Washington State School Seismic Safety Assessments Project

SEISMIC UPGRADES CONCEPT DESIGN REPORT

Naches Valley High School – Main Building

Naches Valley School District 3

June 2019

PREPARED FOR

PREPARED BY

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WASHINGTON STATE SCHOOL SEISMIC SAFETY ASSESSMENTS PROJECT

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Naches Valley High School – Main Building

Naches Valley School District 3

June 2019

Prepared for:

State of Washington
Department of Natural Resources and Office of Superintendent of Public Instruction

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6/6/2019

6/5/2019

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EXECUTIVE SUMMARY

This report documents the findings of a preliminary seismic evaluation of Naches Valley High School's Main Building (Building #2) in Naches Valley, Washington. The school serves more than 450 high school students in grades 9 through 12. Naches Valley High School is an 85,000-square-foot complex with three buildings, including Building #1 (Vocational/Technical), Building #2 (Classrooms/Commons), and Building #3 (Gym). Buildings #2 and #3 are connected by a hallway.

The #2 Main building is a 47,500-square-foot, two-story building. The site is mostly flat, but the north end of the site slopes up such that the north side of the second floor is over a crawl space. The building has administration space, classrooms, and a two-story library space. The building was constructed in 1978 in accordance with the 1976 Uniform Building Code (UBC). The first floor is concrete slab on grade with continuous and spread footings supporting walls and columns. Exterior walls are a combination of masonry walls and wood-frame walls with CMU veneer. Interior walls are a combination of masonry and wood frame. The second floor is wood frame with plywood sheathing and gypcrete topping supported by beams and bearing walls. The two-story library space has concrete beams framing a large interior opening. The roof is wood-frame construction with plywood sheathing and consists of multiple levels; the building is one story at the administration space and two stories over the classroom and open library space. Roof framing is supported by wood beams and wood frame or CMU bearing walls.

Unusual elements include a large, concrete cantilevered stair at the south entry, precast concrete beams supporting the second floor at the interior opening at the library, and precast concrete beams supporting the second floor exterior walls along the south and east sides. The exterior precast concrete beams are supported on precast concrete columns.

The lateral-force-resisting system consists of plywood roof and floor diaphragms supported by wood stud shear walls and masonry shear walls.

BergerABAM performed a Tier 1 screening in accordance with the ASCE 41-17 standard *Seismic Evaluation and Retrofit of Existing Buildings*. The evaluation included field observations and review of record drawings to verify the existing construction. The structural seismic evaluation indicated that the building is well detailed, but structural deficiencies were identified, including a lack of continuous cross ties at wood diaphragms between masonry walls and a potential for failure at the joint where the main building (#2) masonry walls meet the precast concrete walls at the gym (#3).

Conceptual seismic upgrade recommendations for structural and nonstructural systems are provided to improve the performance of the building to meet the designated performance criteria of ASCE 41-17. Sketches for the concept-level seismic upgrades are provided in Appendix B. The structural upgrades include installing blocking and straps to provide cross ties between masonry walls and additional connection between the masonry walls at the connecting corridor to the precast concrete wall panels at the gym.

The recommendations for nonstructural upgrades include upgrading sprinkler systems to comply with NFPA 13, restraining containers holding hazardous materials (if any), bracing suspended ceilings, providing independent supports for light fixtures, anchoring storage cabinets and shelving to adjacent floors or walls, and providing seismic bracing for mechanical equipment and life safety systems.

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Acronyms

ADA	Americans with Disabilities Act
ASCE	American Society of Civil Engineers
BPOE	Basic Performance Objective for Existing Buildings
BSE	Basic Safety Earthquake
BU	Built-Up
CMU	Concrete Masonry Unit
CP	Collapse Prevention
DNR	Department of Natural Resources
DCR	Demand-to-Capacity Ratio
EERI	Earthquake Engineering Research Institute
EPAT	EERI Earthquake Performance Assessment Tool
FEMA	Federal Emergency Management Agency
IBC	International Building Code
ICOS	Information and Condition of Schools
IEBC	International Existing Building Code
IO	Immediate Occupancy
LS	Life Safety
MCE	Maximum Considered Earthquake
MEP	Mechanical/Electrical/Plumbing
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
OSPI	Office of the Superintendent of Public Instruction
PBEE	Performance-Based Earthquake Engineering
PR	Position Retention
ROM	Rough Order-of-Magnitude
SSSSC	School Seismic Safety Steering Committee
UBC	Uniform Building Code
USGS	United States Geological Survey
WF	Wide Flange
WGS	Washington Geological Survey

Reference List

Codes and References

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FEMA E-74, *Reducing the Risks of Nonstructural Earthquake Damage.* Prepared by https://www.fema.gov/fema-e-74-reducing-risks-nonstructural-earthquake-damage

FEMA Earthquake School Hazard Hunt Game and Poster. Prepared by https://www.fema.gov/media-library/assets/documents/90409

Promoting Seismic Safety: Guidance for Advocates. Prepared by https://www.fema.gov/media-library/assets/documents/3229

Drawings

Structural Drawings dated June 1993.

1.0 Introduction

1.1 Background

The Washington Geological Survey (WGS), a division of the Department of Natural Resources (DNR), is conducting a seismic assessment of 222 school buildings and 5 fire stations across Washington State to better understand the current level of seismic risk of Washington State's public-school buildings. The two main components of this project are: (1) geologic site characterization, and (2) the seismic assessment of buildings. As a part of the seismic assessments, Tier 1 screening of structural systems and nonstructural assessments were performed in accordance with the American Society of Civil Engineers' (ASCE) Standard 41-17 *Seismic Evaluation and Retrofit of Existing Buildings*. Concept-level seismic upgrades were developed to address the identified deficiencies of a select number of school buildings to evaluate seismic upgrade strategies, feasibilities, and implementation costs.

Fifteen school buildings were selected in consultation with WGS and the School Seismic Safety Steering Committee (SSSSC) to receive concept-level seismic upgrade designs utilizing the ASCE 41 Tier 1 evaluation results. This report documents the concept-level seismic upgrade design for one of those school buildings. The concept-level seismic upgrades will include structural and nonstructural seismic upgrade recommendations, with concept-level sketches and rough order-of-magnitude (ROM) construction costs determined for each building. The fifteen school buildings were selected from the list of schools with the intent of representing a variety of regions, building uses, construction eras, and construction materials.

The overall goal of the project is to provide a better understanding of the current seismic risk of our state's K-12 school buildings and what needs to be done to improve the buildings in accordance with ASCE 41 to meet seismic performance objectives.

The seismic evaluation consists of a Tier 1 screening for the structural systems performed in accordance with ASCE 41-17.

1.2 Scope of Services

The project is being performed in several distinct and overlapping phases of work. The scope of this report is as listed in the following sections.

1.2.1 Information Review

1. Project Research: Reid Middleton and their project team researched available school building records, such as relevant site data and record drawings, in advance of the field investigations. This research included searching school building records and contacting the districts and/or the Office of Superintendent of Public Instruction (OSPI) to obtain building plans, seismic reports, condition reports, property records, or related construction information useful for the project.

2. Site Geologic Data: Site geological data provided by the WGS, including site shear wave velocities, was utilized to determine the project Site Class in accordance with ASCE 41, which is included in the Tier 1 checklists and concept-level seismic upgrades design work.

1.2.2 Field Investigations

1. Field Investigations: Each of the identified buildings was visited to observe the building's age, condition, configuration, and structural systems for the purposes of the ASCE 41 Tier 1 seismic evaluations. This task included confirmation of general information in building records or layout drawings and visual observation of the structural condition of the facilities. Engineer field reports, notes, photographs, and videos of the facilities were prepared and utilized to record and document information gathered in the field investigation work.

2. Limitations Due to Access and Worker Safety: Field observations at each site were typically performed by an individual engineer. Observation efforts were limited to areas and building elements that were readily observable and safely accessible. Observations requiring access to confined spaces, potential hazardous material exposure, access by unsecured ladder, work around energized equipment or mechanical hazards, access to areas requiring Occupational Safety and Health Administration (OSHA) fall-protection, steep or unstable slopes, deteriorated structural assemblies, or other conditions deemed potentially unsafe by the engineer were not performed. Removal of finishes (e.g., gypsum board, lathe and plaster, brick veneer, roofing materials) for access to concealed conditions or to expose elements that could not otherwise be visually observed and assessed was not performed. Material testing or sampling was not performed. The ASCE checklist items that were not documented due to access limitations are noted.

1.2.3 Seismic Evaluations

1. Preliminary Seismic Evaluations: Preliminary seismic assessments of the structural and nonstructural systems of the school buildings were performed in accordance with ASCE 41-17 Tier 1 Evaluation Procedures.

2. Concept-Level Designs: Further seismic evaluation work was performed to provide concept-level seismic retrofits and/or upgrade designs for the selected school buildings based on the results of the Tier 1 seismic evaluations. The concept-level seismic upgrades design work included narrative descriptions of proposed seismic retrofits and/or upgrade schemes and concept sketches depicting the extent and type of recommended structural upgrades.

3. Cost Estimating: Through the concept-level seismic upgrades design process, ProDims provided opinions of probable construction costs for the concept-level seismic upgrade designs for the selected school buildings. These concept-level seismic upgrade designs and the associated opinions of probable construction costs are intended to be

representative samples that can be extrapolated to estimate the overall capital needs of seismically upgrading Washington State schools.

1.2.4 Reporting and Documentation

1. Project Reports: A preliminary seismic evaluation report on the overall Tier 1 seismic assessment of the schools will be provided to DNR/WGS and OSPI. The Tier 1 seismic evaluation of each building was documented by a standard report format that provides a summary of the structural systems of the building, Tier 1 checklist, building sketches/plans (if available), and site photographs. The reports will summarize the seismic evaluation, with concept-level seismic upgrade sketches and opinions of probable construction costs for seismic upgrades for each school building.

2. Building Photography: Photos and videos were taken of each building during on-site walkthroughs to document the existing building configurations, conditions, and structural systems.

3. Record Drawings: Record drawings and other information that was collected during the evaluation process are available for DNR/WGS, OSPI, and the school districts.

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2.0 Seismic Evaluation Procedures and Criteria

2.1 ASCE 41 Seismic Evaluation and Retrofit Overview

The current standard for seismic evaluation and retrofit (upgrades) of existing buildings is ASCE 41-17. ASCE 41 provides screening and evaluation procedures used to identify potential seismic deficiencies that may require further investigation or hazard mitigation. It presents a three-tiered review process, implemented by first following a series of predefined checklists and "quick check" structural calculations. Each successive tier is designed to perform an increasingly refined evaluation procedure for seismic deficiencies identified in previous tiers in the process. The flow chart in Figure 2.1 illustrates the evaluation process.

TIER 1 – Screening Phase

- Checklists of evaluation statements to quickly identify potential deficiencies
- Requires field investigation and/or review of record drawings
- Analysis limited to "Quick Checks" of global elements
- May proceed to Tier 2, Tier 3, or rehabilitation design if deficiencies are identified

TIER 2 – Evaluation Phase

- "Full Building" or "Deficiency Only" evaluation
- Address all Tier 1 seismic deficiencies
- Analysis more refined than Tier 1, but limited to simplified linear procedures
- Identify buildings not requiring rehabilitation

TIER 3 – Detailed Evaluation Phase

- Component-based evaluation of entire building using reduced ASCE 41 forces
- Advanced analytical procedures available if Tier 1 and/or Tier 2 evaluations are judged to be overly conservative
- Complex analysis procedures may result in construction savings equal to many times their cost

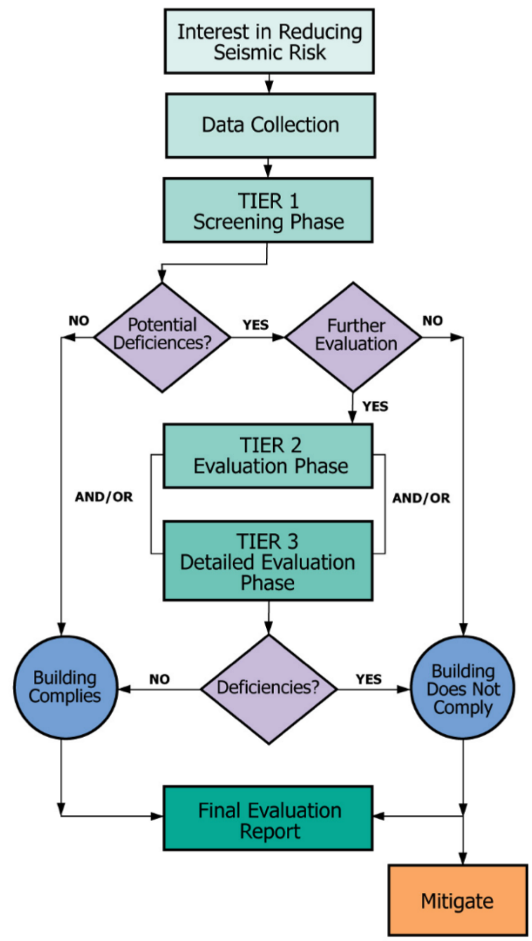

Figure 2-1. Flow Chart and Description of ASCE 41 Seismic Evaluation Procedure.

The Tier 1 checklists in ASCE 41 are specific to each common building type and contain seismic evaluation statements based on observed structural damage in past earthquakes. These checklists screen for potential seismic deficiencies by examining the lateral-force-resisting systems and details of construction that have historically caused poor seismic performance in similar buildings. Tier 1 screenings include basic "Quick Check" analyses for primary components of the lateral system: in this building's case, the plywood roof and floor diaphragms, the masonry and wood shear walls, and the anchorage of the masonry walls to the diaphragms. Tier 1 screenings also include prescriptive checks for proper seismic detailing of connections, diaphragm spans and continuity, and overall system configuration.

Tier 2 evaluations then follow with more-detailed structural and seismic calculations and assessments to either confirm the potential deficiencies identified in the Tier 1 review or demonstrate their adequacy. A Tier 3 evaluation involves an even more detailed analysis and advanced structural and seismic computations to review each structural component's seismic demand and capacity. A Tier 3 evaluation is similar in scope and complexity to the types of analyses often required to design a new building in accordance with the International Building Code (IBC), with a comprehensive analysis aimed at evaluating each component's seismic performance. Generally, Tier 3 evaluations are not practical for typical and regular-type buildings due to the rigorous and complicated calculations and procedures. As indicated in the Scope of Services, this evaluation included a Tier 1 screening of the structural systems.

2.2 Seismic Evaluation and Retrofit Criteria

Performance-Based Earthquake Engineering (PBEE) can be defined as the engineering of a structure to resist different levels of earthquake demand in order to meet the needs and performance objectives of building owners and other stakeholders. ASCE 41 employs a PBEE design methodology that allows building owners, design professionals, and the local building code authorities to establish seismic hazard levels and performance goals for individual buildings.

2.2.1 Naches Valley High School Seismicity

Seismic hazards for the United States have been quantified by the United States Geological Survey (USGS). The information has been used to create seismic hazard maps, which are currently used in building codes to determine the design-level earthquake magnitudes for building design.

The Level of Seismicity is categorized as Very Low, Low, Moderate, or High based on the probabilistic ground accelerations. Ground accelerations and mass generate inertial (seismic) forces within a building (Force = mass x acceleration). Ground acceleration therefore is the parameter that classifies the level of seismicity. From geographic region to region, as the ground accelerations increase, so does the level of seismicity (from low to high). Where this building is located, the design short-period spectral acceleration, S_{DS}, is 0.507 g, and the design 1-second period spectral acceleration, S_{D1} is 0.297 g. Based on ASCE 41 Table 2-4, the Level of Seismicity for this building is classified as **High**.

The ASCE 41 Basic Performance Objective for Existing Buildings (BPOE) makes use of the Basic Safety Earthquake – 1E (BSE-1E) seismic hazard level and the Basic Safety Earthquake – 2E (BSE-2E). The BSE-1E earthquake is defined by ASCE 41 as the probabilistic ground motion with a 20 percent probability of exceedance in 50 years, or otherwise characterized as a ground motion acceleration with a probabilistic 225-year return period. The BSE-2E earthquake is defined by ASCE 41 as the probabilistic ground motion with a 5 percent probability of exceedance in 50 years, or otherwise characterized as a ground motion acceleration with a probabilistic 975-year return period. The BSE-2N seismic hazard level is the Maximum Considered Earthquake (MCE) ground motion used in current codes for the design of new buildings and is also used in ASCE 41 to classify the Level of Seismicity for a building. The BSE-2N has a statistical ground motion acceleration with 2 percent probability of exceedance in 50 years, or otherwise characterized as a ground motion acceleration with a probabilistic 2,475-year return period.

Table 2.2.1-1 provides the spectral accelerations for the 225-year, 975-year, and 2,475-year return interval events specific to Naches Valley High School that are considered in this study.

Table 2.2.1-1 Spectral Acceleration Parameters (Not Site-Modified).

BSE-1E 20%/50 (225-year) Event		BSE-1N 2/3 of 2,475-year Event		BSE-2E 5%/50 (975-year) Event		BSE-2N 2%/50 (2,475-year) Event	
0.2 Seconds	0.19 g	0.2 Seconds	0.51 g	0.2 Seconds	0.39 g	0.2 Seconds	0.56 g
1.0 Seconds	0.08 g	1.0 Seconds	0.30 g	1.0 Seconds	0.16 g	1.0 Seconds	0.23 g

2.2.2 Naches Valley High School Structural Performance Objective

The school building is an Educational Group E Occupancy (Risk Category III) structure and has not been identified as a critical structure requiring immediate use following an earthquake. However, Risk Category III buildings are structures that represent a substantial hazard to human life in the event of failure. According to ASCE 41, the BPOE for Risk Category III structures is the Damage Control structural performance level at the BSE-1E seismic hazard level and the Life Safety structural performance level at the BSE-2E seismic hazard level. The ASCE 41 Tier 1 evaluations were conducted in accordance with ASCE 41 requirements and ASCE 41 seismic performance levels. Concept-level upgrades were developed for the **Life Safety** structural performance level at the **BSE-1N** seismic hazard level in accordance with DNR direction, the project scope of work, and the project legislative language.

At the Life-Safety performance level, the building may sustain damage while still protecting occupants from life-threatening injuries and allowing occupants to exit the building. Structural and nonstructural components may be extensively damaged, but some margin against the onset of partial or total collapse remains. Injuries to occupants or persons in the immediate vicinity may occur during an earthquake; however, the overall risk of life-threatening injury as a result of structural damage is anticipated to be low. Repairs may be required before reoccupying the building, and, in some cases, repairs may be economically unfeasible.

Knowledge Factor

A knowledge factor, *k*, is an ASCE 41 prescribed factor that is used to account for uncertainty in the as-built data considering the selected Performance Objective and data collection processes (availability of existing drawings, visual observation, and level of materials testing). No in-situ testing of building materials was performed; however, some material properties and existing construction information were provided in the existing record drawings. If the concept design is developed further, additional materials tests and site investigations will be required to substantiate assumptions about the existing framing systems.

ASCE 41 Classified Building Type

Use of ASCE 41 for seismic evaluations requires buildings to be classified from a group of common building types historically defined in previous seismic evaluation standards (ATC-14, FEMA 310, and ASCE 31-03). The school is classified in ASCE 41 Table 3-1 as Reinforced Masonry Wall Building with Flexible Diaphragms, **RM1**. Reinforced masonry shear wall buildings (RM1) include those that have bearing shear walls constructed of reinforced masonry with elevated floor and roof framing structural systems consisting of wood framing. Naches Valley High School Main Building also has wood-frame shear walls and precast reinforced concrete elements, but classification RM1 best fits the building.

2.3 Report Limitations

The professional services described in this report were performed based on available record drawing information and limited visual observation of the structure. No other warranty is made as to the professional advice included in this report. This report provides an overview of the seismic evaluation results and does not address programming and planning issues. This report has been prepared for the exclusive use of DNR/WGS and is not intended for use by other parties, as it may not contain sufficient information for purposes of other parties or their uses.

3.0 Building Description & Seismic Evaluation Findings

3.1 Building Overview

3.1.1 Building Description

Original Year Built: 1979
Building Code: Unknown

Number of Stories: 2
Floor Area: 47,500 SF

FEMA Building Type: RM1
ASCE 41 Level of Seismicity: High
Site Class: D

Naches Valley High School is a complex of three buildings: the Gym (#1), the Main Building (#2), and the Vocational-Technical Building (#3). The total square footage is 85,173 sf. The Main Building (#2) is a two-story building housing classrooms, offices, and administration. The exterior wall construction varies, with some walls wood stud and veneer and some walls reinforced masonry. The second floor and roof are wood-frame construction. There is a large two-story space for the library, with the opening in the second floor bounded by concrete beams supported by concrete columns. The site of the Main Building (#2) is flat. The building was constructed in 1979 in accordance with the 1976 Unified Building Code (UBC) code.

3.1.2 Building Use

The Main Building (#2) is used to house classrooms, offices, and administration. The school serves approximately 450 students. The central library space is a unique, two-story space that is open to the floor above. The exterior concrete stair at the entrance is a cantilevered stair that appeared to be in excellent condition.

3.1.3 Structural System

Table 3.1.3-1. Structural System Descriptions.

Structural System	Description
Structural Roof	The roof framing consists of TJI wood joist framing with a plywood sheathed diaphragm. Existing drawings indicate the roof diaphragm nailing plans and schedule (Sheet S-19).
Structural Floor(s)	The floor framing consists of TJI wood joist framing with a plywood sheathed diaphragm. Drawings indicated a blocked floor diaphragm and nailing schedule (Sheet S-19). The second floor framing is supported by concrete

Table 3.1.3-1. Structural System Descriptions.

Structural System	Description
	beams at the edges of the open library space, which also functions as the handrail for the second floor.
Foundation	The foundations consist of shallow continuous footings meeting frost depth requirements. Stepped footings are provided as needed to account for the grade change at the north entry.
Gravity System	The gravity system consists of a wood-frame roof and floor supported by bearing walls (wood-frame, reinforced masonry) and concrete beams/walls all supported by shallow foundations.
Lateral System	The lateral-force-resisting system consists of flexible plywood roof and floor diaphragms with reinforced shear walls (concrete and masonry).

3.1.4 Structural System Visual Condition

Table 3.1.4-1. Structural System Condition Descriptions.

Structural System	Description
Structural Roof	Did not observe signs of corrosion, damage, or deterioration.
Structural Floor	Did not observe signs of corrosion, damage, or deterioration.
Foundations	Unknown.
Gravity System	Did not observe signs of corrosion, damage, or deterioration.
Lateral System	Did not observe signs of corrosion, damage, or deterioration.

3.2 Seismic Evaluation Findings

3.2.1 Structural Seismic Deficiencies

The structural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is provided based on this evaluation.

Table 3.2.1-1. Identified Structural Seismic Deficiencies Based on Tier 1 Checklists.

Deficiency	Description
Cross Ties	Building is well detailed, including diaphragm nailing plans, but continuous cross ties are not detailed, likely due to the 1979 date of construction. Additional straps could be added as needed; additional investigation required.

3.2.2 Structural Checklist Items Marked as "U"nknown

Where building structural component seismic adequacy was unknown due to lack of available information or limited observation, the structural checklist items were marked as "unknown". These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown structural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is provided based on the evaluation.

Table 3.2.2-1. Identified Structural Checklist Items Marked as Unknown.

Deficiency	Description
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. Very low to low liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure.
Surface Fault Rupture	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.

3.2.3 Nonstructural Seismic Deficiencies

The nonstructural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is provided based on this evaluation. Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 3.2.3-1. Identified Nonstructural Seismic Deficiencies based on Tier 1 Checklists.

Deficiency	Description
LSS-1 Fire Suppression Piping	No available record drawing information on fire suppression piping and unable to verify during site investigation. Based on the building's year of construction (1979), it is assumed that seismic bracing for fire suppression piping does not comply with NFPA 13. Further investigation may be appropriate to mitigate seismic risk.

Table 3.2.3-1. Identified Nonstructural Seismic Deficiencies based on Tier 1 Checklists.

Deficiency	Description
LSS-2 Flexible Couplings	No available record drawing information on fire suppression piping and unable to verify during site investigation. Based on age of the building, it is assumed the flexible couplings on the fire suppression piping do not comply with NFPA 13. Flexible coupling for fire suppression piping may be appropriate to mitigate seismic risk.
ME-1 Fall-Prone Equipment	Mechanical room was exceptionally clean and well kept. Some equipment in the mechanical rooms did not appear to be braced. Bracing required for equipment weighing more than 20 pounds and located 4 feet or more above the floor to mitigate seismic risk.

3.2.4 Nonstructural Checklist Items Marked as "U"nknown

Where building nonstructural component seismic adequacy was unknown due to lack of available information or limited observation, the nonstructural checklist items were marked as "unknown". These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown nonstructural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is provided based on the evaluation.

Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 3.2.4-1. Identified Nonstructural Checklist Items Marked as Unknown.

Deficiency	Description
LSS-3 Emergency Power	Available record drawings do not have information on anchorage or bracing for emergency power equipment and could not be verified during site investigation. Based on age of the building, emergency power equipment is either nonexistent or noncompliant. Evaluation of emergency power equipment may be appropriate to mitigate seismic risk.
LSS-5 Sprinkler Ceiling Clearance	No available record drawing information on sprinkler head clearance and unable to verify during site investigation. Further evaluation may be appropriate to mitigate seismic risk.
HM-2 Hazardous Material Storage	Unknown whether the building has hazardous materials. Further investigation may be appropriate to mitigate seismic risk.

Table 3.2.4-1. Identified Nonstructural Checklist Items Marked as Unknown.

Deficiency	Description
HM-4 Shutoff Valves	It is unknown if there are shutoff valves for piping containing hazardous materials. Further investigation may be appropriate to mitigate seismic risk.
HM-5 Flexible Couplings	Did not observe flexible couplings. Further investigation may be appropriate to mitigate seismic risk.
LF-1 Independent Support	It appears the light fixtures are supported by the ceiling grid. Unknown what supports or bracing may be hidden in the ceiling space. Further investigation may be appropriate to mitigate seismic risk.
M-2 Shelf Angles	Details not provided in available structural drawings. Further investigation may be appropriate to mitigate seismic risk.
CF-1 Industrial Storage Tacks	Pictures and drawings do not indicate any industrial storage racks or pallet racks greater than 12 feet high. Further investigation may be appropriate to mitigate seismic risk.
CF-2 Tall Narrow Contents	Drawings do not include details showing anchorage at tall narrow contents. Did not observe if the book shelves in the library were anchored to the walls. District to confirm. Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint.
CF-3 Fall-Prone Contents	Did not observe. District to confirm. Heavy items on upper shelves should be restrained by netting or cabling to avoid falling hazards.
ME-2 In-Line Equipment	Mechanical room was exceptionally clean and well kept. Unclear if in-line equipment was braced as required. Bracing for heavy in-line equipment may be appropriate to mitigate seismic risk.
EL-1 Retainer Guards	Details not available. Further investigation may be appropriate to mitigate seismic risk.
EL-2 Retainer Plate	Details not available. Further investigation may be appropriate to mitigate seismic risk.

