PORT TOWNSEND HIGH SCHOOL
GYM BUILDING
Port Townsend School District

SEISMIC UPGRADES CONCEPT DESIGN REPORT
June 2021
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WASHINGTON STATE SCHOOL SEISMIC SAFETY ASSESSMENTS PROJECT

SEISMIC UPGRADES CONCEPT DESIGN REPORT
Port Townsend High School – Gym Building
Port Townsend School District

June 2021

Prepared for:

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

Prepared by:

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Reid Middleton, Inc.

Contributions by:

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EXECUTIVE SUMMARY

This report documents the findings of a seismic evaluation of the Port Townsend High School Gym building in Port Townsend, Washington. The Port Townsend High School Gym building is a one-story building with mezzanines that was originally constructed in 1941. A major renovation and addition took place in 1984. The 1984 modernization seismically renovated the original unreinforced masonry (URM) building with rosette wall anchors and plywood sheathing overlay on top of the tongue-and-groove wood decking. The 1984 modernization also included a new auxiliary gym and shop area that replaced the original shop building north of the main gym. The original gym and locker rooms have 12-inch-thick URM bearing walls that support a wood-framed roof and bowstring trusses that clear span the main gym floor. The auxiliary gym and shop area also have a wood-framed roof that is supported by glulam girders and exterior CMU walls, which also serve as backing walls for the original 12-inch URM walls that were preserved.

Reid Middleton performed a Tier 1 screening in accordance with the ASCE 41-17 standard Seismic Evaluation and Retrofit of Existing Buildings. The evaluation included field observations and review of record drawings to verify the existing construction. The structural seismic evaluation indicated that the building has multiple seismic deficiencies; the most susceptible ones being out-of-plane wall anchorage and bracing, tall and slender URM walls, narrow wood diaphragms that laterally support URM walls, no secondary support for the long-spanning bowstring trusses, and in-plane shear strength of the existing URM shear walls that support the roof over the main gym. Other seismic deficiencies include lack of continuous diaphragm cross-ties and wood ledgers susceptible to cross-grain bending.

Conceptual seismic upgrade recommendations for the structural systems are provided to improve the performance of the building to meet the Life Safety structural performance objective criteria of ASCE 41-17. Sketches for the concept-level seismic upgrades are provided in Appendix B. The structural upgrades include strongbacking of the north and south URM walls of the main gym, out-of-plane wall anchorage and bracing for the exterior and interior URM and concrete masonry unit (CMU) walls, replacing wood infills of openings in the URM walls with reinforced CMU, plywood shear walls and cross walls to reduce narrow diaphragm aspect ratios, secondary vertical support for the long-spanning bowstring trusses, and direct connection of rosette anchors to the roof diaphragms. The recommendations for nonstructural upgrades are to further investigate and brace overhead mechanical equipment and ductwork, integrated ceiling system and lighting fixtures in paths of egress, and unbraced interior masonry partition walls.

An opinion of probable construction costs is provided in Appendix C. It is our opinion that the total cost (construction costs plus soft costs) to upgrade the structure would range between $1.68M and $3.15M with the baseline estimated total cost being $2.1M.
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<th>ACM</th>
<th>Association for the Advancement of Cost Engineering</th>
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<tr>
<td>ADA</td>
<td>Americans with Disabilities Act</td>
</tr>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
</tr>
<tr>
<td>A-E</td>
<td>Architect-Engineer</td>
</tr>
<tr>
<td>BPOE</td>
<td>Basic Performance Objective for Existing Buildings</td>
</tr>
<tr>
<td>BSE</td>
<td>Basic Safety Earthquake</td>
</tr>
<tr>
<td>CMU</td>
<td>Concrete Masonry Unit</td>
</tr>
<tr>
<td>CP</td>
<td>Collapse Prevention</td>
</tr>
<tr>
<td>DNR</td>
<td>Department of Natural Resources</td>
</tr>
<tr>
<td>DCR</td>
<td>Demand-to-Capacity Ratio</td>
</tr>
<tr>
<td>EERI</td>
<td>Earthquake Engineering Research Institute</td>
</tr>
<tr>
<td>EPAT</td>
<td>EERI Earthquake Performance Assessment Tool</td>
</tr>
<tr>
<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
</tr>
<tr>
<td>GC/CM</td>
<td>General Contractor / Construction Manager</td>
</tr>
<tr>
<td>GWB</td>
<td>Gypsum Wallboard</td>
</tr>
<tr>
<td>IBC</td>
<td>International Building Code</td>
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<tr>
<td>ICOS</td>
<td>Information and Condition of Schools</td>
</tr>
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<td>IEBC</td>
<td>International Existing Building Code</td>
</tr>
<tr>
<td>IO</td>
<td>Immediate Occupancy</td>
</tr>
<tr>
<td>LS</td>
<td>Life Safety</td>
</tr>
<tr>
<td>MCE</td>
<td>Maximum Considered Earthquake</td>
</tr>
<tr>
<td>MEP</td>
<td>Mechanical/Electrical/Plumbing</td>
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<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>OSPI</td>
<td>Office of Superintendent of Public Instruction</td>
</tr>
<tr>
<td>PBEE</td>
<td>Performance-Based Earthquake Engineering</td>
</tr>
<tr>
<td>PR</td>
<td>Position Retention</td>
</tr>
<tr>
<td>ROM</td>
<td>Rough Order-of-Magnitude</td>
</tr>
<tr>
<td>SSSSC</td>
<td>School Seismic Safety Steering Committee</td>
</tr>
<tr>
<td>UBC</td>
<td>Uniform Building Code</td>
</tr>
<tr>
<td>URM</td>
<td>Unreinforced Masonry</td>
</tr>
<tr>
<td>USGS</td>
<td>United States Geological Survey</td>
</tr>
<tr>
<td>WF</td>
<td>Wide Flange</td>
</tr>
<tr>
<td>WGS</td>
<td>Washington Geological Survey</td>
</tr>
<tr>
<td>WSSSSAP</td>
<td>Washington State School Seismic Safety Assessments Project</td>
</tr>
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Drawings


1.0 Introduction

1.1 Background

In 2018-2019, the Washington Geological Survey (WGS), a division of the Department of Natural Resources (DNR), led a Washington State School Seismic Safety Assessments Project (WSSSSAP) that seismically and geologically screened 222 school buildings and 5 fire stations across Washington State to better understand the current level of seismic risk of Washington State’s public-school buildings. This first phase of the WSSSSAP was executed with the help of Washington State’s Office of Superintendent of Public Instruction (OSPI) and Reid Middleton, along with their team of structural engineers, architects, and cost estimators.

Building upon the success of Phase 1, WGS, OSPI, and Reid Middleton’s team embarked on Phase 2 of this project to seismically and geologically screen another 339 school buildings and 2 fire stations, mostly located in the high-seismic risk regions of Washington State. Similar to Phase 1, the two main components of Phase 2 of this seismic safety assessments project are: (1) geologic site characterization, and (2) the seismic assessment of buildings. As a part of the seismic assessments, Tier 1 screening of structural systems and nonstructural assessments were performed in accordance with the American Society of Civil Engineers’ (ASCE) Standard 41-17 *Seismic Evaluation and Retrofit of Existing Buildings*. Concept-level seismic upgrades were developed to address the identified deficiencies of a select number of school buildings to evaluate seismic upgrade strategies, feasibilities, and implementation costs.

Seventeen school buildings were selected in consultation with WGS and OSPI to receive concept-level seismic upgrade designs utilizing the ASCE 41 Tier 1 evaluation results. This report documents the concept-level seismic upgrade design for one of those school buildings. The concept-level seismic upgrades will include structural and nonstructural seismic upgrade recommendations, with concept-level sketches and rough order-of-magnitude (ROM) construction costs determined for each building. The 17 school buildings were selected from the list of schools with the intent of representing a variety of regions, building uses, construction eras, and construction materials.

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

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

1.2 Scope of Services

The project is being performed in several distinct and overlapping phases of work. The scope of this report is 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, 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: Field observation efforts were limited to areas and building elements that were readily observable and safely accessible. Observations requiring access to confined spaces, potential hazardous material exposure, access by unsecured ladder, work around energized equipment or mechanical hazards, access to areas requiring Occupational Safety and Health Administration (OSHA) fall-protection, steep or unstable slopes, deteriorated structural assemblies, or other conditions deemed potentially unsafe by the engineer were not performed. Removal of finishes (e.g., gypsum board, lath and plaster, brick veneer, roofing materials) for access to concealed conditions or to expose elements that could not otherwise be visually observed and assessed was not performed. Material testing or sampling was not performed. The ASCE 41 checklist items that were not documented due to access limitations are noted.

1.2.3 Seismic Evaluations and Conceptual Upgrades Design

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

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

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

4. **Cost Estimating:** Through the concept-level seismic upgrades report process, ProDims, LLC, provided opinions of probable construction costs for the concept-level seismic upgrade designs for the selected school buildings. These concept-level seismic upgrade designs and the associated opinions of probable construction costs are intended to be representative samples that can be extrapolated to estimate the overall capital needs of seismically upgrading Washington State schools.

### 1.2.4 Reporting and Documentation

1. **Conceptual Upgrade Design Reports:** Buildings that were selected to receive a conceptual upgrade design will have a report prepared that will include an introduction summarizing the overall findings and recommendations, along with individual sections documenting each building’s seismic evaluation, list of deficiencies, conceptual seismic upgrade sketches and opinions of probable construction costs.

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

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

2.1 ASCE 41 Seismic Evaluation and Retrofit Overview

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

![Flow Chart and Description of ASCE 41 Seismic Evaluation Procedure.](image)

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

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

2.2 Seismic Evaluation and Retrofit Criteria

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

2.2.1 Site Class Definition

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

2.2.2 Port Townsend High School Seismicity

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

The Level of Seismicity is categorized as Very Low, Low, Moderate, or High based on the probabilistic ground accelerations. Ground accelerations and mass generate inertial (seismic) forces within a building (Force = mass x acceleration). Ground acceleration therefore is the
parameter that classifies the level of seismicity. From geographic region to region, as the ground accelerations increase, so does the level of seismicity (from low to high). Where this building is located, the design short-period spectral acceleration, \( S_{DS} \), is 0.90 g, and the design 1-second period spectral acceleration, \( S_{D1} \), is 0.594 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 Port Townsend High School that are considered in this study.

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

<table>
<thead>
<tr>
<th></th>
<th>BSE-1E 20%/50 (225-year Event)</th>
<th>BSE-1N 2/3 of 2,475-year Event</th>
<th>BSE-2E 5%/50 (975-year Event)</th>
<th>BSE-2N 2%/50 (2,475-year Event)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 Seconds</td>
<td>0.683 g</td>
<td>0.2 Seconds 0.90 g</td>
<td>0.2 Seconds 1.111 g</td>
<td>0.2 Seconds 1.35 g</td>
</tr>
<tr>
<td>1.0 Seconds</td>
<td>0.347 g</td>
<td>1.0 Seconds 0.594 g</td>
<td>1.0 Seconds 0.699 g</td>
<td>1.0 Seconds 0.891 g</td>
</tr>
</tbody>
</table>

### 2.2.3 Port Townsend High School Gym Building Structural Performance Objective

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

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

**Knowledge Factor**

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

**ASCE 41 Classified Building Type**

Use of ASCE 41 for seismic evaluations requires buildings to be classified from a group of common building types historically defined in previous seismic evaluation standards (ATC-14, FEMA 310, and ASCE 31-03). The original main gym and locker room areas that were constructed in 1941 is classified in ASCE 41 Table 3-1 as an unreinforced masonry bearing wall building with flexible diaphragms, URM. Unreinforced masonry shear wall buildings (URM) include those that have bearing walls and shear walls constructed of unreinforced masonry with elevated floor and roof framing structural systems consisting of wood framing.

The Auxiliary Gym and Shop area that was modernized in 1984 is classified in ASCE 41 Table 3-1 as a Reinforced Masonry shear wall building with flexible diaphragms, RM1. Reinforced masonry shear wall buildings (RM1) include those that have bearing shear walls constructed of reinforced masonry with elevated floor and roof framing structural systems consisting of wood framing.

**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: 1941
Building Code: Unknown

Number of Stories: 1
Floor Area: 34,112 SF

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

Structural Drawings Available: No

The Port Townsend High School, in Jefferson County, is a public school that serves approximately 375 students in Grades 9 through 12. It is one of the oldest high schools in Washington State, graduating its first class in 1891. The Port Townsend High School Gym/Shop building is a one-story building with mezzanines in the shop area. The building was originally constructed in 1941 with a major renovation and addition in 1984. The original gym and shop areas have URM bearing walls and support a wood-framed, bowstring-trussed roof. The shop replacement at the north end of the building was constructed in 1984. At that time, seismic improvements were made to the existing gym that included out-of-plane URM rosette wall anchors and plywood sheathing overlay over the original tongue-and-groove decking. Existing window and glass-block openings in the URM walls were removed and infilled with wood framing. In 1994, a wood-framed weight room addition with brick veneer was constructed on the east side of the building.

Original construction drawings or structural drawings from the major 1984 modernization were not available to review. However, limited architectural drawings and a separate detail book from that 1984 modernization were available. No drawings of the 1994 weight room addition were available.

3.1.2 Building Use

The original building consists of a multipurpose gymnasium with locker rooms. The 1984 modernization replaced the auxiliary gym and shop areas to the north of the main gym. There is also a weight room addition on the east side of the building that was constructed in 1994.
3.1.3 Structural System

Table 3.1.3-1. Structural System Descriptions.

<table>
<thead>
<tr>
<th>Structural System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Roof</td>
<td>The structural roof system over the original gym and locker rooms consists of plywood sheathing overlay (added in 1984) over existing 2x decking. At the lower roofs of the locker rooms, the 2x decking spans between 6x beams at approximately 8 feet on center that span from exterior URM wall to interior URM wall. Over the gym, the 2x decking spans between timber 6x purlins that span to bowstring trusses spaced at approximately 15 feet on center that clear span the gym and are supported by interior URM walls and pilasters. The roof framing over the auxiliary gym and shop areas north of the main gym consists of plywood sheathing over wood I-joists spanning approximately 22 feet to large GL 8 3/4 glulam beams that clear span to the CMU walls of the auxiliary gym and shop area.</td>
</tr>
<tr>
<td>Structural Floor(s)</td>
<td>The main floor consists of a concrete slab on grade with the exception of wood sheathing on timber floor beams over a partial reinforced concrete basement. The original gym slab thickness is unknown; however, the auxiliary gym and shop areas have 4- and 6-inch-thick slabs on grade, respectively.</td>
</tr>
<tr>
<td>Foundations</td>
<td>Foundations are not visible but appear to be shallow reinforced concrete footings.</td>
</tr>
<tr>
<td>Gravity System</td>
<td>The gravity system of the original gym consists of wood roof framing supported primarily by URM bearing walls founded on conventional spread footings. The gravity system of the auxiliary gym and shop area consists of wood framing supported by reinforced masonry walls founded on conventional spread footings.</td>
</tr>
<tr>
<td>Lateral System</td>
<td>The lateral-force-resisting system consists of URM shear walls, reinforced masonry shear walls, and flexible wood diaphragms at the roof.</td>
</tr>
</tbody>
</table>

3.1.4 Structural System Visual Condition

Table 3.1.4-1. Structural System Condition Descriptions.

<table>
<thead>
<tr>
<th>Structural System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Roof</td>
<td>Roof appears to be in satisfactory condition.</td>
</tr>
<tr>
<td>Structural Floor(s)</td>
<td>Floor system appears to be in satisfactory condition.</td>
</tr>
</tbody>
</table>
### Table 3.1.4-1. Structural System Condition Descriptions.

<table>
<thead>
<tr>
<th>Structural System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundations</td>
<td>Foundations are not visible but there are no visible indications of damage or distress.</td>
</tr>
<tr>
<td>Gravity System</td>
<td>Gravity system appears to be in satisfactory condition.</td>
</tr>
<tr>
<td>Lateral System</td>
<td>Lateral system appears to be in satisfactory condition.</td>
</tr>
</tbody>
</table>

### 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.

<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear Stress Check</td>
<td>Wall shear stress per quick check does not appear to be compliant in north and south URM walls of main gym. Further investigation should be performed. Lateral system strengthening or replacing wood infill of original glass block openings with masonry may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>Wall Anchorage</td>
<td>North and south URM walls of gym did not appear to have sufficient out-of-plane wall anchorage or bracing. East and west URM walls of main gym have visible rosette anchors but only thru bolt to wood ledger. Rosette anchors are visible on east and west exterior URM that likely attach to low roof beams but no drawings or visibility to verify adequacy. Detached details in detail book for 1984 shop area addition did not indicate steel wall anchors for the I-joist bearing on the exterior CMU walls that strong back original URM. Additional out-of-plane anchoring is recommended to mitigate seismic risk.</td>
</tr>
<tr>
<td>Wood Ledgers</td>
<td>Rosette thru-bolt anchor rods induce cross-grain bending at east and west walls of main gym. Additional blocking and strapping is recommended to mitigate seismic risk.</td>
</tr>
<tr>
<td>Proportions</td>
<td>URM walls assumed 12 inches in thickness. North and south URM walls of main gym are approximately 25 to 35 feet tall and braced height-to-thickness ratio exceeds 13. East and west exterior URM walls and east and west URM walls of gym have braced height-to-thickness ratios that are less than 13 and are braced by diaphragms over locker rooms. East, west, and north URM walls of shop area have 8-inch CMU backing walls</td>
</tr>
</tbody>
</table>
Table 3.2.1-1. Identified Structural Seismic Deficiencies Based on Tier 1 Checklists.

