PHASE **2**

Washington State
School Seismic Safety Assessments Project

TACOMA SCHOOL OF THE ARTS PACIFIC AVENUE BUILDING

Tacoma Public Schools

SEISMIC UPGRADES CONCEPT DESIGN REPORT

June 2021

PREPARED FOR

Washington Department of Natural Resources
Superintendent of Public Instruction Washington

PREPARED BY

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EXECUTIVE SUMMARY

This report documents the findings of a seismic evaluation of the Tacoma School of the Arts-Pacific in Tacoma, Washington. Tacoma School of the Arts (SOTA) is a visual and performing arts school for high school students and has an enrollment of approximately 620 students in multiple buildings in downtown Tacoma. The Pacific building is a rectangular two-story building with approximately 10,800 square feet of space on each floor. It has several classrooms, office space, restrooms, and storage space on the first floor, and classrooms, restrooms, and storage on the second floor. Many of the classrooms on each floor serve as studio or workshop space. The original building was constructed in 1904. Minor renovations appear to have been done in 2003, although it is unclear what the scope of the renovation included. The building has unreinforced masonry (URM) bearing walls, with some additional support provided by interior wood-framed bearing walls and wood columns. The second floor and roof diaphragm appear to be straight-sheathed with 2x-decking over wood joists and girders, while the main floor appears to be slab on grade. The foundations are assumed to be shallow continuous wall footings and shallow spread footings.

DCI Engineers 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 has multiple seismic deficiencies; the most susceptible deficiencies are inadequate load path, insufficient clear distance between adjacent buildings, noncompliant shear stress capacity, inadequate wall anchorage, and inadequate structural panels in the diaphragm. Some items that were not observed include adequate ledger connections, a connection to adequately transfer shear from the diaphragm to the shear walls, adequate cross ties in each direction, and adequate void space in the masonry layup. Nonstructural seismic deficiencies include inadequate restraint on tall narrow contents and fall-prone contents.

Conceptual seismic upgrade recommendations for the structural systems are provided to improve the performance of the building to meet the Life Safety structural performance objective criteria of ASCE 41-17. Sketches for the concept-level seismic upgrades are provided in Appendix B. The structural upgrades include providing seismic ties and adequate anchorage at the existing URM walls, adding braced frames, and adding plywood sheathing over the existing diaphragms. Prior to a seismic upgrade design for this building, engineering investigation of the adjacent seven-story building is highly recommended. This building appears to have been modernized and renovated in recent years. Investigation and coordination with the owner of the adjacent building would be required to determine if seismic measures have already taken, as such measures may impact the design of the seismic upgrade of this building.

An opinion of probable construction costs is provided in Appendix C. It is our opinion that the total cost (construction costs plus soft costs) to upgrade the structure would range between $5.94M and $11.14M, with the baseline estimated total cost being $7.43M.

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Acronyms

AACE	Association for the Advancement of Cost Engineering
ADA	Americans with Disabilities Act
ASCE	American Society of Civil Engineers
A-E	Architect-Engineer
BPOE	Basic Performance Objective for Existing Buildings
BSE	Basic Safety Earthquake
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
GC/CM	General Contractor/Construction Manager
GWB	Gypsum Wallboard
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 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
URM	Unreinforced Masonry
USGS	United States Geological Survey
WF	Wide Flange
WGS	Washington Geological Survey
WSSSSAP	Washington State School Seismic Safety Assessments Project

Reference List

Codes and References

2018 IBC, *2018 International Building Code,* prepared by the International Code Council, Washington, D.C.

AACE International Recommended Practice No. 56R-08, 2020, *Cost Estimate Classification System*, prepared by the Association for the Advancement of Cost Engineering International, Fairmont, West Virginia.

ASCE 7-16, 2017, *Minimum Design Loads for Buildings and Other Structures*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

ASCE 41-17, 2017, *Seismic Evaluation and Retrofit of Existing Buildings*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

FEMA E-74, 2011, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, prepared by Applied Technology Council, Redwood City, California.

Structural Engineers of Northern California, 2017, Earthquake Performance Rating System ASCE 41-13 Translation Procedure: The Buildings Ratings Committee, a sub-committee of the Existing Buildings Committee of The Structural Engineers Association of Northern California.

Structural Engineers of Northern California, 2015, Earthquake Performance Rating System User's Guide: The Buildings Ratings Committee, a sub-committee of the Existing Buildings Committee of The Structural Engineers Association of Northern California.

Drawings

No original construction drawings were available for review for the seismic evaluation and development of this conceptual seismic upgrade report. Structural system descriptions and seismic deficiencies are based on limited field observation only and the engineers' experience with buildings of similar construction type and vintage.

A general floor plan, provided by OSPI, has been included in Appendix E.

1.0 Introduction

1.1 Background

In 2018-2019, the Washington Geological Survey (WGS), a division of the Department of Natural Resources (DNR), led a Washington State School Seismic Safety Assessments Project (WSSSSAP) that seismically and geologically screened 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. This first phase of the WSSSSAP was executed with the help of the Washington Office of Superintendent of Public Instruction (OSPI) and Reid Middleton, along with their team of structural engineers, architects, and cost estimators.

Building upon the success of Phase 1, WGS, OSPI, and Reid Middleton's team embarked on Phase 2 of this project to seismically and geologically screen another 339 school buildings and 2 fire stations, mostly located in the high-seismic risk regions of Washington State. Similar to Phase 1, the two main components of Phase 2 of this seismic safety assessments 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.

Seventeen school buildings were selected in consultation with WGS and OSPI 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 17 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 outlined 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 OSPI to obtain building plans, seismic reports, condition reports, 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 identified building 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: Field 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, lath 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 41 checklist items that were not documented due to access limitations are noted.

1.2.3 Seismic Evaluations and Conceptual Upgrades Design

1. Seismic Evaluations: Limited 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. Conceptual Upgrades Design: 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. Architectural Review: The seismic upgrade concept developed by the structural engineers was reviewed by Rolluda Architects, Inc., for general guidance and consideration of the architectural aspects of the seismic upgrade. The architects discussed the seismic upgrade concepts with the structural engineer and reviewed available existing drawings, pictures taken during the engineer's field investigations, and the ASCE 41 Tier 1 Screening reports. However, field visits by the architect and meetings with the school district and facilities personnel to discuss phasing and programming requirements were not included in the project scope of work. The architectural considerations are discussed in Section 4.4, Nonstructural Recommendations and Considerations. These conceptual designs were reviewed with high-level recommendations. Future planning for seismic improvements should include further review with a design team.

4. Cost Estimating: Through the concept-level seismic upgrades report process, ProDims, LLC, 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. Conceptual Upgrade Design Reports: Buildings selected to receive a conceptual upgrade design will have a report prepared that will include an introduction summarizing the overall findings and recommendations and individual sections documenting each building's seismic evaluation, list of deficiencies, conceptual seismic upgrade sketches, and opinions of probable construction costs.

2. Building Photography: Photos were taken of each building during on-site walkthroughs to document the existing building configurations, conditions, and structural systems. These are available upon request through DNR/WGS.

3. Existing Drawings: Select and available existing drawings and other information were collected during the evaluation process. These are available upon request through DNR/WGS.

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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

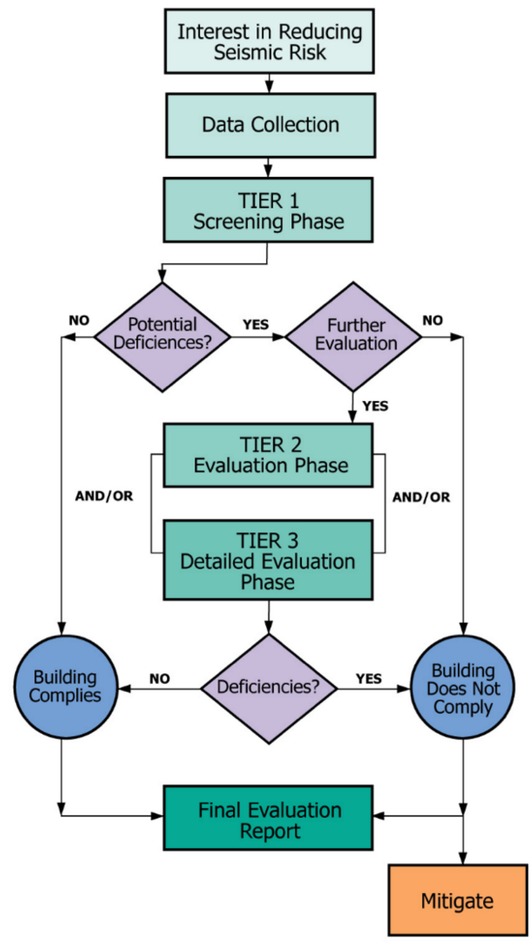

Figure 2-1. Flow Chart and Description of ASCE 41 Seismic Evaluation Procedure.

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. 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 Site Class Definition

The building site class definition quantifies the site soil's propensity to amplify or attenuate earthquake ground motion propagating from underlying rock. Site class has a direct impact on the seismic design forces utilized to design and evaluate a structure. There are six distinct site classes defined in ASCE 7-16, Site Class A through Site Class F, that range from hard rock to soils that fail, such as liquefiable soils. Buildings located on soft or loose soils will typically sustain more damage than similar buildings located on stiff soils or rock, all other things being equal. The DNR measured the time-averaged shear-wave velocity at each site to 30 meters (100 feet) below the ground surface, Vs30. This measured shear-wave velocity was used to determine the site class. The site class for this building was determined to be **Site Class C**.

2.2.2 Tacoma School of the Arts-Pacific 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 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 1.078 g, and the design 1-second period spectral acceleration, S_{D1}, is 0.465 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) and the Basic Safety Earthquake – 2E (BSE-2E) seismic hazard levels. 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 Tacoma School of the Arts-Pacific that are considered in this study.

Table 2.2.1-1. Spectral Acceleration Parameters (Site Class C).

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	0.660 g	0.2 Seconds	1.078 g	0.2 Seconds	1.238 g	0.2 Seconds	1.617 g
1.0 Seconds	0.235 g	1.0 Seconds	0.465 g	1.0 Seconds	0.524 g	1.0 Seconds	0.698 g

2.2.3 Tacoma School of the Arts-Pacific 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 Limited 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 an Unreinforced Masonry shear wall building with flexible diaphragms, **URM**. Unreinforced masonry shear wall buildings (URM) include those that have bearing shear walls constructed of unreinforced masonry, with elevated floor and roof framing structural systems consisting of wood framing.

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: 1904
Building Code: "unknown"

Number of Stories: 2
Floor Area: 21,601 SF

FEMA Building Type: URM
ASCE 41 Level of Seismicity: High
Site Class: C

The Tacoma School of the Arts-Pacific was originally constructed in 1904. The rectangular two-story building has an area on each floor of a little over 10,800 square feet. The building is approximately 119 feet long by 92 feet wide. Minor renovations appear to have been done in 2004, although the scope of those renovations is unknown.

The roof structure appears to be wood decking over wood joists and girders, and the second-floor framing appears to be the same. With only pictures available, it is possible that there is a structural element over the wood decking in both the roof and floor diaphragms. The roof and second floor are vertically supported by URM exterior walls, with a CMU wall on the west side of the first floor. The girders span over wood columns found throughout the building. The structural floor on the main floor is slab on grade. Although unknown, the foundations are likely conventional concrete spread and continuous footings.

3.1.2 Building Use

The Pacific building is one of the structures used by the Tacoma School of the Arts for its visual and performing arts curriculum. It has multiple classrooms, labs and studios, and various administrative spaces.

3.1.3 Structural System

Table 3.1.3-1. Structural System Descriptions.

Structural System	Description
Structural Roof over Library	The roof structure is wood decking over timber joists and girders.

Table 3.1.3-1. Structural System Descriptions.

Structural System	Description
Structural Floor(s)	The structural floor is slab on grade at the main level, and wood decking over timber joists and girders.
Foundations	The foundations are assumed to be conventional concrete spread and continuous footings.
Gravity System	The gravity system primarily consists of URM bearing walls at the exterior and wood columns at the interior. There are also some CMU wall infill elements at the exterior on the west side of the building.
Lateral System	The lateral system is flexible wood diaphragms at the 2nd floor and roof, spanning to URM exterior walls.

3.1.4 Structural System Visual Condition

Table 3.1.4-1. Structural System Condition Descriptions.

Structural System	Description
Structural Roof	Average. Several locations display visible signs of minor splits in the wood girders and joists. Signs of previous water infiltration that have since been mitigated.
Structural Floor	Average. Several locations display visible signs of minor splits in the wood girders and joists.
Foundations	Good. No visible signs of excessive settlement.
Masonry Walls	Decent. Minor cracks and deterioration were observed on the exterior walls.
Wood Columns	Average. Splits and checks were observed in many of the interior wood columns, with some large splits.

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
Load Path	While the gravity load-carrying system appeared complete, in-plane load connections between the roof/floor diaphragms were not observed, and the out-of-plane tension ties between the walls and diaphragms appeared insufficient.
Adjacent Buildings	The clear distance between the building being evaluated and the building adjacent to it is less than 1.5% the height of the shorter building.
Shear Stress Check	Per the Quick Check procedure, the shear stress is noncompliant. Further investigation should be performed prior to retrofit. Lateral system strengthening, such as shotcreting walls or adding new shear walls or braced frames may be appropriate to mitigate seismic risk.
Wall anchorage	Tie-rods were observed, but were spaced out roughly 20-feet on center and appear inadequate for the design loads. No existing drawings and inadequate access to verify. Further investigation should be performed prior to retrofit. Diaphragm reinforcement, including tension ties, blocking, strapping, and diaphragm nailing to provide out-of-plane connection at masonry walls may be appropriate to mitigate seismic risk.
Spans	Wood diaphragms with spans greater than 24 feet do not consist of wood structural panels or diagonal sheathing. Further investigation should be performed prior to retrofit. Installation of wood structural panel sheathing may be appropriate to mitigate seismic risk.

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
Mezzanines	There is a mechanical mezzanine above the second level, but its lateral bracing system could not be identified. It is likely this is compliant and the mezzanine relies on surrounding walls as shear walls to transfer seismic load to the 2nd level diaphragm.

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

Deficiency	Description
Liquefaction	"Very 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. The structure appears to be located on a relatively flat site.
Surface Fault Rupture	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.
Wood Ledgers	Likely compliant. No existing drawings and inadequate access to verify, but there appear to be limited connections between the walls and diaphragms. Further investigation should be performed.
Transfer to Shear Walls	Likely noncompliant. Diaphragm connections to shear walls were either unclear in photos or not available in drawings.
Masonry Layup	Details or photos were unavailable to observe the masonry layup; likely compliant.
Cross Ties	Likely noncompliant. Ties were observed in both directions at many interior column locations, but not all of them.

3.2.3 Nonstructural Seismic Deficiencies

Table 3.2.3-1 summarizes the seismic deficiencies in the nonstructural systems. The Tier 1 screening checklists are provided in Appendix A.

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

Deficiency	Description
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH	It did not appear that contents taller than 6 feet were adequately restrained. Restraining contents by bracing top of contents to nearest backing wall or providing overturning base restraint may be appropriate to mitigate seismic risk.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	A number of bookshelves appear to support heavy items that do not appear well secured. Heavy items on upper shelves should be restrained by netting or cabling 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
HM-3 Hazardous Material Distribution. HR-MH; LSMH; PR-MH.	Piping for gas not fully accessible for observation. Further investigation may be appropriate to mitigate seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PRL-MH.	Piping for gas not fully accessible for observation. Further investigation may be appropriate to mitigate seismic risk.
P-2 Heavy Partitions Supported by Ceilings. HRLMH; LS-LMH; PR-LMH.	An interior CMU wall was observed, but the details of how it is attached to the structure could not be seen.
P-3 Drift. HR-not required; LS-MH; PR-MH.	An interior CMU wall was observed, but the details of how it is attached to the structure could not be seen.
P-3 Drift. HR-not required; LS-MH; PR-MH.	A few areas had suspended ceilings with light fixtures, but their attachment could not be observed.
PCOA-1 URM Parapets or Cornices. HR-LMH; LSLMH; PR-LMH.	Likely compliant. No existing drawings and inadequate access to verify. Further investigation should be performed, but the parapets do not appear to be very tall and likely meet the 1:5 height to thickness ratio.
S-2 Stair Details. HR-not required; LS-LMH; PR-LMH.	No existing drawings and inadequate access to verify. Further investigation should be performed.
EL-1 Retainer Guards. HR-not required; LS-H; PR-H.	Elevator equipment was not observed. The elevator checklist items should be verified by an elevator designer or supplier.
EL-2 Retainer Plate. HR-not required; LS-H; PR-H.	Elevator equipment was not observed. The elevator checklist items should be verified by an elevator designer or supplier.

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4.0 Recommendations and Considerations

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 Adjacent Building

The building has no existing seismic gap between itself and the adjacent building, which spans about seven stories high. However, according the building photos, it appears that the wall between the two buildings is a shared wall. It also appears that renovations were done to remove a story from the School of the Arts no earlier than the 1950s. Renovations were recently made on the adjacent building, but no information was available on the extent of the seismic strengthening performed.

For purposes of this conceptual design, the School of the Arts building does not rely on the adjacent building for support, nor does it account for any load from the adjacent building. Further investigation is required by the design team for any future renovation projects.

One potential risk considered in this conceptual design is the possibility that debris could fall from the adjacent building during a seismic event. It is recommended that about one third of the roof be strengthened with an overbuild to protect from potential falling debris. This can be done with thicker sheathing over additional wood joists spanning between cripple walls aligned with purlins. The plan for this overbuild is provided in Appendix B.

4.1.2 URM Wall Anchorage

The out-of-plane anchorage of the walls at the diaphragms is assumed to be inadequate based on the age and nature of the building and the limited information from the available drawings. Where floor joists are perpendicular to the unreinforced masonry piers, HTT/LTT tension ties should be added to the joists, as required, to properly brace the walls. Where the floor joists are parallel to shear walls, blocking between joists should be installed at a specified spacing in as many bays as required to develop the anchorage load into the diaphragm. A strap should be installed over the existing 2x-decking, aligned with the blocking, and an HTT/LTT tension tie should be installed from the blocking to the wall. If found necessary, a HDU horizontal hold-down should be installed instead of the tension tie. Different anchorage conditions also exist in the building, such as anchoring into a blind wall and anchoring above the window openings. The different wall anchorage details are in Appendix B. The anchorage applies at both floor and roof levels.

4.1.3 Roof Diaphragm Sheathing and Second Floor Diaphragm Sheathing

The roof and second-floor diaphragms in the building are assumed to be straight-sheathed with 2x-wood decking with no overlaying structural plywood. The span exceeds the limit without having either wood structural panels or diagonal sheathing. It is advised to fix this deficiency by strengthening the diaphragm by overlaying the existing decking with plywood sheathing. The current floor and roof finishes should be removed and then sheathed with APA-rated plywood panels. To ensure an adequate load path, the diaphragm panels will need to have a positive connection to the shear walls.

Further investigation should be made prior to any retrofit. This structural upgrade is recommended under the assumption that no structural plywood sheathing exists at each diaphragm level, based on the information provided in any drawings or photographs. If adequate structural plywood sheathing is found in the diaphragms, with the proper connections to the existing shear walls, no structural upgrade needs to be made for this area of concern.

4.1.4 New Braced Frames

The unreinforced masonry piers at the perimeter of the building were determined to be overstressed from the seismic forces applied on the building. To mitigate seismic risk, new seismic-resisting elements should be installed. It is recommended that inverted chevron braced frames be installed between piers at select locations. These braced frames should then be connected by a drag element, such as a steel beam. The proposed braced frame locations and drag elements are on the conceptual floor plan in Appendix B. The installation of braced frames will also require foundation work to adequately transfer shear and overturning forces resisted by the braced frame. It is recommended that grade beams be installed at each proposed location of the braced frames.

4.1.5 Cross Ties

Although cross ties were observed in both directions at many interior columns, they were not observed at all necessary locations. New cross ties and wall connections can be added to resist the required out-of-plane wall forces and distribute these forces through the diaphragm. New strap plates and/or rod connections can be used to connect existing framing members together so that they function as a cross tie in the diaphragm. This includes tying together the existing joists where they intersect at the girders, as well as tying the girders together at each interior column.

4.2 Foundations and Geotechnical Considerations

A detailed geotechnical analysis of the site soils was not included in the scope of this study. As a result, the geotechnical seismic effects on the existing building and its foundations, such as the presence of liquefiable soils and allowable soil bearing pressures, are unknown at this time. However, based on Washington State liquefaction mapping, the building is located on soils classified with a very low susceptibility to liquefaction. Future seismic upgrade projects should consider completing a geotechnical investigation to verify that the underlying soils are not susceptible to liquefaction and to determine the nature of the liquefaction hazard and the characteristics of the site soils. Foundation mitigation and ground improvement may be required, and the recommended geotechnical investigation could have a major impact on the scope of work required for seismic retrofit.

Liquefaction is the tendency of certain soils to saturate and lose strength during strong earthquake shaking, causing soils to flow and deform similar to a liquid. Liquefaction, when it occurs, drastically decreases the soil bearing capacity and tends to lead to large differential settlement of soil across a building's footprint. Liquefaction can also cause soils to spread laterally and can dramatically affect a building's response to earthquake motions, all of which can significantly compromise the overall stability of the building and possibly lead to isolated or widespread collapse in extreme cases. Existing foundations damaged as a result of liquefiable soils also make the building much more difficult to repair after an earthquake.

Buildings that are not founded on a raft foundation or deep foundation system (such as grade beams and piles), and those with conventional strip footings and isolated spread footings that are not interconnected well with tie beams, are especially vulnerable to liquefiable soils. Mitigation techniques used to improve structures in liquefiable soils vary based on the type and amount of liquefiable soils and may include ground improvements to densify the soil (aggregate piers, compaction piling, jet grouting), installation of deep foundations (pin piling, augercast piling, micro-piling), and installation of tie beams between existing footings.

4.3 Tsunami Considerations

The building is not located in a tsunami inundation zone according to Washington State DNR tsunami inundation mapping. It is not necessary to consider tsunamis when planning seismic upgrades to this building.

4.4 Nonstructural Recommendations and Considerations

Table 3.2.3-1 identifies nonstructural deficiencies that do not meet the performance objective selected for the Tacoma School of the Arts-Pacific. It is recommended that these deficiencies be addressed to provide nonstructural performance consistent with the performance of the upgraded structural lateral-force-resisting system. As-built information for the existing nonstructural systems, such as fire sprinklers, mechanical ductworks, and piping, are not available for review. Only limited visual observation of the systems was performed during field investigation due to limited access or visibility to observe existing conditions. The conceptual mitigation strategies provided in this study are preliminary only. The final analysis and design for seismic rehabilitation should include a detailed field investigation.

4.4.1 Architectural Systems

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

For any remodel project of an existing building, the International Existing Building Code (IEBC) would be 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.

Energy Code

Elements of the exterior building envelope to be affected by the proposed seismic upgrade work may be required to be brought up to the current Washington State Energy Code per Chapter 5, where applicable.

Accessibility

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 the current accessibility standards of the Americans 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, and Life Safety alarm systems. 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 should be performed to determine the extent to which an existing facility would need to be improved in order to comply with current ADA requirements.

Hazardous Materials Survey

Given the age of the building, there may be existing construction elements, such as floor tile, tile adhesive or pipe insulation, that could contain asbestos. Verify that a Hazardous Materials survey and abatement of the building has been performed prior to the start of any demolition work.

Protect Roof from Adjacent Building

The adjacent building towers six stories above this building's roof level, and the adjacent wall is faced with brick that could fall onto this building's roof in a seismic event. It is recommended that about one third of the roof be strengthened with an overbuild to protect from potential falling debris. This can be done with thicker sheathing over additional wood joists spanning between cripple walls aligned with purlins. This work may impact the existing roof membrane, necessitating replacement of the roof membrane. Reroofing recommendations are discussed below.

URM Wall Anchorage

The out-of-plane anchorage of the walls at the diaphragms is assumed to be inadequate based on the age and nature of the building. HTT/LTT tension ties should be added to the joists, blocking between joists. A strap should be installed over the existing 2x-decking, aligned with the blocking, and an HTT/LTT tension tie should be installed from the blocking to the wall. If found necessary, a HDU horizontal hold-down should be installed instead of the tension tie.

The existing floor/roof framing is exposed throughout much of the building; the work will have limited impact in these areas. In areas with existing ceilings, repair/replacement will need to be considered, depending on the extent of the work.

Roof Diaphragm Sheathing and Second Floor Diaphragm Sheathing

The roof and second-floor diaphragms in the building have spans that exceed current structural design limits. It is advised to fix this deficiency by strengthening the diaphragm by overlaying the existing decking with plywood sheathing. The current floor and roof finishes should be removed and then be sheathed with APA-rated plywood panels.

The second level will require new floor finishes throughout. Plumbing fixtures will need to be removed and reset, and elevator thresholds and stair landings will need to be modified to match the new finished floor elevation.

As part of a reroof project, we recommend installing an above-roof continuous rigid insulation of R-38 over the entire roof to comply with current energy code. Mechanical equipment curbs should be raised to accommodate the thicker insulation. Alternately, additional batt insulation above the ceilings at the bottom of the trusses would need to be added to increase the existing R-13 insulation to an R-49. Since most of the floor/roof structure is exposed, this is a less desirable option, because it will conceal the attractive wood decking.

Cross Ties

New cross ties and wall connections can be added to resist the required out-of-plane wall forces and distribute these forces through the diaphragm. New strap plates and/or rod connections can be used to connect existing framing members together so that they function as a cross tie in the diaphragm. This includes tying together the existing joists where they intersect at the girders, as well as tying the girders together at each interior column.

The existing floor/roof framing is exposed throughout much of the building; the work will have limited impact in these areas. In areas with existing ceilings, repair/replacement will need to be considered, depending on the extent of the work.

New Braced Frames

New seismic resisting elements should be installed at unreinforced masonry piers at the perimeter of the building. Inverted chevron braced frames should be installed between piers at select locations, connected by steel beams. The installation of braced frames will require foundation work; it is recommended that grade beams be installed at each proposed location of the braced frames.

Proposed braced frame locations will impact existing fenestration.

Installing braced frames on the interior side of exterior walls would require invasive work, especially for foundation/grade beam installation. Braced frames would be painted, if left exposed, or enclosed within framed gypsum board enclosures.

Installing braced frames on the exterior of the building would minimize the impact on the interior but would significantly alter the design of the building's exterior. Exterior foundation work would impact pedestrian traffic near the building. The braced frames could be exposed w/exterior grade finishes or enclosed with framing/EIFS. The building's exterior appearance will be altered significantly.

Ceiling in Paths of Egress

The suspended ceiling in the main corridor is an integrated acoustical ceiling system, likely with a suspended metal T-grid. Because this corridor is a main path of egress, it is recommended that the ceiling grid support system be further investigated and checked for proper seismic bracing and compression support for every 12 square feet of area and proper edge clearance detailing at the corridor walls. Preventing the risk of a fallen integrated ceiling system will mitigate the risk of obstructions impeding the paths of egress as students and faculty evacuate the building following a seismic event.

Lighting Fixtures in Paths of Egress

The light fixtures observed in the main corridor are supported within an integrated ceiling system or suspended from exposed structure above, over a main path of egress. Maintenance and facility staff should verify that each fixture is independently supported to the roof structure from opposite corners and add wire supports as necessary.