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4.0 Conclusion and Recommendations

4.1 Seismic-Structural Upgrade Recommendations

Concept-level seismic upgrade recommendations to improve the lateral-force-resisting system were developed. The sketches in Appendix B depict the concept-level structural upgrade recommendations outlined in this section. The following concept recommendations are intended to address the structural deficiencies noted in Table 3.2.1-1. This concept-level seismic upgrade design represents just one of several alternative seismic upgrade design solutions and is based on preliminary seismic evaluation and analysis results. Final analysis and design for seismic upgrades must include a more detailed seismic evaluation of the building in its present or future configuration. Proposed seismic upgrades include the following.

4.1.1 Masonry to Concrete Wall Connection

The masonry walls of the Main Building intersect the precast concrete Gym walls. New construction would typically separate the two buildings with a seismic joint. It is possible to separate the two buildings, but a more reasonable solution is to add anchorage at the joint between the main building and the gym. Upgrades to existing details 8/S5 and 9/S14 will better tie the two buildings together to improve performance in an earthquake.

4.1.2 Wall Anchorage at Roof

Exterior masonry wall-to-roof diaphragm anchors are part of the original construction, but to meet current standards, "cross-ties" or straps that run from wall to wall are recommended at the roof. Sketches are provided that indicate a number of upgrades to the existing details. It may be possible to install straps during a scheduled re-roof project to minimize facility disruption.

4.2 Nonstructural Upgrade Recommendations

4.2.1 Life Safety Systems

Life safety systems are responsible for protecting and evacuating occupants of a building during emergencies or disasters. These systems include, but are not limited to, fire suppression piping, emergency lighting, and stair and smoke ducts. Proper bracing, coupling, and clearances of fire suppression piping not only increase reliability of performance but also help minimize the damage to pipes and sprinkler heads. Based on the age of the building, it is likely that the sprinkler systems in the building do not meet the requirements of current NFPA 13 seismic bracing and flexible coupling.

The recommended seismic mitigation for the life safety systems are:

- Provide bracing and flexible couplings of risers, feed mains, cross-mains, and branch lines in accordance with NFPA 13.

- Provide 1-inch sprinkler head clearance holes in ceiling finishes.
- Provide seismic bracing or anchor the emergency power system to the structure.

4.2.2 Hazardous Materials

The extent of hazardous material contents in the building is unknown. The following recommendations should be implemented to prevent the release of hazardous materials:

- Breakable containers that hold hazardous material, including gas cylinders, should be restrained by latched doors, shelf lips, wires, or other methods.
- Piping or ductwork conveying hazardous materials should be braced or otherwise protected from damage resulting in hazardous material release.
- Piping containing hazardous material, including natural gas, should have shutoff valves or other devices to limit spills or leaks.
- Hazardous material ductwork and piping, including natural gas piping, should have flexible couplings.

4.2.3 Ceilings

The suspended ceilings in the building appear to be acoustical ceiling tiles supported by steel channel systems. The recommended seismic mitigation for the architectural systems are:

- Provide independent support with a minimum of two wires diagonally at opposite corners of each fixture for the light fixtures that weigh more per square foot than the suspended ceiling they penetrate. Fluorescent light fixtures are often supported by the suspended ceiling system, causing the light fixtures to become overhead falling hazards during an earthquake. Therefore, light fixtures within the integrated suspended ceilings are required to be independently supported to the structure above with a minimum of two wires at opposite corners.

4.2.4 Contents and Furnishings

The building contains various tall and narrow furniture, such as shelving and storage units, that are freestanding away from any backing walls. This furniture is highly susceptible to toppling if not anchored properly and can become a life safety hazard or adversely affect post-earthquake operations. The recommended seismic mitigation for tall and narrow furniture is:

- Anchor storage cabinets or shelving units that are more than 6 feet high and with a height-to-depth or height-to-width ratio greater than 3-to-1 to the structure or to each other to prevent toppling during an earthquake.
- Provide bracing or restraint for equipment, stored items, or other contents weighing more than 20 pounds and with a center of mass that is more than 4 feet above the adjacent floor level.

4.2.5 Architectural Considerations

This section addresses existing construction that, while not posing specific hazards during a seismic event, would be affected by the seismic improvements proposed.

For existing building remodel projects, the International Existing Building Code (IEBC) is applicable. The intent of the IEBC is to provide flexibility to permit the use of alternative approaches to achieve compliance with minimum requirements to safeguard the public health, safety, and welfare insofar as they are affected by the work being done. Elements of the exterior building envelope being affected by the seismic work would also be required to be brought up to the current Washington State Energy Code per Chapter 5, where applicable.

It should also be noted that as a part of any upgrade to existing buildings, the IEBC will require that any altered primary function spaces (classrooms, gyms, entrances, offices) and routes to these spaces, be made accessible to current accessibility standards per the American with Disabilities Act (ADA), unless technically infeasible. This would include, but is not limited to: accessible restrooms, paths of travel, entrances and exits, parking, signage, fire alarm system, etc. Under no circumstances should the facility be made less accessible. The IEBC does however have exceptions for areas that do not contain a primary function (storage room, utility rooms) and states that costs of providing the accessible route are not required to exceed 20 percent of the costs of the alterations affecting the area of Primary Function. As with any major renovation and modernization, an ADA study would be recommended to determine the extent to which an existing facility needs to be improved to be in compliance with the ADA.

Masonry to Concrete Wall Connection

The masonry walls of the Main Building intersect the precast concrete Gym walls; need to add anchorage at the joint between the main building and the gym.

Anchorage would consist of steel angles anchoring base of CMU walls and steel straps strengthening roof-to-wall connection.

It would be preferable to install the roof framing straps during a scheduled re-roof project to minimize facility disruption.

Floor, wall finishes, and ceiling systems will be affected.

Wall Anchorage at Roof

Roof diaphragm upgrades require the removal of finishes above and below the roof deck for access to install new work. If existing insulation is above the roof deck, it will need to be replaced with additional insulation to meet current energy code requirements (R-38). Existing plywood ceilings will need to be removed and replaced to allow access to the underside of the deck in order to install blocking and perimeter roof and wall connections.

It would be ideal to install straps during a scheduled re-roof project to minimize facility disruption.

Access may be complicated above classroom and locker room spaces. These rooms may need to be completely demolished and rebuilt with all new finishes, depending on extent of access to roof framing required. If this is the case, current ADA requirements may require relocation of plumbing fixtures and waste and water lines.

Ceilings

Removal of the existing plaster and acoustic ceiling tiles may be required to gain access to the underside of the roof deck for installation of blocking and straps. Repair plaster ceilings to match existing, and replace damaged acoustic tiles to match. Fire ratings, if present, must be retained.

Existing suspended T-bar ceilings may need to be removed and reinstalled with new seismically braced T-bar in order to gain access to the underside of the roof diaphragm for blocking installation.

Existing ceiling-mounted light fixtures may be substandard and could become dangerous in an earthquake. Lighting should be updated to current lightweight LED fixtures with seismic bracing.

4.2.6 Mechanical/Electrical/Plumbing (MEP) Systems

The main seismic concerns for mechanical equipment, ducting, and piping are sliding, swinging, and overturning. Inadequate lateral restraint or anchorage can shift equipment off its supports or topple equipment to the ground or onto other equipment. Inadequate bracing of piping and ducting, or the inability for piping to tolerate differential movement from the equipment it is attached to, can damage or dislodge connections. Such damage in fluid piping can potentially lead to major leaks or loss and disruption by damaging contents. The recommended seismic mitigation for MEP systems is:

- Provide seismic bracing for equipment that weighs more than 20 pounds, has a center of mass more than 4 feet above the adjacent floor level, and is not in-line equipment.

4.3 Opinion of Conceptual Construction Costs

A preliminary opinion of probable construction costs to perform the concept-level seismic upgrade recommendations provided in this report is included in Appendix C. The input for these preliminary probable costs are the Tier 1 checklists and the preliminary concept-level seismic upgrades design recommendations and sketches. These preliminary concept-level design sketches depict a design concept that could be implemented to improve the seismic safety of the building structure. It is important to note that this preliminary seismic upgrades design concept is based on the results of the Tier 1 seismic screening checklists and engineering design judgement and has not been substantiated by detailed structural analyses and calculations. Consequently, the costs presented in this concept-level design report are very preliminary in nature and are only intended to be utilized in their aggregate form with the entire statewide school seismic safety assessments study.

For this preliminary opinion of probable construction costs, an estimate of the current year (2019) construction costs of the probable scope of work was developed. These costs were developed based on the Tier 1 checklist, concept-level seismic upgrade design sketches, and project narratives. Then a -20 percent (low) to +50 percent (high) range variance was used to develop the construction cost estimate range for the concept-level scope of work. The -20 percent to +50 percent range variance guidance is from Table 1 of the AACE International Recommended Practice 56R-08, *Cost Estimate Classification System for Class 5 Estimates*. The variable cost range of a Class 5 estimate is due to the limited design completeness and is defined as 0 percent to 2 percent Project Definition Deliverables.

The estimated structural and nonstructural construction cost to mitigate the deficiencies identified in the Tier 1 checklists of the Naches Valley High School Main Building ranges between $1.1M and $2.0M (-20 percent/+50 percent). The estimated construction cost to seismically upgrade this building is $1.3M. On a per-square-foot basis, the seismic upgrade construction cost is estimated to be approximately $29 per square foot in 2019 dollars, with a variance range between $22 per square foot and $42 per square foot.

This preliminary opinion of construction cost includes labor, materials, equipment, and general contractor general conditions (mobilization), overhead, and profit. This is based on a public sector design-bid-build project delivery method. Project delivery methods such as negotiated, State of Washington GC/CM, and design-build are not the basis of the construction costs. Owner's project costs not included in the construction cost estimate are building permits, design fees, change order contingencies, escalation at a recommended 4.1 percent* per year to the midpoint of construction (currently unknown), materials testing/inspection, project planning and design schedule delay contingencies, and owner's overall project contingency. Additional owner's project costs would likely include owner's general overhead costs, including project management, financing/bond costs, administration/contract/accounting costs, review of plans, value engineering studies, equipment, fixtures, furnishings and technology, and relocation of the school staff and students during construction. These additional costs are not included in this preliminary concept-level design construction cost estimate.

Costs of all types excluded from the construction costs are site work, construction of replacement facilities, and mitigation of seismic risks for existing facilities and building code changes that occur over time after this report. Future planning budgets should not be set on the basis of the preliminary construction costs estimate based on the concept-level design ideas presented in this report. For budget planning purposes, it is highly recommended that a seismic upgrade budget be determined after the owner defines the scope of work and obtains the services of an A/E design team to study the proposed seismic mitigation strategies and to refine the concept-level seismic upgrades design approach contained in this report.

*-4.1%/year escalation rate for planning purposes should be compounded annually to the midpoint of construction and is sourced from *Engineering News Record (ENR),* November, 2017, the most recent rate representative of the escalation of construction costs throughout the state of Washington.

Table 4.3.1. Seismic Upgrades Opinion of Probable Construction Costs

Building	FEMA Bldg Type	ASCE 41 Level of Seismicity / Site Class	Structural Performance Objective	Bldg Gross Area	Estimated Seismic Upgrade Cost Range $/SF (Total)	Estimated Seismic Upgrade Cost/SF (Total)
Naches Valley High School Main Building	RM1	High / D	**Structural**			
			Life Safety	85,173 SF	$16 ($781K) - $31 ($1.47M)	$21 ($977K)
			Nonstructural			
			Life Safety	85,173 SF	$6 ($287K) - $11 ($538K)	$8 ($358K)
			Total			
				85,173 SF	$22 ($1.07M) - $42 ($2.01M)	$29 ($1.34M)

W: Wood-Framed; URM: Unreinforced Masonry; RM: Reinforced Masonry; C: Reinforced Concrete; PC: Precast concrete; S: Steel-framed

Appendix A: Field Investigation Report and Tier 1 Checklists

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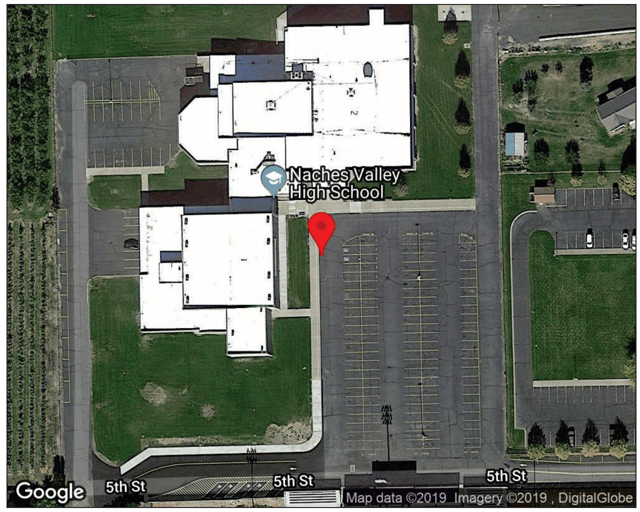
1. Naches Valley, Naches Valley High School, Main Building

1.1 Building Description

Building Name:	Main Building
Facility Name:	Naches Valley High School
District Name:	Naches Valley
ICOS Latitude:	46.736
ICOS Longitude:	-120.703
ICOS County/District ID:	39003
ICOS Building ID:	17680
ASCE 41 Bldg Type:	RM1
Enrollment:	453
Gross Sq. Ft. :	47,500
Year Built:	1979
Number of Stories:	2
$S_{XS\ BSE\text{-}2E}$:	0.581
$S_{X1\ BSE\text{-}2E}$:	0.352
ASCE 41 Level of Seismicity:	High
Site Class:	D
V_{S30}(m/s):	354
Liquefaction Potential:	very low to low
Tsunami Risk:	None
Structural Drawings Available:	Yes
Evaluating Firm:	BergerABAM/WSP



Naches Valley High School is a complex of three buildings, the Gym (#1), the Main building (#2) and the Vocational-Technical Building (#3). The total square footage is 85,173 sf. The Main building (aka #2) is a two-story building housing classrooms, offices and administration. The exterior wall construction varies, with some walls wood stud + veneer and some walls reinforced masonry. The second floor and roof are wood frame construction. There is a large two-story space for the library with the opening in the second floor bounded by concrete beams supported by concrete columns. The site of the Main building (#2) is flat. The building was constructed in 1979 in accordance with the 1976 UBC code.

1.1.1 Building Use

The Main building (#2) is used to house classrooms, offices and administration. The school houses approximately 450 students. The central library space is a unique two-story space that is open to the floor above. The exterior concrete stair at the entrance is a cantilevered stair which appeared to be in excellent condition.

1.1.2 Structural System

Table 1.1-1. Structural System Description of Naches Valley High School

Structural System	Description
Structural Roof	The roof framing consists of TJI wood joist framing with a plywood sheathed diaphragm. Existing drawings indicate the roof diaphragm nailing plans and schedule (Sheet S-19).
Structural Floor(s)	The floor framing consists of TJI wood joist framing with a plywood sheathed diaphragm. Drawings indicated a blocked floor diaphragm and nailing schedule (Sheet S-19). The second floor framing is supported by concrete beams at the edges of the open library space which also functions as the handrail for the second floor.
Foundations	The foundations consist of shallow continuous footings meeting frost depth requirements. Stepped footings are provided as needed to account for the grade change at the north entry.
Gravity System	The gravity system consists of a wood frame roof and floor supported by bearing walls (wood frame, reinforced masonry) and concrete beams/walls all supported by shallow foundations.
Lateral System	The lateral force resisting system consists of flexible plywood roof and floor diaphragms with reinforced shear walls (concrete and masonry).

1.1.3 Structural System Visual Condition

Table 1.1-2. Structural System Condition Description of Naches Valley High School

Structural System	Description
Structural Roof	Did not observe signs of corrosion, damage or deterioration.
Structural Floor(s)	Did not observe signs of corrosion, damage or deterioration.
Foundations	Unknown
Gravity System	Did not observe signs of corrosion, damage or deterioration.
Lateral System	Did not observe signs of corrosion, damage or deterioration.

1.2 Seismic Evaluation Findings

1.2.1 Structural Seismic Deficiencies

The structural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation.

Table 1-3. Identified Structural Seismic Deficiencies for Naches Valley Naches Valley High School Main Building

Deficiency	Description
Cross Ties	Building is well detailed including diaphragm nailing plans, but continuous cross ties are not detailed which is not surprising due to the 1979 date of construction. Additional straps could be added as needed, additional investigation required.

1.2.2 Structural Checklist Items Marked as 'U'nknown

Where building structural component seismic adequacy was unknown due to lack of available information or limited observation, the structural checklist items were marked as "unknown". These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown structural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

Table 1-4. Identified Structural Checklist Items Marked as Unknown for Naches Valley Naches Valley High School Main Building

Unknown Item	Description
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. \very low to low\ liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure.
Surface Fault Rupture	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.

1.3.1 Nonstructural Seismic Deficiencies

The nonstructural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation. Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 1-5. Identified Nonstructural Seismic Deficiencies for Naches Valley Naches Valley High School Main Building

Deficiency	Description
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	No available record drawing information on fire suppression piping and unable to verify during site investigation. Based on year of construction (1979) of the building, it is assumed that seismic bracing for fire suppression piping does not comply with NFPA 13. Further investigation may be appropriate to mitigate seismic risk.
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	No available record drawing information on fire suppression piping and unable to verify during site investigation. Based on age of the building, it is assumed the flexible couplings on the fire suppression piping do not comply with NFPA 13. Flexible coupling for fire suppression piping may be appropriate to mitigate seismic risk.
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	Mechanical room was exceptionally clean and well kept. Some equipment in the mechanical rooms did not appear to be braced. Bracing required for equipment weighing more than 20 lb located 4 feet or more above the floor to mitigate seismic risk.

1.3.2 Nonstructural Checklist Items Marked as 'U'nknown

Where building nonstructural component seismic adequacy was unknown due to lack of available information or limited observation, the nonstructural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown nonstructural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 1-6. Identified Nonstructural Checklist Items Marked as Unknown for Naches Valley Naches Valley High School Main Building

Unknown Item	Description
LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Available record drawings do not have information on anchorage or bracing for emergency power equipment and could not verify during site investigation. Based on age of the building, emergency power equipment is either nonexistent or noncompliant. Evaluation of emergency power equipment may be appropriate to mitigate seismic risk.
LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	No available record drawing information on sprinkler head clearance and unable to verify during site investigation. Further evaluation may be appropriate to mitigate seismic risk.
HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Unknown whether the building has hazardous materials. Further investigation may be appropriate to mitigate seismic risk.
HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	It is unknown if there are shutoff valves for piping containing hazardous materials. Further investigation may be appropriate to mitigate seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	Did not observe flexible couplings. Further investigation may be apprpopriate to mitigate seismic risk.
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	It appears the light fixtures are supported by the ceiling grid. Unknown what supports or bracing may be hidden in the ceiling space. Further investigation may be appropriate to mitigate seismic risk.
M-2 Shelf Angles. HR-not required; LS-LMH; PR-LMH.	Details not provided in available structural drawings. Further investigation may be appropriate to mitigate seismic risk.
CF-1 Industrial Storage Racks. HR-LMH; LS-MH; PR-MH.	Pictures and drawings do not indicate any industrial storage racks or pallet racks greater than 12 ft high. Further investigation may be appropriate to mitigate seismic risk.
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Drawings do not include details showing anchorage at tall narrow contents. Did not observe if the book shelves in the library were anchored to the walls. District to confirm. Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint.\n Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Did not observe. District to confirm. Heavy items on upper shelves should be restrained by netting or cabling to avoid falling hazards.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Mechanical room was exceptionally clean and well kept. Unclear if in-line equipment was braced as required. Bracing for heavy in-line equipment may be appropriate to mitigate seismic risk.
EL-1 Retainer Guards. HR-not required; LS-H; PR-H.	Details not available. Further investigation may be appropriate to mitigate seismic risk.
EL-2 Retainer Plate. HR-not required; LS-H; PR-H.	Details not available. Further investigation may be appropriate to mitigate seismic risk.

Photos:

Figure 1-1. Naches Valley HS Classroom Bldg Main Entry

Figure 1-2. Naches Valley HS Classroom Bldg exterior entry stair

Figure 1-3. Naches Valley HS Classroom Bldg SE corner

Figure 1-4. Naches Valley HS Classroom Bldg North wall

Figure 1-5. Naches Valley HS Classroom Bldg Entry

Figure 1-6. Naches Valley HS Classroom Bldg two-story library space

Figure 1-7. Naches Valley HS Classroom Bldg - new door opening exposes wall construction

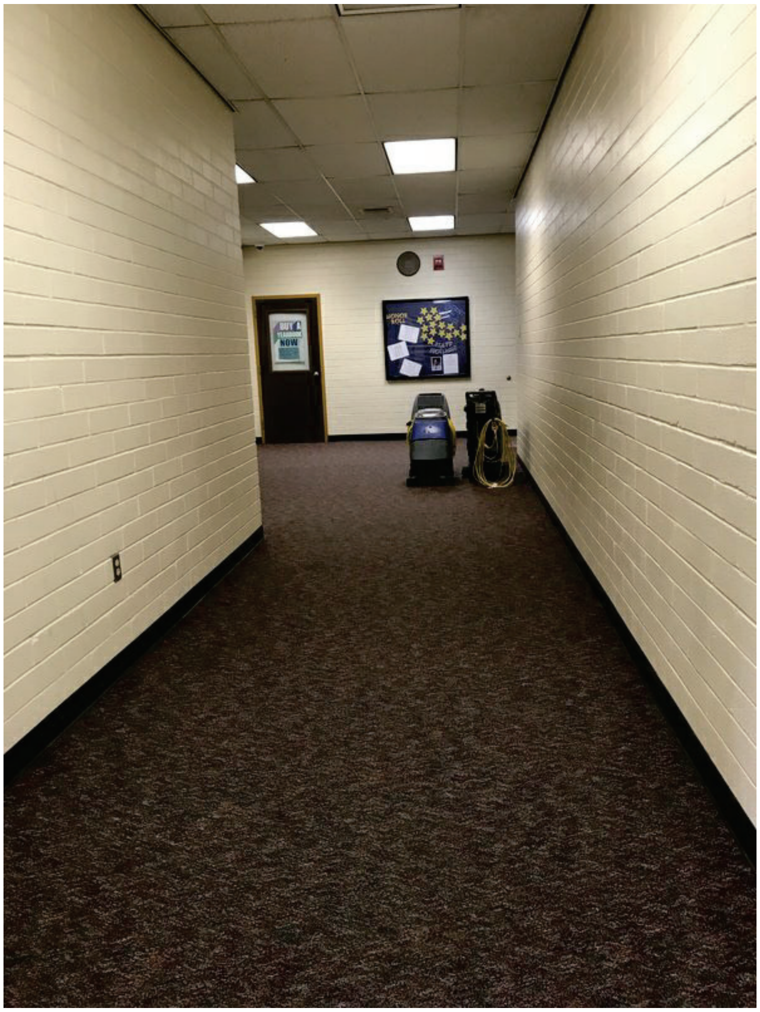


Figure 1-8. Naches Valley HS Classroom Bldg hallway (cmu construction)

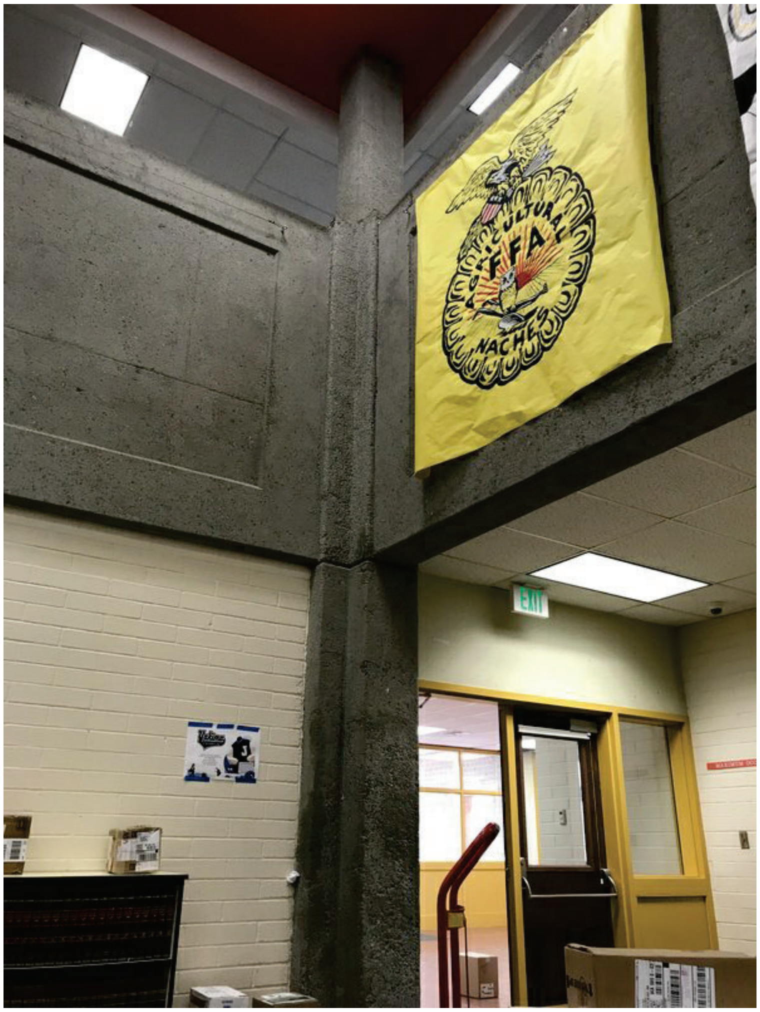


Figure 1-9. Two story construction - concrete beam supported on concrete column

Figure 1-10. Classroom building mechanical space

Naches Valley, Naches Valley High School, Main Building

17-2 Collapse Prevention Basic Configuration Checklist

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

Low Seismicity

Building System - General

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Load Path	The structure contains 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. (Tier 2: Sec. 5.4.1.1; Commentary: Sec. A.2.1.10)	X				The existing structural drawings indicate well designed and detailed connections between the structural elements.
Adjacent Buildings	The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity. (Tier 2: Sec. 5.4.1.2; Commentary: Sec. A.2.1.2)			X		No seismic joint at intersection with adjacent gym constructed with precast panels. Main building masonry walls are doweled into the intersecting gym precast walls with #4 x 24-inch threaded rod and expansion bolt insert per detail 8/S5.
Mezzanines	Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Tier 2: Sec. 5.4.1.3; Commentary: Sec. A.2.1.3)			X		No interior mezzanines.

Building System - Building Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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. (Tier 2: Sec. 5.4.2.1; Commentary: Sec. A.2.2.2)	X				No weak story identified.
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. (Tier 2: Sec. 5.4.2.2; Commentary: Sec. A.2.2.3)	X				No soft story identified.

Vertical Irregularities	All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Tier 2: Sec. 5.4.2.3; Commentary: Sec. A.2.2.4)	X				The vertical elements are either continuous to the foundation or they are one-story at the first level.
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. (Tier 2: Sec. 5.4.2.4; Commentary: Sec. A.2.2.5)	X				The existing drawings show this to be a very well designed and detailed structure. The two-story section of the building is close to square and the adjacent one-story sections are well detailed.
Mass	There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 5.4.2.5; Commentary: Sec. A.2.2.6)	X				There is a two-story building section adjacent to a tall one-story section (they share the same roof elevation) but they are well detailed and connected.
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. (Tier 2: Sec. 5.4.2.6; Commentary: Sec. A.2.2.7)	X				The building has flexible diaphragms and a generous layout of shear walls so torsion should not be an issue.