<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross Ties</td>
<td>Continuous ties do not appear to be present between north and south walls of main gym. Presence of continuous ties over the auxiliary gym and shop areas in the east and west direction are unknown due to structural drawings not being available. Diaphragm reinforcement, strapping, or strut ties are recommended in the north-south direction of the main gym and in the east-west direction of the auxiliary gym and shop areas to mitigate seismic risk.</td>
</tr>
<tr>
<td>Diagonally Sheathed and Unblocked Diaphragms</td>
<td>Horizontal span of diaphragms exceeds 40 feet but are wood structural panel diaphragms. Further investigation should be performed. Diaphragm reinforcement may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>Beam, Girder, and Truss Supports</td>
<td>No independent secondary columns observed for bowstring trusses in the main gym. Further investigation should be performed. Independent secondary columns for trusses may be appropriate to mitigate seismic risk; however, space to accommodate an additional support in main gym is very limited.</td>
</tr>
</tbody>
</table>

3.2.2 Structural Checklist Items Marked as “U”known

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.

<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mezzanines</td>
<td>Only the exposed mezzanine in the shop area was observed and is laterally supported by masonry shear walls. The three other mezzanines above general storage and on the west side were not observed but appear to have lateral support on at least three sides. However, structural drawings were not available for review and should be further investigated. The liquefaction potential of site soils is unknown at this time given available information. Very low liquefaction potential is identified</td>
</tr>
</tbody>
</table>

Washington State School Seismic Safety Assessments Project
Seismic Upgrades Concept Design Report – Port Townsend School District
Port Townsend High School, Gym Building
June 2021
Reid Middleton
<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquefaction</td>
<td>per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.</td>
</tr>
<tr>
<td>Slope Failure</td>
<td>Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure.</td>
</tr>
<tr>
<td>Surface Fault Rupture</td>
<td>Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.</td>
</tr>
<tr>
<td>Transfer to Shear Walls</td>
<td>Unknown, no structural drawings available to review diaphragm connections to shear walls. Likely noncompliant based on standard of care at time of original construction. Further investigation should be performed. Diaphragm to shear wall strengthening may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>Girder-Column Connection</td>
<td>Bowstring trusses are pocketed into URM walls and bear on pilasters, but positive connection to URM is not visible. Further investigation should be performed. Additional connection hardware may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>Masonry Layup</td>
<td>Original drawings are not available; however, URM walls appear to be 12 inches thick, multiple wythes, and solid. If any future work to the URM walls observes a cavity between the inner and outer wythes, the presence of collar joints should be further investigated.</td>
</tr>
<tr>
<td>Stiffness of Wall Anchors</td>
<td>The connection of the rosette anchors at the east and west exterior URM walls to the 6x beams at the low roofs are unknown. Further investigation should be performed. Additional anchoring may be appropriate to mitigate seismic risk. The rosette anchors of the east and west URM walls of the main gym appear to be taught and stiff to the wood ledger; however, cross-grain bending of ledger should be mitigated.</td>
</tr>
</tbody>
</table>
3.2.3 Nonstructural Seismic Deficiencies

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

<table>
<thead>
<tr>
<th>Deficiency Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagonal or lateral bracing of in-line ducting and equipment in gym, auxiliary gym, and shop areas were not apparent and should be further investigated. Bracing or anchoring of equipment and ducting may be appropriate to mitigate seismic risk.</td>
</tr>
</tbody>
</table>

3.2.4 Nonstructural Checklist Items Marked as “U”known

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>
<thead>
<tr>
<th>Deficiency Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of emergency power was not verified with maintenance or facility staff. If emergency power is used to power life-safety equipment, evaluation of emergency power equipment may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>It is unknown if equipment is mounted on vibration isolators. Further investigation may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>It is unknown if the structure contains natural gas or other hazardous materials. Further investigation of mechanical piping should be performed. Providing shutoff valves may be appropriate to mitigate seismic risk.</td>
</tr>
</tbody>
</table>

Table 3.2.4-1. Identified Nonstructural Checklist Items Marked as Unknown.
<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.</td>
<td>Unknown whether the building has hazardous materials. There may be gas lines present. Further investigation of mechanical piping should be performed. Flexible coupling for piping and ductwork may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>P-1 Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH.</td>
<td>There appear to be a few interior masonry partition walls at the south end of the building and on the west side of the auxiliary gym. However, the presence of bracing of these walls could not be confirmed. This should be further investigated, and bracing may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>P-2 Heavy Partitions Supported by Ceilings. HR-LMH; LS-LMH; PR-LMH.</td>
<td>There appear to be a few interior masonry partition walls at the south end of the building and on the west side of the auxiliary gym. However, the tops of these walls were not observed. This should be further investigated, and bracing may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>C-2 Suspended Gypsum Board. HR-not required; LS-MH; PR-LMH.</td>
<td>It is unknown if the building has suspended gypsum board ceilings. Further investigation should be performed for large areas of suspended gypsum board ceiling or suspended gypsum board ceilings in path of egress. Bracing for suspended gypsum board ceilings may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>LF-1 Independent Support. HR-not required; LS-MH; PR-MH.</td>
<td>It is unclear how much the light fixtures weigh, and light fixtures in ACT ceilings were not observed during our site walk. Further investigation can and should be performed by maintenance staff to see if light fixtures in areas with ACT ceilings are supported independently to the roof or mezzanine structures above by at least two wires at diagonally opposite corners.</td>
</tr>
<tr>
<td>M-1 Ties. HR-not required; LS-LMH; PR-LMH.</td>
<td>Brick veneer occurs at the north exterior wall of the classrooms; however, the limited architectural drawings available do not address anchoring of veneer. Further investigation required.</td>
</tr>
<tr>
<td>M-2 Shelf Angles. HR-not required; LS-LMH; PR-LMH.</td>
<td>There is URM above the main outside entry area at the south end of the building. However, without original drawings it is unclear how this overhead brick is supported. Further investigation should be performed, and supplemental anchoring may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>M-3 Weakened Planes. HR-not required; LS-LMH; PR-LMH.</td>
<td>It is unknown how the masonry veneer is connected to the walls at the north exterior wall of the classrooms; however, brick does not appear to be over windows.</td>
</tr>
</tbody>
</table>
Table 3.2.4-1. Identified Nonstructural Checklist Items Marked as Unknown.

<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-6 Anchorage.</td>
<td>The existing and original exterior URM walls at the east, west, and north side of the auxiliary gym and shop area is backed by CMU walls that were added in the 1984 modernization. However, without structural drawings, it is not known if anchors were installed to tie the CMU backing walls to the exterior URM. Further investigation should be performed. Additional anchoring of the URM walls to the CMU backup walls may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>S-2 Stair Details</td>
<td>No structural drawings were available for review; however the stairs do not appear to be contributing to lateral stiffness to the overall building’s lateral system.</td>
</tr>
<tr>
<td>CF-2 Tall Narrow Contents.</td>
<td>Not able to verify all tall and narrow contents during site investigation. There were instances of bookshelves and cabinets in the shop area. This item is commonly noncompliant for contents meeting the criteria. Brace tops of shelves taller than 6 feet to nearest backing wall or provide overturning base restraint.</td>
</tr>
<tr>
<td>CF-3 Fall-Prone Contents.</td>
<td>Not able to verify all equipment or contents during site investigation. This item is commonly not compliant for contents meeting the criteria. Heavy items on upper shelves and cabinets should be moved down to lower shelves or to the ground or restrained by netting or cabling to avoid becoming falling hazards.</td>
</tr>
<tr>
<td>ME-1 Fall-Prone Equipment.</td>
<td>Suspended units were observed in the shop area with lightly cabled diagonal bracing. This should be further investigated. Additional bracing of overhead equipment may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>ME-3 Tall Narrow Equipment.</td>
<td>Not able to verify during site investigation. Further investigation should be performed. Brace tops of equipment taller than 6 feet to nearest backing wall or provide overturning base restraint.</td>
</tr>
</tbody>
</table>
4.0 Recommendations and Considerations

4.1 Seismic-Structural Upgrade Recommendations

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

4.1.1 URM Infill Strengthening

The original URM walls of the main gym and locker rooms have numerous window and glass-block openings that were infilled with wood framing in the 1984 modernization. In the main gym, the original window and glass-block openings occurred above the lower roofs. Although it appears that the solid and lower portions of the main gym URM walls have sufficient in-plane shear capacity for Life Safety at the BSE-1N, the available URM piers between the upper windows are overstressed. It is recommended that the existing wood infill walls of these openings be removed and replaced with reinforced CMU infills. The amount of infilled openings can be further analyzed and possibly reduced; however, for the purpose of this conceptual upgrade design and estimate, it is assumed that all the upper window and glass-block openings will be required to be infilled. See Figures 3 and 4, and Detail 1 of Figure 5 in Appendix B.

4.1.2 Strongbacking of Tall URM Walls In the Main Gym

Based on the existing 1984 architectural drawings, it appears that the original north and south walls of the main gym are 12-inch-wide URM. The URM walls were observed to be approximately 25 feet tall at the low end of the bowstring roof and 35 feet tall at the peak of the bowstring roof, and they exceed the height-to-thickness ratios of ASCE 41-17. Available details from the 1984 modernization do not indicate that out-of-plane bracing or strongbacking was installed to support these tall URM walls out-of-plane. Furthermore, the original glass-block openings in the north and south walls of the main gym also decrease the URM’s ability to span vertically to the roof diaphragms. To maintain the exterior brick aesthetic and envelope, it is recommended that strongback HSS columns be added to the south URM gym wall on the north face and extend up to the underside of the bowstring roof diaphragm. See the Main Floor Plan of Figure 1 and the South Elevation in Figure 3 of Appendix B for locations. Due to the tall height required to span to the roof diaphragm, intermediate bracing of these strongback steel columns will likely be required. This could be accomplished with diagonal steel bracing and struts within the first truss bay.
At the north URM wall of the main gym, the incoming roof from the auxiliary gym frames into
the URM wall approximately 23 to 26 feet above finish floor. Also, a main HVAC duct and
equipment platform for the main gym runs along the south face of the north URM wall.
Therefore, it is recommended that the HSS strongbacks be installed in the auxiliary gym on the
north face of the north URM gym wall and connect to the auxiliary gym roof diaphragm.

4.1.3 Out-of-Plane Wall Anchorage of URM and CMU Walls

The details for the rosette anchors installed in the 1984 modernization are not known, and they
may no longer be adequate for out-of-plane seismic loading to meet today’s building codes. It is
recommended that additional anchors be installed to the exterior and interior URM walls that
support each end of the low roof 6x beams as shown in Detail 1 of Figure 4 of Appendix B. See
Figure 2 for extents. These added out-of-plane anchors will help ensure the 12-inch URM walls
maintain a height-to-width ratio of less than 13 to meet the acceptance criteria in ASCE 41-17
Chapter 16.

The tops of the existing CMU walls that are the east and west exterior walls of the shop and
auxiliary gym areas do not appear to have positive out-of-plane wall connections to the existing
TJI roof joists that bear on these walls. The 1984 architectural building sections show that the
8-inch CMU walls that were added in 1984 were installed as backing walls to the original
12-inch URM walls that remained, making these walls appreciably heavy seismically. It is
recommended that out-of-plane bracing be added along the east and west exterior walls that are
north of the main gym as shown in Detail 3 of Figure 5 in Appendix B. See Figure 2 for extents.
Concurrent to the installation of the out-of-plane bracing, it is also recommended that the in-
plane diaphragm to shear wall load path be further investigated and strengthened as shown in
Detail 3.

4.1.4 Additional Support for Low Roof Diaphragms Over Locker Rooms

The low-roof diaphragms over the locker rooms that laterally support the east and west exterior
URM walls and brace the tall URM walls of the main gym have narrow 5:1 aspect ratios and
insufficient strength and stiffness to span over 100 feet to transverse URM shear walls. This
long of a flexible diaphragm span also amplifies the seismic demands on out-of-plane wall
anchors and increases the risk to the existing anchors installed in the 1984 upgrade, which
thereby increases the risk to the integrity of the URM walls, particularly the tall URM walls of
the main gym. To mitigate this risk, it is recommended that shear walls that serve as cross walls
be added to reduce the diaphragm spans and help distribute the lateral loads to the foundation.
See Figure 1 of Appendix B for possible locations based on the wall layout shown in the 1984
architectural floor plan. This layout of additional shear walls would reduce the diaphragm aspect
ratios to no greater than 2:1, which would be a significant improvement to the diaphragm
stiffness and demands on the diaphragm stresses and out-of-plane wall anchorage demands.

4.1.5 Avoiding Cross-Grain Bending of Upper Gym Roof Ledgers

Rosette anchors near the top of the east and west walls of the main gym are visible, as are their
connections to the wood ledger on the inside face of the URM walls. However, the rosette
anchor rods are not directly transferring the out-of-plane wall loading to the roof diaphragm through tension anchor hardware and will likely induce cross-grain bending stresses into the wood ledger during a seismic event. To avoid a brittle cross-grain bending failure of the ledgers, and thereby the out-of-plane wall anchorage support, it is recommended that tension anchor hardware such as HDU hold-downs or LTT/HTT straps be connected to each rosette anchor rod and fastened to beveled engineering wood blocking that is attached to the underside of the existing tongue-and-groove decking. See Detail 1 of Figure 5 in Appendix B.

4.1.6 Secondary Support for Bowstring Trusses and Mezzanine Beam

The existing bowstring trusses are pocketed in the east and west URM walls of the main gym and bear on pilasters. However, it is unknown how the trusses are connected to the URM walls. During large seismic events, URM walls and pilasters are susceptible to brittle failures and loss of masonry capacity, which would consequently result in loss of vertical support for the bowstring trusses that clear span over 90 feet across the main gym. Therefore, it is recommended that secondary and supplemental vertical support be provided at each end of the bowstring trusses. HSS 7x4 columns in a flatwise orientation against the URM walls is recommended to provide secondary support for the bowstring trusses. See Figure 1 in Appendix B.

4.1.7 Continuous Cross-Ties between Diaphragm Chords

Continuous cross-ties are not apparent in the north-south direction of the upper roof diaphragm of the main gym and in the north-south direction of the auxiliary/shop roof diaphragm. In the main gym, it is recommended that the existing 6x purlins that span between the bowstring trusses be strapped together for the entire length of the main gym. See Figure 1 in Appendix B for extents. In the auxiliary gym and shop area, it is recommended that the main glulam 8-3/4-inch girders be tied together to serve as continuous cross-ties as shown in Figure 2 and Detail 2 of Figure 5 in Appendix B.

At the storage mezzanine in the shop area, the main girder that supports the storage mezzanine framing bears at a re-entrant corner of a CMU wall. Although the beam is connected to the CMU wall with a steel embed plate, this condition is susceptible and often damaged during sizeable seismic events and could lead to localized masonry failure or loss of support for this 30-foot-long beam that supports half of the storage mezzanine above. A supplemental column is recommended here as well for the secondary support of this mezzanine beam. See Figure 2 of Appendix B for location.

4.2 Foundations and Geotechnical Considerations

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

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

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

4.3 Tsunami Considerations

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

4.4 Nonstructural Recommendations and Considerations

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

4.4.1 Architectural Systems

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

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.

**Accessibility**

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

**Hazardous Materials Survey**

It is recommended that all existing construction be surveyed for the presence of hazardous materials. Elements such as floor tile, adhesive, and pipe insulation could contain asbestos. Lead may be present in paint and light fixtures may contain PCB ballasts. A hazardous materials survey and abatement of the buildings should be performed prior to the start of any demolition work.

**URM Infill Strengthening**

Where windows are shown to be infilled with reinforced CMU, an exterior finish system (EFS) should be applied to the exterior and painted. It is unclear how the local jurisdiction might apply the Energy Code for a project of this type and purpose. If the infilled portions of wall are required to meet the current Energy Code, the interior should be furred out with 6-inch metal studs, R-21 insulation, and 5/8-inch gypsum wallboard, painted. If Energy Code compliance is not required, the CMU could be painted. For the purposes of this report, Energy Code compliance is assumed, but this should be verified by the design team.

**Strongbacking of Tall URM Walls In the Main Gym**

Surface-mounted electrical conduit and bleachers will need to be removed and replaced to allow for installation of vertical strongbacks along the south wall of the main Gymnasium. Steel strongbacks should be painted, and the bleachers should be modified to accommodate the new strongbacks.
Along the south wall of the auxiliary gym, crash mats and one section of direct-applied acoustic ceiling tile will need to be removed and reinstalled to allow for installation of new vertical strongbacks. The steel strongbacks should be furred out with metal framing and gypsum wallboard to avoid causing injury.