Contents and Furnishings

Buildings often contain various tall and narrow furniture, such as shelving and storage units, that are freestanding away from any backing walls. There are several nonstructural deficiencies that do not meet the performance objective selected for Tacoma School of the Arts-Pacific. It is recommended that these deficiencies be addressed to provide nonstructural performance consistent with the performance of the upgraded structural lateral–force-resisting system. High book shelving in the library, for example, can be highly susceptible to toppling if not anchored properly to the backing walls or to each other, and can become a life safety hazard. It is recommended that maintenance and facility staff verify that the tops of the shelving units are braced or anchored to the nearest backing wall or provide overturning base restraint. Heavy items weighing more than 20 pounds on upper shelves or cabinet furniture should be restrained by netting or cabling to avoid becoming falling hazards to students or faculty below.

4.4.2 Mechanical Systems

The main seismic concerns for mechanical equipment are sliding, swinging, and overturning. Inadequate lateral restraint or anchorage can shift equipment off its supports, topple equipment to the ground, or dislodge overhead equipment, making them falling hazards. Investigation of above-ceiling mechanical equipment and systems was not part of this study, but an initial investigation for the presence of mechanical equipment bracing can be performed by maintenance and facility staff to see if equipment weighing more than 20 pounds with a center of mass more than 4 feet above the adjacent floor level is laterally braced. If bracing is not present, and the equipment poses a falling hazard to students and faculty below, further investigation is recommended by a structural engineer. There is a mechanical mezzanine above the second level/below roof level, but its lateral bracing system could not be identified.

4.5 Opinion of Conceptual Seismic Upgrades Costs

An opinion of probable project costs of the concept-level seismic upgrade recommendations provided in this report is included in Appendix C. The scope of work to develop the probable costs is based on input from 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 the 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.

For this preliminary opinion of probable costs, the estimate of construction costs of the preliminary scope of work is developed based on current 1st Quarter (1Q) 2021 costs. Costs are then escalated to 4Q 2022 at 6% per year of the baseline cost estimate. Costs are developed based on the Tier 1 checklist, concept-level seismic upgrade design sketches, and project narratives.

A range of the cost estimate of –20% (low) to +50% (high) is used to develop the range of the construction cost estimate for the concept-level scope of work. The –20% to +50% range guidance is from Table 1 of the AACE International Recommended Practice 56R-08, *Cost Estimate Classification System*. This estimate is classified as a Class 5 based on the level of design of 0% to 2%. The range of a Class 5 construction cost estimate based on the AACE guidance selected for this estimate is –20% to +50%.

The estimated total cost (construction costs plus soft costs) to mitigate the deficiencies identified in the Tier 1 checklists of the Tacoma School of the Arts Pacific Building ranges between approximately \$5.94M and \$11.14M (–20%/+50%). The baseline estimated total cost to seismically upgrade this building is approximately \$7.43M. On a per-square-foot basis, the baseline seismic upgrade cost is estimated to be approximately \$344 per square foot in 4Q 2022 dollars, with a range between \$275 per square foot and \$516 per square foot.

4.5.1 Opinion of Probable Construction Costs

This conceptual opinion of construction costs includes labor, materials, equipment, and scope contingency, general contractor general conditions, home office 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 Soft Costs are described below in Section 4.5.2.

The cost is developed in 1Q 2021 costs. The costs are then escalated to 4Q 2022 using an escalation rate of 6.0% per year. If the mid-point of construction will occur at a date earlier or later than 4Q 2022, then it is appropriate to adjust the escalation to the revised mid-point of construction. Construction costs excluded from the opinion are site work, phasing of construction, additional building modifications not directly related to the seismic scope of work, off-hours labor costs, accelerated schedule overtime labor costs, replacement/relocation/additional FF+E, and building code changes that occur after this report.

For project budget planning purposes, it is highly recommended that the opinion of probable project costs is determined including: the overall construction budget of the seismic upgrade and additional scope of work for the building via the services of an A/E design team to study the proposed seismic mitigation strategies to refine the concept-level seismic upgrades design approach contained in this report, determine the construction timeline to adjust the escalation costs, define the construction phasing, if any, and the project soft costs.

4.5.2 Opinion of Probable A-E Design Budgets and Owner's Additional Project Costs (Soft Costs)

Additional owner's project costs would likely include owner's project administration costs, including project management, financing/bond costs, administration/contract/accounting costs, review of plans, value engineering studies, building permits, bidding costs, equipment, fixtures, furnishings and technology, and relocation of the school staff and students during construction. These costs are known as soft costs.

These soft costs have been included in the opinion of probable costs at 40% of the baseline probable construction cost for the seismic upgrade of this building.

The soft costs used for the project that total to 40% are:

A+E Design - 10%
QA/QC Testing - 2%
Project Administration - 2%
Owner Contingency - 11%
Average Washington State Sales Tax - 9%
Building Permits - 6%

It is typical for soft costs to vary from owner to owner. Based on our team members' experience on K-12 school projects in the state of Washington, it is our opinion that an allowance of 40% of the average probable construction cost is a reasonable and appropriate soft cost recommendation for planning purposes. We also recommend that each owner develop their own soft costs as part of their budgeting process and not rely solely on this recommended percentage.

4.5.3 Opinion of Escalation Rates

A 6.0%/year construction cost escalation rate is used for planning purposes for the conceptual estimates. The rate is compounded annually to the projected midpoint of construction. This rate is representative of the escalation based on the previous five years of market experience of construction costs throughout the state of Washington and is projected going forward for these projects. This rate is calculated to the 4th Quarter of 2022 as an allowance for planning purposes. The actual construction schedule for the project is to be determined, and we recommend the escalation cost be revised based on revised construction schedule using the 6%/year rate.

Table 4.5.3-1. 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)
Tacoma School of the Arts – Pacific Building	URM	High / C-D	**Structural**			
			Life Safety	21,601 SF	$117 ($2.53M) - $219 ($4.74M)	$146 ($3.16M)
			Nonstructural			
			Life Safety	21,601 SF	$80 ($1.72M) - $149 ($3.22M)	$99 ($2.15M)
			Total			
				21,601 SF	$196 ($4.24M) - $368 ($7.96M)	$246 ($5.30M)
					Estimated Soft Costs:	$2.12M
					Total Estimated Project Costs:	**$7.43M**

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

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Appendix A: ASCE 41 Tier 1 Screening Report

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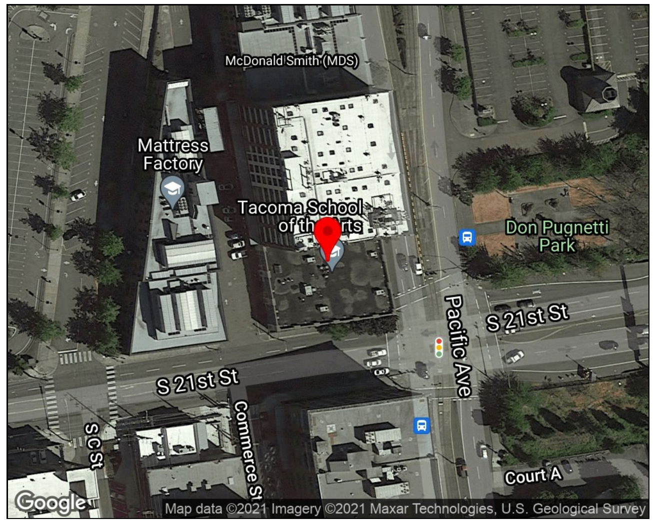
1. Tacoma, Tacoma School of the Arts-Pacific, SOTA Pacific Ave

1.1 Building Description

Building Name:	SOTA Pacific Ave
Facility Name:	Tacoma School of the Arts-Pacific
District Name:	Tacoma
ICOS Latitude:	47.243533
ICOS Longitude:	-122.436639
ICOS Building ID:	59768
ASCE 41 Bldg Type:	URM
Enrollment:	608
Gross Sq. Ft. :	21601
Year Built:	1904
Number of Stories:	2
$S_{XS\ BSE\text{-}2E}$:	1.238
$S_{X1\ BSE\text{-}2E}$:	0.524
ASCE 41 Level of Seismicity:	High
Site Class:	C
V_{S30}(m/s):	399
Liquefaction Potential:	very low
Tsunami Risk:	No
Structural Drawings Available:	No
Evaluating Firm:	DCI Engineers

** Liquification Potential and Tsunami Risk is based on publicly available state geologic hazard mapping.*



The Tacoma School of the Arts on Pacific Ave was originally constructed in 1904. It is a rectangular two-story building that consists of a little over 10,000 square feet of area on each floor. It is approximately 119-ft long by 92-ft wide. The roof structure appears to be wood decking over wood joists and girders, and the second floor framing appears to be the same. The roof and second floor are vertically supported by URM exterior walls with a CMU wall on the the west side of the first floor, and by wood columns found in various locations throughout the building. The structural floor on the main floor is slab on grade, likely with conventional concrete spread and continuous footings acting as the foundation of the building.

1.1.1 Building Use

The building is one structure used by the Tacoma School of the Arts for its visual and performing arts curriculum. It has multiple classrooms, labs and studios, and various administrative spaces.

1.1.2 Structural System

Table 1-1. Structural System Description of Tacoma School of the Arts-Pacific

Structural System	Description
Structural Roof	The roof structure is wood decking over timber joists and girders.
Structural Floor(s)	The structural floor is slab on grade at the main level, and wood decking over timber joists and girders.
Foundations	The foundations are assumed to be conventional concrete spread and continuous footings.
Gravity System	The gravity system primarily consists of URM bearing walls at the exterior and wood columns at the interior. There are also some CMU wall infill elements at the exterior on the west side of the building.
Lateral System	The lateral system is flexible wood diaphragms at the 2nd floor and roof, spanning to URM exterior walls.

1.1.3 Structural System Visual Condition

Table 1-2. Structural System Condition Description of Tacoma School of the Arts-Pacific

Structural System	Description
Structural Roof	Average. Several locations displayed visible signs of minor splits in the wood girders and joists. Signs of previous water infiltration that have since been mitigated.
Structural Floor(s)	Average. Several locations displayed visible signs of minor splits in the wood girders and joists.
Foundations	Good. No visible signs of excessive settlement.
Gravity System	Average. Splits and checks were observed in many of the interior wood columns and some were quite large. Minor cracks and deterioration were observed on the exterior URM walls.
Lateral System	Decent. Minor cracks and deterioration were observed on the exterior walls.

Figure 1-1. The west side of the building. Some minor deterioration is present at the URM walls.

Figure 1-2. The south side of the building. Some minor deterioration is present at the URM walls

Figure 1-3. Wood post supporting a girder at a partition wall. Post has major split, and girder has minor split where it bears on the post.

Figure 1-4. Connection of floor joists and girder at URM exterior wall.

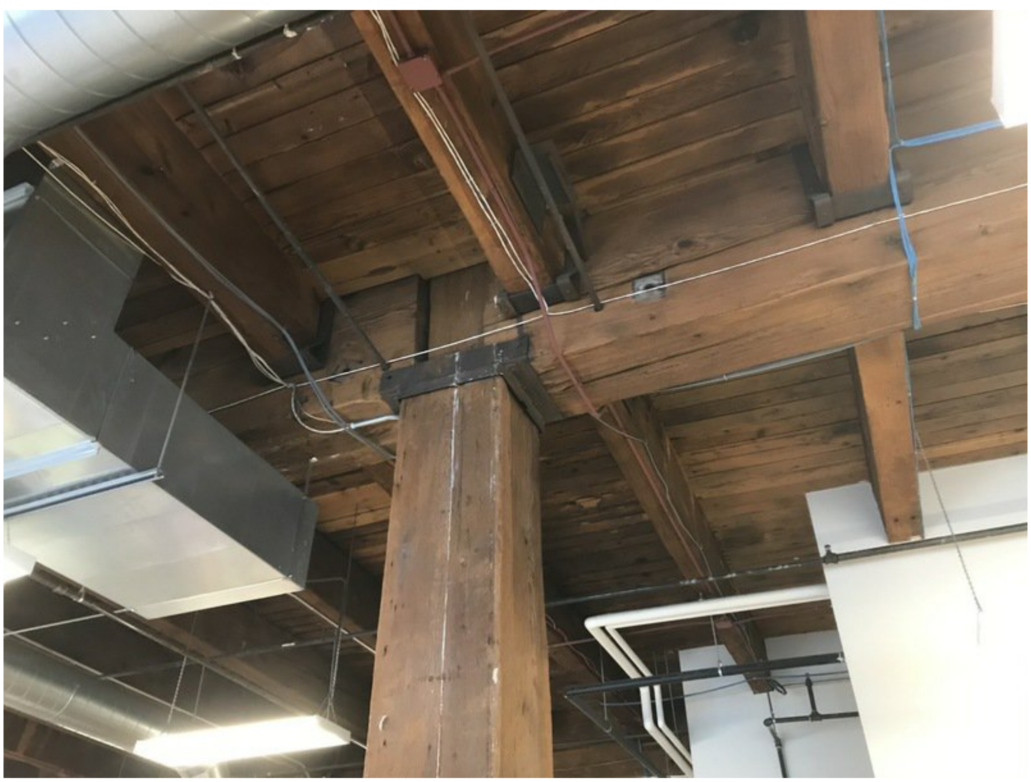


Figure 1-5. Wood post to girder connection. Some minor splitting is present in the girder.

Figure 1-6. Northeast corner of the building on the first floor. Appears to be minor damage to the URM, as is common in various locations throughout the building.

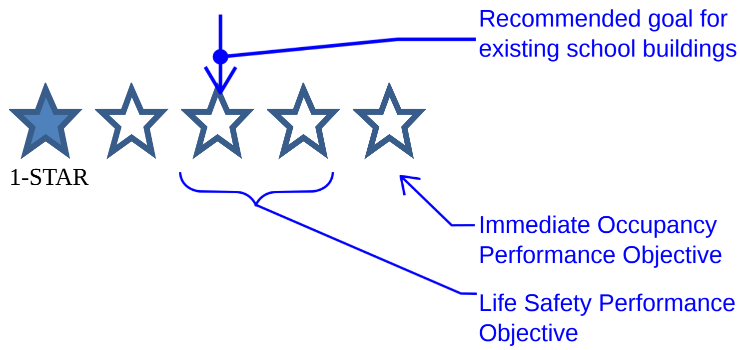
Figure 1-7. Joist to girder connection at the interior mechanical space.

1.1.4 Earthquake Performance Rating System - Structural Safety Rating

The seismic evaluation items from the ASCE 41 Tier 1 seismic evaluation checklist have been translated to a Structural Safety star-rating using the *EPRS ASCE 41-13 Translation Procedure*. There are two other safety sub-ratings using the EPRS *Translation Procedure*: a Geologic safety sub-rating and a Nonstructural safety sub-rating, that are not included below.

The structural safety star-rating below is a preliminary rating based on the information available for this study. The geologic checklist items have been excluded from the structural safety star-rating. If a building's structural safety star-rating is to be improved, it may also be necessary to further assess the geologic conditions of the building site. Determining the final star-rating of a building is intended to be an iterative process and preliminary ratings will often times be conservative until more field investigation, structural analysis, and engineering judgment is performed by a structural engineer. The intent in providing a preliminary star-rating as part of this study is to provide school districts with the action lists below to further improve the seismic performance and safety of the buildings that were assessed. The tables below indicate the Unknown (U) or Noncompliant (NC) structural seismic evaluation items that should be mitigated or further investigated to improve the Earthquake Performance Rating System (EPRS) structural safety rating for this building.

EPRS Structural Safety Rating for Tacoma School of the Arts-Pacific, SOTA Pacific Ave:



1-STAR — Risk of Collapse in Multiple or Widespread Locations (Expected performance as a whole would lead to multiple or widespread conditions known to be associated with earthquake-related collapse resulting in injury, entrapment, or death.)

2-STAR — Risk of Collapse in Isolated Locations (Expected performance in certain locations within or adjacent to the building would lead to conditions known to be associated with earthquake-related collapse resulting in injury, entrapment, or death.)

3-STAR — Loss of Life Unlikely (Expected performance results in conditions that are unlikely to cause severe structural damage or loss of life). A 3-star rating meets the Tier 1 Life Safety (LS) structural performance objective.

4-STAR — Serious Injuries Unlikely (Expected performance results in conditions that are associated with limited structural damage and are unlikely to cause serious injuries).

5-STAR — Injuries and Entrapment Unlikely (Expected performance results in conditions that are associated with minimal structural damage and are unlikely to cause injuries or keep people from exiting the building). A 5-star rating meets the Tier 1 Immediate Occupancy (IO) structural performance objective.

Table 1-3. Identified Seismic Evaluation Items to Address for an improved ★★ 2-STAR Rating

Evaluation Item	Tier 1 Screening	Description
Load Path	Noncompliant	While the gravity load carrying system appeared complete, in-plane load connections between the roof/floor diaphragms were not observed and the out-of-plane tension ties between the walls and diaphragms appeared insufficient.
Shear Stress Check	Noncompliant	Per the Quick Check procedure, the shear stress is noncompliant. Further investigation should be performed prior to retrofit. Lateral system strengthening, such as shotcreting walls or adding new shear walls or braced frames may be appropriate to mitigate seismic risk.
Wall Anchorage	Noncompliant	Tie-rods were observed, but were spaced out roughly 20-feet on center and appear inadequate for the design loads. No existing drawings and inadequate access to verify. Further investigation should be performed prior to retrofit. Diaphragm reinforcement, including tension ties, blocking, strapping, and diaphragm nailing to provide out-of-plane connection at masonry walls may be appropriate to mitigate seismic risk.
Wood Ledgers	Unknown	Likely compliant. No existing drawings and inadequate access to verify, but there appeared to be limited connections between the walls and diaphragms. Further investigation should be performed.
Transfer to Shear Walls	Unknown	Likely noncompliant. Diaphragm connections to shear walls were either unclear in photos or not available in drawings.
Cross Ties	Unknown	Likely noncompliant. Ties were observed in both directions at many interior column locations, but not all of them.
Spans	Noncompliant	Wood diaphragms with spans greater than 24 ft do not consist of wood structural panels or diagonal sheathing. Further investigation should be performed prior to retrofit. Installation of wood structural panel sheathing may be appropriate to mitigate seismic risk.

Note: All of the evaluation items in Table 3 need to be assessed as Compliant (C) in order to achieve a 2-Star Structural Safety Rating.

Table 1-4. Additional Seismic Evaluation Items to Mitigate or Further Investigate for an improved ★★★ 3-STAR Rating

Evaluation Item	Tier 1 Evaluation	Description
Adjacent Buildings	Noncompliant	The clear distance between the building being evaluated and the adjacent building to it is less than 1.5% the height of the shorter building.
Mezzanines	Unknown	There is a mechanical mezzanine above the second level, but its lateral bracing system could not be identified. It is likely this is COMPLIANT and the mezzanine relies on surrounding walls as shear walls to transfer seismic load to the 2nd level diaphragm.
Masonry Layup	Unknown	Details or photos were unavailable to observe the masonry layup; likely compliant.

Note: Tables 3 and 4 are cumulative. All of the evaluation items in Table 4 need to be assessed as Compliant (C) in addition to all of the evaluation items in Table 3 being assessed as Compliant (C), in order to achieve a 3-Star Structural Safety Rating.

The Structural Safety star-rating contained in this report is based on ASCE 41 Tier 1 Screening Checklists only. These seismic screening checklists are often the first step employed by structural engineers when trying to determine the seismic vulnerabilities of existing buildings and to begin a process of mitigating these seismic vulnerabilities. School district facilities management personnel and their design consultants should be able to take advantage of this information to help inform and address seismic risks in existing or future renovation, repair, or modernization projects.

It is important to note that information used for these school seismic screenings was limited to available construction drawings and limited site observations by our team of licensed structural engineers. In some cases, construction drawings were not available for review. Due to the limited scope of the study, our team of engineers were not able to perform more-detailed investigations above ceilings, behind wall finishes, in confined spaces, or in other areas obstructed from view. In many cases, further investigation and engineering analysis may find that items marked as unknown or noncompliant may not require seismic mitigation if it is shown that the existing structure is acceptable in its current state. In these cases, further investigation and engineering analysis should be conducted ahead of a seismic upgrade construction project, especially when a building is marked as having many unknown items.

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 1-5. Identified Structural Seismic Deficiencies for Tacoma Tacoma School of the Arts-Pacific SOTA Pacific Ave

Deficiency	Description
Load Path	While the gravity load carrying system appeared complete, in-plane load connections between the roof/floor diaphragms were not observed and the out-of-plane tension ties between the walls and diaphragms appeared insufficient.
Adjacent Buildings	The clear distance between the building being evaluated and the adjacent building to it is less than 1.5% the height of the shorter building.
Shear Stress Check	Per the Quick Check procedure, the shear stress is noncompliant. Further investigation should be performed prior to retrofit. Lateral system strengthening, such as shotcreting walls or adding new shear walls or braced frames may be appropriate to mitigate seismic risk.
Wall Anchorage	Tie-rods were observed, but were spaced out roughly 20-feet on center and appear inadequate for the design loads. No existing drawings and inadequate access to verify. Further investigation should be performed prior to retrofit. Diaphragm reinforcement, including tension ties, blocking, strapping, and diaphragm nailing to provide out-of-plane connection at masonry walls may be appropriate to mitigate seismic risk.
Spans	Wood diaphragms with spans greater than 24 ft do not consist of wood structural panels or diagonal sheathing. Further investigation should be performed prior to retrofit. Installation of wood structural panel sheathing may be appropriate to mitigate seismic risk.

1.2.2 Structural Checklist Items Marked as Unknown

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 1-6. Identified Structural Checklist Items Marked as Unknown for Tacoma Tacoma School of the Arts-Pacific SOTA Pacific Ave

Unknown Item	Description
Mezzanines	There is a mechanical mezzanine above the second level, but its lateral bracing system could not be identified. It is likely this is COMPLIANT and the mezzanine relies on surrounding walls as shear walls to transfer seismic load to the 2nd level diaphragm.
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. very 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	The site is located within 5 miles of a mapped fault according to DNR state mapping. Further investigation by a licensed geotechnical engineer is necessary to determine the potential for surface fault rupture at the site.
Wood Ledgers	Likely compliant. No existing drawings and inadequate access to verify, but there appeared to be limited connections between the walls and diaphragms. Further investigation should be performed.
Transfer to Shear Walls	Likely noncompliant. Diaphragm connections to shear walls were either unclear in photos or not available in drawings.
Masonry Layup	Details or photos were unavailable to observe the masonry layup; likely compliant.
Cross Ties	Likely noncompliant. Ties were observed in both directions at many interior column locations, but not all of them.

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 1-7. Identified Nonstructural Seismic Deficiencies for Tacoma Tacoma School of the Arts-Pacific SOTA Pacific Ave

Deficiency	Description
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	It did not appear that contents taller than 6 feet were adequately restrained. Restraining contents by bracing top of contents to nearest backing wall or providing overturning base restraint may be appropriate to mitigate seismic risk.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	A number of bookshelves appear to support heavy items that do not appear well secured. Heavy items on upper shelves should be restrained by netting or cabling to mitigate seismic risk.

1.3.2 Nonstructural Checklist Items Marked as Unknown

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 1-8. Identified Nonstructural Checklist Items Marked as Unknown for Tacoma Tacoma School of the Arts-Pacific SOTA Pacific Ave

Unknown Item	Description
HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	Piping for gas not fully accessible for observation. Further investigation may be appropriate to mitigate seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	Piping for gas not fully accessible for observation. Further investigation may be appropriate to mitigate seismic risk.
P-2 Heavy Partitions Supported by Ceilings. HR-LMH; LS-LMH; PR-LMH.	An interior CMU wall was observed, but the details of how it is attached to the structure could not be seen.
P-3 Drift. HR-not required; LS-MH; PR-MH.	An interior CMU wall was observed, but the details of how it is attached to the structure could not be seen.
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	A few areas had suspended ceilings with light fixtures, but their attachment could not be observed.
PCOA-1 URM Parapets or Cornices. HR-LMH; LS-LMH; PR-LMH.	Likely compliant. No existing drawings and inadequate access to verify. Further investigation should be performed, but the parapets do not appear to be very tall and likely meet the 1.5 height to thickness ratio.
S-2 Stair Details. HR-not required; LS-LMH; PR-LMH.	No existing drawings and inadequate access to verify. Further investigation should be performed.
EL-1 Retainer Guards. HR-not required; LS-H; PR-H.	Elevator equipment was not observed. The elevator checklist items should be verified by an elevator designer or supplier.
EL-2 Retainer Plate. HR-not required; LS-H; PR-H.	Elevator equipment was not observed. The elevator checklist items should be verified by an elevator designer or supplier.

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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			While the gravity load carrying system appeared complete, in-plane load connections between the roof/floor diaphragms were not observed and the out-of-plane tension ties between the walls and diaphragms appeared insufficient.
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			The clear distance between the building being evaluated and the adjacent building to it is less than 1.5% the height of the shorter building.
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	There is a mechanical mezzanine above the second level, but its lateral bracing system could not be identified. It is likely this is COMPLIANT and the mezzanine relies on surrounding walls as shear walls to transfer seismic load to the 2nd level diaphragm.

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				

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				
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				
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				
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				
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				

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 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	The site is located within 5 miles of a mapped fault according to DNR state mapping. Further investigation by a licensed geotechnical engineer is necessary to determine the potential for surface fault rupture at the site.

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				
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				

17-36 Collapse Prevention Structural Checklist for Building Types URM and URMa

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				
Shear Stress Check	The shear stress in the unreinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 30 lb/in.2 (0.21 MPa) for clay units and 70 lb/in.2 (0.48 MPa) for concrete units. (Tier 2: Sec. 5.5.3.1.1; Commentary: Sec. A.3.2.5.1)		X			Per the Quick Check procedure, the shear stress is noncompliant. Further investigation should be performed prior to retrofit. Lateral system strengthening, such as shotcreting walls or adding new shear walls or braced frames may be appropriate to mitigate seismic risk.

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			Tie-rods were observed, but were spaced out roughly 20-feet on center and appear inadequate for the design loads. No existing drawings and inadequate access to verify. Further investigation should be performed prior to retrofit. Diaphragm reinforcement, including tension ties, blocking, strapping, and diaphragm nailing to provide out-of-plane connection at masonry walls may be appropriate to mitigate seismic risk.

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	Likely compliant. No existing drawings and inadequate access to verify, but there appeared to be limited connections between the walls and diaphragms. Further investigation should be performed.
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	Likely noncompliant. Diaphragm connections to shear walls were either unclear in photos or not available in drawings.
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				

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

Seismic-Force-Resisting System

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Proportions	The height-to-thickness ratio of the shear walls at each story is less than the following: Top story of multi-story building – 9; First story of multi-story building – 15; All other conditions – 13. (Tier 2: Sec. 5.5.3.1.2; Commentary: Sec. A.3.2.5.2)	X				
Masonry Layup	Filled collar joints of multi-wythe masonry walls have negligible voids. (Tier 2: Sec. 5.5.3.4.1; Commentary: Sec. A.3.2.5.3)				X	Details or photos were unavailable to observe the masonry layup; likely compliant.

Diaphragms (Stiff or Flexible)

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				
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				

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	Likely noncompliant. Ties were observed in both directions at many interior column locations, but not all of them.

