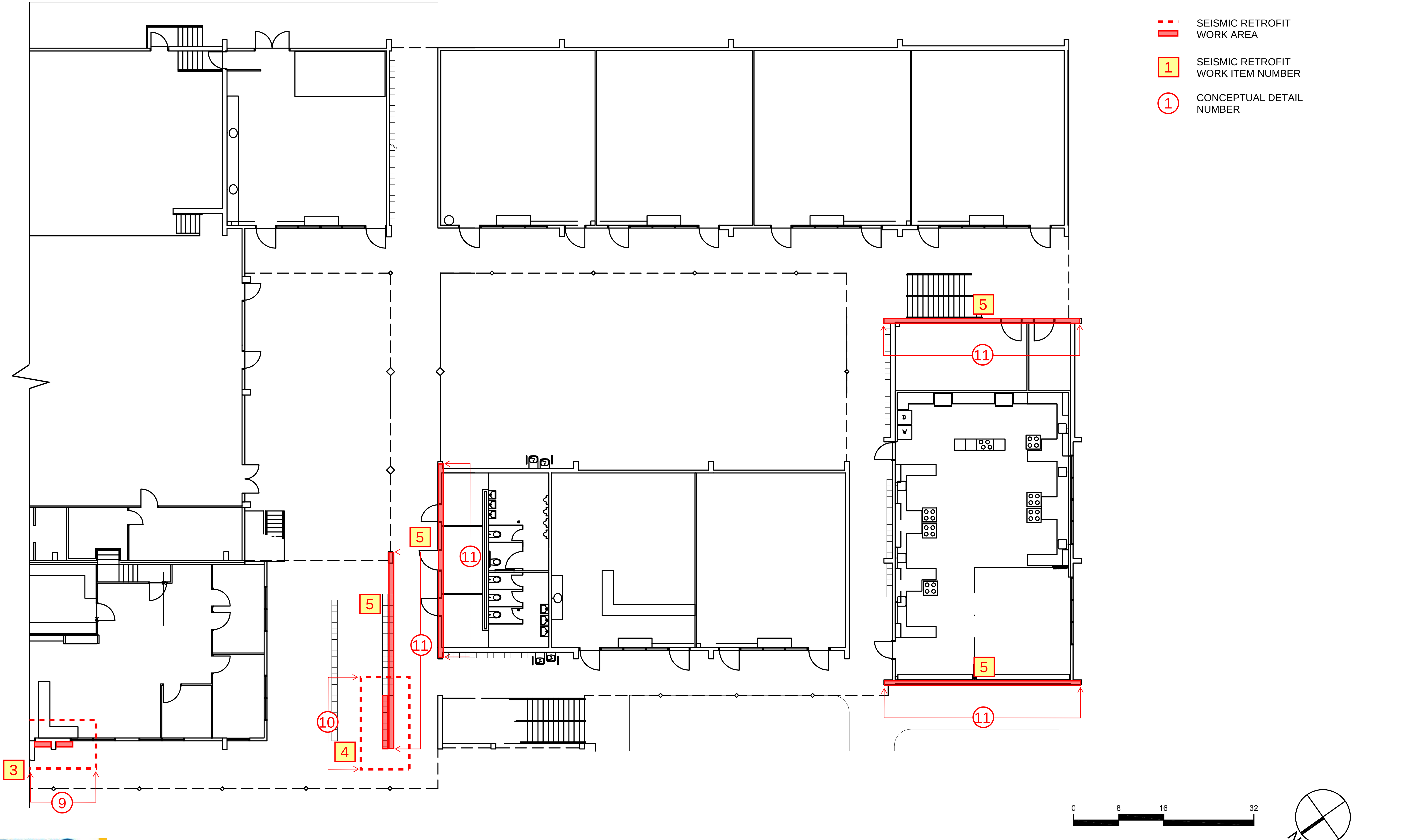
Fig 8. Cracked concrete at guard rail

Fig 9. Existing recent spawled concrete repair