Moderate Seismicity **(Complete the Following Items in Addition to the Items for Low Seismicity)**

Geologic Site Hazards

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Liquefaction	Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.1)				X	The liquefaction potential of site soils is unknown at this time given available information. Very low to low liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.2)				X	Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure.

Surface Fault Rupture	Surface fault rupture and surface displacement at the building site are not anticipated. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.3)				X	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.

High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

Foundation Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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. (Tier 2: Sec. 5.4.3.3; Commentary: Sec. A.6.2.1)	X				Base/height > 3 which is much greater than 0.6Sa = 0.35.
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. (Tier 2: Sec. 5.4.3.4; Commentary: Sec. A.6.2.2)	X				Soil Site Class D and the footings are restrained by slabs.

17-34 Collapse Prevention Structural Checklist for Building Types RM1 and RM2

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

Low and Moderate Seismicity

Seismic-Force-Resisting System

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Redundancy	The number of lines of shear walls in each principal direction is greater than or equal to 2. (Tier 2: Sec. 5.5.1.1; Commentary: Sec. A.3.2.1.1)	X				The flexible diaphragm will distribute the loads to the many shear walls on a tributary area basis.
Shear Stress Check	The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 70 lb/in.2 (0.48 MPa). (Tier 2: Sec. 5.5.3.1.1; Commentary: Sec. A.3.2.4.1)	X				The ASCE Quick check of the shear stress in the reinforced masonry shear walls indicated compliance.
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. (1220 mm), and all vertical bars extend to the top of the walls. (Tier 2: Sec. 5.5.3.1.3; Commentary: Sec. A.3.2.4.2)	X				According to the structural drawings, the wall reinforcement complies.

Stiff Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Topping Slab	Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (Tier 2: Sec. 5.6.4; Commentary: Sec. A.4.5.1)			X		No precast concrete diaphragm elements.

Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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 strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. (Tier 2: Sec. 5.7.1.1; Commentary: Sec. A.5.1.1)	X				Existing connection capacity unknown but the available drawings indicated a well-designed and detailed building. Further analysis of anchorage capacity suggested.

Wood Ledgers	The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 5.7.1.3; Commentary: Sec. A.5.1.2)	X				Most details have ties. Warrants further study.
Transfer to Shear Walls	Diaphragms are connected for transfer of seismic forces to the shear walls. (Tier 2: Sec. 5.7.2; Commentary: Sec. A.5.2.1)	X				Existing connection capacity unknown but the available drawings indicated a well-designed and detailed building.
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. (Tier 2: Sec. 5.7.2; Commentary: Sec. A.5.2.)			X		No precast concrete diaphragm elements.
Foundation Dowels	Wall reinforcement is doweled into the foundation. (Tier 2: Sec. 5.7.3.4; Commentary: Sec. A.5.3.5)	X				The available drawings indicated a well-designed and detailed building with wall dowels into the foundations.
Girder-Column Connection	There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 5.7.4.1; Commentary: Sec. A.5.4.1)	X				Exterior precast concrete beams are connected to concrete columns with #11 dowels grouted into the columns (detail 1/S6). Interior precast concrete beams (at library space) are slotted into the supporting columns (Detail 8 & 9/S23). Precast concrete beams supported on masonry walls are fastened with dowels. These details bear further study because they may not meet code requirements even though they are well detailed.

High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

Stiff Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Openings at Shear Walls	Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.4)	X				With the exception of stairs and elevators, the only diaphragm opening is the large two-story library space which is well tied into the diaphragm.

Openings at Exterior Masonry Shear Walls	Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.6)	X				With the exception of stairs and elevators, the only diaphragm opening is the large two-story library space which is well tied into the diaphragm and is not adjacent to exterior shear walls.

Flexible Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Cross Ties	There are continuous cross ties between diaphragm chords. (Tier 2: Sec. 5.6.1.2; Commentary: Sec. A.4.1.2)		X			Building is well detailed including diaphragm nailing plans, but continuous cross ties are not detailed which is not surprising due to the 1979 date of construction. Additional straps could be added as needed, additional investigation required.
Openings at Shear Walls	Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.4)	X				With the exception of stairs and elevators, the only diaphragm opening is the large two-story library space which is well tied into the diaphragm.
Openings at Exterior Masonry Shear Walls	Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.6)	X				With the exception of stairs and elevators, the only diaphragm opening is the large two-story library space which is well tied into the diaphragm and is not adjacent to exterior shear walls.
Straight Sheathing	All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.1)			X		No straight sheathed diaphragms.
Spans	All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.2)	X				Wood unblocked diaphragms comply.
Diagonally Sheathed and Unblocked Diaphragms	All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4 to-1. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.3)	X				Roof diaphragm nailing plan and schedule provided on the structural drawings. Roof diaphragm is unblocked, but aspect ratios are less than 4:1. Floor framing diaphragm is blocked.

Other Diaphragms	Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 5.6.5; Commentary: Sec. A.4.7.1)	X				Wood frame roof and floor diaphragms.

Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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. (3 mm) before engagement of the anchors. (Tier 2: Sec. 5.7.1.2; Commentary: Sec. A.5.1.4)	X				Structural drawings indicate construction is well detailed, anchorage is assumed compliant.

Naches Valley, Naches Valley High School, Main Building

17-38 Nonstructural Checklist

Notes:
C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.
Performance Level: HR = Hazards Reduced, LS = Life Safety, and PR = Position Retention.
Level of Seismicity: L = Low, M = Moderate, and H = High

Life Safety Systems

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping is anchored and braced in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.1)		X			No available record drawing information on fire suppression piping and unable to verify during site investigation. Based on year of construction (1979) of the building, it is assumed that seismic bracing for fire suppression piping does not comply with NFPA 13. Further investigation may be appropriate to mitigate seismic risk.
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping has flexible couplings in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.2)		X			No available record drawing information on fire suppression piping and unable to verify during site investigation. Based on age of the building, it is assumed the flexible couplings on the fire suppression piping do not comply with NFPA 13. Flexible coupling for fire suppression piping may be appropriate to mitigate seismic risk.

LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Equipment used to power or control Life Safety systems is anchored or braced. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.1)				X	Available record drawings do not have information on anchorage or bracing for emergency power equipment and could not verify during site investigation. Based on age of the building, emergency power equipment is either nonexistent or noncompliant. Evaluation of emergency power equipment may be appropriate to mitigate seismic risk.
LSS-4 Stair and Smoke Ducts. HR-not required; LS-LMH; PR-LMH.	Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.1)			X		No enclosed stairs.
LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.3)				X	No available record drawing information on sprinkler head clearance and unable to verify during site investigation. Further evaluation may be appropriate to mitigate seismic risk.
LSS-6 Emergency Lighting. HR-not required; LS-not required; PR-LMH	Emergency and egress lighting equipment is anchored or braced. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.1)			X		Not required for Life Safety Performance Level

Hazardous Materials

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
HM-1 Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH.	Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.2)			X		Did not observe equipment containing hazardous materials mounted on vibration isolators. Further investigation may be appropriate to mitigate seismic risk.
HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 13.8.3; Commentary: Sec. A.7.15.1)				X	Unknown whether the building has hazardous materials. Further investigation may be appropriate to mitigate seismic risk.

HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Did not observe any piping or ductwork conveying hazardous materials.
HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	Piping containing hazardous material, including natural gas, has shutoff valves or other devices to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.3)				X	It is unknown if there are shutoff valves for piping containing hazardous materials. Further investigation may be appropriate to mitigate seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	Hazardous material ductwork and piping, including natural gas piping, have flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.15.4)				X	Did not observe flexible couplings. Further investigation may be apprpopriate to mitigate seismic risk.
HM-6 Piping or Ducts Crossing Seismic Joints. HR-MH; LS-MH; PR-MH.	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. (Tier 2: Sec. 13.7.3, 13.7.5, 13.7.6; Commentary: Sec. A.7.13.6)			X		Building has no seismic joints.

Partitions

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
P-1 Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft (3.0 m) in Low or Moderate Seismicity, or at most 6 ft (1.8 m) in High Seismicity. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.1)			X		There are no URM partitions in the building.
P-2 Heavy Partitions Supported by Ceilings. HR-LMH; LS-LMH; PR-LMH.	The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)	X				Did not observe, but drawings indicate masonry partitions are reinforced and braced. (Diagonal bracing provided at 12 ft on center max per detail 6/S7, existing drawings)
P-3 Drift. HR-not required; LS-MH; PR-MH.	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. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.2)			X		There were no rigid cementitious partitions observed in building.
P-4 Light Partitions Supported by Ceilings. HR-not required; LS-not required; PR-MH.	The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)			X		Not required for life safety performance level.

P-5 Structural Separations. HR-not required; LS-not required; PR-MH.	Partitions that cross structural separations have seismic or control joints. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.3)			X		Not required for life safety performance level.
P-6 Tops. HR-not required; LS-not required; PR-MH.	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 (1.8 m). (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.4)			X		Not required for Life Safety Performance Level

Ceilings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
C-1 Suspended Lath and Plaster. HR-H; LS-MH; PR-LMH.	Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft2 (1.1 m2) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		No suspended lath and plaster ceilings observed.
C-2 Suspended Gypsum Board. HR-not required; LS-MH; PR-LMH.	Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft2 (1.1 m2) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		There are no suspended gypsum board ceilings.
C-3 Integrated Ceilings. HR-not required; LS-not required; PR-MH.	Integrated suspended ceilings with continuous areas greater than 144 ft2 (13.4 m2) and ceilings of smaller areas that are not surrounded by restraining partitions are laterally restrained at a spacing no greater than 12 ft (3.6 m) 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. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.2)			X		Not required for life safety performance level.
C-4 Edge Clearance. HR-not required; LS-not required; PR-MH.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft2 (13.4 m2) have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in. (13 mm); in High Seismicity, 3/4 in. (19 mm). (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.4)			X		Not required for life safety performance level.
C-5 Continuity Across Structure Joints. HR-not required; LS-not required; PR-MH.	The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.5)			X		Not required for life safety performance level.
C-6 Edge Support. HR-not required; LS-not required; PR-H.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft2 (13.4 m2) are supported by closure angles or channels not less than 2 in. (51 mm) wide. (Tier 2: Sec. 13.6.4 ; Commentary: Sec. A.7.2.6)			X		Not required for Life Safety Performance Level

C-7 Seismic Joints. HR-not required; LS-not required; PR-H.	Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2,500 ft2 (232.3 m2) and has a ratio of long-to-short dimension no more than 4-to-1. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.7)			X		Not required for life safety performance level.

Light Fixtures

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	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. (Tier 2: Sec. 13.6.4, 13.7.9; Commentary: Sec. A.7.3.2)				X	It appears the light fixtures are supported by the ceiling grid. Unknown what supports or bracing may be hidden in the ceiling space. Further investigation may be appropriate to mitigate seismic risk.
LF-2 Pendant Supports. HR-not required; LS-not required; PR-H.	Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft. Unbraced suspended fixtures are free to allow a 360-degree range of motion at an angle not less than 45 degrees from horizontal without contacting adjacent components. Alternatively, if rigidly supported and/or braced, they are free to move with the structure to which they are attached without damaging adjoining components. Additionally, the connection to the structure is capable of accommodating the movement without failure. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.3)			X		Not required for life safety performance level.
LF-3 Lens Covers. HR-not required; LS-not required; PR-H.	Lens covers on light fixtures are attached with safety devices. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.4)			X		Not required for Life Safety Performance Level

Cladding and Glazing

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CG-1 Cladding Anchors. HR-MH; LS-MH; PR-MH.	Cladding components weighing more than 10 lb/ft2 (0.48 kN/m2) are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft (1.8 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft (1.2 m) (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.1)			X		The building does not have any exterior cladding components.

CG-2 Cladding Isolation. HR-not required; LS-MH; PR-MH.	For steel or concrete moment-frame buildings, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes 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, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.3)			X		The building is not a steel or concrete moment frame building.
CG-3 Multi-Story Panels. HR-MH; LS-MH; PR-MH.	For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes 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, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.4)			X		The building does not have any exterior cladding components.
CG-4 Threaded Rods. HR-not required; LS-MH; PR-MH.	Threaded rods for panel connections detailed to accommodate drift by bending of the rod have a length-to-diameter ratio greater than 0.06 times the story height in inches for Life Safety in Moderate Seismicity and 0.12 times the story height in inches for Life Safety in High Seismicity and Position Retention in any seismicity. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.9)			X		The building does not have any exterior cladding components.
CG-5 Panel Connections. HR-MH; LS-MH; PR-MH.	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. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.5)			X		The building does not have any exterior cladding components.
CG-6 Bearing Connections. HR-MH; LS-MH; PR-MH.	Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.6)			X		The building does not have any exterior cladding components.
CG-7 Inserts. HR-MH; LS-MH; PR-MH.	Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.7)			X		The building does not have any exterior cladding components.

CG-8 Overhead Glazing. HR-not required; LS-MH; PR-MH.	Glazing panes of any size in curtain walls and individual interior or exterior panes more than 16 ft2 (1.5 m2) in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (Tier 2: Sec. 13.6.1.5; Commentary: Sec. A.7.4.8)			X		The building does not have glazing panes/curtain walls.

Masonry Veneer

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
M-1 Ties. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft2 (0.25 m2), and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in. (914 mm); for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (610 mm). (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.1)	X				Details provided in available structural drawings.
M-2 Shelf Angles. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.2)				X	Details not provided in available structural drawings. Further investigation may be appropriate to mitigate seismic risk.
M-3 Weakened Planes. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.3)			X		Compliance expected because well detailed veneer anchorage details are provided in available structural drawings.
M-4 Unreinforced Masonry Backup. HR-LMH; LS-LMH; PR-LMH.	There is no unreinforced masonry backup. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.2)	X				Veneer backup is reinforced masonry or stud walls.
M-5 Stud Tracks. HR-not required; LS-MH; PR-MH.	For veneer with coldformed steel stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. (610 mm) on center. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.)			X		There is no cold formed steel stud backup for the masonry veneer.
M-6 Anchorage. HR-not required; LS-MH; PR-MH.	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. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.1)	X				Details provided in available structural drawings.
M-7 Weep Holes. HR-not required; LS-not required; PR-MH.	In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.6)			X		Not required for Life Safety Performance Level

M-8 Openings. HR-not required; LS-not required; PR-MH.	For veneer with cold-formed-steel stud backup, steel studs frame window and door openings. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.2)			X		Not required for Life Safety Performance Level

Parapets, Cornices, Ornamentation, and Appendages

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PCOA-1 URM Parapets or Cornices. HR-LMH; LS-LMH; PR-LMH.	Laterally unsupported unreinforced masonry parapets or cornices have height-tothickness 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. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.1)			X		No URM parapets or cornices.
PCOA-2 Canopies. HR-not required; LS-LMH; PR-LMH.	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 (3.0 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft (1.8 m). (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.2)	X				Existing drawings indicate framing above entries are well fastened to structure.
PCOA-3 Concrete Parapets. HR-H; LS-MH; PR-LMH.	Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.3)	X				Drawings indicate concrete parapet is reinforced. Dimensions not provided, but h/t does not appear to exceed 2.5.
PCOA-4 Appendages. HR-MH; LS-MH; PR-LMH.	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 (1.8 m). This evaluation statement item does not apply to parapets or cornices covered by other evaluation statements. (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.4)			X		No appendages.

Masonry Chimneys

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
MC-1 URM Chimneys. HR-LMH; LS-LMH; PR-LMH.	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. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.1)			X		There are no masonry chimneys.
MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.	Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.2)			X		There are no masonry chimneys.

Stairs

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
S-1 Stair Enclosures. HR-not required; LS-LMH; PR-LMH.	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. (Tier 2: Sec. 13.6.2, 13.6.8; Commentary: Sec. A.7.10.1)			X		Interior stairs are bounded by reinforced masonry walls. Exterior stair at main entry is bounded by reinforced concrete walls.
S-2 Stair Details. HR-not required; LS-LMH; PR-LMH.	The connection between the stairs and the structure does not rely on post-installed anchors in concrete or masonry, and the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.4.3.1 for moment-frame structures or 0.5 in. for all other structures without including any lateral stiffness contribution from the stairs. (Tier 2: Sec. 13.6.8; Commentary: Sec. A.7.10.2)	X				The interior stairs are detailed with dowels to the supporting masonry walls. The exterior concrete stair is detailed with dowels to the supporting concrete walls.

Contents and Furnishings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CF-1 Industrial Storage Racks. HR-LMH; LS-MH; PR-MH.	Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/RMI MH 16.1 as modified by ASCE 7, Chapter 15. (Tier 2: Sec. 13.8.1; Commentary: Sec. A.7.11.1)				X	Pictures and drawings do not indicate any industrial storage racks or pallet racks greater than 12 ft high. Further investigation may be appropriate to mitigate seismic risk.
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Contents more than 6 ft (1.8 m) 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. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.2)				X	Drawings do not include details showing anchorage at tall narrow contents. Did not observe if the book shelves in the library were anchored to the walls. District to confirm. Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint. Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint.

CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Equipment, stored items, or other contents weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level are braced or otherwise restrained. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.3)				X	Did not observe. District to confirm. Heavy items on upper shelves should be restrained by netting or cabling to avoid falling hazards.
CF-4 Access Floors. HR-not required; LS-not required; PR-MH.	Access floors more than 9 in. (229 mm) high are braced. (Tier 2: Sec. 13.6.10; Commentary: Sec. A.7.11.4)			X		Not required for life safety performance level.
CF-5 Equipment on Access Floors. HR-not required; LS-not required; PR-MH.	Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (Tier 2: Sec. 13.7.7 13.6.10; Commentary: Sec. A.7.11.5)			X		Not required for life safety performance level.
CF-6 Suspended Contents. HR-not required; LS-not required; PR-H.	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. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.6)			X		Not required for life safety performance level.

Mechanical and Electrical Equipment

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	Equipment weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level, and which is not in-line equipment, is braced. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.4)		X			Mechanical room was exceptionally clean and well kept. Some equipment in the mechanical rooms did not appear to be braced. Bracing required for equipment weighing more than 20 lb located 4 feet or more above the floor to mitigate seismic risk.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Equipment installed in line with a duct or piping system, with an operating weight more than 75 lb (34.0 kg), is supported and laterally braced independent of the duct or piping system. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.5)				X	Mechanical room was exceptionally clean and well kept. Unclear if in-line equipment was braced as required. Bracing for heavy in-line equipment may be appropriate to mitigate seismic risk.

ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	Equipment more than 6 ft (1.8 m) 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. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.6)	X				Mechanical room was exceptionally clean and well kept. Did not observe that any of the equipment falls into this category, district to confirm. Brace tops of tall narrow equipment taller than 6 feet to nearest backing wall, provide overturning base restraint.
ME-4 Mechanical Doors. HR-not required; LS-not required; PR-MH.	Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (Tier 2: Sec. 13.6.9; Commentary: Sec. A.7.12.7)			X		Not required for life safety performance level.
ME-5 Suspended Equipment. HR-not required; LS-not required; PR-H.	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. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.8)			X		Not required for life safety performance level.
ME-6 Vibration Isolators. HR-not required; LS-not required; PR-H.	Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.9)			X		Not required for life safety performance level.
ME-7 Heavy Equipment. HR-not required; LS-not required; PR-H.	Floor supported or platform-supported equipment weighing more than 400 lb (181.4 kg) is anchored to the structure. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.10)			X		Not required for life safety performance level.
ME-8 Electrical Equipment. HR-not required; LS-not required; PR-H.	Electrical equipment is laterally braced to the structure. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.11)			X		Not required for life safety performance level.
ME-9 Conduit Couplings. HR-not required; LS-not required; PR-H.	Conduit greater than 2.5 in. (64 mm) trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (Tier 2: Sec. 13.7.8; Commentary: Sec. A.7.12.12)			X		Not required for life safety performance level.

Piping

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PP-1 Flexible Couplings. HR-not required; LS-not required; PR-H.	Fluid and gas piping has flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.2)			X		Not required for life safety performance level.
PP-2 Fluid and Gas Piping. HR-not required; LS-not required; PR-H.	Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Not required for life safety performance level.

PP-3 C-Clamps. HR-not required; LS-not required; PR-H.	One-sided C-clamps that support piping larger than 2.5 in. (64 mm) in diameter are restrained. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.5)			X		Not required for Life Safety Performance Level
PP-4 Piping Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	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. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.6)			X		Not required for life safety performance level.

Ducts

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
D-1 Duct Bracing. HR-not required; LS-not required; PR-H.	Rectangular ductwork larger than 6 ft2 (0.56 m2) in cross-sectional area and round ducts larger than 28 in. (711 mm) in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft (9.2 m). The maximum spacing of longitudinal bracing does not exceed 60 ft (18.3 m). (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.2)			X		Not required for Life Safety Performance Level
D-2 Duct Support. HR-not required; LS-not required; PR-H.	Ducts are not supported by piping or electrical conduit. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.3)			X		Not required for Life Safety Performance Level
D-3 Ducts Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	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. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.4)			X		Not required for life safety performance level.

Elevators

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
EL-1 Retainer Guards. HR-not required; LS-H; PR-H.	Sheaves and drums have cable retainer guards. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.1)				X	Details not available. Further investigation may be appropriate to mitigate seismic risk.
EL-2 Retainer Plate. HR-not required; LS-H; PR-H.	A retainer plate is present at the top and bottom of both car and counterweight. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.2)				X	Details not available. Further investigation may be appropriate to mitigate seismic risk.
EL-3 Elevator Equipment. HR-not required; LS-not required; PR-H.	Equipment, piping, and other components that are part of the elevator system are anchored. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.3)			X		Not required for life safety performance level.

EL-4 Seismic Switch. HR-not required; LS-not required; PR-H.	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. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.4)			X		Not required for life safety performance level.
EL-5 Shaft Walls. HR-not required; LS-not required; PR-H.	Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.5)			X		Not required for Life Safety Performance Level
EL-6 Counterweight Rails. HR-not required; LS-not required; PR-H.	All counterweight rails and divider beams are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.6)			X		Not required for life safety performance level.
EL-7 Brackets. HR-not required; LS-not required; PR-H.	The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.7)			X		Not required for Life Safety Performance Level
EL-8 Spreader Bracket. HR-not required; LS-not required; PR-H.	Spreader brackets are not used to resist seismic forces. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.8)			X		Not required for life safety performance level.
EL-9 Go-Slow Elevators. HR-not required; LS-not required; PR-H.	The building has a go-slow elevator system. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.9)			X		Not required for life safety performance level.

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Appendix B: Concept-Level Seismic Upgrade Figures

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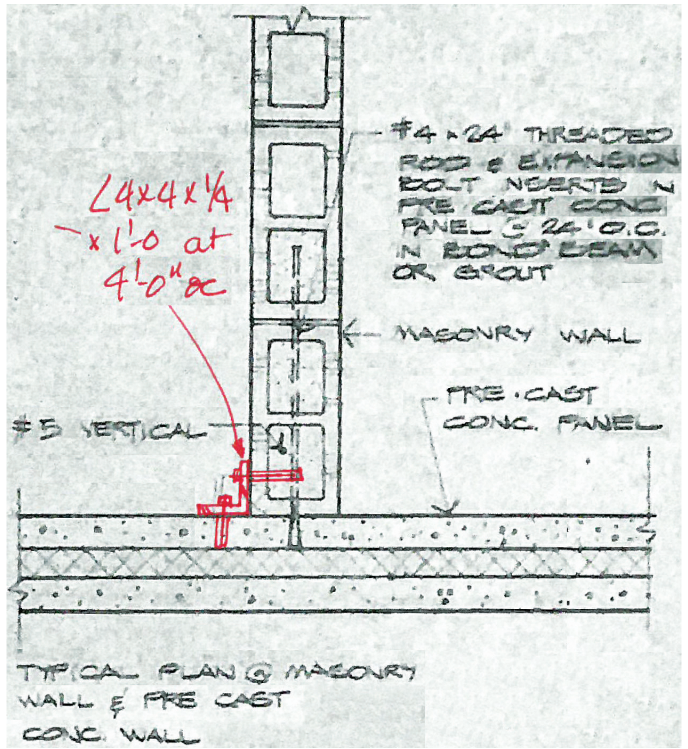
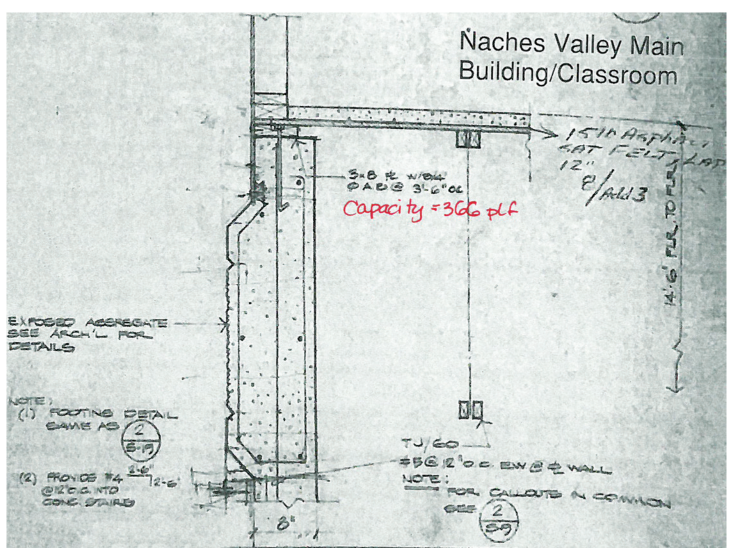


SECTION A
Plan View



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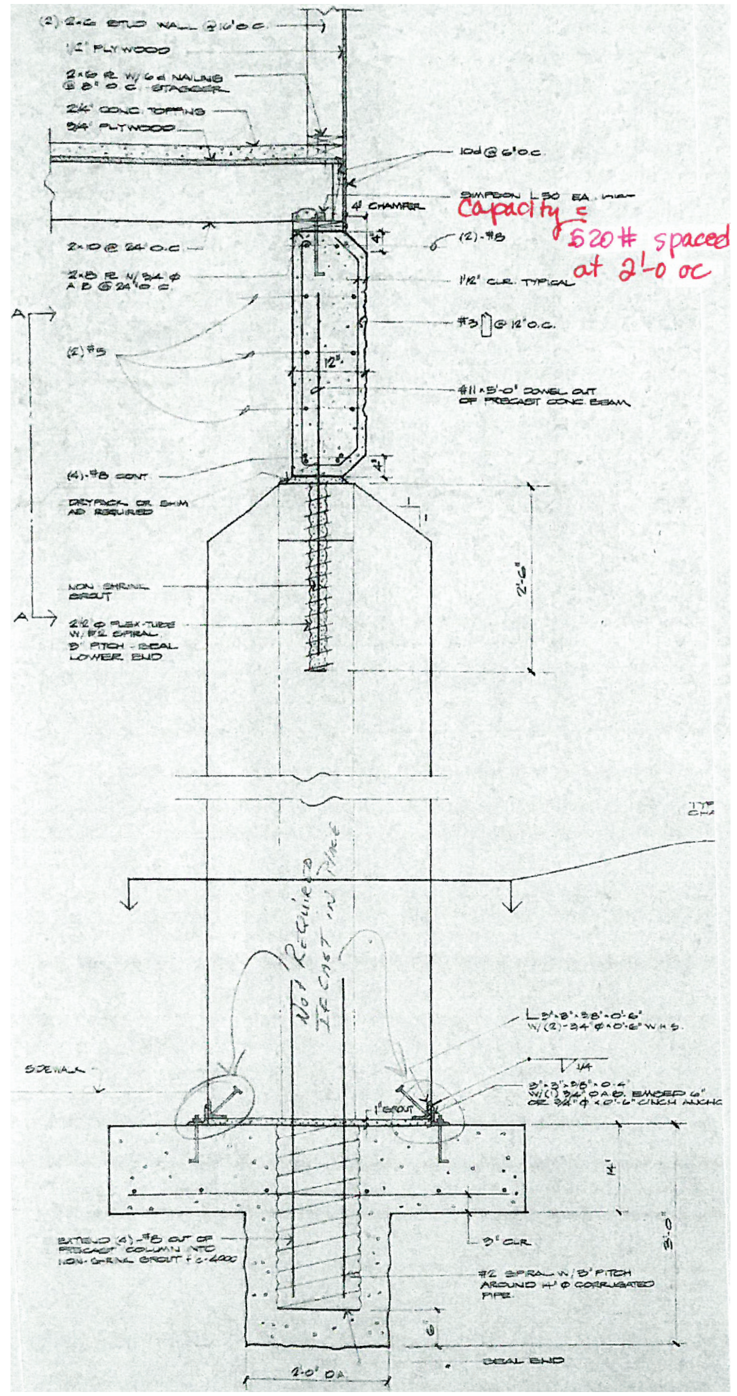