**Out of-Plane Wall Anchorage of URM and CMU Walls**

The suspended gypsum wallboard ceiling and lighting in the main gymnasium’s boy’s and girl’s locker rooms will need to be removed to install out-of-plane anchoring at the low roof 6x beams. The ceiling should be replaced with a suspended gypsum wallboard ceiling and 1 x 4 recessed LED light fixtures.

Ceilings and lights in the toilet rooms and classrooms along the east and west exterior walls of the auxiliary gym and shop will need to be removed to allow access for installation of out-of-plane anchorage of the CMU walls to TJI roof joists. The ceiling in the toilet room areas should be replaced with suspended gypsum wallboard and 1 x 4 LED light fixtures. The ceilings in classroom areas should be replaced with a suspended acoustical ceiling system and 2 x 4 recessed LED light fixtures. At the shop, a one-panel-length section of direct-applied acoustical ceiling panel should be removed and replaced in-kind to allow for installation of the anchors.

**Additional Support for Low Roof Diaphragms Over Locker Rooms**

Where new plywood sheathing is called for on existing stud walls, the existing wall finishes will need to be removed and replaced with new 5/8-inch gypsum wallboard, except for toilet room and showers, which should receive 1/2-inch tile backerboard and ceramic tile. Existing electrical outlets, switches, and other items will need to be reinstalled in the new stud shear walls. Paint and new wall base should be installed to match adjacent wall finishes. The District might consider installation of acoustical insulation in the stud cavity to mitigate sound transfer between rooms, where appropriate. Floor finishes should not require replacement provided they are protected. It is recommended that this work be accomplished in conjunction with the out-of-plane wall anchorage work, while the ceilings are removed.

**Avoiding Cross-Grain Bending of Upper Gym Roof Ledgers**

Out-of-plane anchoring at existing rosettes in the main gymnasium may be accomplished from inside the gym. Anchors and blocking should be painted to match the existing bowstring trusses. The gym floor should be protected during construction.

**Secondary Support for Bowstring Trusses**

Where supplemental support columns are indicated beneath each bowstring truss along the east and west walls of the gymnasium, the steel columns should be furred out with metal framing and gypsum wallboard. The bottom 8 feet of the east and west walls should be furred out along their entire length to conceal the columns and provide a solid surface on which existing crash pads may be reinstalled.
Continuous Cross-Ties Between Diaphragm Chords

Installation of purlin straps in the main gymnasium may be accomplished from inside the gym. Straps should be painted to match the existing purlins. The gym floor should be protected during construction.

Glulam beam tie connections may be accomplished from inside the auxiliary gym and shop. Straps should be painted to match the glulam beams and the floor should be protected during construction. The ceiling in the physical conditioning classroom should be verified. If the existing ceiling is beneath the level of the glulam beams, a 4-foot strip of panels should be removed and replaced to allow access to the glulam beam above.

Contents and Furnishings

Buildings often contain various tall and narrow furniture, such as shelving and storage units, that are freestanding away from any backing walls. High book shelving, for example, can be highly susceptible to toppling if not anchored properly to the backing walls or to each other, and can become a life safety hazard. It is recommended that maintenance and facility staff verify that the tops of the shelving units are braced or anchored to the nearest backing wall or provide overturning base restraint. Heavy items weighing more than 20 pounds on upper shelves or cabinet furniture should also be restrained by netting or cabling to avoid becoming falling hazards to students or faculty below.

4.4.2 Mechanical Systems

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

4.5 Opinion of Probable Conceptual Seismic Upgrades Costs

An opinion of probable project costs of the concept-level seismic upgrade recommendations provided in this report is included in Appendix C. The input of the scope of work to develop the probable costs is the Tier 1 checklists and the preliminary concept-level seismic upgrades design recommendations and sketches. These preliminary concept-level design sketches depict a design concept that could be implemented to improve the seismic safety of the building structure. It is important to note the preliminary seismic upgrades design concept is based on the results of the Tier 1 seismic screening checklists and engineering design judgement and has not been substantiated by detailed structural analyses and calculations.
For this preliminary opinion of probable costs the estimate of construction costs of the preliminary scope of work is developed based on current 1st Quarter (1Q) 2021 costs. Costs are then escalated to 4Q 2022 at 6% per year of the baseline cost estimate. Costs are developed based on the Tier 1 checklist, concept-level seismic upgrade design sketches, and project narratives.

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

The estimated total cost (construction costs plus soft costs) to mitigate the deficiencies identified in the Tier 1 checklists of the Port Townsend High School Gym ranges between approximately $1.68M and $3.15M (-20%/+50%). The baseline estimated total cost to seismically upgrade this building is approximately $2.1M. On a per-square-foot basis, the baseline seismic upgrade cost is estimated to be approximately $61 per square foot in 4Q 2022 dollars, with a range between $49 per square foot and $92 per square foot.

### 4.5.1 Opinion of Probable Construction Costs

This conceptual opinion of probable construction cost includes labor, materials, equipment, and scope contingency, general contractor general conditions, home office overhead, and profit. This is based on a public sector design-bid-build project delivery method. Project delivery methods such as negotiated, state of Washington GC/CM, and design-build are not the basis of the construction costs. Owner’s soft costs are described below in section 4.5.2.

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

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

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

These soft costs have been included in the opinion of probable costs at 40% of the baseline probable construction cost for the seismic upgrade of this building. The soft costs used for the projects that total to 40% are:

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

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

4.5.3 Escalation Rate

A 6.0%/year construction cost escalation rate is used for planning purposes for the conceptual estimates. The rate is compounded annually to the projected midpoint of construction. This rate is representative of the escalation based on the previous five years of market experience of construction costs throughout the state of Washington and is projected going forward for these projects. This rate is calculated to the 4th Quarter of 2022 as an allowance for planning purposes. The actual construction schedule for the project is to be determined and we recommend the escalation cost be revised based on revised construction schedule using the 6%/year rate.
Table 4.5.3-1. Seismic Upgrades Opinion of Probable Construction Costs.

<table>
<thead>
<tr>
<th>Building</th>
<th>FEMA Bldg Type</th>
<th>ASCE 41 Level of Seismicity / Site Class</th>
<th>Structural Performance Objective</th>
<th>Bldg Gross Area</th>
<th>Estimated Seismic Upgrade Cost Range $/SF (Total)</th>
<th>Estimated Seismic Upgrade Cost/SF (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Townsend High School Gym Bldg</td>
<td>URM</td>
<td>High / D</td>
<td>Structural</td>
<td></td>
<td>$23 (800K) - $44 (1.50M)</td>
<td>$29 (999K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>34,112 SF</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nonstructural</td>
<td></td>
<td>$12 (400K) - $22 (750K)</td>
<td>$15 (500K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Life Safety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td></td>
<td>$35 (1.20M) - $66 (2.25M)</td>
<td>$44 (1.50M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>34,112 SF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated Soft Costs:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$600K</td>
<td></td>
</tr>
</tbody>
</table>

Total Estimated Project Costs: $2.10M

W: Wood-Framed; URM: Unreinforced Masonry; RM: Reinforced Masonry; C: Reinforced Concrete; PC: Precast concrete; S: Steel-framed
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1. Port Townsend, Port Townsend High School, Gym

1.1 Building Description

- Building Name: Gym
- Facility Name: Port Townsend High School
- District Name: Port Townsend
- ICOS Latitude: 48.118
- ICOS Longitude: -122.768
- ICOS County/District ID: 16050
- ICOS Building ID: 13775
- ASCE 41 Bldg Type: URM
- Enrollment: 366
- Gross Sq. Ft.: 34,112
- Year Built: 1941
- Number of Stories: 1
- SXS BSE-2E: 1.066
- SX1 BSE-2E: 0.630
- ASCE 41 Level of Seismicity: High
- Site Class: D
- V_{S30}(m/s): 355
- Liquefaction Potential: very low
- Tsunami Risk: Extremely Low
- Structural Drawings Available: Partial
- Evaluating Firm: Reid Middleton, Inc.

Port Townsend High School, in Jefferson County, is a public school that serves approximately 375 students in grades 9-12. It is one of the oldest high schools in Washington State, graduating its first class in 1891. The Port Townsend High School Gym/Shop building is a one-story building with mezzanines in the shop area that was originally constructed in 1941 with a major renovation and addition taking place in 1984. The original gym and shop areas has URM bearing walls and supports a wood-framed bow-string trussed roof. The shop replacement at the north end of the building was constructed in 1984. At that time seismic improvements were made to the existing gym that remained that included out-of-plane URM rosette wall anchors, plywood wood sheathing overlay.

Original construction drawings or structural drawings from the major 1984 modernization were not available to review. However, limited architectural drawings and a separate detail book from that 1984 modernization were available.
1.1.1 Building Use

The building consists of a multipurpose gymnasium floor with locker rooms, shop areas to the north and a weight room addition on the east side.

1.1.2 Structural System

Table 1.1-1. Structural System Description of Port Townsend High School

<table>
<thead>
<tr>
<th>Structural System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Roof</td>
<td>The structural roof system over the original gym and locker rooms consists of plywood sheathing overlay (added in 1984) over existing 2x decking. At the lower roofs of the locker rooms, the 2x decking spans between 6x beams at approximately 8 feet on center that span from exterior URM wall to interior URM wall. Over the gym, the 2x decking spans between timber purlins that span to bow string trusses spaced at approximately 15 feet on center that clear span the gym and are supported by interior URM walls and pilasters. The roof framing over the auxiliary gym and shop areas north of the main gym consists of plywood sheathing over wood I-joists spanning approximately 22 feet to large GL 8 3/4 glulam beams that clear span to the CMU walls of the auxiliary gym and shop area.</td>
</tr>
<tr>
<td>Structural Floor(s)</td>
<td>The main floor consists of a concrete slab-on-grade with the exception of wood sheathing on timber floor beams over a partial reinforced concrete basement. The original gym slab thickness is unknown, however the aux gym and shop areas have a 4-inch and 6-inch thick slab on grade respectively.</td>
</tr>
<tr>
<td>Foundations</td>
<td>Foundations are not visible but appear to be shallow reinforced concrete footings.</td>
</tr>
<tr>
<td>Gravity System</td>
<td>The gravity system of the original gym consists of wood roof framing supported primarily by unreinforced masonry bearing walls founded on conventional spread footings. The gravity system of the auxiliary gym and shop area consists of wood framing supporting by reinforced masonry walls founded on conventional spread footings.</td>
</tr>
<tr>
<td>Lateral System</td>
<td>The lateral force-resisting system consists of unreinforced masonry shear walls, reinforced masonry shear walls and flexible wood diaphragms at the roof.</td>
</tr>
</tbody>
</table>

1.1.3 Structural System Visual Condition

Table 1.1-2. Structural System Condition Description of Port Townsend High School

<table>
<thead>
<tr>
<th>Structural System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Roof</td>
<td>Roof appears to be in satisfactory condition.</td>
</tr>
<tr>
<td>Structural Floor(s)</td>
<td>Floor system appears to be in satisfactory condition.</td>
</tr>
<tr>
<td>Foundations</td>
<td>Foundations are not visible but there are no visible indications of damage or distress.</td>
</tr>
<tr>
<td>Gravity System</td>
<td>Gravity system appears to be in satisfactory condition.</td>
</tr>
<tr>
<td>Lateral System</td>
<td>Lateral system appears to be in satisfactory condition.</td>
</tr>
</tbody>
</table>
Photos:

Figure 1-1. Gym/Shop Building, North Elevation (From 2018)

Figure 1-2. Gym/Shop Building, North Elevation (From 2018)
Figure 1-5. Gym/Shop Building, Typical Roof Framing (From 2018)
Figure 1-6. Main Gym Trusses Supported by URM
Figure 1-7. Ledger Connection at Main Gym

Figure 1-8. Tall South URM Wall of Main Gym
Figure 1-9. Shop Area at North End of Bldg
Figure 1-10. Auxiliary Gym
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>
<thead>
<tr>
<th>Deficiency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear Stress Check</td>
<td>Wall shear stress is not compliant for the N &amp; S URM walls of main gym due to original band of openings above the lower roof. The stress check of the solid lengths of URM wall below, as well as the URM walls in the longitudinal direction are less than 30 psi. Lateral system strengthening or replacing wood infill of original glass block openings with masonry in the upper N &amp; S walls of the main gym is recommended to mitigate seismic risk.</td>
</tr>
<tr>
<td>Wall Anchorage</td>
<td>N &amp; S URM walls of gym did not appear to have sufficient out of plane wall anchorage or bracing. E &amp; W URM walls of main gym have visible rosette anchors but only thru bolt to wood ledger. Rosettes anchors are visible on E &amp; W exterior URM that likely attach to low roof beams but no drawings or visibility to verify adequacy. Detached details in detail book for 1984 shop area addition did not indicate steel wall anchors for the I-joist bearing on the exterior CMU walls that strong back original URM. Additional out-of-plane anchoring is recommended to mitigate seismic risk.</td>
</tr>
<tr>
<td>Wood Ledgers</td>
<td>Rosette thru bolt anchor rods induce cross-grain bending at E&amp;W walls of main gym. Additional blocking and strapping is recommended to mitigate seismic risk.</td>
</tr>
<tr>
<td>Proportions</td>
<td>URM walls assumed 12 inches in thickness. N &amp; S URM walls of main gym are approximately 25 -35 feet tall and braced height to thickness ratio exceeds 13. E &amp; W exterior URM walls and E &amp; W URM walls of gym have raced height to thickness ratio that are less than 13 and are braced by diaphragms over locker rooms. E, W, &amp; N URM of shop area have 8-inch CMU backing walls that were added in 1984. Strong backing or intermediate bracing of N &amp; S URM walls of main gym is recommended to mitigate seismic risk.</td>
</tr>
<tr>
<td>Cross Ties</td>
<td>Continuous ties do not appear to be present between N &amp; S walls of main gym. Presence of continuous ties over the aux gym and shop areas is the E &amp; W direction are unknown due to no structural drawings being available. Diaphragm reinforcement, strapping, or strut ties is recommended in the N &amp; S direction of the main gym, to the main GL girders in the N &amp; S of the aux gym and shop areas, and in the E &amp; W direction of the aux gym and shop areas to mitigate seismic risk.</td>
</tr>
<tr>
<td>Diagonally Sheathed and Unblocked Diaphragms</td>
<td>Horizontal span of diaphragms exceed 40 feet but are wood structural panel diaphragms. Further investigation should be performed. Diaphragm reinforcement may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>Beam</td>
<td>Girder, and Truss Supports, No independent secondary columns observed for bowstring trusses in main gym. Further investigation should be performed. Independent secondary columns for trusses may be appropriate to mitigate seismic risk, however space to accommodate an additional support in main gym is very limited.</td>
</tr>
</tbody>
</table>
1.2.2 Structural Checklist Items Marked as ‘Unknown’

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

Table 1-4. Identified Structural Checklist Items Marked as Unknown for Port Townsend Port Townsend High School Gym

<table>
<thead>
<tr>
<th>Unknown Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mezzanines</td>
<td>Only the exposed mezzanine in the shop area was observed and is laterally supported by masonry shear walls. The 3 other mezzanines above general storage and on the west side were not observed but appear to have lateral support on at least 3 sides. However structural drawings were not available for review and should be further investigated.</td>
</tr>
<tr>
<td>Liquefaction</td>
<td>The liquefaction potential of site soils is unknown at this time given available information. Very low liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.</td>
</tr>
<tr>
<td>Slope Failure</td>
<td>Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure.</td>
</tr>
<tr>
<td>Surface Fault Rupture</td>
<td>Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.</td>
</tr>
<tr>
<td>Transfer to Shear Walls</td>
<td>Unknown, no structural drawings available to review diaphragm connections to shear walls. Likely noncompliant based on standard of care at time of original construction. Further investigation should be performed. Diaphragm to shear wall strengthening may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>Girder-Column Connection</td>
<td>Bow string trusses are pocketed into URM walls and bear on pilasters but positive connection to URM is not visible. Further investigation should be performed. Additional connection hardware may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>Masonry Layup</td>
<td>Original drawings are not available, however URM walls appear to be 12 inches thick, multiple wythes, and solid. If any future work to the URM walls observes a cavity between the inner and outer wythes, the presence of collar joints should be further investigated.</td>
</tr>
<tr>
<td>Stiffness of Wall Anchors</td>
<td>The connection of the rosette anchors at the E &amp; W exterior URM walls to the 6x beams at the low roofs are unknown. Further investigation should be performed. Additional anchoring may be appropriate to mitigate seismic risk. The rosette anchors of the E &amp; W URM walls of the main gym appear to be taught and stiff to the wood ledger, however cross-grain bending of ledger should be mitigated.</td>
</tr>
</tbody>
</table>
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>
<thead>
<tr>
<th>Deficiency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-2 In-Line Equipment, HR</td>
<td>Diagonal or lateral bracing of in-line ducting and equipment in gym, aux gym, and shop areas were not apparent and should be further investigated. Bracing or anchoring of equipment and ducting may be appropriate to mitigate seismic risk.</td>
</tr>
</tbody>
</table>

