Washington State School Seismic Safety Assessments Project

SEISMIC UPGRADES CONCEPT DESIGN REPORT

Edison Elementary School – Main Building

Centralia School District 401

June 2019

PREPARED FOR

PREPARED BY

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WASHINGTON STATE SCHOOL SEISMIC SAFETY ASSESSMENTS PROJECT

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Centralia School District 401

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Prepared for:

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

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EXECUTIVE SUMMARY

This report documents the findings of a preliminary seismic evaluation of Edison Elementary School in Centralia, Washington. The single-story building is shaped like a capitalized "E" in plan, with an approximate floor area of 32,000 square feet. Originally constructed in 1918, the three parallel buildings were connected to form the "E" shape in 1922. In 1957, an addition was made to extend the west face of the auditorium/gymnasium further to the west to make a backstage/music area.

The "modernization" renovation the school underwent in 1987 did not include any efforts to address the condition of the lateral system. Portions of the structure were apparently damaged during the 2001 Nisqually earthquake, and repairs were limited to the damage in the main lobby area. This report appears to be the first effort to evaluate the seismic capacity of the school.

No existing drawings were available at the time of this review. Based on site observations, it appears that the building is primarily a single-story, unreinforced masonry building, with a basement under the lobby that has both concrete and masonry basement (retaining) walls. The mezzanine level floor and roofs are likely to be framed with wood structural elements. The lobby floor is a cast-in-place concrete slab with beams. The foundations appear to be a conventional shallow foundation system that consists of continuous strip footings supporting walls and spread footings supporting columns.

The building was constructed prior to the time seismic loads were considered in design; moreover, this region was not known to be seismically active at the time. It is expected that the ability for the building to resist seismic loads is incidental. It appears the primary lateral system of the building is wood roof diaphragms with unreinforced masonry shear walls.

BergerABAM performed a Tier 1 screening in accordance with the ASCE 41-17 standard *Seismic Evaluation and Retrofit of Existing Buildings*. The screening evaluation included field observations to verify the existing construction and completion of the standardized ASCE 41-17 Tier 1 checklist for unreinforced masonry (URM) buildings. The Tier 1 seismic evaluation indicated that the building has four structural deficiencies in addition to a number of unknowns that should be investigated further. The first deficiency identified is the vertical irregularities in the lateral system between the first and second story walls in the lobby area. The next two deficiencies identified involve the shear wall overturning and shear wall stress check calculations, both of which relate to the narrowness of the typical shear wall panels and were found to exceed the maximum overturning and stress limits. The last deficiency identified is the ratio of wall thickness to unbraced wall height in the auditorium/gym, which exceeds the permitted ratio. Remaining items that are critical to the seismic-force-resisting system but are unknowns include a well-defined load path and the connectivity between lateral load resisting elements, if any.

Conceptual seismic upgrade recommendations for structural and nonstructural systems are provided to improve the performance of the building to meet the designated performance criteria of ASCE 41-17. Sketches for the concept-level seismic upgrades are provided in Appendix B. The conceptual recommendations are detailed in Section 4.

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Table of Contents

Appendix List

Figure List

Table List

Acronyms

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

Reference List

Codes and References

2015 IBC, *2015 International Building Code,* prepared by the International Code Council, Washington, D.C.

ASCE 7-10, 2010, *Minimum Design Loads for Buildings and Other Structures*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

ASCE 31-03, 2003, *Seismic Evaluation of Existing Buildings*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

ASCE 41-06, 2007, *Seismic Rehabilitation of Existing Buildings*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

ASCE 41-13, 2014, *Seismic Evaluation and Retrofit of Existing Buildings*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

ASCE 41-17, 2018, *Seismic Evaluation and Retrofit of Existing Buildings*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

ATC-14, *Evaluating the Seismic Resistance of Existing Buildings,* prepared for Applied Technology Council by H.J. Degenkolb Associates, San Francisco, California.

FEMA E-74, 1994, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, prepared by Wiss, Janney, Elstner Associates, Inc., under contract from the Federal Emergency Management Agency (FEMA), Washington, D.C.

FEMA E-74-FM, 2005, *Earthquake Hazard Mitigation for Nonstructural Elements, Field Manual*, prepared by Wiss, Janney, Elstner Associates, Inc., under contract with URS Corporation for the Federal Emergency Management Agency (FEMA), Washington, D.C.

FEMA 310, 1998, *Handbook for Seismic Evaluations of Buildings – A Prestandard*, prepared by America Society of Civil Engineers, Reston, Virginia.

FEMA 547, 2006, *Techniques for the Seismic Rehabilitation of Existing Buildings*, prepared by Rutherford & Chekene Consulting Engineers under contract with the National Institute of Standards and Technology (NIST), funded by the Federal Emergency Management Agency (FEMA).

NFPA 13, 2019, *Standard for the Installation of Sprinkler Systems*, prepared by National Fire Protection Association.

FEMA P-1000, *Safer, Stronger, Smarter: A Guide to Improving School Natural Hazard Safety*. Prepared by www.fema.gov/media-library/assets/documents/132592

Case Studies of Successful U.S. School Seismic Screening Programs. Prepared by EERI Staff, Members and Volunteers. https://www.eeri.org/wp-content/uploads/SESI_Screening_BestPractices_Version1_Dec2016.pdf

Incremental Seismic Rehabilitation of School Buildings (K-12): Providing Protection to People and Buildings (2003). Prepared by https://www.fema.gov/media-library/assets/documents/5154

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

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

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

Drawings

Structural drawings were not available for review.

1.0 Introduction

1.1 Background

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

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

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

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

1.2 Scope of Services

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

1.2.1 Information Review

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

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

1.2.2 Field Investigations

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

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

1.2.3 Seismic Evaluations

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

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

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

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

1.2.4 Reporting and Documentation

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

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

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

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2.0 Seismic Evaluation Procedures and Criteria

2.1 ASCE 41 Seismic Evaluation and Retrofit Overview

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

TIER 1 – Screening Phase
- Checklists of evaluation statements to quickly identify potential deficiencies
- Requires field investigation and/or review of record drawings
- Analysis limited to "Quick Checks" of global elements
- May proceed to Tier 2, Tier 3, or rehabilitation design if deficiencies are identified

TIER 2 – Evaluation Phase
- "Full Building" or "Deficiency Only" evaluation
- Address all Tier 1 seismic deficiencies
- Analysis more refined than Tier 1, but limited to simplified linear procedures
- Identify buildings not requiring rehabilitation

TIER 3 – Detailed Evaluation Phase
- Component-based evaluation of entire building using reduced ASCE 41 forces
- Advanced analytical procedures available if Tier 1 and/or Tier 2 evaluations are judged to be overly conservative
- Complex analysis procedures may result in construction savings equal to many times their cost

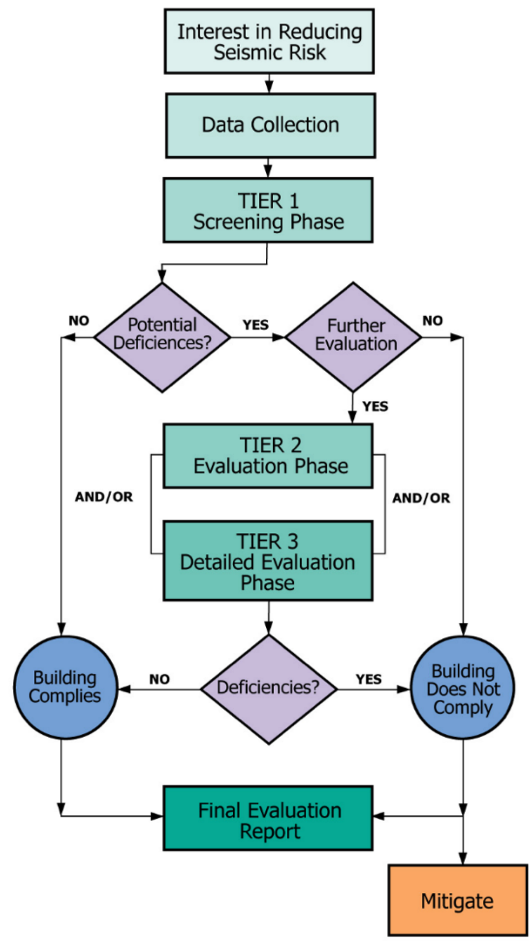

Figure 2-1. Flow Chart and Description of ASCE 41 Seismic Evaluation Procedure.

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

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

2.2 Seismic Evaluation and Retrofit Criteria

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

2.2.1 Edison Elementary School Seismicity

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

The Level of Seismicity is categorized as Very Low, Low, Moderate, or High based on the probabilistic ground accelerations. Ground accelerations and mass generate inertial (seismic) forces within a building (Force = mass x acceleration). Ground acceleration therefore is the parameter that classifies the level of seismicity. From geographic region to region, as the ground accelerations increase, so does the level of seismicity (from low to high). Where this building is located, the design short-period spectral acceleration, S_{DS}, is 0.788 g, and the design 1-second period spectral acceleration, S_{D1} is 0.441 g. Based on ASCE 41 Table 2-4, the Level of Seismicity for this building is classified as **High**.

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

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

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

BSE-1E 20%/50 (225-year) Event		BSE-1N 2/3 of 2,475-year Event		BSE-2E 5%/50 (975-year) Event		BSE-2N 2%/50 (2,475-year) Event	
0.2 Seconds	0.411 g	0.2 Seconds	0.788 g	0.2 Seconds	0.853 g	0.2 Seconds	1.182 g
1.0 Seconds	0.158 g	1.0 Seconds	0.44 g	1.0 Seconds	0.367 g	1.0 Seconds	0.58 g

2.2.2 Edison Elementary School Structural Performance Objective

The school building is a Category 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). In-situ testing of building materials and removal of architectural finishes are outside of the scope of this study. Material properties and existing construction information were assumed since existing structural drawings were not available. 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 a URM, "unreinforced masonry shear wall," which also serve as shear walls, with flexible wood roof diaphragms.

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: 1918
Building Code: Unknown

Number of Stories: 1
Floor Area: 31,521 SF

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

Edison Elementary is a single-story, unreinforced masonry school building, measuring approximately 340 feet by 125 feet at its greatest plan extents. The building is approximately 15 feet tall at the eaves, except the middle portion of the building is a high-story with an approximately 25-foot-high eave. There is a partial basement under the center, high-bay structure. The school was constructed in 1918, with additional classrooms added in 1921 and 1922. Two more classrooms, a music room added to the gym, a kitchen, and new restrooms were added in 1957. The structure underwent a modernization remodel in 1987 to 1988. After the Nisqually earthquake in 2001, some emergency repairs were made to remedy extensive damage to the foyer, but it does not appear that the structure was evaluated for seismic resistance at that time.

3.1.2 Building Use

The building contains a number of classrooms for elementary school students. A school kitchen is adjacent to the large high-bay multi-purpose room, which serves as a gymnasium, auditorium, and cafeteria.

3.1.3 Structural System

Table 3.1.3-1. Structural System Descriptions.

Structural System	Description
Structural Roof	The roofs are hip and gable style, appear to be wood-framed with composite shingles, and slope at 3:12 or 4:12.
Structural Floor(s)	The foyer floor, over the basement area, is a concrete slab and beam system. No drawings were found at the time of the site visit, but the appearance of the construction is indicative of the early twentieth century and was likely built in 1918. The construction type of the

Table 3.1.3-1. Structural System Descriptions.

Structural System	Description
	mezzanine level floor is unknown but is likely timber wood-framed based on the time period.
Foundation	The foundations are a traditional shallow system composed of strip and isolated pad footings. The basement walls are primarily concrete, with one of the walls made of unreinforced masonry.
Gravity System	The basement retaining walls are cast-in-place concrete. The walls above grade are all unreinforced masonry walls.
Lateral System	The roof system was not confirmed but is likely a flexible wood diaphragm, based on the typical practices of the era. It is most likely a straight or diagonal rafter system that carries lateral loads to the unreinforced masonry shear walls.

3.1.4 Structural System Visual Condition

Table 3.1.4-1. Structural System Condition Descriptions.

Structural System	Description
Structural Roof	No visible signs of damage or deterioration.
Structural Floor(s)	The underside of the structural floor shows some signs of deterioration.
Foundation	The concrete basement walls have some cracking and other signs of moderate deterioration. Minor cracking in the foundations at the classroom wings.
Gravity System	No visible signs of damage or deterioration of the unreinforced masonry walls.
Lateral System	No visible signs of damage or deterioration of the unreinforced masonry walls.

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
Vertical Irregularities	There appear to be some shear walls that are discontinuous over the front of the foyer.
Overturning	Although structural drawings were not found, approximate field measurements of some of the URM wall piers indicate that this structure does not comply with this condition.
Shear Stress Check	A field survey of the building geometry is necessary; however, preliminary estimates based on approximate dimensions indicate the structure is likely not compliant.
Proportions	It appears that this condition is not met at the gymnasium area. This condition may potentially be satisfied when considering the stiffening effect from the low roof; however, at this point such a rationalization cannot be made as the roof to wall connections could not be visually verified.

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
Load Path	Critical load path components could not be visually verified during site visit.
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. Moderate to high 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.

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

Deficiency	Description
Surface Fault Rupture	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.
Ties Between Foundation Elements	Items could not be visually verified during site visit.
Wall Anchorage	Items could not be visually verified during site visit.
Wood Ledgers	Items could not be visually verified during site visit.
Transfer to Shear Walls	Items could not be visually verified during site visit.
Girder-Column Connection	Items could not be visually verified during site visit.
Masonry Layup	Items could not be visually verified during site visit.
Cross Ties	Items could not be visually verified during site visit.
Straight Sheathing	Items could not be visually verified during site visit.
Spans	Items could not be visually verified during site visit.
Diagonally Sheathed and Unblocked Diaphragms	Items could not be visually verified during site visit.
Other Diaphragms	Items could not be visually verified during site visit.
Stiffness of Wall Anchors	Items could not be visually verified during site visit.
Beams	Girder and truss supports. Items could not be visually verified during site visit.

3.2.3 Nonstructural Seismic Deficiencies

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

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

Deficiency	Description
CF-2 Tall Narrow Contents	A number of tall and narrow components in the basement and classroom wings did not appear to comply with this requirement.
CF-3 Fall-Prone Contents	A number of fall-prone components in the basement and classroom wings did not appear to comply with this requirement.

3.2.4 Nonstructural Checklist Items Marked as "U"nknown

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

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

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

Deficiency	Description
LSS-1 Fire Suppression Piping	Presence of a fire suppression system could not be visually verified during time of the site visit. Further investigation may be appropriate to mitigate seismic risk.
LSS-2 Flexible Couplings	Items could not be visually verified during site visit. Flexible coupling for fire suppression piping may be appropriate to mitigate seismic risk.
LSS-3 Emergency Power	Available record drawings do not have information on anchorage or bracing for emergency power equipment and was unable to be verified during site investigation. Based on the age of the building, emergency power equipment is either nonexistent or noncompliant. Evaluation of emergency power equipment may be appropriate to mitigate seismic risk.
LSS-5 Sprinkler Couplings	No available record drawing information on sprinkler head clearance and unable to verify during site investigation. Further evaluation may be appropriate to mitigate seismic risk.
HM-2 Hazardous Material	Unknown whether the building has hazardous materials. Further investigation may be appropriate to mitigate seismic risk.

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

Deficiency	Description
P-1 Unreinforced Masonry	It is unclear if some of the interior partition walls are URM, and if so, how they are braced.
P-3 Drift	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
P-4 Light Partitions Supported by Ceilings	Items could not be visually verified during site visit.
C-1 Suspended Lath and Plaster	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
C-2 Suspended Gypsum Board	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
LF-1 Independent Support	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
CG-1 Cladding Anchors	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
CG-8 Overhead Glazing	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
PCOA-2 Canopies	Details of the canopy connection to the foyer front wall could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
MC-2 Anchorage	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
S-1 Stair Enclosures	Stairs to the basement appear to be surrounded by concrete walls. The construction type of the walls around the stairs to the foyer mezzanine could not be visually verified during the site visit. Further investigation may be appropriate to mitigate seismic risk.
ME-1 Fall Prone Equipment	Bracing required for equipment weighing more than 20 pounds located 4 feet or more above the floor to mitigate seismic risk.
ME-2 In-Line Equipment	Items could not be visually verified during site visit. Bracing for heavy in-line equipment may be appropriate to mitigate seismic risk.
ME-3 Tall Narrow Equipment	Items could not be visually verified during site visit. Brace tall narrow equipment to back wall or provide overturning anchors to mitigate seismic risk.

4.0 Conclusion and Recommendations

4.1 Seismic-Structural Upgrade Recommendations

This section outlines recommendations of conceptual upgrades that would address the identified deficiencies in the seismic lateral-force-resisting system. The sketches in Appendix B illustrate the concepts introduced here.

This report outlines a single alternative out of many potential options and is based on the Tier 1 Rapid Screening, which is a preliminary evaluation and analysis. Before any retrofit scheme is selected, the final design should be based on more detailed evaluation and analysis. Such an analysis should consider the current and future performance goals of the facility.

4.1.1 Shear Walls

The perimeter unreinforced masonry walls should be stiffened and strengthened by applying shotcrete (spray-applied concrete), full height, to the interior face of the walls. While adding concrete to the interior face of these walls increases the seismic mass of the building, the shotcrete portion will be designed to resist its own contribution to the base shear.

Adding drag strut beams near the main entrance of the building to connect the shear wall lines and distribute diaphragm loading more evenly along the building length is recommended. Similarly, a drag truss should be installed in the gymnasium to transfer loads from the roof diaphragm to the exterior shear walls at the first floor.

The interior transverse walls (those that divide the classrooms spaces) should be sheathed with APA-rated shear panels. In order to tie these walls into the lateral-force-resisting system, the sheathing needs to be positively connected to the roof diaphragms as well as to the foundations.

At the wall-to-roof joint, exterior and interior structural shear wall connections should be upgraded. These upgrades are intended to tie the roof diaphragm to the shear walls for better transfer of vertical and lateral loads through the system.

4.1.2 Roof Diaphragms

The construction and condition of the roof diaphragms was not visible at the time of the site visit. Based on the construction era, it is likely wood-framed with rafters supporting lath to which the roofing is directly applied. The roofing needs to be removed and sheathed with APA-rated shear panels.

To bring the diaphragm aspect ratios within acceptable limits, the roof diaphragm will be subdivided by engaging the transverse interior walls as shear walls. In order to complete the load path, as mentioned previously, the roof diaphragm will need to be connected to these shear walls.

This retrofit of the roof diaphragms will require removing the existing roof and reroofing after the structural modifications have been completed.

4.1.3 Foundation Systems

At the proposed concrete shotcrete wall locations, thickened slabs are recommended to be constructed next to existing spread footings on the interior face. The thickened slabs are intended to transfer the vertical and lateral loads being carried by the proposed shotcrete to the ground. At a select number of interior shear locations, footing upgrades are recommended in order to address the potential overturning deficiencies within the structure. Spread footings are suggested to be constructed beneath structural shear walls to increase the area of footing soil interaction.

4.2 Nonstructural Upgrade Recommendations

Table 3.2.3-1 identifies several nonstructural deficiencies that do not meet the performance objective selected for Edison Elementary School. 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, was 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.

4.2.1 Life Safety Systems

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

The recommended seismic mitigation for the life-safety systems are as follows:

- Provide bracing and flexible couplings of risers, feed mains, cross-mains, and branch lines in accordance with NFPA 13.
- Provide 1-inch sprinkler head clearance holes in ceiling finishes.
- Provide seismic bracing or anchor the emergency power system to the structure.

4.2.2 Hazardous Materials

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

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

4.2.3 Architectural Considerations

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

For 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. Elements of the exterior building envelope being affected by the seismic work would also be required to be brought up to the current Washington State Energy Code per Chapter 5, where applicable.

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

Exterior Shear Walls

Existing gypsum board or plaster finishes on the interior face of the exterior brick masonry walls will need to be removed, including any stud furring, after shotcrete is installed. New wall furring, gypsum board, and insulation would be installed to a point above the ceiling line to complete the insulation envelope. Window trim would be removed and new deeper casing trim installed inside around the windows. Exterior doors and frames could remain in place if the thicker walls are held back from the frame in order to run new gypsum board returns to the existing interior wall face.

Existing suspended T-bar ceilings in the perimeter rooms would need to be removed and reinstalled with new T-bar in order to gain access to the exterior wall for installation of shotcrete above to the roof diaphragm. Salvaged ceiling tiles could be reinstalled. Items such as electrical outlets along the exterior walls would need to be relocated and rerouted in the new furring.

Drag truss and strut installation will require removal and installation of existing ceiling tiles and lights in at least one structural bay between existing beams in the gymnasium. Drag strut installation located on either side of the entry and corridors will require a portion of the existing T-bar ceilings and lights to be removed and reinstalled.

Interior Shear Walls

Proposed interior shear wall installation will involve every room in the school. The existing lath and plaster or gypsum board on one side of the new shear walls will need to be removed and new gypsum board installed over the shear panels. Suspended ceilings in the rooms will be removed sufficiently to allow installation of the shear panels and connections to the roof diaphragm above the ceilings. New T-bar ceiling grids would be installed along with salvaged ceiling panels.

Roof Diaphragm

New three-tab composite roofing and metal flashing would be installed over the new roof diaphragm. Attic ventilation appears to be inadequate, except maybe at the roof turrets. Additional investigation should be done to determine if additional ventilation is required. This could be resolved with the installation of ridge venting or roof-mounted ventilators.

Slab Foundations

In order to install a thickened slab around the building perimeter shotcrete walls, flooring would need to be replaced throughout the facility. This would consist of new carpeting in the classrooms and corridors. Gym flooring appears to be a vinyl sports flooring that could be patched and seamed with new at the perimeter walls.

Contents and Furnishings

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

- Anchor storage cabinets or shelving units that are more than 6 feet high and have a height-to-depth or height-to-width ratio greater than 3-to-1 to the structure or to each other to prevent toppling during an earthquake.

- Provide bracing or restraint for equipment, stored items, or other contents weighing more than 20 pounds and with a center of mass that is more than 4 feet above the adjacent floor level.

4.3 Opinion of Conceptual Construction Costs

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

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

The estimated structural and nonstructural construction cost to mitigate the deficiencies identified in the Tier 1 checklists of the Edison Elementary School main building ranges between approximately $2.7M and $5.1M (-20 percent/+50 percent). The estimated construction cost to seismically upgrade this building is approximately $3.4M. On a per-square-foot basis, the seismic upgrade construction cost is estimated to be approximately $107 per square foot in 2019 dollars, with a variance range between $86 per square foot and $160 per square foot.

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

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

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

Table 4.3.1. Seismic Upgrades Opinion of Probable Construction Costs.