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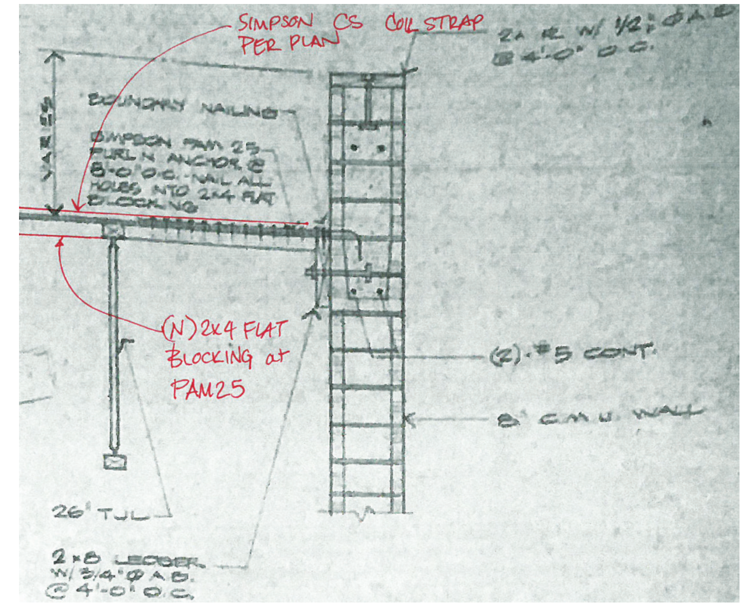

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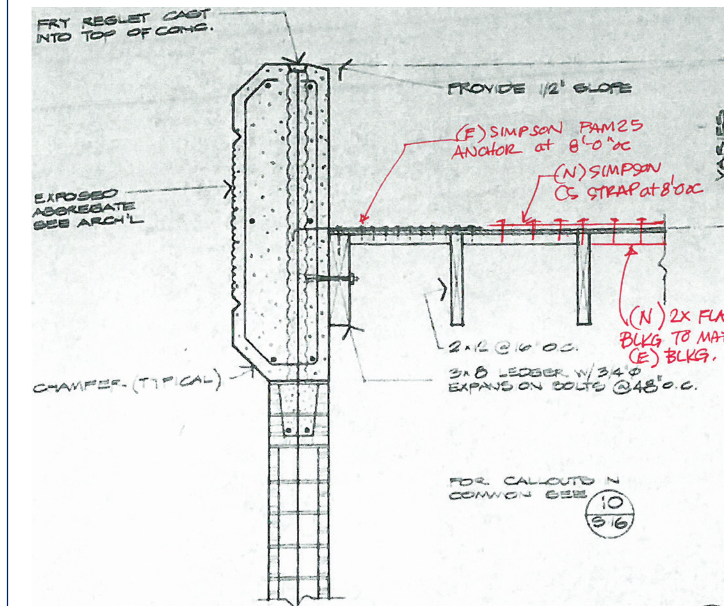

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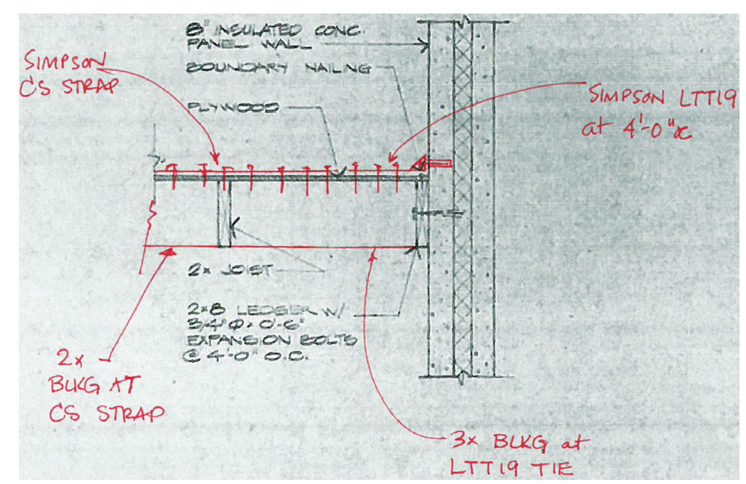

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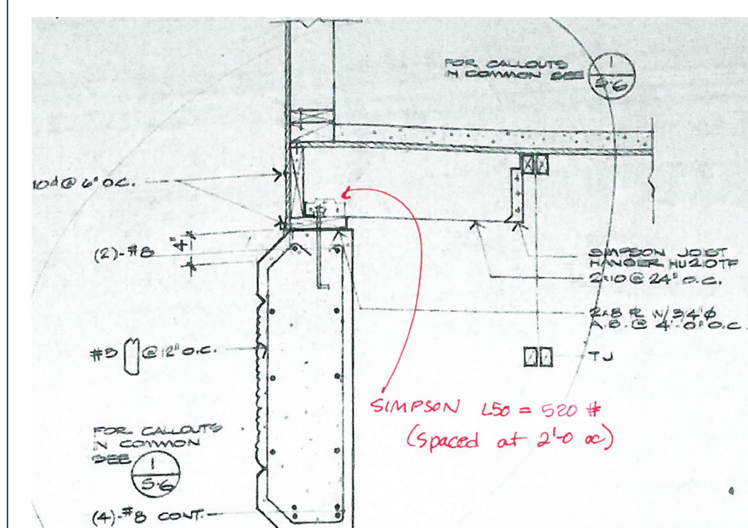

SECTION G

ReidMiddleton BergerABAM

Naches Valley High School Seismic Upgrades – Main Building
Washington State School Seismic Safety Assessments Project – Naches Valley School District – June 2019

Figure 1 - Conceptual Sections

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Appendix C: Opinion of Probable Construction Costs

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PRODIMS PROJECT MANAGEMENT SERVICES

520 Kirkland Way, Suite 301
Kirkland, WA 98033
tel: (425) 828-0500
fax: (425) 828-0700
www.prodims.com

Name:	**Wa State School Seismic Safety Assessment**
Second Name:	**Naches Valley High School**
Location:	**State of Washington**
Design Phase:	**ROM Cost Estimates**
Date of Estimate:	**April 8, 2019**
Date of Revision:	
Month of Cost Basis:	**1Q, 2019**

Naches Valley High School

Master Estimate Summary

Project Name		Total Estimated Construction Cost
Naches Valley High School	Structural Costs	$976,713
Naches Valley High School	Non-Structural Costs	$358,350
TOTAL ESTIMATED CONSTRUCTION COST		**$1,335,064**

Estimate Assumptions:

The ROM Construction Cost estimates are based on the Concept Design Report for the Project.
Construction Escalation is not included. Costs are current as of month of Cost Basis noted Above

Estimate Qualifications:

The ROM estimates are not be relied on solely for proforma development and financial decisions.
Further design work is required to determine construction budgets.
All Buildings Estimated to the 5' foot line for Utilities, All Sitework is estimated to go with any combination of the buildings and alternatives.
The ROM estimates do not include any Hazardous Material Abatement/Disposal.
For Construction Cost Markups they are additive, not cumulative. Percentages are added to the previous subtotal rather than the direct cost subtotal.
Owner Soft Costs are not included in the estimates. Soft costs can include design fees, sales tax, permits, owner's contingency and FF+E.
Estimated labor is based on an 8 hour per day shift 5 days a week. Accelerated schedule work of overtime has not been included.
Estimated labor is based on working on unoccupied facility without phased construction.
Estimate is based on a competitive public bid with at least 3 bona fide submitted and unrescinded general contractor bids.
Estimate is based on a competitive public bid with a minimum 6 week bidding schedule and no significant addendums within 2 weeks of bid opening.
State of Washington General Contractor/ Construction Manager (GC/CM) contracts typically raises construction costs. It is Not Included in this estimate.
Estimated construction cost is for the entire project. This estimate is not intended to be used for other projects.
Please consult the cost estimator for any modifications to this estimate. Unilaterally adding and deleting markups, scope of work, schedule, specifications, plans and bid forms could incorrectly restate the project construction cost.
Construction reserve contingency for change orders is not included in the estimate.
Sole source supply of materials and/ or installers typically results in a 40% to 100% premium on costs over open specifications.

PRODIMS
520 Kirkland Way, Suite 301
Kirkland, WA 98033
Phone: 425-828-0500 Fax: 425-828-0700
www.prodims.com

Structural Costs

Name: Wa State School Seismic Safety Assessment
Second Name: Naches Valley High School
Location: Naches, WA
Design Phase: ROM Cost Estimates
Date of Estimate: April 8, 2019
Date of Revision:
Month of Cost Basis: 4Q, 2018, 1Q, 2019

Areas	sqft
Building Area	47,500
Total Areas	47,500

Naches Valley High School

Construction Cost Estimate

Subtotal Direct Cost From the Estimate Detail Below $ 745,583

	Percentage of Previous Subtotal	Amount	Running Subtotal
Scope Contingency	10.0%	$ 74,558	$ 820,141
General Conditions	10.0%	$ 74,558	$ 894,699
Home Office Overhead	5.0%	$ 37,279	$ 931,979
Profit	6.0%	$ 44,735	$ 976,713
Escalation Not Included-Costs in 4Q, 2018 Dollars	0.0%	$ -	$ 976,713
Washington State Sales Tax	0.0%	$ -	$ 976,713

Total Markups Applied to the Direct Cost 31.00%
Markups are multiplied from each subtotal- They are not multiplied from the direct cost

		$/sqft
TOTAL ESTIMATED CONSTRUCTION COST--→	**$ 976,713**	**$ 20.56**
-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 781,371**	**$ 16.45**
+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 1,465,070**	**$ 30.84**

Please see the Master Summary for Assumptions and Qualifications for ROM Cost Estimates

Direct Cost of Construction

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	1 - Seismic Retrofit										
	Superstructure										
	Upper Floor and Roof Systems										
	Detail 8/S5										
	Tie CMU wall to Precast Wall - Allowance of Intersection Points	20	each	$ 552.50	$ 11,050.00	$ 297.50	$ 5,950.00	$ 51.00	$ 1,020.00	$ 901.00	$ 18,020.00
	Detail 4/S13										
	Add 2x4 Blocking and Coil Strap with Nails at Existing PAM25 Hardware at Second Floor	145	each	$ 150.50	$ 21,822.50	$ 64.50	$ 9,352.50	$ 12.90	$ 1,870.50	$ 227.90	$ 33,045.50
	Detail 3/S21										
	Add Simpson L50 Angle Clip with Nails	200	each	$ 14.08	$ 2,816.00	$ 7.92	$ 1,584.00	$ 1.32	$ 264.00	$ 23.32	$ 4,664.00
	Detail 9/S14										
	Add 3x8 Blocking, LTTI19 with Epoxy Anchor to Precast Wall and Coil Strap with Nails	43	each	$ 476.00	$ 20,468.00	$ 204.00	$ 8,772.00	$ 40.80	$ 1,754.40	$ 720.80	$ 30,994.40
	Roofing Systems										
	Remove Existing Roofing System	30,100	sqft	$ 2.02	$ 60,681.60	$ 0.08	$ 2,528.40	$ 0.13	$ 3,792.60	$ 2.23	$ 67,002.60
	Install New Roofing System - Including Roof Membrane, New Insulation, Coverboard and Flashing and Trim for a Complete System	30,100	sqft	$ 10.02	$ 301,511.70	$ 8.53	$ 256,843.30	$ 1.11	$ 33,501.30	$ 19.66	$ 591,856.30
	Subtotal of the Direct Cost of Construction			**Naches Valley High School**							**$ 745,583**

PRODIMS

520 Kirkland Way, Suite 301
Kirkland, WA 98033
Phone: 425-828-0500 Fax: 425-828-0700
www.prodims.com

Non-Structural Costs

Name: Wa State School Seismic Safety Assessment
Second Name: Naches Valley High School
Location: Naches, WA
Design Phase: ROM Cost Estimates
Date of Estimate: April 8, 2019
Date of Revision:
Month of Cost Basis: 4Q, 2018, 1Q, 2019

Areas	sqft
Building Area	47,500
Total Areas	47,500

Naches Valley High School

Construction Cost Estimate

Subtotal Direct Cost From the Estimate Detail Below $ 273,550

	Percentage of Previous Subtotal	Amount	Running Subtotal
Scope Contingency	10.0%	$ 27,355	$ 300,905
General Conditions	10.0%	$ 27,355	$ 328,260
Home Office Overhead	5.0%	$ 13,677	$ 341,937
Profit	6.0%	$ 16,413	$ 358,350
Escalation Not Included-Costs in 4Q, 2018 Dollars	0.0%	$ -	$ 358,350
Washington State Sales Tax	0.0%	$ -	$ 358,350

Total Markups Applied to the Direct Cost 31.00%
Markups are multiplied from each subtotal- They are not multiplied from the direct cost

		$/sqft
TOTAL ESTIMATED CONSTRUCTION COST--→	**$ 358,350**	**$ 7.54**
-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 286,680**	**$ 6.04**
+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 537,525**	**$ 11.32**

Please see the Master Summary for Assumptions and Qualifications for ROM Cost Estimates

Direct Cost of Construction

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	2- Non- Structural Demo/Restoration*										
	Interiors and M/E/P/FP systems										
	New Ceilings and Finishes for Installation of Seismic Work	47,500	sqft	$ 0.54	$ 25,878.54	$ 0.45	$ 21,173.35	$ 0.06	$ 2,823.11	$ 1.05	$ 49,875.00

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	Mechanical/Electrical/Fire Protection Systems	47,500	sqft	$ 2.44	$ 116,057.70	$ 2.00	$ 94,956.30	$ 0.27	$ 12,660.84	$ 4.71	$ 223,674.84
*Allows 30 percent of existing nonstructural systems M/E/P/FP require upgrades/replacement.											
Subtotal of the Direct Cost of Construction				**Naches Valley High School**							**$ 273,550**

Appendix D: Earthquake Performance Assessment Tool (EPAT) Worksheet

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Washington Schools Earthquake Performance Assessment Tool (EPAT)
MAIN PAGE

Full District Name	Naches Valley		
Point of Contact	John Blanchard		
Telephone	509-653-1529		
E-Mail	jblanchard@nvsd.org		
File Name	Naches Valley, Naches Valley High School, Main Building EPAT.xlsm	**File Date:**	7/6/2018

District	Naches Valley
Facility Name	Naches Valley High School
Building Part Name	Main Building

Earthquake Ground Motion (% g)		**Earthquake Hazards**	
20% in 50 year PGA	11.4%	**Site Class**	D
10% in 50 year PGA	17.0%	**Ground Shaking Hazard**	Moderate to High
2% in 50 year PGA	30.7%	**Liquefaction Potential**	Very Low to Low
Percentile S_s *Among all WA Campuses*	26%	**Combined Earthquake Hazard Level**	Moderate to High

Total Building Part Area (Square Feet)	**Building Evaluated By**	**Input Data by Person(s)**
47,500	DNR, Reid Middleton	Tim Green, Reid Middleton

The Earthquake Ground Motion and Earthquake Hazard Hazards data shown above are primarily for use and interpretation by engineers.

Refer to the EPAT User Guide for technical explanations of the Earthquake Ground Motion and the Earthquake Hazards information.

Washington Schools Earthquake Performance Assessment Tool (EPAT)
BUILDING DATA PAGE

Facility Name	Naches Valley High School
Building Name	Main Building
Building Use	Educational

Data Entry Item	User Entered Values	Default Values	Used for BCA
Seismic Data			
Decimal Latitude	46.736258	46.736258	46.736258
Decimal Longitude	-120.69469	-120.69469	-120.69469
Site Class (Soil/Rock Type)	D	D	D
Liquefaction Potential	Very Low to Low	Very Low to Low	Very Low to Low
Geographic Region for Seismic Zones	Eastern	Eastern	Eastern
Building Structural Data			
HAZUS Building Type***	RM1	Reinforced Masonry Bearing Walls w/ Wood or Metal Diaphragms	RM1
Number of Stories (Excluding Basement)***	2		2
Year Built***	1979		1979
Code for Building Design (if known)	UBC	**Use the Drop-Down menus to Select Data Entries for the Bright Green Shaded data cells.**	UBC
Design Code Year (if known)	1973		1973
Severe Vertical Irregularity***	No		No
Moderate Vertical Irregularity***	No		No
Plan (Horizontal) Irregularity***	No		No

***** Mandatory Data Entry**

Washington Schools Earthquake Performance Assessment Tool (EPAT)
RESULTS SUMMARY

District Name	Naches Valley	**Existing Building Life Safety Risk & Priority for Retrofit or Replacement**
School Name	Naches Valley High School	
Building Name	Main Building	Low-Moderate

Building Data

HAZUS Building Type	RM1	Reinforced Masonry Bearing Walls w/ Wood or Metal Diaphragms
Year Built	1979	These parameters determine the capacity of the existing building to withstand earthquake forces.
Building Design Code	1973 UBC	
Existing Building Code Level	Low-Pre	
Geographic Area	Eastern	
Severe Vertical Irregularity	No	Buildings with irregularities have greater earthquake damage than otherwise similar buildings that are regular.
Moderate Vertical Irregularity	No	
Plan Irregularity	No	

Seismic Data

Earthquake Ground Shaking Hazard Level	Moderate to High	Frequency and severity of earthquakes at this site
Percentile S_s Among WA K-12 Campuses	26%	Earthquake ground shaking hazard is higher than 26% of WA campuses.
Site Class (Soil or Rock Type)	D	Stiff Soil
Liquefaction Potential	Very Low to Low	Liquefaction increases the risk of major damage to a building
Combined Earthquake Hazard Level	Moderate to High	Earthquake ground shaking and liquefaction potential

Severe Earthquake Event (Design Basis Earthquake Ground Motion)[1]

Building State	**Building Damage Estimate**[2]	**Probability Building is not Repairable**[3]	**Life Safety**[4] **Risk Level**	**Most Likely Post-Earthquake Tagging**[5]
Existing Building	37%	35%	Low-Moderate	Red
Life Safety Retrofit Building	24%	19%	Low	Green/Yellow
Current Code Building	19%	14%	Low	Green/Yellow

1. 2/3rds of the 2% in 50 year ground motion
2. Percentage of building replacement value.
3. Probability building is in the Extensive or Complete damage states. For existing buildings, the probability that the building is not economically repairable may be higher: some buildings in the Moderate Damage state are also likely to be demolished.
4. Based on probability of Complete Damage State.
5. Most likely post-earthquake damage state per ATC-20.

Source for the Data Entered into the Tool

Building Evaluated By:	DNR, Reid Middleton
Person(s) Who Entered Data in EPAT:	Tim Green, Reid Middleton
User Overrides of Default Parameters:	Building Design Code Year, Latitude, Longitude, Site Class, Liquefaction, Geographic Region

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Appendix E: Naches Valley High School Existing Drawings

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Appendix F: FEMA E-74 Nonstructural Seismic Bracing Excerpts

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Life Safety Systems

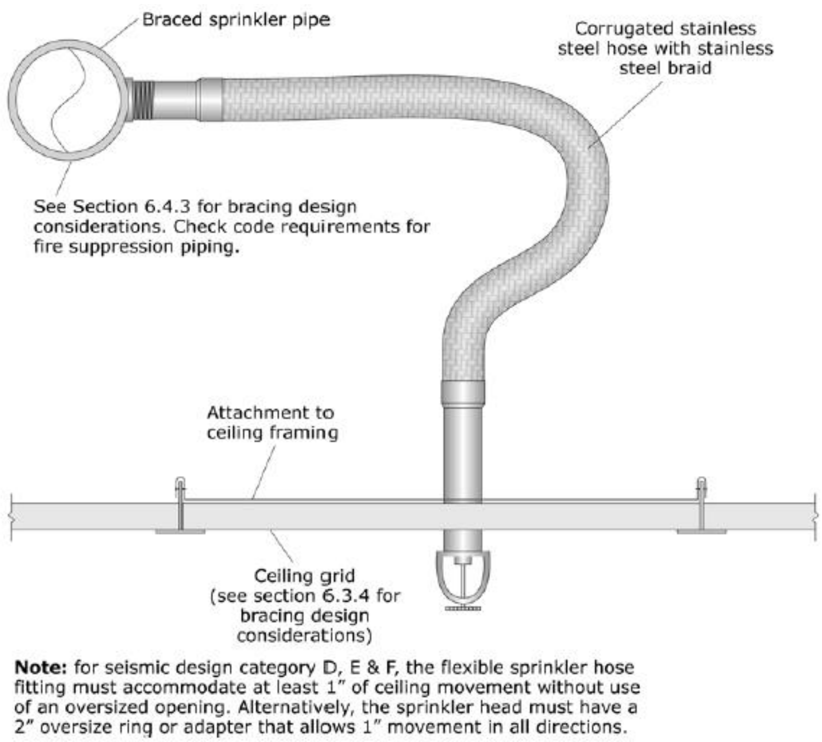


Figure G-1. Flexible Sprinkler Drop.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

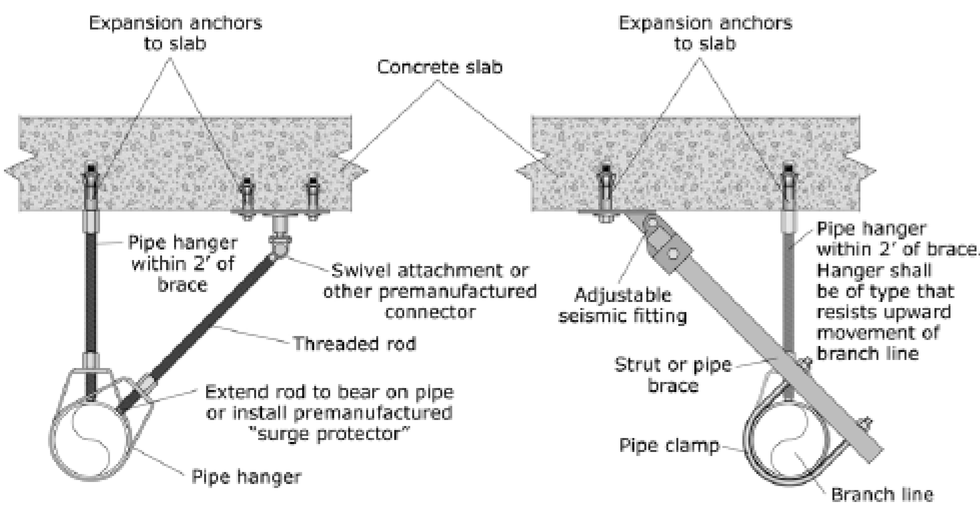


Figure G-2. End of Line Restraint.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Partitions