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				
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 diaphragms with spans greater than 24 ft do not consist of wood structural panels or diagonal sheathing. Further investigation should be performed prior to retrofit. Installation of wood structural panel sheathing may be appropriate to mitigate seismic risk.
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		No diagonally sheathed or unblocked structural panel diaphragms were observed.
Other Diaphragms	The 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				

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. before engagement of the anchors. (Tier 2: Sec. 5.7.1.2; Commentary: Sec. A.5.1.4)	X				
Beam, Girder, and Truss Supports	Beams, girders, and trusses supported by unreinforced masonry walls or pilasters have independent secondary columns for support of vertical loads. (Tier 2: Sec. 5.7.4.4; Commentary: Sec. A.5.4.5)	X				

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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				Piping appears to meet NFPA-13 requirements.
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				Piping appears to meet NFPA-13 requirements.
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		The building does not have emergency power.
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		The stairs are not enclosed.
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		Fire suppression device does not penetrate panelized ceilings.
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		No hazardous material-containing equipment observed.
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		Breakable containers with hazardous contents were not observed.
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	Piping for gas not fully accessible for observation. Further investigation may be appropriate to mitigate seismic risk.

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				Shutoff valves for the natural gas piping was observed in several locations.
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	Piping for gas not fully accessible for observation. Further investigation may be appropriate 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		The building does not have 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		URM partitions were not observed.
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	An interior CMU wall was observed, but the details of how it is attached to the structure could not be seen.
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	An interior CMU wall was observed, but the details of how it is attached to the structure could not be seen.
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		No suspended gypsum board ceilings observed.
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	A few areas had suspended ceilings with light fixtures, but their attachment could not be observed.
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 does not have any exterior cladding components.

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 appear to have any glazing panes greater than 16 ft2.

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		The building does not have any masonry veneer.
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		The building does not have any masonry veneer.
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		The building does not have any masonry veneer.
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		The building does not have any masonry veneer.
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		The building does not have any 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		The building does not have any masonry veneer.
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	Likely compliant. No existing drawings and inadequate access to verify. Further investigation should be performed, but the parapets do not appear to be very tall and likely meet the 1.5 height to thickness ratio.
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		Cloth awnings are present at the main entry, but heavier steel canopies were not observed.
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		There are no concrete parapets.
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		There does not appear to be any cornices, parapets, signs and other ornamentation or 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 URM 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		The building does not have any hollow-clay tile or unreinforced masonry walls around stair enclosures.
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	No existing drawings and inadequate access to verify. Further investigation should be performed.

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		Does not appear that there are any industrial storage racks taller than 12 feet in the building.
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			It did not appear that contents taller than 6 feet were adequately restrained. Restraining contents by bracing top of contents to nearest backing wall or providing overturning base restraint may be appropriate to mitigate seismic risk.
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			A number of bookshelves appear to support heavy items that do not appear well secured. Heavy items on upper shelves should be restrained by netting or cabling to mitigate seismic risk.
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				There did not appear to be any unbraced equipment weighing more than 20 lb.
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				It appeared that the equipment in the mechanical room was adequately braced.
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		No equipment taller than 6 feet was observed.
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	Elevator equipment was not observed. The elevator checklist items should be verified by an elevator designer or supplier.
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	Elevator equipment was not observed. The elevator checklist items should be verified by an elevator designer or supplier.
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.

Appendix B: Concept-Level Seismic Upgrade Figures

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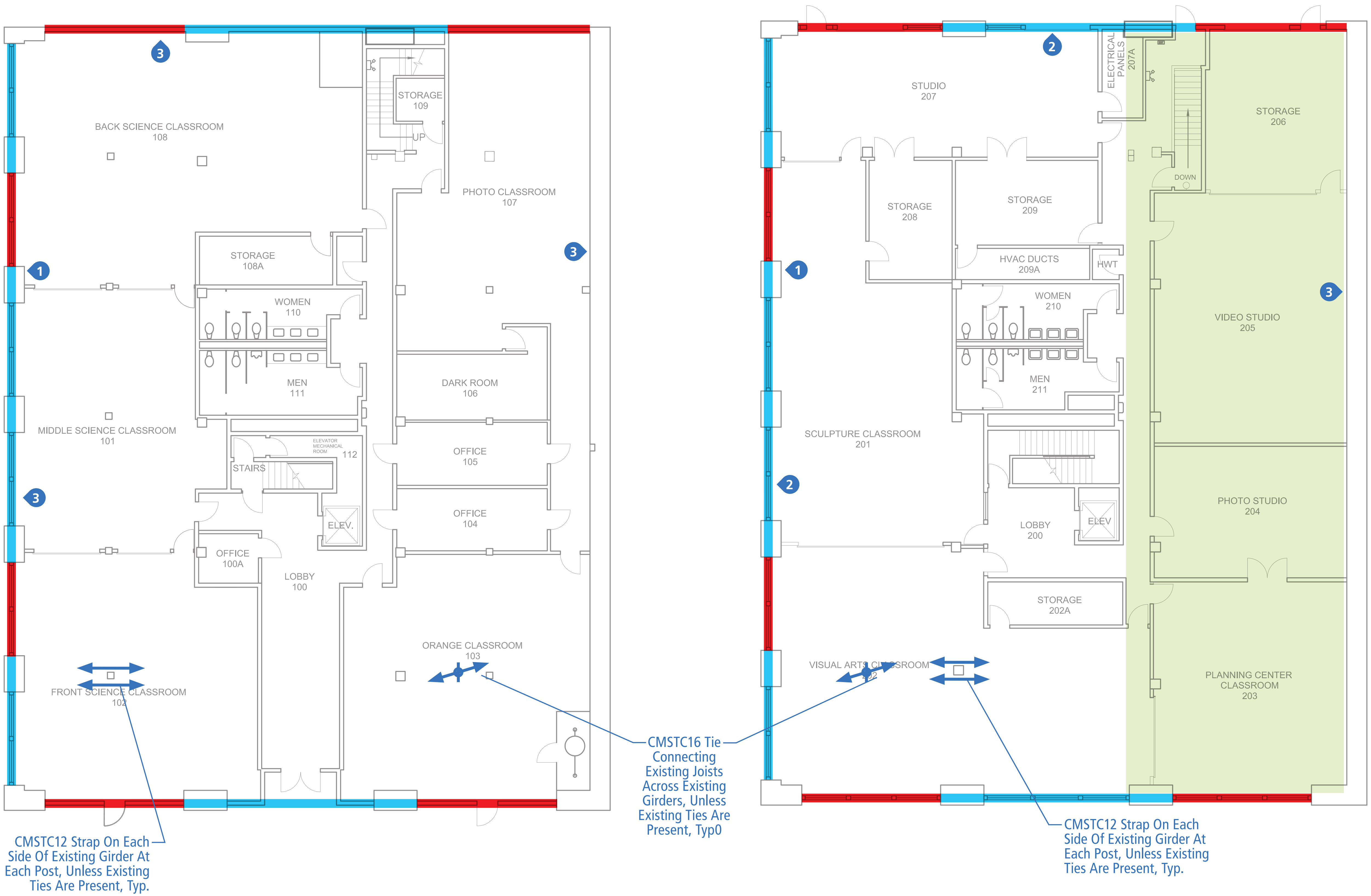
PHASE 2



LEGEND

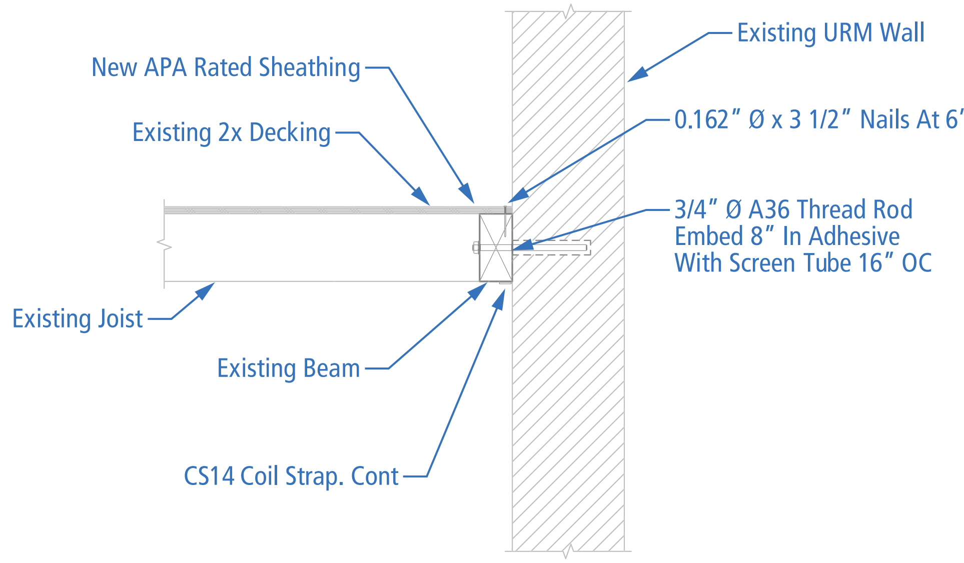
- New Inverted Chevron Braced Frame, Grade Beam To Be Installed At The Proposed Braced Frame Locations
- Steel Drag Element
- 5/8" APA-Rated Sheathing On 2x8 At 24" OC Spanning Between Cripple Walls Aligned With Purlins (~48" OC)
- 1 Typical In-Plane & Out-Of-Plane Wall Anchorage Details At The URM Pier Locations
- 2 Typical In-Plane & Out-Of-Plane Wall Anchorage Detail At Window/Door Openings, Both (A) Perpendicular To Joists & (B) Parallel To Joists
- 3 Typical In-Plane & Out-Of-Plane Wall Anchorage Detail At Blind Walls, Applies At Both The Shared Wall On The North Side Of The Building & The Reinforced Masonry Wall On The West Side Of The Building

ReidMiddleton DCI ENGINEERS

Tacoma School Of The Arts Seismic Upgrades – Pacific Avenue Building

Washington State School Seismic Safety Assessments Project – Tacoma Public Schools – June 2021

Figure 1 – First & Second Floor Plan

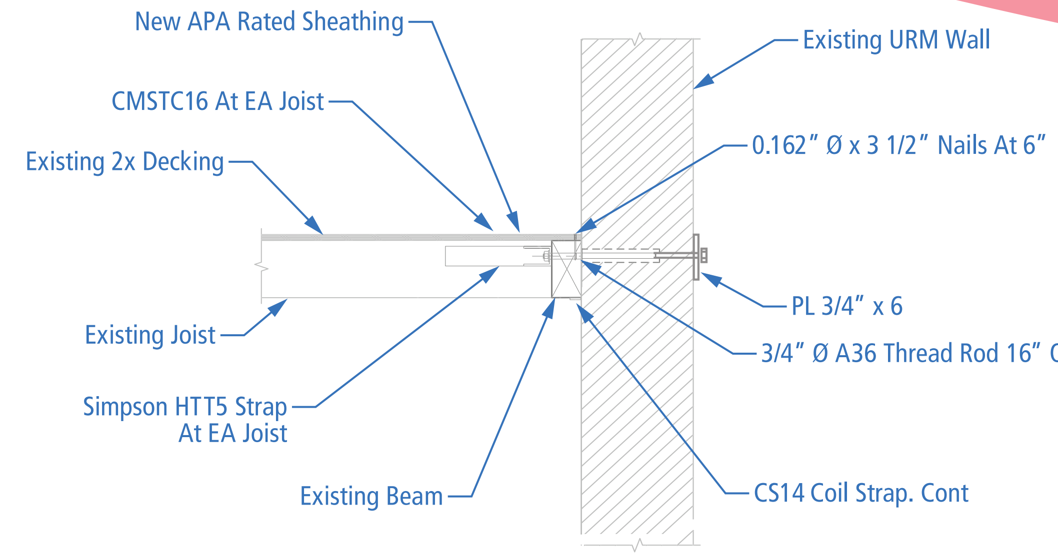


NOTES

1. Existing beam is deeper than existing joist by approximately 6"

IN-PLANE ANCHORAGE

Perpendicular to Floor Joists

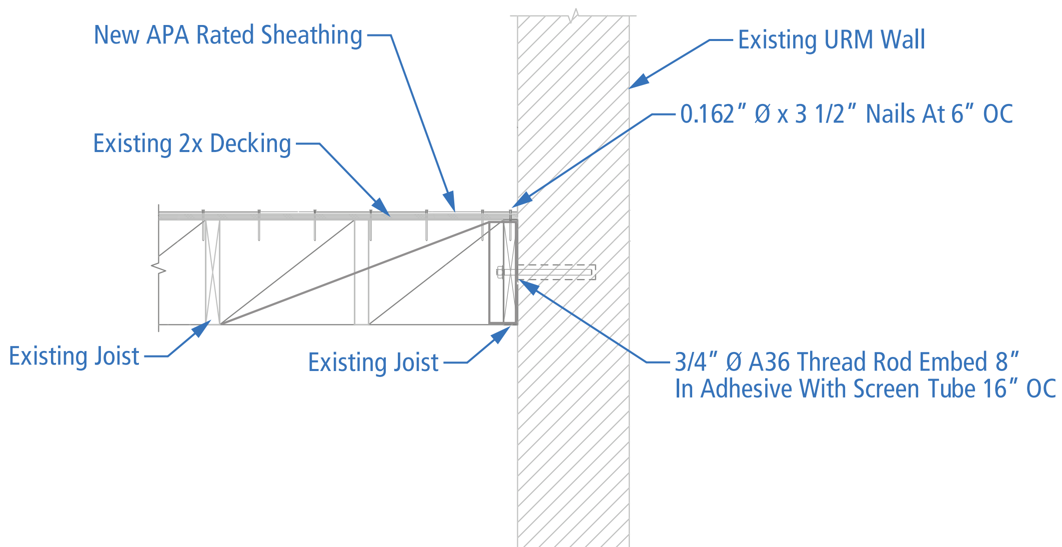


NOTES

1. Existing Beam Is Deeper Than Existing Joist By Approximately 6"

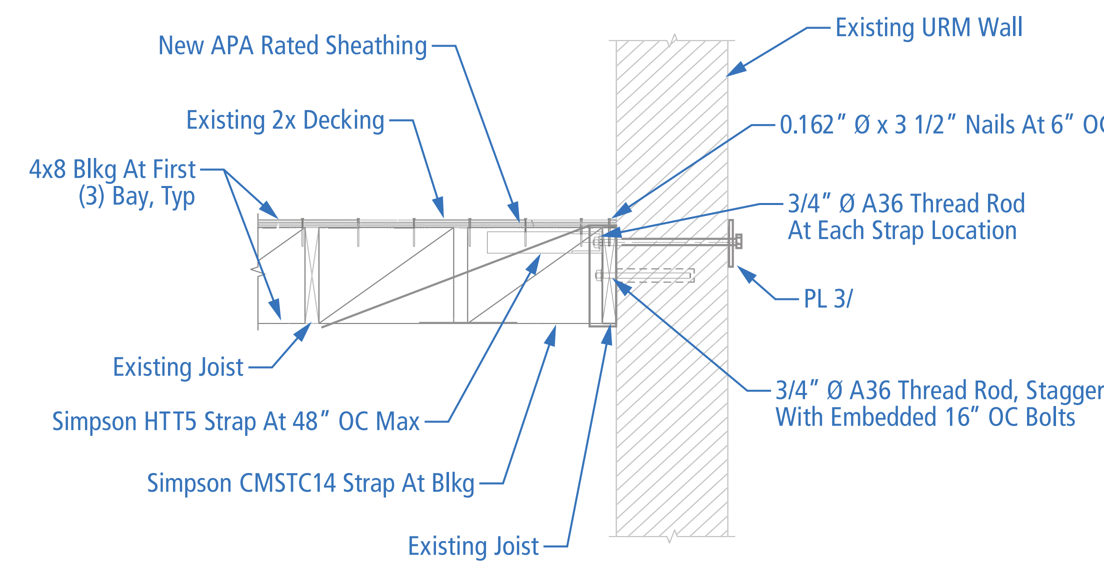
OUT-OF-PLANE ANCHORAGE

Perpendicular to Floor Joists



IN-PLANE ANCHORAGE

Parallel to Floor Joists



NOTES

1. Existing Joists Are Probably 4x Joists, & Spaced 48" OC

OUT-OF-PLANE ANCHORAGE

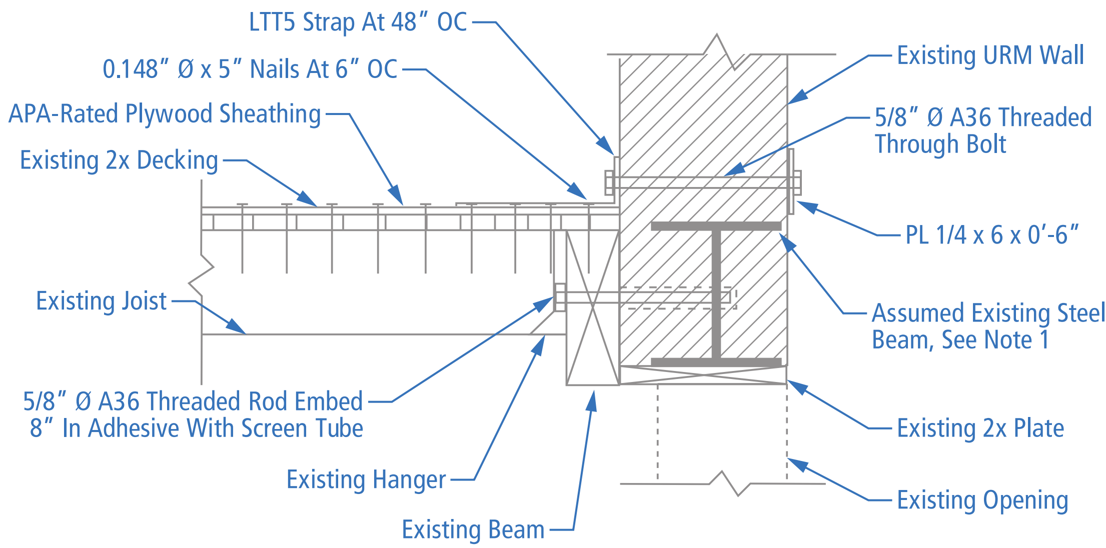
Parallel to Floor Joists

NOTES

1. Materials, sizes, and spacing shown on details are for example only. Structural analysis of existing building and applicable loads is required for construction.
2. Drill all holes in URM with a drill set to rotation only, typical throughout.

1 TYPICAL IN-PLANE & OUT-OF-PLANE WALL ANCHORAGE AT URM PIERS

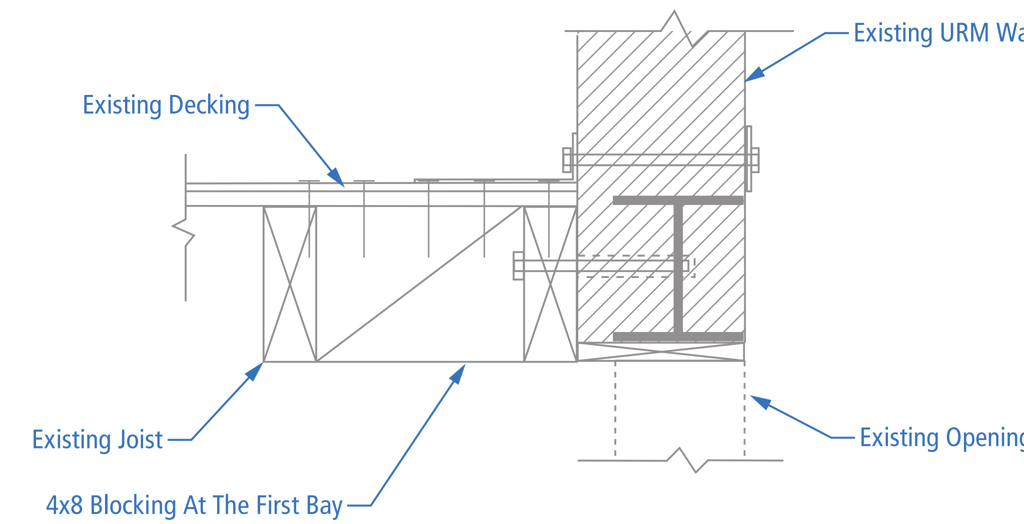
Figure 2 – First & Second Floor Plan



NOTES

1. Based on visual observation, it is assumed that there is a steel header element above window openings. However, the size and shape of the beam is unknown. Further investigation should be done prior to retrofit. Similar assumptions were made at door openings.
2. Spacing of joists is assumed to be ~48" OC. LTT straps to match the joist spacing. Further investigation should done prior to retrofit.

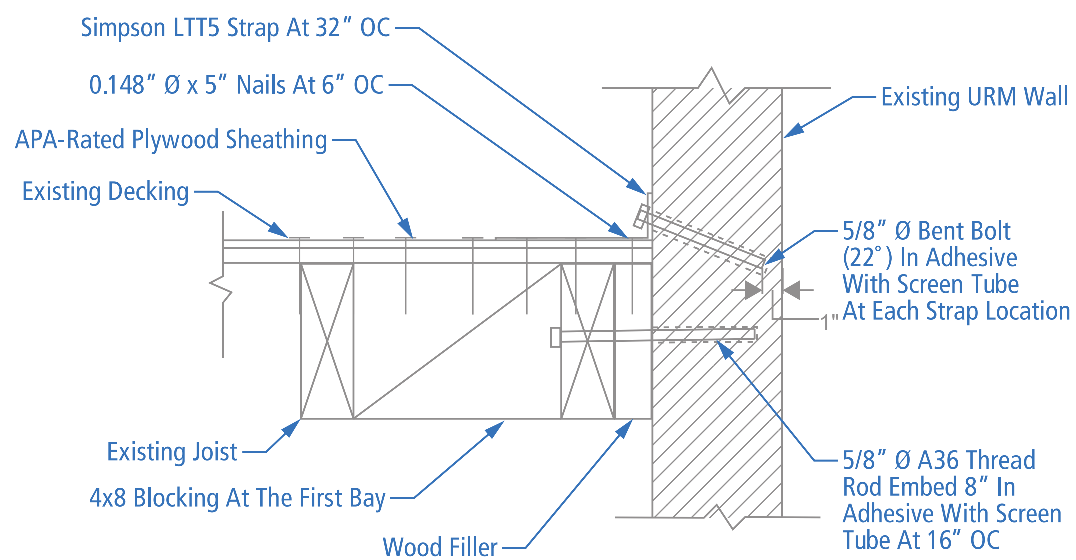
2a WALL ANCHORAGE FOR JOISTS PERPENDICULAR TO WALL AT WINDOW OPENINGS



NOTES

1. Refer to detail (2a) for additional details.

2b WALL ANCHORAGE FOR JOISTS PARALLEL TO WALL AT WINDOW OPENINGS



NOTES

1. Detail is applicable at the URM wall on the north side of the building. A similar detail concept can be applied at the reinforced masonry wall on the first floor of the west side of the building.
2. Wood filler gap size is unknown, and likely varies from location to location where applicable. Further investigation should be done prior to retrofit.

3 IN-PLANE & OUT-OF-PLANE WALL ANCHORAGE FOR JOISTS PARALLEL TO WALL AT THE BLIND WALLS

Figure 3 – First & Second Floor Plan

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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 Phase 2
Second Name:	Tacoma School of the Arts
Location:	Tacoma, WA
Design Phase:	ROM Cost Estimates
Date of Estimate:	February 9, 2021
Date of Revision:	April 13, 2021
Month of Cost Basis:	1Q, 2021

Tacoma School of the Arts

Master Estimate Summary

Project Name	Construction Cost Type	Estimated Construction Cost
Tacoma School of the Arts	Structural Costs	$3,156,909
Tacoma School of the Arts	Non-Structural Costs	$2,146,698
TOTAL ESTIMATED CONSTRUCTION COST	→	**$5,303,606**

Soft Costs	Soft Costs % Construction Cost	Estimated Soft Costs
Project Soft Cost Allowance	40.0%	$2,121,443
		Sum of the Above
TOTAL ESTIMATED PROJECT COST	→	**$7,425,049**

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 the month of Cost Basis noted above right.