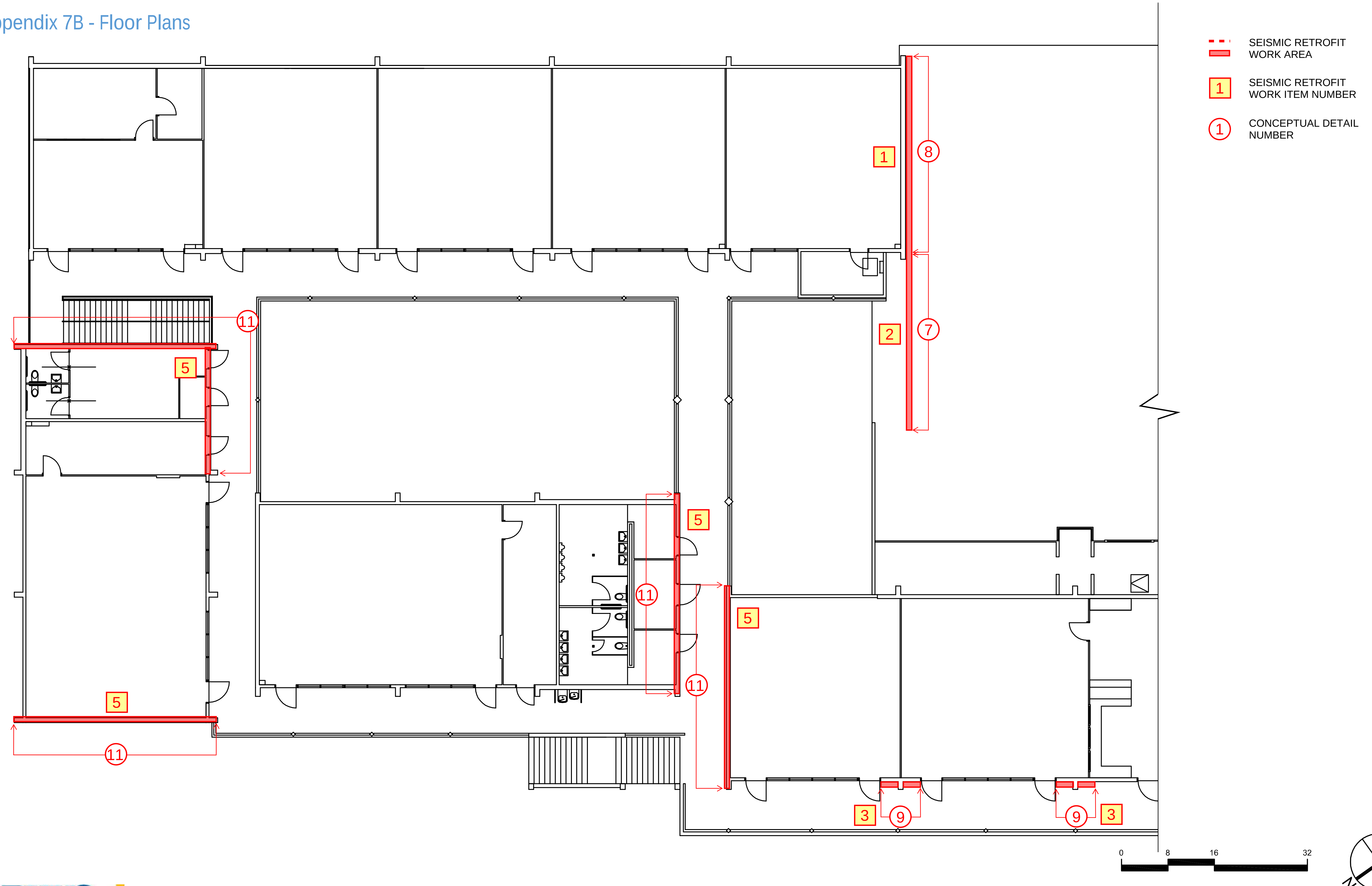
PBWS

PENINSULA HS - BUILDING H
1ST FLOOR SEGMENT A



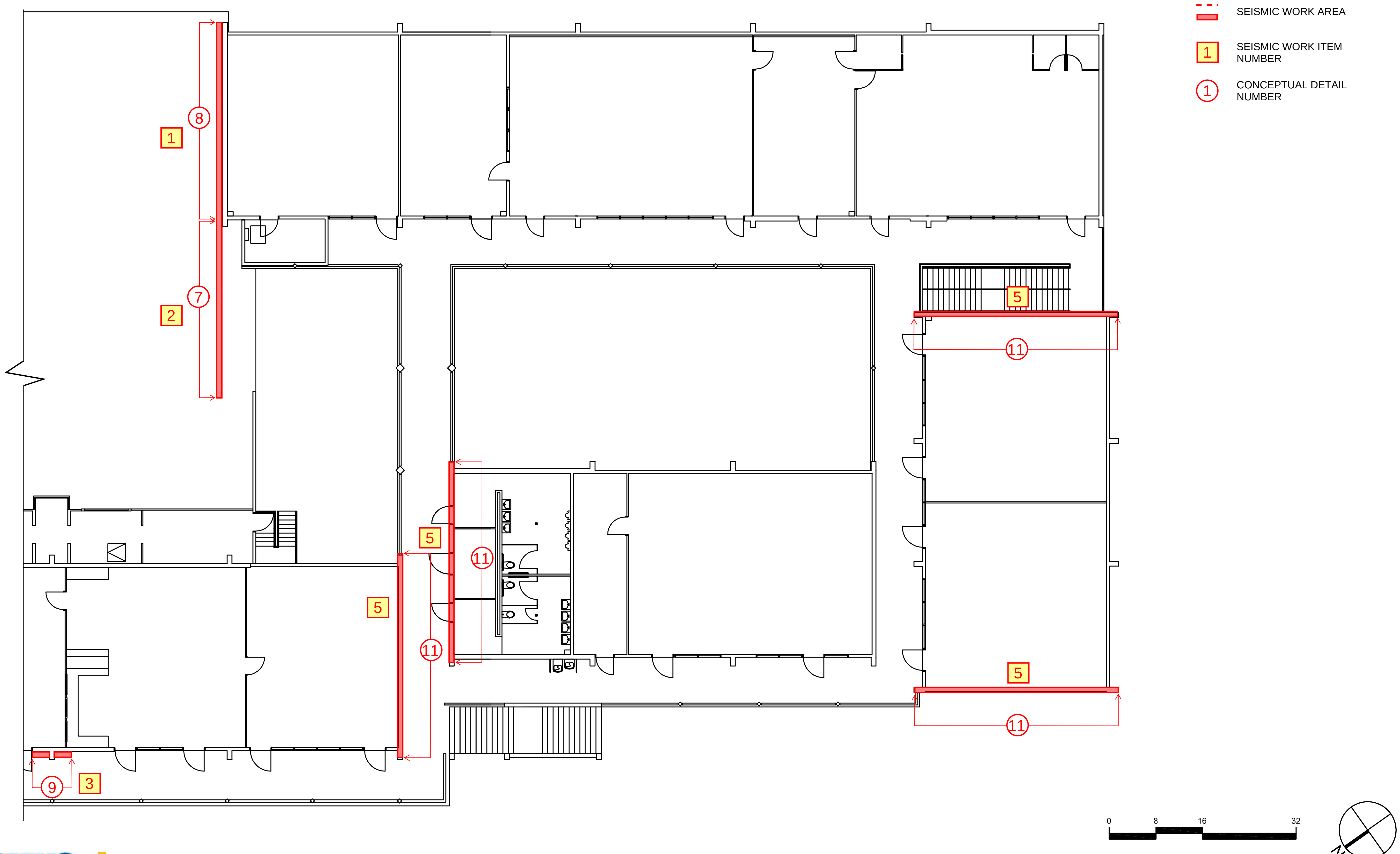
PBWS