Table 1-5. Identified Nonstructural Seismic Deficiencies for Port Townsend Port Townsend High School Gym
1.3.2 Nonstructural Checklist Items Marked as 'U'unknown

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

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

Table 1-6. Identified Nonstructural Checklist Items Marked as Unknown for Port Townsend Port Townsend High School Gym

<table>
<thead>
<tr>
<th>Unknown Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSS-3</td>
<td>Emergency Power. HR-not required; LS-LMH; PR-LMH. Use of emergency power was not verified with maintenance or facility staff. If emergency power is used to power life-safety equipment, evaluation of emergency power equipment may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>HM-1</td>
<td>Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH. It is unknown if equipment is mounted on vibration isolators. Further investigation may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>HM-4</td>
<td>Shutoff Valves. HR-MH; LS-MH; PR-MH. It is unknown if the structure contains natural gas or other hazardous materials. Further investigation of mechanical piping should be performed. Providing shutoff valves may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>HM-5</td>
<td>Flexible Couplings. HR-LMH; LS-LMH; PR-LMH. Unknown whether the building has hazardous materials. There may be gas lines present. Further investigation of mechanical piping should be performed. Flexible coupling for piping and ductwork may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>P-1</td>
<td>Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH. There appear to be a few interior masonry partition walls at the south end of the building and on the west side of the auxiliary gym. However the presence of bracing of these walls could not be confirmed. This should be further investigated and bracing may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>P-2</td>
<td>Heavy Partitions Supported by Ceilings. HR-LMH; LS-LMH; PR-LMH. There appear to be a few interior masonry partition walls at the south end of the building and on the west side of the auxiliary gym. However the tops of these walls were not observed. This should be further investigated and bracing may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>C-2</td>
<td>Suspended Gypsum Board. HR-not required; LS-MH; PR-LMH. It is unknown if the building has suspended gypsum board ceilings. Further investigation should be performed for large areas of suspended GWB ceilings or suspended GWB ceilings in path of egress. Bracing for suspended GWB ceilings may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>LF-1</td>
<td>Independent Support. HR-not required; LS-MH; PR-MH. It is unclear how much the light fixtures weigh and light fixtures in ACT ceilings were not observed during our site walk. Further investigation can and should be performed by maintenance staff to see if light fixtures in areas with ACT ceilings are supported independently to the roof or mezzanine structures above by at least two wires at diagonally opposite corners.</td>
</tr>
<tr>
<td>M-1</td>
<td>Ties. HR-not required; LS-LMH; PR-LMH. Brick veneer occurs at the north exterior wall of the classrooms however limited architectural drawings available does not address anchoring of veneer. Further investigation required.</td>
</tr>
<tr>
<td>M-2</td>
<td>Shelf Angles. HR-not required; LS-LMH; PR-LMH. There is URM above the main outside entry area at the south end of the building. However without original drawings it is unclear how this overhead brick is supported. Further investigation should be performed and supplemental anchoring may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>M-3</td>
<td>Weakened Planes. HR-not required; LS-LMH; PR-LMH. It is unknown how the masonry veneer is connected to the walls at the north exterior wall of the classrooms however brick does not appear to be over windows.</td>
</tr>
<tr>
<td>M-6</td>
<td>Anchorage. HR-not required; LS-MH; PR-MH. The existing and original exterior URM walls at the east, west, and north side of the aux gym and shop area is backed by CMU walls that were added in the 1984 modernization. However without structural drawings, it is not known if anchors were installed to tie the CMU backing walls to the exterior URM. Further investigation should be performed. Additional anchoring of the URM walls to the CMU backup walls may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>Unknown Item</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>S-2 Stair Details. HR-not required; LS-LMH; PR-LMH.</td>
<td>No structural drawings available for review, however the stairs do not appear to be contributing to lateral stiffness to the overall building’s lateral system.</td>
</tr>
<tr>
<td>CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.</td>
<td>Not able to verify all tall and narrow contents during site investigation. There were instances of book shelves and cabinets in the shop area. This item is commonly noncompliant for contents meeting the criteria. Brace tops of shelves taller than 6 feet to nearest backing wall or provide overturning base restraint.</td>
</tr>
<tr>
<td>CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.</td>
<td>Not able to verify all equipment or contents during site investigation. This item is commonly not compliant for contents meeting the criteria. Heavy items on upper shelves and cabinets should be moved down to lower shelves or to the ground, or restrained by netting or cabling to avoid becoming falling hazards.</td>
</tr>
<tr>
<td>ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.</td>
<td>Suspended units were observed in the shop area with lightly cabled diagonal bracing. This should be further investigated. Additional bracing of overhead equipment may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.</td>
<td>Not able to verify during site investigation. Further investigation should be performed. Brace tops of equipment taller than 6 feet to nearest backing wall or provide overturning base restraint.</td>
</tr>
</tbody>
</table>
Port Townsend, Port Townsend High School, Gym

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

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
<th>EVALUATION STATEMENT</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Path</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Roof diaphragms are continuous and connected to the masonry shear walls and the shear walls are continuous to the foundations.</td>
</tr>
<tr>
<td>Adjacent Buildings</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>It does not appear that there are any immediately adjacent structures.</td>
</tr>
<tr>
<td>Mezzanines</td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Only the exposed mezzanine in the shop area was observed and is laterally supported by masonry shear walls. The 3 other mezzanines above general storage and on the west side were not observed but appear to have lateral support on at least 3 sides. However structural drawings were not available for review and should be further investigated.</td>
</tr>
</tbody>
</table>

Building System - Building Configuration

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
<th>EVALUATION STATEMENT</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak Story</td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>The gym building is a one-story building.</td>
</tr>
<tr>
<td>Soft Story</td>
<td>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)</td>
<td>X</td>
<td>The gym building is a one-story building.</td>
<td></td>
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</tr>
<tr>
<td>------------</td>
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</tr>
<tr>
<td>Vertical Irregularities</td>
<td>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)</td>
<td>X</td>
<td>Vertical elements appear to be continuous to the foundation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geometry</td>
<td>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)</td>
<td>X</td>
<td>The gym building is a one-story building.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>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)</td>
<td>X</td>
<td>The gym building is a one-story building.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Torsion</td>
<td>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)</td>
<td>X</td>
<td>There does not appear to be a torsional irregularity. Roof diaphragms are flexible and are supported on each of the 4 sides.</td>
<td></td>
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</tr>
</tbody>
</table>

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

**Geologic Site Hazards**

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
<th>EVALUATION STATEMENT</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquefaction</td>
<td>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)</td>
<td>X</td>
<td>The liquefaction potential of site soils is unknown at this time given available information. Very low liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope Failure</td>
<td>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)</td>
<td>X</td>
<td>Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure.</td>
<td></td>
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</tr>
</tbody>
</table>
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)

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
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<th>N/A</th>
<th>U</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overturning</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>The ratio of least horizontal dimension to height exceeds 0.6Sa.</td>
</tr>
<tr>
<td>Ties Between Foundation Elements</td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Likely compliant as restraint is provided by ground floor slab.</td>
</tr>
</tbody>
</table>

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

**Foundation Configuration**
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

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
<th>EVALUATION STATEMENT</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redundancy</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Wall shear stress is not compliant for the N &amp; S URM walls of main gym due to original band of openings above the lower roof. The stress check of the solid lengths of URM wall below, as well as the URM walls in the longitudinal direction are less than 30 psi. Lateral system strengthening or replacing wood infill of original glass block openings with masonry in the upper N &amp; S walls of the main gym is recommended to mitigate seismic risk.</td>
</tr>
<tr>
<td>Shear Stress Check</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Connections

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
<th>EVALUATION STATEMENT</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
<th>COMMENT</th>
</tr>
</thead>
</table>

Port Townsend, Port Townsend High School, Gym ASCE 41 Tier 1 Summary
Washington State School Seismic Safety Assessments Project
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Anchorage</td>
<td>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)</td>
<td>N &amp; S URM walls of gym did not appear to have sufficient out-of-plane wall anchorage or bracing. E &amp; W URM walls of main gym have visible rosette anchors but only thru bolt to wood ledger. Rosettes anchors are visible on E &amp; W exterior URM that likely attach to low roof beams but no drawings or visibility to verify adequacy. Detached details in detail book for 1984 shop area addition did not indicate steel wall anchors for the I-joist bearing on the exterior CMU walls that strong back original URM. Additional out-of-plane anchoring is recommended to mitigate seismic risk.</td>
</tr>
<tr>
<td>Wood Ledgers</td>
<td>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)</td>
<td>Rosette thru bolt anchor rods induce cross-grain bending at E&amp;W walls of main gym. Additional blocking and strapping is recommended to mitigate seismic risk.</td>
</tr>
<tr>
<td>Transfer to Shear Walls</td>
<td>Diaphragms are connected for transfer of seismic forces to the shear walls. (Tier 2: Sec. 5.7.2; Commentary: Sec. A.5.2.1)</td>
<td>Unknown, no structural drawings available to review diaphragm connections to shear walls. Likely noncompliant based on standard of care at time of original construction. Further investigation should be performed. Diaphragm to shear wall strengthening may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>Girder-Column Connection</td>
<td>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)</td>
<td>Bow string trusses are pocketed into URM walls and bear on pilasters but positive connection to URM is not visible. Further investigation should be performed. Additional connection hardware may be appropriate to mitigate seismic risk.</td>
</tr>
</tbody>
</table>
### High Seismicity
(Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

#### Seismic-Force-Resisting System

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
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<th>C</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Proportions</strong></td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>URM walls assumed 12 inches in thickness. N &amp; S URM walls of main gym are approximately 25 -35 feet tall and braced height to thickness ratio exceeds 13. E &amp; W exterior URM walls and E &amp; W URM walls of gym have raced height to thickness ratio that are less than 13 and are braced by diaphragms over locker rooms. E, W, &amp; N URM of shop area have 8-inch CMU backing walls that were added in 1984. Strong backing or intermediate bracing of N &amp; S URM walls of main gym is recommended to mitigate seismic risk.</td>
</tr>
<tr>
<td><strong>Masonry Layup</strong></td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Original drawings are not available, however URM walls appear to be 12 inches thick, multiple wythes, and solid. If any future work to the URM walls observes a cavity between the inner and outer wythes, the presence of collar joints should be further investigated.</td>
</tr>
</tbody>
</table>

#### Diaphragms (Stiff or Flexible)

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
<th>EVALUATION STATEMENT</th>
<th>C</th>
<th>NC</th>
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<th>U</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Openings at Shear Walls</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>There does not appear to be any diaphragm openings adjacent to shear walls.</td>
</tr>
<tr>
<td>Openings at Exterior Masonry Shear Walls</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>There does not appear to be any openings adjacent to exterior shear walls.</td>
</tr>
</tbody>
</table>

#### Flexible Diaphragms

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
<th>EVALUATION STATEMENT</th>
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</tr>
</thead>
</table>
### Cross Ties
There are continuous cross ties between diaphragm chords. (Tier 2: Sec. 5.6.1.2; Commentary: Sec. A.4.1.2) Continuous ties do not appear to be present between N & S walls of main gym. Presence of continuous ties over the aux gym and shop areas is the E & W direction are unknown due to no structural drawings being available. Diaphragm reinforcement, strapping, or strut ties is recommended in the N & S direction of the main gym, to the main GL girders in the N & S of the aux gym and shop areas, and in the E & W direction of the aux gym and shop areas to mitigate seismic risk.

### 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) Diaphragms at original gym building are diagonally sheathed and 1984 architectural drawings indicate plywood sheathing overlay at both low and high roofs.

### 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) Horizontal span of diaphragms exceed 40 feet but are wood structural panel diaphragms. Further investigation should be performed. Diaphragm reinforcement may be appropriate to mitigate seismic risk.

### Diagonally Sheathed and Unblocked Diaphragms
All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4 to-1. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.3)

### 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)

### Connections
<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
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<td></td>
</tr>
<tr>
<td>Stiffness of Wall Anchors</td>
<td>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)</td>
<td>X</td>
<td>The connection of the rosette anchors at the E &amp; W exterior URM walls to the 6x beams at the low roofs are unknown. Further investigation should be performed. Additional anchoring may be appropriate to mitigate seismic risk. The rosette anchors of the E &amp; W URM walls of the main gym appear to be taught and stiff to the wood ledger, however cross-grain bending of ledger should be mitigated.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beam, Girder, and Truss Supports</td>
<td>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)</td>
<td>X</td>
<td>No independent secondary columns observed for bowstring trusses in main gym. Further investigation should be performed. Independent secondary columns for trusses may be appropriate to mitigate seismic risk, however space to accommodate an additional support in main gym is very limited.</td>
<td></td>
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</tr>
</tbody>
</table>
# 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

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
<th>EVALUATION STATEMENT</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.</td>
<td>Fire suppression piping is anchored and braced in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.1)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>The gym building does not have a fire sprinkler system.</td>
</tr>
<tr>
<td>LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.</td>
<td>Fire suppression piping has flexible couplings in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.2)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Use of emergency power was not verified with maintenance or facility staff. If emergency power is used to power life-safety equipment, evaluation of emergency power equipment may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LSS-4 Stair and Smoke Ducts. HR-not required; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Stair pressurization was not observed at stairs to mezzanines.</td>
</tr>
<tr>
<td>LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>The gym building does not have a fire sprinkler system.</td>
</tr>
<tr>
<td>LSS-6 Emergency Lighting. HR-not required; LS-not required; PR-LMH</td>
<td>Emergency and egress lighting equipment is anchored or braced. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.1)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
</tbody>
</table>

## Hazardous Materials

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
<th>EVALUATION STATEMENT</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
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<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM-1 Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>It is unknown if equipment is mounted on vibration isolators. Further investigation may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td>Unknown whether the building has hazardous materials. There may be gas lines present. Further investigation of mechanical piping should be performed. Bracing and anchoring of piping may be appropriate to mitigate seismic risk.</td>
<td></td>
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<tr>
<td>HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td>It is unknown if the structure contains natural gas or other hazardous materials. Further investigation of mechanical piping should be performed. Providing shutoff valves may be appropriate to mitigate seismic risk.</td>
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<tr>
<td>HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td>Unknown whether the building has hazardous materials. There may be gas lines present. Further investigation of mechanical piping should be performed. Flexible coupling for piping and ductwork may be appropriate to mitigate seismic risk.</td>
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<tr>
<td>HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td>The building does not appear to contain seismic joints, isolation planes, or independent structures.</td>
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</tr>
<tr>
<td>HM-6 Piping or Ducts Crossing Seismic Joints. HR-MH; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
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Port Townsend, Port Townsend High School, Gym ASCE 41 Tier 1 Summary
Washington State School Seismic Safety Assessments Project
June 2021
<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
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<tbody>
<tr>
<td>P-1 Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>There appear to be a few interior masonry partition walls at the south end of the building and on the west side of the auxiliary gym. However the presence of bracing of these walls could not be confirmed. This should be further investigated and bracing may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>P-2 Heavy Partitions Supported by Ceilings. HR-LMH; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>There appear to be a few interior masonry partition walls at the south end of the building and on the west side of the auxiliary gym. However the tops of these walls were not observed. This should be further investigated and bracing may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>P-3 Drift. HR-not required; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
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</tr>
<tr>
<td>P-4 Light Partitions Supported by Ceilings. HR-not required; LS-not required; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>P-5 Structural Separations. HR-not required; LS-not required; PR-MH.</td>
<td>Partitions that cross structural separations have seismic or control joints. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.3)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>P-6 Tops. HR-not required; LS-not required; PR-MH.</td>
<td>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)</td>
<td>X</td>
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<td>Not required for life safety performance level.</td>
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<tr>
<td><strong>C-1 Suspended Lath and Plaster. HR-H; LS-MH; PR-LMH.</strong></td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>We did not observe any lath and plaster ceilings in our site walk, but this should be verified by school district personnel.</td>
</tr>
<tr>
<td><strong>C-2 Suspended Gypsum Board. HR-not required; LS-MH; PR-LMH.</strong></td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>It is unknown if the building has suspended gypsum board ceilings. Further investigation should be performed for large areas of suspended GWB ceilings or suspended GWB ceilings in path of egress. Bracing for suspended GWB ceilings may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td><strong>C-3 Integrated Ceilings. HR-not required; LS-not required; PR-MH.</strong></td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td><strong>C-4 Edge Clearance. HR-not required; LS-not required; PR-MH.</strong></td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td><strong>C-5 Continuity Across Structure Joints. HR-not required; LS-not required; PR-MH.</strong></td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td><strong>C-6 Edge Support. HR-not required; LS-not required; PR-H.</strong></td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
</tbody>
</table>
### 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)

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<tr>
<td>LF-1 Independent Support. HR-not required; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>It is unclear how much the light fixtures weigh and light fixtures in ACT ceilings were not observed during our site walk. Further investigation can and should be performed by maintenance staff to see if light fixtures in areas with ACT ceilings are supported independently to the roof or mezzanine structures above by at least two wires at diagonally opposite corners.</td>
</tr>
<tr>
<td>LF-2 Pendant Supports. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>LF-3 Lens Covers. HR-not required; LS-not required; PR-H.</td>
<td>Lens covers on light fixtures are attached with safety devices. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.4)</td>
<td>X</td>
<td></td>
<td></td>
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<td>Not required for life safety performance level.</td>
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</table>

### Light Fixtures

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<tr>
<td>LF-1 Independent Support. HR-not required; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>It is unclear how much the light fixtures weigh and light fixtures in ACT ceilings were not observed during our site walk. Further investigation can and should be performed by maintenance staff to see if light fixtures in areas with ACT ceilings are supported independently to the roof or mezzanine structures above by at least two wires at diagonally opposite corners.</td>
</tr>
<tr>
<td>LF-2 Pendant Supports. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>LF-3 Lens Covers. HR-not required; LS-not required; PR-H.</td>
<td>Lens covers on light fixtures are attached with safety devices. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.4)</td>
<td>X</td>
<td></td>
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<td>Not required for life safety performance level.</td>
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### Cladding and Glazing

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<tbody>
<tr>
<td>CG-1 Cladding Anchors. HR-MH; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>The gym building does not have heavy cladding components.</td>
</tr>
<tr>
<td>CG-2 Cladding Isolation. HR-not required; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td>The gym building does not have heavy cladding components and is not a steel or concrete moment frame building.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CG-3 Multi-Story Panels. HR-MH; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td>The gym building does not have heavy cladding components.</td>
<td></td>
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</tr>
<tr>
<td>CG-4 Threaded Rods. HR-not required; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td>The gym building does not have heavy cladding components.</td>
<td></td>
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<tr>
<td>CG-5 Panel Connections. HR-MH; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td>The gym building does not have heavy cladding components.</td>
<td></td>
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<tr>
<td>CG-6 Bearing Connections. HR-MH; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td>The gym building does not have heavy cladding components.</td>
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<tr>
<td>CG-7 Inserts. HR-MH; LS-MH; PR-MH.</td>
<td>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)</td>
<td>X</td>
<td>There are no concrete cladding components.</td>
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</table>
**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)

Large overhead panes of glazing was not observed.