Building	FEMA Bldg Type	ASCE 41 Level of Seismicity / Site Class	Structural Performance Objective	Bldg Gross Area	Estimated Seismic Upgrade Cost Range $/SF (Total)			Estimated Seismic Upgrade Cost/SF (Total)
Edison Elementary, Main Building	URM	High / C	**Structural**					
			Life Safety	31,520 SF	$59 ($1.86M)	-	$110 ($3.48M)	$74 ($2.32M)
			Nonstructural					
			Life Safety	31,520 SF	$27 ($837K)	-	$50 ($1.57M)	$33 ($1.05M)
			Total					
				31,520 SF	$86 ($2.70M)	-	$160 ($5.05M)	$107 ($3.37M)

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

Appendix A: Field Investigation Report and Tier 1 Checklists

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1. Centralia, Edison Elementary School, Main Building

1.1 Building Description

Building Name:	Main Building
Facility Name:	Edison Elementary School
District Name:	Centralia
ICOS Latitude:	46.722
ICOS Longitude:	-122.959
ICOS County/District ID:	21401
ICOS Building ID:	13954
ASCE 41 Bldg Type:	URM
Enrollment:	345
Gross Sq. Ft. :	31,521
Year Built:	1918
Number of Stories:	1
$S_{XS\ BSE-2E}$:	0.903
$S_{X1\ BSE-2E}$:	0.526
ASCE 41 Level of Seismicity:	High
Site Class:	C
V_{S30}(m/s):	424
Liquefaction Potential:	Moderate to High
Tsunami Risk:	None
Structural Drawings Available:	No
Evaluating Firm:	BergerABAM/WSP

Edison Elementary is a single-story unreinforced masonry school building, measuring approximately 340 feet by 125 feet at it's greatest plan extents. The building is approximately 15 feet tall at the eaves, except the middle portion of the building is a high-story with an approximately 25 foot high eave. There is a partial basement under the center, high bay structure. The school was constructed in 1918, with additional classrooms added in 1921-1922. Two more classrooms, a music room added to the gym, a kitchen, and new restrooms were added in 1957. The structure underwent a modernization remodel in 1987-1988. After the Nisqually earthquake in 2001, some emergency repairs were made to remedy extensive damage to the foyer, but it does not appear that the structure was evaluated for seismic resistance at that time.

1.1.1 Building Use

The building contains a number of classrooms for elementary school students. There is a school kitchen adjacent to a large high bay multi-purpose room, which clearly serves as a gymnasium, auditorium and cafeteria.

1.1.2 Structural System

Table 1.1-1. Structural System Description of Edison Elementary School

Structural System	Description
Structural Roof	The roofs are hip and gable style, appear to be wood framed with composite shingles and slope at 3:12 or 4:12.
Structural Floor(s)	The foyer floor, over the basement area, is a concrete slab and beam system. No drawings were found at the time of the site visit, but it the appearance of the construction is indicative of the early twentieth century and was likely built in 1918. The construction type of the mezzanine level floor is unknown, but is likely timber wood framed based on the time period.
Foundations	The foundations are a traditional shallow system comprised of strip and isolated pad footings. The basement walls are primarily concrete, with one of the walls made of unreinforced masonry.
Gravity System	The basement retaining walls are cast in place concrete. The walls above grade are all unreinforced masonry walls.
Lateral System	Although the roof system was not confirmed as a flexible wood diaphragm, based on the typical practices of the era, it is likely such. It is most likely a straight or diagonally rafter system that carries lateral loads to the unreinforced masonry shear walls.

1.1.3 Structural System Visual Condition

Table 1.1-2. Structural System Condition Description of Edison Elementary School

Structural System	Description
Structural Roof	No visible signs of damage or deterioration.
Structural Floor(s)	The underside of the structural floor does show some signs of deterioration.
Foundations	The concrete basement walls do have some cracking and other signs of moderate deterioration. Minor cracking in the foundations at the classroom wings.
Gravity System	No visible signs of damage or deterioration of the unreinforced masonry walls.
Lateral System	No visible signs of damage or deterioration of the unreinforced masonry walls.

1.2 Seismic Evaluation Findings

1.2.1 Structural Seismic Deficiencies

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

Table 1-3. Identified Structural Seismic Deficiencies for Centralia Edison Elementary School Main Building

Deficiency	Description
Vertical Irregularities	There appear to be some shear walls that are discontinuous over the front of the foyer.
Overturning	Although structural drawings were not found approximate field measurements of some of the URM wall piers indicate that this structure does not comply with this condition.
Shear Stress Check	A field survey of the building geometry is necessary however preliminary estimates based on approximate dimensions indicate the structure is likely not compliant.
Proportions	It would appear that this condition is not met at the gymnasium area. This condition may potentially be satisfied when considering the stiffening effect from the low roof however at this point such a rationalization cannot be made as the roof to wall connections could not be visually verified.

1.2.2 Structural Checklist Items Marked as 'U'nknown

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

Table 1-4. Identified Structural Checklist Items Marked as Unknown for Centralia Edison Elementary School Main Building

Unknown Item	Description
Load Path	Critical load path components could not be visually verified during site visit.
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. \moderate to high\ 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.
Ties Between Foundation Elements	Items could not be visually verified during site visit.
Wall Anchorage	Items could not be visually verified during site visit.
Wood Ledgers	Items could not be visually verified during site visit.
Transfer to Shear Walls	Items could not be visually verified during site visit.
Girder-Column Connection	Items could not be visually verified during site visit.
Masonry Layup	Items could not be visually verified during site visit.
Cross Ties	Items could not be visually verified during site visit.
Straight Sheathing	Items could not be visually verified during site visit.
Spans	Items could not be visually verified during site visit.
Diagonally Sheathed and Unblocked Diaphragms	Items could not be visually verified during site visit.
Other Diaphragms	Items could not be visually verified during site visit.
Stiffness of Wall Anchors	Items could not be visually verified during site visit.
Beam	Girder, and Truss Supports,Items could not be visually verified during site visit.

1.3.1 Nonstructural Seismic Deficiencies

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

Table 1-5. Identified Nonstructural Seismic Deficiencies for Centralia Edison Elementary School Main Building

Deficiency	Description
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	A number of tall and narrow components in the basement and classroom wings did not appear to comply with this requirement. Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	A number of fall-prone components in the basement and classroom wings did not appear to comply with this requirement. Heavy items on upper shelves should be restrained by netting or cabling to avoid falling hazards.

1.3.2 Nonstructural Checklist Items Marked as 'U'nknown

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

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

Table 1-6. Identified Nonstructural Checklist Items Marked as Unknown for Centralia Edison Elementary School Main Building

Unknown Item	Description
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	Presence of a fire suppression system could not be visually verified during time of the site visit. Further investigation may be appropriate to mitigate seismic risk.
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	Items could not be visually verified during site visit. Flexible coupling for fire suppression piping may be appropriate to mitigate seismic risk.
LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Available record drawings do not have information on anchorage or bracing for emergency power equipment and could not verify during site investigation. Based on age of the building, emergency power equipment is either nonexistent or noncompliant. Evaluation of emergency power equipment may be appropriate to mitigate seismic risk.
LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	No available record drawing information on sprinkler head clearance and unable to verify during site investigation. Further evaluation may be appropriate to mitigate seismic risk.
HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Unknown whether the building has hazardous materials. Further investigation may be appropriate to mitigate seismic risk.
P-1 Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH.	It is unclear if some of the interior partition walls are URM, and if they are how they are braced.
P-3 Drift. HR-not required; LS-MH; PR-MH.	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
P-4 Light Partitions Supported by Ceilings. HR-not required; LS-not required; PR-MH.	Items could not be visually verified during site visit.
C-1 Suspended Lath and Plaster. HR-H; LS-MH; PR-LMH.	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
C-2 Suspended Gypsum Board. HR-not required; LS-MH; PR-LMH.	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
CG-1 Cladding Anchors. HR-MH; LS-MH; PR-MH.	Items could not be visually verified during site visit. Further investigation may be warranted to mitigate seismic risk.
CG-8 Overhead Glazing. HR-not required; LS-MH; PR-MH.	Items could not be visually verified during site visit. Further investigation may be warranted to mitigate seismic risk.
PCOA-2 Canopies. HR-not required; LS-LMH; PR-LMH.	Details of the canopy connection to the foyer front wall could not be visual verified during site visit. Further investigation may be appropriate to mitigate seismic risk.

Unknown Item	Description
MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
S-1 Stair Enclosures. HR-not required; LS-LMH; PR-LMH.	Stairs to the basement appear to be surrounded by concrete walls, however the construction type of the walls around the stairs to the foyer mezzanine could not be visual verified during the site visit. Further investigation may be appropriate to mitigate seismic risk.
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	Bracing required for equipment weighing more than 20 lb located 4 feet or more above the floor to mitigate seismic risk.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Items could not visually verified during site visit. Bracing for heavy in-line equipment may be appropriate to mitigate seismic risk.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	Items could not visually verified during site visit. Brace tall narrow equipment to backwall or provide overturning anchors to mitigate seismic risk.

Photos:

Figure 1-1. South entrance

Figure 1-2. Main entrance

Figure 1-3. Southwest elevation of the gym/auditorium

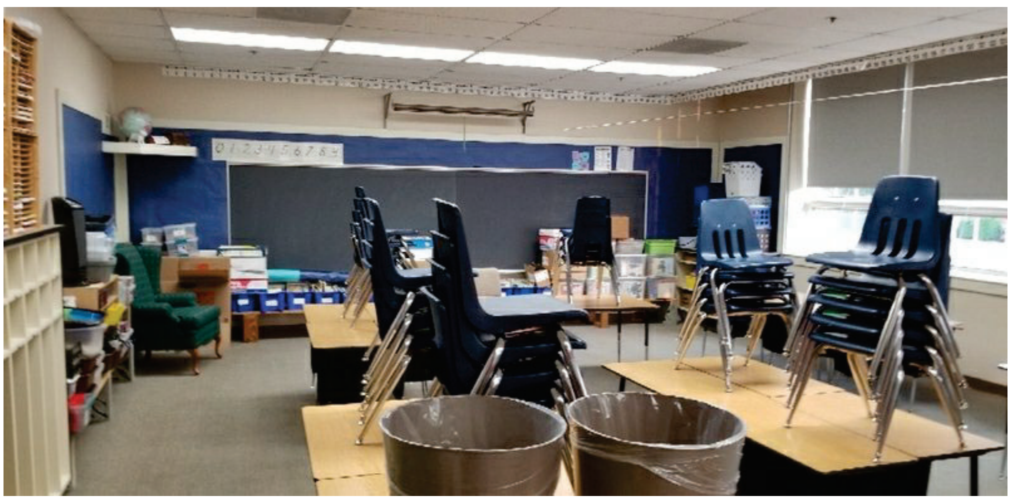

Figure 1-4. Typical classroom layout

Figure 1-5. View of the lobby mezzanine at the main entrance

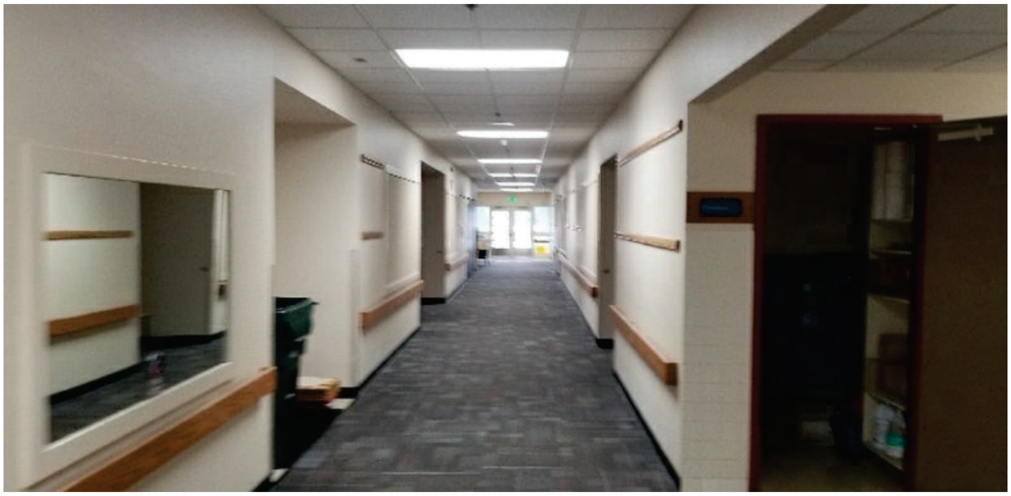

Figure 1-6. Typical hallway

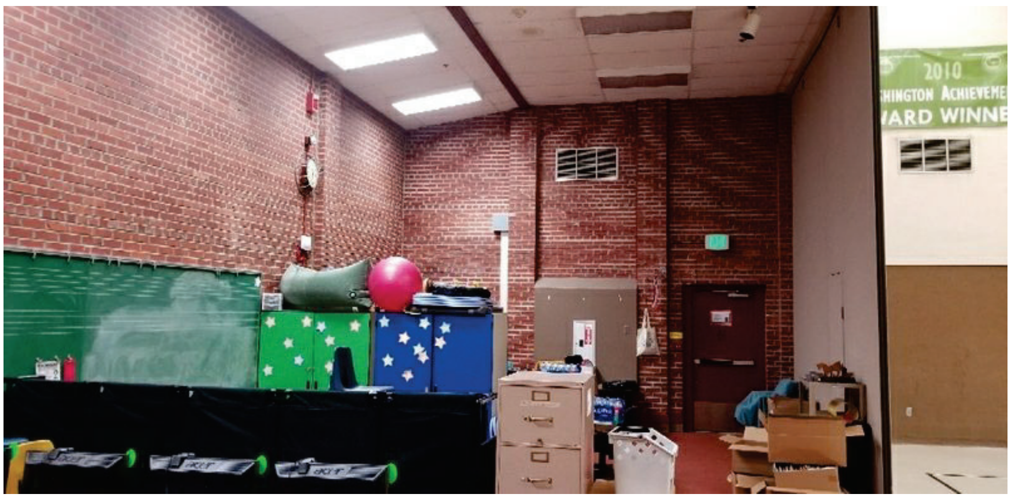

Figure 1-7. 1957 music room addition to the backside of the the gym/auditorium

Figure 1-8. Kitchen

Figure 1-9. Interior view of the gym/auditorium facing the 1957 music room addition (beyond)

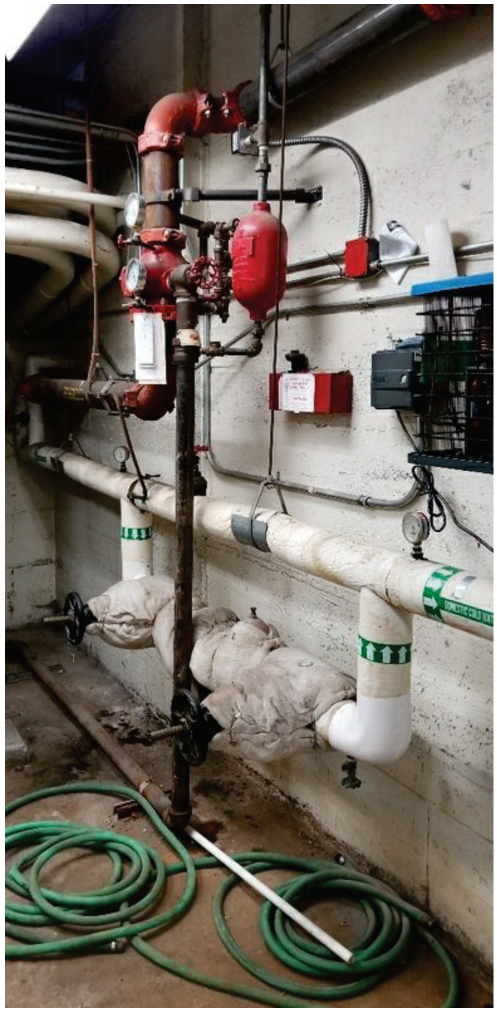

Figure 1-10. Piping in the basement mechanical space

Centralia, Edison Elementary School, Main Building

17-2 Collapse Prevention Basic Configuration Checklist

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

Low Seismicity

Building System - General

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Load Path	The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Tier 2: Sec. 5.4.1.1; Commentary: Sec. A.2.1.10)				X	Critical load path components could not be visually verified during site visit.
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				
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				

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		This building is a single-story structure.
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		This building is a single-story structure.
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			There appear to be some shear walls that are discontinuous over the front of the foyer.

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		This building is a single-story structure.
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		This building is a single-story structure.
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				As the roof is believed to be a light-framed wood roof and would be idealized as a flexible diaphragm, this condition is likely met.

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

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

Foundation Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Overturning	The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (Tier 2: Sec. 5.4.3.3; Commentary: Sec. A.6.2.1)		X			Although structural drawings were not found approximate field measurements of some of the URM wall piers indicate that this structure does not comply with this condition.
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	Items could not be visually verified during site visit.

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			A field survey of the building geometry is necessary however preliminary estimates based on approximate dimensions indicate the structure is likely not compliant.

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	Items could not be visually verified during site visit.
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	Items could not be visually verified during site visit.
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	Items could not be visually verified during site visit.
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	Items could not be visually verified during site visit.

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			It would appear that this condition is not met at the gymnasium area. This condition may potentially be satisfied when considering the stiffening effect from the low roof however at this point such a rationalization cannot be made as the roof to wall connections could not be visually verified.
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	Items could not be visually verified during site visit.

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	Items could not be visually verified during site visit.
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	Items could not be visually verified during site visit.
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	Items could not be visually verified during site visit.
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	Items could not be visually verified during site visit.

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	Items could not be visually verified during site visit.

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	Items could not be visually verified during site visit.
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	Items could not be visually verified during site visit.

Centralia, Edison Elementary School, Main Building

17-38 Nonstructural Checklist

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

Life Safety Systems

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping is anchored and braced in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.1)				X	Presence of a fire suppression system could not be visually verified during time of the site visit. Further investigation may be appropriate to mitigate seismic risk.
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping has flexible couplings in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.2)				X	Items could not be visually verified during site visit. Flexible coupling for fire suppression piping may be appropriate to mitigate seismic risk.
LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Equipment used to power or control Life Safety systems is anchored or braced. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.1)				X	Available record drawings do not have information on anchorage or bracing for emergency power equipment and could not verify during site investigation. Based on age of the building, emergency power equipment is either nonexistent or noncompliant. Evaluation of emergency power equipment may be appropriate to mitigate seismic risk.
LSS-4 Stair and Smoke Ducts. HR-not required; LS-LMH; PR-LMH.	Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.1)			X		Item not visually verified during site visit, but assumed to be noncompliant due to year of original construction. Further investigation may be appropriate to mitigate seismic risk.

LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.3)				X	No available record drawing information on sprinkler head clearance and unable to verify during site investigation. Further evaluation may be appropriate to mitigate seismic risk.
LSS-6 Emergency Lighting. HR-not required; LS-not required; PR-LMH	Emergency and egress lighting equipment is anchored or braced. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.1)			X		Not required for Life Safety Performance Level

Hazardous Materials

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
HM-1 Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH.	Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.2)			X		No equipment containing hazardous materials found during site visit.
HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 13.8.3; Commentary: Sec. A.7.15.1)				X	Unknown whether the building has hazardous materials. Further investigation may be appropriate to mitigate seismic risk.
HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Facility does not appear to have hazardous materials on the premises.
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		Facility does not appear to have hazardous materials on the premises.
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		Facility does not appear to have hazardous materials on the premises.
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		Facility does not appear to have hazardous materials on the premises.

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	It is unclear if some of the interior partition walls are URM, and if they are how they are braced.
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		
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	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
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	Items could not be visually verified during site visit.
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		
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	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
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	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.

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		
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		
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		
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		

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	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.

LF-2 Pendant Supports. HR-not required; LS-not required; PR-H.	Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft. Unbraced suspended fixtures are free to allow a 360-degree range of motion at an angle not less than 45 degrees from horizontal without contacting adjacent components. Alternatively, if rigidly supported and/or braced, they are free to move with the structure to which they are attached without damaging adjoining components. Additionally, the connection to the structure is capable of accommodating the movement without failure. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.3)			X		
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	Items could not be visually verified during site visit. Further investigation may be warranted to mitigate seismic risk.
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		
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		

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		
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		
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		
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		
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	Items could not be visually verified during site visit. Further investigation may be warranted to mitigate seismic risk.

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 masonry appears to serve a structural and architectural purpose.
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		

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		
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		
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		
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		
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		
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	Details of the canopy connection to the foyer front wall could not be visual verified during site visit. Further investigation may be appropriate to mitigate seismic risk.
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		

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		The two small "turret" like structures over the classroom wings appear to be wood framed construction.

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				Actual measurements of the URM (upper) chimney could not be made during the site visit, but it appears that the chimney height above the top of roof is approximately 2 times the dimension of the least width. The lower chimney appears to be wood frame construction.
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	Items could not be visually verified during site visit. Further investigation may be appropriate to mitigate seismic risk.

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	Stairs to the basement appear to be surrounded by concrete walls, however the construction type of the walls around the stairs to the foyer mezzanine could not be visual verified during the site visit. Further investigation may be appropriate to mitigate seismic risk.