PENINSULA HS - BUILDING H
1ST FLOOR SEGMENT B



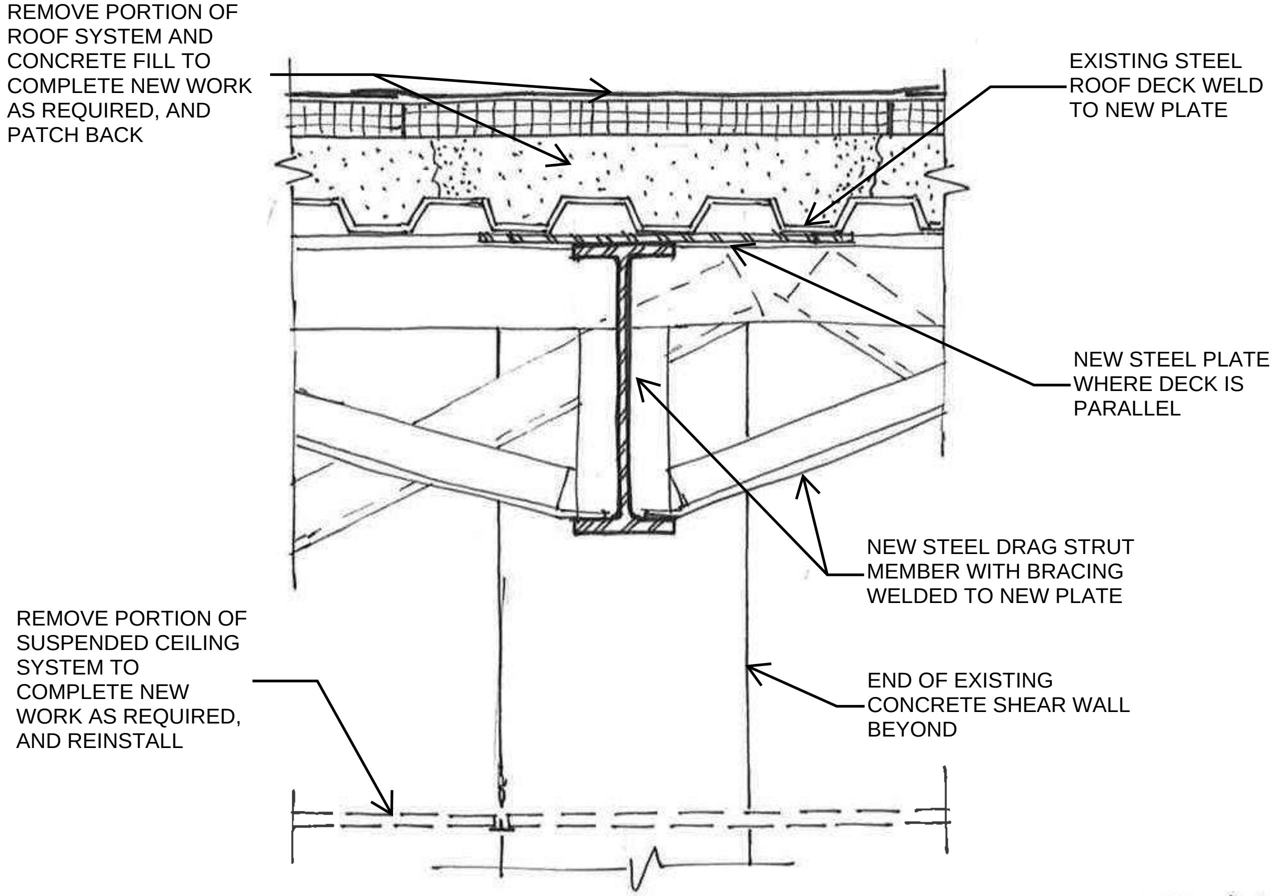
PBWS

PENINSULA HS - BUILDING H
2ND FLOOR SEGMENT A