**Masonry Veneer**

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<tbody>
<tr>
<td>M-1 Ties. HR-not required; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
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<td></td>
<td></td>
<td>Brick veneer occurs at the north exterior wall of the classrooms however limited architectural drawings available does not address anchoring of veneer. Further investigation required.</td>
</tr>
<tr>
<td>M-2 Shelf Angles. HR-not required; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>There is URM above the main outside entry area at the south end of the building. However without original drawings it is unclear how this overhead brick is supported. Further investigation should be performed and supplemental anchoring may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>M-3 Weakened Planes. HR-not required; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>It is unknown how the masonry veneer is connected to the walls at the north exterior wall of the classrooms however brick does not appear to be over windows.</td>
</tr>
<tr>
<td>M-4 Unreinforced Masonry Backup. HR-LMH; LS-LMH; PR-LMH.</td>
<td>There is no unreinforced masonry backup. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.2)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>M-5 Stud Tracks. HR-not required; LS-MH; PR-MH.</td>
<td>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.)</td>
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<td></td>
<td></td>
<td>X</td>
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</table>
M-6 Anchorage. HR-not required; LS-MH; PR-MH.

For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.1)

X

The existing and original exterior URM walls at the east, west, and north side of the aux gym and shop area is backed by CMU walls that were added in the 1984 modernization. However without structural drawings, it is not known if anchors were installed to tie the CMU backing walls to the exterior URM. Further investigation should be performed. Additional anchoring of the URM walls to the CMU backup walls may be appropriate to mitigate seismic risk.

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

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<tr>
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<tr>
<td>PCOA-1 URM Parapets or Cornices. HR-LMH; LS-LMH; PR-LMH.</td>
<td>Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.1)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>diagonal parapet bracing of the N and S URM walls of the main gym is visible from the exterior. Original URM parapets have a 2:1 ratio at the east and west exterior walls but are clad with wood framing that will help brace the parapet.</td>
</tr>
<tr>
<td>PCOA-2 Canopies. HR-not required; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>There are no canopies around the perimeter of the structure.</td>
</tr>
<tr>
<td>PCOA-3 Concrete Parapets. HR-H; LS-MH; PR-LMH.</td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>There are no concrete parapets.</td>
</tr>
</tbody>
</table>
### Masonry Chimneys

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
<th>EVALUATION STATEMENT</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
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<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC-1 URM Chimneys. HR-LMH; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>There does not appear to be any masonry chimneys.</td>
</tr>
<tr>
<td>MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>There does not appear to be any masonry chimneys.</td>
</tr>
</tbody>
</table>

### Stairs

<table>
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<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-1 Stair Enclosures. HR-not required; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>There does not appear to be any URM or HCT at the mezzanine stairs at the shop and aux gym areas of the building.</td>
</tr>
<tr>
<td>S-2 Stair Details. HR-not required; LS-LMH; PR-LMH.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>No structural drawings available for review, however the stairs do not appear to be contributing to lateral stiffness to the overall building's lateral system.</td>
</tr>
</tbody>
</table>
## Contents and Furnishings

<table>
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<tr>
<th>EVALUATION ITEM</th>
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</tr>
</thead>
<tbody>
<tr>
<td>CF-1 Industrial Storage Racks. HR-LMH; LS-MH; PR-MH.</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Storage racks were not observed.</td>
</tr>
<tr>
<td>CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Not able to verify all tall and narrow contents during site investigation. There were instances of book shelves and cabinets in the shop area. This item is commonly noncompliant for contents meeting the criteria. Brace tops of shelves taller than 6 feet to nearest backing wall or provide overturning base restraint.</td>
</tr>
<tr>
<td>CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Not able to verify all equipment or contents during site investigation. This item is commonly not compliant for contents meeting the criteria. Heavy items on upper shelves and cabinets should be moved down to lower shelves or to the ground, or restrained by netting or cabling to avoid becoming falling hazards.</td>
</tr>
<tr>
<td>CF-4 Access Floors. HR-not required; LS-not required; PR-MH.</td>
<td>Access floors more than 9 in. (229 mm) high are braced. (Tier 2: Sec. 13.6.10; Commentary: Sec. A.7.11.4)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>CF-5 Equipment on Access Floors. HR-not required; LS-not required; PR-MH.</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>CF-6 Suspended Contents. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>EVALUATION ITEM</td>
<td>EVALUATION STATEMENT</td>
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<td>COMMENT</td>
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</tr>
<tr>
<td>ME-1 Fall-Prone</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Suspended units were observed in the shop area with lightly cabled diagonal bracing. This should be further investigated. Additional bracing of overhead equipment may be required to mitigate seismic risk.</td>
</tr>
<tr>
<td>Equipment. HR-not required; LS-H; PR-H.</td>
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</tr>
<tr>
<td>ME-2 In-Line</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Diagonal or lateral bracing of in-line ducting and equipment in gym, aux gym, and shop areas were not apparent and should be further investigated. Bracing or anchoring of equipment and ducting may be appropriate to mitigate seismic risk.</td>
</tr>
<tr>
<td>Equipment. HR-not required; LS-H; PR-H.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>ME-3 Tall Narrow</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Not able to verify during site investigation. Further investigation should be performed. Brace tops of equipment taller than 6 feet to nearest backing wall or provide overturning base restraint.</td>
</tr>
<tr>
<td>Equipment. HR-not required; LS-H; PR-MH.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>ME-4 Mechanical Doors</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>HR-not required; LS-not required; PR-MH.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>ME-5 Suspended</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>Equipment. HR-not required; LS-not required; PR-H.</td>
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</tr>
<tr>
<td>ME-6 Vibration Isolators</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>HR-not required; LS-not required; PR-H.</td>
<td></td>
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</tr>
<tr>
<td>ME-7 Heavy Equipment</td>
<td>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)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>HR-not required; LS-not required; PR-H.</td>
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</tr>
<tr>
<td>ME-8 Electrical</td>
<td>Electrical equipment is laterally braced to the structure. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.11)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>Equipment. HR-not required; LS-not required; PR-H.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
### 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)

<table>
<thead>
<tr>
<th>EVALUATION ITEM</th>
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<th>C</th>
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<th>N/A</th>
<th>U</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP-1 Flexible Couplings. HR-not required; LS-not required; PR-H.</td>
<td>Fluid and gas piping has flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.2)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>PP-2 Fluid and Gas Piping. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>PP-3 C-Clamps. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>PP-4 Piping Crossing Seismic Joints. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
</tbody>
</table>

### Piping

<table>
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<tr>
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<th>N/A</th>
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<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP-1 Flexible Couplings. HR-not required; LS-not required; PR-H.</td>
<td>Fluid and gas piping has flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.2)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>PP-2 Fluid and Gas Piping. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>PP-3 C-Clamps. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>PP-4 Piping Crossing Seismic Joints. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
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### Ducts

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<th>N/A</th>
<th>U</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-1 Duct Bracing. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>D-2 Duct Support. HR-not required; LS-not required; PR-H.</td>
<td>Ducts are not supported by piping or electrical conduit. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.3)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
</tr>
<tr>
<td>D-3 Ducts Crossing Seismic Joints. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Not required for life safety performance level.</td>
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### Elevators

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<th>COMMENT</th>
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</thead>
<tbody>
<tr>
<td>EL-1 Retainer Guards. HR-not required; LS-H; PR-H.</td>
<td>Sheaves and drums have cable retainer guards. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.1)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>No elevator in this building.</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Requirement</td>
<td>Notes</td>
<td></td>
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</tr>
<tr>
<td>EL-2</td>
<td>Retainer Plate. HR-not required; LS-H; PR-H.</td>
<td>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)</td>
<td>X</td>
<td>No elevator in this building.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EL-3</td>
<td>Elevator Equipment. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EL-4</td>
<td>Seismic Switch. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
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</tr>
<tr>
<td>EL-5</td>
<td>Shaft Walls. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>EL-6</td>
<td>Counterweight Rails. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EL-7</td>
<td>Brackets. HR-not required; LS-not required; PR-H.</td>
<td>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)</td>
<td>X</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>EL-8</td>
<td>Spreader Bracket. HR-not required; LS-not required; PR-H.</td>
<td>Spreader brackets are not used to resist seismic forces. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.8)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EL-9</td>
<td>Go-Slow Elevators. HR-not required; LS-not required; PR-H.</td>
<td>The building has a go-slow elevator system. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.9)</td>
<td>X</td>
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Appendix B: Concept-Level Seismic Upgrade Figures
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Figure 1 - Main Gym Floor Plan

**Legend**

- Plywood Sheathed Cross Walls With Anchor Bolts To Existing Slab & Connect To Roof Diaphragm Above
- Connect Existing Purlins With CMST12 X 6'-0" Strap To Serve As Cross Ties (All Purlins ~ 16 Ft OC)
- HSS 8x8 Strongbacks Full-Height Along Existing South URM Wall To Underside Of Bowstring Roof, See Figure 3
- HSS 8x8 Strongbacks Along Existing North URM Wall To Underside Of Aux Gym Roof, See Elevations In Figure 4
- HSS 7x4 Supplemental Support Under Bowstring Trusses
- See Figure 3 For Infill Walls Above
- See Figure 4 For Infill Walls Above

**Key Plan**

- 1984 AUX GYM & SHOP
- ORIGINAL 1941 GYM

Port Townsend High School Seismic Upgrades – Gym Building
LEGEND

- Infill Existing Windows With 12” Reinforced CMU Doweled To Existing URM
- Intermediate Strongback Bracing With Diagonal Bracing Systems To Bowstring Roof Diaphragm
- Existing URM Wall
- Infilled Window Openings, See Legend

WEST ELEVATION OF MAIN GYM (EAST ELEVATION SIMILAR)

Ref: 1984 Drawing A5.10

SOUTH ELEVATION OF SOUTH WALL OF MAIN GYM (NORTH ELEVATION SIMILAR)

Ref: 1984 Drawing A5.9

Figure 3 – Infill Shear Wall Elevations
Figure 4 – Infill Shear Wall Elevations

NORTH ELEVATION OF NORTH WALL OF MAIN GYM

Ref: 1984 Drawing A5.9

LEGEND
- HSS 8x8 Strongbacks With Connections To URM Wall & At Top To Aux Gym Roof Diaphragm
- Infill Existing Upper Windows With 12" Reinforced CMU Dowelled To Existing URM
- Existing URM Wall

North Wall Of Main Gym (12" URM)
Pitched Roof Line Of Aux Gym In Foreground
HSS 8x8 Strongbacks With Connections To URM Wall & At Top To Bowstring Roof Diaphragm
Infill Window Openings, See Legend
Phase 2

Port Townsend High School Seismic Upgrades – Gym Building

Figure 5 – Details

1. **OUT-OF-PLANE CONNECTIONS TO URM AT MAIN GYM**
   - Existing Rosette Anchors
   - HDU8
   - Install Coupler On Existing Anchors & Extend With Threaded Rod to HDU
   - 12” Reinforced CMU infill
   - LVL 3 1/2” Blg With (3) HGA10KT Each Block
   - HDU4 Each 6X Purlin At Each End With 5/8” Diameter Anchor In Epoxy Grouted Hole
   - 12” Reinforced CMU infill

   **Ref:** 1984 Section 1&2 /A5.15

2. **GL TO GL TIE CONNECTION**
   - Connect TJI Blg To Sill Plate With A35 At 24” OC & Web Filler
   - Web Filler Each Side
   - (2) 2x8 Brace At 48” OC With HGA10 Each Side
   - 4x Ledger With 5/8” Diameter AB At 24” OC In Epoxy Grouted Holes
   - HDU4 8 Each Side
   - HDU4 Each 6X

   **Ref:** 1984 Detail 1/X-792

3. **EXTERIOR MASONRY WALL ANCHORAGE AT AUX GYM & SHOP AREA**
   - Connect TJI Blg To Sill Plate With A35 At 24” OC & Web Filler
   - Web Filler Each Side
   - (2) 2x8 Brace At 48” OC With HGA10 Each Side
   - 4x Ledger With 5/8” Diameter AB At 24” OC In Epoxy Grouted Holes
   - Original URM Exterior Wall Where Occurs
   - (2) 2x8 Brace At 48” OC With HGA10 Each Side
   - 4x Ledger With 5/8” Diameter AB At 24” OC In Epoxy Grouted Holes

   **Ref:** 1984 Detail 2/X-793
Appendix C: Opinion of Probable Construction Costs
## Master Estimate Summary

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Construction Cost Type</th>
<th>Estimated Construction Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Townsend High School Gym</td>
<td>Structural Costs</td>
<td>$999,463</td>
</tr>
<tr>
<td>Port Townsend High School Gym</td>
<td>Non-Structural Costs</td>
<td>$499,732</td>
</tr>
</tbody>
</table>

**TOTAL ESTIMATED CONSTRUCTION COST** → $1,499,195

<table>
<thead>
<tr>
<th>Soft Costs</th>
<th>Soft Costs % Construction Cost</th>
<th>Estimated Soft Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Soft Cost Allowance</td>
<td>40.0%</td>
<td>$599,678</td>
</tr>
</tbody>
</table>

**TOTAL ESTIMATED PROJECT COST** → $2,098,873

### Estimate Assumptions:
- The ROM Construction Cost estimates are based on the Concept Design Report for the Project.
- Construction Escalation is not included. Costs are current as of the month of Cost Basis noted above right.

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

### Port Townsend High School Gym

#### Construction Cost Estimate

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage of Previous Subtotal</th>
<th>Amount</th>
<th>Running Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope Contingency</td>
<td>10.0%</td>
<td>$67,902</td>
<td>$746,924</td>
</tr>
<tr>
<td>General Conditions</td>
<td>10.0%</td>
<td>$67,902</td>
<td>$814,826</td>
</tr>
<tr>
<td>Home Office Overhead</td>
<td>5.0%</td>
<td>$33,951</td>
<td>$848,778</td>
</tr>
<tr>
<td>Profit</td>
<td>6.0%</td>
<td>$40,741</td>
<td>$889,519</td>
</tr>
<tr>
<td>Escalation Included to 4Q, 2022</td>
<td>12.4%</td>
<td>$109,945</td>
<td>$999,463</td>
</tr>
<tr>
<td>Washington State Sales Tax - Included in Soft Costs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Markups Applied to the Direct Cost: 47.19%

Markups are multiplied on each subtotal. They are not multiplied from the direct cost.