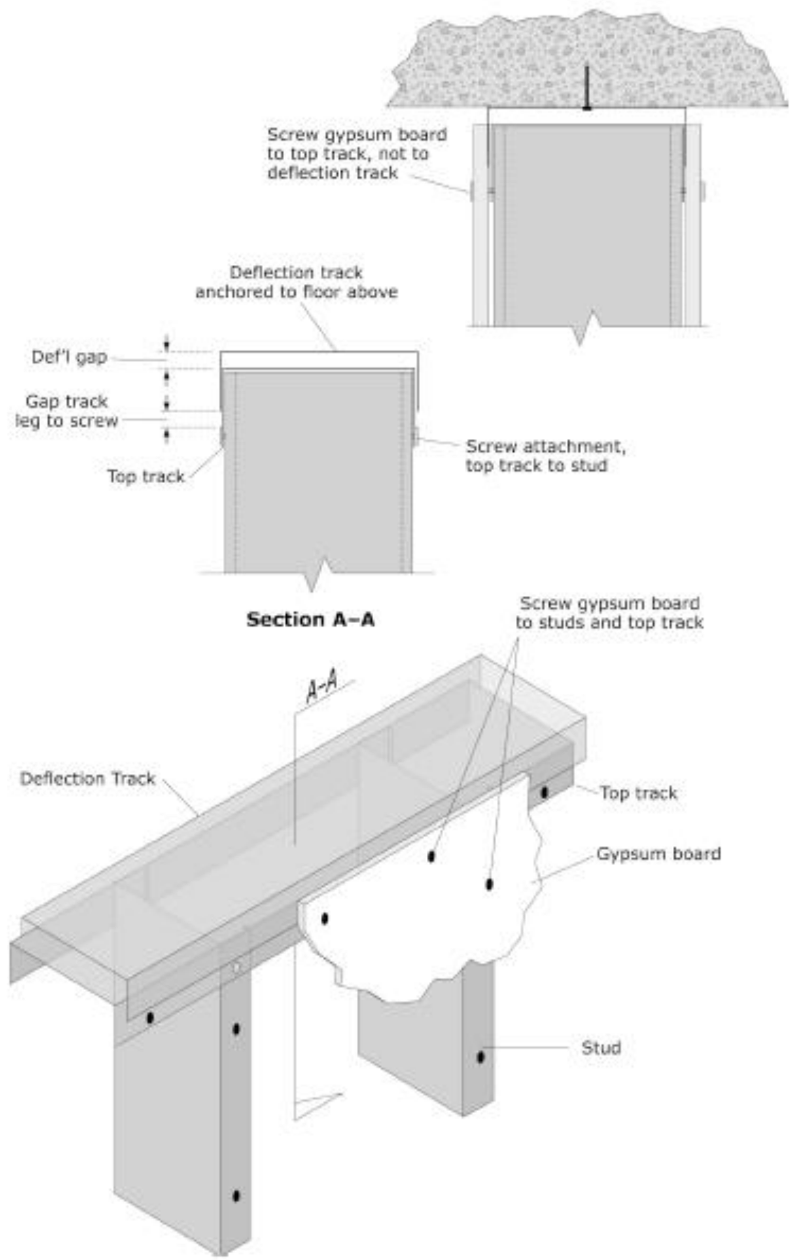


Figure G-3. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

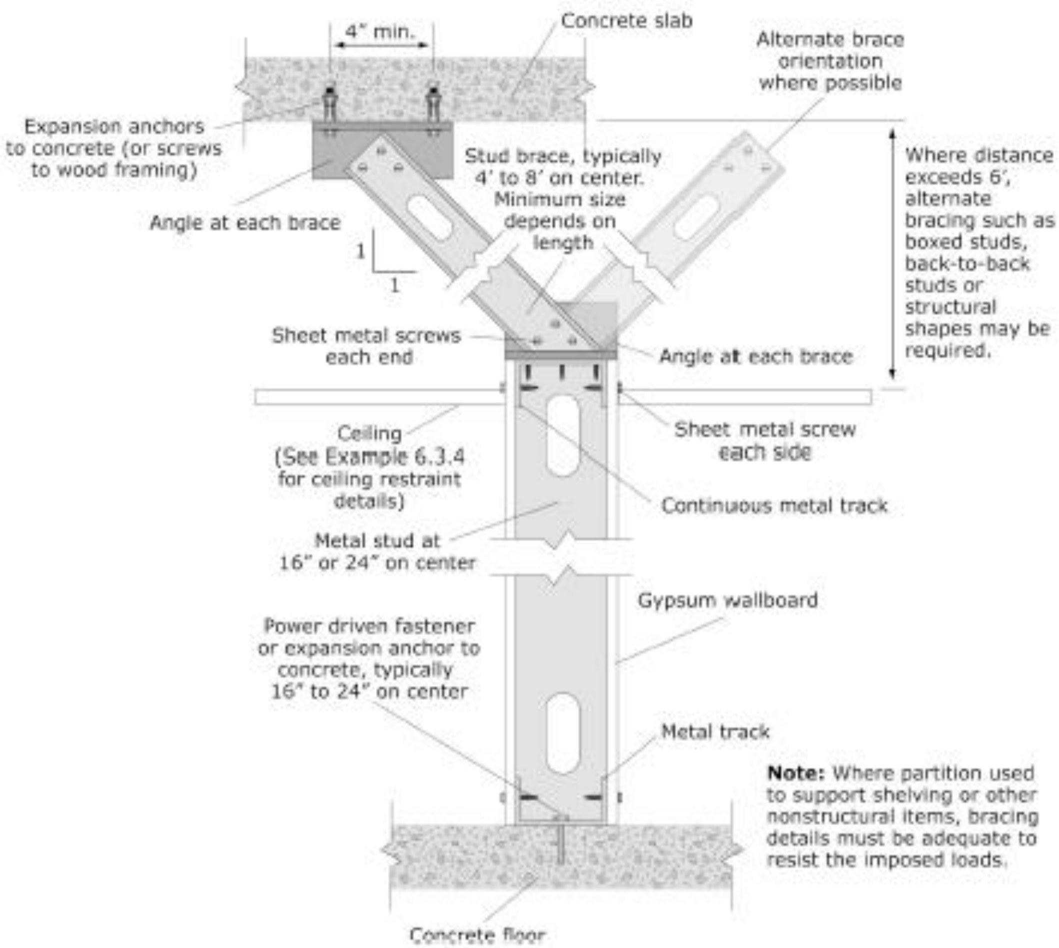


Figure G-4. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

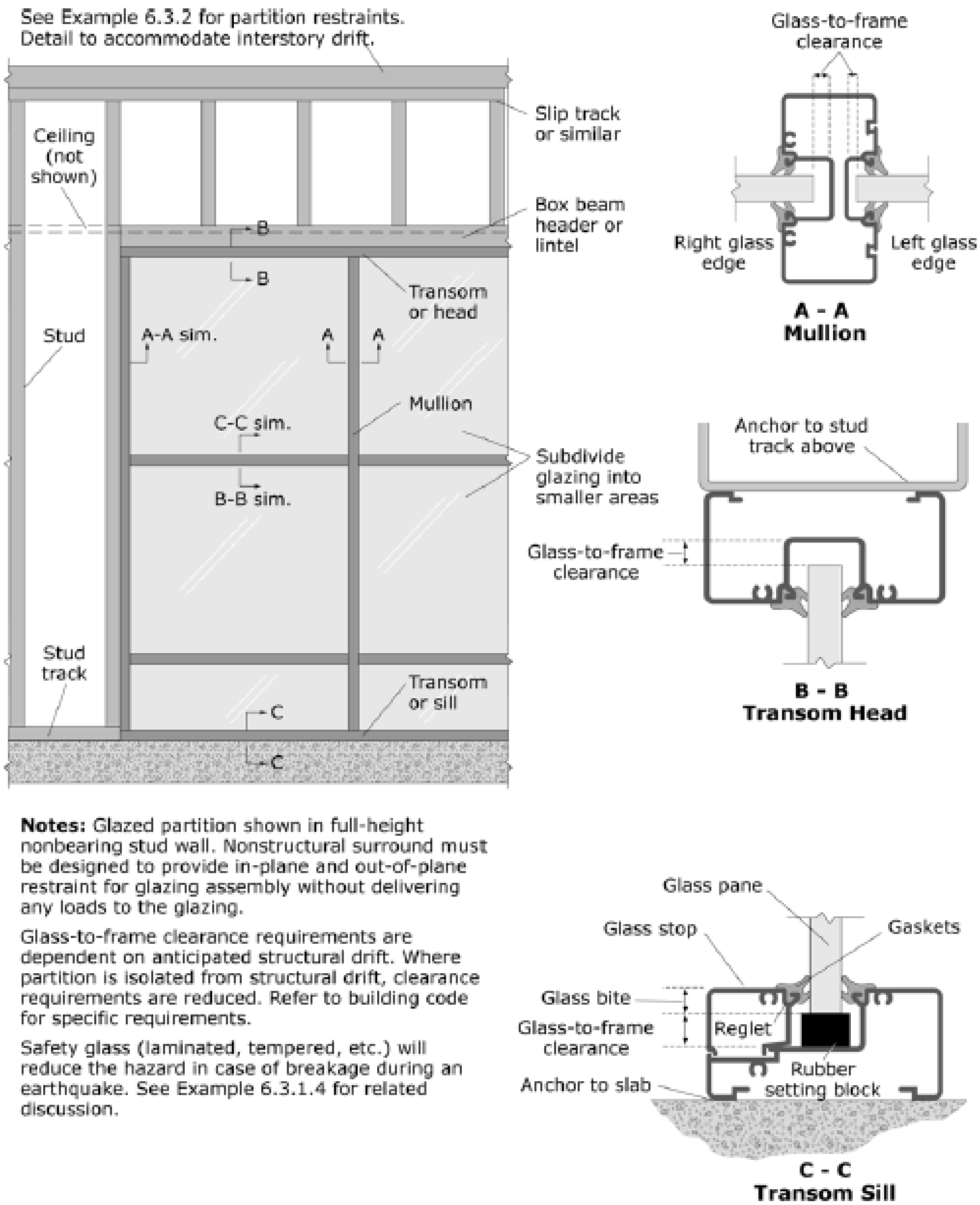


Figure G-5. Full-height Glazed Partition.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

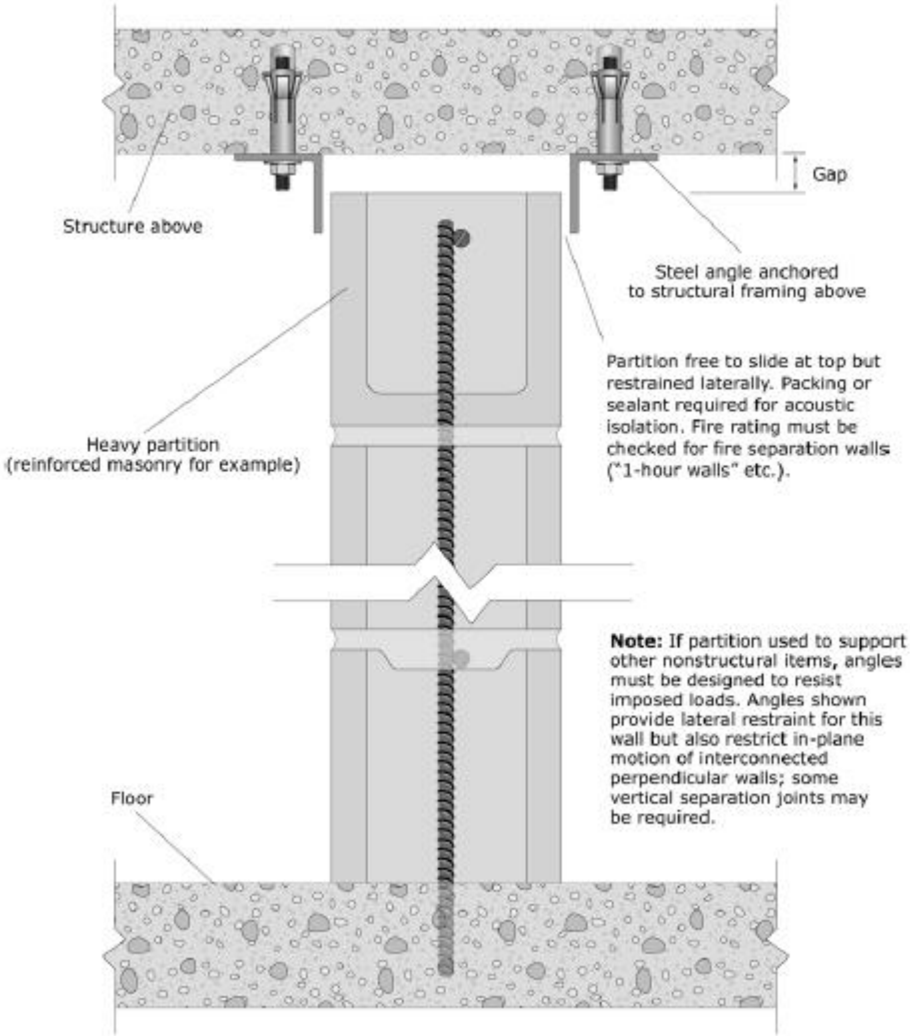


Figure G-6. Full-height Heavy Partition.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

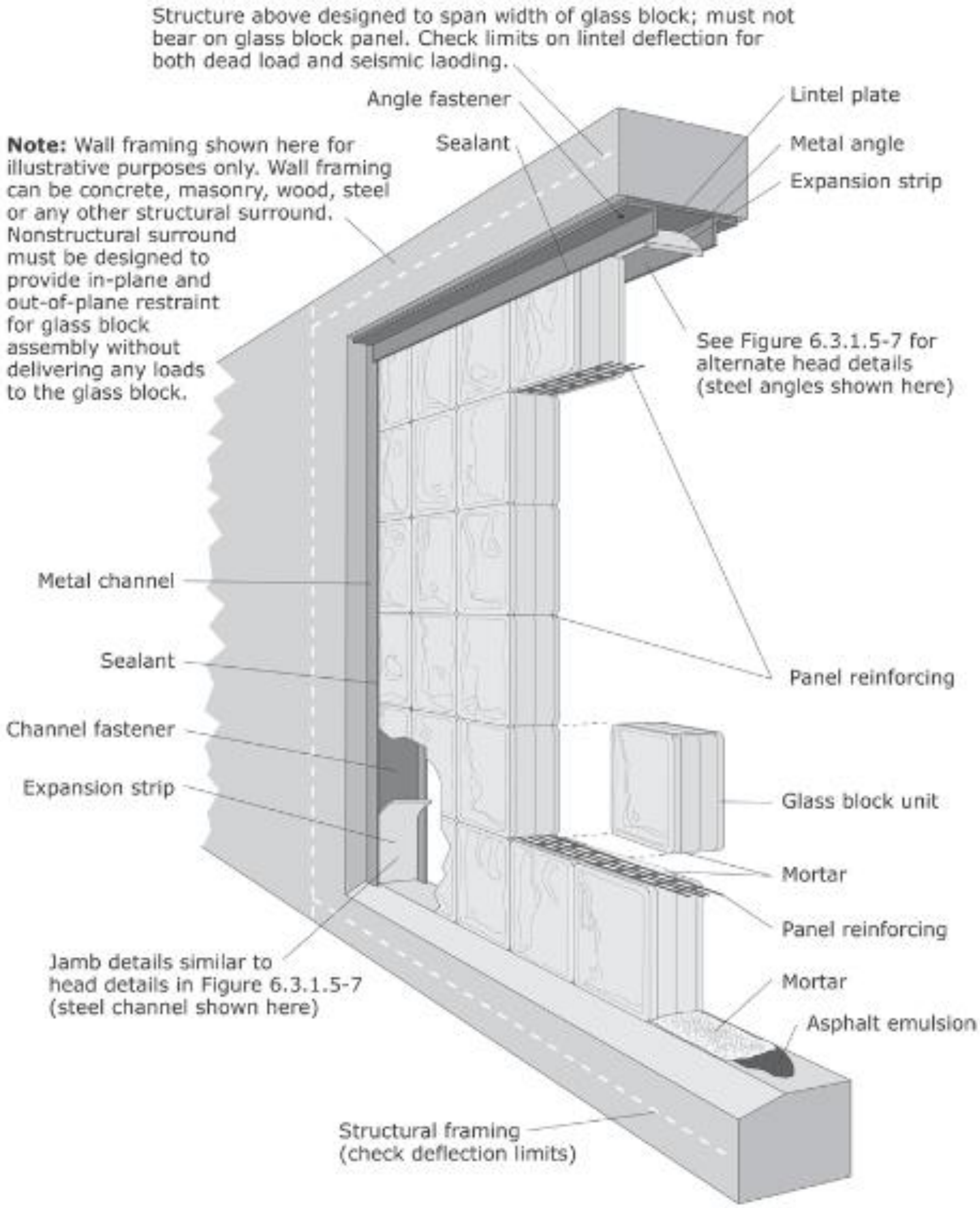


Figure G-7. Typical Glass Block Panel Details.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Ceilings

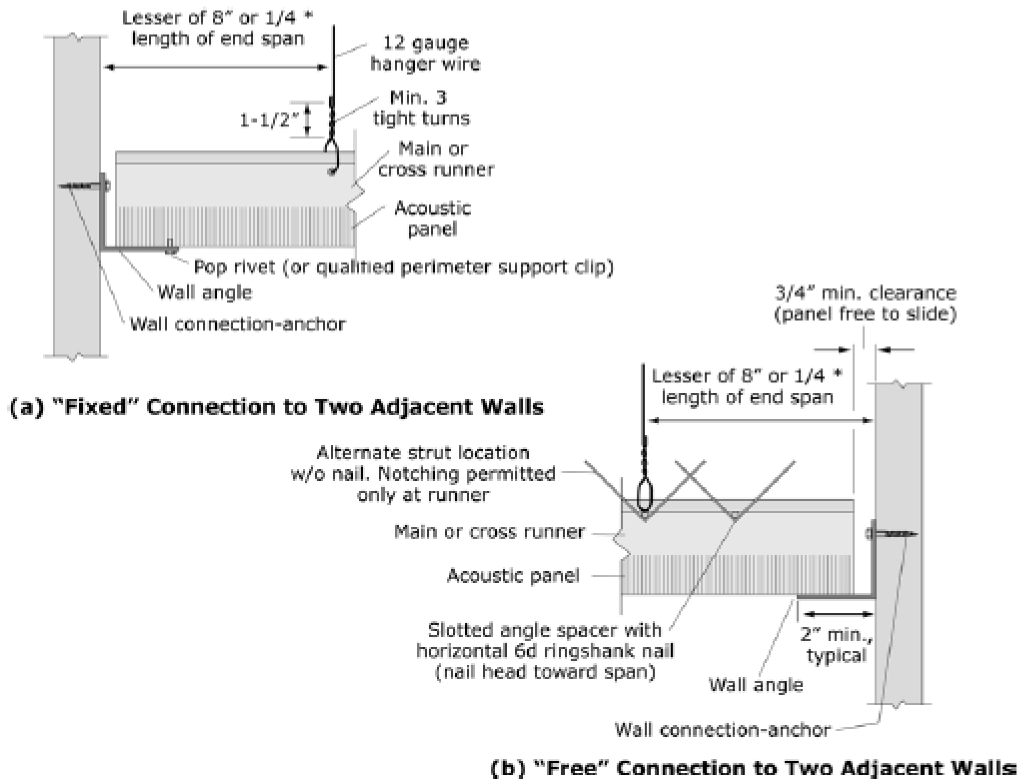
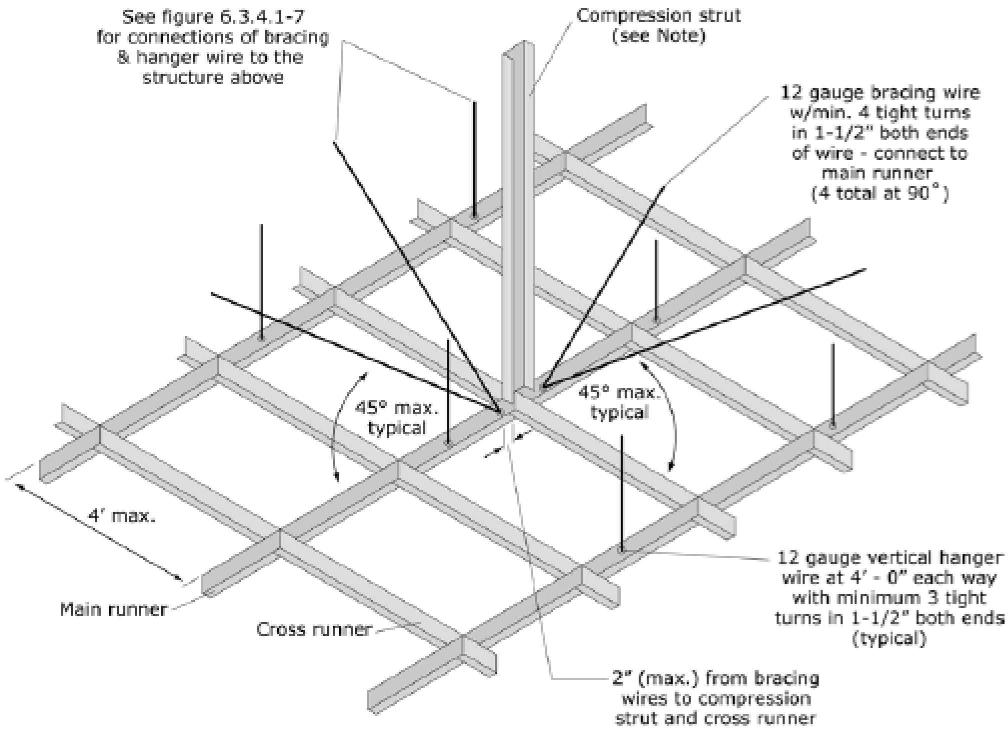


Figure G-8. Suspension System for Acoustic Lay-in Panel Ceilings – Edge Conditions.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Note: Compression strut shall not replace hanger wire. Compression strut consists of a steel section attached to main runner with 2 - #12 sheet metal screws and to structure with 2 - #12 screws to wood or 1/4" min. expansion anchor to structure. Size of strut is dependent on distance between ceiling and structure (l/r ≤ 200). A 1" diameter conduit can be used for up to 6', a 1-5/8" X 1-1/4" metal stud can be used for up to 10'

Per DSA IR 25-5, ceiling areas less than 144 sq. ft, or fire rated ceilings less than 96 sq. ft., surrounded by walls braced to the structure above do not require lateral bracing assemblies when they are attached to two adjacent walls. (ASTM E580 does not require lateral bracing assemblies for ceilings less than 1000 sq. ft.; see text.)

Figure G-9. Suspension System for Acoustic Lay-in Panel Ceilings – General Bracing Assembly.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

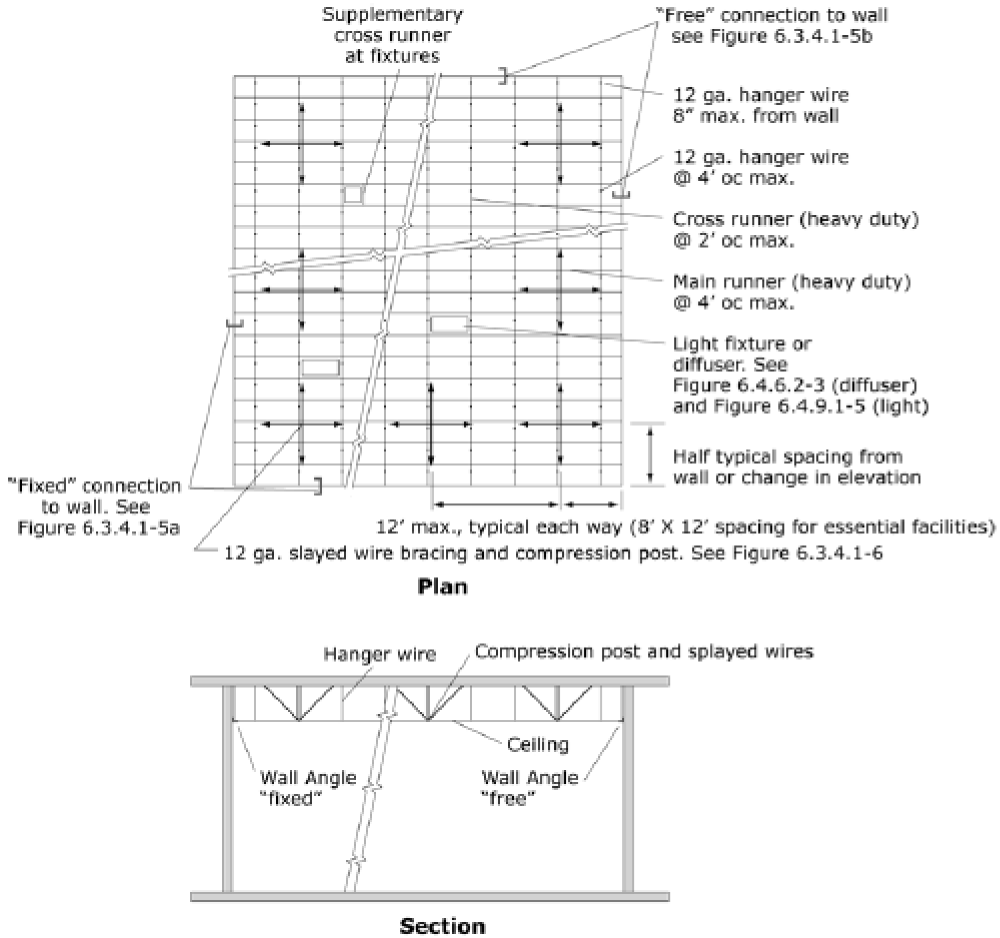


Figure G-10. Suspension System for Acoustic Lay-in Panel Ceilings – General Bracing Layout.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

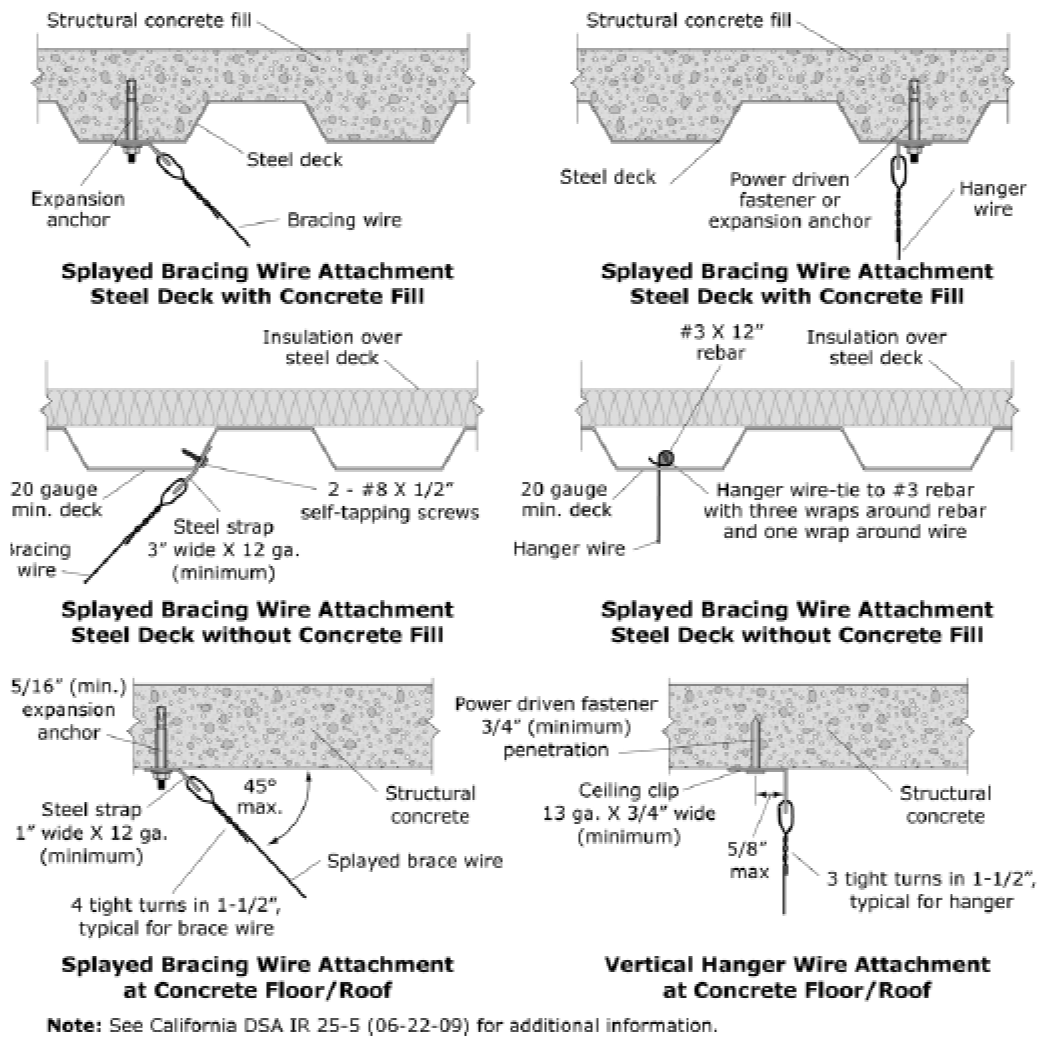
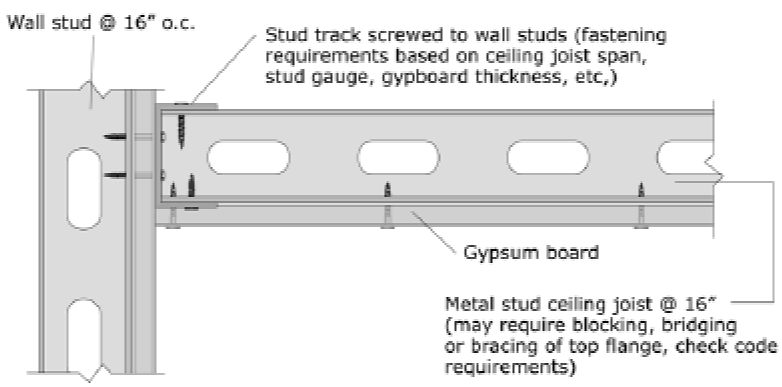
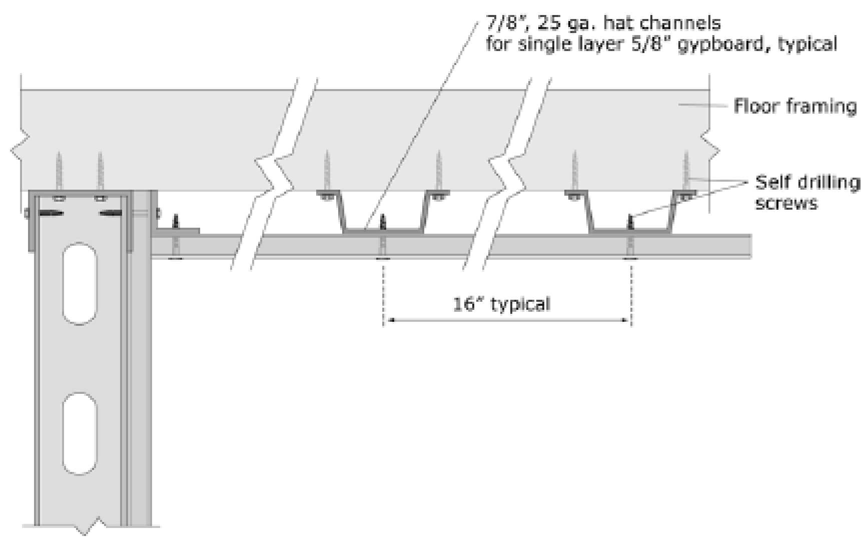


Figure G-11. Suspension System for Acoustic Lay-in Panel Ceilings – Overhead Attachment Details.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



a) Gypsum board attached directly to ceiling joists



b) Gypsum board attached directly to furring strips (hat channel or similar)

Note: Commonly used details shown; no special seismic details are required as long as furring and gypboard secured. Check for certified assemblies (UL listed, FM approved, etc.) if fire or sound rating required.