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 Allowance are: A/E design fees, QA/QC, Project Administration, Owners Project Contingency, Average Washington State Sale Tax and
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
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www.prodims.com

Structural Costs

Name:	Wa State School Seismic Safety Assessment Phase 2	Areas	sqft
Second Name:	Tacoma School of the Arts	1st Floor	10,800
Location:	Tacoma, WA	2nd Floor	10,800
Design Phase:	ROM Cost Estimates		
Date of Estimate:	February 9, 2021		
Date of Revision:	April 13, 2021		
Month of Cost Basis:	1Q, 2021	Total Areas	21,600

Tacoma School of the Arts

Construction Cost Estimate

Subtotal Direct Cost From the Estimate Detail Below $ 2,144,761

	Percentage of Previous Subtotal	Amount	Running Subtotal
Scope Contingency	10.0%	$ 214,476	$ 2,359,238
General Conditions	10.0%	$ 214,476	$ 2,573,714
Home Office Overhead	5.0%	$ 107,238	$ 2,680,952
Profit	6.0%	$ 128,686	$ 2,809,637
Escalation Included to 4Q, 2022	12.4%	$ 347,271	$ 3,156,909
Washington State Sales Tax - Included in Soft Costs			

Total Markups Applied to the Direct Cost 47.19%
Markups are multiplied on each subtotal- They are not multiplied from the direct cost

		$/sqft
TOTAL ESTIMATED CONSTRUCTION COST--→	**$ 3,156,909**	**$ 146.15**
-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 2,525,527**	**$ 116.92**
+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 4,735,363**	**$ 219.23**

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
1 - Seismic Retrofit											
Foundations											
	Grade Beam System- Excavation, Backfill, Formwork, Concrete, Reinforcing and Detailing. At Perimeter of Existing Building	19.4	cuyd	$ 499.20	$ 9,688.18	$ 280.80	$ 5,449.60	$ 46.80	$ 908.27	$ 826.80	$ 16,046.04
Substructure											
	Demo/Resintall Slab on Grade System for New Grade Beam Installation.	524	sqft	$ 9.90	$ 5,187.60	$ 8.10	$ 4,244.40	$ 1.08	$ 565.92	$ 19.08	$ 9,997.92
Superstructure											
Upper Floor Systems											
	Install New 1/2" Plywood Directly to T+G Deck with Specified Nailing Pattern	10,800	sqft	$ 0.97	$ 10,454.40	$ 1.23	$ 13,305.60	$ 0.13	$ 1,425.60	$ 2.33	$ 25,185.60
	Structural Steel Chevron Brace System - Allowance	6	each	$ 13,770.00	$ 82,620.00	$ 11,730.00	$ 70,380.00	$ 1,530.00	$ 9,180.00	$ 27,030.00	$ 162,180.00
	Structural Steel Drag Strut Element - Allowance	160	lnft	$ 68.85	$ 11,016.00	$ 58.65	$ 9,384.00	$ 7.65	$ 1,224.00	$ 135.15	$ 21,624.00
	CMSTC16 with Nails to Existing Joist Across Girder	110	each	$ 62.40	$ 6,864.00	$ 33.60	$ 3,696.00	$ 5.76	$ 633.60	$ 101.76	$ 11,193.60
	CMSTC12 with Nails at Each Side Girder at Post	40	each	$ 72.45	$ 2,898.00	$ 32.55	$ 1,302.00	$ 6.30	$ 252.00	$ 111.30	$ 4,452.00
	Det 1-Out of Plane-Perp to Floor/Roof Joist at Piers: Wall to Joist Anchorage - CMSTC16 with Nails to Existing Joist with HTT5 bolted to Each Joist with 3/4" Dia All Thread Rod Drilled Through Wall with 2 Ea Nuts and 3/4" x 6" Sq Plate and Washer	18	each	$ 329.80	$ 5,936.40	$ 155.20	$ 2,793.60	$ 29.10	$ 523.80	$ 514.10	$ 9,253.80

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	Det 1-Out of Plane-Parallel to Floor/Roof Joist at Piers: Wall to Joist Anchorage - 2 Ea 4x8 Blocking by 48" long, CMSTC14 with Nails to New Blocking and Existing Joist with HTT5 bolted to New Blocking with 3/4" Dia All Thread Rod Drilled Through Wall with 2 Ea Nuts and 3/4" x 6" Sq Plate and Washer. Plus 3/4" Dia All Thread with Nut and Washer Epoxied into Existing Rim Joist and Masonry Wall at 16" o.c. - 3 Ea per Detail	14	each	$ 692.25	$ 9,691.50	$ 282.75	$ 3,958.50	$ 58.50	$ 819.00	$ 1,033.50	$ 14,469.00
	Det 2a-Out of Plane-Perp to Floor/Roof Joist at Window Openings: Wall to Joist Anchorage - LTT5 Nailed to Each Existing Joist with 5/8" Dia All Thread Rod Drilled Through Wall with 2 Ea Nuts and 3/4" x 6" Sq Plate and Washer. Plus 5/8" Dia All Thread with Nut and Washer Epoxied into Existing Rim Joist and Masonry Wall	14	each	$ 360.40	$ 5,045.60	$ 169.60	$ 2,374.40	$ 31.80	$ 445.20	$ 561.80	$ 7,865.20
	Det 2b-Out of Plane-Perp to Floor/Roof Joist at Window Openings: Wall to Joist Anchorage - LTT5 Nailed to Each Existing Joist with 5/8" Dia All Thread Rod Drilled Through Wall with 2 Ea Nuts and 3/4" x 6" Sq Plate and Washer with 4x8x48" Blocking. Plus 5/8" Dia All Thread with Nut and Washer Epoxied into Existing Rim Joist and Masonry Wall	40	each	$ 384.20	$ 15,368.00	$ 180.80	$ 7,232.00	$ 33.90	$ 1,356.00	$ 598.90	$ 23,956.00
	Det 3-In/Out of Plane-Perp to Floor/Roof Joist Blind Wall: Wall to Joist Anchorage - LTT5 Nailed to Each Existing Joist with 5/8" Dia Bent Bolt Epoxied with 1 Ea Nut 4x8x48" Blocking. Plus 5/8" Dia All Thread with Nut and Washer Epoxied into Existing Rim Joist/Masonry Wall	46	each	$ 312.80	$ 14,388.80	$ 147.20	$ 6,771.20	$ 27.60	$ 1,269.60	$ 487.60	$ 22,429.60
	Det 3 SIM-In/Out of Plane-Parallel to 1st Floor Joist Blind Wall: Wall to Joist Anchorage - LTT5 Nailed to Each Existing Joist with 5/8" Dia Bent Bolt Epoxied with 1 Ea Nut 4x8x48" Blocking. Plus 5/8" Dia All Thread with Nut and Washer Epoxied into Existing Rim Joist/Masonry Wall	14	each	$ 299.20	$ 4,188.80	$ 140.80	$ 1,971.20	$ 26.40	$ 369.60	$ 466.40	$ 6,529.60

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	Roof Systems										
	Install New 1/2" Plywood Directly to T+G Deck with Specified Nailing Pattern	10,800	sqft	$ 0.97	$ 10,454.40	$ 1.23	$ 13,305.60	$ 0.13	$ 1,425.60	$ 2.33	$ 25,185.60
	Structural Steel Chevron Brace System - Allowance	6	each	$ 13,770.00	$ 82,620.00	$ 11,730.00	$ 70,380.00	$ 1,530.00	$ 9,180.00	$ 27,030.00	$ 162,180.00
	Structural Steel Drag Strut Element - Allowance	160	lnft	$ 68.85	$ 11,016.00	$ 58.65	$ 9,384.00	$ 7.65	$ 1,224.00	$ 135.15	$ 21,624.00
	CMSTC16 with Nails to Existing Joist Across Girder	110	each	$ 62.40	$ 6,864.00	$ 33.60	$ 3,696.00	$ 5.76	$ 633.60	$ 101.76	$ 11,193.60
	CMSTC12 with Nails at Each Side Girder at Post	40	each	$ 72.45	$ 2,898.00	$ 32.55	$ 1,302.00	$ 6.30	$ 252.00	$ 111.30	$ 4,452.00
	Det 1-Out of Plane-Perp to Floor/Roof Joist at Piers: Wall to Joist Anchorage - CMSTC16 with Nails to Existing Joist with HTT5 bolted to Each Joist with 3/4" Dia All Thread Rod Drilled Through Wall with 2 Ea Nuts and 3/4" x 6" Sq Plate and Washer	18	each	$ 329.80	$ 5,936.40	$ 155.20	$ 2,793.60	$ 29.10	$ 523.80	$ 514.10	$ 9,253.80
	Det 1-Out of Plane-Parallel to Floor/Roof Joist at Piers: Wall to Joist Anchorage - 2 Ea 4x8 Blocking by 48" long, CMSTC14 with Nails to New Blocking and Existing Joist with HTT5 bolted to New Blocking with 3/4" Dia All Thread Rod Drilled Through Wall with 2 Ea Nuts and 3/4" x 6" Sq Plate and Washer. Plus 3/4" Dia All Thread with Nut and Washer Epoxied into Existing Rim Joist and Masonry Wall at 16" o.c. - 3 Ea per Detail	14	each	$ 692.25	$ 9,691.50	$ 282.75	$ 3,958.50	$ 58.50	$ 819.00	$ 1,033.50	$ 14,469.00
	Det 2a-Out of Plane-Perp to Floor/Roof Joist at Window Openings: Wall to Joist Anchorage - LTT5 Nailed to Each Existing Joist with 5/8" Dia All Thread Rod Drilled Through Wall with 2 Ea Nuts and 3/4" x 6" Sq Plate and Washer. Plus 5/8" Dia All Thread with Nut and Washer Epoxied into Existing Rim Joist and Masonry Wall	28	each	$ 360.40	$ 10,091.20	$ 169.60	$ 4,748.80	$ 31.80	$ 890.40	$ 561.80	$ 15,730.40
	Det 2b-Out of Plane-Perp to Floor/Roof Joist at Window Openings: Wall to Joist Anchorage - LTT5 Nailed to Each Existing Joist with 5/8" Dia All Thread Rod Drilled Through Wall with 2 Ea Nuts and 3/4" x 6" Sq Plate and Washer with 4x8x48" Blocking. Plus 5/8" Dia All Thread with Nut and Washer Epoxied into Existing Rim Joist and Masonry Wall	40	each	$ 384.20	$ 15,368.00	$ 180.80	$ 7,232.00	$ 33.90	$ 1,356.00	$ 598.90	$ 23,956.00

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	Det 3-In/Out of Plane-Perp to Floor/Roof Joist Blind Wall: Wall to Joist Anchorage - LTT5 Nailed to Each Existing Joist with 5/8" Dia Bent Bolt Epoxied with 1 Ea Nut 4x8x48" Blocking. Plus 5/8" Dia All Thread with Nut and Washer Epoxied into Existing Rim Joist/Masonry Wall	46	each	$ 312.80	$ 14,388.80	$ 147.20	$ 6,771.20	$ 27.60	$ 1,269.60	$ 487.60	$ 22,429.60
	5/8" APA-rated sheathing on 2x8 @ 24" OC spanning between cripple walls aligned with purlins (~48" OC)	4,250	sqft	$ 3.64	$ 15,470.00	$ 3.36	$ 14,280.00	$ 0.42	$ 1,785.00	$ 7.42	$ 31,535.00
	Exterior Closure										
	Exterior Wall System										
	New Exterior Siding with Metal Stud Backup and Finish System with Window Systems at New Braced Frames	6,720	sqft	$ 40.30	$ 270,816.00	$ 24.70	$ 165,984.00	$ 3.90	$ 26,208.00	$ 68.90	$ 463,008.00
	Roofing System										
	Remove Roofing System Down to Plywood Deck	10,800	sqft	$ 4.04	$ 43,605.00	$ 0.21	$ 2,295.00	$ 0.26	$ 2,754.00	$ 4.51	$ 48,654.00
	New Membrane Roofing System with R-38 Rigid Insulation, Flashing and Trim and Downspout Roof Drainage System	10,800	sqft	$ 11.18	$ 120,744.00	$ 10.32	$ 111,456.00	$ 1.29	$ 13,932.00	$ 22.79	$ 246,132.00
	Interior Wall/Door/Casework/Specialties Systems										
	Remove and Reinstall Partitions/Doors for Seismic Installation Through out the Building	21,600	sqft	$ 6.60	$ 142,560.00	$ 5.40	$ 116,640.00	$ 0.72	$ 15,552.00	$ 12.72	$ 274,752.00
	Remove and Reinstall Casework at Wall Plywood Sheathing Installation Near Mech Mezzanine	21,600	sqft	$ 3.30	$ 71,280.00	$ 2.70	$ 58,320.00	$ 0.36	$ 7,776.00	$ 6.36	$ 137,376.00
	Remove and Reinstall Floor Finish Systems-Allow 100% of the Floor Area	21,600	sqft	$ 3.72	$ 80,352.00	$ 2.28	$ 49,248.00	$ 0.36	$ 7,776.00	$ 6.36	$ 137,376.00
	Remove and Reinstall New ACT Ceiling Systems - Allow 100% of the Floor Area	21,600	sqft	$ 4.34	$ 93,744.00	$ 2.66	$ 57,456.00	$ 0.42	$ 9,072.00	$ 7.42	$ 160,272.00
Subtotal of the Direct Cost of Construction				**Tacoma School of the Arts**							**$ 2,144,761**

PD PRODIMS

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

Non-Structural Costs

Name:	Wa State School Seismic Safety Assessment Phase 2	Areas	sqft
Second Name:	Tacoma School of the Arts	1st Floor	10,800
Location:	Tacoma, WA	2nd Floor	10,800
Design Phase:	ROM Cost Estimates		
Date of Estimate:	February 9, 2021		
Date of Revision:	April 13, 2021		
Month of Cost Basis:	1Q, 2021	Total Areas	21,600

Tacoma School of the Arts

Construction Cost Estimate

Subtotal Direct Cost From the Estimate Detail Below $ 1,458,438

	Percentage of Previous Subtotal	Amount		Running Subtotal
Scope Contingency	10.0%	$ 145,844	$	1,604,282
General Conditions	10.0%	$ 145,844	$	1,750,125
Home Office Overhead	5.0%	$ 72,922	$	1,823,047
Profit	6.0%	$ 87,506	$	1,910,553
Escalation Included to 4Q, 2022	12.4%	$ 236,144	$	2,146,698
Washington State Sales Tax - Included in Soft Costs				

Total Markups Applied to the Direct Cost 47.19%
Markups are multiplied on each subtotal- They are not multiplied from the direct cost

		$/sqft
TOTAL ESTIMATED CONSTRUCTION COST--→	**$ 2,146,698**	**$ 99.38**
-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 1,717,358**	**$ 79.51**
+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 3,220,047**	**$ 149.08**

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*											
M/E/P/FP Systems											
	Mechanical/Electrical/Fire Protection Systems *	21,600	sqft	$ 35.03	$ 756,736.56	$ 28.66	$ 619,148.09	$ 3.82	$ 82,553.08	$ 67.52	$ 1,458,437.73
*Allows 150 percent of existing nonstructural systems M/E/P/FP require upgrades/replacement.											
Subtotal of the Direct Cost of Construction				**Tacoma School of the Arts**							**$ 1,458,438**

Appendix D: Earthquake Performance Assessment Tool (EPAT) Worksheet

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Washington Schools Earthquake Performance Assessment Tool (EPAT)
RESULTS SUMMARY

District Name	Tacoma	**Existing Building Life Safety Risk & Priority for Retrofit or Replacement**
School Name	Tacoma School of the Arts	
Building Name	SOTA Pacific Ave	Very High

Building Data

HAZUS Building Type	URM	Unreinforced Masonry Bearing Walls
Year Built	1904	These parameters determine the capacity of the existing building to withstand earthquake forces.
Building Design Code	<1973 UBC	
Existing Building Code Level	Pre	
Geographic Area	Puget Sound	
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	High	Frequency and severity of earthquakes at this site
Percentile S_s Among WA K-12 Campuses	70%	Earthquake ground shaking hazard is higher than 70% of WA campuses.
Site Class (Soil or Rock Type)	C	Very Dense Soil and Soft Rock
Liquefaction Potential	Very Low	Liquefaction increases the risk of major damage to a building
Combined Earthquake Hazard Level	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	74%	72%	Very High	Red
Life Safety Retrofit Building	19%	11%	Very Low	Green/Yellow
Current Code Building	15%	7.6%	Very 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:	Josh Comfort, Colby Litzenberger
Person(s) Who Entered Data in EPAT:	Rami Sabra, Reid Middleton
User Overrides of Default Parameters:	Building Design Code Year, Site Class, Liquefaction

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Appendix E: Existing Drawing

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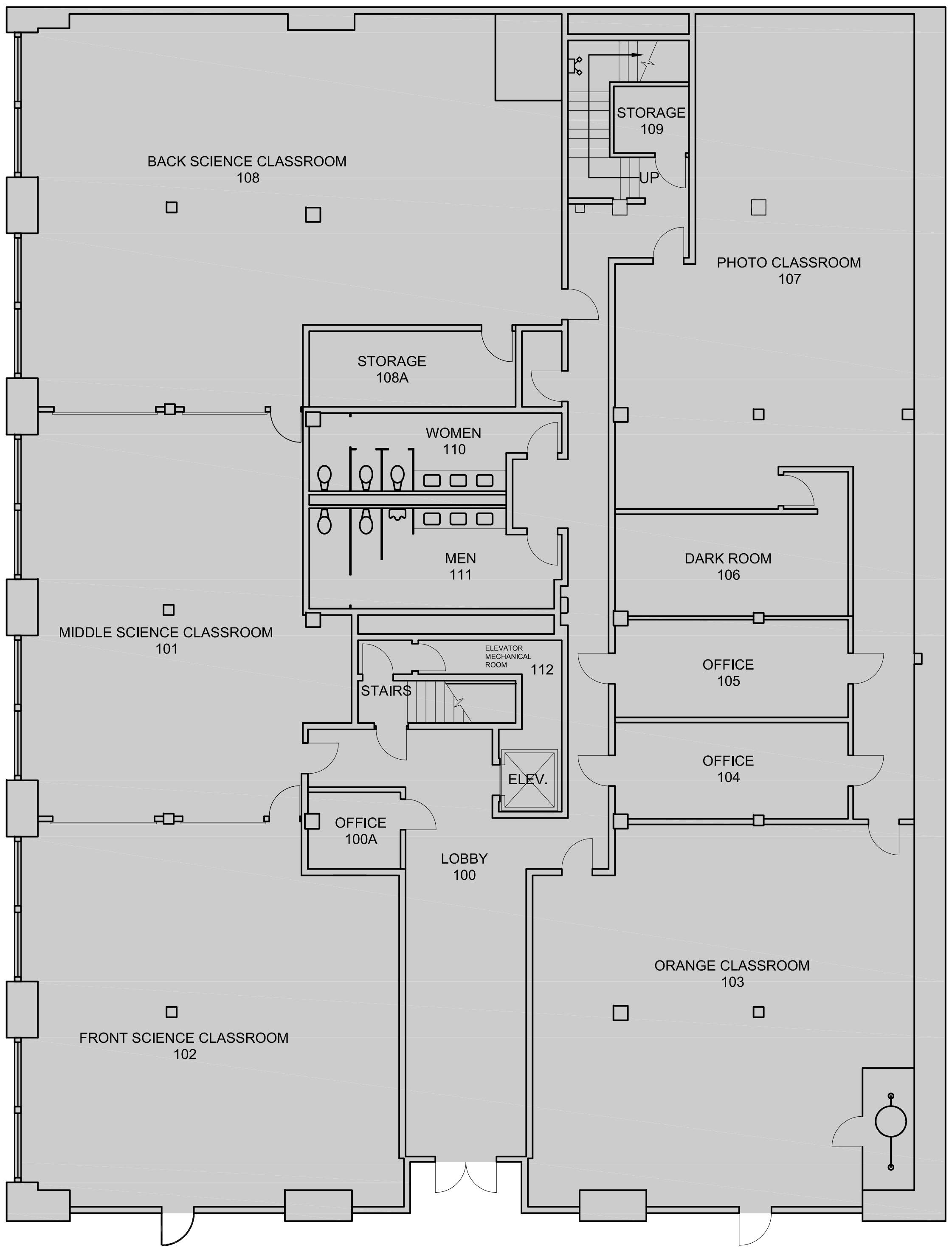
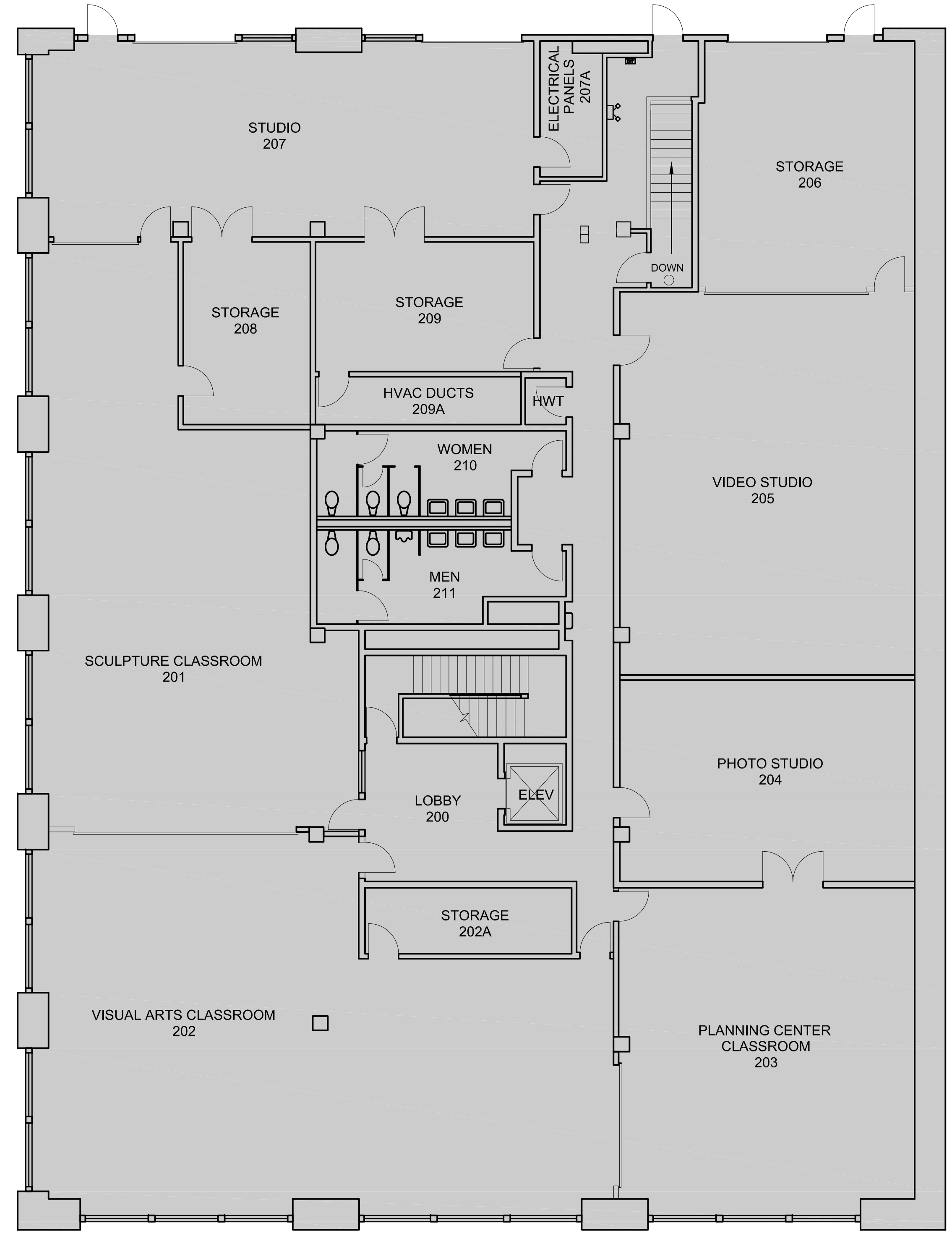


AREA A
ORIGINAL BLDG
FIRST FLOOR
CLASSROOMS
10,801 SQ FT

FIRST FLOOR



AREA B
ORIGINAL BLDG
SECOND FLOOR
ART CLASSROOMS
10,800 SQ FT

SECOND FLOOR

SOTA–PACIFIC AVENUE

SCALE: 1/16" = 1'–0"

GENERAL NOTES

THE ARCHITECTURAL AREAS ARE BASED ON THE WAC 180-27-019. THE GROSS AMOUNT OF SQUARE FOOTAGE IS CALCULATED IN ACCORDANCE WITH THE AMERICAN INSTITUTE OF ARCHITECTS, DOCUMNT D101, THE ARCHITECTURAL AREA AND VOLUME OF BUILDINGS, LATEST EDITION, FOR A SCHOOL FACILITY UTILIZED BY A SCHOOL DISTRICT FOR THE PURPOSE OF INSTRUCTING STUDENTS: PROVIDED, THAT THE FOLLOWING AREAS SHALL NOT BE INCLUDED IN ANY CALCULATION OF INSTRUCTIONAL SPACE:

(1) EXTERIOR COVERED WALKWAYS, CANTILEVERED OR SUPPORTED.
(2) EXTERIOR PORCHES INCLUDING LOADING PLATFORMS.
(3) AREAS LOCATED ABOVE INSTRUCTIONAL SPACES WHICH ARE EITHER VACANT OR PRIMARILY HOUSING MECHANICAL AND/OR ELECTRICAL EQUIPMENT.
(4) SPACE USED BY CENTRAL ADMINISTRATIVE PERSONNEL.
(5) STADIA AND GRANDSTANDS.
(6) BUS GARAGES.
(7) FREE-STANDING WAREHOUSE SPACE SPECIFICALLY DESIGNED FOR THAT PURPOSE.
(8) PORTABLE FACILITIES.
(9) OTHER SQUARE FOOTAGE NOT OTHERWISE AVAILABLE OR RELATED TO DIRECT INSTRUCTION OR INSTRUCTIONAL SUPPORT OF THE EDUCATION PROGRAM IN THE DISTRICT.

AREA CALCULATION

THE AREA CALCULATION HAS BEEN PERFOMED UTILIZING AUTOCADD SOFTWARE ARE AS FOLLOWS:

AREA A–FIRST FLOOR–CLASSROOMS	10,801 SQ FT
AREA B–SECOND FLOOR–ART CLASSROOMS	10,800 SQ FT
TOTAL SQ FT	21,601 SQ FT

THIS DRAWING HAS BEEN PREPARED FOR THE STATE STUDY AND SURVEY AS REQUIRED UNDER WAC180-25-025.

SOTA-PACIFIC AVENUE
1950 PACIFIC AVENUE
TACOMA, WA 98409
AREA CALCULATION

Planning & Construction
Tacoma Public Schools
3223 South Union Avenue, Tacoma WA 98409

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Appendix F: FEMA E-74 Nonstructural Seismic Bracing Excerpts

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Life Safety Systems

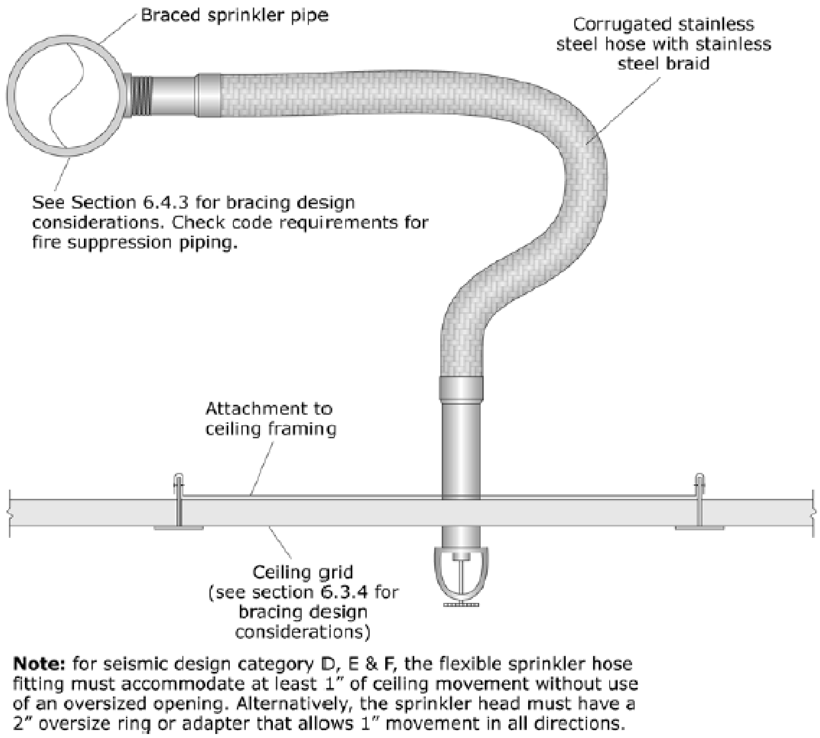


Figure G-1. Flexible Sprinkler Drop.

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

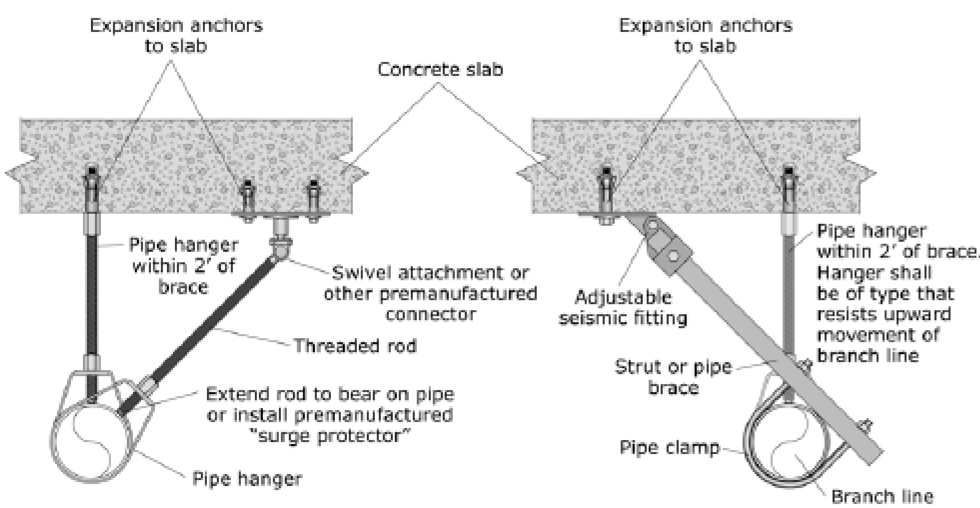


Figure G-2. End of Line Restraint.