**TOTAL ESTIMATED CONSTRUCTION COST** → $999,463 $29.30/sqft

**-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE** → $799,571 $23.44/sqft

**+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE** → $1,499,195 $43.95/sqft

Please see the Master Summary for Assumptions and Qualifications for ROM Cost Estimates.
## Direct Cost of Construction

<table>
<thead>
<tr>
<th>WBS Description</th>
<th>Quantity</th>
<th>U of M</th>
<th>Labor</th>
<th>Labor Total</th>
<th>Material</th>
<th>Material Total</th>
<th>Equipment</th>
<th>Equipment Total</th>
<th>Total $/U of M</th>
<th>Direct Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 - Seismic Retrofit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Superstructure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Upper Floor Systems</strong></td>
<td>Install 1 Tube Steel Column HSS 4x4 under Main Mezzanine Beam with Footing</td>
<td>1 each</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1,300.00</td>
<td></td>
<td>$1,300.00</td>
<td></td>
<td>$700.00</td>
<td></td>
<td>$700.00</td>
<td></td>
<td>$120.00</td>
</tr>
<tr>
<td></td>
<td><strong>Roof Systems</strong></td>
<td>Shotcrete 12&quot; Thick Shear Wall with Rebar EW + EF Including Drill and Epoxy in Rebar</td>
<td>852 cuyd</td>
<td></td>
<td>$772.00</td>
<td></td>
<td>$65,762.96</td>
<td></td>
<td>$193.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Install Tube Steel Columns HSS 8x8 for Strongback Support Fasten to CMU Wall with 5/8&quot; Epoxy Bolts 24&quot; o.c.</td>
<td>22.50 ton</td>
<td></td>
<td>$5,551.00</td>
<td></td>
<td>$124,897.50</td>
<td></td>
<td>$3,549.00</td>
<td></td>
<td>$79,852.50</td>
</tr>
<tr>
<td></td>
<td>Install Tube Steel Columns HSS 7x4 for Strongback Support Fasten to CMU Wall with 5/8&quot; Epoxy Bolts 24&quot; o.c.</td>
<td>4.13 ton</td>
<td></td>
<td>$5,551.00</td>
<td></td>
<td>$22,897.88</td>
<td></td>
<td>$3,549.00</td>
<td></td>
<td>$14,639.63</td>
</tr>
<tr>
<td></td>
<td>Upgrade Shearwall with 1/2&quot; Plywood Sheathing and 2x Panel Edge Blocking with Connection to Roof Diaphragm and 1/2&quot; Sill Bolts - Remove GWB and Reinstall</td>
<td>1,760 sq ft</td>
<td></td>
<td>$4.68</td>
<td></td>
<td>$8,236.80</td>
<td></td>
<td>$2.52</td>
<td></td>
<td>$4,435.20</td>
</tr>
<tr>
<td></td>
<td>Det 3 - 4x12 Ledger with 5/8&quot; Anchor Bolts at 24&quot; o.c.</td>
<td>200 lnft</td>
<td></td>
<td>$31.05</td>
<td></td>
<td>$6,210.00</td>
<td></td>
<td>$13.95</td>
<td></td>
<td>$2,790.00</td>
</tr>
<tr>
<td></td>
<td>Det 3 - 2-2x8 Brace with 2 HGA10 Clip and Nailed to 2 Web Filler at Existing TJI Joist with 2 per Each A35 Clip and Web Filler at Existing TJI Blocking Panel at 24&quot; o.c.</td>
<td>50 each</td>
<td></td>
<td>$75.90</td>
<td></td>
<td>$3,795.00</td>
<td></td>
<td>$34.10</td>
<td></td>
<td>$1,705.00</td>
</tr>
<tr>
<td></td>
<td>CMST12 Nailed to 6x - 6' Long</td>
<td>25 each</td>
<td></td>
<td>$54.60</td>
<td></td>
<td>$1,365.00</td>
<td></td>
<td>$23.40</td>
<td></td>
<td>$585.00</td>
</tr>
<tr>
<td></td>
<td>Det 1 - Beam to Wall Tie - 2 Each HDU4 with Nails to Beam with 2 Each 5/8&quot; Dia Bolt Epoxy Into CMU Wall with 2 Ea Nuts &amp; Washers</td>
<td>50 each</td>
<td></td>
<td>$356.32</td>
<td></td>
<td>$17,816.00</td>
<td></td>
<td>$167.68</td>
<td></td>
<td>$8,384.00</td>
</tr>
<tr>
<td></td>
<td>Det 1 - Roof to Wall Tie - 1 Each HDU8 with Nails to 3-1/2&quot; LVL Blocking Plate with 3 HGA Plates Nailed to Existing Truss with 1 Each Coupler with 5/8&quot; Dia All Thread with 1 Ea Nut &amp; Washer</td>
<td>30 each</td>
<td></td>
<td>$280.16</td>
<td></td>
<td>$8,404.80</td>
<td></td>
<td>$131.84</td>
<td></td>
<td>$3,955.20</td>
</tr>
<tr>
<td></td>
<td>Det 2 - GL to GL Tie - 2 Each HDU8 with Nails to GL Beam with 5/8&quot; Dia All Thread Rod Drilled Through CMU Wall with 2 Ea Nuts &amp; Washers</td>
<td>3 each</td>
<td></td>
<td>$238.00</td>
<td></td>
<td>$714.00</td>
<td></td>
<td>$112.00</td>
<td></td>
<td>$336.00</td>
</tr>
<tr>
<td>WBS</td>
<td>Description</td>
<td>Quantity</td>
<td>U of M</td>
<td>Labor</td>
<td>Labor Total</td>
<td>Material</td>
<td>Material Total</td>
<td>Equipment</td>
<td>Equipment Total</td>
<td>Total $/U of M</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------------------------------</td>
<td>----------</td>
<td>-------</td>
<td>-------</td>
<td>-------------</td>
<td>----------</td>
<td>----------------</td>
<td>-----------</td>
<td>----------------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td>Det 2-SIM - GL to CMU Wall Tie - HDU8 with Nails to GL Beam and Steel Plate with Bolts at CMU Wall with 5/8” Dia All Thread Rod Drilled Through CMU Wall with 2 Ea Nuts &amp; Washers</td>
<td>1 each</td>
<td></td>
<td>$414.80</td>
<td>$414.80</td>
<td>$195.20</td>
<td>$195.20</td>
<td>$36.60</td>
<td>$36.60</td>
<td>$646.60</td>
</tr>
<tr>
<td></td>
<td><strong>Interior Wall/Door/Casework/Specialties Systems</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Remove and Reinstall Floor Finish Systems-Allow 50% of the Floor Area</td>
<td>17,056 sqft</td>
<td>$3.01</td>
<td>$51,287.39</td>
<td>$1.84</td>
<td>$31,434.21</td>
<td>$0.29</td>
<td>$4,963.30</td>
<td>$5.14</td>
<td>87,684.90</td>
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<tr>
<td></td>
<td>Remove and Reinstall Wall Finish Systems-Allow 30% of the Floor Area</td>
<td>10,234 sqft</td>
<td>$2.79</td>
<td>$28,551.74</td>
<td>$1.71</td>
<td>$17,499.46</td>
<td>$0.27</td>
<td>$2,763.07</td>
<td>$4.77</td>
<td>48,814.27</td>
</tr>
<tr>
<td></td>
<td>Remove Ceiling and Reinstall New ACT Ceiling Systems-Allow 50% of the Floor Area</td>
<td>17,056 sqft</td>
<td>$4.22</td>
<td>$71,908.10</td>
<td>$2.58</td>
<td>$44,072.70</td>
<td>$0.41</td>
<td>$6,958.85</td>
<td>$7.21</td>
<td>122,939.65</td>
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<tr>
<td></td>
<td><strong>Subtotal of the Direct Cost of Construction Port Townsend High School Gym</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Non-Structural Costs

Port Townsend High School Gym

Construction Cost Estimate

<table>
<thead>
<tr>
<th>Subtotal Direct Cost From the Estimate Detail Below</th>
<th>$339,511</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Previous Subtotal</td>
<td>Amount</td>
</tr>
<tr>
<td>Scope Contingency</td>
<td>10.0%</td>
</tr>
<tr>
<td>General Conditions</td>
<td>10.0%</td>
</tr>
<tr>
<td>Home Office Overhead</td>
<td>5.0%</td>
</tr>
<tr>
<td>Profit</td>
<td>6.0%</td>
</tr>
<tr>
<td>Escalation Included to 4Q, 2022</td>
<td>12.4%</td>
</tr>
</tbody>
</table>

Washington State Sales Tax - Included in Soft Costs

Total Markups Applied to the Direct Cost | 47.19% |

$/sqft

TOTAL ESTIMATED CONSTRUCTION COST | $499,732 | 14.65 |

-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE | $399,785 | 11.72 |

+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE | $749,598 | 21.97 |

Please see the Master Summary for Assumptions and Qualifications for ROM Cost Estimates
## Direct Cost of Construction

<table>
<thead>
<tr>
<th>WBS Description</th>
<th>Quantity</th>
<th>U of M</th>
<th>Labor</th>
<th>Labor Total</th>
<th>Material</th>
<th>Material Total</th>
<th>Equipment</th>
<th>Equipment Total</th>
<th>Total $/U of M</th>
<th>Direct Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2- Non- Structural Demo/Restoration*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>M/E/P/FP Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical/Electrical/Fire Protection Systems *</td>
<td>34,112 sqft</td>
<td></td>
<td>$ 5.16</td>
<td>$ 176,161.37</td>
<td>$ 4.23</td>
<td>$ 144,132.03</td>
<td>$ 0.56</td>
<td>$ 19,217.60</td>
<td>$ 9.95</td>
<td>$ 339,511.01</td>
</tr>
<tr>
<td>*Allows 50 percent of existing nonstructural systems M/E/P/FP require upgrades/replacement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Subtotal of the Direct Cost of Construction

| Port Townsend High School Gym | $ | 339,511 |
Appendix D: Earthquake Performance Assessment Tool (EPAT) Worksheet
This page intentionally left blank.
<table>
<thead>
<tr>
<th>District Name</th>
<th>Port Townsend</th>
<th>Existing Building Life Safety Risk &amp; Priority for Retrofit or Replacement</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Name</td>
<td>Port Townsend High School</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building Name</td>
<td>Gymnasium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HAZUS Building Type</td>
<td>URM</td>
<td>Unreinforced Masonry Bearing Walls</td>
<td></td>
</tr>
<tr>
<td>Year Built</td>
<td>1941</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building Design Code</td>
<td>&lt;1973 UBC</td>
<td>These parameters determine the capacity of the existing building to withstand earthquake forces.</td>
<td></td>
</tr>
<tr>
<td>Existing Building Code Level</td>
<td>Pre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geographic Area</td>
<td>Puget Sound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe Vertical Irregularity</td>
<td>No</td>
<td>Buildings with irregularities have greater earthquake damage than otherwise similar buildings that are regular.</td>
<td></td>
</tr>
<tr>
<td>Moderate Vertical Irregularity</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan Irregularity</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seismic Data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earthquake Ground Shaking Hazard Level</td>
<td>High</td>
<td>Frequency and severity of earthquakes at this site</td>
<td></td>
</tr>
<tr>
<td>Percentile Sₘ Among WA K-12 Campuses</td>
<td>82%</td>
<td>Earthquake ground shaking hazard is higher than 82% of WA campuses.</td>
<td></td>
</tr>
<tr>
<td>Site Class (Soil or Rock Type)</td>
<td>D</td>
<td>Stiff Soil</td>
<td></td>
</tr>
<tr>
<td>Liquefaction Potential</td>
<td>Very Low</td>
<td>Liquefaction increases the risk of major damage to a building</td>
<td></td>
</tr>
<tr>
<td>Combined Earthquake Hazard Level</td>
<td>High</td>
<td>Earthquake ground shaking and liquefaction potential</td>
<td></td>
</tr>
<tr>
<td>Severe Earthquake Event (Design Basis Earthquake Ground Motion)¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building State</td>
<td>Building Damage Estimate²</td>
<td>Probability Building is not Repairable³</td>
<td>Life Safety Risk Level</td>
</tr>
<tr>
<td>Existing Building</td>
<td>74%</td>
<td>73%</td>
<td>Very High</td>
</tr>
<tr>
<td>Life Safety Retrofit Building</td>
<td>20%</td>
<td>12%</td>
<td>Very Low</td>
</tr>
<tr>
<td>Current Code Building</td>
<td>16%</td>
<td>8.1%</td>
<td>Very Low</td>
</tr>
<tr>
<td>Source for the Data Entered into the Tool</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building Evaluated By:</td>
<td>DNR, Reid Middleton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person(s) Who Entered Data in EPAT:</td>
<td>Brian Matsumoto, Reid Middleton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>User Overrides of Default Parameters:</td>
<td>Building Design Code Year, Latitude, Longitude, Site Class, Liquefaction, Geographic Region</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ Combined earthquake hazard level combines frequency and severity of earthquakes at this site and liquefaction potential.
² Percentage of building replacement value.
³ Probability building is in the Extensive or Complete damage states.
⁴ Based on probability of Complete Damage State.
⁵ Most likely post-earthquake damage state per ATC-20.
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Appendix E: Existing Drawings
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Gym/Shop Building
Port Townsend High School
1610 Blaine Street
Port Townsend, WA 98368
Jefferson County

Site Information
Site Size: 16 1/2 acres (approximate)

Building Information
Building Construction History
This building was originally constructed in 1941, expanded in 1956, and significantly remodeled in 1984. The weight room was added to the east side of the existing gymnasium building in 1994.

Original construction of the gymnasium building consisted of concrete footings and foundation walls, concrete slab-on-grade, brick masonry exterior wall construction, wood truss roof framing with shiplap decking.

In 1984, the building underwent a significant modernization that included complete demolition and replacement of the shop area and substantial improvements to the gymnasium building. The shop area was rebuilt with new concrete slab-on-grade either 4-inches or 6-inches thick, concrete masonry walls, glulam beams with wood joist framing, plywood sheathing, batt insulation, and built-up roofing. Exterior finish also included new brick veneer on the east and west sides to compliment the existing brick on the gymnasium portion of the building, and new metal fascia cladding with metal battens.

During the 1984 improvement project, the exterior wall brick veneer and wood truss structure over the gymnasium facility remained. However, extensive seismic improvements were added including steel rod tie-backs through the existing exterior masonry and into existing floor and roof framing. Tie-back locations are evident on the exterior surface of the building with decorative rosettes. The brick veneer was also cleaned and restored. Exterior window openings were infilled with pre-finished panels on the upper levels and framed in and covered with a metal clad fascia on the lower level. The gymnasium portion was re-roofed with built-up roofing over
R-25 rigid insulation over plywood decking. Significant interior improvements were included such as new wood flooring over a recessed concrete slab. No additional space was added to the building with this project. Project designers were Tsang Merrit Associates of Tacoma.

In 1994, the Weight Room was added to the east side of the gymnasium. This addition consisted of concrete footings and foundation walls, wood wall framing, brick veneer, metal cladding fascia, steel web joists, single-ply membrane roofing, over 3-inch rigid insulation and plywood decking.

In 1995, the ventilation system for the shop was upgraded. In addition a mezzanine for added storage was constructed.

Sometime between the 1995 Study and Survey Update and this 2006 review, a automotive repair facility was added to the north side of the building, adjacent to the wood shop. The review team did not have access to any drawings or other documentation for this space. However, the square footage of this space has been added to the total inventory under this Study and Survey report.

### Building Data

<table>
<thead>
<tr>
<th>Building Area Summary</th>
<th>Actual</th>
<th>OSPI Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gymnasium/Shop/Weight Room</td>
<td>28,064 s.f.</td>
<td>28,064 s.f.</td>
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<tr>
<td>Shop Mezzanines*</td>
<td>3,759</td>
<td>3,759</td>
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<tr>
<td>Weight Room Addition</td>
<td>1,815</td>
<td>1,815</td>
</tr>
<tr>
<td>Automotive Shop</td>
<td>600</td>
<td>600</td>
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<tr>
<td><strong>Total Area</strong></td>
<td><strong>34,239 s.f.</strong></td>
<td><strong>34,239 s.f.</strong></td>
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</tbody>
</table>

Area analysis for the Study and Survey was conducted according to WAC 180-27-035.

**Total Number of Teaching Stations:**

- Regular Education: 2
- Shop: 1
- Weight Room: 1
- Auxiliary Gymnasium: 1
- Main Gymnasium: 2

**OSPI Rated Capacity**

- Regular
- Handicapped
1984 Aux Gym & Shop

Original 1941 Gym
GENERAL

A. Any discrepancies found among the Drawings, Specifications, and Notes shall be reported to the Owner's Representative for clarification.

B. Unless specifically noted otherwise, the Contractor shall furnish all material, labor, plant, equipment and services to accomplish all work defined on these drawings and specifications.

C. Contractor shall verify and coordinate dimensions among all drawings prior to proceeding with any work or fabrication.

D. Existing framing shown for reference only, contractor to verify and provide adequate shoring prior to removal of existing structural elements.

E. Contractor responsible for all erection bracing and shoring during construction.

F. Contractor responsible for repairing, patching & finishing existing areas, presently scheduled to remain as is, which may be damaged during the course of the structural work.

STANDARDS

All methods, materials and workmanship shall conform to the Uniform Building Code, 1979 Edition. These structures do not conform to present earthquake code requirements for new buildings. They have been analyzed and reinforced in accordance with Section 104 (a) and (b) and Section 203 of the Uniform Building Code and within current practice for renovation of existing buildings.