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		

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		
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			A number of tall and narrow components in the basement and classroom wings did not appear to comply with this requirement. Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Equipment, stored items, or other contents weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level are braced or otherwise restrained. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.3)		X			A number of fall-prone components in the basement and classroom wings did not appear to comply with this requirement. Heavy items on upper shelves should be restrained by netting or cabling to avoid falling hazards.
CF-4 Access Floors. HR-not required; LS-not required; PR-MH.	Access floors more than 9 in. (229 mm) high are braced. (Tier 2: Sec. 13.6.10; Commentary: Sec. A.7.11.4)			X		
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		

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		

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	Bracing required for equipment weighing more than 20 lb located 4 feet or more above the floor to mitigate seismic risk.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Equipment installed in line with a duct or piping system, with an operating weight more than 75 lb (34.0 kg), is supported and laterally braced independent of the duct or piping system. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.5)				X	Items could not visually verified during site visit. Bracing for heavy in-line equipment may be appropriate to mitigate seismic risk.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	Equipment more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.6)				X	Items could not visually verified during site visit. Brace tall narrow equipment to backwall or provide overturning anchors to mitigate seismic risk.
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		
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		
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		
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		
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		

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		

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		
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		
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		

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		

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		

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		
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		
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		
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		
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		
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		

Appendix B: Concept-Level Seismic Upgrade Figures

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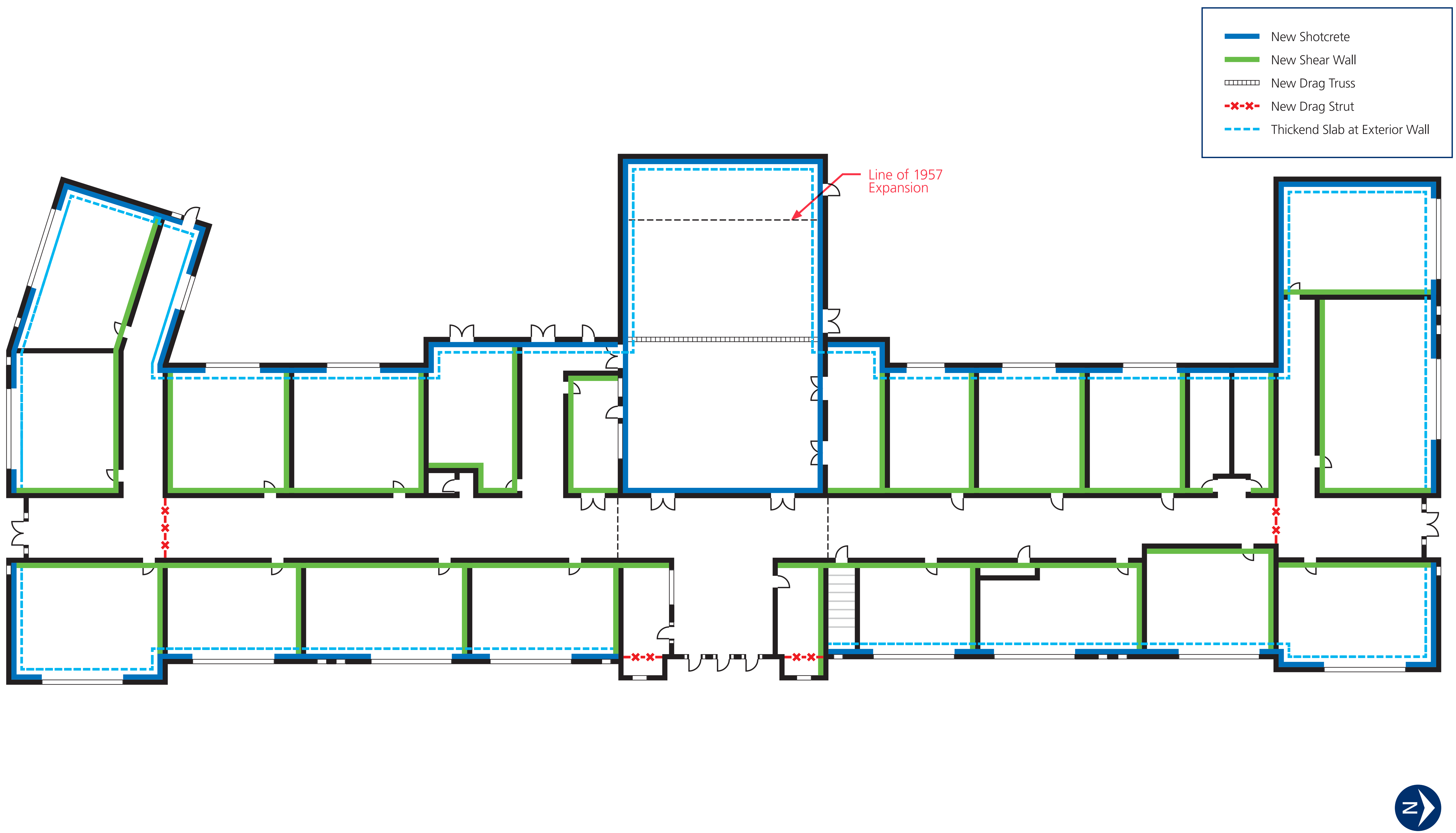
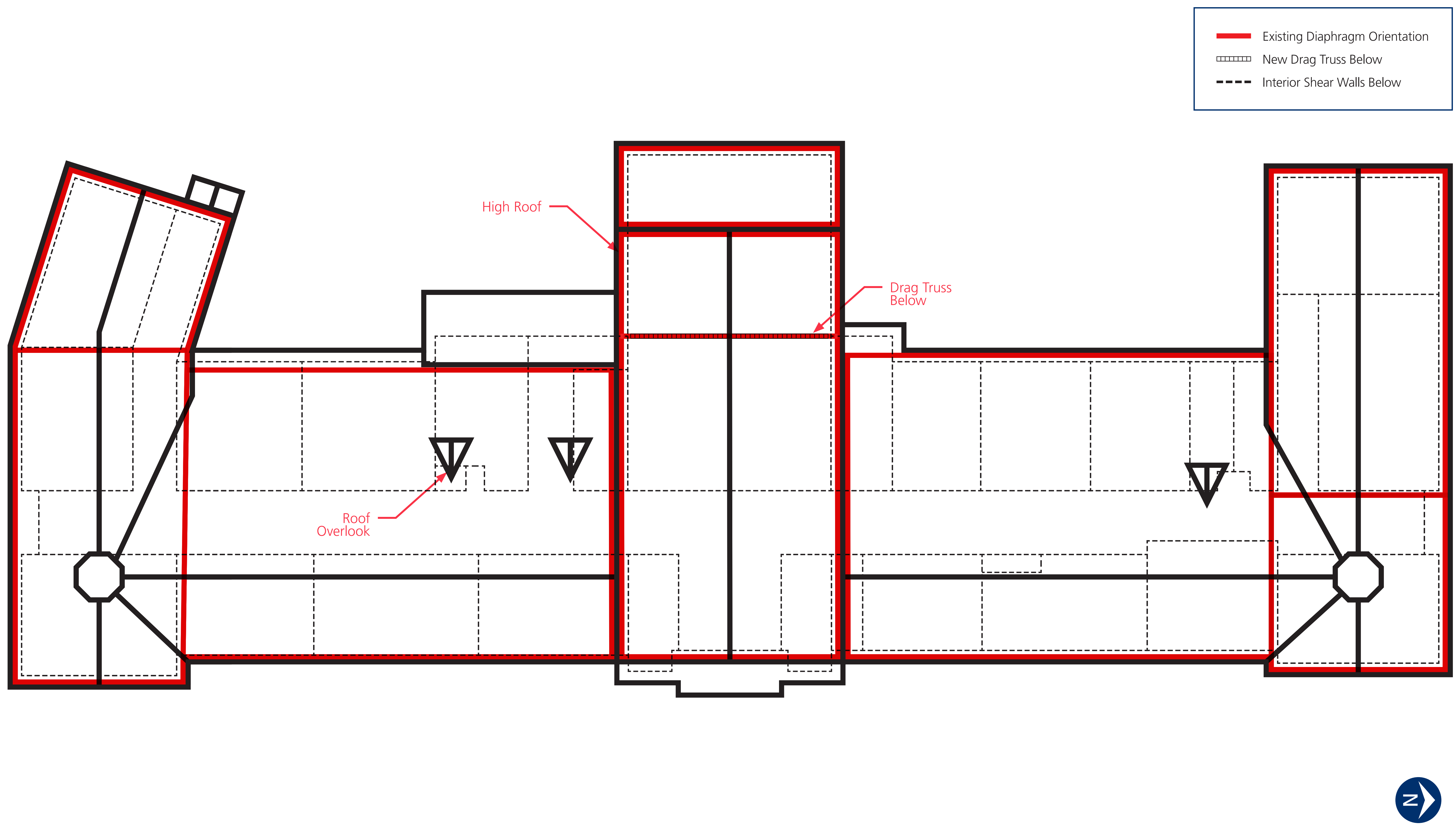


Edison Elementary School Seismic Upgrades – Gym Building

Washington State School Seismic Safety Assessments Project – Centralia District – June 2019

Figure 1 - Main Floor Strengthening Plan



ReidMiddleton BergerABAM

Edison Elementary School Seismic Upgrades – Gym Building
Washington State School Seismic Safety Assessments Project – Centralia District – June 2019

Figure 2 - Roof Strengthening Plan

Appendix C: Opinion of Probable Construction Costs

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520 Kirkland Way, Suite 301
Kirkland, WA 98033
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Name:	**Wa State School Seismic Safety Assessment**
Second Name:	**Edison Elemetary School**
Location:	**State of Washington**
Design Phase:	**ROM Cost Estimates**
Date of Estimate:	**April 12, 2019**
Date of Revision:	
Month of Cost Basis:	**1Q, 2019**

Edison Elemetary School

Master Estimate Summary

Project Name		Total Estimated Construction Cost
Edison Elemetary School	**Structural Costs**	**$2,320,991**
Edison Elemetary School	**Non-Structural Costs**	**$1,046,458**
TOTAL ESTIMATED CONSTRUCTION COST		**$3,367,449**

Estimate Assumptions:

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

Estimate Qualifications:

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

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Structural Costs

Name: Wa State School Seismic Safety Assessment
Second Name: Edison Elemetary School
Location: Centralia, WA
Design Phase: ROM Cost Estimates
Date of Estimate: April 12, 2019
Date of Revision:
Month of Cost Basis: 4Q, 2018, 1Q, 2019

Areas	sqft
1st Floor	31,521
Total Areas	31,521

Edison Elemetary School

Construction Cost Estimate

Subtotal Direct Cost From the Estimate Detail Below $ 1,771,749

	Percentage of Previous Subtotal	Amount	Running Subtotal
Scope Contingency	10.0%	$ 177,175	$ 1,948,924
General Conditions	10.0%	$ 177,175	$ 2,126,099
Home Office Overhead	5.0%	$ 88,587	$ 2,214,686
Profit	6.0%	$ 106,305	$ 2,320,991
Escalation Not Included-Costs in 4Q, 2018 Dollars	0.0%	$ -	$ 2,320,991
Washington State Sales Tax	0.0%	$ -	$ 2,320,991

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

		$/sqft
TOTAL ESTIMATED CONSTRUCTION COST--	**$ 2,320,991**	**$ 73.63**
-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --	**$ 1,856,793**	**$ 58.91**
+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --	**$ 3,481,487**	**$ 110.45**

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

Direct Cost of Construction

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

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	1 - Seismic Retrofit										
	Foundations										
	Tie Building Interior Shear Wall System to Concrete Foundation with Anchor Bolt System	1,122	lnft	$ 30.72	$ 34,467.84	$ 17.28	$ 19,388.16	$ 2.88	$ 3,231.36	$ 50.88	$ 57,087.36
	Thickened Slab/Footings For Shear Walls System	1,054	lnft	$ 52.25	$ 55,071.50	$ 42.75	$ 45,058.50	$ 5.70	$ 6,007.80	$ 100.70	$ 106,137.80
	Substructure										
	Remove and Reinstall Slab on Grade System with Reinforcing, New Flooring System at Thickened Slab Installation	4,216	sqft	$ 13.20	$ 55,651.20	$ 10.80	$ 45,532.80	$ 1.44	$ 6,071.04	$ 25.44	$ 107,255.04
	1 - Seismic Retrofit										
	Superstructure										
	Roof Systems										
	Drag Struts	48	lnft	$ 81.60	$ 3,916.80	$ 38.40	$ 1,843.20	$ 7.20	$ 345.60	$ 127.20	$ 6,105.60
	Drag Strut Truss Assembly	50	lnft	$ 153.68	$ 7,684.00	$ 72.32	$ 3,616.00	$ 13.56	$ 678.00	$ 239.56	$ 11,978.00
	Shotcrete Wall Systems - Shotcrete, Formwork, Reinforcing, Screeding at Perimeter of Building	263	cuyd	$ 666.40	$ 175,263.20	$ 313.60	$ 82,476.80	$ 58.80	$ 15,464.40	$ 1,038.80	$ 273,204.40
	Connect Roof Diaphram to Exterior Wall	800	lnft	$ 42.50	$ 34,000.00	$ 20.00	$ 16,000.00	$ 3.75	$ 3,000.00	$ 66.25	$ 53,000.00
	Connect Roof Diaphram to Interior Wall	1,122	lnft	$ 105.00	$ 117,810.00	$ (42.50)	$ (47,685.00)	$ 3.75	$ 4,207.50	$ 66.25	$ 74,332.50
	Add Plywood Sheating/Blocking at Roof Structure	31,521	sqft	$ 2.31	$ 72,734.71	$ 1.24	$ 39,164.84	$ 0.21	$ 6,713.97	$ 3.76	$ 118,613.52
	Exterior Closure										
	Exterior Wall System										
	Remove and Reinstall Inside Finish System of Exterior Wall	10,632	sqft	$ 6.38	$ 67,832.16	$ 4.62	$ 49,119.84	$ 0.66	$ 7,017.12	$ 11.66	$ 123,969.12
	Exterior Window and Door System										
	New Detailing at Windows at New Shotcrete Wall System of Exterior Wall	10,632	sqft	$ 4.64	$ 49,332.48	$ 3.36	$ 35,723.52	$ 0.48	$ 5,103.36	$ 8.48	$ 90,159.36
	Roofing System										
	Remove Existing Roofing System	31,521	sqft	$ 2.02	$ 63,546.34	$ 0.08	$ 2,647.76	$ 0.13	$ 3,971.65	$ 2.23	$ 70,165.75
	Install New Roofing System - Including Roof Membrane, New Insulation, Coverboard and Flashing and Trim for a Complete System	31,521	sqft	$ 10.02	$ 315,745.86	$ 8.53	$ 268,968.69	$ 1.11	$ 35,082.87	$ 19.66	$ 619,797.42

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	Interiors										
	Interior Wall/Door/Casework/Specialties Systems										
	Add Plywood Sheathing/Blocking System at Interior Walls to Roof	5,800	sqft	$ 1.89	$ 10,933.00	$ 1.37	$ 7,917.00	$ 0.20	$ 1,131.00	$ 3.45	$ 19,981.00
	Remove and Reinstall New Interior Wall Finish System	5,800	sqft	$ 3.77	$ 21,866.00	$ 2.73	$ 15,834.00	$ 0.39	$ 2,262.00	$ 6.89	$ 39,962.00
	Subtotal of the Direct Cost of Construction			**Edison Elemetary School**							**$ 1,771,749**

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520 Kirkland Way, Suite 301
Kirkland, WA 98033
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Non-Structural Costs

Name:	Wa State School Seismic Safety Assessment	Areas	sqft
Second Name:	Edison Elemetary School	Building Area	31,521
Location:	Centralia, WA		
Design Phase:	ROM Cost Estimates		
Date of Estimate:	April 12, 2019		
Date of Revision:			
Month of Cost Basis:	4Q, 2018, 1Q, 2019	Total Areas	31,521

Edison Elemetary School

Construction Cost Estimate

Subtotal Direct Cost From the Estimate Detail Below $ 798,823

	Percentage of Previous Subtotal	Amount	Running Subtotal
Scope Contingency	10.0%	$ 79,882	$ 878,705
General Conditions	10.0%	$ 79,882	$ 958,587
Home Office Overhead	5.0%	$ 39,941	$ 998,528
Profit	6.0%	$ 47,929	$ 1,046,458
Escalation Not Included-Costs in 4Q, 2018 Dollars	0.0%	$ -	$ 1,046,458
Washington State Sales Tax	0.0%	$ -	$ 1,046,458

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

		$/sqft
TOTAL ESTIMATED CONSTRUCTION COST--→	**$ 1,046,458**	**$ 33.20**
-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 837,166**	**$ 26.56**
+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --→	**$ 1,569,687**	**$ 49.80**

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

Direct Cost of Construction

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	2- Non- Structural Demo/Restoration*										
	Interiors and M/E/P/FP systems										
	New Floor Finishes for Installation of Seismic Work - Shotcrete/Thickened Slab	31,521	sqft	$ 1.40	$ 44,129.40	$ 1.10	$ 34,673.10	$ 0.15	$ 4,728.15	$ 2.65	$ 83,530.65
	New Ceilings and Finishes for Installation of Seismic Work	31,521	sqft	$ 3.03	$ 95,351.03	$ 2.48	$ 78,014.48	$ 0.33	$ 10,401.93	$ 5.83	$ 183,767.43
	Mechanical/Electrical/Fire Protection Systems	31,521	sqft	$ 8.75	$ 275,791.10	$ 7.16	$ 225,647.26	$ 0.95	$ 30,086.30	$ 16.86	$ 531,524.66

*Allows 30 percent of existing nonstructural systems M/E/P/FP require upgrades/replacement.

Subtotal of the Direct Cost of Construction	**Edison Elemetary School**	**$ 798,823**

Appendix D: Earthquake Performance Assessment Tool (EPAT) Worksheet

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Washington Schools Earthquake Performance Assessment Tool (EPAT)
MAIN PAGE

Full District Name	Centralia		
Point of Contact	Eric Wilson		
Telephone	360-330-7646		
E-Mail	ewilson@centralia.wednet.edu		
File Name	Centralia, Edison Elementary School, Main Building EPAT	**File Date:**	7/5/2018

District	Centralia
Facility Name	Edison Elementary School
Building Part Name	Main Building

Earthquake Ground Motion (% g)		**Earthquake Hazards**	
20% in 50 year PGA	20.1%	**Site Class**	C
10% in 50 year PGA	29.1%	**Ground Shaking Hazard**	High
2% in 50 year PGA	54.0%	**Liquefaction Potential**	Moderate to High
Percentile S_s *Among all WA Campuses*	47%	**Combined Earthquake Hazard Level**	Very High

Total Building Part Area (Square Feet)	**Building Evaluated By**	**Input Data by Person(s)**
31,521	DNR, Reid Middleton	Tim Green, Reid Middleton

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

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

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

Facility Name	Edison Elementary School
Building Name	Main Building
Building Use	Educational

Data Entry Item	User Entered Values	Default Values	Used for BCA
Seismic Data			
Decimal Latitude	46.721921	46.721921	46.721921
Decimal Longitude	-122.959083	-122.959083	-122.959083
Site Class (Soil/Rock Type)	C	D-E	C
Liquefaction Potential	Moderate to High	Moderate to High	Moderate to High
Geographic Region for Seismic Zones	Puget Sound	Puget Sound	Puget Sound
Building Structural Data			
HAZUS Building Type***	URM	Unreinforced Masonry Bearing Walls	URM
Number of Stories (Excluding Basement)***	1		1
Year Built***	1918		1918
Code for Building Design (if known)	Unknown	**Use the Drop-Down menus to Select Data Entries for the Bright Green Shaded data cells.**	Unknown
Design Code Year (if known)	Unknown		Unknown
Severe Vertical Irregularity***	Yes		Yes
Moderate Vertical Irregularity***	Yes		Yes
Plan (Horizontal) Irregularity***	Yes		Yes

*** **Mandatory Data Entry**

Washington Schools Earthquake Performance Assessment Tool (EPAT)
RESULTS SUMMARY

District Name	Centralia	**Existing Building Life Safety Risk & Priority for Retrofit or Replacement**
School Name	Edison Elementary School	
Building Name	Main Building	Very High

Building Data

HAZUS Building Type	URM	Unreinforced Masonry Bearing Walls
Year Built	1918	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	Yes	Buildings with irregularities have greater earthquake damage than otherwise similar buildings that are regular.
Moderate Vertical Irregularity	Yes	
Plan Irregularity	Yes	

Seismic Data

Earthquake Ground Shaking Hazard Level	High	Frequency and severity of earthquakes at this site
Percentile S_s Among WA K-12 Campuses	47%	Earthquake ground shaking hazard is higher than 47% of WA campuses.
Site Class (Soil or Rock Type)	C	Very Dense Soil and Soft Rock
Liquefaction Potential	Moderate to High	Liquefaction increases the risk of major damage to a building
Combined Earthquake Hazard Level	Very 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	83%	82%	Very High	Red
Life Safety Retrofit Building	17%	9.5%	Very Low	Green/Yellow
Current Code Building	14%	6.3%	Very Low	Green

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

Source for the Data Entered into the Tool

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

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Appendix E: Edison Elementary School Existing Drawings

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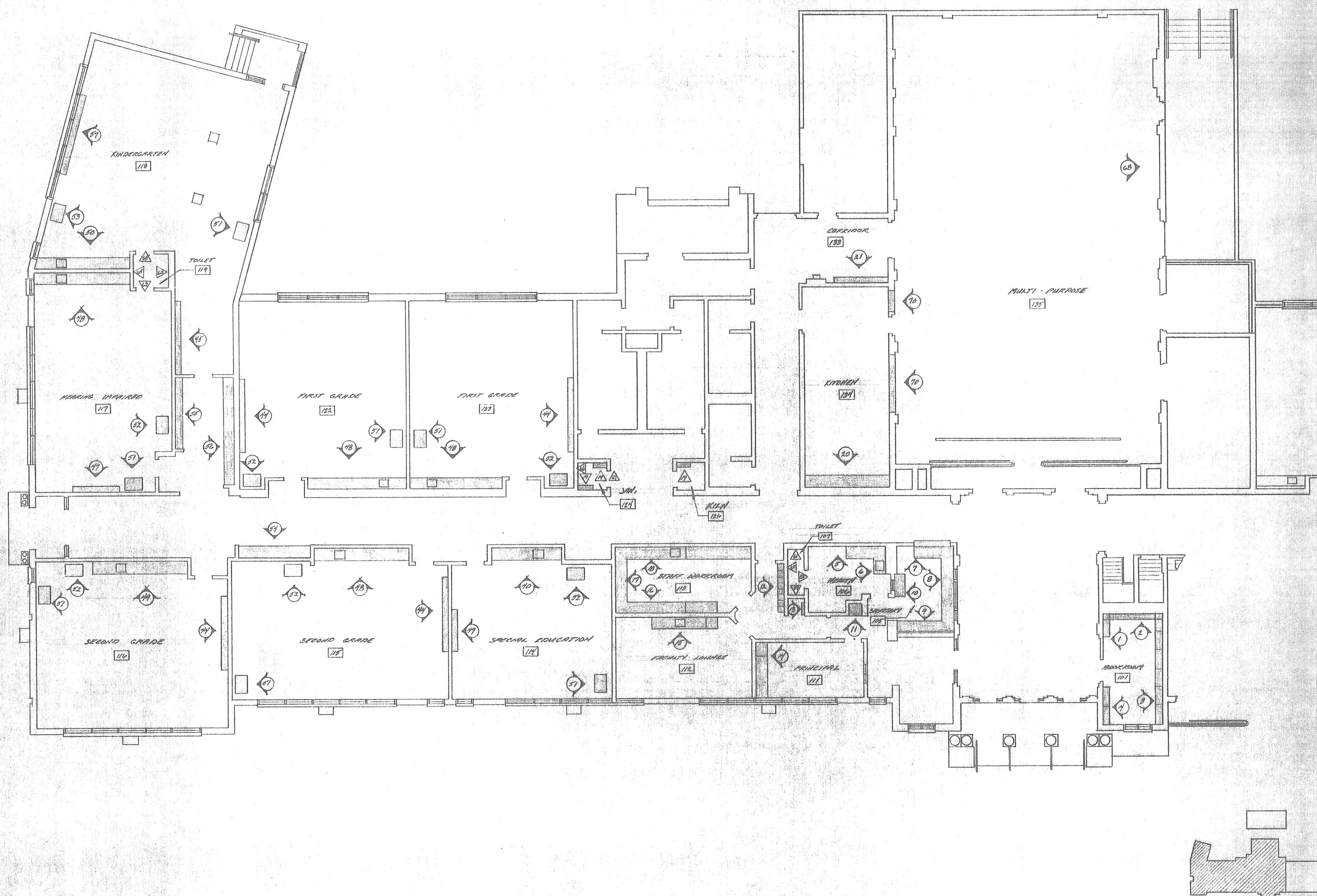
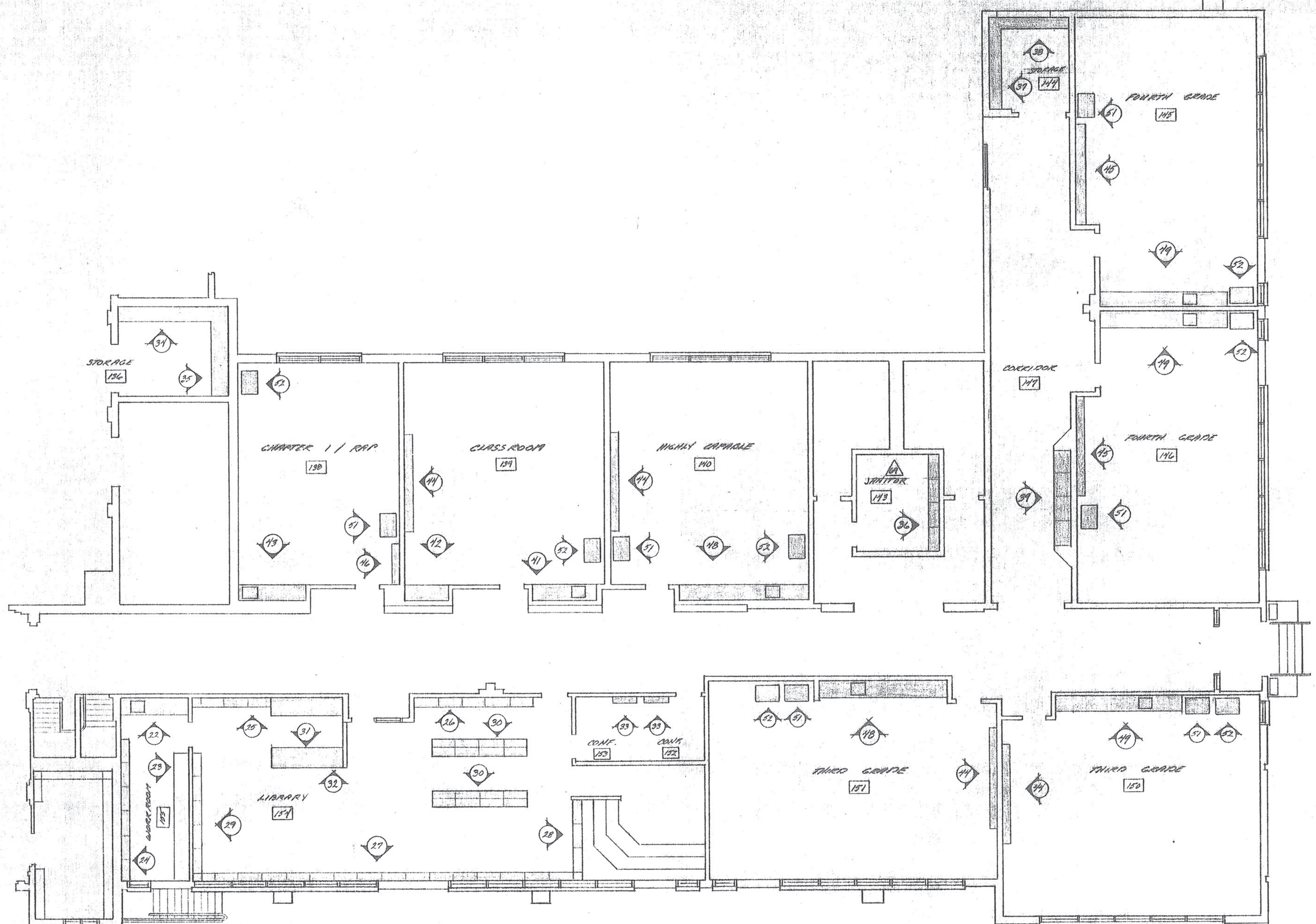