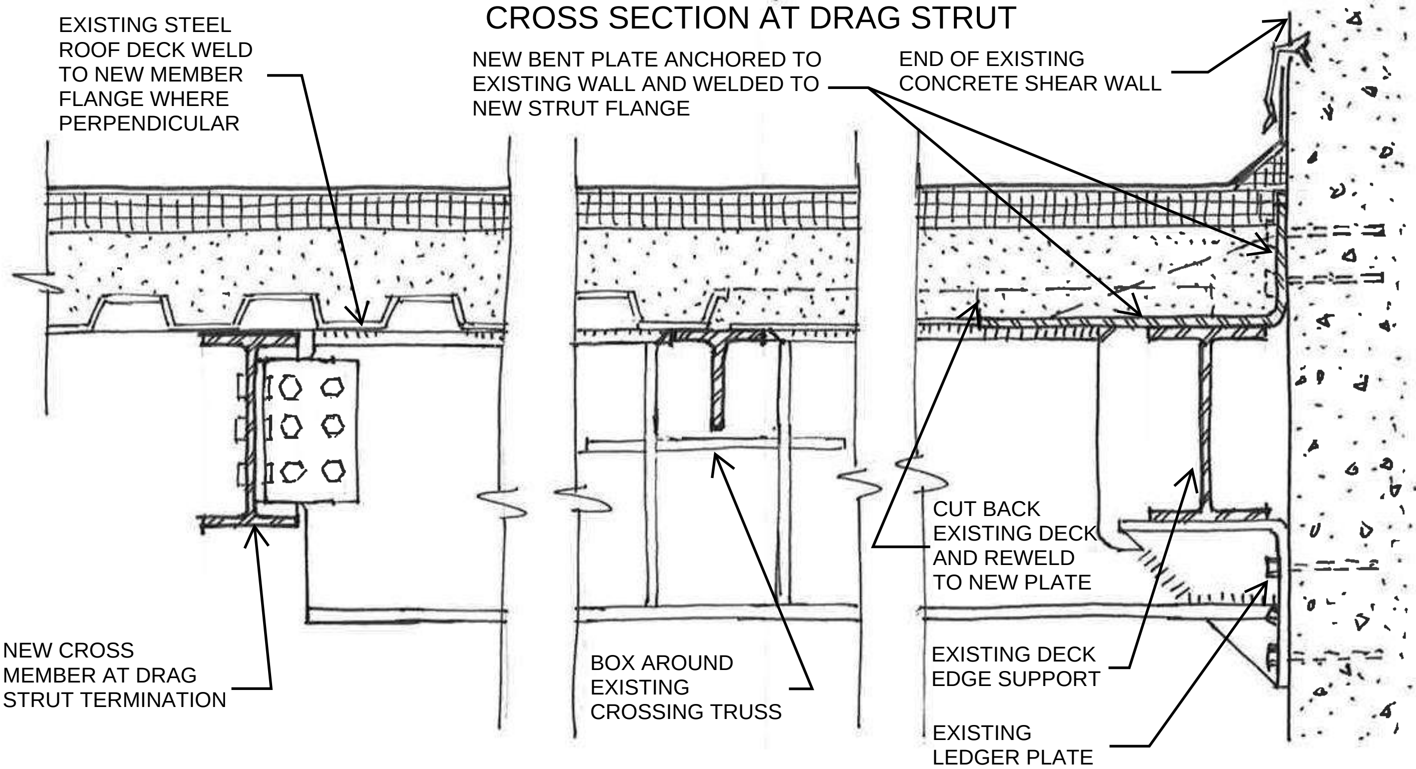


PBWS

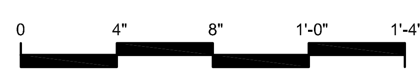
PENINSULA HS - BUILDING H
2ND FLOOR SEGMENT B