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

Partitions

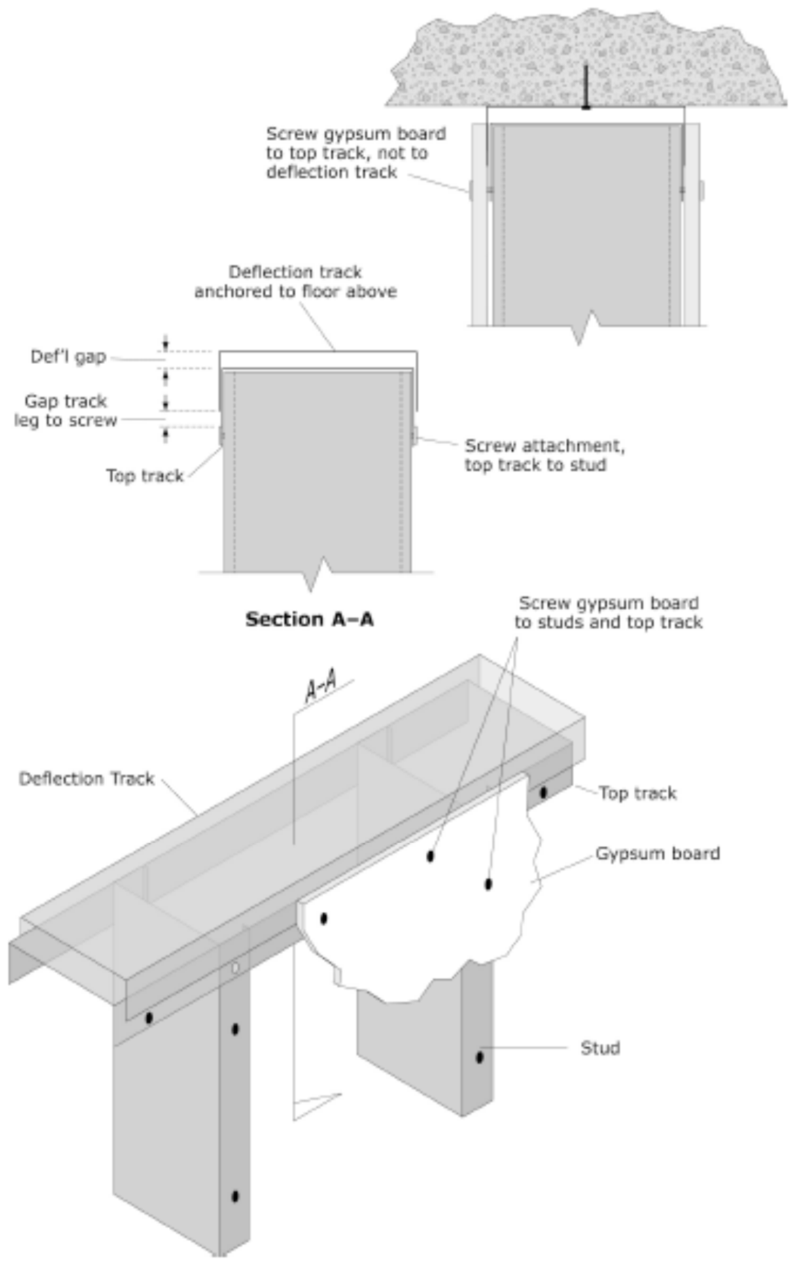


Figure G-3. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.

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

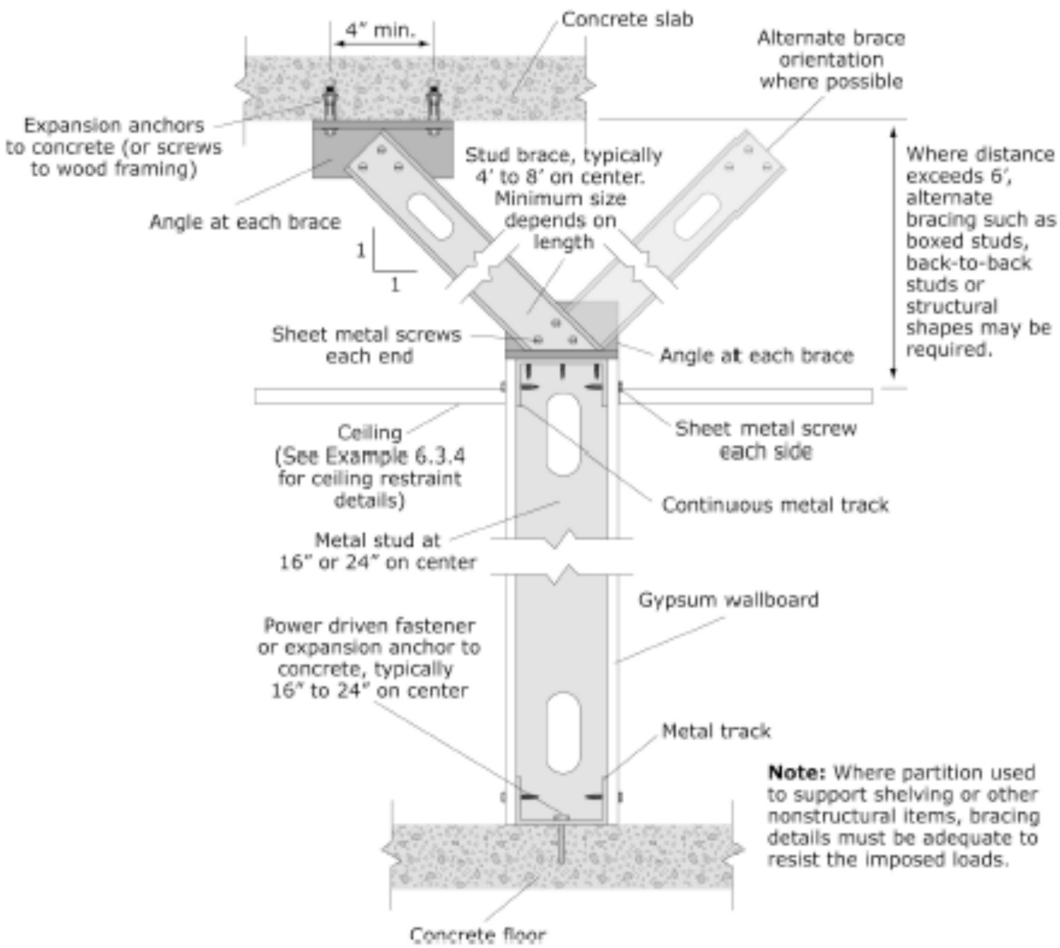


Figure G-4. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

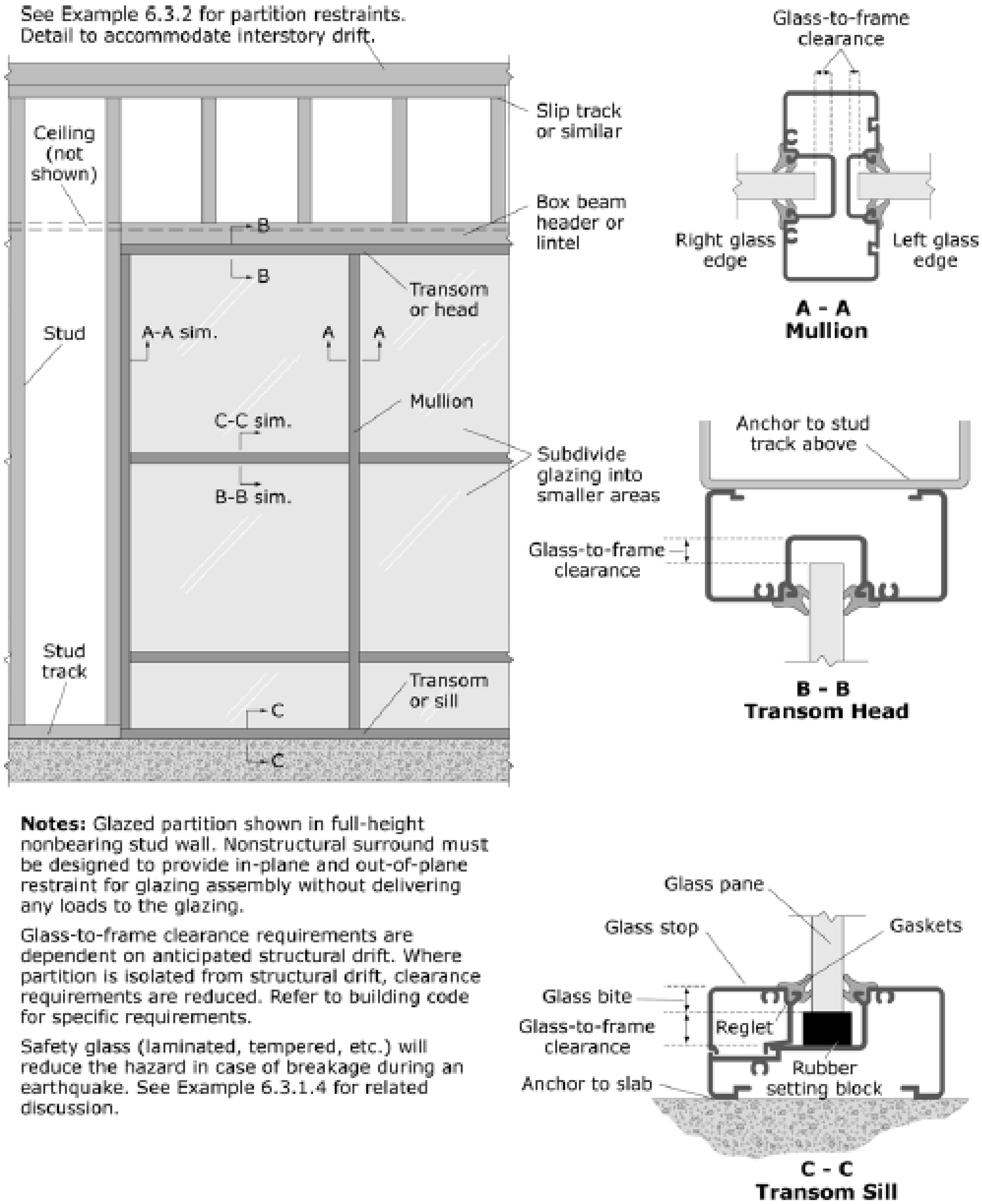


Figure G-5. Full-height Glazed Partition.

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

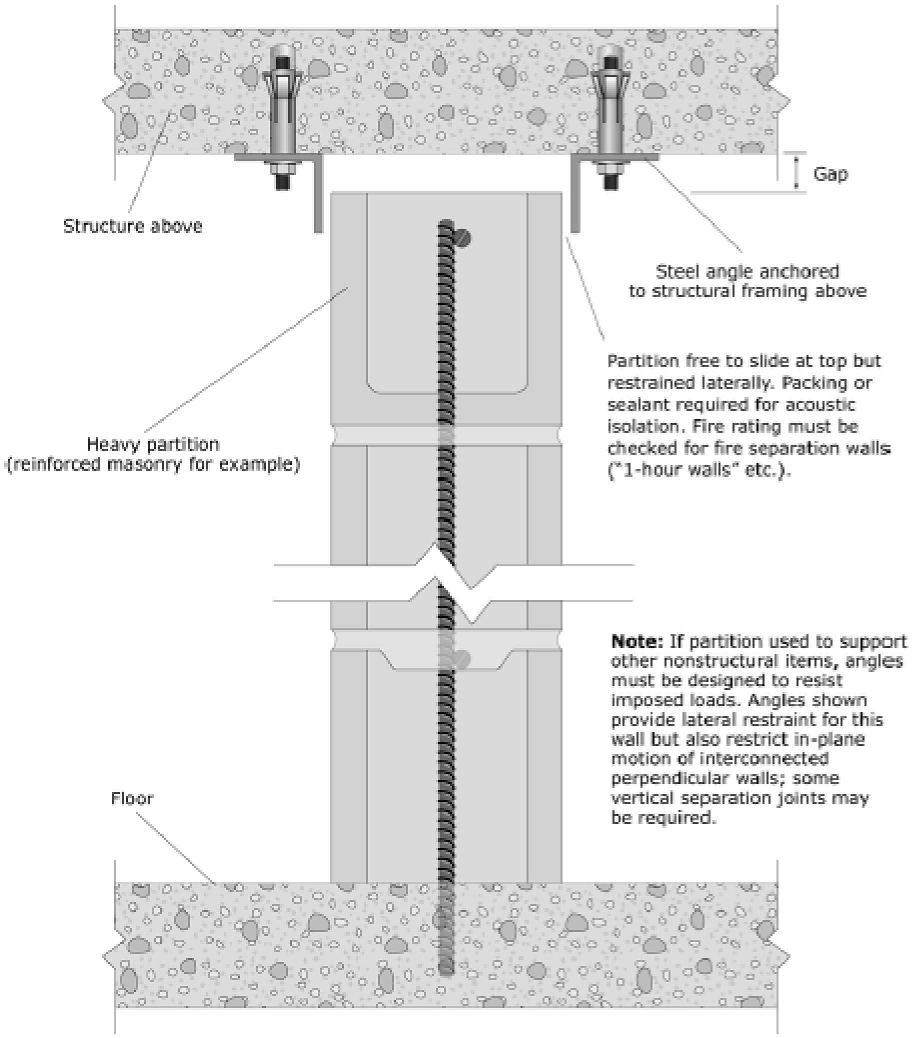


Figure G-6. Full-height Heavy Partition.

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

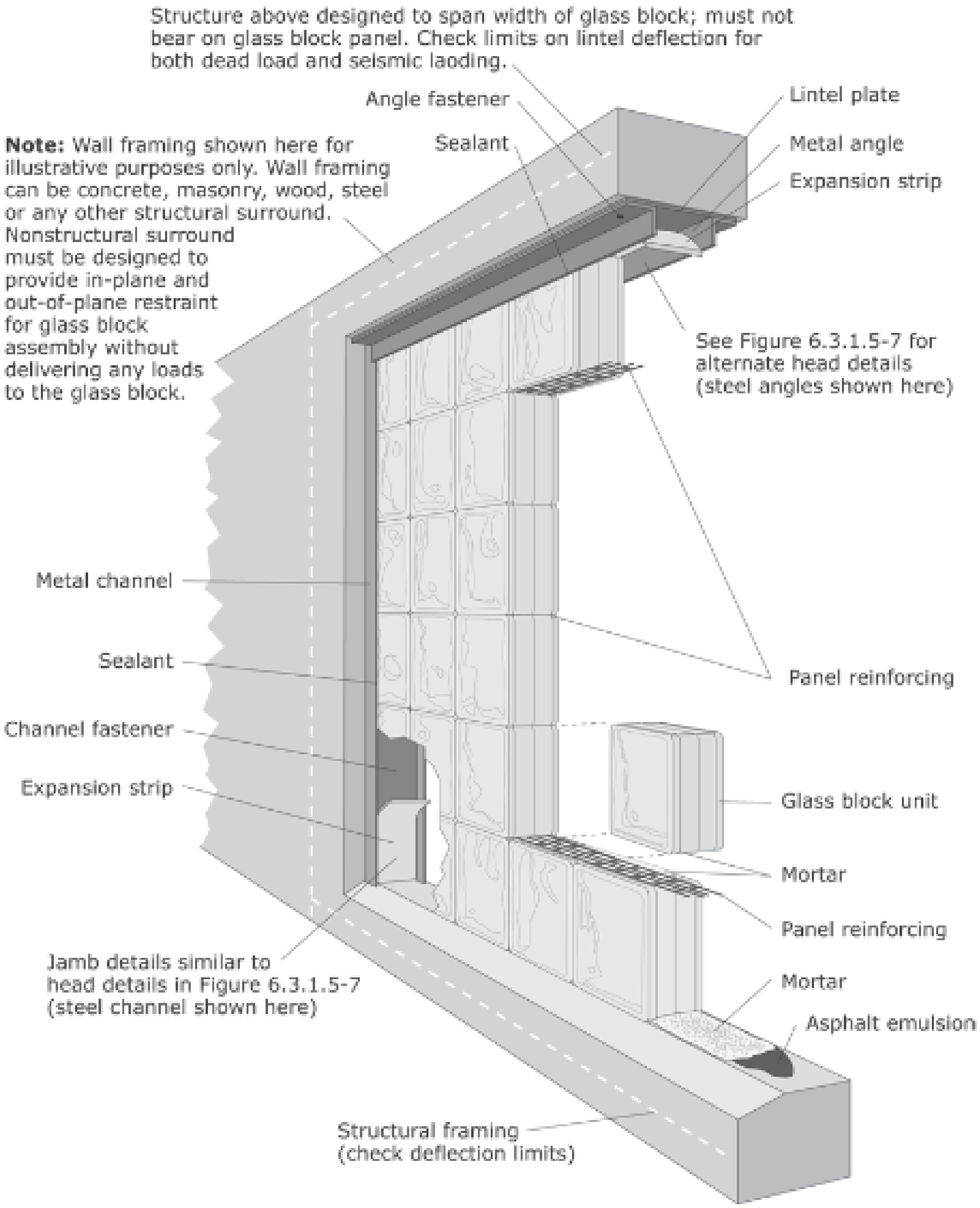


Figure G-7. Typical Glass Block Panel Details.

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

Ceilings

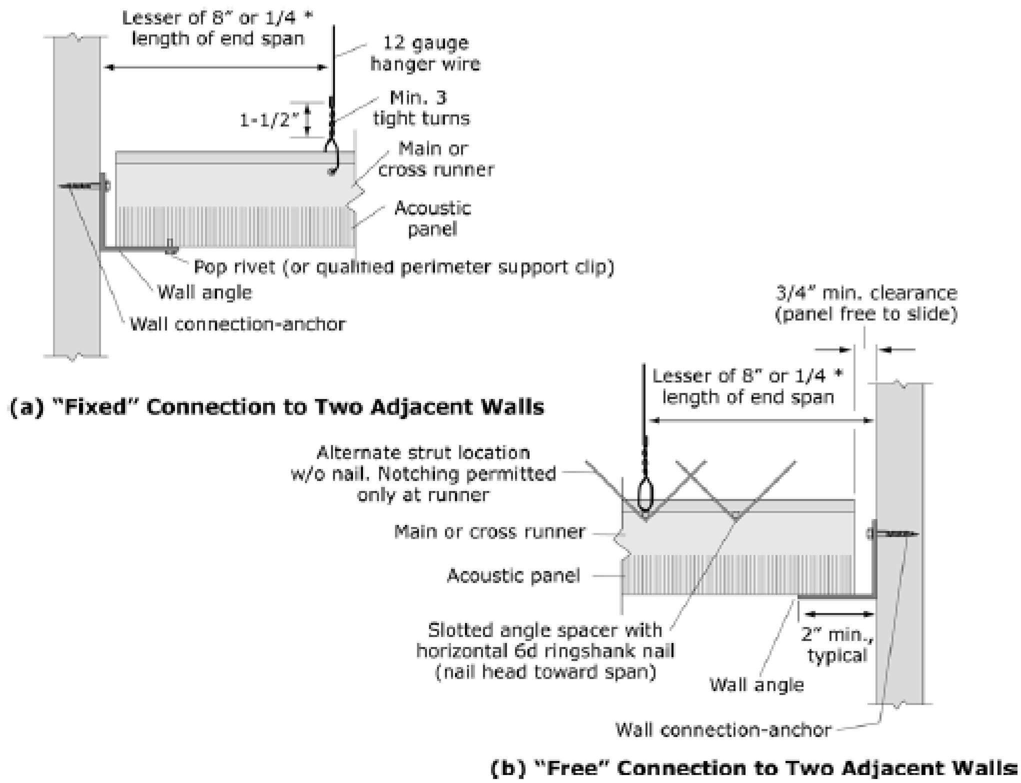
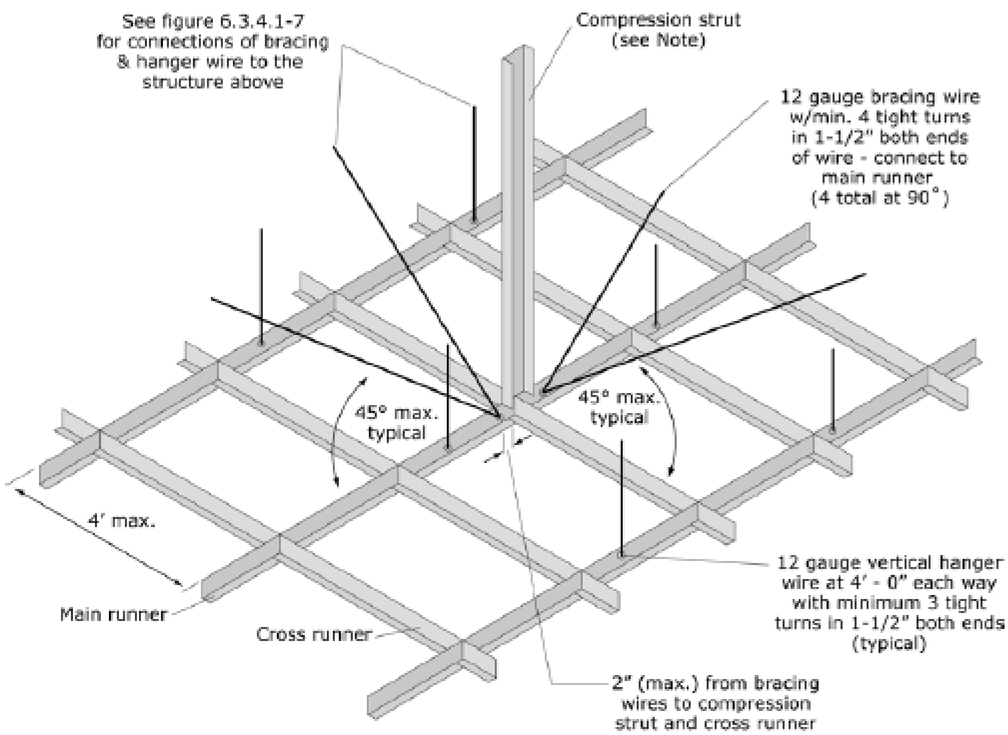


Figure G-8. Suspension System for Acoustic Lay-in Panel Ceilings – Edge Conditions.

(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)

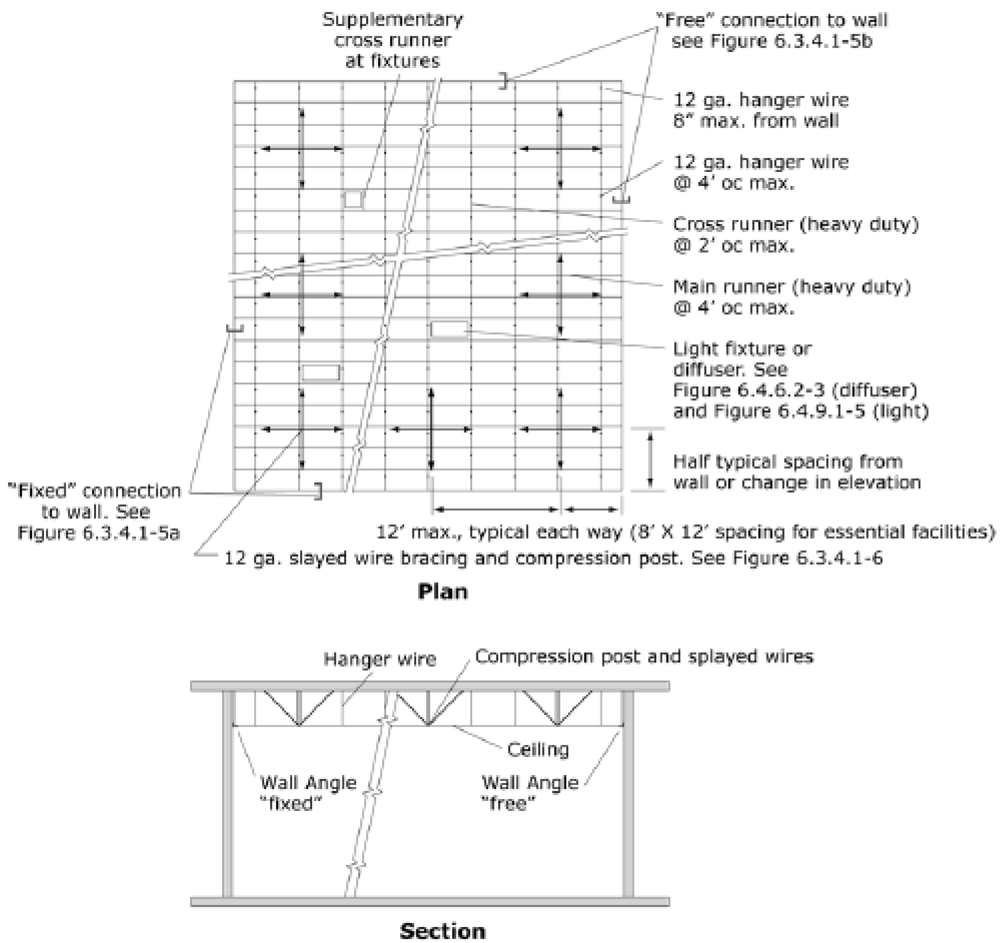


Figure G-10. Suspension System for Acoustic Lay-in Panel Ceilings – General Bracing Layout.

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

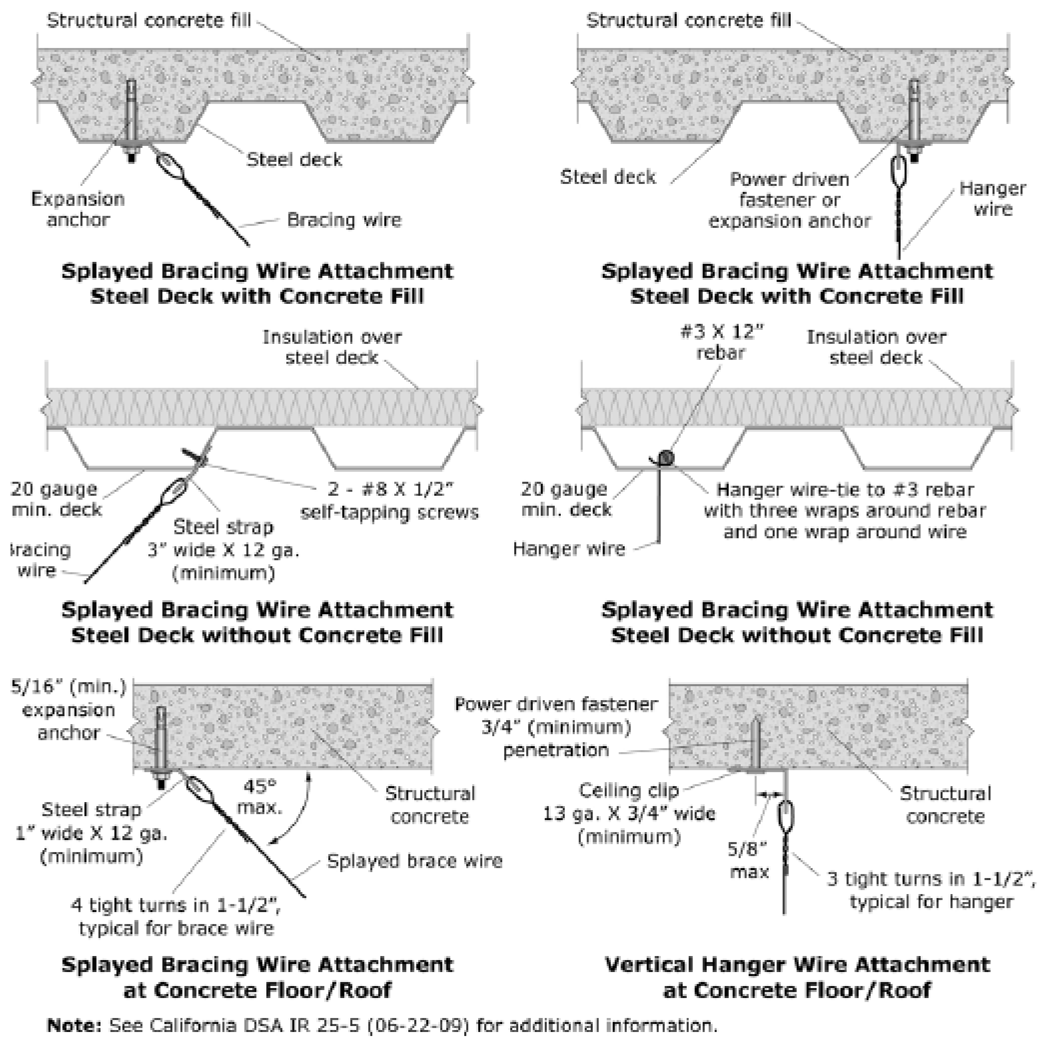
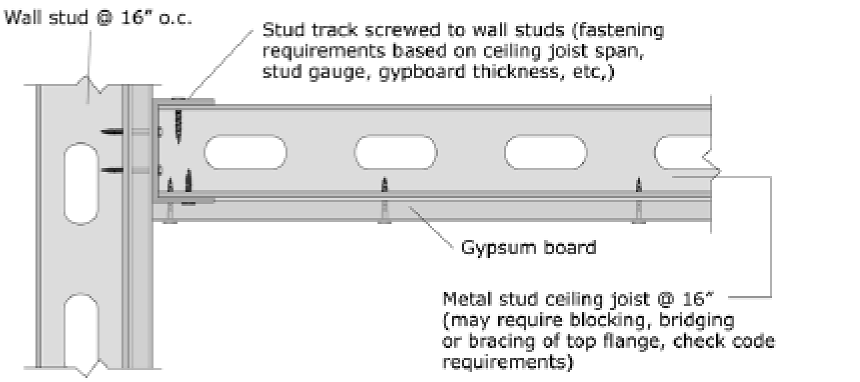
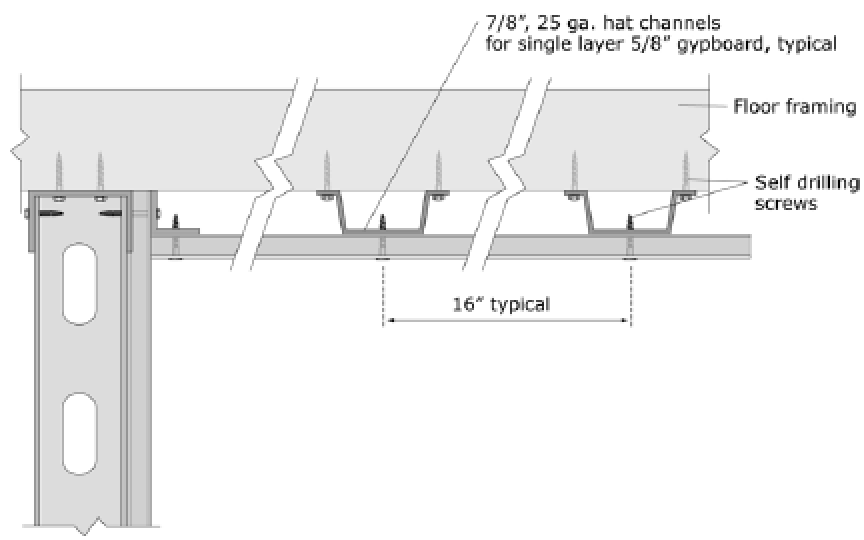


Figure G-11. Suspension System for Acoustic Lay-in Panel Ceilings – Overhead Attachment Details.