FLOOR PLAN PARTIAL

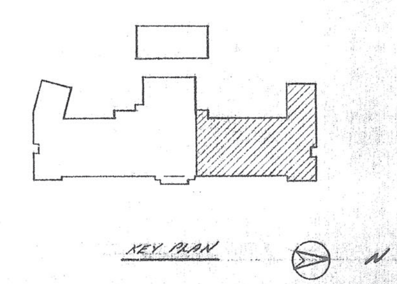
SUBMITTAL REVIEW
APPROVED [X] APPROVED AS CORRECTED [ ]
REVISE AND RESUBMIT [ ] NOT APPROVED [ ]
APPLIES ONLY FOR DESIGN CONFORMANCE & COMPLIANCE WITH CONTRACT DOCUMENTS.
NOT CHECKED FOR DIMENSIONS OR QUANTITY EXCEPT AS NOTED.
SCHWIESOW CONSTRUCTION, INC.
DATE 12-17-87 BY [signature]

EDISON ELEMENTARY SCHOOL
CENTRALIA, WA JOB # 0204

SCALE 1/8" = 1'-0	REVISIONS	BY	DATE
DATE 11-24-87			
DR'N.	CH'D.		
APP'D.			
TITLE WESTMARK PRODUCTS INC.		NO. 1 of 16	



FLOOR PLAN PARTIAL



SUBMITTAL REVIEW
APPROVED ☒ APPROVED AS CORRECTED ☐
REVISE AND RESUBMIT ☐ NOT APPROVED ☐
APPLIES ONLY FOR DESIGN CONFORMANCE & COMPLIANCE WITH CONTRACT DOCUMENTS.
NOT CHECKED FOR DIMENSIONS OR QUANTITY EXCEPT AS NOTED.
SCHWIESOW CONSTRUCTION, INC.
DATE 12-17-87 BY

EDISON ELEMENTARY SCHOOL CENTRALIA, WA JOB # 0204			
SCALE 1/8" = 1'-0"	REVISIONS	BY	DATE
DATE 11-24-87			
DR'N. JC	CKD.		
AP'VD.			
TITLE WESTMARK PRODUCTS INC. 1721 STEELE ST. SO. TACOMA, WA 98411	NO. 2 of 16		

Appendix F: FEMA E-74 Nonstructural Seismic Bracing Excerpts

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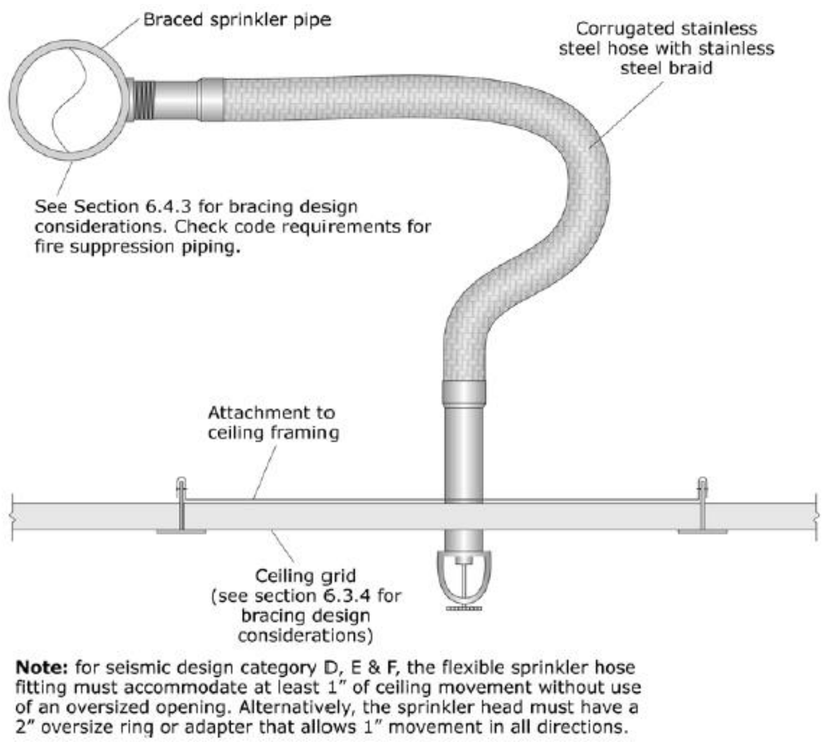


Figure G-1. Flexible Sprinkler Drop.

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

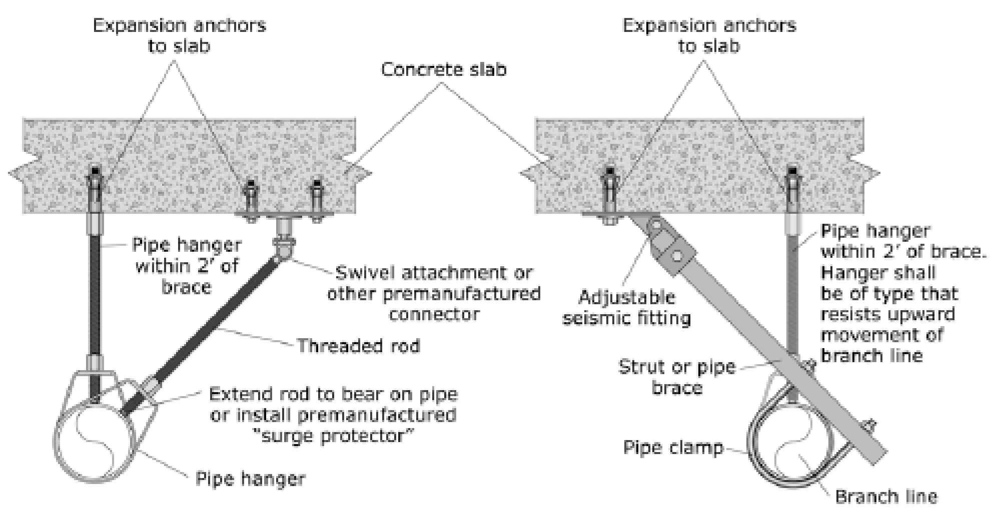


Figure G-2. End of Line Restraint.

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

Partitions

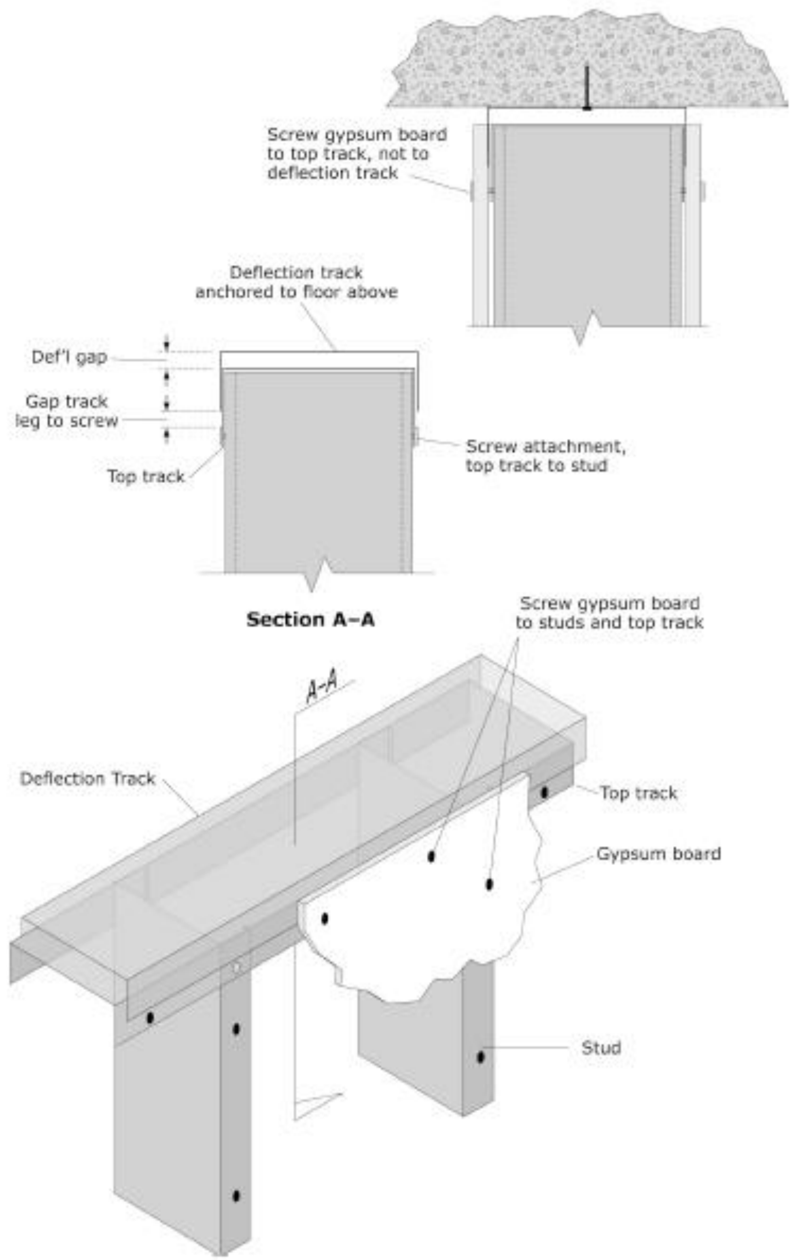


Figure G-3. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.

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

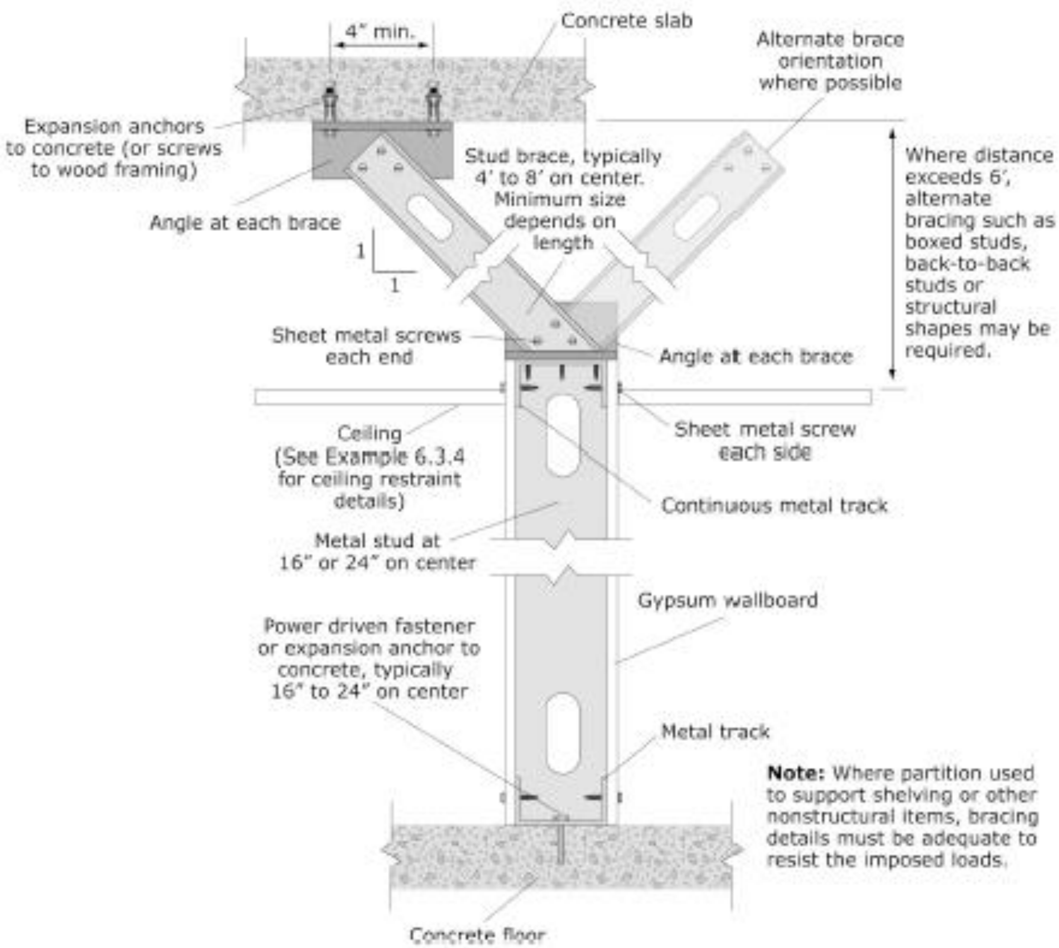


Figure G-4. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.

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

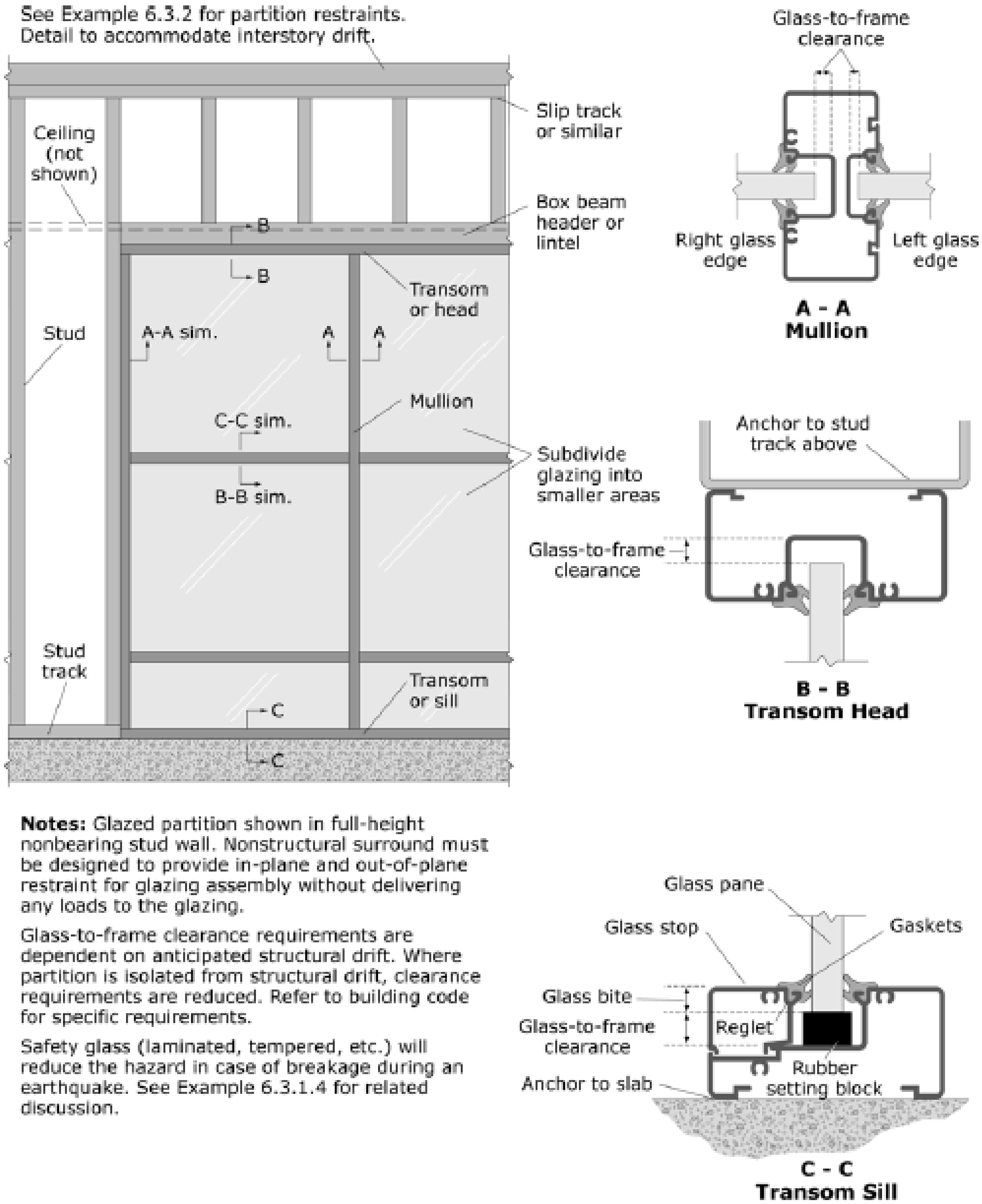


Figure G-5. Full-height Glazed Partition.

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

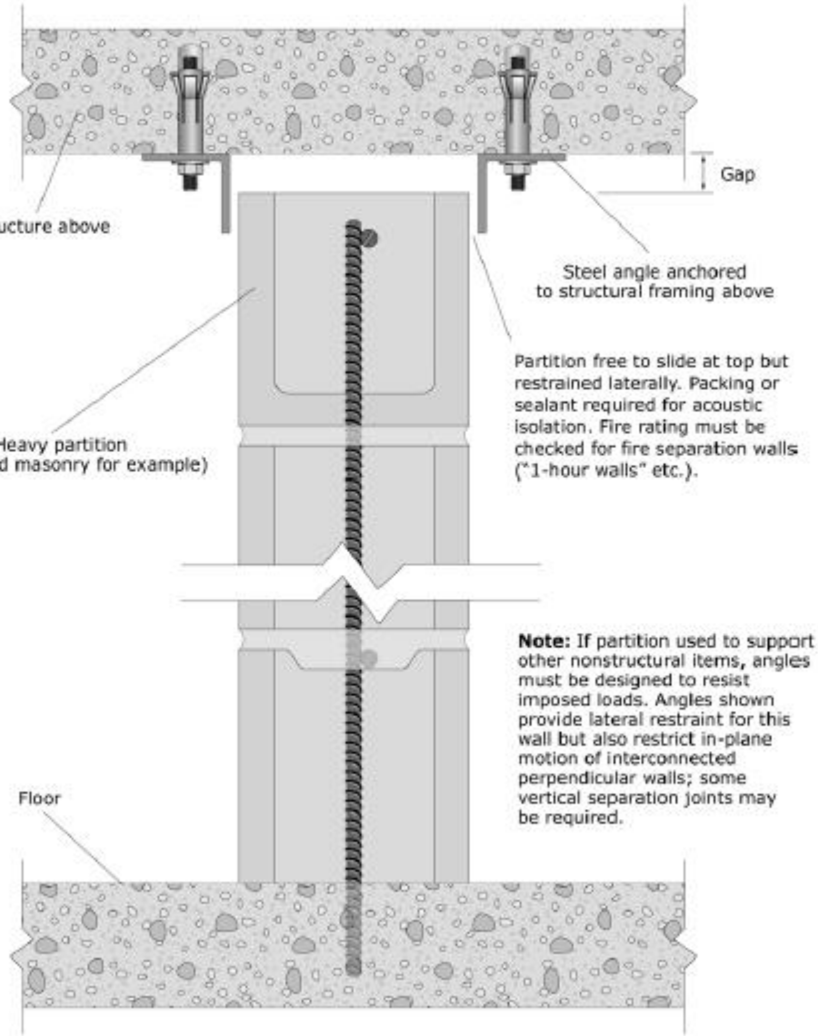


Figure G-6. Full-height Heavy Partition.

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

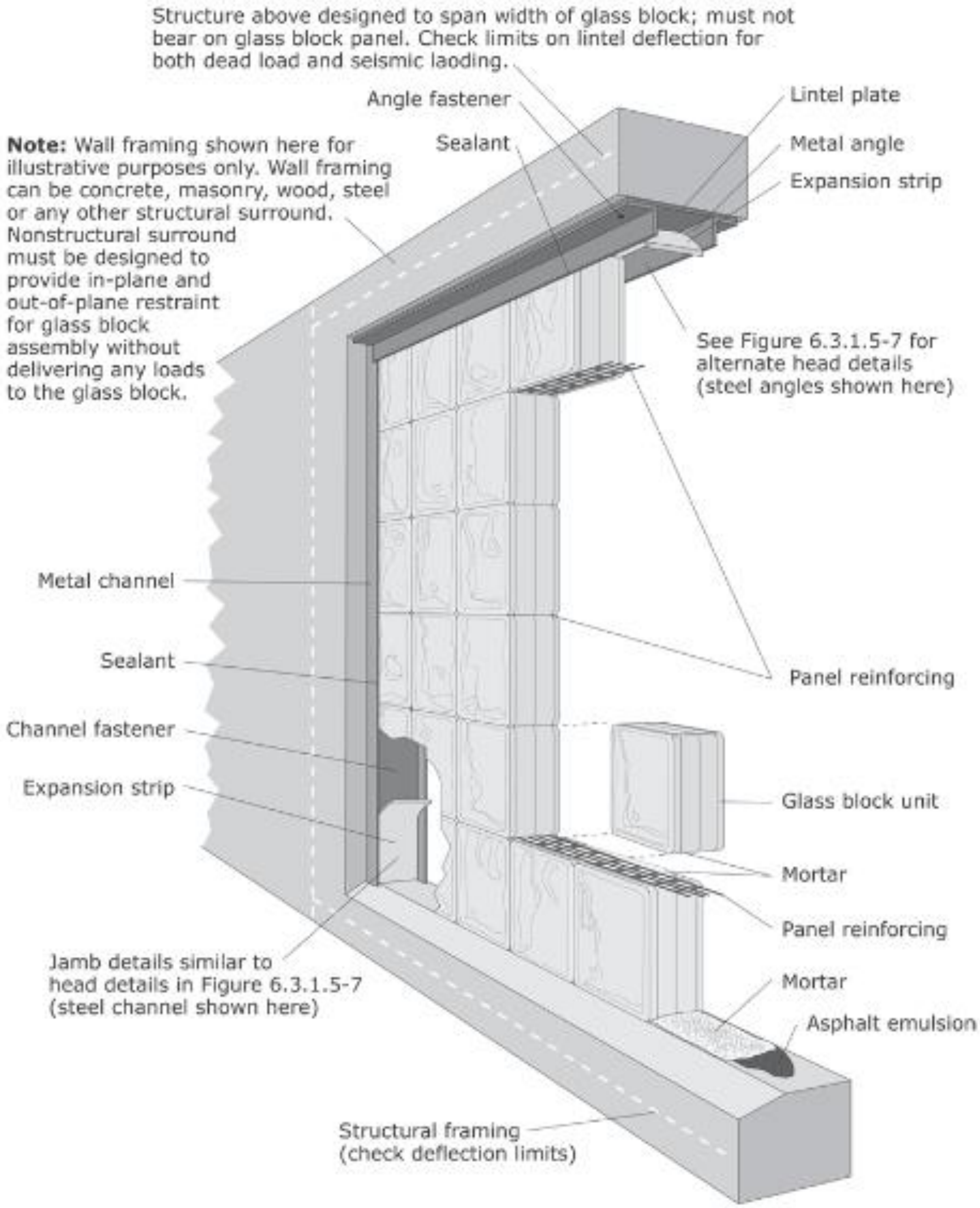


Figure G-7. Typical Glass Block Panel Details.