DESIGN CRITERIA

A. Vertical Loads (PSF): 

<table>
<thead>
<tr>
<th></th>
<th>Mech. rooms</th>
<th>Stairs</th>
<th>Slab on Roof</th>
<th>Grade</th>
<th>Classrooms</th>
<th>Corridors</th>
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<tbody>
<tr>
<td>Live Load</td>
<td>25</td>
<td>Actual</td>
<td>150</td>
<td>40</td>
<td>100</td>
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<tr>
<td>Dead Load</td>
<td>Actual</td>
<td>Actual</td>
<td>Actual</td>
<td>Actual</td>
<td>Actual</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shop Mezz</td>
<td></td>
<td>Auditorium</td>
<td>L. R. C.</td>
<td>Shop Ceilings</td>
<td></td>
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<tr>
<td>Live Load</td>
<td>125</td>
<td>50</td>
<td>75</td>
<td></td>
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</tr>
<tr>
<td>Dead Load</td>
<td>Actual</td>
<td>Actual</td>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Lateral Loads:

1. Forces transmitted by diaphragm action to shear walls and thence to foundations where displacement is resisted by passive pressure and sliding friction of earth.

2. Wind: 20 psf on vertical surface 30 feet or less above
grade. 25 psf on vertical surface 30 feet to 49 feet above grade.

3. Seismic: \( V = Z \times k \), \( Z = 0.75 \), \( k = 1.33 \), \( CS = 0.14 \), \( I = 1.0 \),  
   (auditorium: \( I = 1.25 \)) \( W = \) Dead load of portion of building  
   under consideration, \( V = \) Base Shear.

C. Uplift: 
   Enclosed Roof Areas: 75% of wind load less 2/3 design dead load. Open Roof Areas: 125% of wind load less 2/3 design dead load.

SOIL BEARING

Allowable soil bearing pressure of 2500 p.s.f. is assumed on undisturbed natural soils or structural fill. Soils testing agency to be consulted as necessary during construction to verify bearing value.

BACKFILL

A. Backfilling at building foundations or as required under building slab on grade to be done with material approved by Architects.

B. Compact to 95% of the Modified Proctor dry density as determined by ASTM D 1557 Laboratory procedure.

CONCRETE

A. Ultimate strength design per Uniform Building Code and ACI 318-77.

B. Reinforcement:

1. Reinforcing Bars: New billet stock ASTM A 615, Grade 40, \( f_y = 40,000 \) psi, for \#5 bars and smaller and Grade 60, \( f_y = 60,000 \) psi, for \#6 bars & larger. Detail, fabricate and place per ACI 315-67 and ACI 318-77. Provide the following minimum cover over reinforcement:  
   Bottom of footing and all concrete poured directly against earth ------------------------- 3"  
   Walls - Interior --------------------------------- 1"  
   Exterior (exposed to weather or earth)  
   \#5 Bar or smaller ----------------------------- 1-1/2"  
   Greater than \#5 ------------------------------ 2"  
   Columns -------------------------------------- 1-1/2"  
   (Where \#5 or greater exposed to weather) --- 2"  

2. Welded Wire Fabric: ASTM A 82 and ASTM A 185, splice with at least one full mesh. Place at mid-depth of slabs or as shown. Block up with brick or concrete blocks to secure while placing concrete.
C. Materials:

<table>
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<tr>
<th>Item</th>
<th>f'c @ 28 Days</th>
<th>Slump Max.</th>
<th>Slump Min.</th>
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<td>All concrete except as noted</td>
<td>3000</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Slab on grade &amp; fnd.</td>
<td>2000</td>
<td>4</td>
<td>1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Min. sacks Cement per c.y.</th>
<th>W/C Maximum</th>
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</thead>
<tbody>
<tr>
<td>All concrete except as noted</td>
<td>.6</td>
<td>.53</td>
</tr>
<tr>
<td>Slab on grade &amp; fnd.</td>
<td>5-1/2</td>
<td>.60</td>
</tr>
</tbody>
</table>

Coarse and Fine Aggregate; ASTM C 33. Maximum size 3/4".
Water: Clean and potable.
Portland Cement: ACTM C 150 Type 1 or Type III
All cement of same manufacturer and same color throughout project.

D. Admixtures:

1. Provide air entraining agent (AEA) MB-AE 10, Master Builders, or approved, 'to attain 5%, ± 1.5%, entrained air, by volume. Use AEA for concrete exposed to the weather and to freeze-thaw cycles such as exterior slabs and exposed walls.

2. Pozzolith 300-N by Master Builders or approved equal, may be used, per manufactures recommendation, at contractors' option.

3. All other admixtures to be used only after approval by Owner's Representative.

E. Mixing Concrete: Ready mix per ASTM C 94 and ACI 304.

F. Cold Weather Concreting: Per "Recommended Practice for Winter Concreting" ACI 304-73.

G. Hot Weather Concreting: Per "Recommended Practice for Hot Weather Concreting" ACI 395-76.

H. Transporting, conveying, placing and joints per ACI 304-73. Use interior mechanical vibrators with 7000 RPM minimum frequency. Do not over vibrate.

I. Expansion Joints: Perimeter of exterior slabs against walls use 1/2" preformed non-extruded resilient fibre expansion joint per ASTM D 994 and ASTM A 1751.

J. Embedded Bolts & Studs: ASTM A 307 with hooked end.

K. "Parabolt", Concrete anchor bolts manufacture by U.S.M. Corporation, Molly Fastener Division.
L. Concrete Curing: Maintain curing for seven days in which mean daily temperature is above 40 degrees F.

1. Slabs – Concrete Curing Paper per ASTM C 171 Type 1, Burkekraft Reinforced Paper Type 1 or approved or spray with liquid membrane forming compound conforming to ASTM C 309, Type 1. Do not use liquid membrane on surfaces to receive additional concrete or cementitious finishing materials, hardeners or sheet vinyl floor covering.

2. Formed Surfaces: Use continuous sprinkling or absorptive mats or fabric kept continuously wet.

Masonry

A. Cement for Mortar & Grout shall be Type 1 Portland Cement conforming to ASTM C 150; aggregate ASTM C 144 for mortar; ASTM C 404 for grout; hydrated lime ASTM C 207; quick lime ASTM C 5; water clean and potable. No admixtures will be permitted in mortar and grout.

B. Concrete Masonry Units shall be Grade N-1, half pumice and half sand/gravel units conforming to ASTM C 90 with Ult. Comp. strength, f'\text{m}=1350 \text{ psi}.

C. Mortar shall be Type S per UBC, freshly prepared and uniformly mixed and shall conform to ASTM C 270. Average compressive stress of mortar in 28 days shall be 1800 psi.

D. Grout for pouring shall be a fluid consistency and conform to ASTM C 176. A minimum compressive strength of 2000 psi at 28 days is required.

E. Reinforcing per ASTM A 615, Gr. 40, f_s=20,000 \text{ psi}.

F. Special inspection required.

METALS

A. Welding:
   1. All welding shall be in accordance with "Code for Welding in Building Construction" by American Welding Society AWS D 1.0-69. Use E60 or E70 electrodes.

   2. Reinforcing bars shall be welded only upon approval of the Owner's Representative and shall be accomplished per "Reinforcing Bar Splices" by Concrete Reinforcing Steel Institute, Latest edition. In no case will a weld be made within 6 bar diameter of a cold bend.

   3. All welding shall be by W.A.B.O. Certified Welders.

B. Structural Steel:
2. Steel shapes and plates shall be ASTM A 36 (fy=36 ksi).

3. Structural Tubing shall be ASTM A 501, fy=36 ksi.

4. Pipe columns shall be standard ASTM A 501, fy=36 ksi or ASTM A 53 type E or S, Grade B, fy=35 ksi.

5. All bolts shall be ASTM A 307 machine bolts.

C. Metal Protection:

1. All steel, shapes, plates, bolts, nuts, washers and other metal items exposed to the weather or to the ground shall be galvanized per ASTM A 123 and 153 with 1.25 oz. of zinc spelter per sq. ft. of surface area. If only a portion of a connection is exposed all parts of that connection shall be galvanized. Field touch-up all items after erection.

2. All bolts, nuts and washers connection any portion of a member exposed to view shall be galvanized per above to prevent rust stain during construction.

D. Metal Deck: 22 ga., galvanized, Type "B" composite deck by Verco Mfr., Inc. or approved equal and shall conform to the requirements of the American Iron & Steel Institute (AISI) and the Steel Deck Institute (SDI). Handling and installation of the deck shall be per the Manufacturers recommendations and specifications.

CARPENTRY

A. Framing Lumber:

2x4, 3x4 & 4x4 Standard Grade Douglas Fir, fb=600 psi.
or stud grade Hem-fir, fb=650 psi.

2x & 3x  
#2 Douglas Fir, fb=1250 psi.
or #2 Hem-fir, fb=1000 psi.
or #2 Western Hemlock, fb=1100 psi.

4x  
#1 Douglas Fir, fb=1500 psi.

6x  
#1 Douglas Fir, fb=1350 psi.

Each piece of lumber shall bear stamp of WWPA or WCLIB showing grade mark. All 2x lumber shall be kiln dried (K.D.)

B. Carpentry Hardware:


2. Nails: Common unless otherwise specified. American or Canadian manufacturer only.

3. Anchors, Connectors: Simpson, Teco, Bowman or approved. ICBO approved card required.
4. Hardware exposed to weather or to view and in unheated portion of building or structure shall be galvanized.

C. Framing
1. Framing members to be set with crown side up. Built-up members shall be connected by 16d nails at 12” o.c. for up to 10” deep members and by 1/2” diameter M.B. at 24” o.c. staggered for members greater than 10” deep.

2. Do not notch, drill nor cut structural members without approval of Owner’s Representative. Provide double plates on top of all stud walls, stagger joint 4” apart minimum. Frame all wall corners solid. Provide blocking in stud walls over 10’ high. Provide headers over all opening. Provide blocking for all edges of plywood on exterior walls, bearing walls and shear walls.

3. All wood in contact with concrete shall be pressure preservative treated.

4. Provide minimum nailing per 1979 UBC Table 25-P.

D. Plywood:
1. Each sheet of plywood shall bear grade trademark of American Plywood Association, all grading shall conform to PS 1-74. Thickness as noted and layup pattern as shown on the Drawings. All nails shall be common, of American or Canadian manufacture. Provide minimum of 3/8” edge distance on all nails. Except as otherwise shown or noted, provide the following minimum plywood nailing; panel edges-10d @ 6” o.c., intermediate support - 10d @ 10” o.c. Block edges as shown on drawings.

2. Floor Sheathing: 1/2” (24/0) C-D w/exterior glue when installed over existing floor sheathing. 3/4” T & G (48/24) C-D w/exterior glue when installed directly over joists. Typical unless otherwise noted on drawings. When laying plywood over existing shiplap provide glued surface along all joist lines and at transverse plywood joints. Layout to be such that plywood joints parallel to joists are centered over joists. When laying plywood directly on joists first apply glue to top of joist.

3. Wall & Roof Sheathing: 1/2” (24-0) C-D w/exterior glue. Unless otherwise noted on drawings.

E. Glue-Laminated Timber:

2. Lumber shall conform to the West Coast Lumberman’s Association “Standard Specificaiton for Structural Glued
Laminated Douglas Fir.

3. All simple span members shall be combination "20F-V3" (fb=2000 psi) and all continuous span or cantilevered members shall be combination "20F-V8" (fb=2000 psi). All members shall be made with exterior glue and will be Industrial Appearance Grade.

4. Treat and protect Glu-Lam members per AITC-111 Standard Protection for Structural Timber Framing.

5. Provide cut washer under all bolt heads and nuts that bear on wood.

6. Provide 15 lb. building paper between masonry and all timber in contact with masonry.

F. Timber Decking:

1. 2 x 6 or 3 x 6, T & G, Hem-Fir Commercial decking (fb=1350 psi) or better. Size to match existing or as noted on drawings.

2. Match existing layup or use controlled random layup with well scattered end joints and each piece resting on at least one support.

3. Nail 2 x 6 decking with (1) 40d face nail and (1) 20d nail thru tongue. Typical at each piece at each support.

4. Nail 3 x 6 decking with (1) 6 inch spike face nail and (1) 40d toenail thru tongue. Typical at each piece at each support. Also spike deck course together with 8" spikes @ 30" o.c. with one spike not more than 10" from each end of each piece. All holes predrilled.

G. Roof Trusses:

1. Trusses of configuration, size and spacing as shown on drawings and manufactured by Trus-Joist Corp. or approved equal.

2. Camber 1-1/2 times dead load deflection, except for TJI.

3. No concentrated loads shall be applied except as indicated on shop drawings.

4. Bridging and other erection bracing shall be per manufacturer's recommendations.

5. Manufacturer shall verify adequacy of trusses shown to carry all dead load & live loads specified in these notes.

6. Shop drawings shall be prepared under the supervision of and bear the stamp of a Structural Engineer licensed to practice as such by the State of Washington.
VERT. REINF., PROVIDE DOWELS TO MATCH VERT. REINF. HOOK (2) DOWELS EA. SIDE OF ALL OPNGS & (4) @ ALL ENDS & CORNERS OF WALLS. ALL OTHER DOWELS CAN BE STRAIGHT EXCEPT AS NOTED.

CONC. WALL SHOWN MASONRY WALL SIM.

HORIZ. REINF.

ROUGHER CONSTR. JT.

LONGITUDINAL REINF. (3)#4

UNDISTURBED SOIL OR COMPACTED FILL

TYPICAL EXTERIOR WALL FIG. 1

N.T.S.

SEE 2#19 FOR TYP. CONC. WALL REINF.

SEE 2#19 FOR TYP. MAS. WALL REINF.

SEE PLAN

CONC. WALL SHOWN MASONRY WALL SIM.

UNDISTURBED SOIL OR COMPACTED FILL

TYPICAL INTERIOR WALL FIG. 2

N.T.S.

SEE 1#16 FOR CALLOUTS IN COMMON

SEE PLAN

Taang Merritt Associates
1701 Commerce
Tacoma, Washington (206) 383-1987

P.T.S.D. #50

Sheet X-708
EXCAVATION

PIPE PARALLEL TO WALL

1 1/2

1 1/2

1 1/2

NO EXCAVATION PERMITTED BELOW THIS LINE - STEP FOOTING IF REQUIRED.

PIPE SLEEVE

NO PIPE PERMITTED THRU WALL IN THIS AREA

JOINT OPTIONAL

SECTION

TYPICAL DETAIL OF PIPE & CONC. FTG.
"C" BARS EQUALLY SPACED OR 6" MIN.
1/2 SPACE

FOR SIZE & REINF. OF FTG. SEE SCHEDULE

FIRM UNDISTURBED SOIL OR COMPACT FILL

FOR COL. REINF. & DET. SEE

DOWELS 1/2" SAME SIZE & QUANTITY AS COL. REINF.

1/2" CLR

TO TIE

DIM."A" OR DIM."B"

FOR DIM. & REINF. SEE SCHEDULE

TYPICAL PLAN OF SPREAD FTG.

PLAN DETAIL

TYPICAL SECTION OF ISOLATED FOOTING W/ CONC. COLUMN

SECTION

EMBED A.B.'S 10" MIN.

PIPE OR TUBE COL.

1 1/4" TYP.

2"

MIN.

PAINT BASE P. & COL.

BELOW FLOOR W/ ASPHALTIC EMULSION

FOR CALLOUTS IN COMMON SEE

TYP. SECTION OF PIPE, OR TUBE COL.

AND SPREAD FTG. FOR OPT. DET. SEE

FOR DIMENSIONS & REINF. SEE

SECTION

TYP 3" MIN.

4 1/4" TYP.

MAX

14" SQ. PLINTH MIN. W/ (4) #5 & 4 3 TIES @ 12" O.C. (MIN. OF 3 TIES)

NOTE: FOR "H" GREATER THAN 48" USE (4) #7 & DBL. TIES TOP & BOTTOM

FOR CALLOUTS IN COMMON SEE

SECTION

P.T.S.D. #50

1701 Commerce
Tacoma, Washington (206) 383-1987
<table>
<thead>
<tr>
<th>MARK</th>
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<th>REINF.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&quot;A&quot;</td>
<td>&quot;B&quot;</td>
</tr>
<tr>
<td>F2.0</td>
<td>2&quot;0&quot;</td>
<td>2&quot;0&quot;</td>
</tr>
<tr>
<td>F2.5</td>
<td>2&quot;6&quot;</td>
<td>2&quot;6&quot;</td>
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</tr>
</tbody>
</table>

**SPEARAD FOOTING SCHEDULE**

**TYP. STEPPED FOOTING DET.**

**TYP. WALL HORIZ. REINF.**

MATCH CONT. FIG. REINF. LAP 1'-6" MIN.

LAP FIG. REINF. 2'-0" MIN.

2" BAR DIA.

P.T.S.D. #50

Tseng Merritt Associates
1701 Commerce
Tacoma, Washington (206) 383-1987
CONSTRUCTION JOINT (INTERIOR SLAB)

SCREED KEY JOINT BY SUPERIOR CONCRETE ACC, INC.

#3 x 25' G.
DIAM. @ 18" OC.