CROSS SECTION AT DRAG STRUT



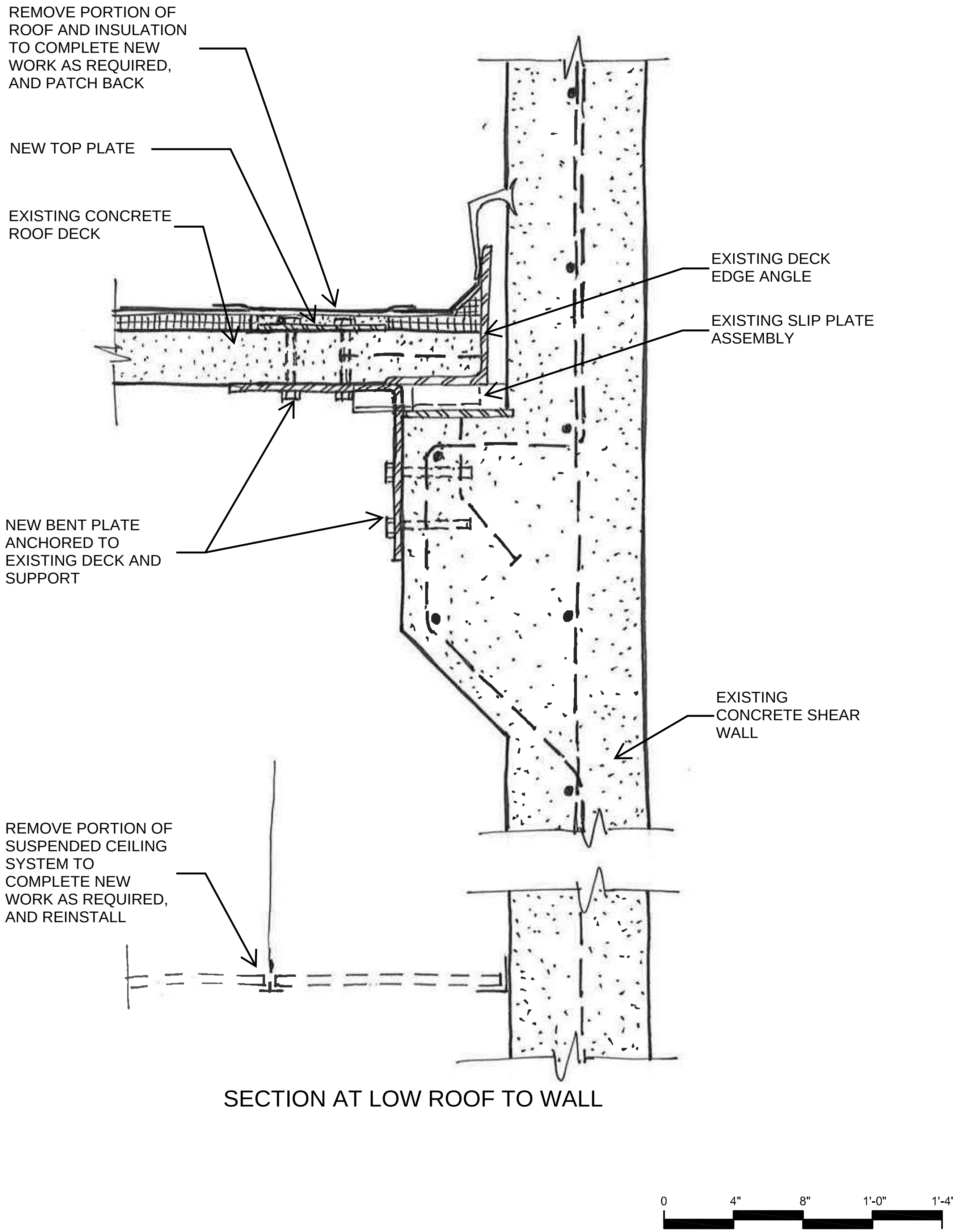
LONGITUDINAL SECTION AT DRAG STRUT



PBWS

LOW ROOF DRAG STRUT TO SHEAR
WALL AT PENHS BUILDINGS H&S

7