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

Ceilings

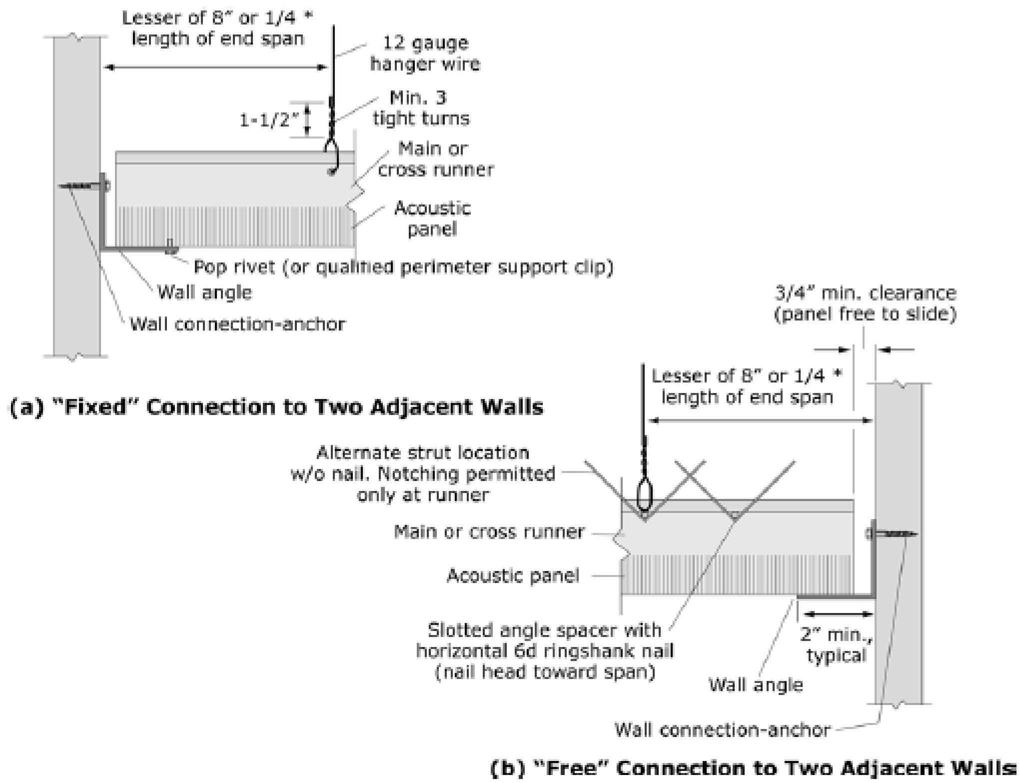
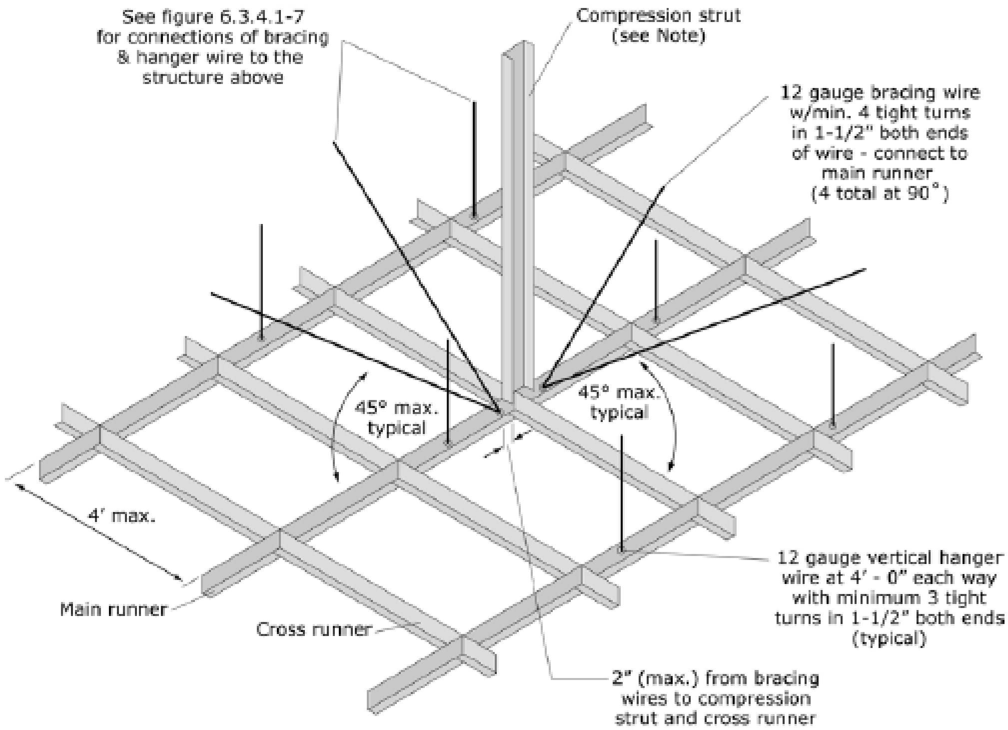


Figure G-8. Suspension System for Acoustic Lay-in Panel Ceilings – Edge Conditions.

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



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

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

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

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

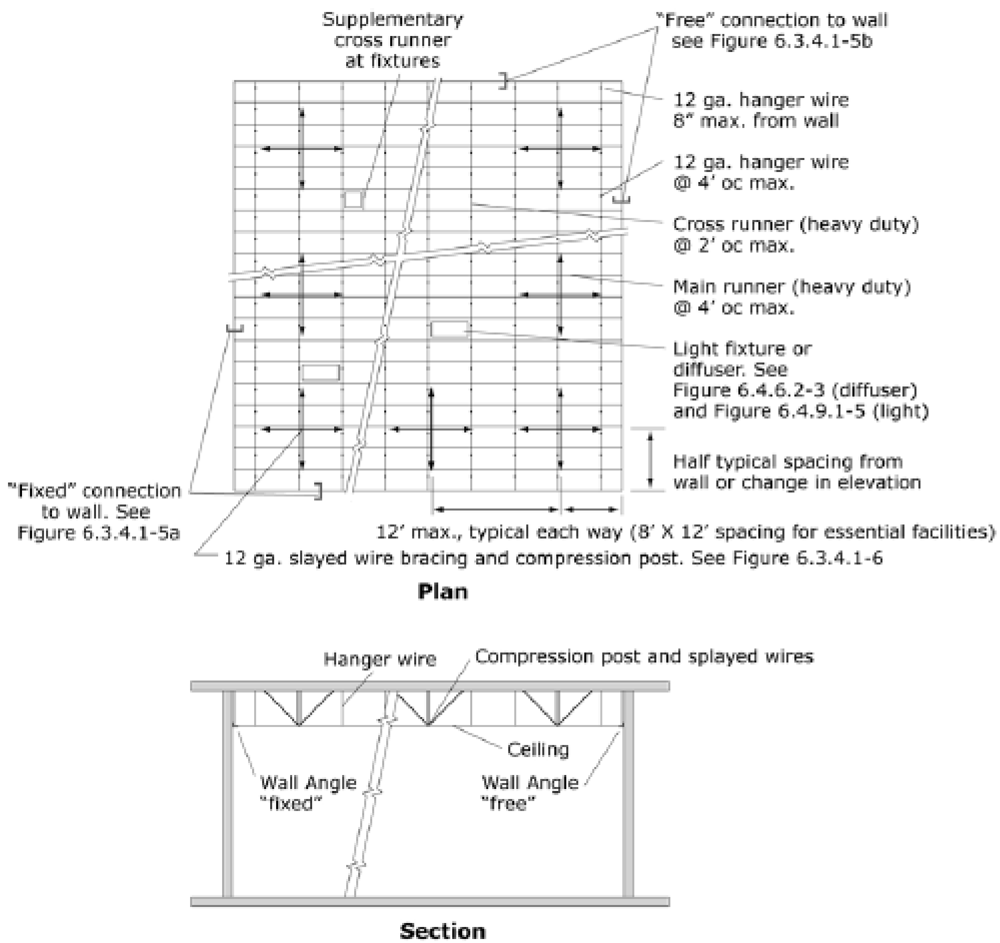


Figure G-10. Suspension System for Acoustic Lay-in Panel Ceilings – General Bracing Layout.

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

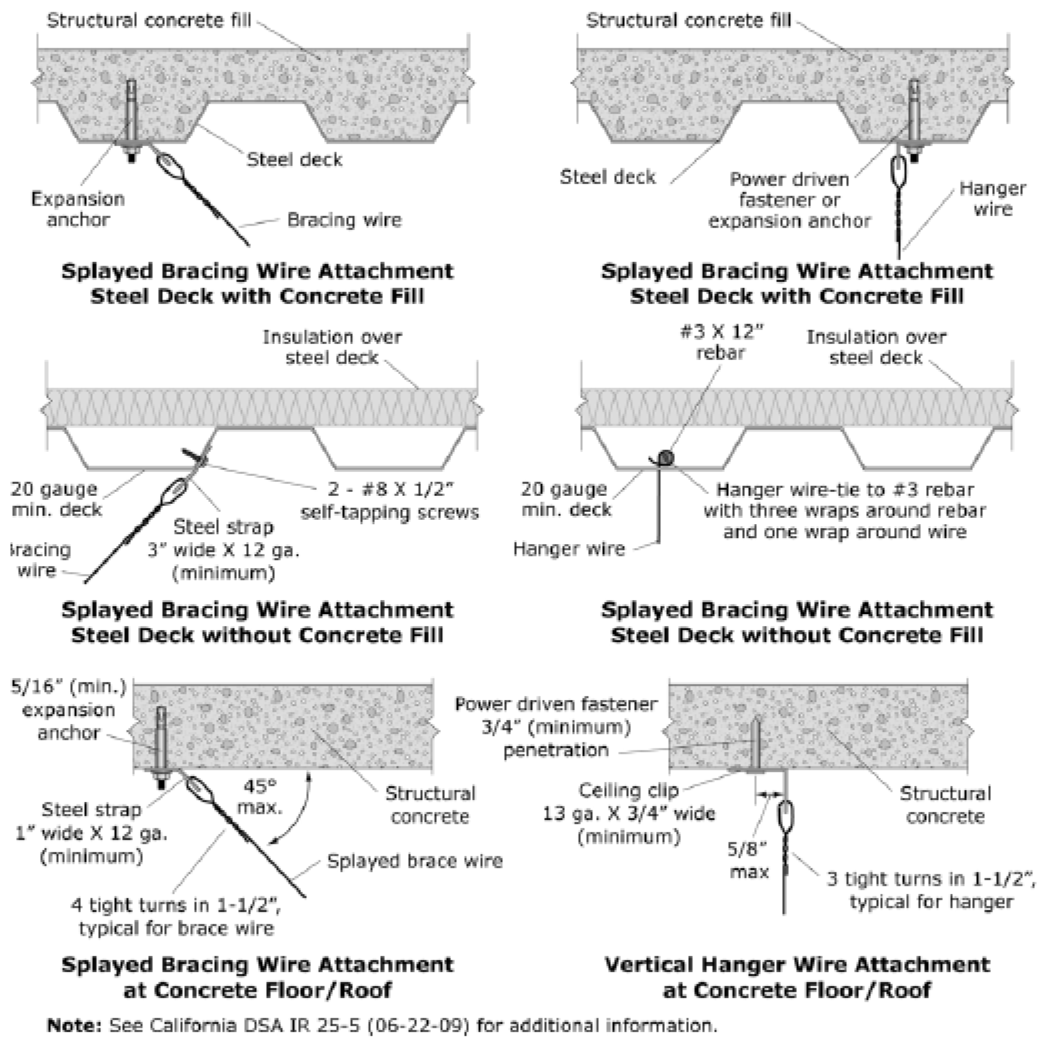
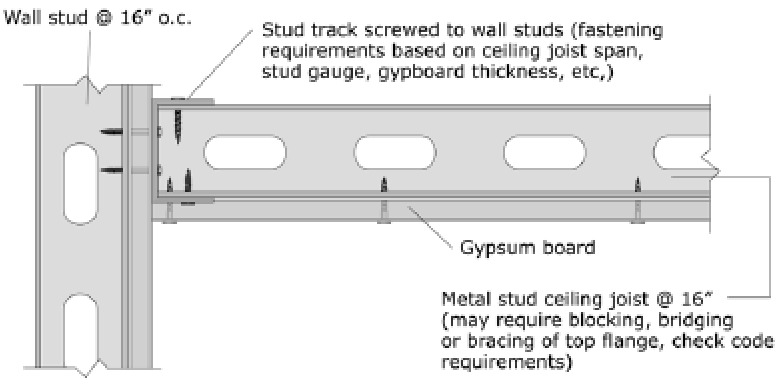
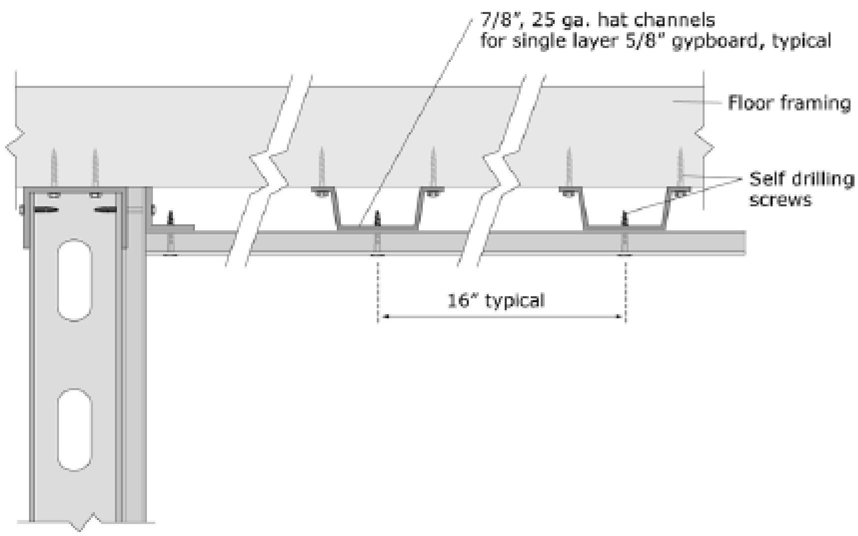


Figure G-11. Suspension System for Acoustic Lay-in Panel Ceilings – Overhead Attachment Details.

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



a) Gypsum board attached directly to ceiling joists



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

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

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

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

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

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

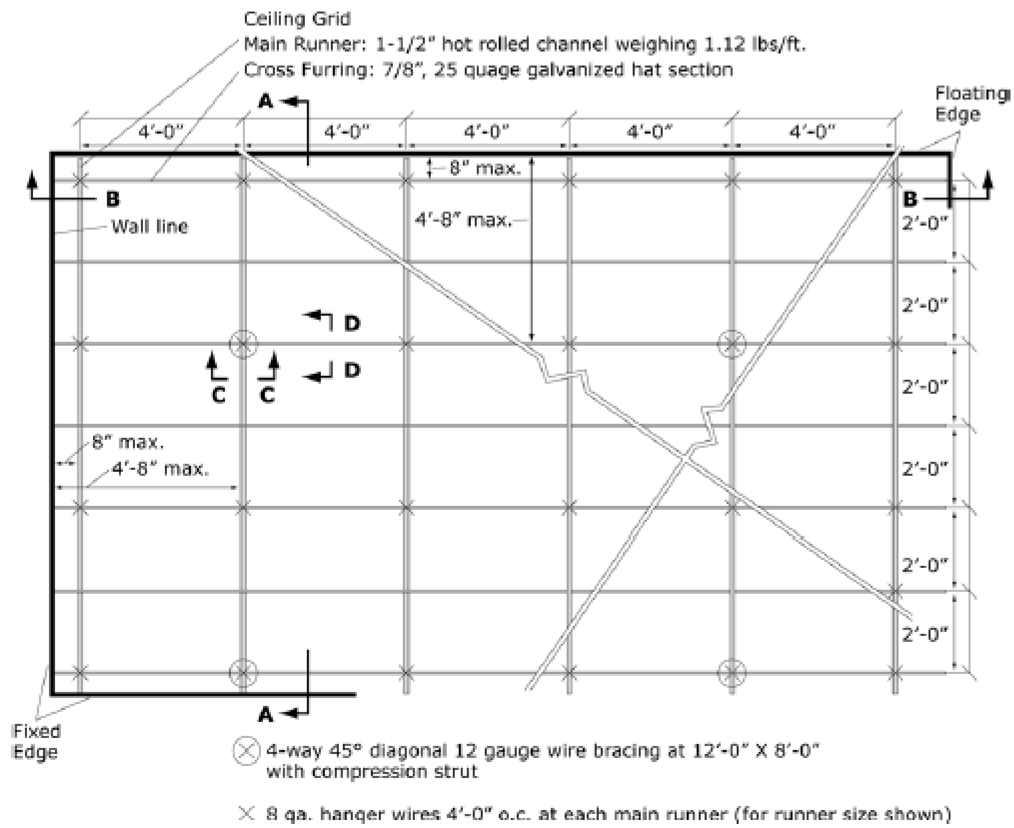


Figure G-14. Diagrammatic View of Suspended Heavy Ceiling Grid and Lateral Bracing.

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

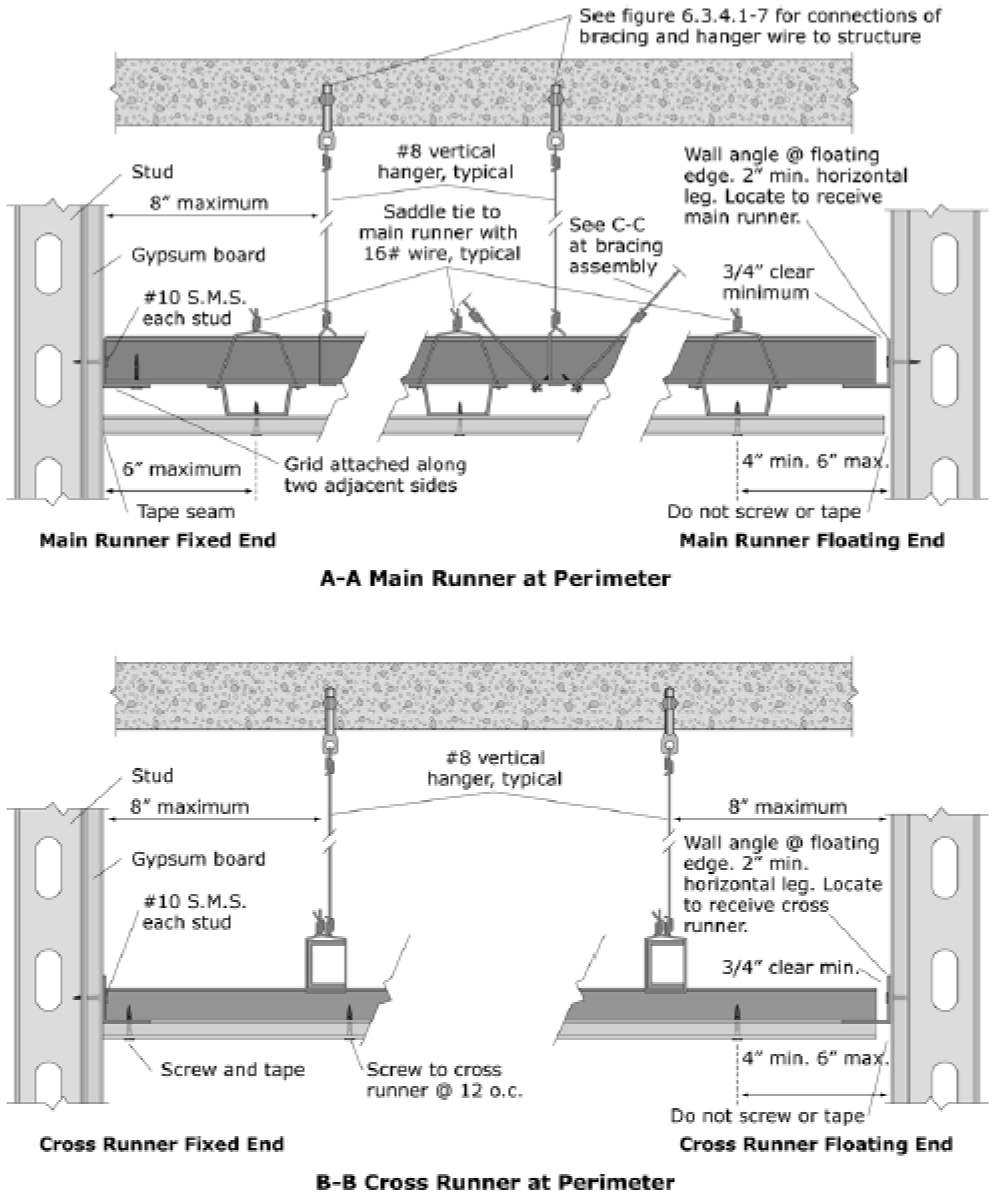
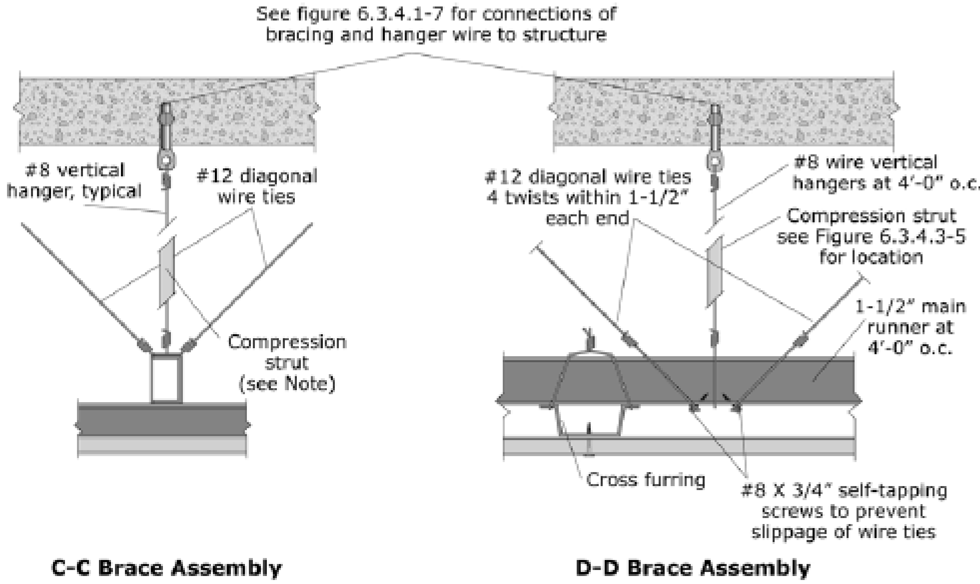


Figure G-15. Perimeter Details for Suspended Gypsum Board Ceiling.