(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)

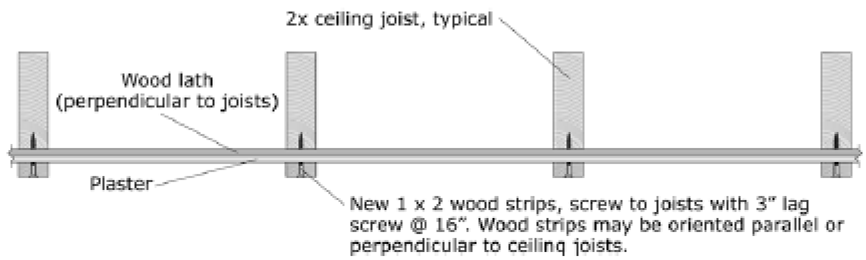


Figure G-13. Retrofit Detail for Existing Lath and Plaster.

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

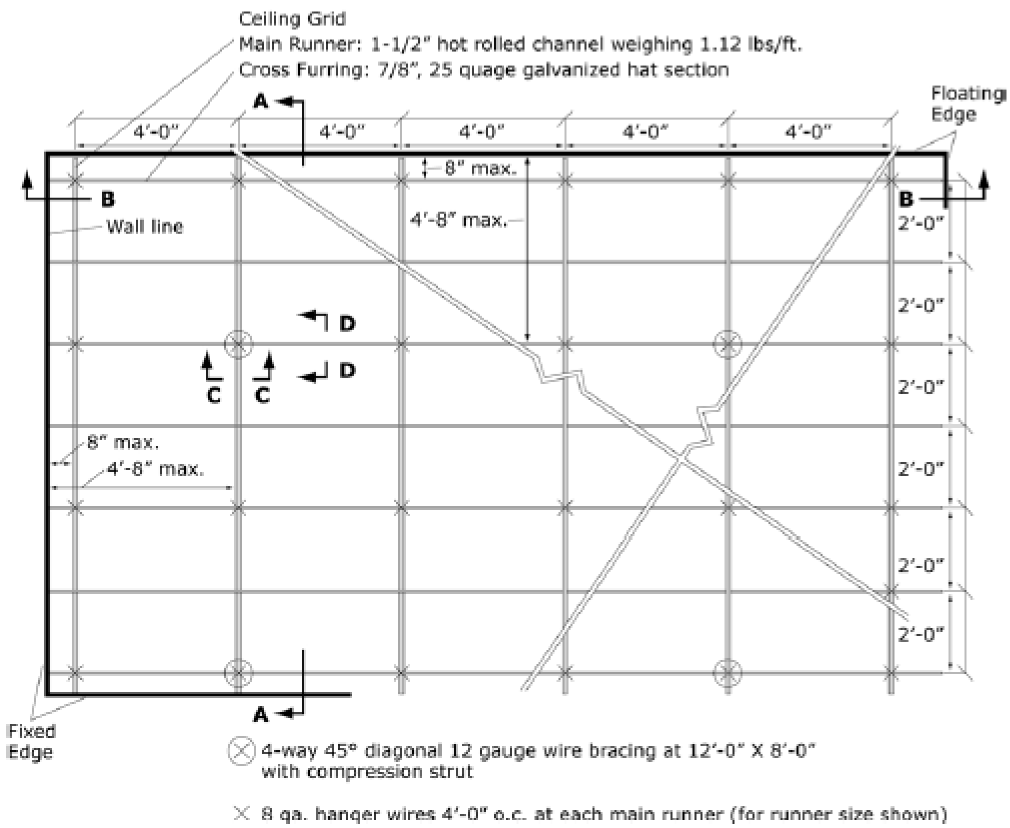


Figure G-14. Diagrammatic View of Suspended Heavy Ceiling Grid and Lateral Bracing.

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

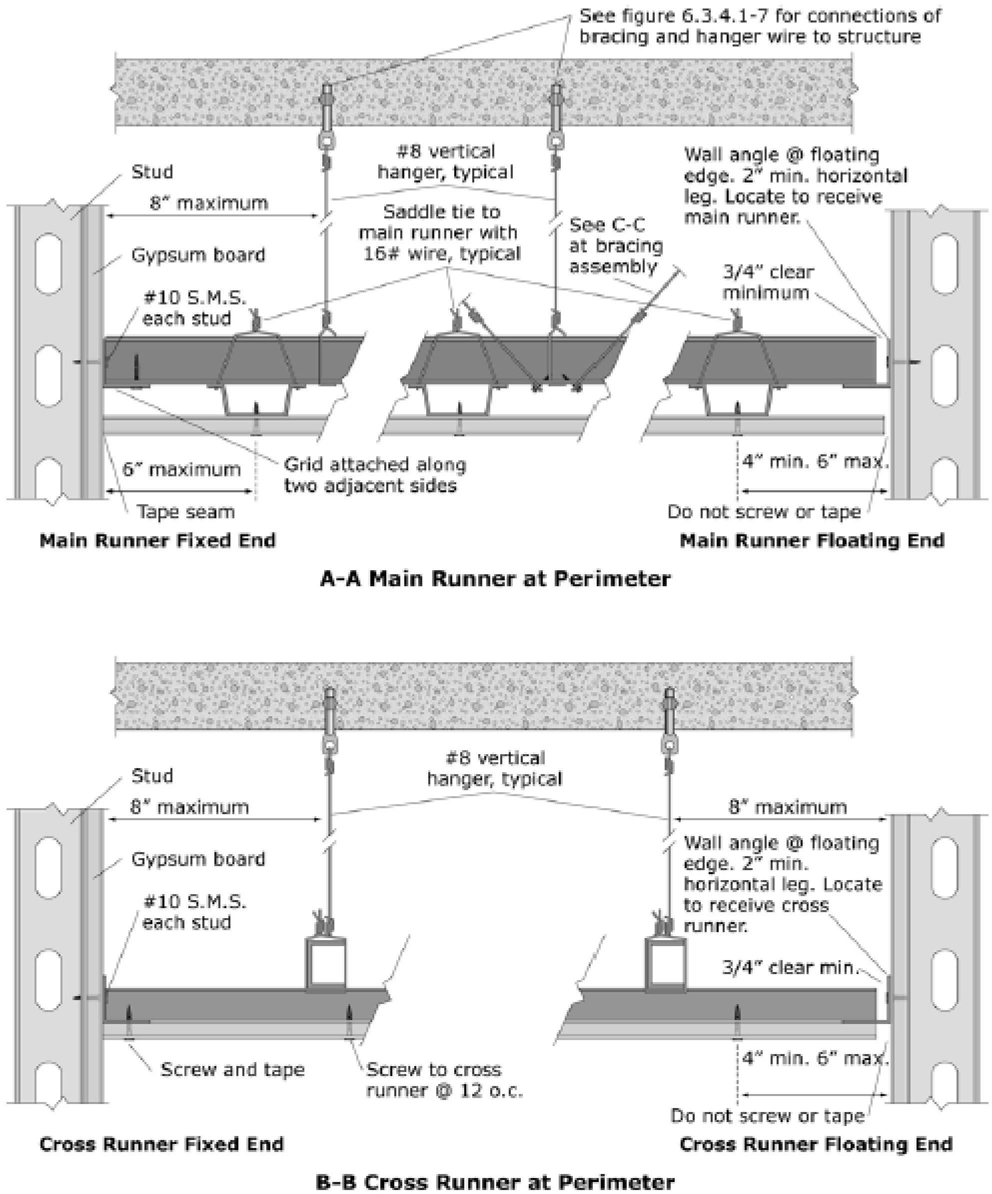


Figure G-15. Perimeter Details for Suspended Gypsum Board Ceiling.

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

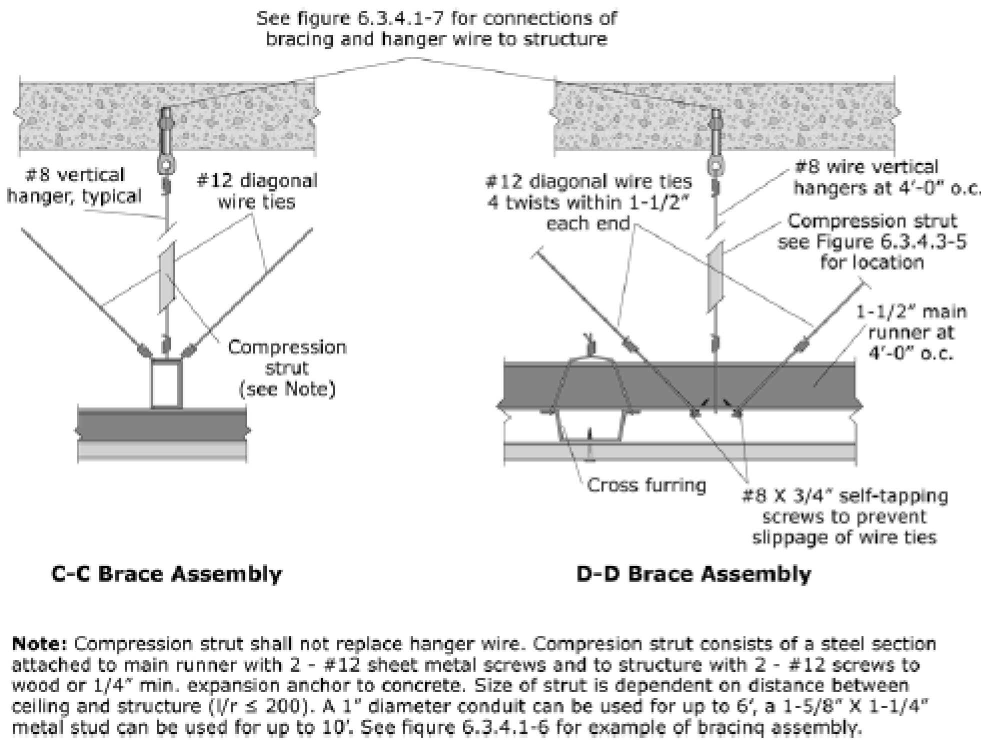


Figure G-16. Details for Lateral Bracing Assembly for Suspended Gypsum Board Ceiling.

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

Light Fixtures

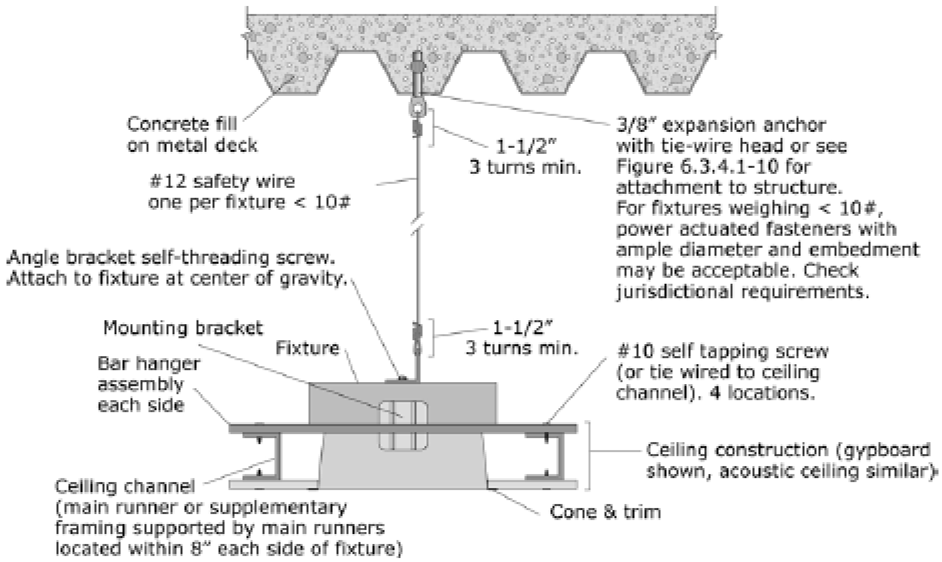


Figure G-17. Recessed Light Fixture in suspended Ceiling (Fixture Weight < 10 pounds).

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

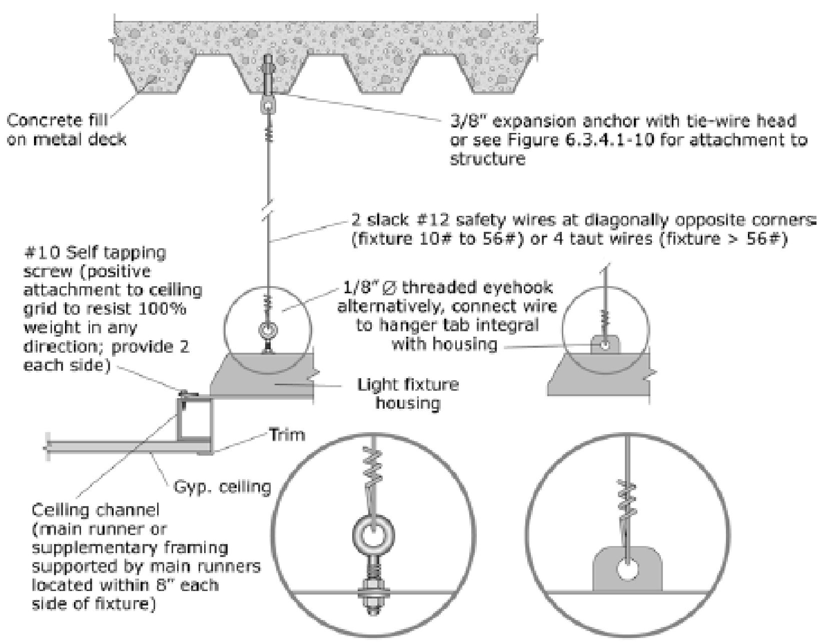


Figure G-18. Recessed Light Fixture in suspended Ceiling (Fixture Weight 10 to 56 pounds).

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

Contents and Furnishings

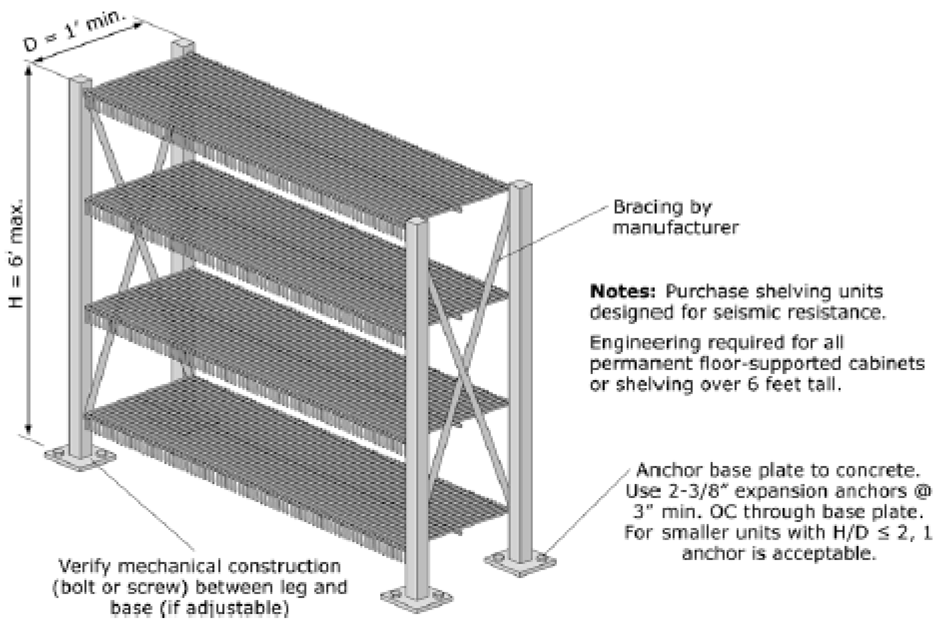
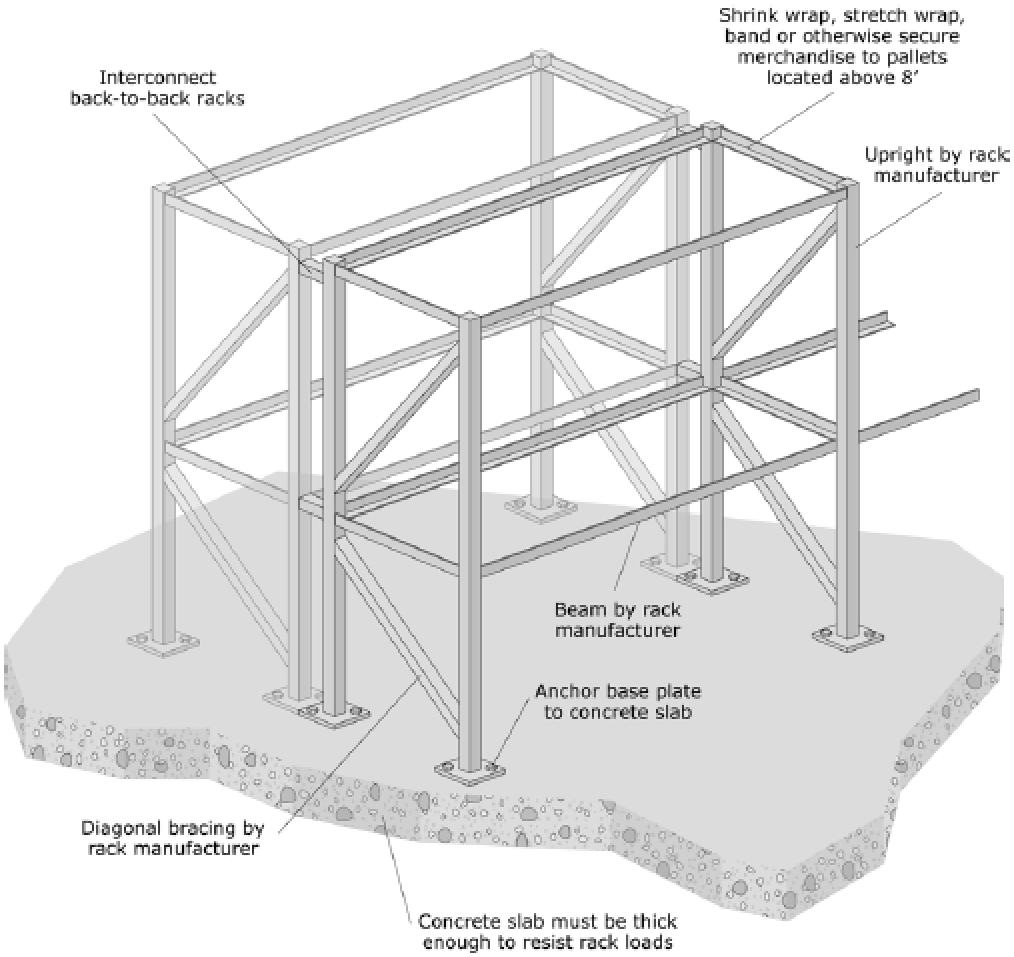


Figure G-19. Light Storage Racks.

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



Note: Purchase storage racks designed for seismic resistance. Storage racks may be classified as either nonstructural elements or nonbuilding structures depending upon their size and support conditions. Check the applicable code to see which provisions apply.

Figure G-20. Industrial Storage Racks.

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

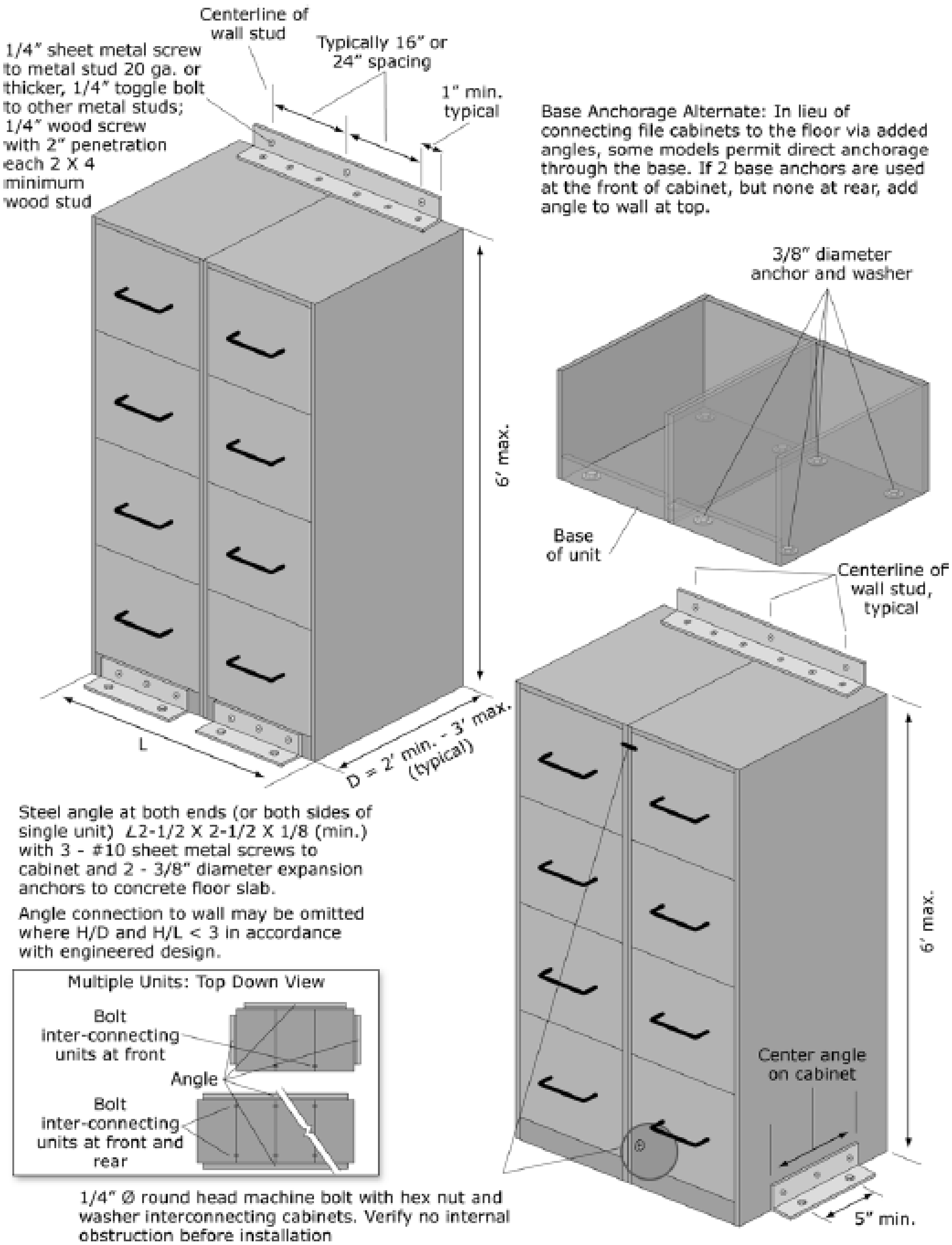


Figure G-21. Wall-mounted File Cabinets.