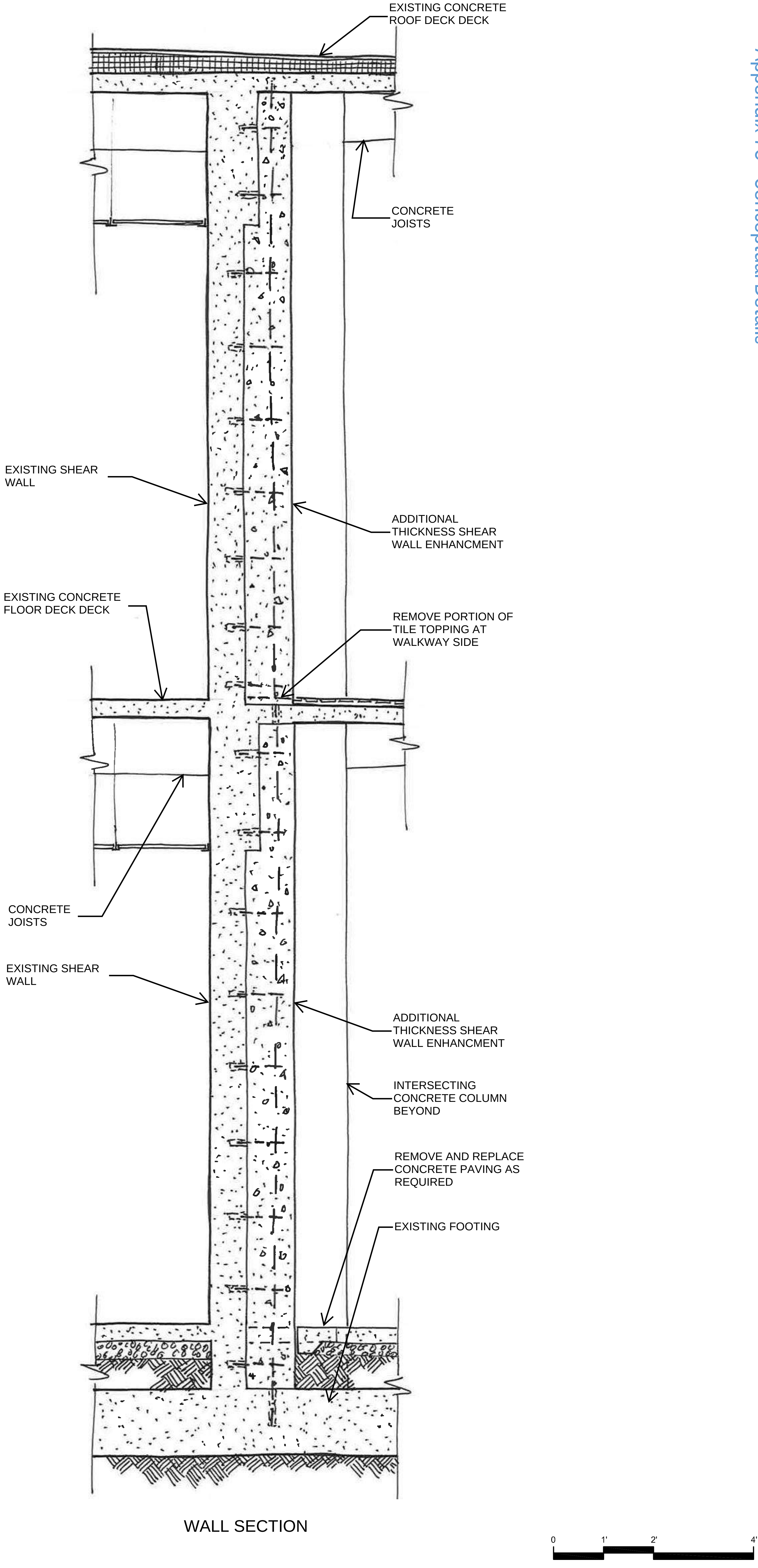


SECTION AT LOW ROOF TO WALL

PBWS

ROOF DECK CONNECTION TO SHEAR WALL AT PENHS BUILDINGS H&S

8

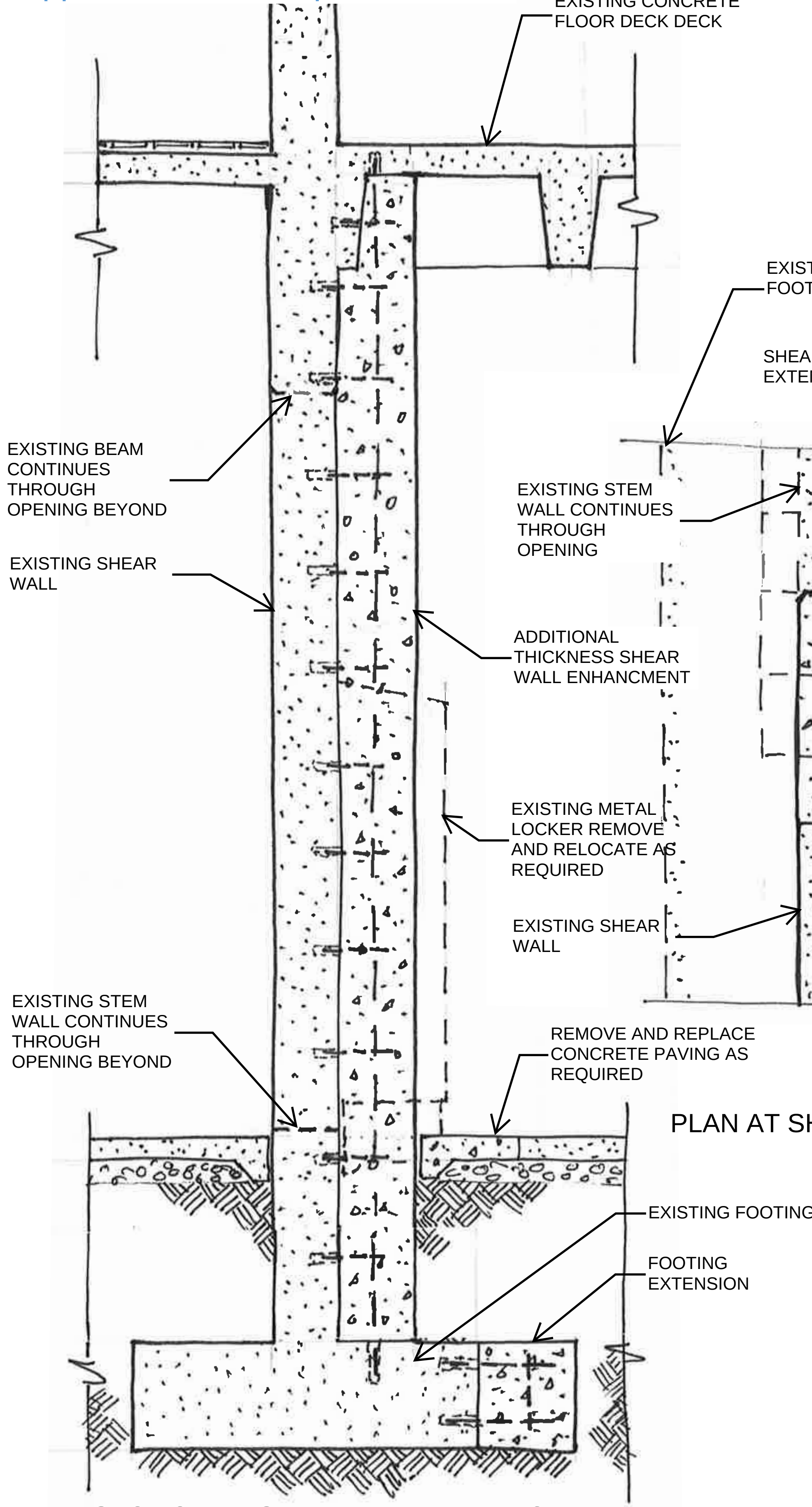


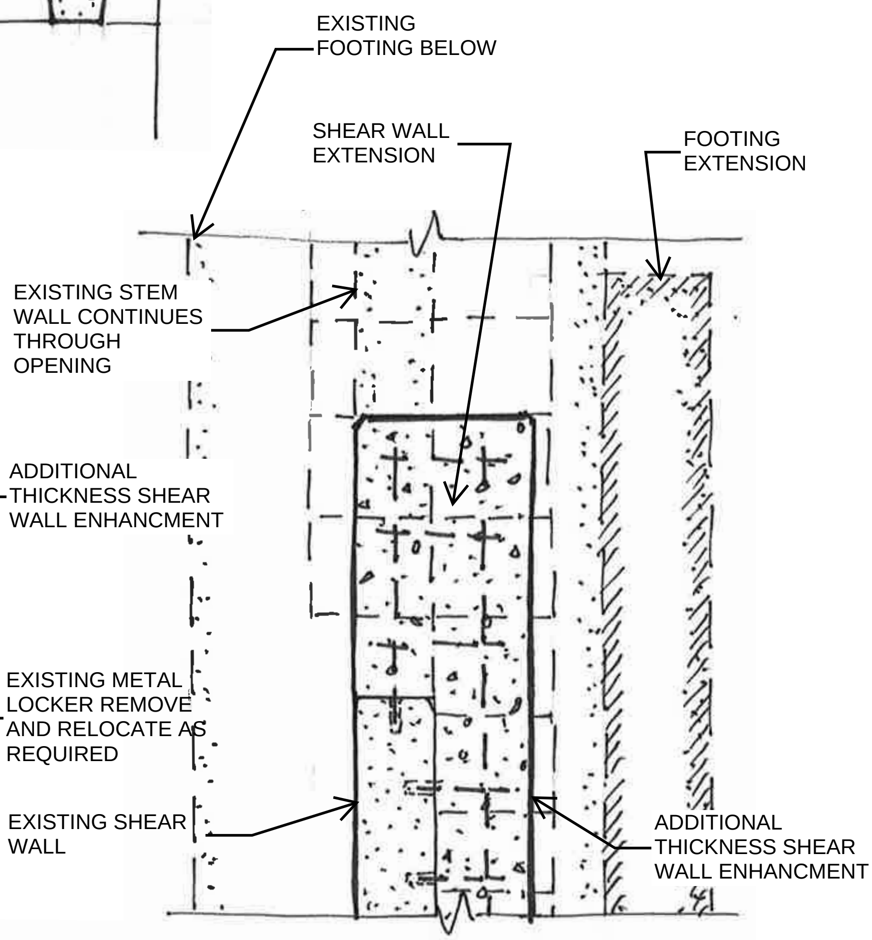