Figure G-12. Gypsum Board Ceiling Applied Directly to Structure.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

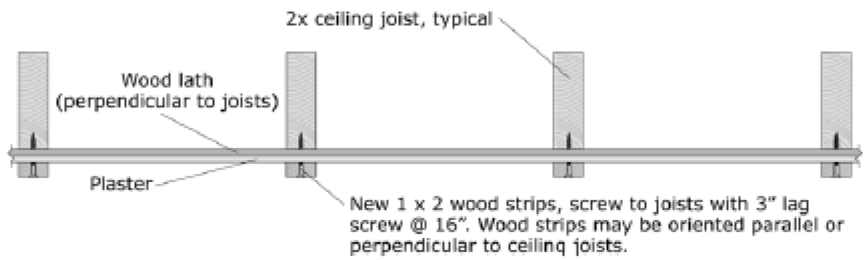


Figure G-13. Retrofit Detail for Existing Lath and Plaster.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

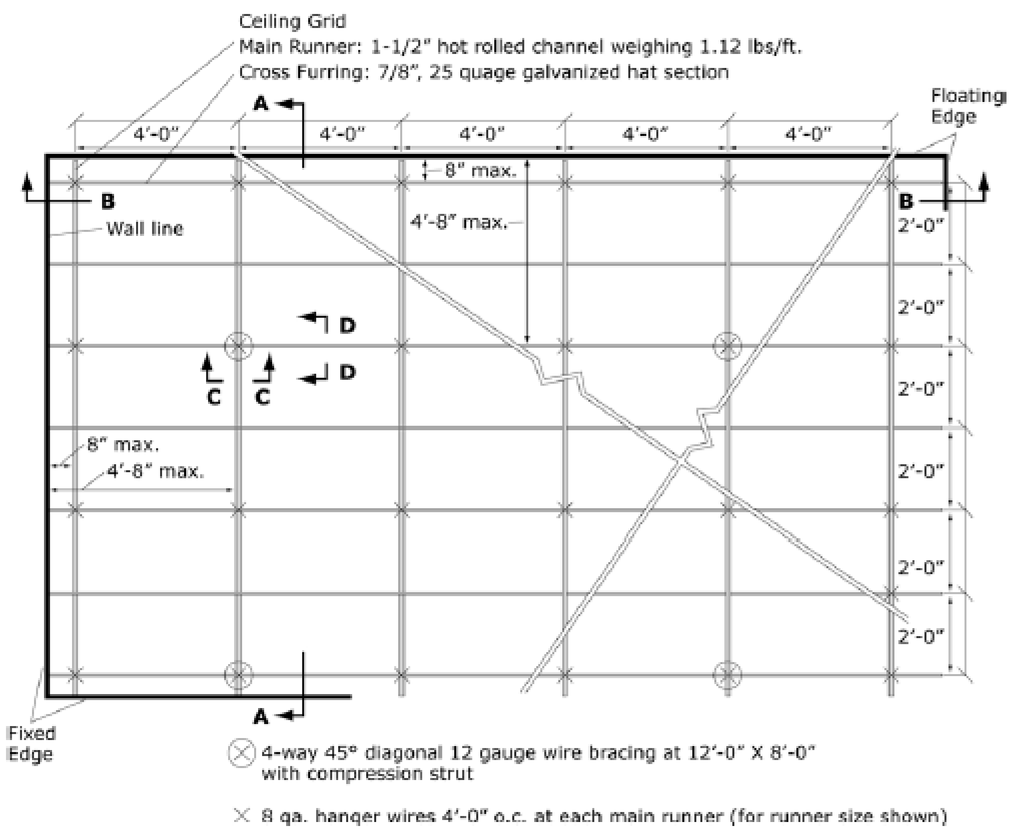


Figure G-14. Diagrammatic View of Suspended Heavy Ceiling Grid and Lateral Bracing.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

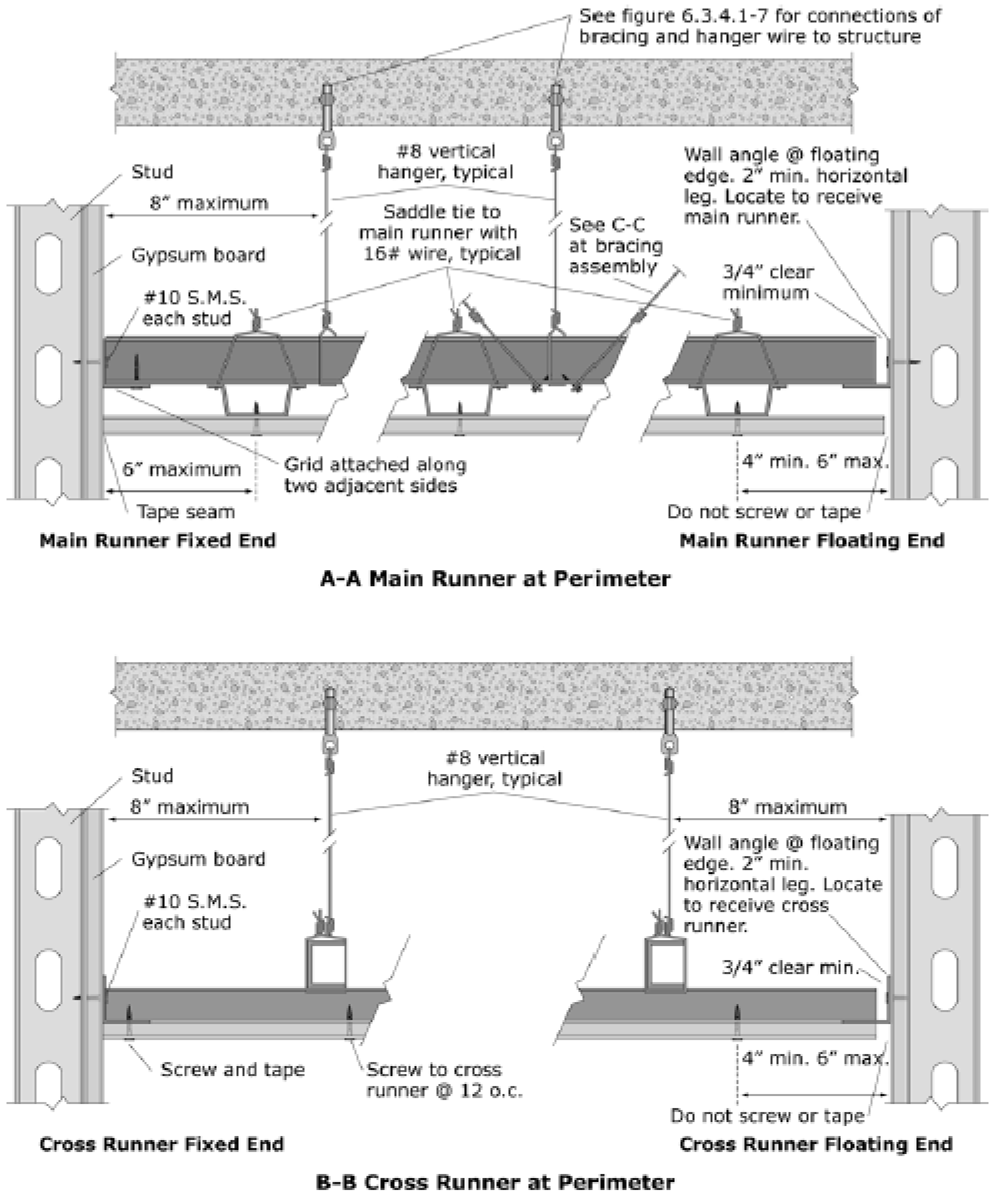
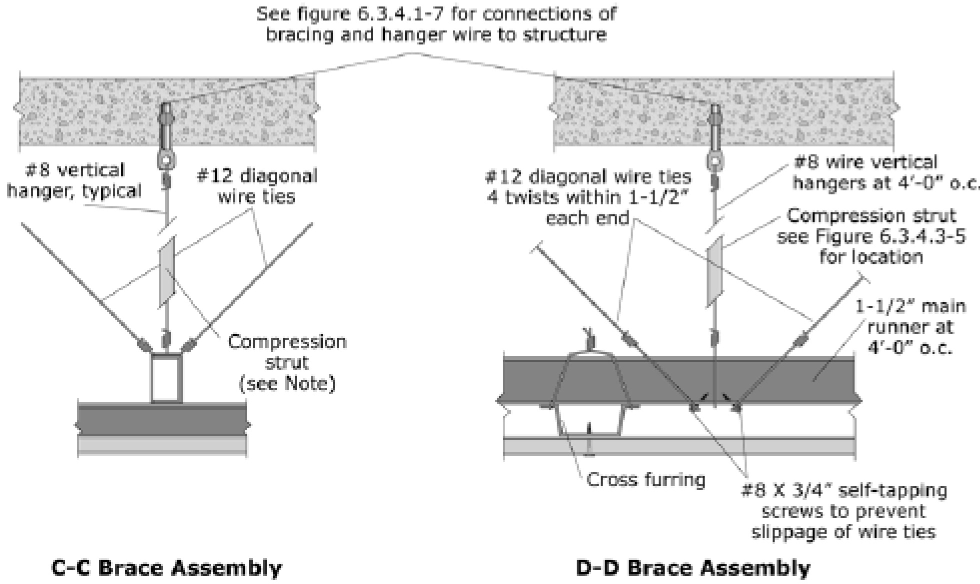


Figure G-15. Perimeter Details for Suspended Gypsum Board Ceiling.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Note: Compression strut shall not replace hanger wire. Compresion strut consists of a steel section attached to main runner with 2 - #12 sheet metal screws and to structure with 2 - #12 screws to wood or 1/4" min. expansion anchor to concrete. Size of strut is dependent on distance between ceiling and structure (l/r ≤ 200). A 1" diameter conduit can be used for up to 6', a 1-5/8" X 1-1/4" metal stud can be used for up to 10'. See figure 6.3.4.1-6 for example of bracing assembly.

Figure G-16. Details for Lateral Bracing Assembly for Suspended Gypsum Board Ceiling.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Light Fixtures

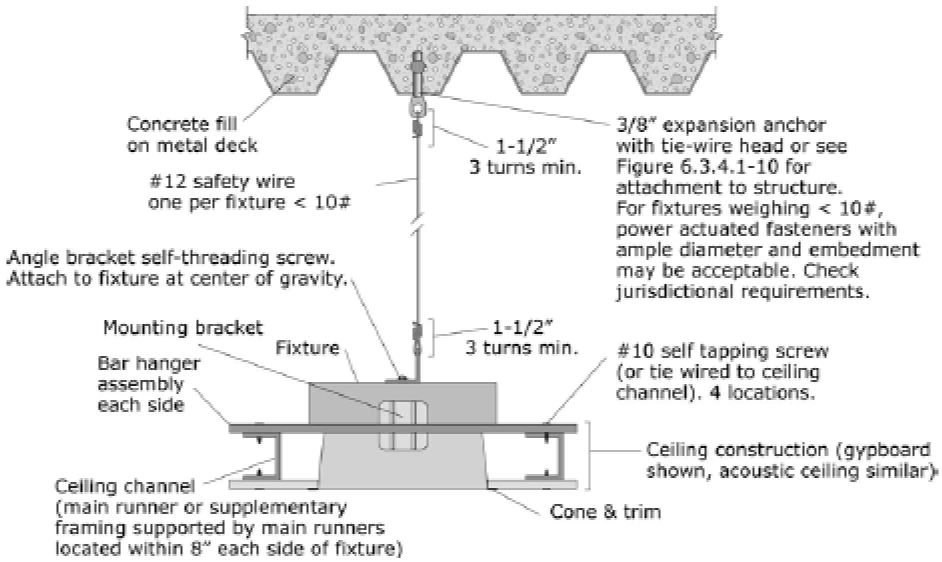


Figure G-17. Recessed Light Fixture in suspended Ceiling (Fixture Weight < 10 pounds).

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

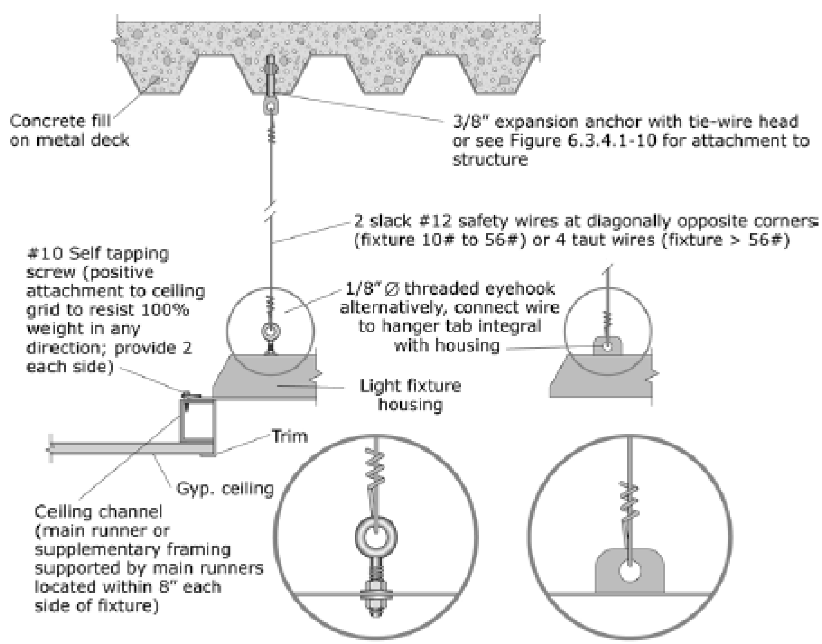


Figure G-18. Recessed Light Fixture in suspended Ceiling (Fixture Weight 10 to 56 pounds).

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Contents and Furnishings

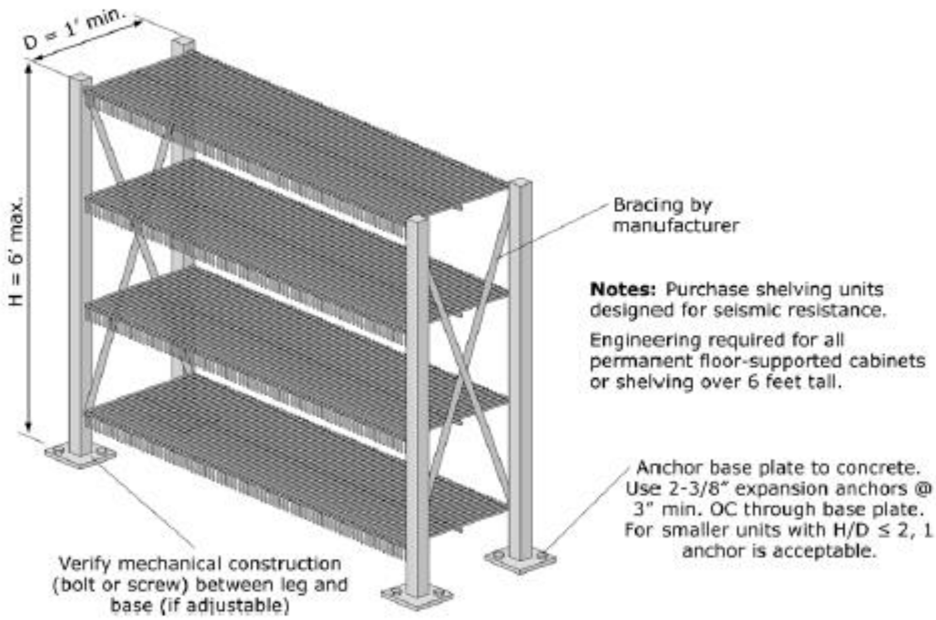


Figure G-19. Light Storage Racks.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

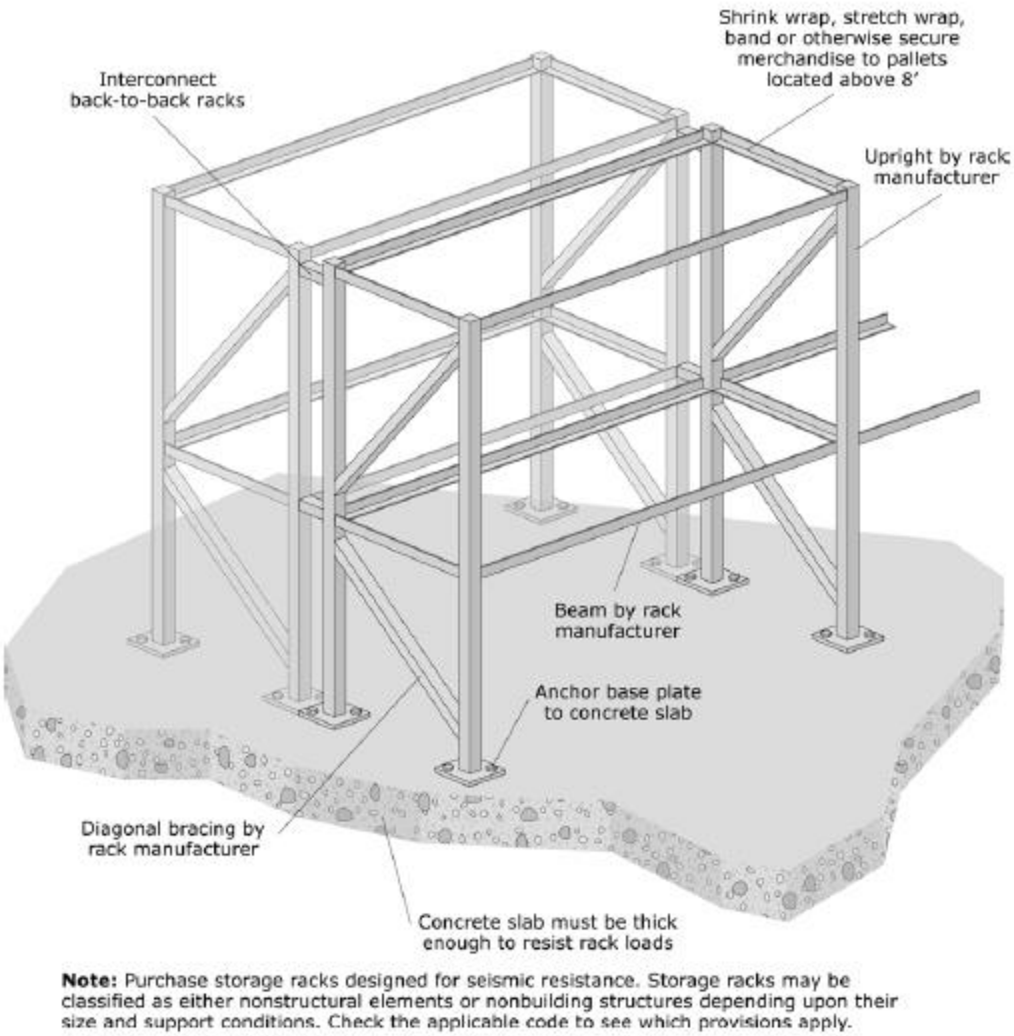


Figure G-20. Industrial Storage Racks.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

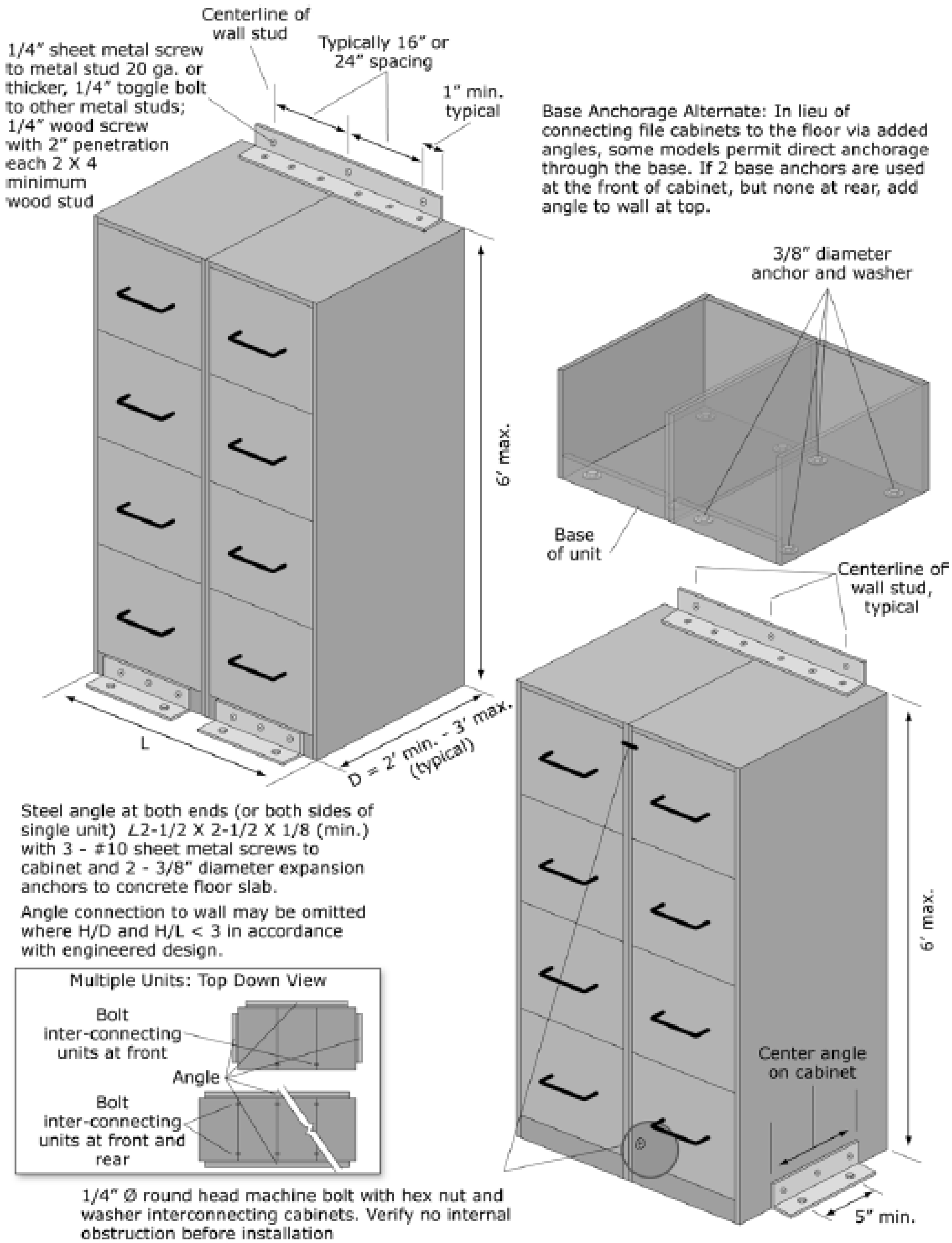


Figure G-21. Wall-mounted File Cabinets.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

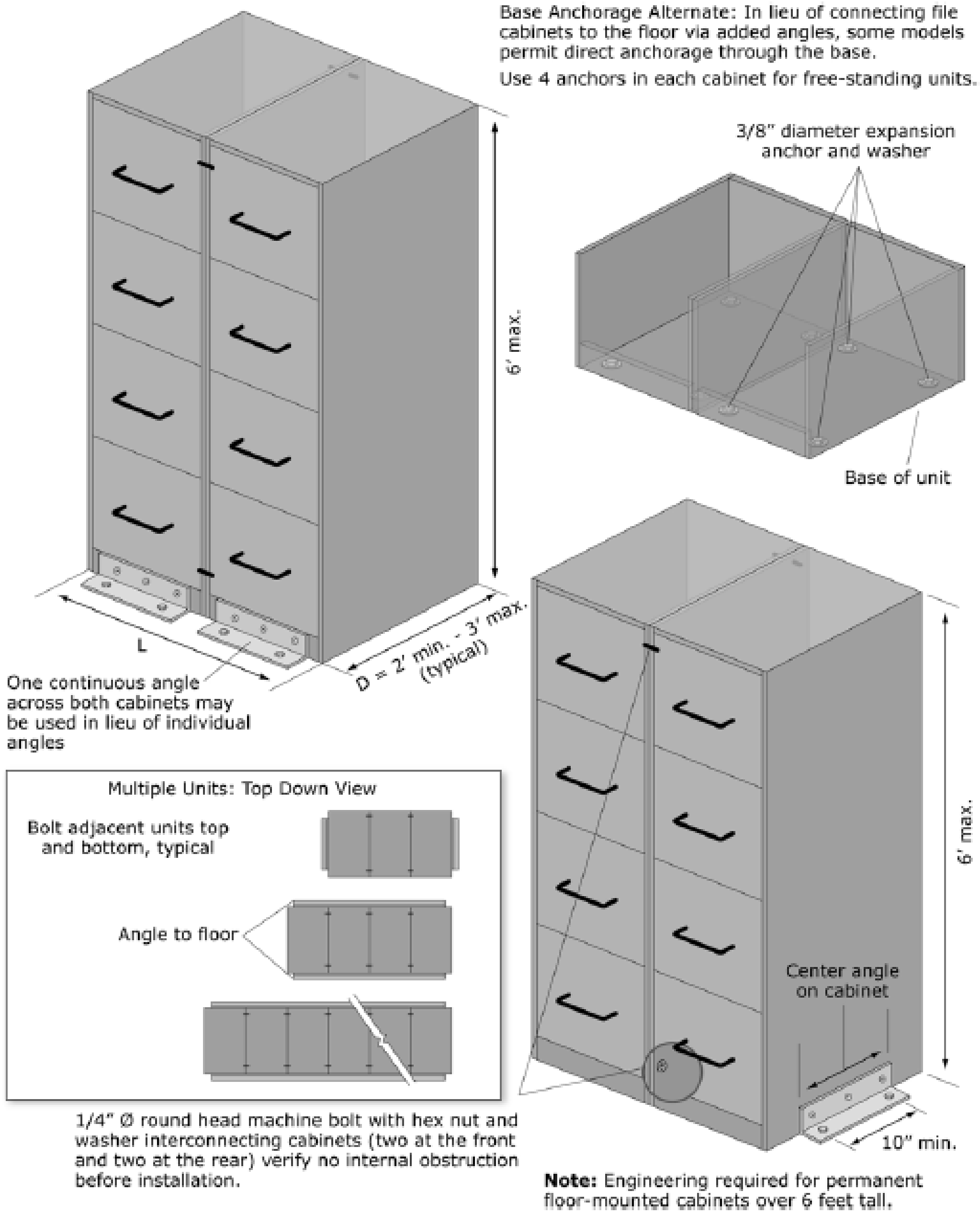


Figure G-22. Base Anchored File Cabinets.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