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

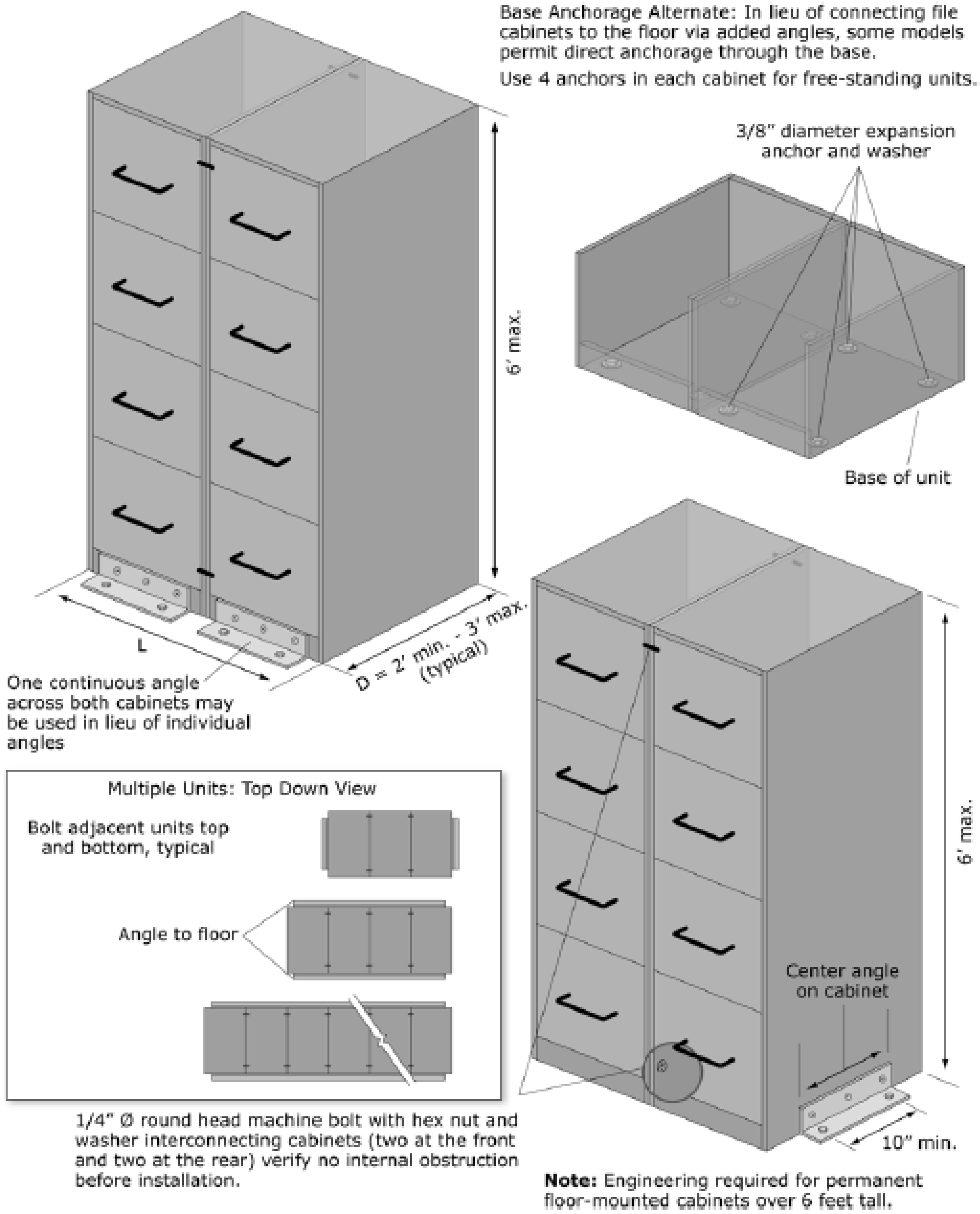


Figure G-22. Base Anchored File Cabinets.

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

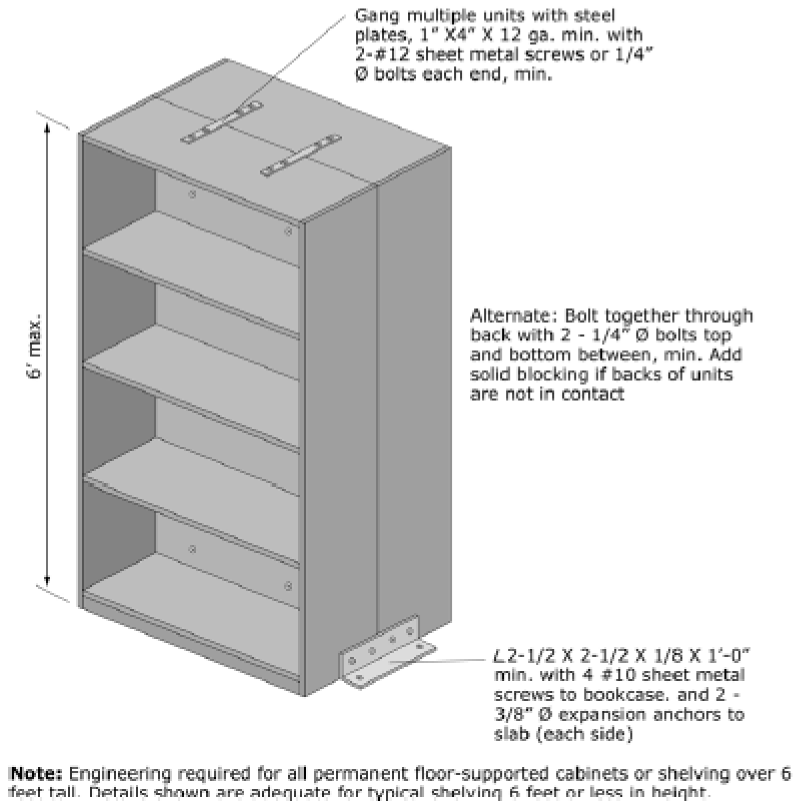


Figure G-23. Anchorage of Freestanding Book Cases Arranged Back to Back.

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

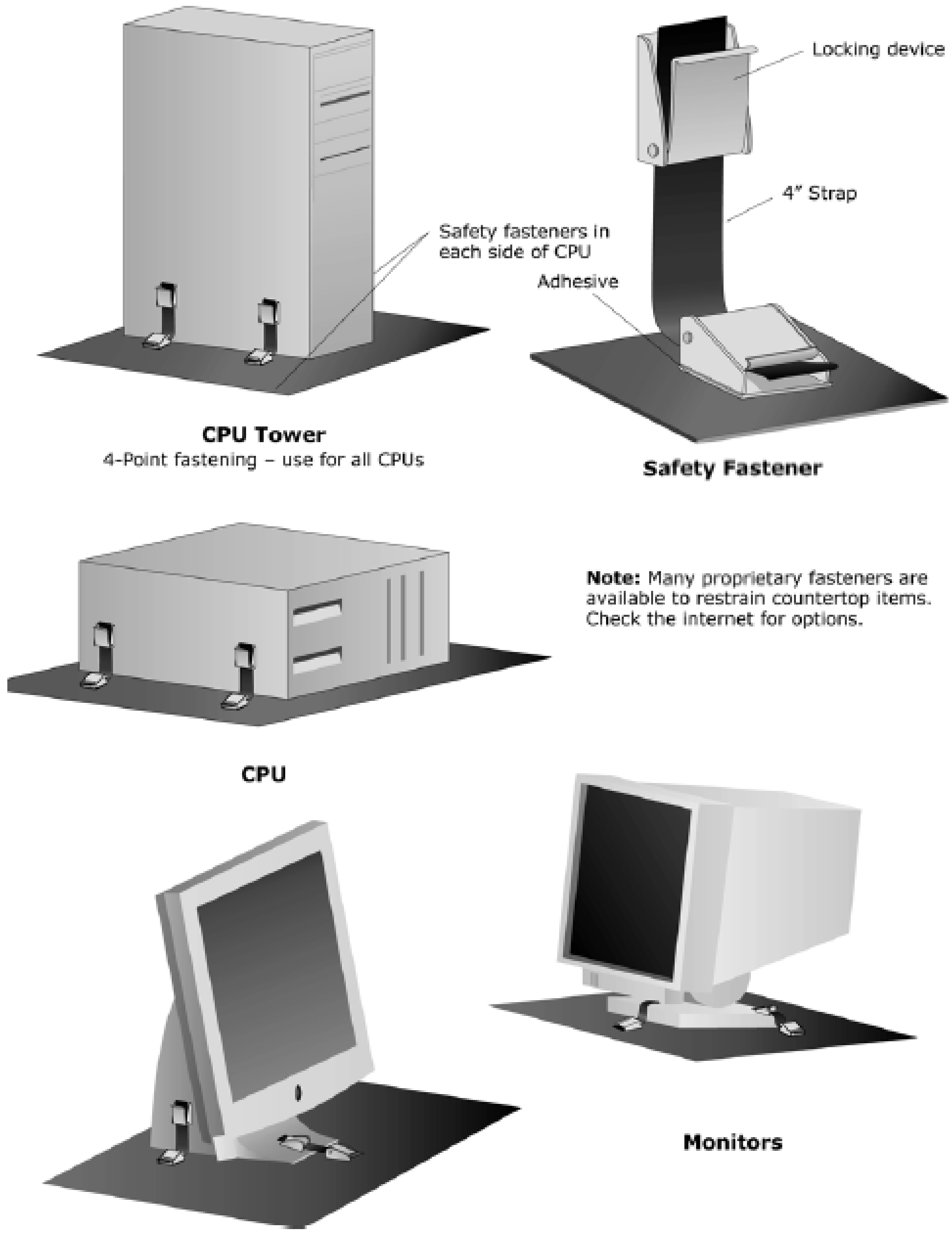
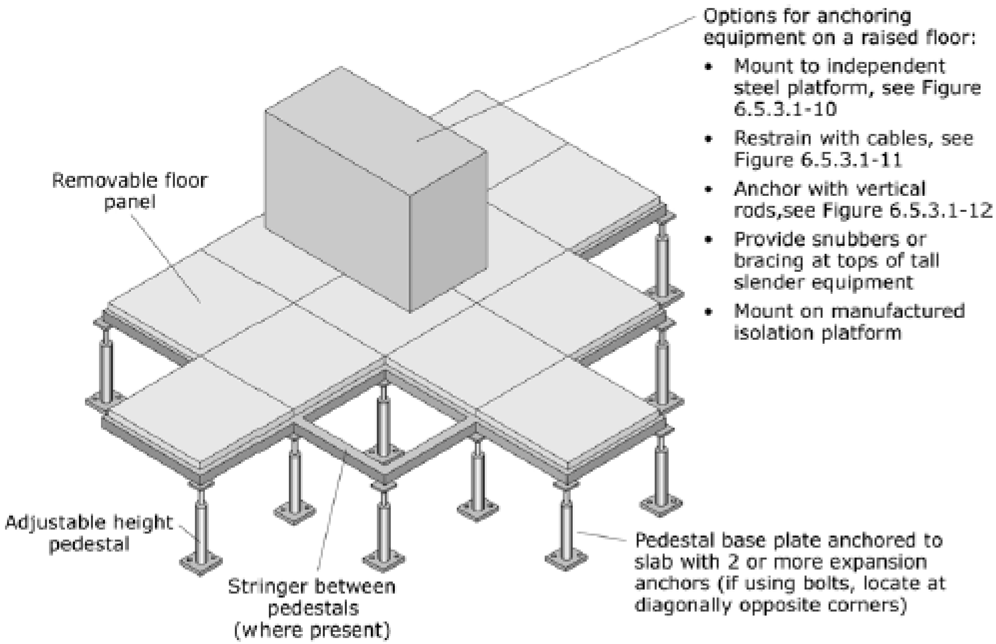
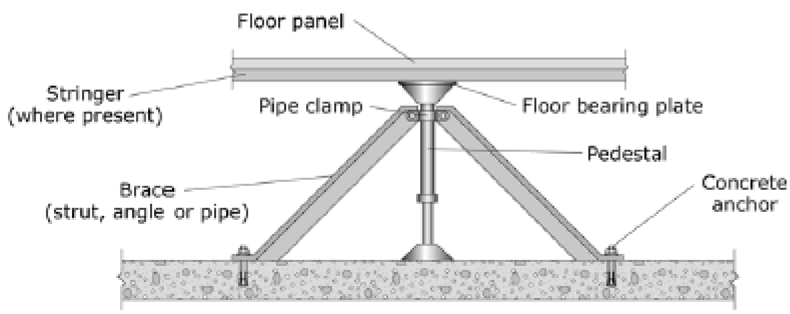


Figure G-24. Desktop Computers and Accessories.

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



Cantilevered Access Floor Pedestal



Braced Access Floor Pedestal
(use for tall floors or where pedestals are not strong enough to resist seismic forces)

Note: For new floors in areas of high seismicity, purchase and install systems that meet the applicable code provisions for "special access floors."

Figure G-25. Equipment Mounted on Access Floor.

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

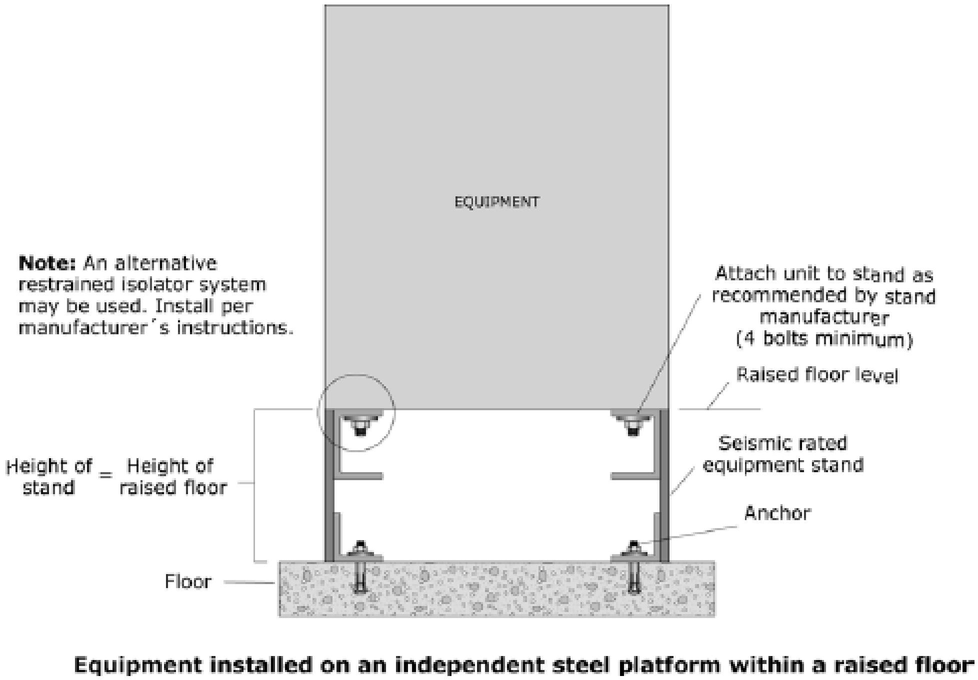


Figure G-26. Equipment Mounted on Access Floor – Independent Base.

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

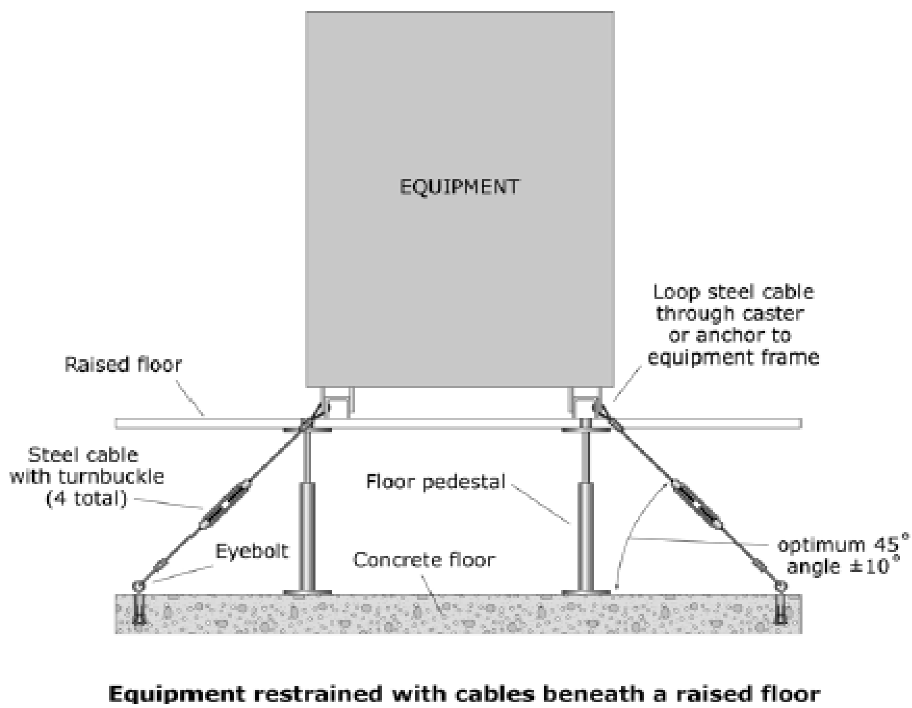
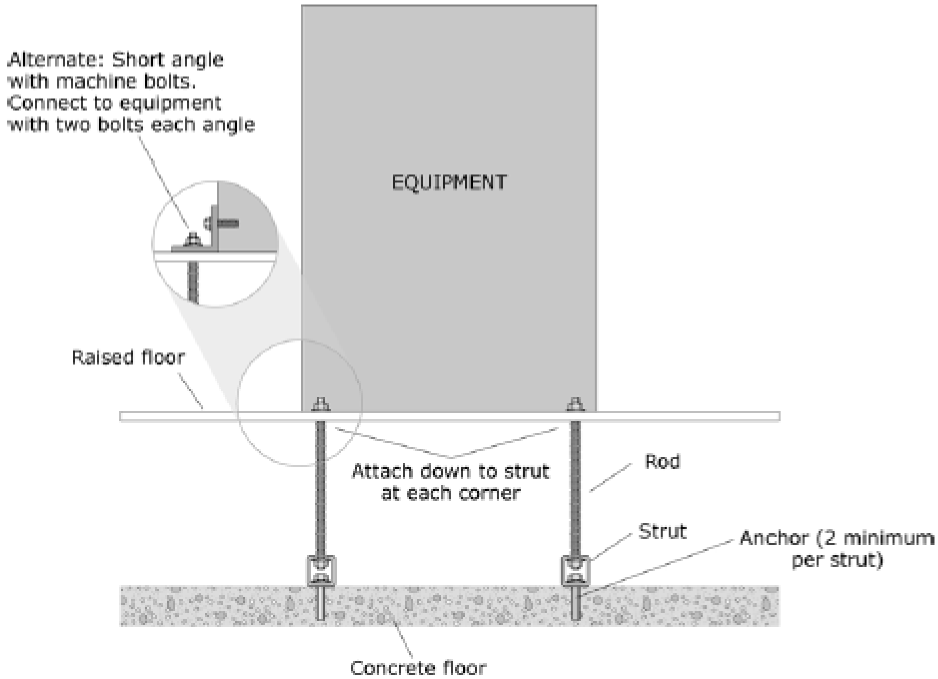


Figure G-27. Equipment Mounted on Access Floor – Cable Braced.

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

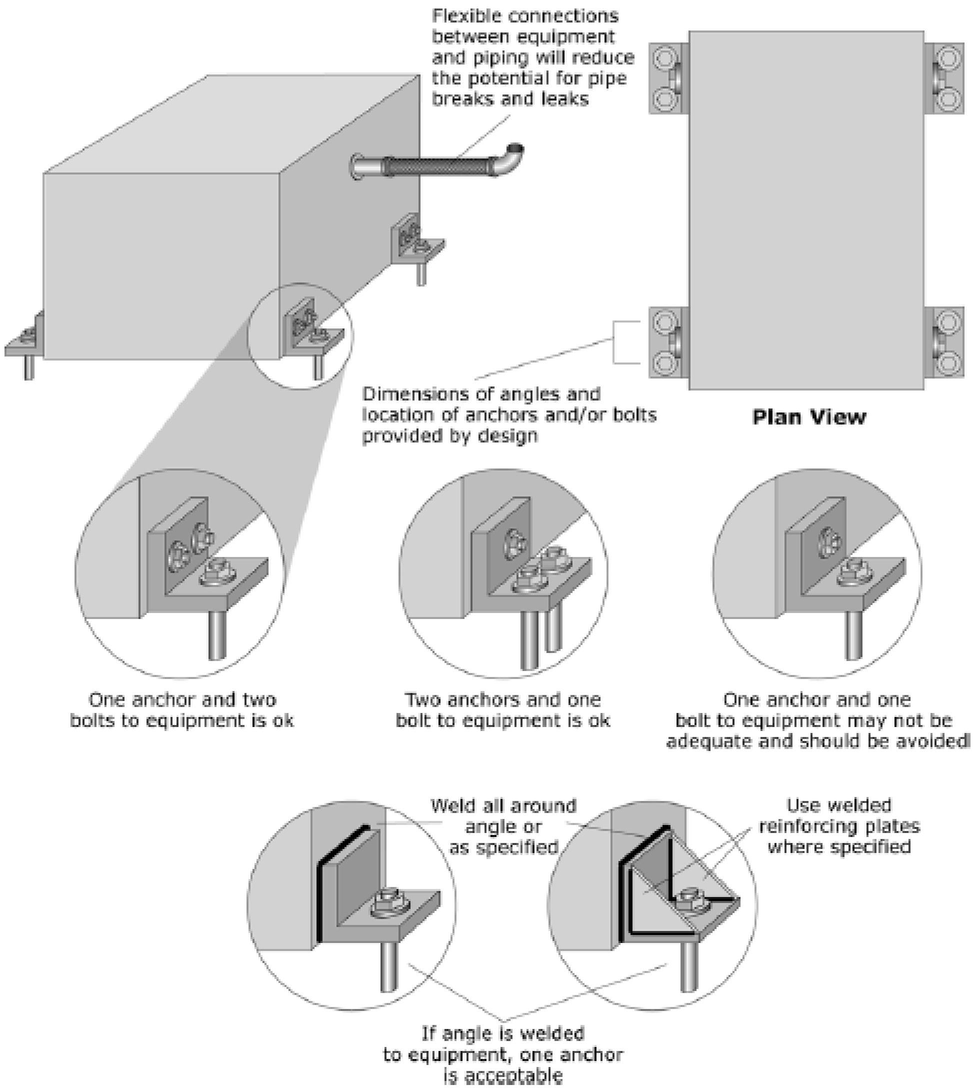


Equipment anchored with vertical rods beneath a raised floor

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

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

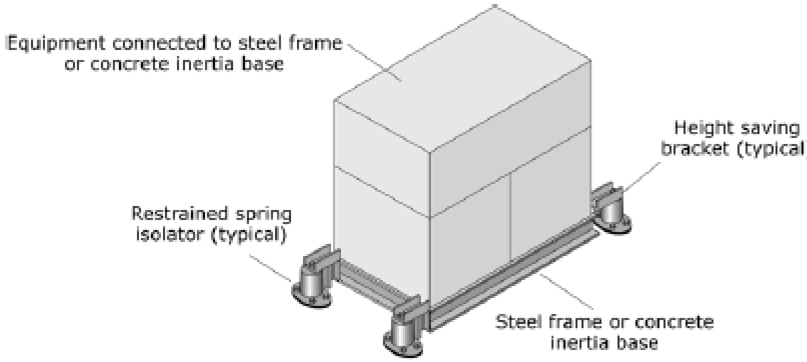
Mechanical and Electrical Equipment



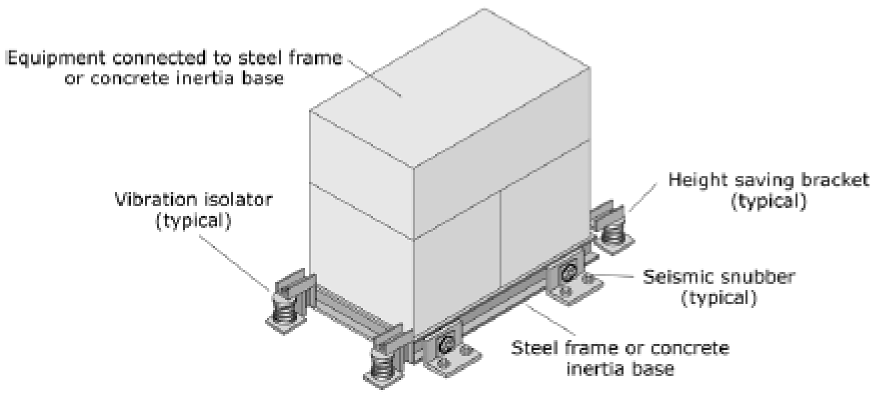
Note: Rigidly mounted equipment shall have flexible connections for the fuel lines and piping.

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

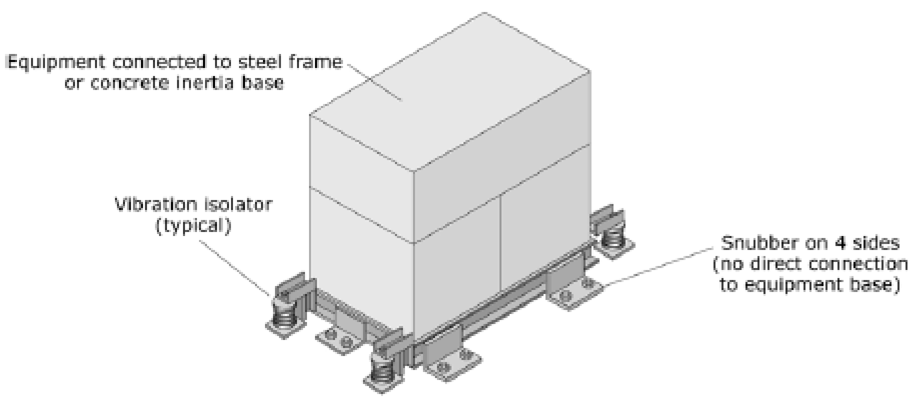
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Supplemental base with restrained spring isolators



Supplemental base with open springs and all-directional snubbers



Supplemental base with open springs and one-directional snubbers

Figure G-30. HVAC Equipment with Vibration Isolation.

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

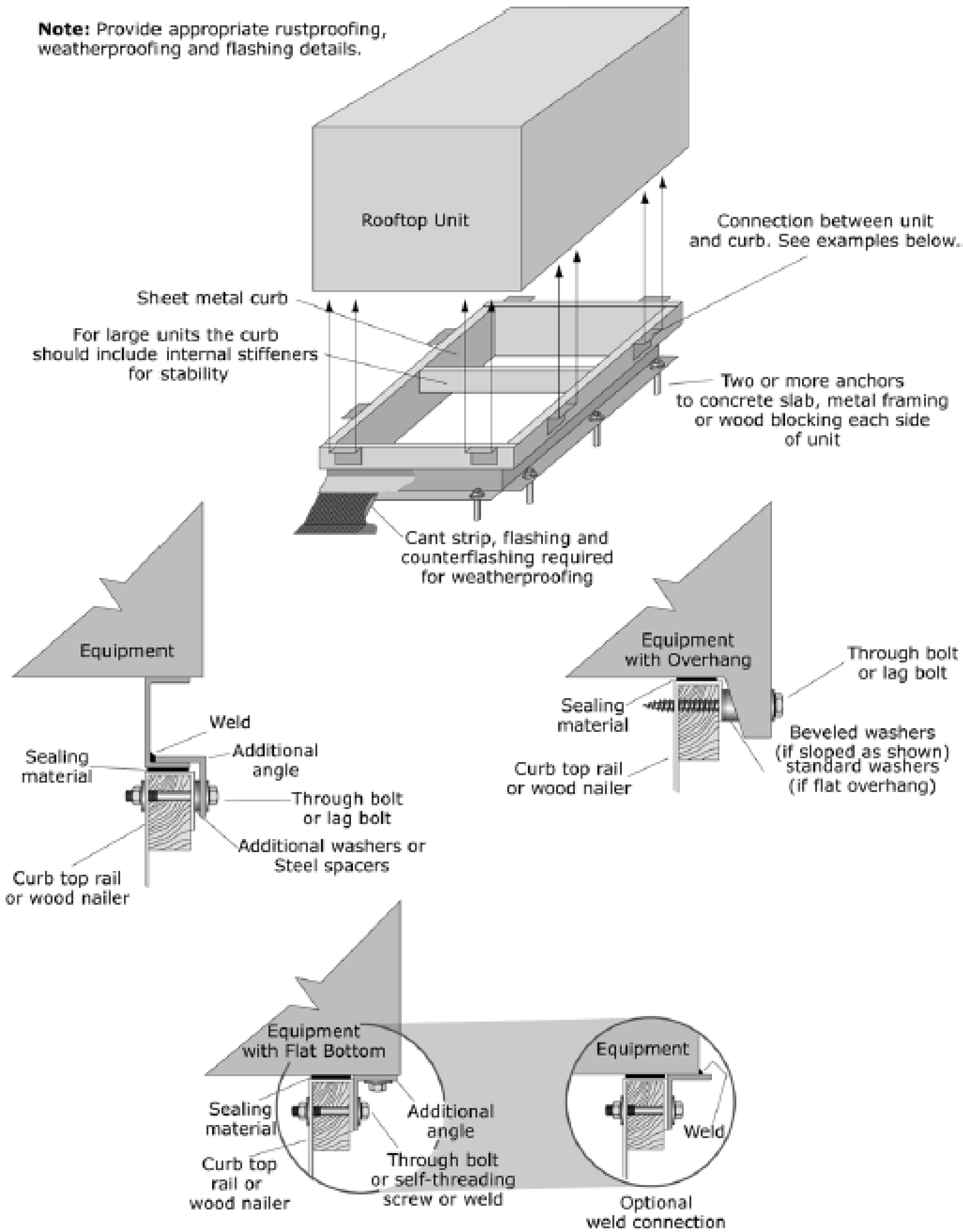


Figure G-31. Rooftop HVAC Equipment.