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



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

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

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

Light Fixtures

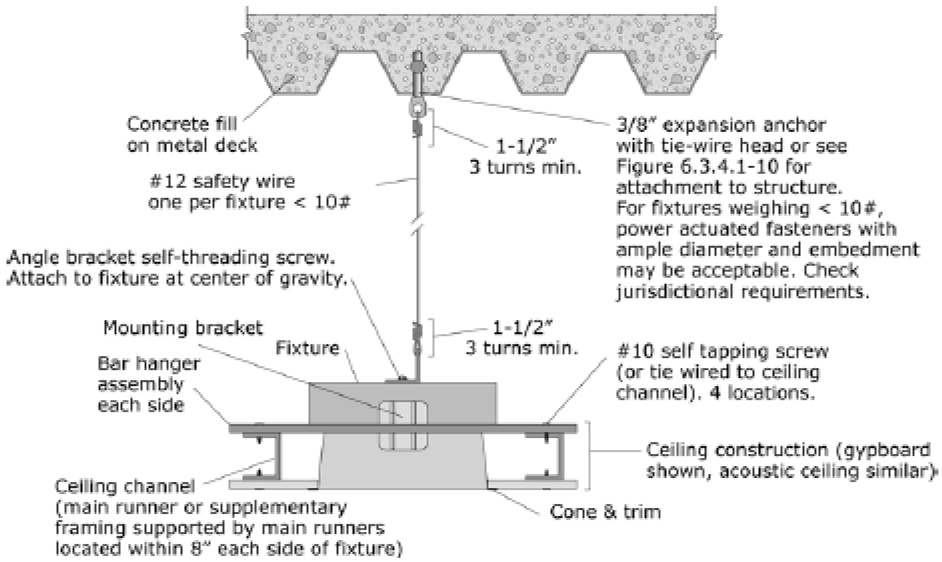


Figure G-17. Recessed Light Fixture in suspended Ceiling (Fixture Weight < 10 pounds).

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

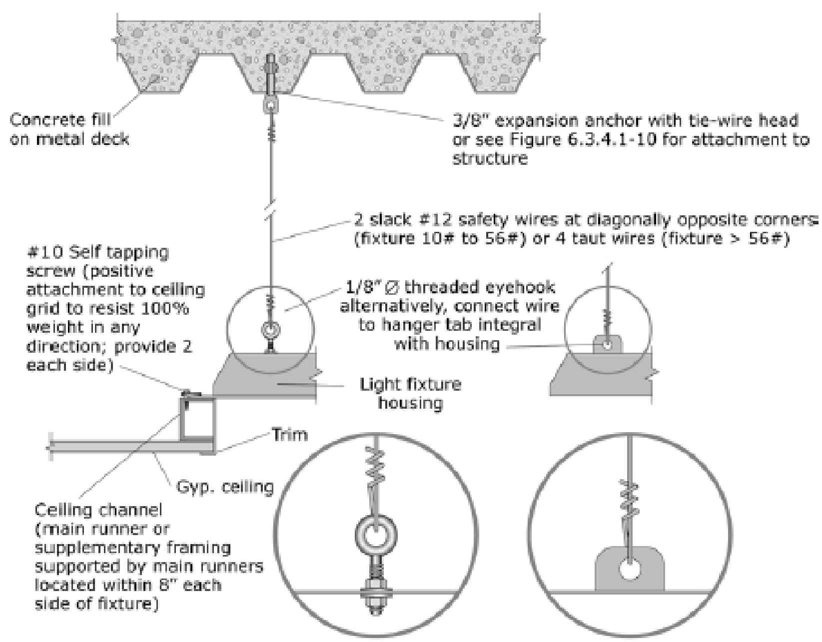


Figure G-18. Recessed Light Fixture in suspended Ceiling (Fixture Weight 10 to 56 pounds).

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

Contents and Furnishings

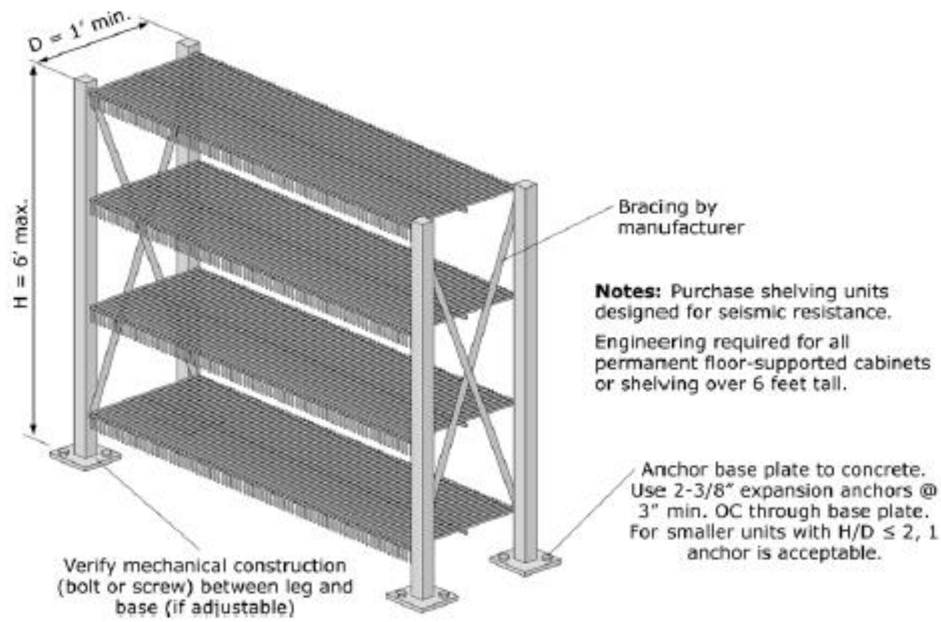


Figure G-19. Light Storage Racks.

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

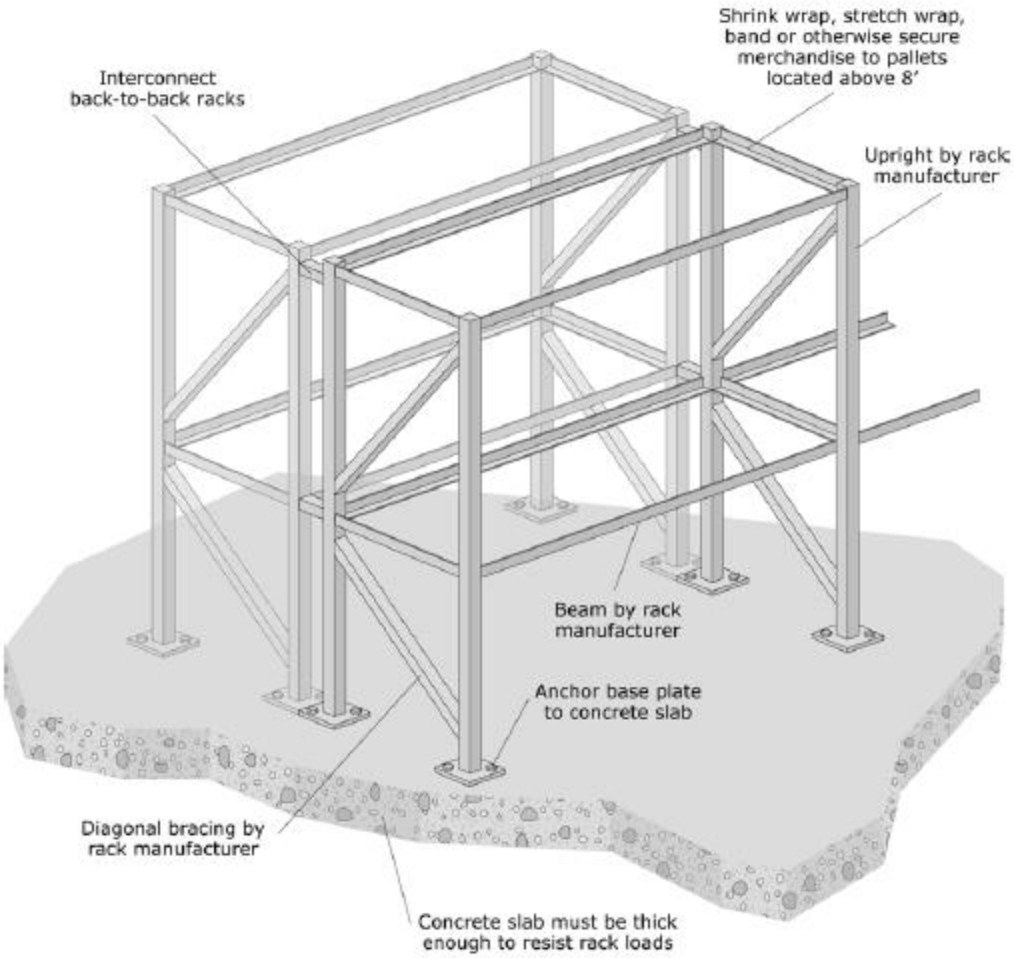


Figure G-20. Industrial Storage Racks.

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

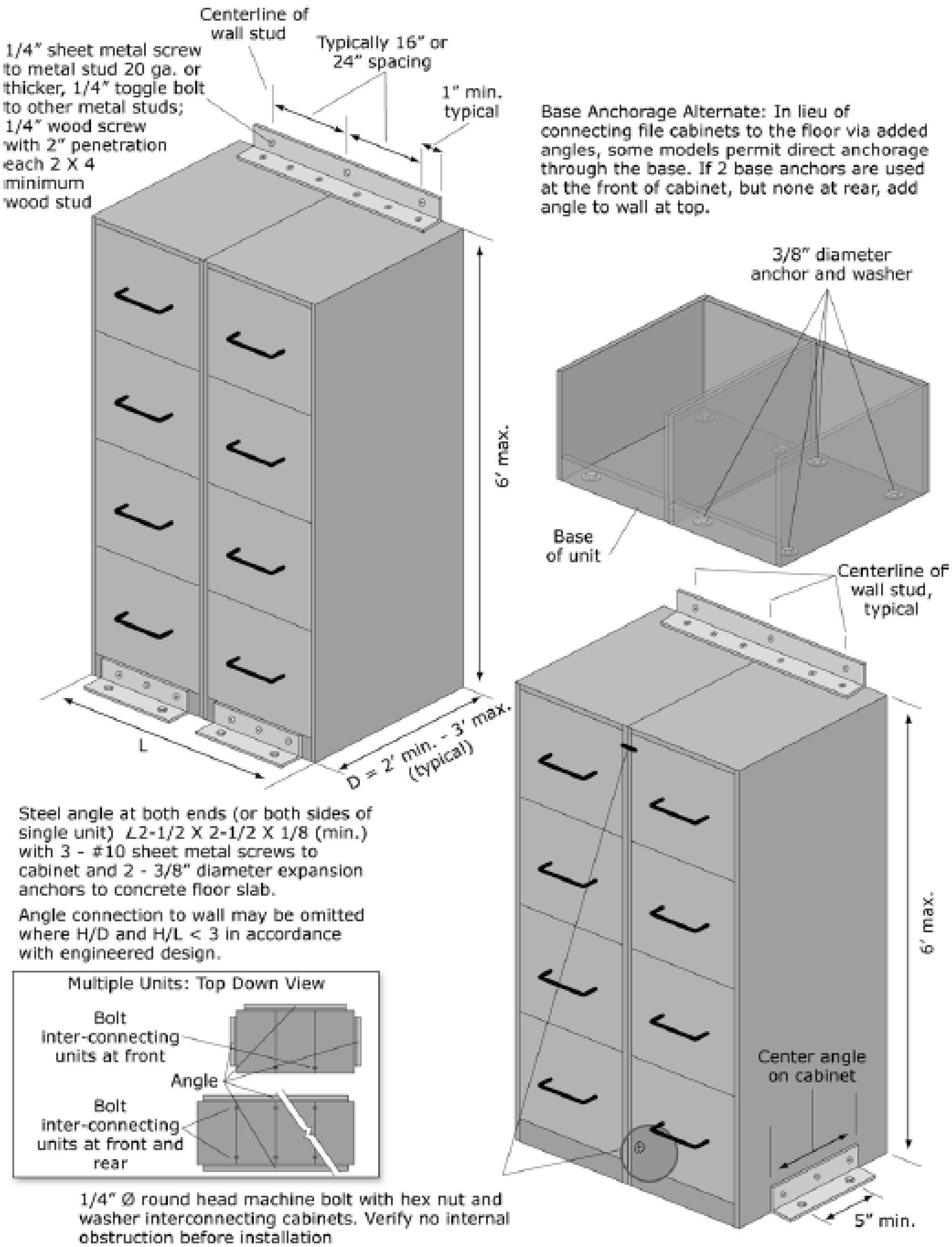


Figure G-21. Wall-mounted File Cabinets.

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

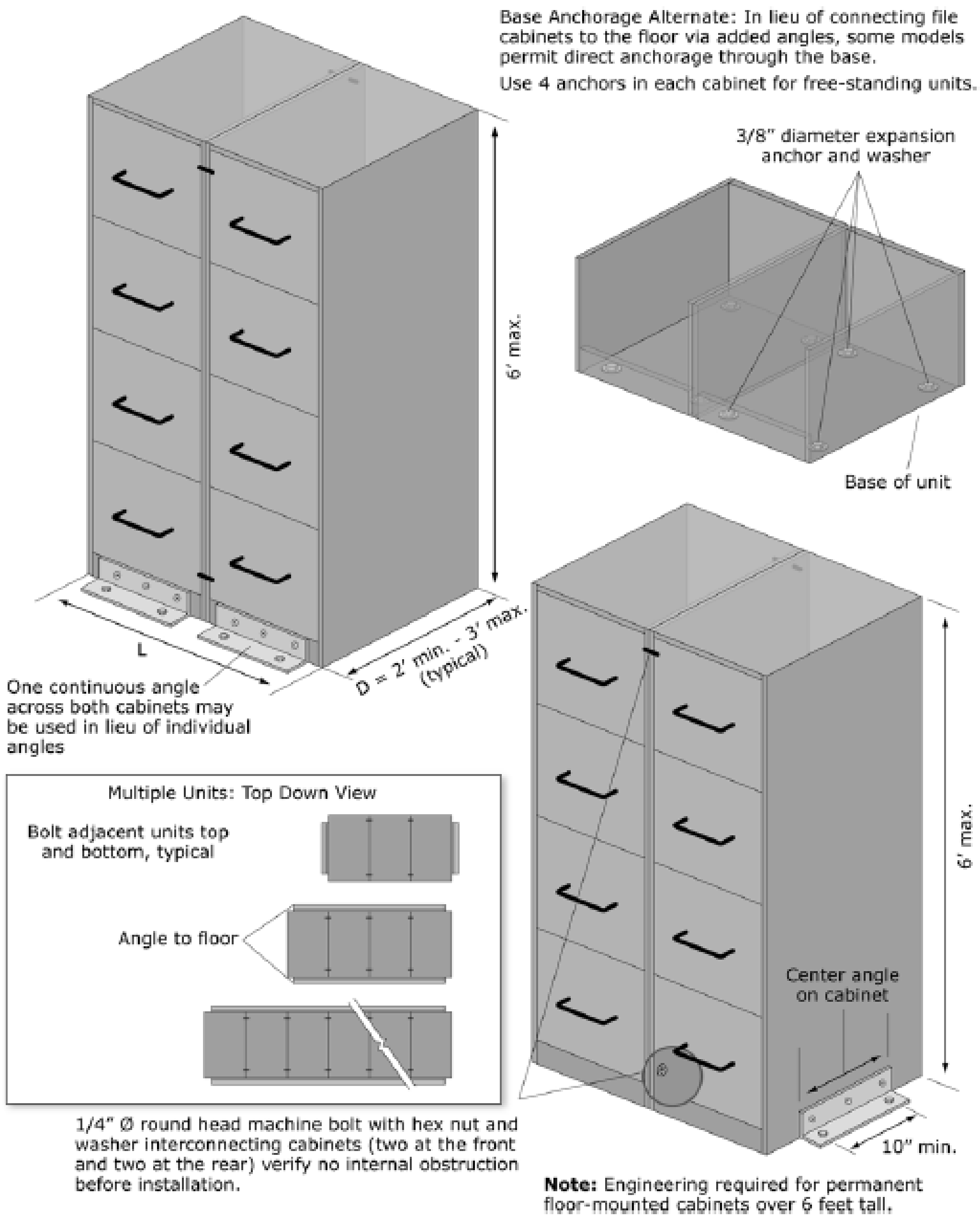


Figure G-22. Base Anchored File Cabinets.

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

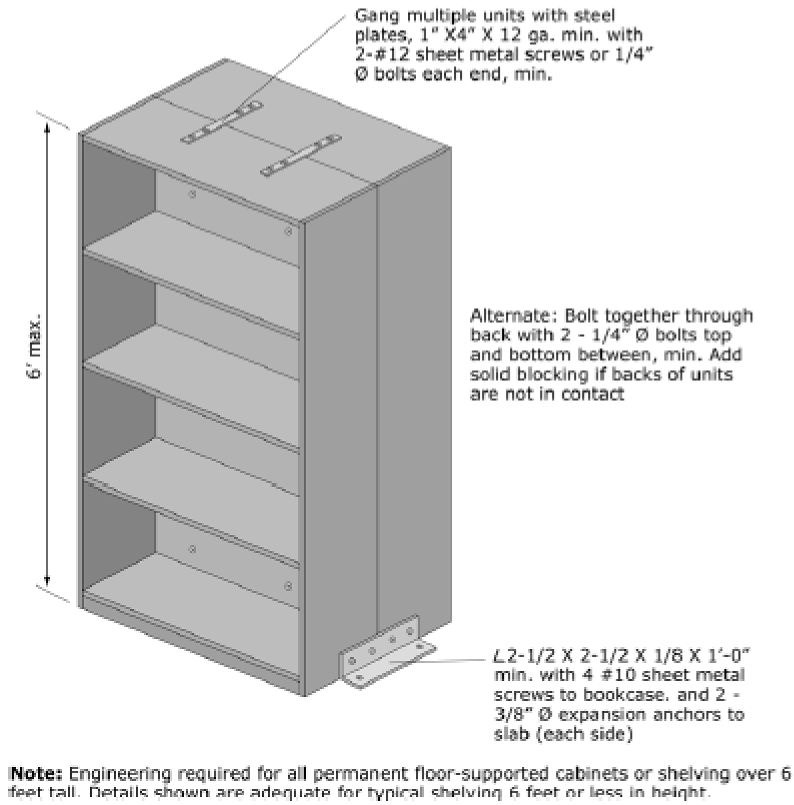


Figure G-23. Anchorage of Freestanding Book Cases Arranged Back to Back.

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

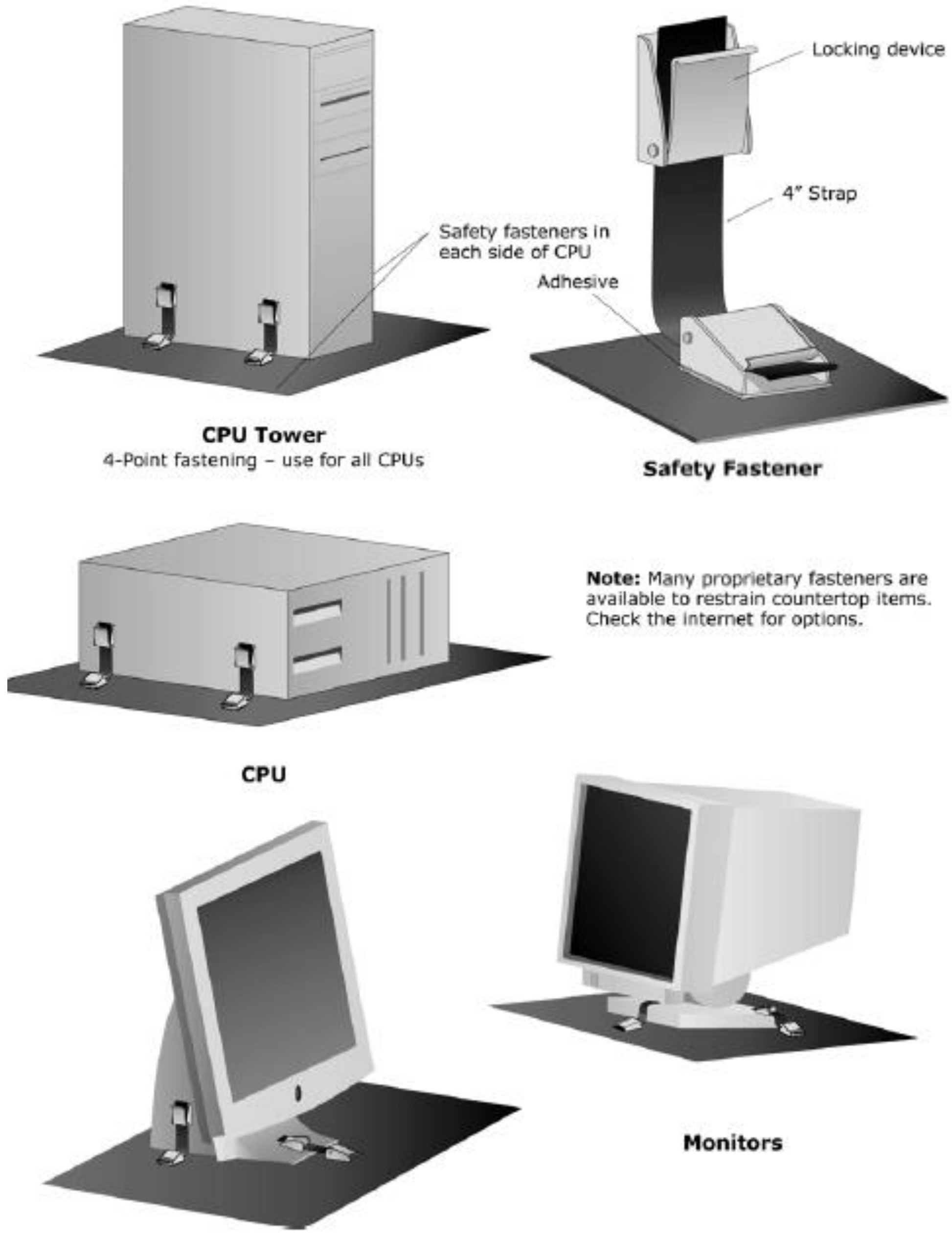
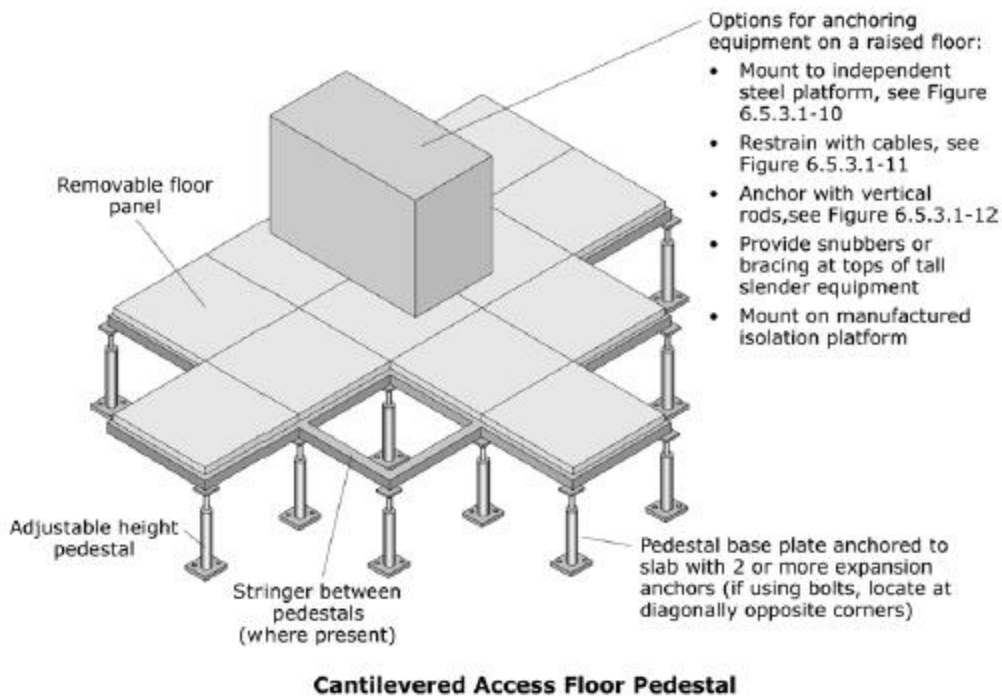
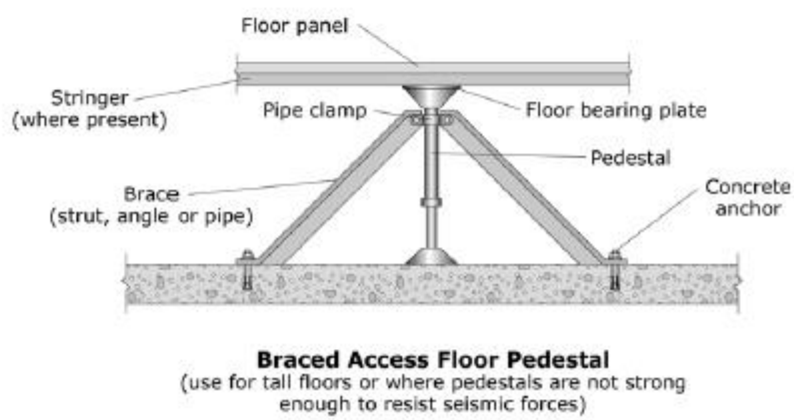


Figure G-24. Desktop Computers and Accessories.