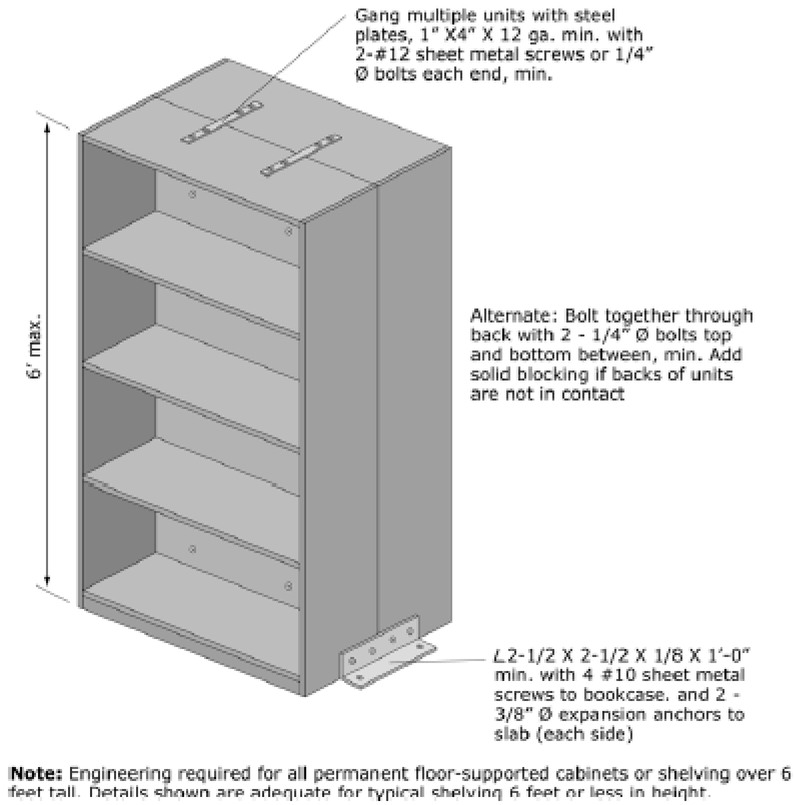


Figure G-23. Anchorage of Freestanding Book Cases Arranged Back to Back.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

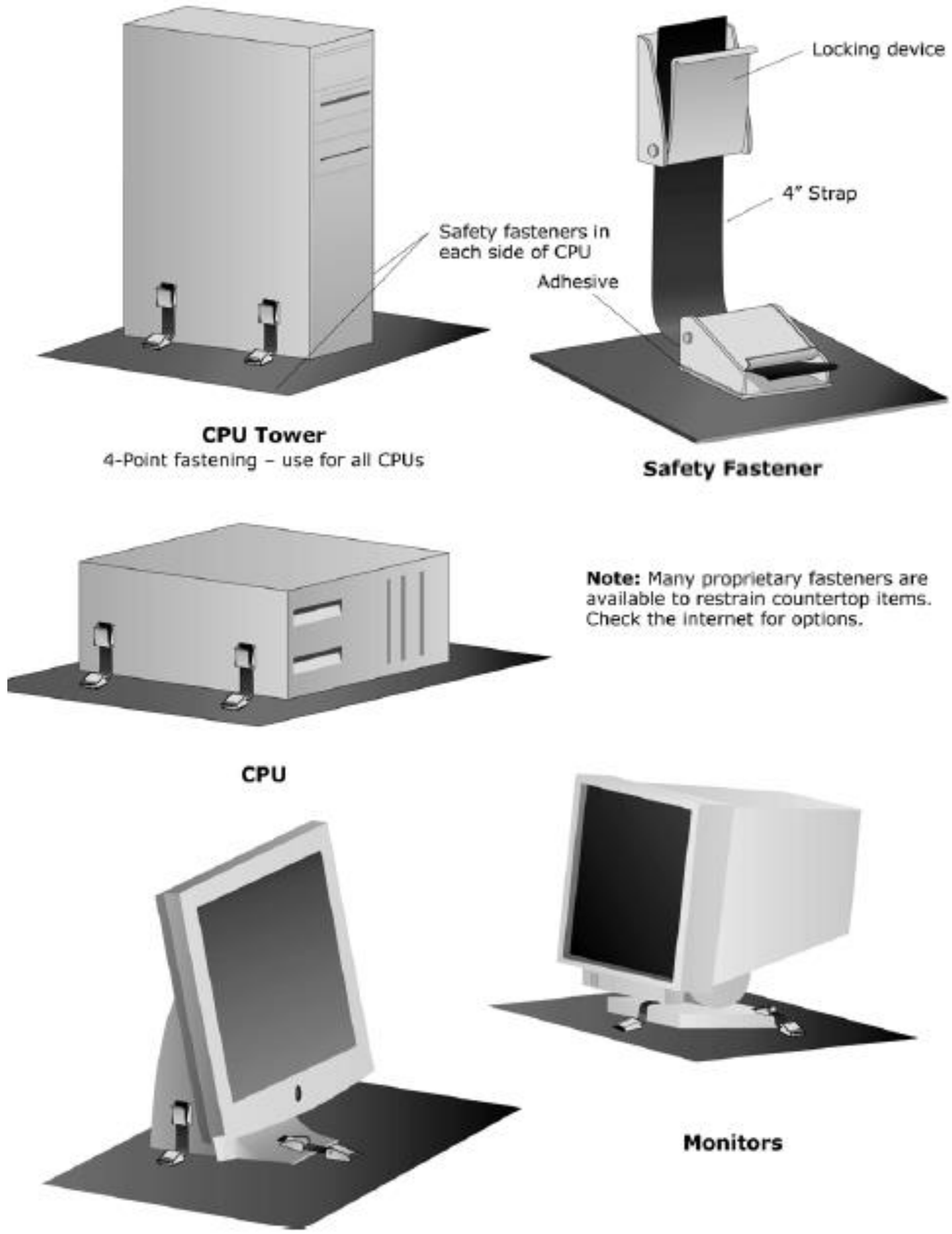
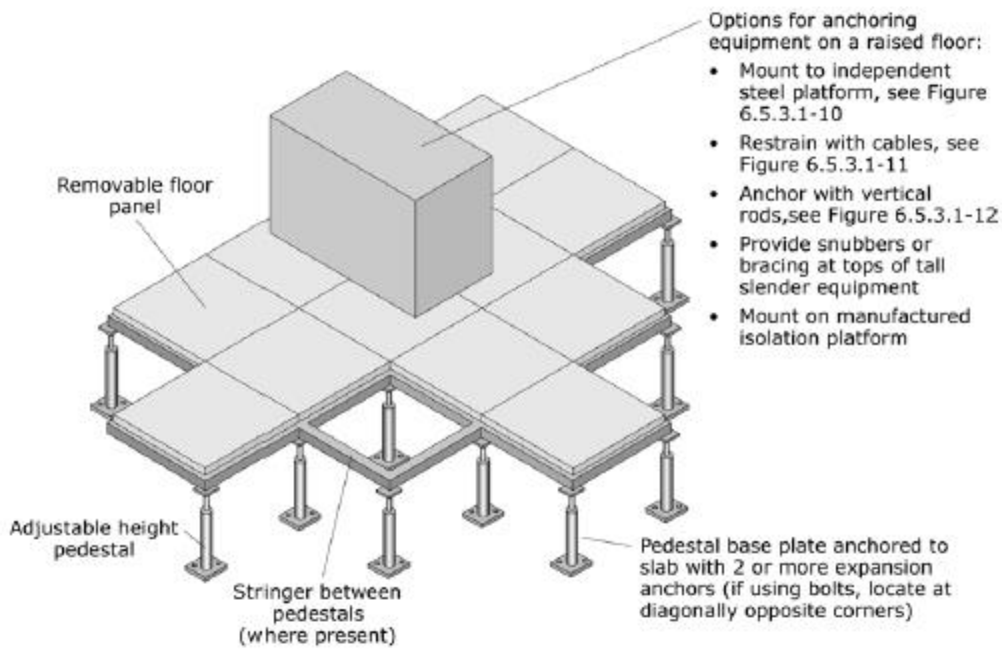


Figure G-24. Desktop Computers and Accessories.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



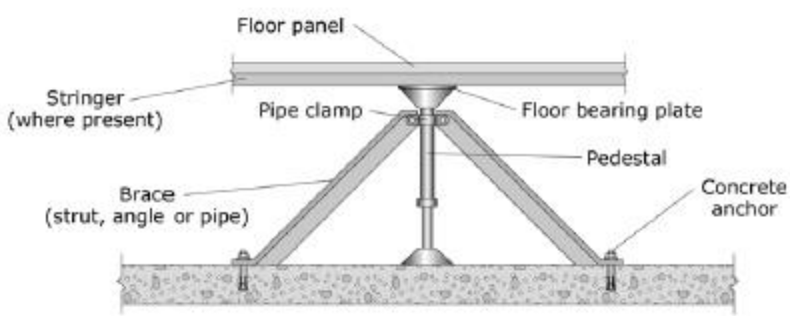


Figure G-25. Equipment Mounted on Access Floor.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

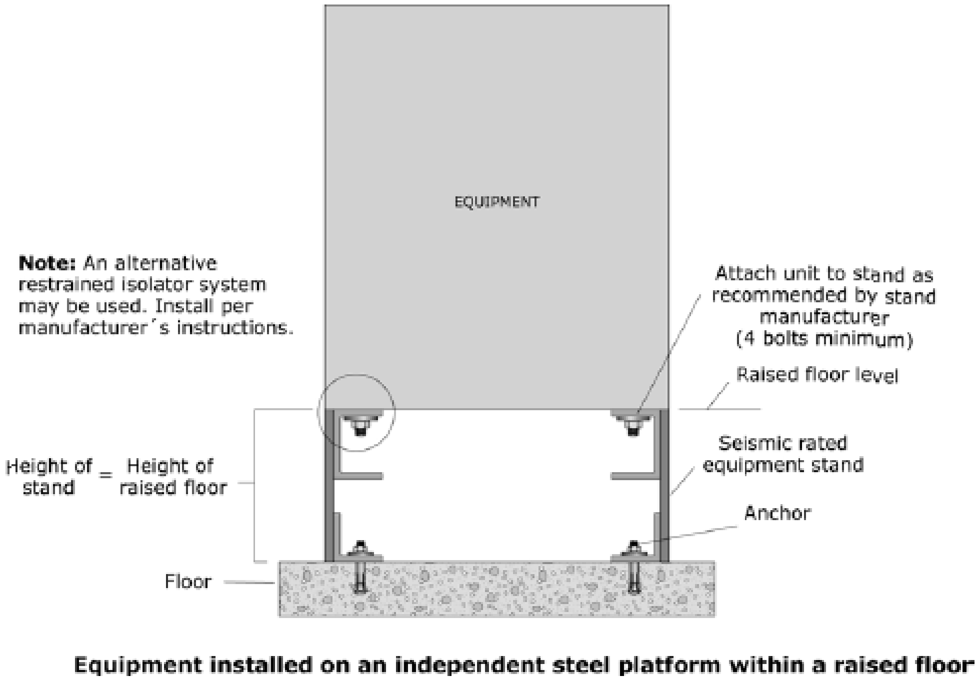


Figure G-26. Equipment Mounted on Access Floor – Independent Base.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

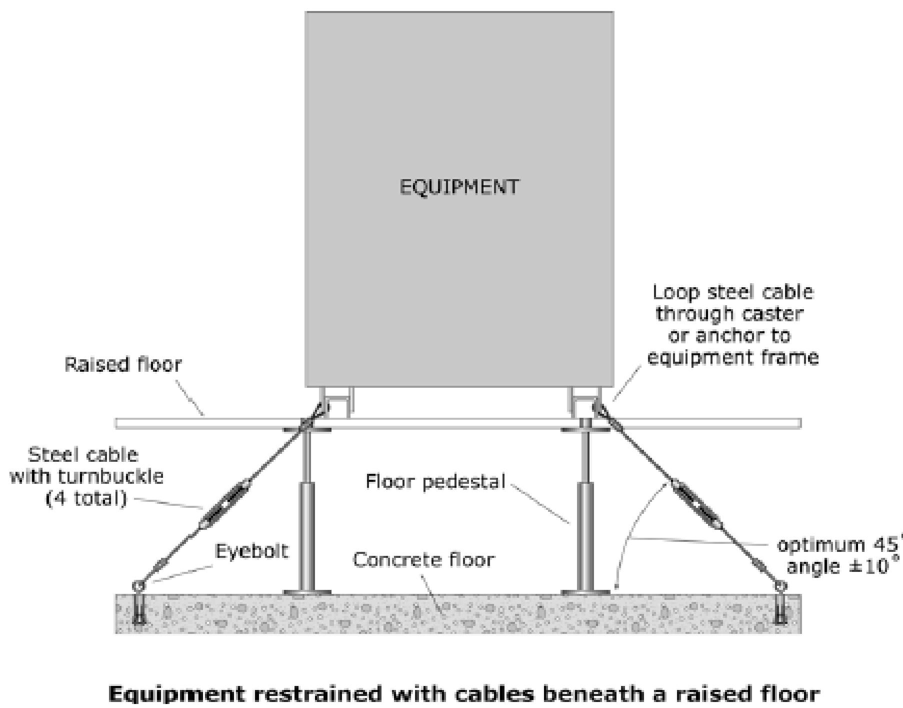
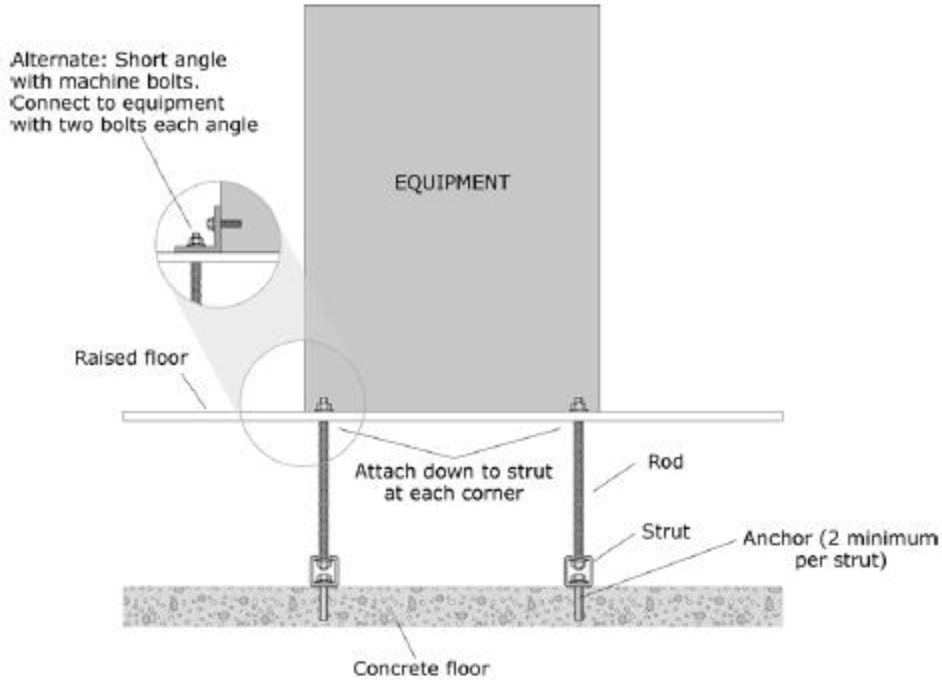


Figure G-27. Equipment Mounted on Access Floor – Cable Braced.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

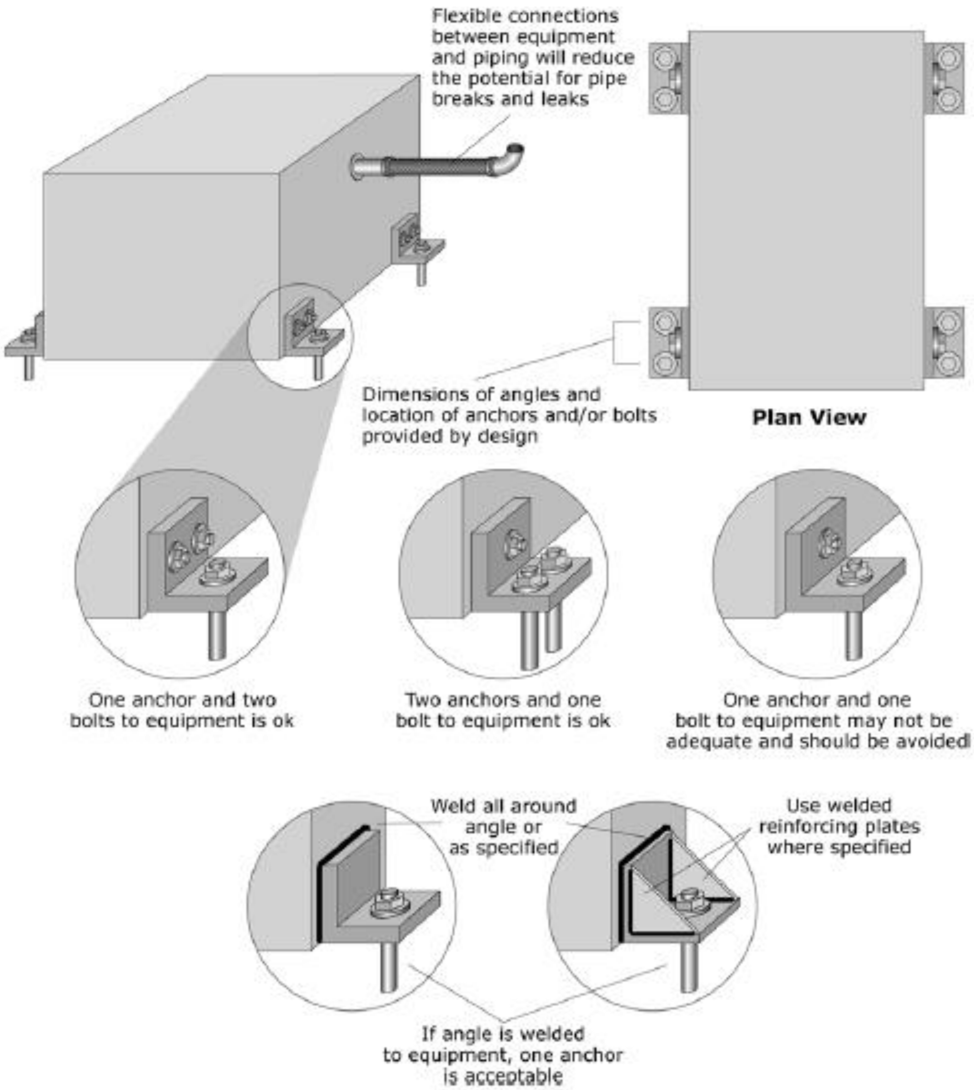


Equipment anchored with vertical rods beneath a raised floor

Figure G-28. Equipment Mounted on Access Floor – Tie-down Rods.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Mechanical and Electrical Equipment



Note: Rigidly mounted equipment shall have flexible connections for the fuel lines and piping.

Figure G-29. Rigidly Floor-mounted Equipment with Added Angles.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

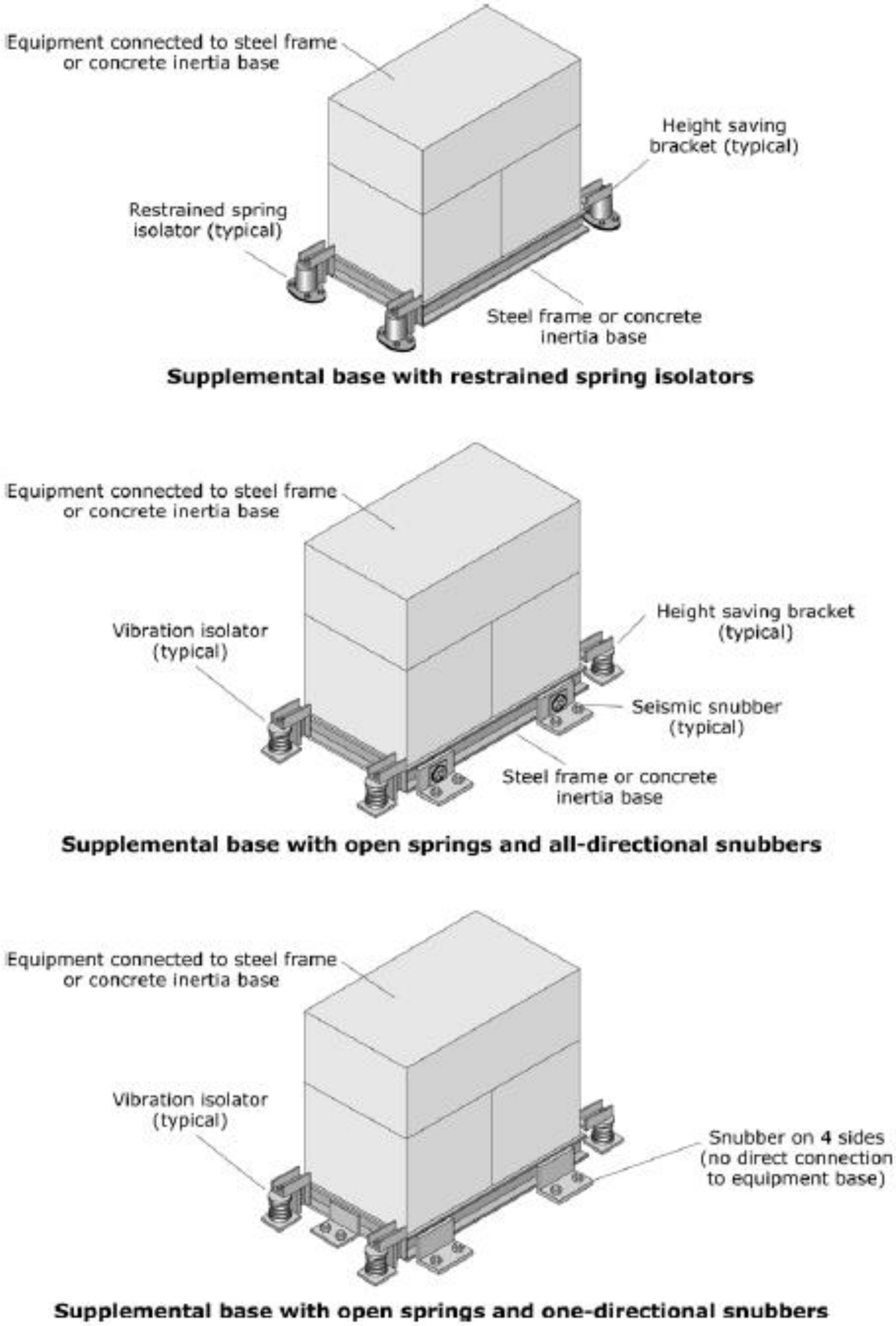


Figure G-30. HVAC Equipment with Vibration Isolation.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

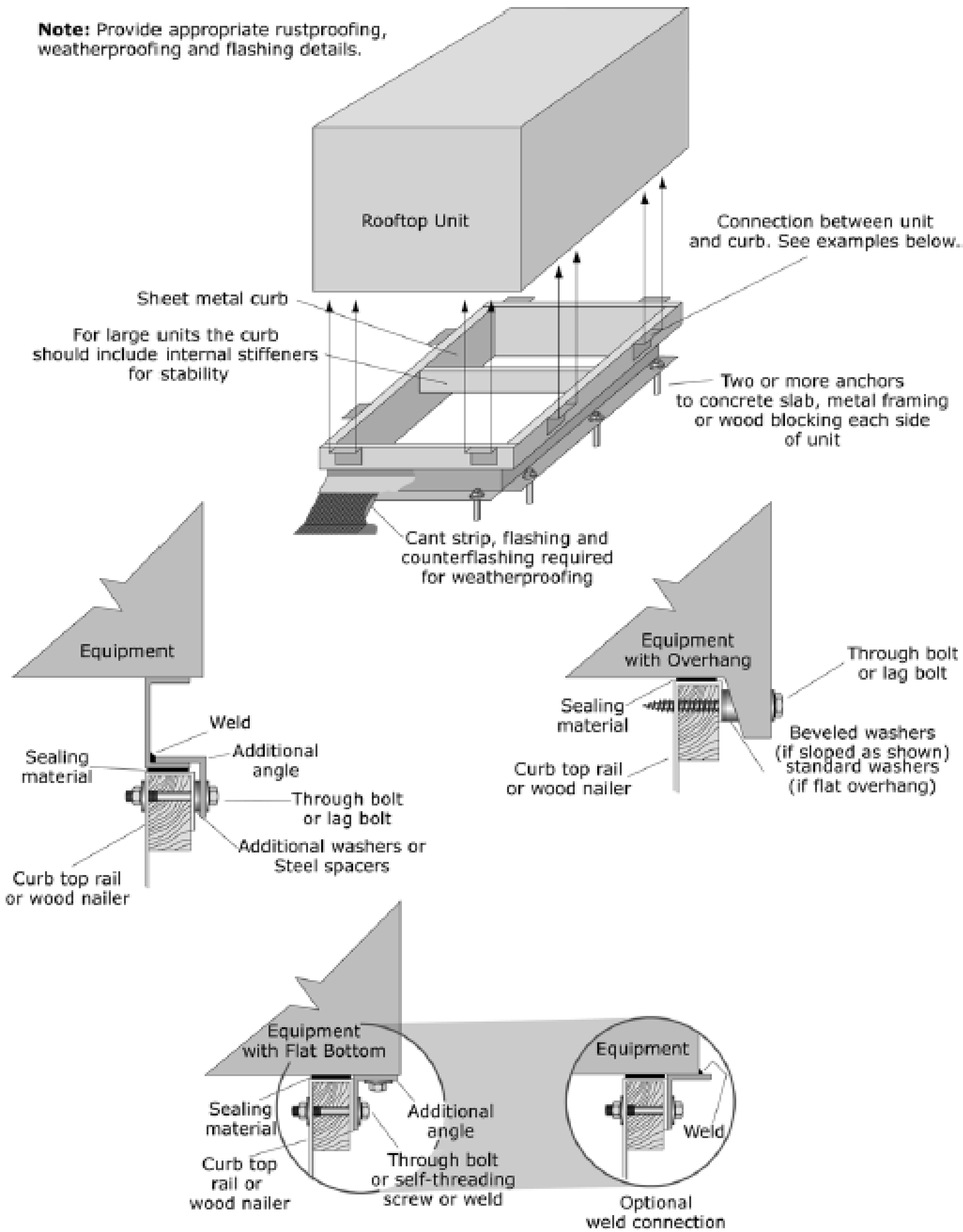


Figure G-31. Rooftop HVAC Equipment.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