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

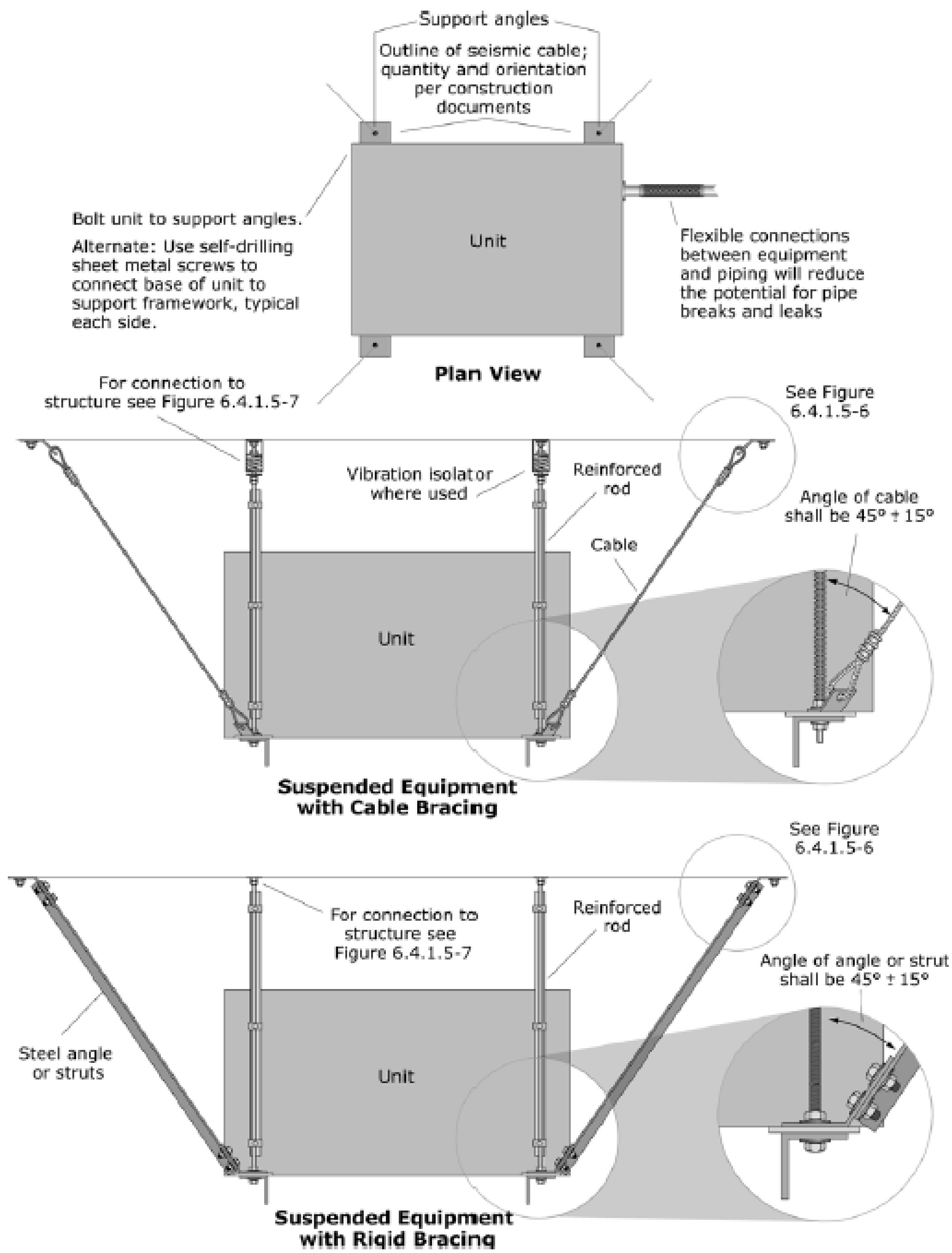


Figure G-32. Suspended Equipment.

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

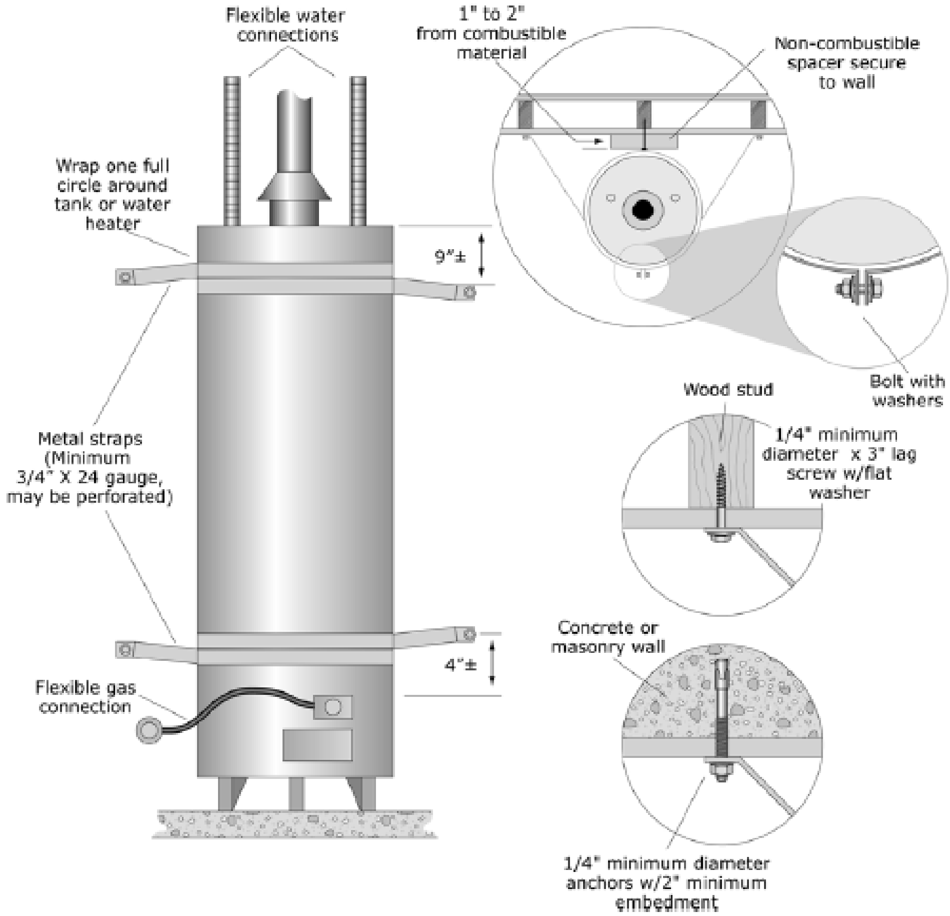


Figure G-33. Water Heater Strapping to Backing Wall.

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

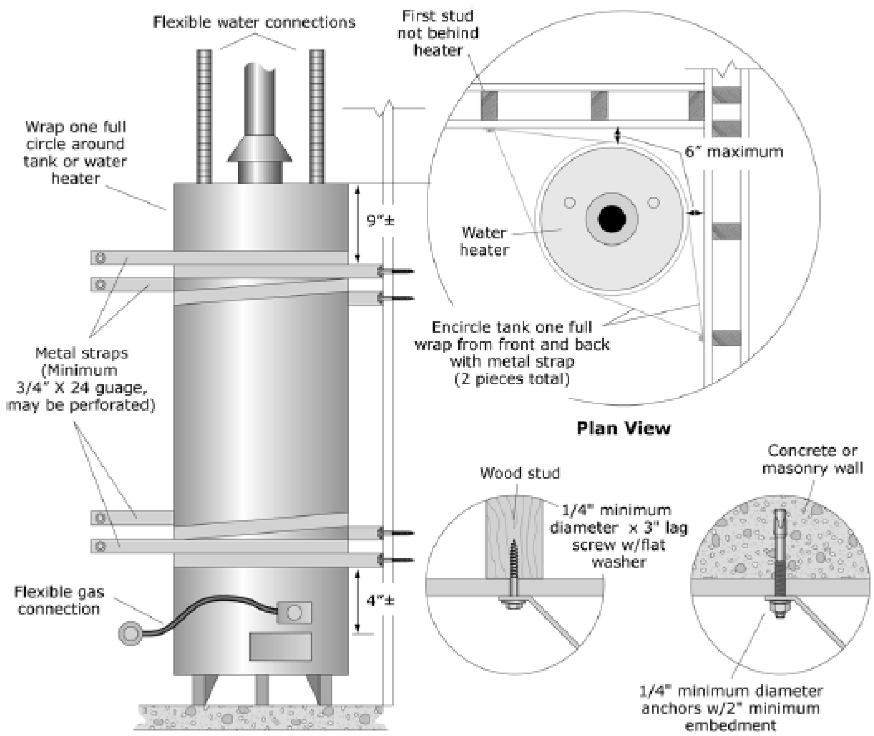


Figure G-34. Water Heater – Strapping at Corner Installation.

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

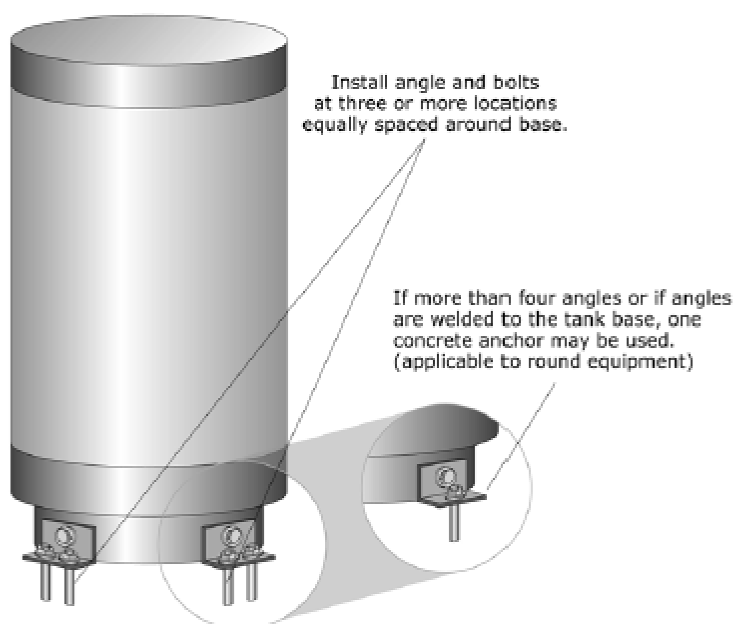


Figure G-35. Water Heater – Base Mounted.

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

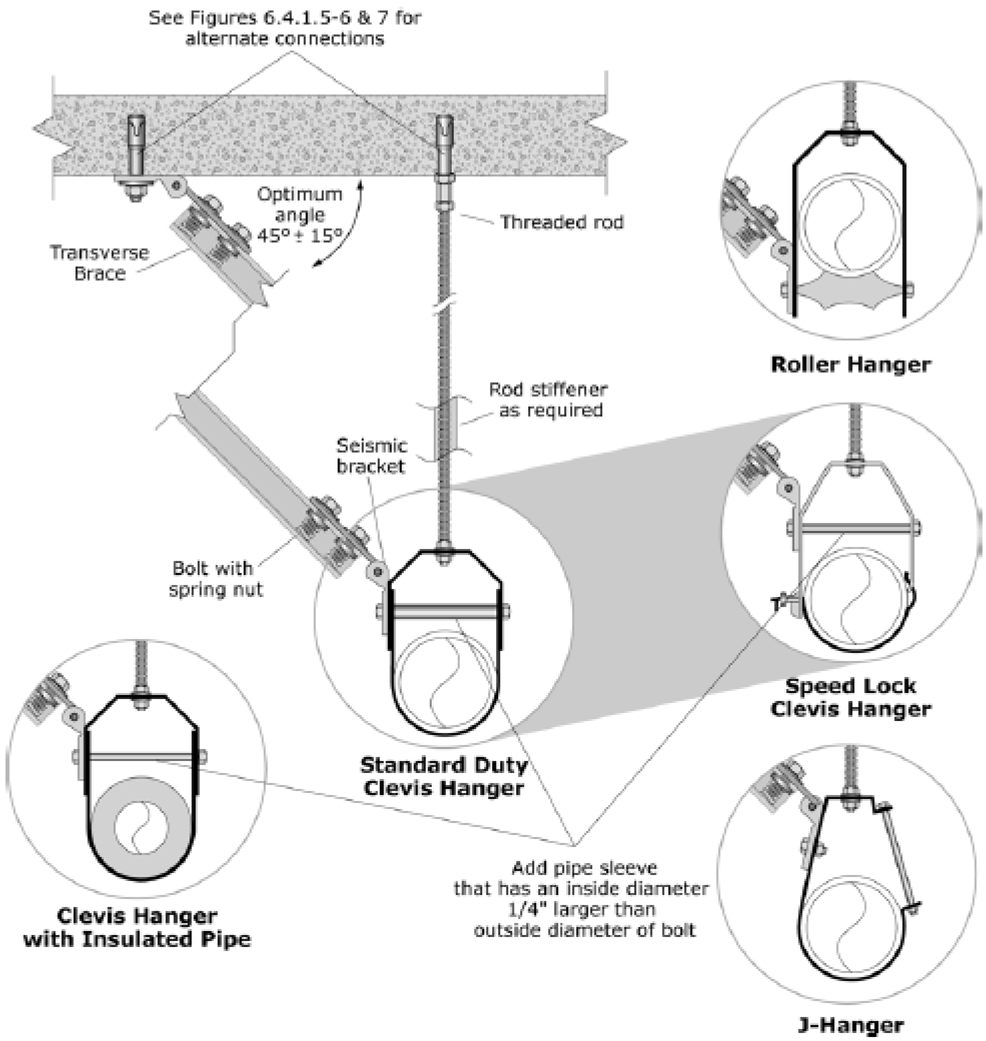


Figure G-36. Rigid Bracing – Single Pipe Transverse.

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

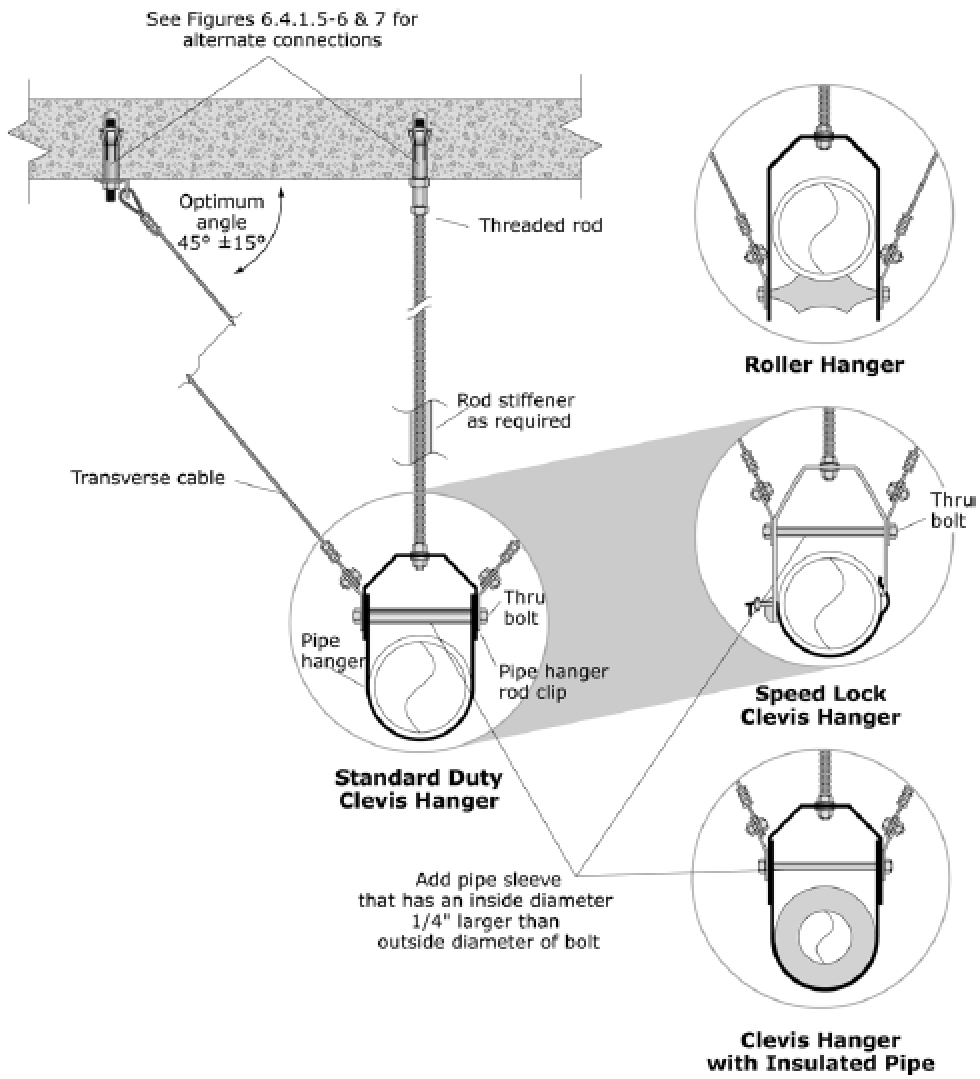


Figure G-37. Cable Bracing – Single Pipe Transverse.

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

Electrical and Communications

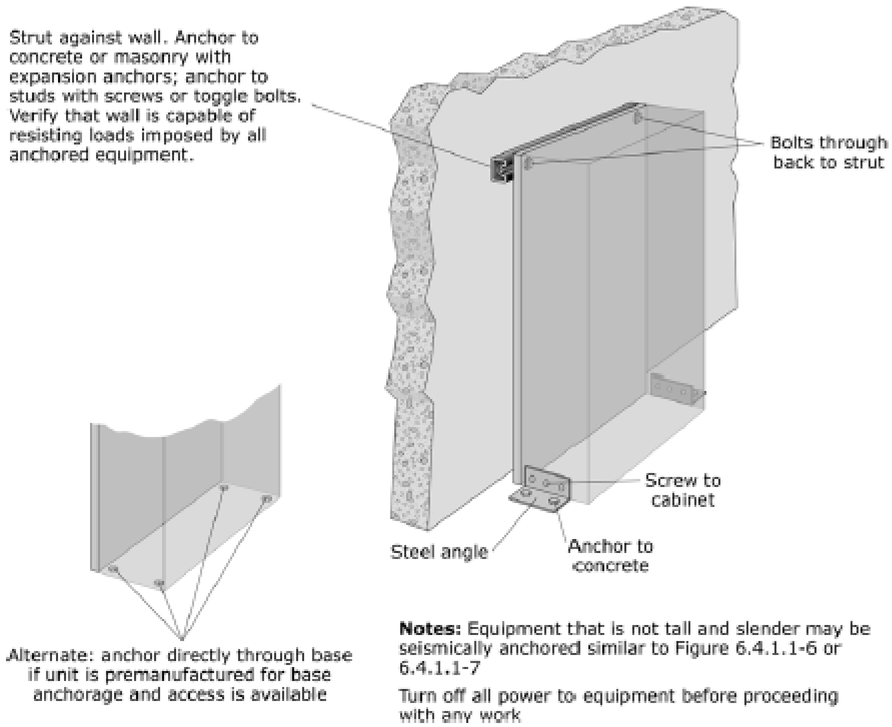


Figure G-38. Electrical Control Panels, Motor Controls Centers, or Switchgear.

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

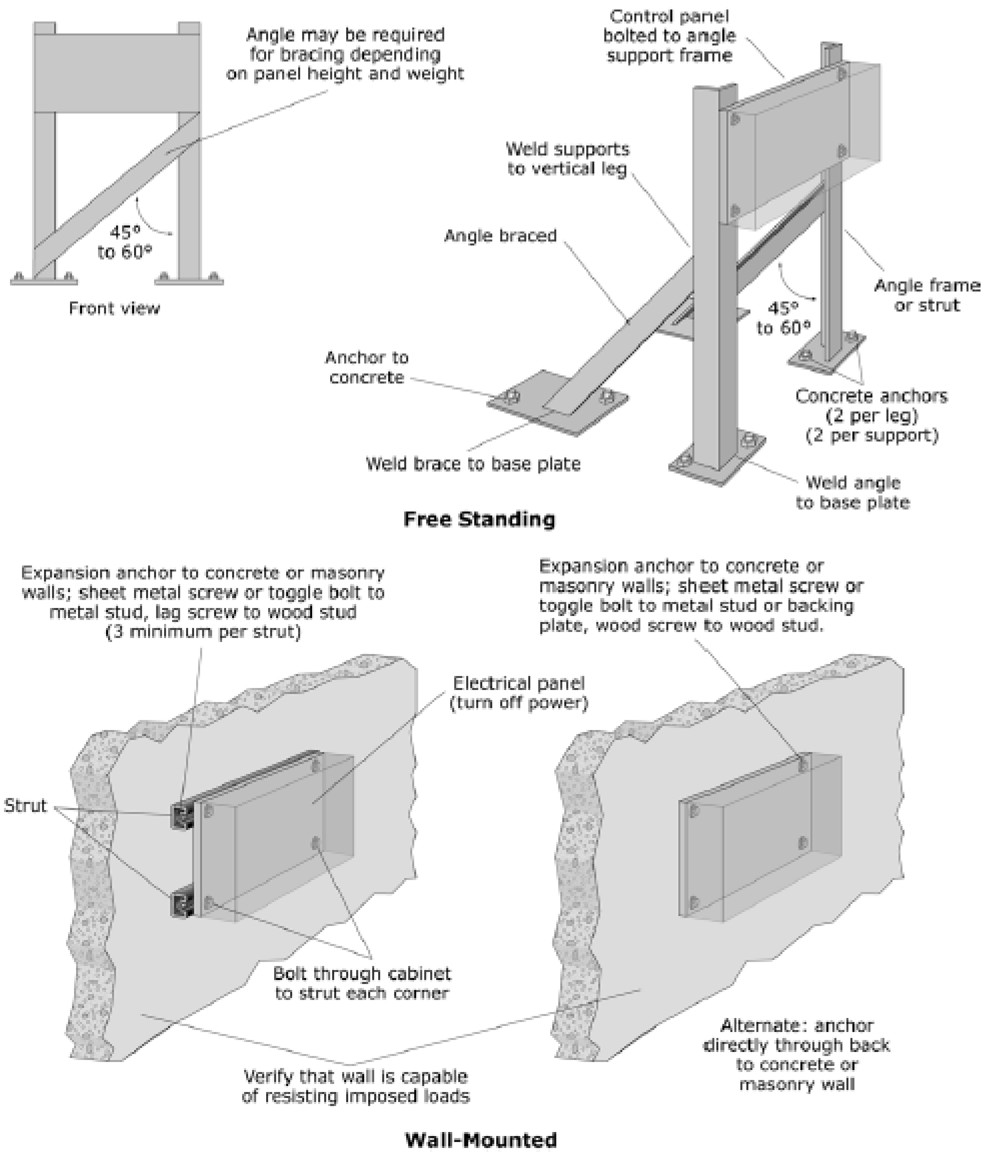


Figure G-39. Freestanding and Wall-mounted Electrical Control Panels, Motor Controls Centers, or Switchgear.

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

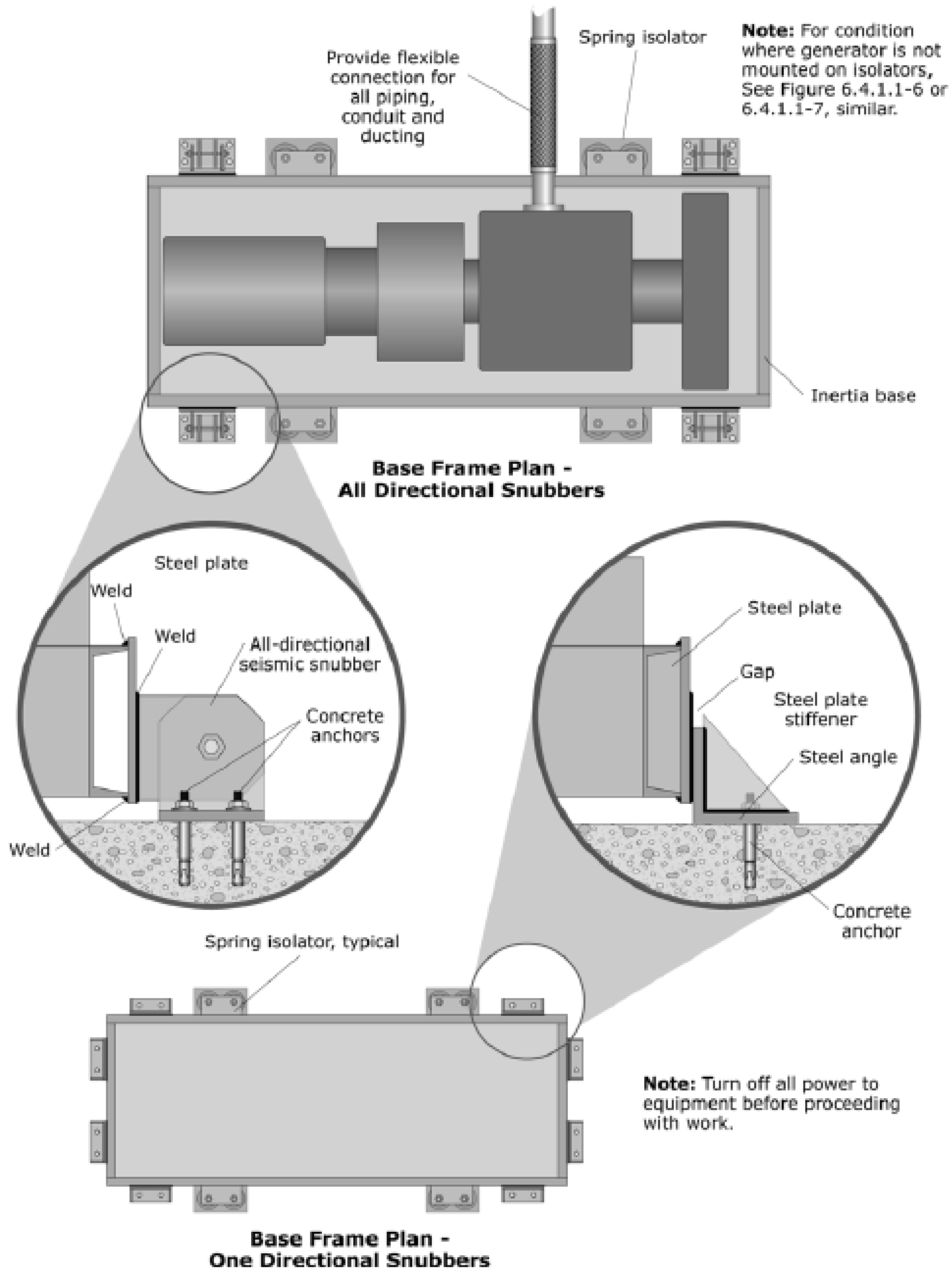


Figure G-40. Emergency Generator.

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