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





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)

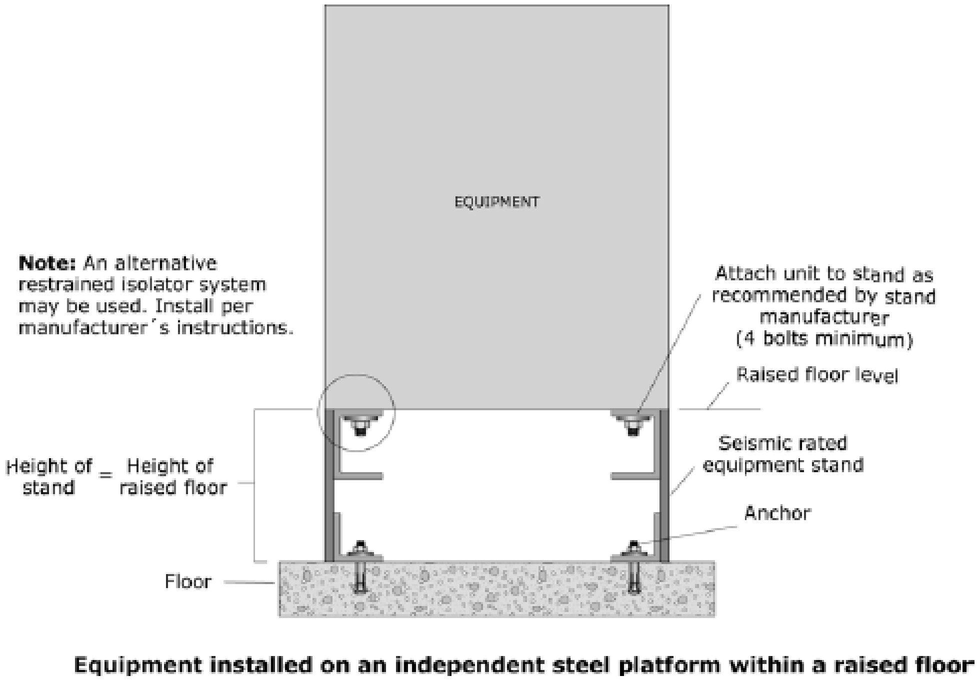


Figure G-26. Equipment Mounted on Access Floor – Independent Base.

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

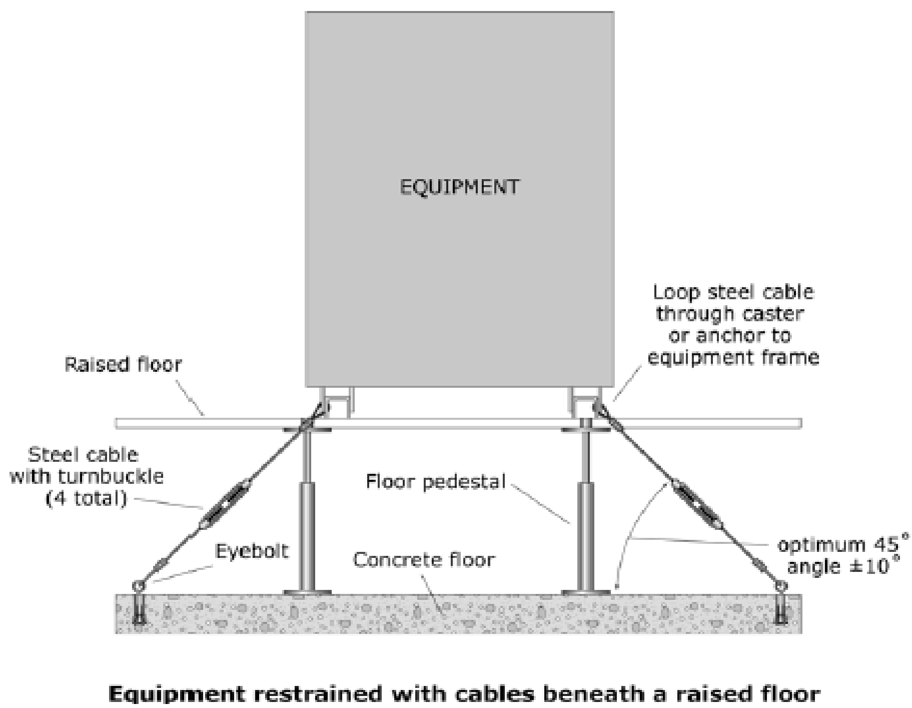


Figure G-27. Equipment Mounted on Access Floor – Cable Braced.

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

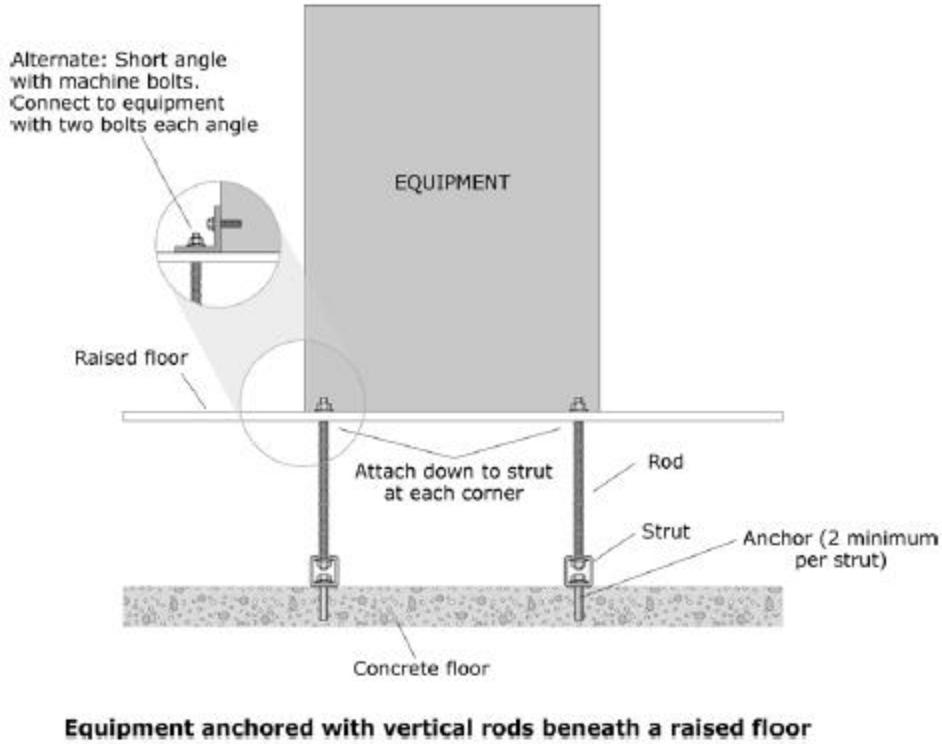
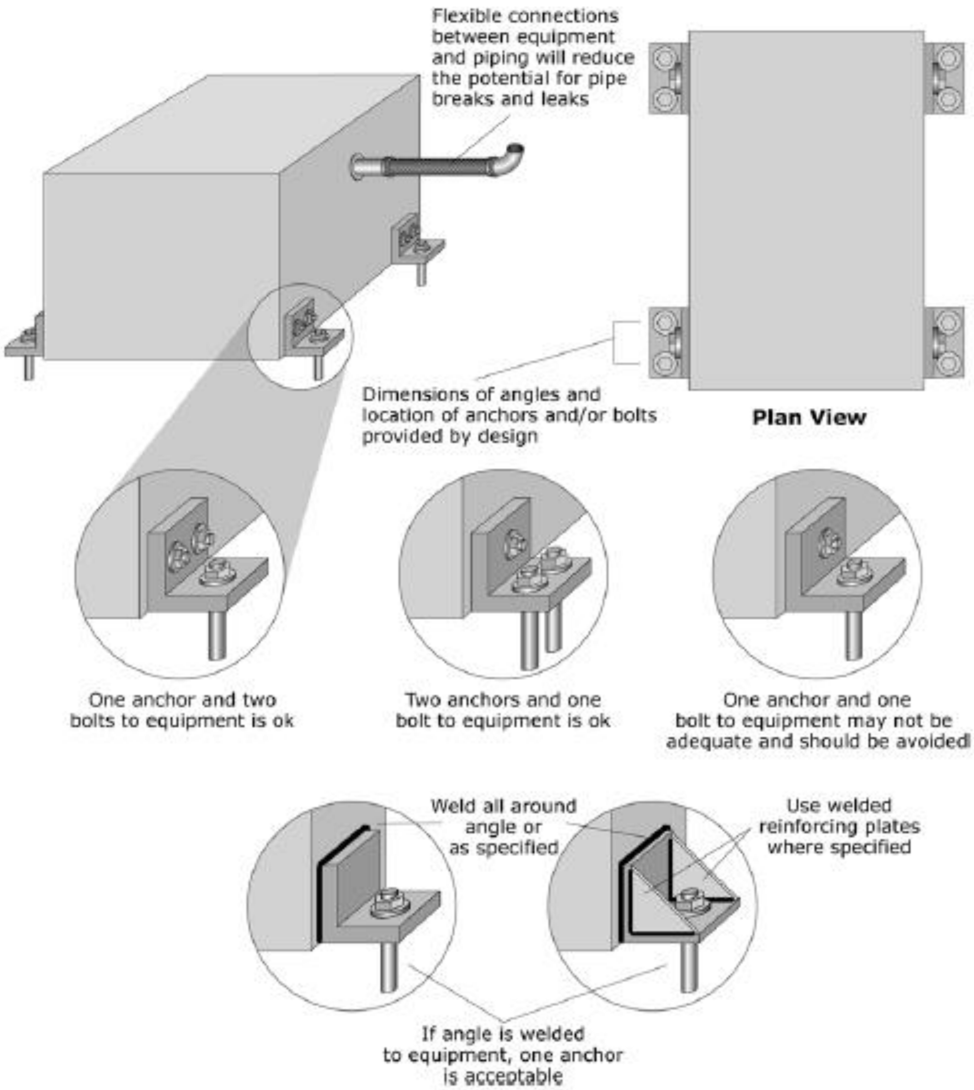


Figure G-28. Equipment Mounted on Access Floor – Tie-down Rods.

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

Mechanical and Electrical Equipment



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

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

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

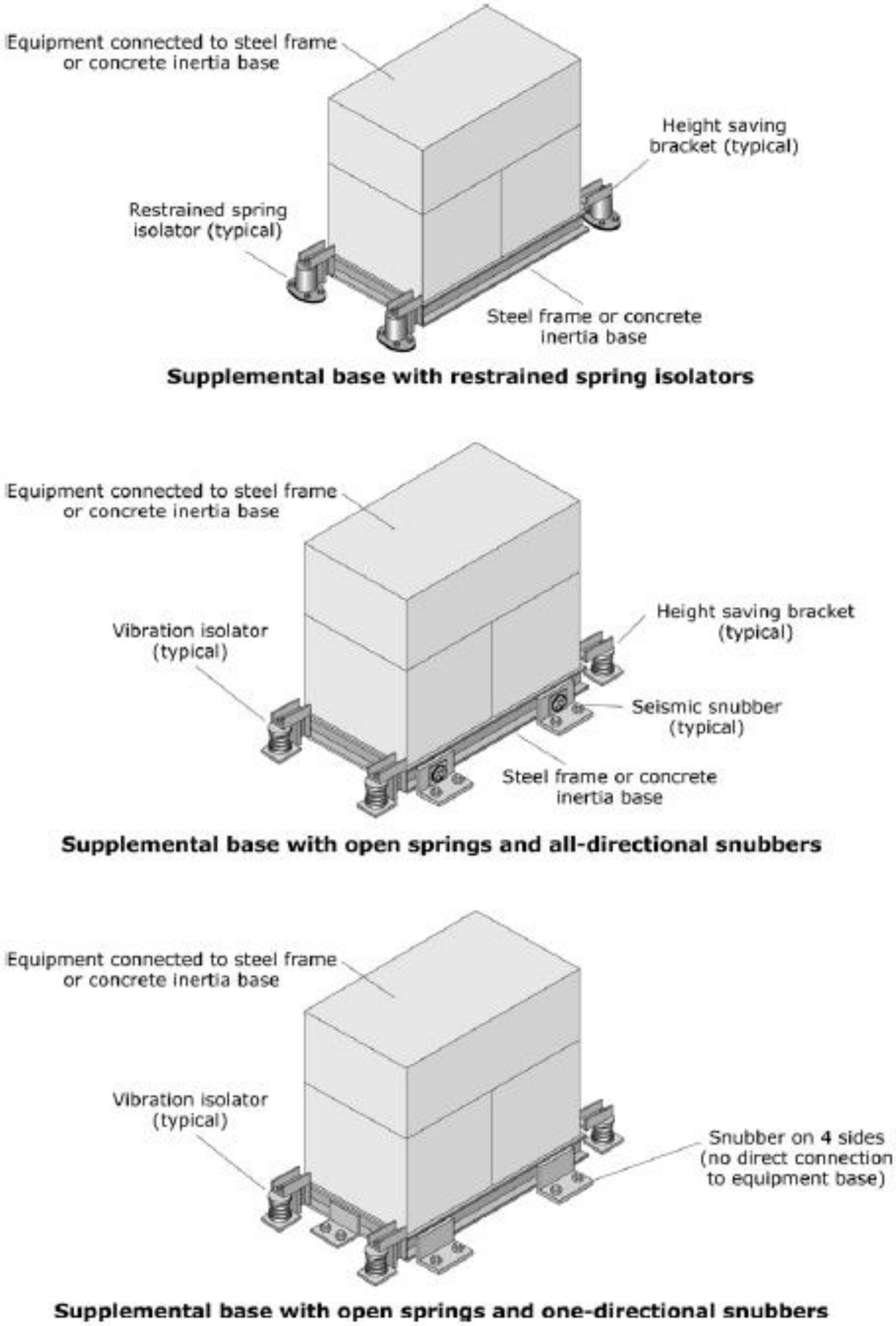


Figure G-30. HVAC Equipment with Vibration Isolation.

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

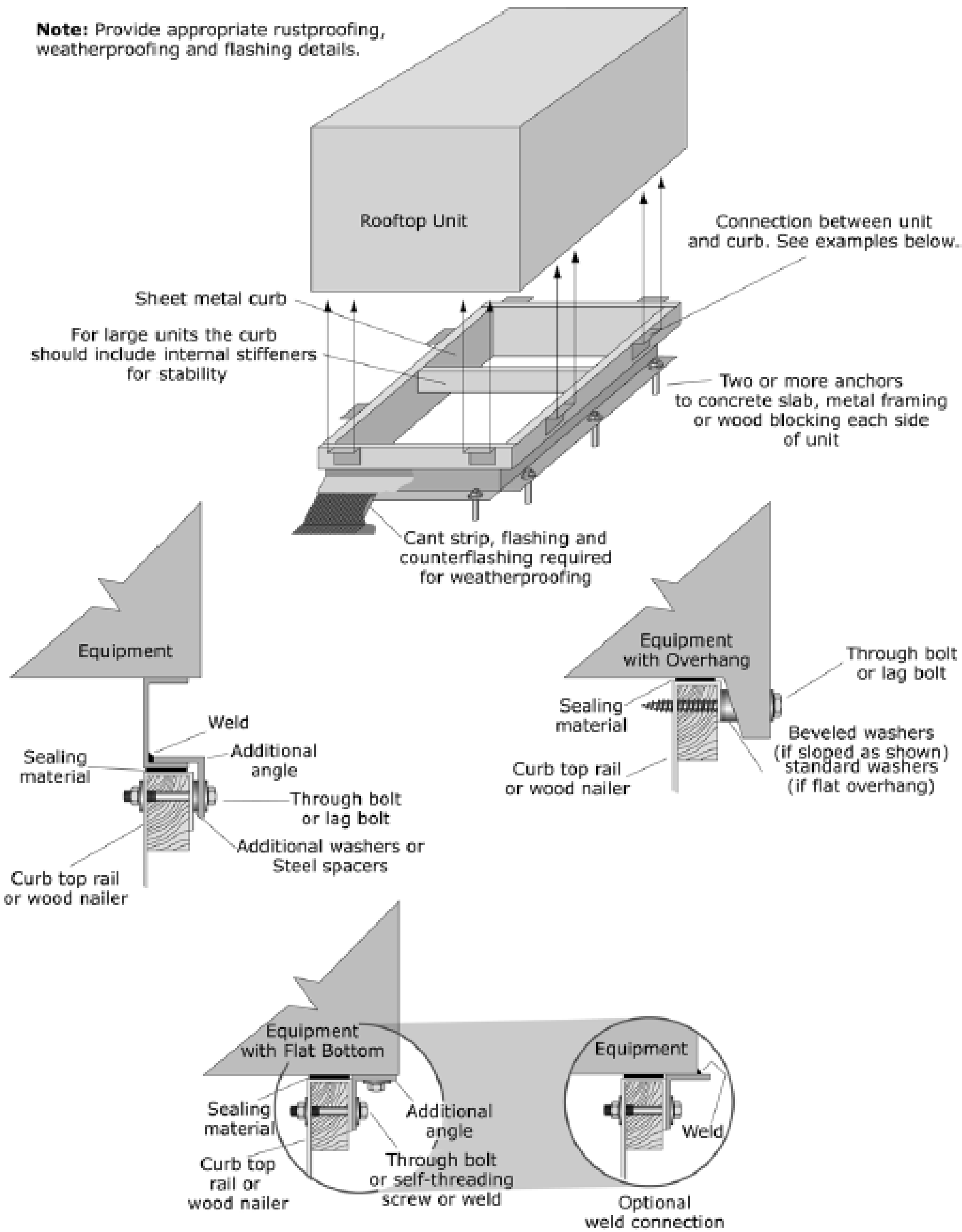


Figure G-31. Rooftop HVAC Equipment.

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

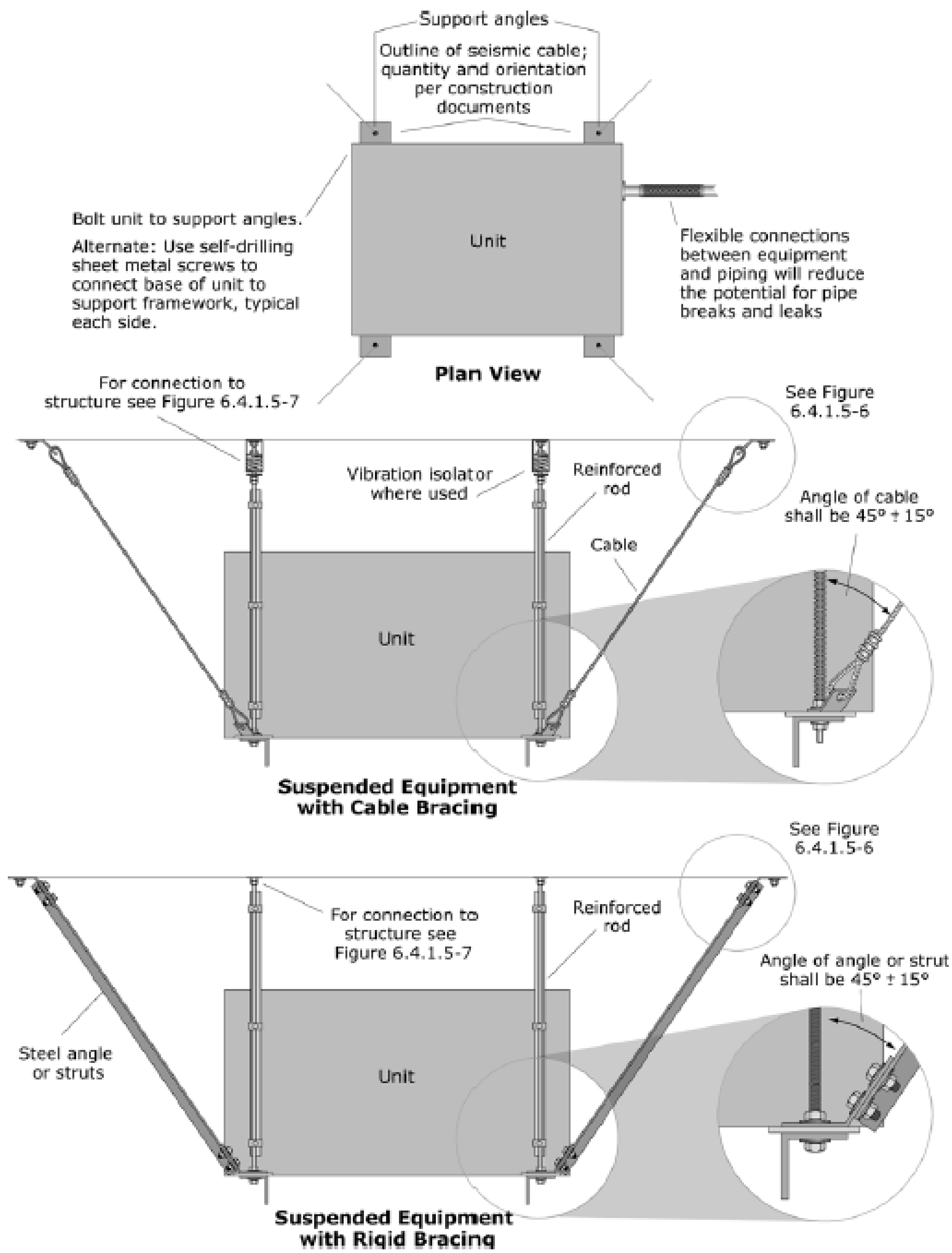


Figure G-32. Suspended Equipment.