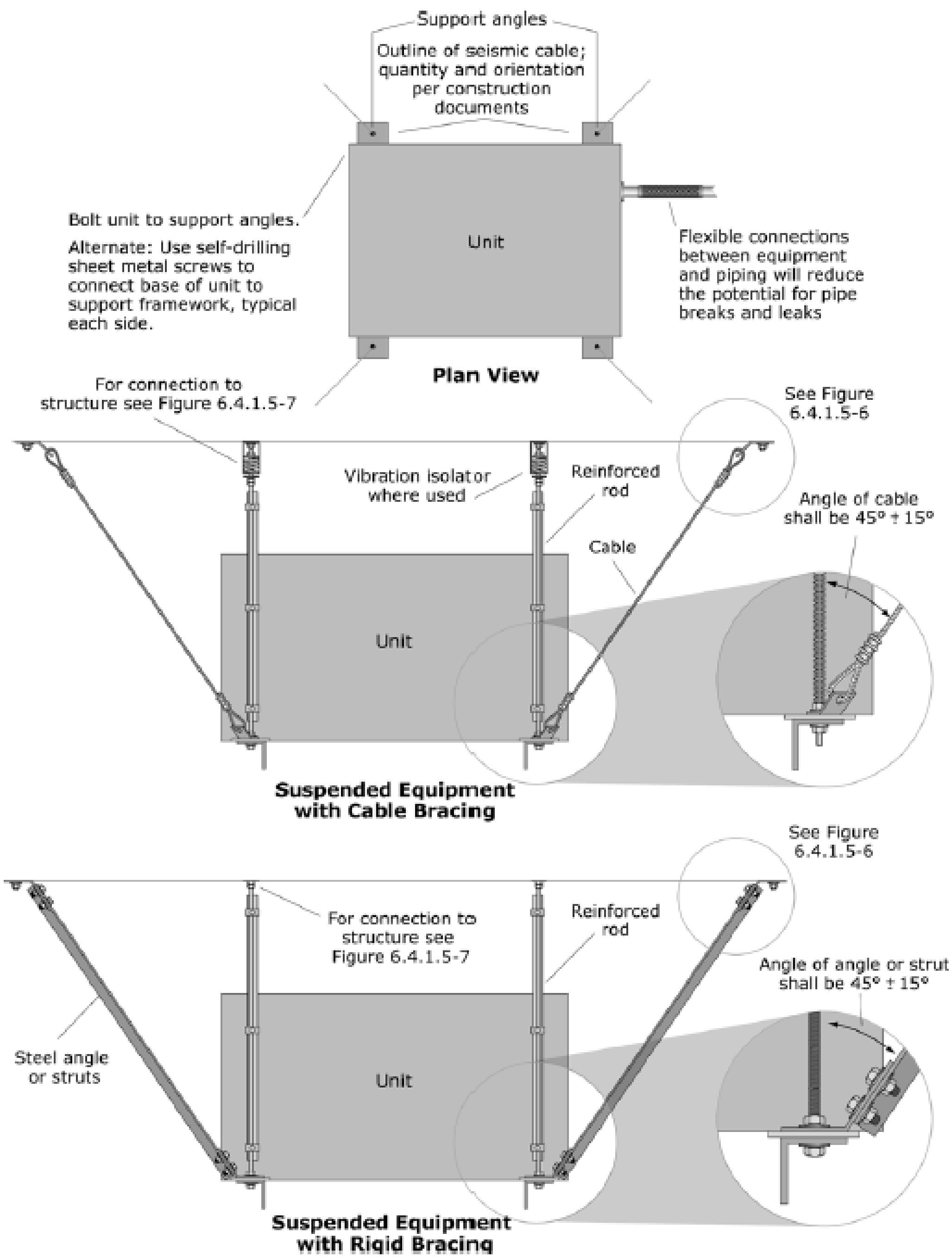


Figure G-32. Suspended Equipment.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

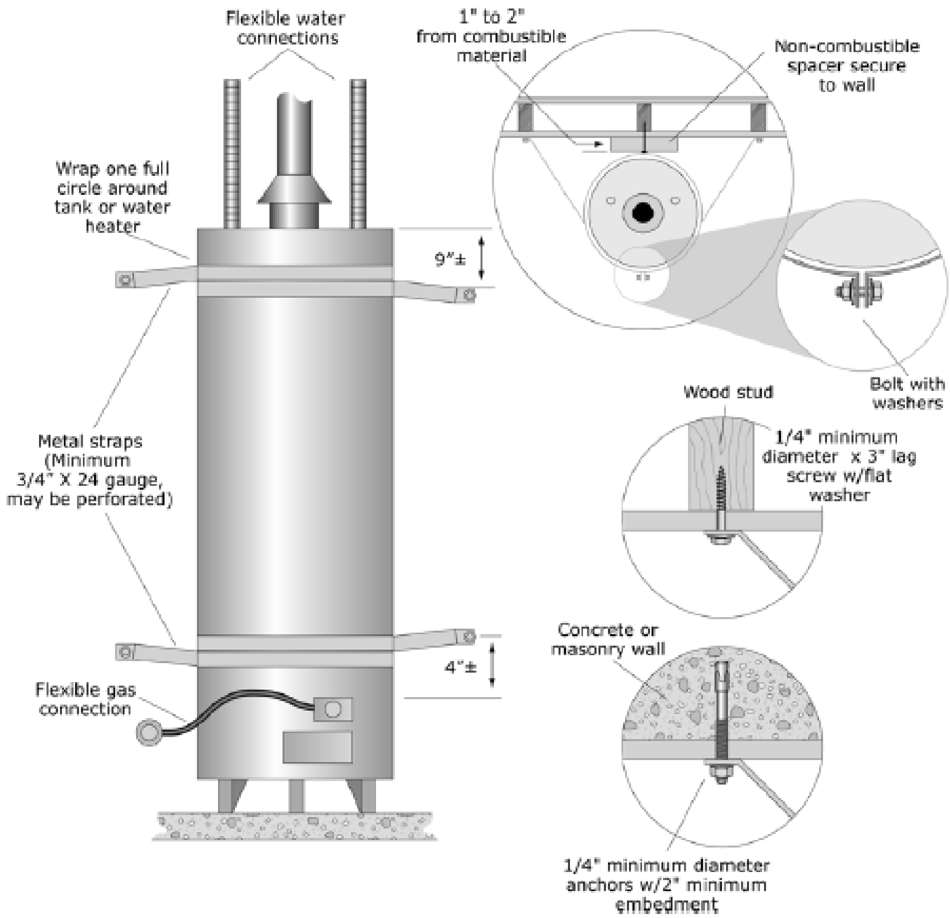


Figure G-33. Water Heater Strapping to Backing Wall.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

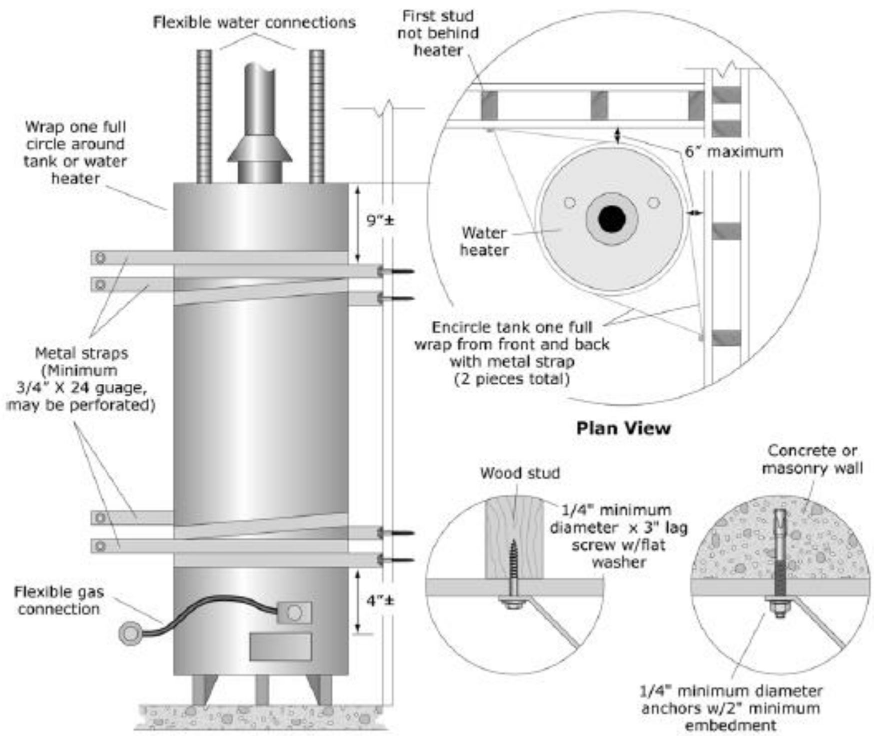


Figure G-34. Water Heater – Strapping at Corner Installation.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

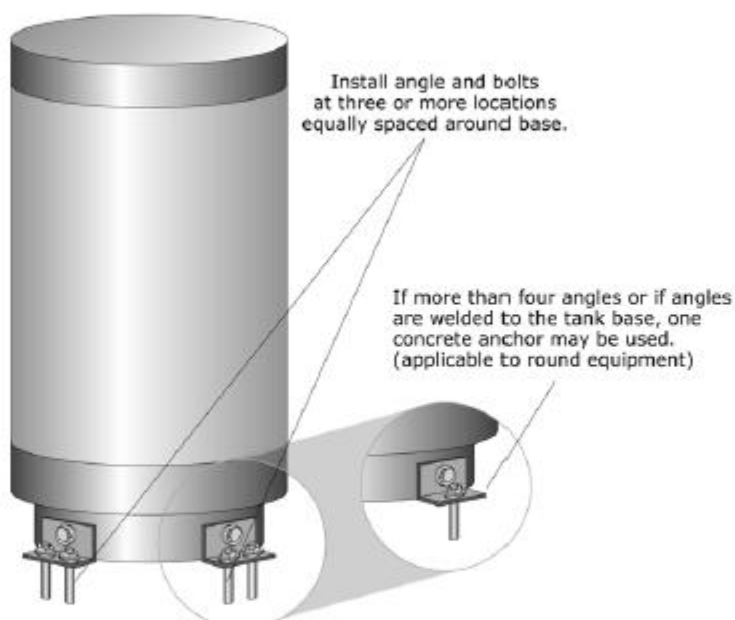


Figure G-35. Water Heater – Base Mounted.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

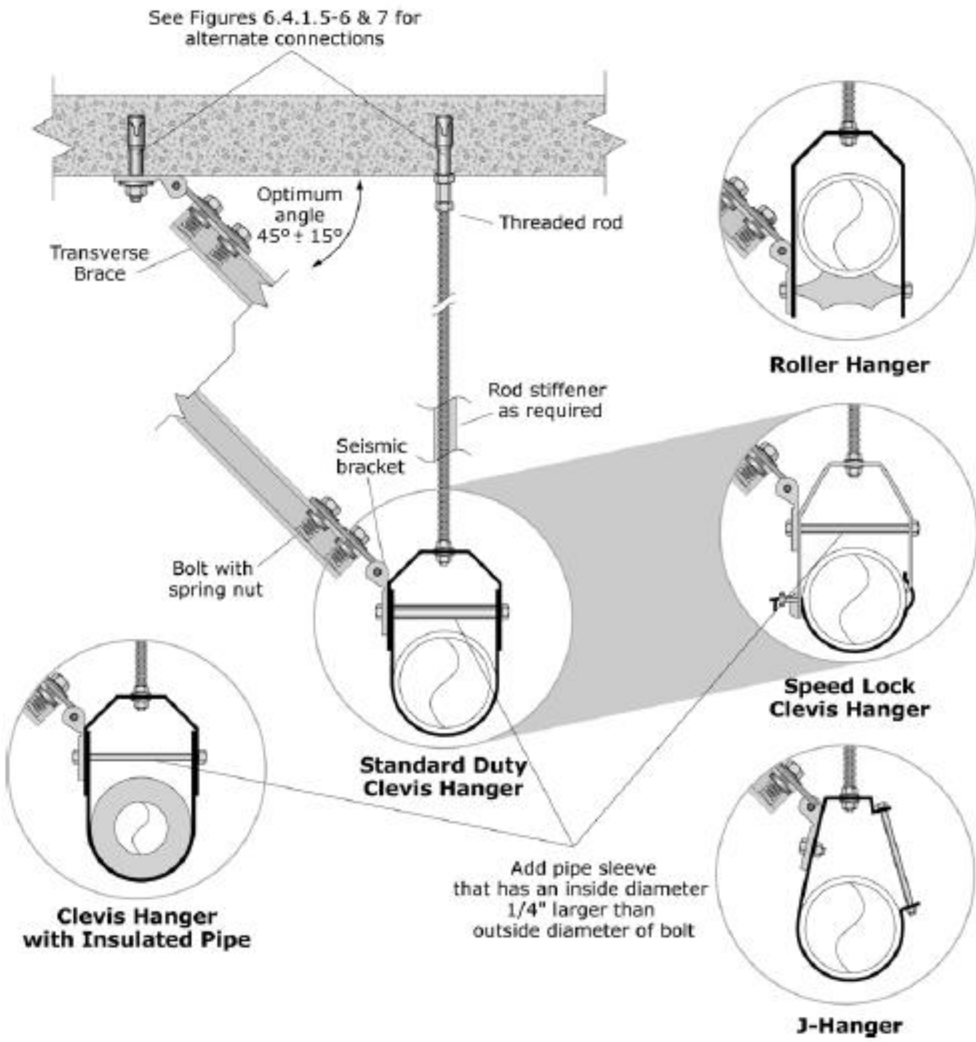


Figure G-36. Rigid Bracing – Single Pipe Transverse.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

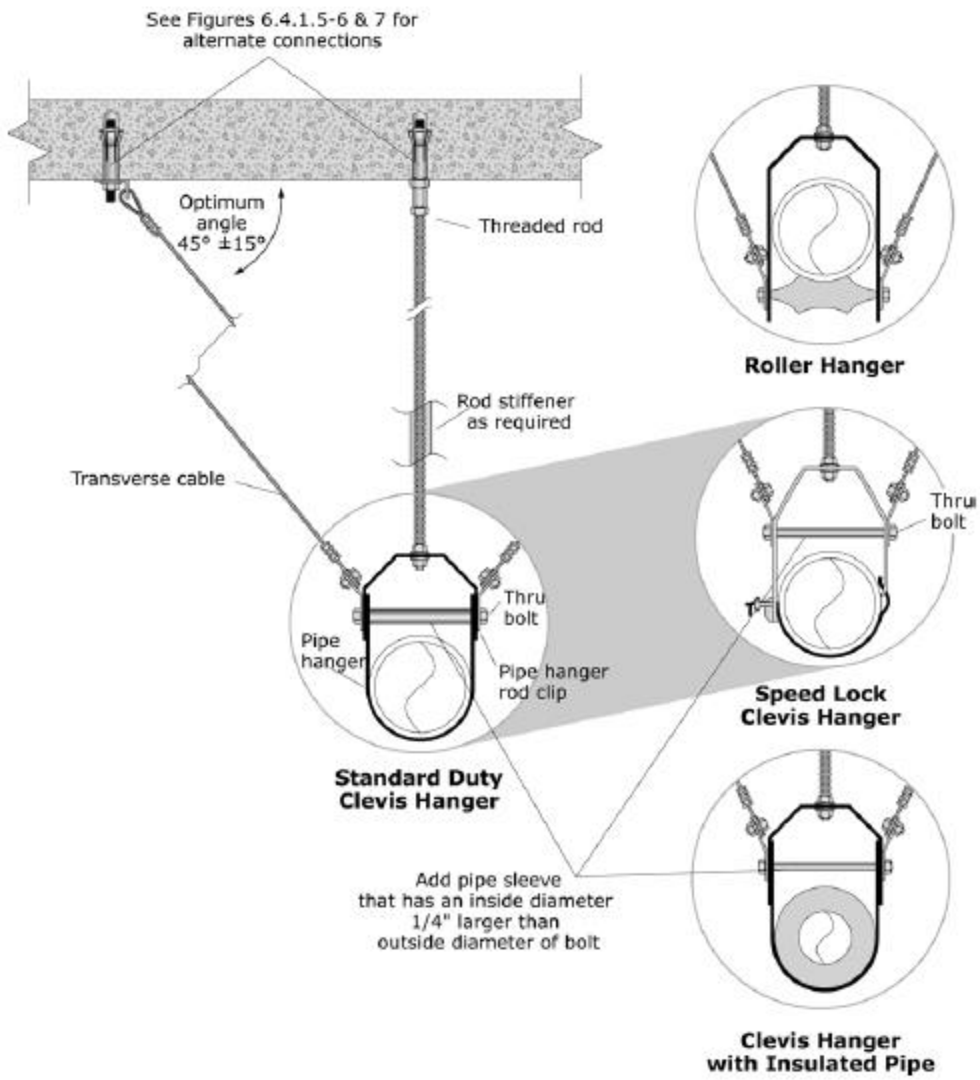


Figure G-37. Cable Bracing – Single Pipe Transverse.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Electrical and Communications

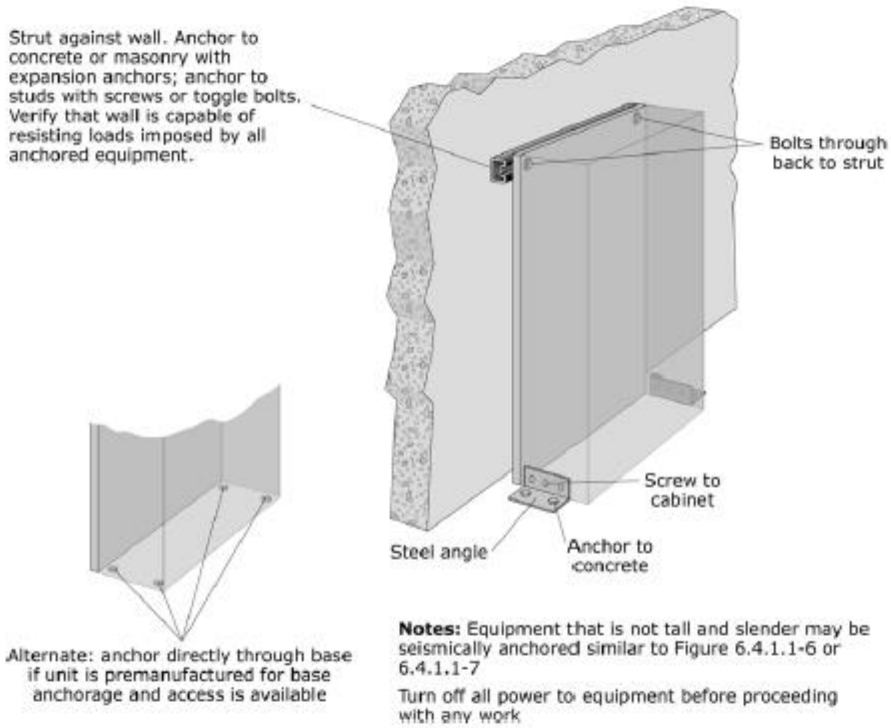


Figure G-38. Electrical Control Panels, Motor Controls Centers, or Switchgear.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

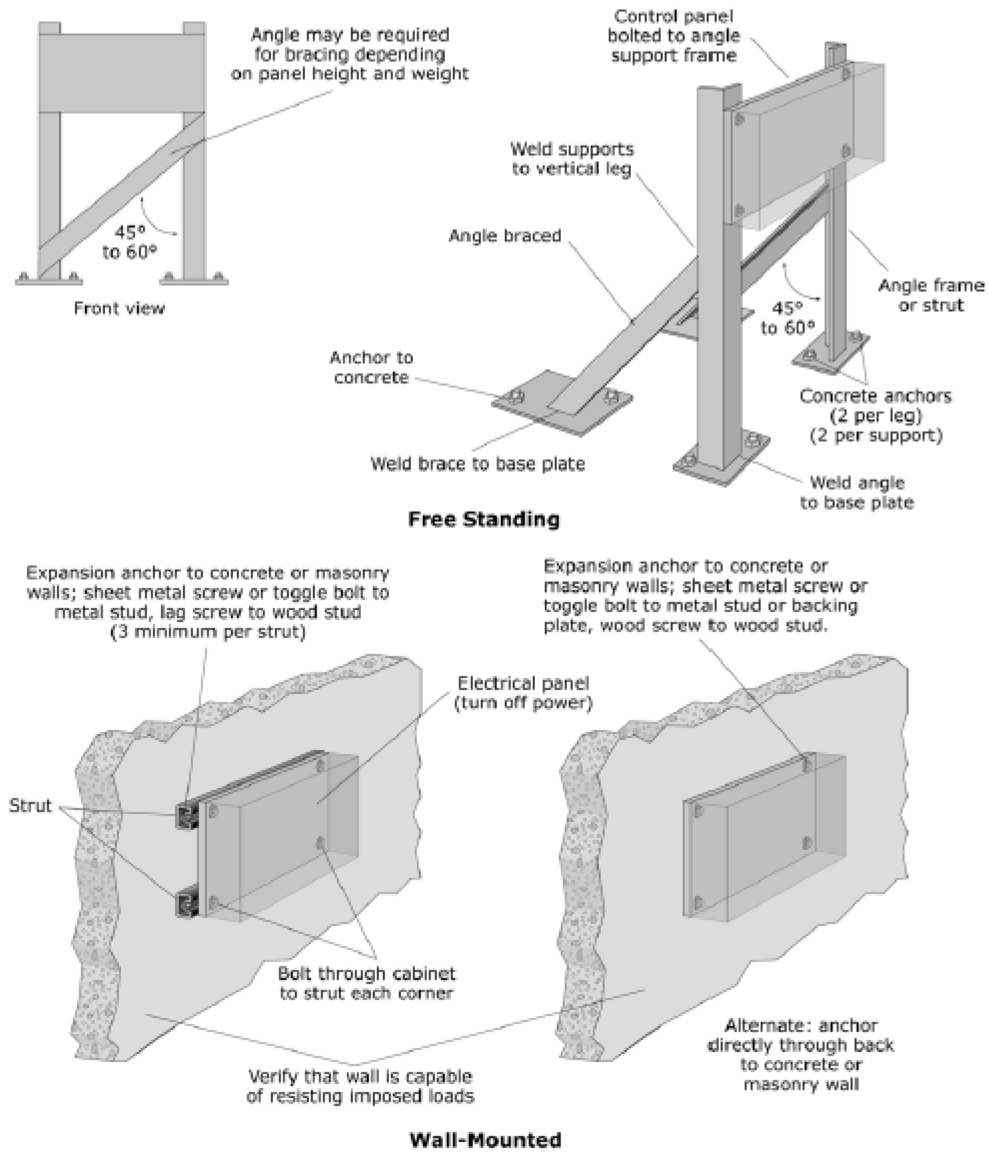


Figure G-39. Freestanding and Wall-mounted Electrical Control Panels, Motor Controls Centers, or Switchgear.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

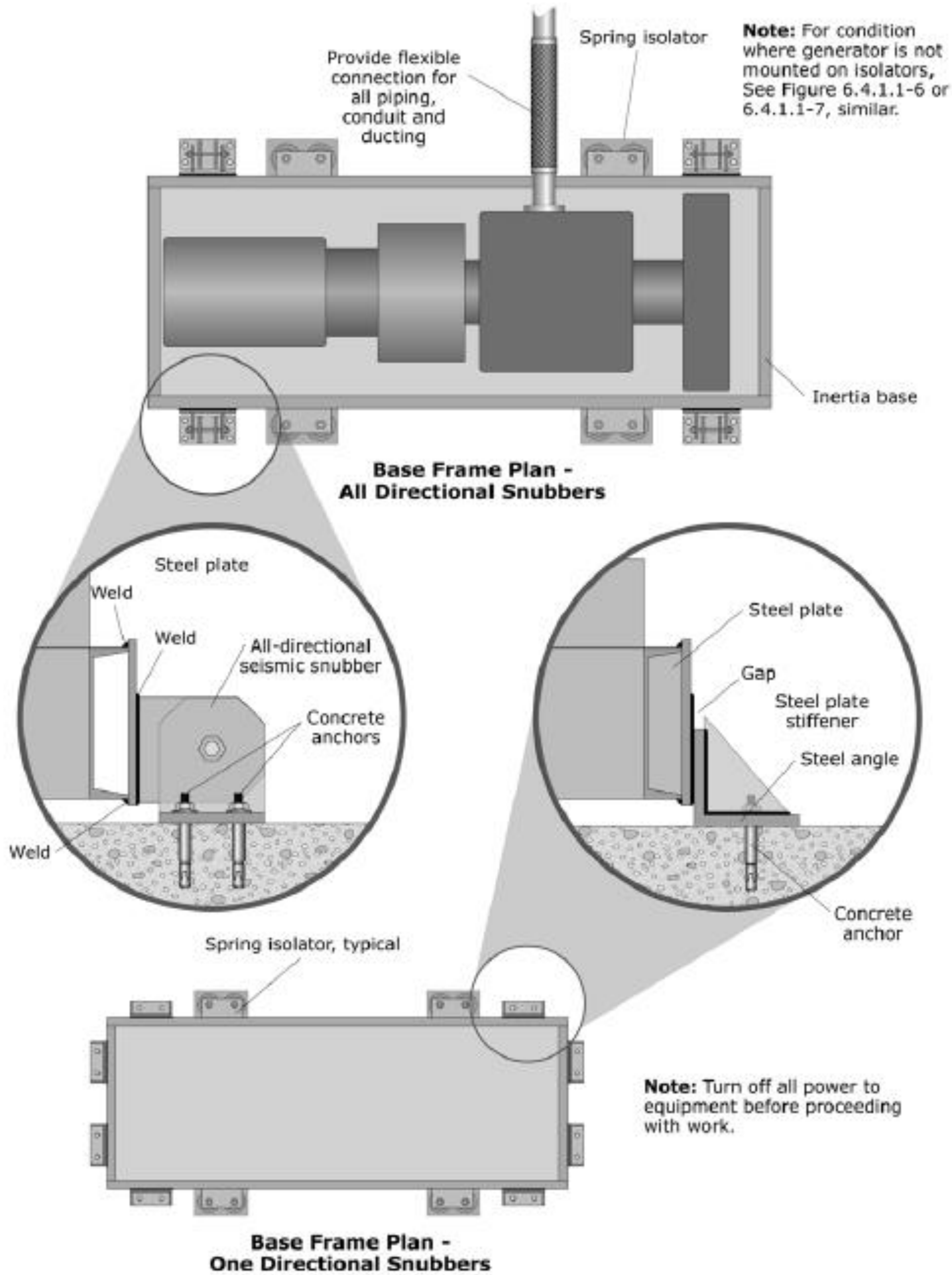


Figure G-40. Emergency Generator.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

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