WALL SECTION

PBWS

SHEAR WALL ENHANCEMENT AT
PENHS BUILDINGS H&S

9





PLAN AT SHEAR WALL EXTENTION

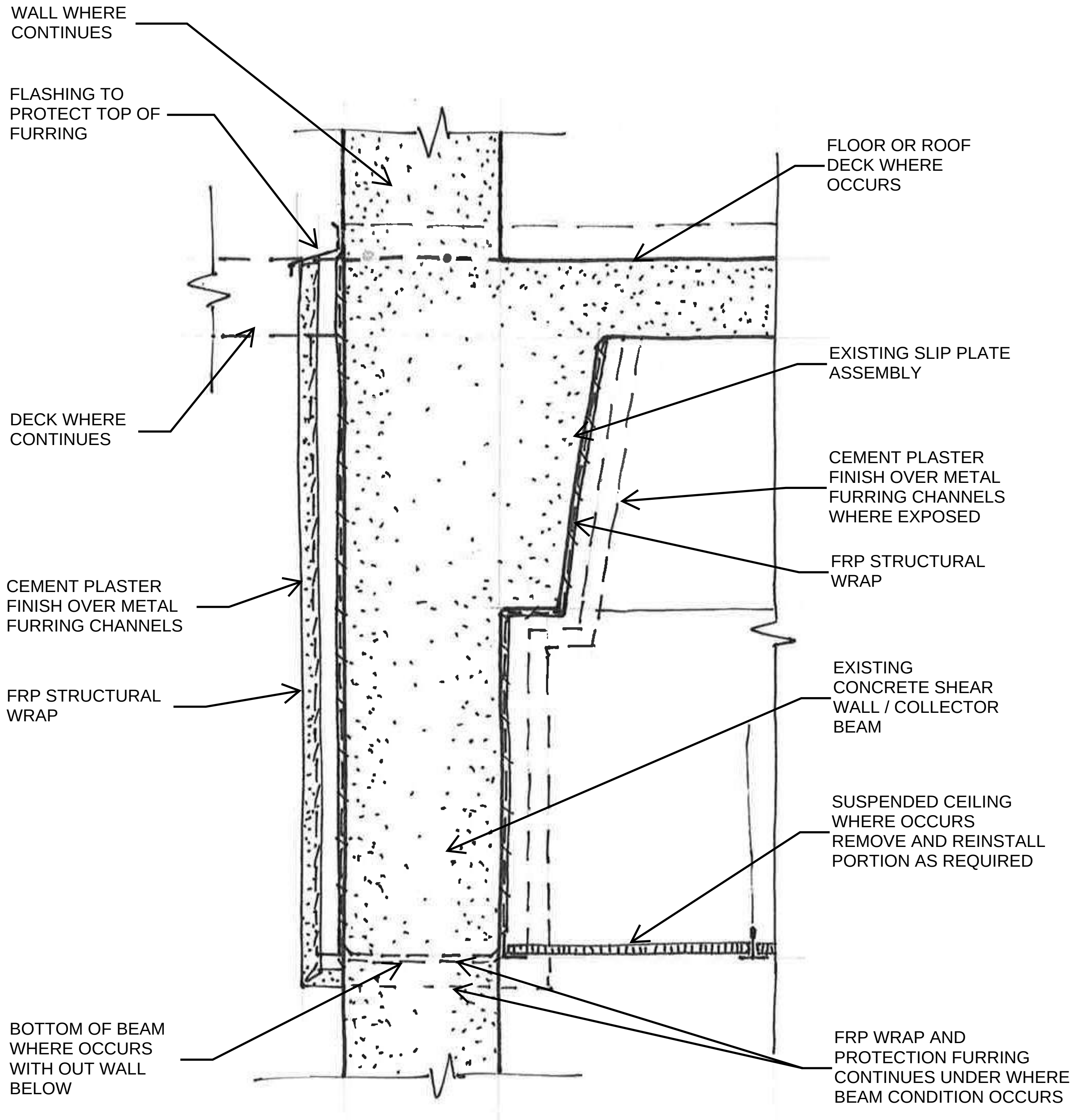
0 1' 2' 4'

SECTION AT SHEAR WALL ENHANCMENT

PBWS

SHEAR WALL ENHANCEMENT AT
PENHS BUILDINGS H&S

10



SECTION AT TOP OF WALL / BEAM

0 4" 8" 1'-0" 1'-4"

PBWS

FIBER WRAP PROTECTION AT COLLECTOR
BEAMS AT PENHS BUILDINGS H&S

11