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

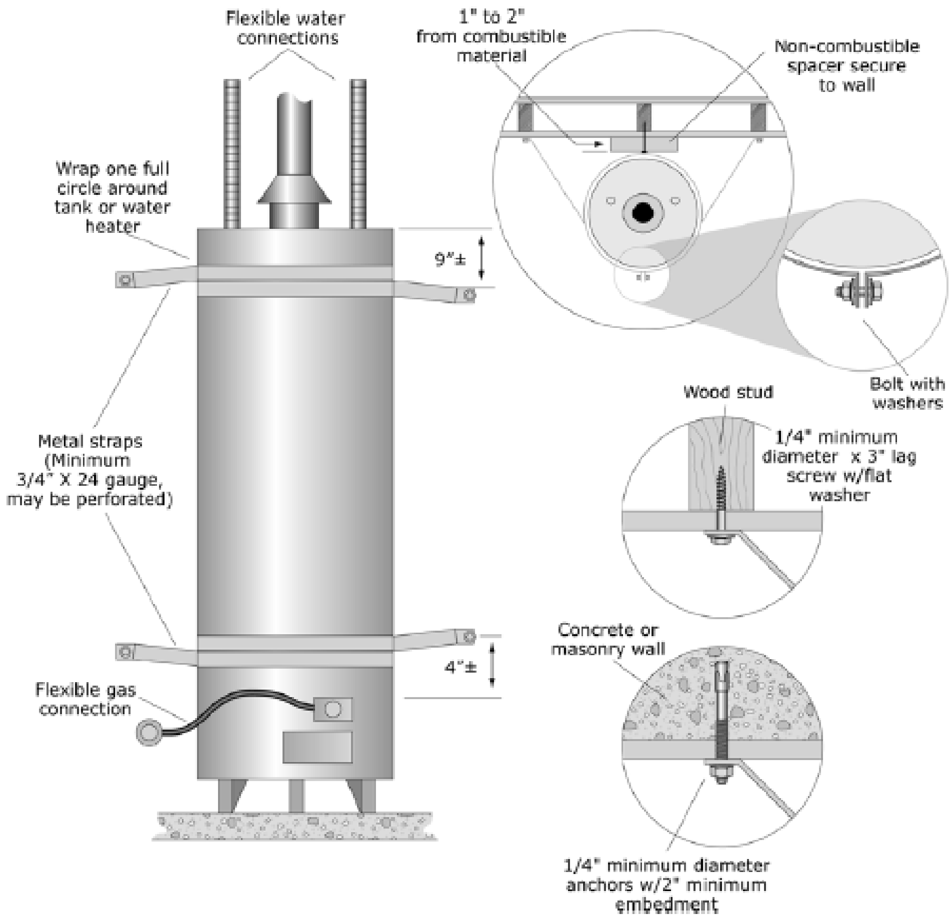


Figure G-33. Water Heater Strapping to Backing Wall.

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

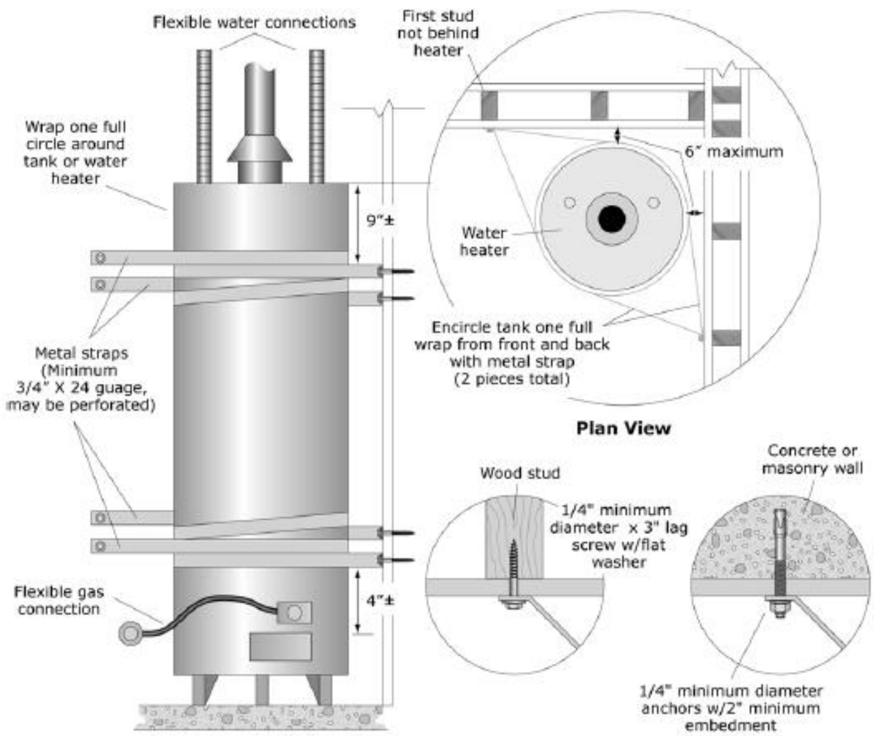


Figure G-34. Water Heater – Strapping at Corner Installation.

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

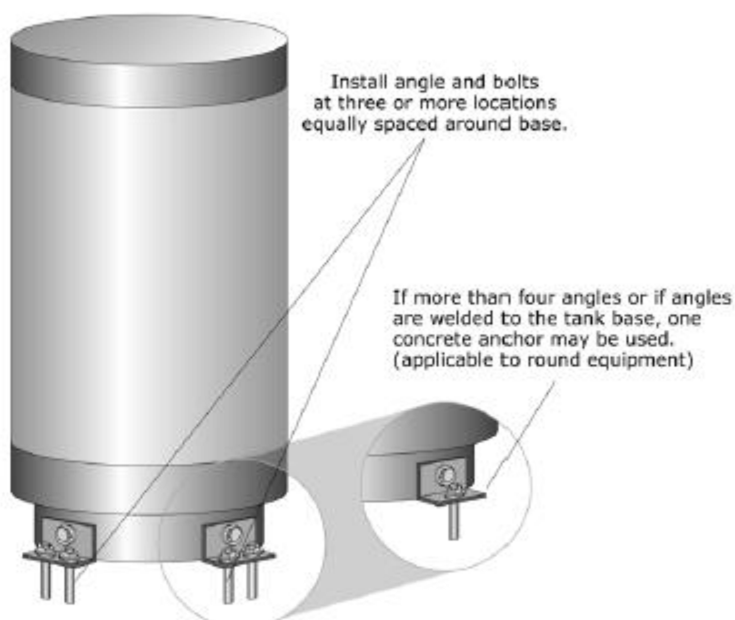


Figure G-35. Water Heater – Base Mounted.

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

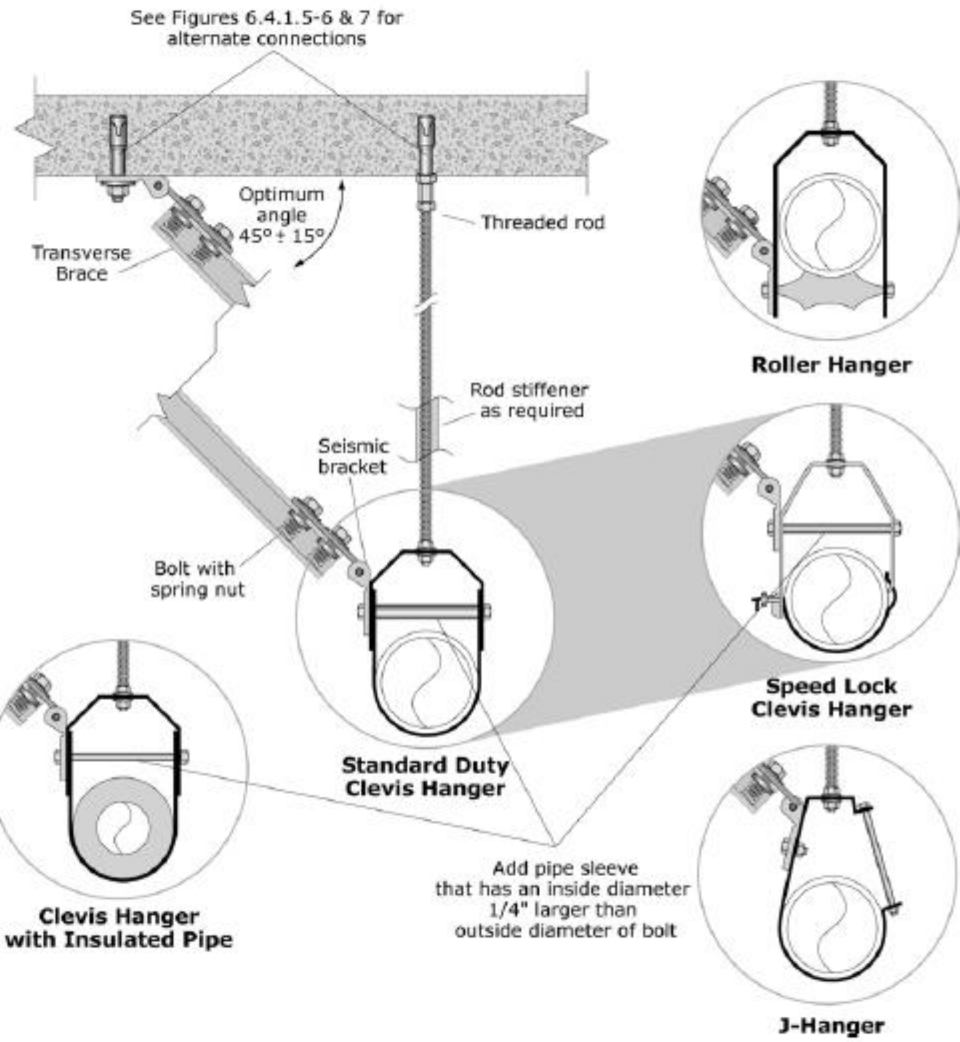


Figure G-36. Rigid Bracing – Single Pipe Transverse.

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

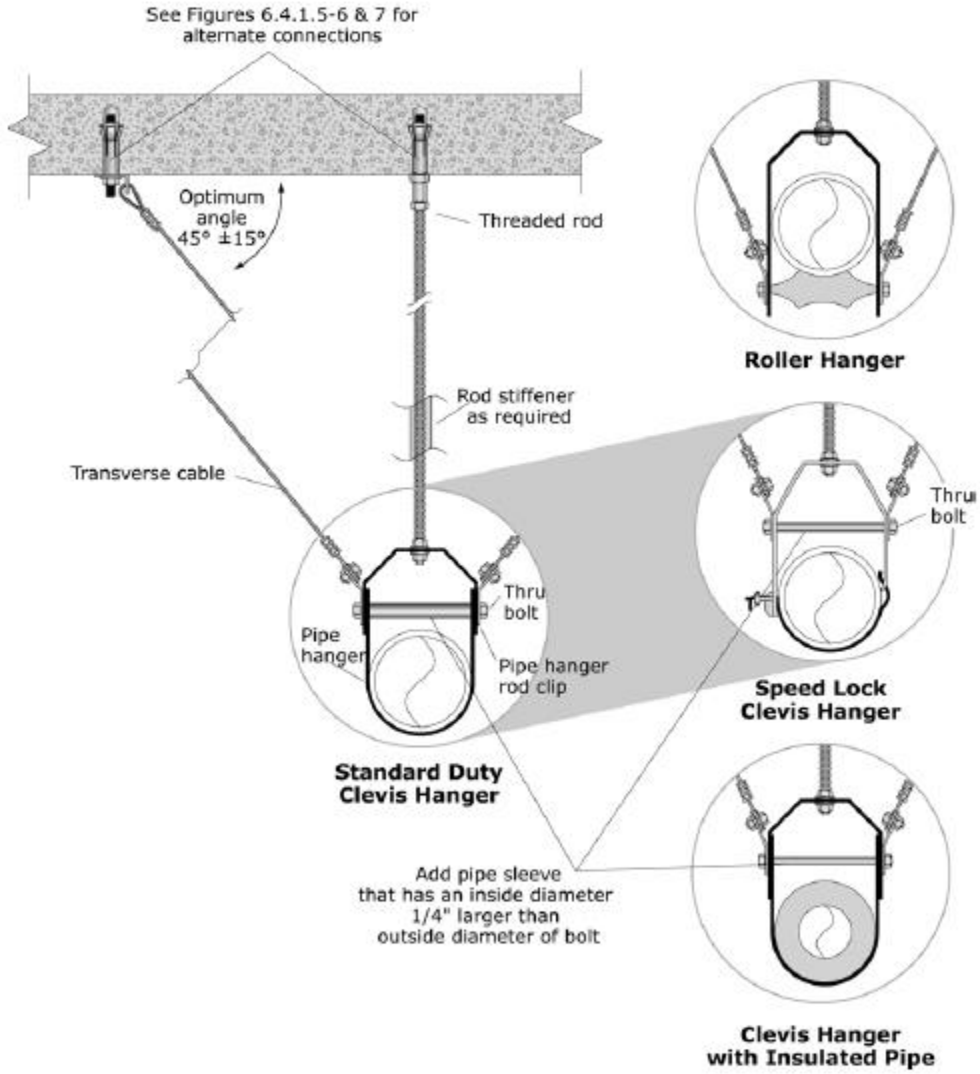


Figure G-37. Cable Bracing – Single Pipe Transverse.

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

Electrical and Communications

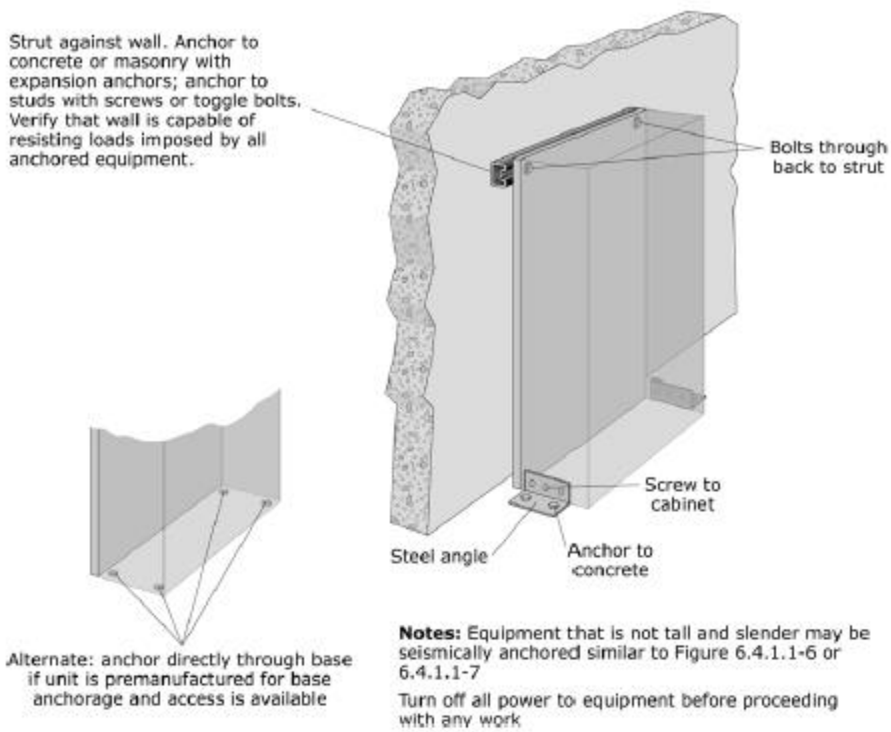


Figure G-38. Electrical Control Panels, Motor Controls Centers, or Switchgear.

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

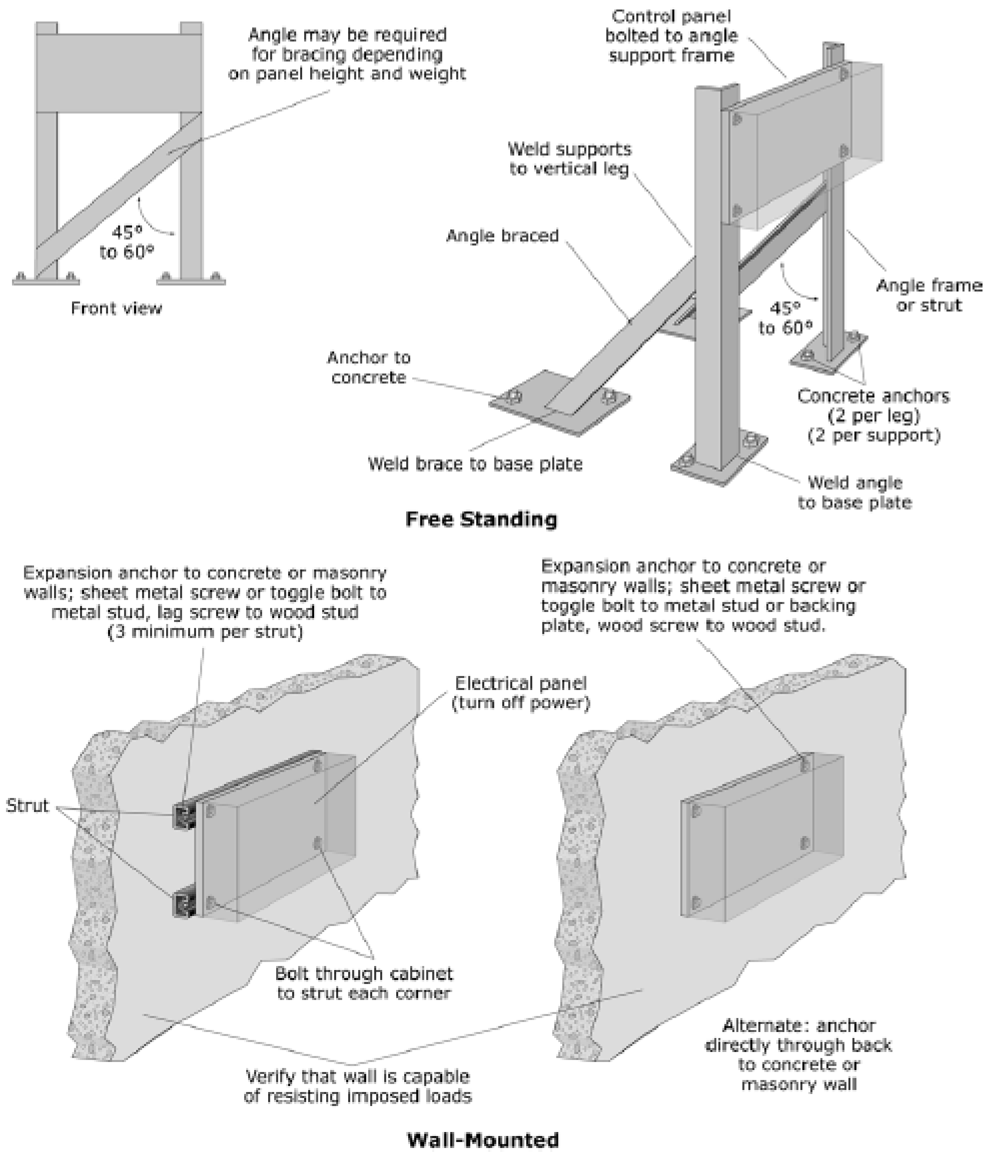


Figure G-39. Freestanding and Wall-mounted Electrical Control Panels, Motor Controls Centers, or Switchgear.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

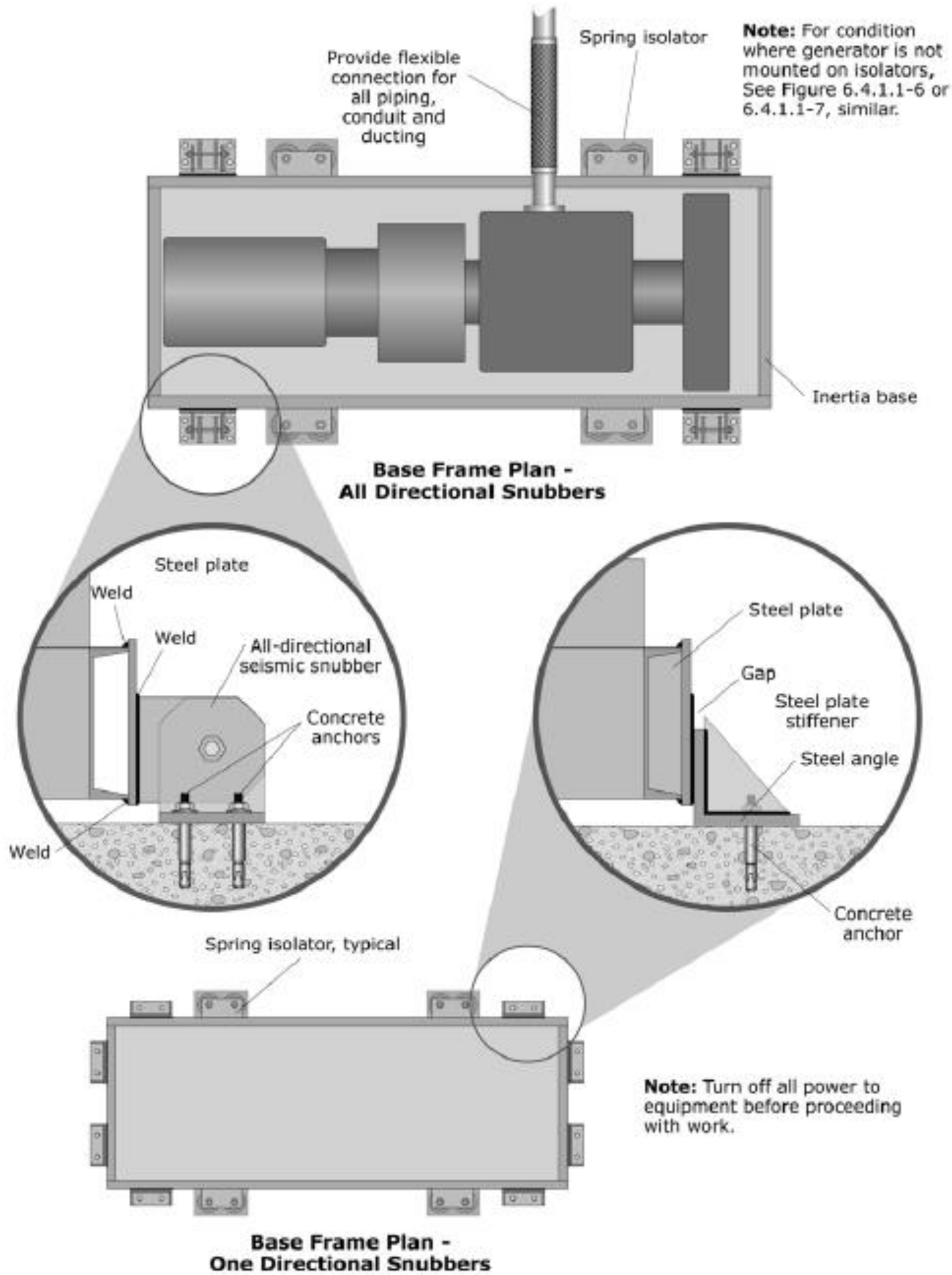


Figure G-40. Emergency Generator.

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

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