12" x 12" x 12"

1/4" DEEP SAWN OR FORMED JOINT, FILL W/ JOINT SEALER PER SPECS. LOCATE @ 30'-0" MAX. EA. ANY ON COLUMN LINES WHERE POSSIBLE.

SUBMIT PLAN OF JOINT LAYOUT FOR OWNERS APPROVAL.

CONTROL JOINTS

BEAM, SLAB & FOOTING JOINT

WATERSTOP IF EXTERIOR WALL OR BELOW GRADE

2x4 NOM. KEY

HORIZ. WALL REINF.

3/8" BAR DIAM.

FLAP

PROVIDE CLEAN LAITANCE FREE J.T. NET & SLUSH W/ NEAT CEMENT GROUT OR USE BONDING AGENT

IN SLABS ADD #4 x 3'0" DONELS @ 18" O.C.

LOCATE NEAR CENTER OF SPAN

NOTE: REINF. THRU JOINT

HORIZ. WALL VERTICAL JOINT

PROVIDE CLEAN LAITANCE FREE J.T. NET & SLUSH W/ NEAT CEMENT GROUT OR USE BONDING AGENT

IN SLABS ADD #4 x 3'0" DONELS @ 18" O.C.

LOCATE NEAR CENTER OF SPAN

NOTE: REINF. THRU JOINT

N.T.S.

N.T.S.
#3 TYP. EXTEND 2'-0" BEYOND OPGN. @ EACH END

TYP. WALL REINF.

TYPICAL DETAIL AT DOOR OPGN.

SECTION

1" = 1'-0"

FINISHED GRADE OR PAVING

TYPICAL THICKENED EDGE

SECTION

1" = 1'-0"
<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>REINFORCING</th>
<th>FACE OF SUPPORT</th>
<th>STIRRUPS</th>
<th>REMARKS</th>
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<tbody>
<tr>
<td>M/B1</td>
<td>8</td>
<td>(2)#7T</td>
<td>(2)#9T</td>
<td>#3</td>
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<tr>
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<tr>
<td>M/B3</td>
<td>8</td>
<td>(2)#9T</td>
<td>(2)#GB</td>
<td>#3</td>
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<tr>
<td>M/B4</td>
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<td>#3</td>
<td>6&quot; O.C.</td>
</tr>
<tr>
<td>M/B5</td>
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<td>(3)#6T</td>
<td>(3)#9B</td>
<td>#3</td>
<td>8&quot; O.C.</td>
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<td>(2) #5T</td>
<td>(2) #7T</td>
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<tr>
<td>U/B4</td>
<td>B</td>
<td>26</td>
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<td>(2) #5T</td>
<td>(2) #7B</td>
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<tr>
<td>U/B5</td>
<td>B</td>
<td>26</td>
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<td>(2) #6T</td>
<td>(2) #7B</td>
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<tr>
<td>U/B6</td>
<td>B</td>
<td>26</td>
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<td>(2) #7B</td>
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<td>(2) #7B</td>
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<td>26</td>
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<td>(2) #7B</td>
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<tr>
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<td>(2) #7T</td>
<td>(2) #7B</td>
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<tr>
<td>U/B10</td>
<td>B</td>
<td>26</td>
<td></td>
<td>(2) #7T</td>
<td>(2) #7B</td>
</tr>
</tbody>
</table>
**CONCRETE WALL OPENING**

**NOTES:**
1. WHERE BSM'T. WALL RETAINS EARTH ON ONE SIDE ONLY, PLACE ALL REINF. ON OPPOSITE FACE U.O.N.
2. LAP TYP. WALL REINF. 24 BAR DIA., 18" MIN. UNLESS NOTED.
3. REINF. CALLED FOR IN THIS SCHEDULE IS MIN. REQ'D. PROVIDE MORE IF CALLED FOR ON DRAWINGS.

### WALL THICKNESS | VERTICAL REINF. | HORIZ. REINF.
---|---|---
6" OR LESS | #4 @ 16" ON C | #4 @ 15" ON C
8" | #4 @ 12" ON C | #5 @ 15" ON C
10" | #4 @ 18" EA. FACE | #4 @ 16" EA. FACE
12" | #4 @ 16" EA. FACE | #4 @ 13" EA. FACE

**CONCRETE WALL REINF.**

P.T.S.D.  #50

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**Sheet**

X-717
30 BAR DIA. TYP.
(24" MIN.)

PLACE ALTERNATING CORNER BAR AS SHOWN

2" MIN. / 6" MAX. - TYP.

1" x 30 BAR DIA.
(24" MIN.)

(2) #5 (TYP)

1" x 30 BAR DIA.
(24" MIN.)

(2) #5

1. VERT. REINF. SHOWN IS ADDTL IF NORMAL REINF.
   NOT IN PROPER LOCATION.

2. CORNER BARS ARE SAME SIZE & SPACING AS HORIZ.
   REINF.

3. REINF AT ALL WALL CORNERS, ENDS &
   INTERSECTIONS SHALL BE FABRICATED & PLACED
   IN ACCORDANCE W/ APPROPRIATE DETAIL
   SHOWN.

TYPICAL HORIZONTAL REINF. PLACING DETAILS

N.T.S.
EXTEND VERT. REINF. FROM WALL BELOW WHERE POSSIBLE OR PROVIDE DOWELS 3'-6" LONG. SAME SIZE & SPACING AS REINF. IN WALL ABOVE. HOOK DOWLS INTO SLAB WHERE NO WALL OCCURS BELOW. GROUT ALL CELLS W/ VERT. BARS.

1-3/4" x 1-3/4" C.B. TO MATCH HORIZ. (TYP.)

#5 VERT. @ CORNERS
#5 VERT. @ INTERSECTIONS

IF NO BRICK BOND @ INTERSECTIONS, PROVIDE 22 GA. GALV. CORRUGATED TIES @ 16" O.C. MAX.

REINF. MASONRY BEARING WALL DETAILS

<table>
<thead>
<tr>
<th>WALL SIZE &amp; TYPE</th>
<th>HORIZONTAL X</th>
<th>VERTICAL X</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; C.M.U.</td>
<td>(2)#4 @ 48&quot; **</td>
<td>#4 @ 48&quot;</td>
</tr>
<tr>
<td>8&quot; C.M.U.</td>
<td>(2)#5 @ 48&quot; **</td>
<td>#5 @ 48&quot;</td>
</tr>
<tr>
<td>12&quot; C.M.U.</td>
<td>(2)#6 @ 48&quot; **</td>
<td>#6 @ 48&quot;</td>
</tr>
</tbody>
</table>

* TYPICAL UNLESS OTHERWISE NOTED.
** IN C.M.U. BOND BEAM UNITS

TYP. MASONRY WALL REINF. SCHEDULE
Typ. brick relief angle & ledger angle @ door & window opnings. See arch. for locations.

Anchorage of veneer per U.B.C. - 79 & U.B.C. std. 30-1

Brick veneer reinf. & anchors

Section

3/4" = 1'-0"
NEW 2" BLKG.
NEW 1/2" PLYWOOD SHTG.
3/4" Ø THD'D. ROD
EXIST. SHIPLAP

6.1/4" Ø ROSETTE WASHER

EXISTING MASONRY WALL

EXIST. JOIST
SIMPSON HD.5
W/ (2) 3/4" Ø M.B.

NOTE:
SEE ARCH. ELEV.
FOR LOCATIONS

SECTION
3/4" = 1'-0"
X-721

NEW 1/2" PLWD. SHTG.
EXIST. SHIPLAP
3/4" Ø THD'D. ROD

(8) 16d NAILS
(8) 16d NAILS

2x BLKG.
2" MAX.

6/4" ROSETTE WASHER
EXIST. BRICK MAS. WALL
NEW (2) 2x BLKG.

NOTE:
SEE ARCH. ELEV.
FOR LOCATIONS

SECTION
3/4" = 1'-0"
X-721

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P.T.S.D. #50
Sheet X-721
NOTE:
SEE STRUCT. PLANS & ARCH. ELEVATIONS FOR LOCATIONS.

(5) 16 d @ 6" O.C. PER JOIST

3" TYP.
6 1/4" Ø ROSETTE WASHER

EXIST. MASONRY
2 x 4 BLKG.

EXIST. 2 x 6 ROOF JOISTS

2 x 4

3 1/4" Ø THD. ROD

2 x 4 BLKG.

3 x 12

SEE 1 FOR CALLOUTS IN COMMON

SECTION 1
3/4" = 1'-0"

SECTION 2
3/4" = 1'-0"
STUD WALL

1" Ø THD'D ROD

NEW ½" PLYWOOD

EXIST. FLOOR

2X SOLID BLKG.

STUD WALL

SIMPSON HOLDOWN W/ BOLTS AS REQ'D. SEE PLAN FOR LOCATION & SIZE-TYP.

SECTION

3/4" = 1'-0"

EXIST. DECK INFILL

3/4" = 1'-0"

10d @ 6" O.C.

3/4" PLWD

EXIST. 3X6 T&G DECKING

6d@ 8" O.C.

2X3 ALL AROUND

EXIST. OPNG

EXIST. OPNG.
SLAB @ EXT. DOOR OPNG.

SECTION

1/2" = 1'-0"

CLG. FRAMING

3/4" = 1'-0"

P.T.S.D. #50
THD'D ROD & F.B. ASSEMBLY TO BE INSTALLED PRIOR TO ROOFING. SHEAR PANEL BELOW MAY BE INSTALLED LATER.

A

EXIST. 4 X 4 TUBE STL.

NOTE: 2 X 4 TUBE STL. ANCHORED IN CONC. @

1 X 12

SIM.

1' 4"

4 EQUAL SPACES @ 24" = 8'-0"

1' 4"

3/4" ROD TYP

3/6" F.B.

EXIST. 3 X NAILER

TYP

NOTE: FLUID NOT SHOWN FOR CLARITY.

2 X 8 STUDS @ 16" OC

3 X 8 END STUD

3 X 8 END STUD

2 EXIST. 6" CONC. WALL 2.

5 EQUAL SPACES = 8'-0"

1' 4"

ELEVATION

1/2" = 1'-0"

1 X 12

2 X 12

PT.S.D. #50

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Sheet X-726
THD'D ROD & F.B. ASSEMBLY TO BE INSTALLED PRIOR TO ROOFING. SHEAR PANEL BELOW MAY BE INSTALLED LATER.
THD'D ROD & F.B. ASSEMBLY TO BE INSTALLED PRIOR TO ROOFING. SHEAR PANEL BELOW MAY BE INSTALLED LATER.

SEE EXIST. 4 X 4 TUBE STL.

NOTE: PLWD. NOT SHOWN FOR CLARITY.

2 X 8 STUD @ 16" O.C.

3 X 8 END STUD

3/8" MIN.

2 EQUAL SPACES 1'-4" 2 EQUAL SPACES 1'-4"

3/4" M.B. C'BORE

SEE DETAIL A FOR ANGLE

(2) 3/4" PARABOLTS

3/8" MIN. EMBEDMENT (FOR SIDE)

ELEVATION 1/2" = 1'-0"

DETAIL A

THD'D ROD & F.B. ASSEMBLY TO BE INSTALLED PRIOR TO ROOFING. SHEAR PANEL BELOW MAY BE INSTALLED LATER.
THD'D ROD ASSEMBLY

NEW 2

EXIST 3x DECKIN

EXIST 3x NAFTER

DRILL & ATTACH W/ 2" x 6" LONG L.S.
@ END & MIDPOINTS
BUT 2x5 @ SUPPORTS

NOTCH PLWD. WHERE NEEDED

SECTION
1" = 1'-0"

1

3/8" PLWD.

3/4" PARABOLT

SEE FOR SPACING

3x6

EXIST. 6" CONC. WALL

SECTION
1" = 1'-0"

2

1/2" x 3/16"

1/4" x 3/32"
STD. FRAMING ANCHOR
SIMPSON A35 - ONE PER JOIST SPACE

2x8 JOIST

SIMPSON ST 2115 STRAP
BEND AS SHOWN
NAIL RWD. TO RIM - JST. - FAR SIDE
2x4 CRIPPLE WALL
10d NAILS @ 6" O.C.
EXIST. 3x DECKING

SECTION
1" = 1'-0"

4x8 LEDGER

3/8" PARABOLT
TO MATCH JST-S

5- SIMPSON N10
HANGER NAILS

STD 2x8 JST. HANGER
SIMPSON U26

1/8" 2x10 1/2" BENT FLAT BAR

SECTION
1" = 1'-0"

P.T.S.D. #50
EXIST. DECK
EXIST. NAILER
EXIST. W.F.G. X 12
NEW 3" STL. C/L

SECTION
1" = 1'-0"

BREAK-OUT EXIST. SLAB &
CUT EXIST. BOLTS FLUSH
W/FIRG. PATCH SMOOTH &
FLUSH AFTER NEW COL. SET

(4) NEW 3/4" PARABOLIC
STL. SHIM TO LEVEL
COL. ON 3/4" MIN.
DRYPACK (TYP).

EXIST. 4" SUB
EXIST. FINISH GRADING

SECTION
1" = 1'-0"
NAIL 2x4 TO 3x6 NAILER
EXIST. 6' CONC. WALL

SECTION
1" = 1'-0"

See X-737
2
X-731

FOR DIM. & SIM. CALLOUTS

See X-737
2
X-731

FOR DIM. & SIM. CALLOUTS

SECTION
1" = 1'-0"

DRILL & ATTACH W/ 1/2" X 6" LONG L.S. @ END & MIDPOINTS BUTT 2x6's @ SUPPORTS

P.T.S.D. #50

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Sheet X-736
STD. FRAMING ANCHOR SIMPSON A35 - ONE PER LAST SPACE.

SECTION 1" = 1'-0"

NOTE: SEE 1/4 FOR CALLOUTS & COMMENTS

SECTION 1" = 1'-0"

SECTION 1" = 1'-0"

SECTION 1" = 1'-0"

SECTION 1" = 1'-0"

Date TMA-3581
Project No.

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P.T.S.D. #50

Sheet X-738
3/4" PLWD.
EXIST. 2x6 PLANKING
EXIST. 2x10

EXIST. 6" CONC. WALL

3/4" Ø PARABOLT @ 12" O.C.

NEW 3x10

NOTE: REMOVE EXIST. 2x LEDGER & CUT EXIST.
BOLTS FLUSH W/ CONC.

SECTION

3/4" = 1'-0"

X-739
NEW CONC. WALL
HORIZ. WALL REINF.

DWLS TO MATCH SIZE & SPACING OF HORIZ. REINF. SET W/ FORROCK GROUT

EXIST. CONC. WALL
6" TYP.

SINGLE DWL.

EXIST. FDN.

TYPICAL INTERSECTION OF NEW CONC. WALL W/ EXIST. CONC. WALL

SECTION
1/2" = 1'-0"

SECTION
1/2" = 1'-0"

SEE 2 FOR CALLOUTS IN COMMON

NEW CONC. COL.

EXIST. FDN.

NEW FTG. SEE

NEW FTG.

EXIST. FTG.

EXIST. CONC. WALL

SECTION
1/2" = 1'-0"
SAW CUT SLAB & BREAKOUT AS REQ'D. TO INSTALL NEW FOOTING

NEW COL.

EXIST. COL.

DRILL 1/4" Ø HOLE IN EXIST. FTG. & SET DWLS. TO MATCH COL. VERT. REINF. W/ POROCK GROUT TYP.

EXIST. FND.

NEW FTG. SEE 1

SECTION

1/2" = 1'-0"

X-742

EXIST. FND.

NEW FTG. SEE 1

SECTION

1/2" = 1'-0"

X-742

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P.T.S.D. #50

Sheet X-742
NEW B" CONC. WALL

#4 @ 10" O.C. E.W.

NEW CONC. WALL ON ONE SIDE ONLY @ SIM. CONDITION

EXIST. FND.

EXIST. BRICK MAS. WALL

#4 @ 12" O.C. E.W. TYP. EACH SIDE

NEW 6" CONC. WALL TYP. EA. SIDE

#4 DWLS. @ 12" O.C. DRILL 1/4" Ø HOLE 8" DEEP & SET DWL. W/ POROCK GROUT TYP. EACH SIDE

(2) #4 @ BOT. & ENDS TYP.

EXIST. FND.

EXIST. CONC. SLAB

#4 DWLS @ 12" O.C. DRILL 1/4" Ø HOLE 8" DEEP & SET DWL. W/ POROCK GROUT

(2) #4 @ BOT. & ENDS

NEW 6" CONC. WALL

#4 @ 10" O.C. E.W. DRILL 1/4" Ø HOLE B" DEEP & SET DWL. IN POROCK GROUT

SECTION

1/2" = 1'-0"

X743

SECTION

1/2" = 1'-0"

X743

SECTION

1/2" = 1'-0"

X743

SECTION

N.T.S.

X743

P.T.S.D. #50

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Sheet

X743

Date

TMA-3581

Project No.
EXIST. BRICK MAS.

NEW CONC.

#4 @ 6" O.C.

(2) 5 x 7'-0" CENTERED OVER DOORWAY

CUT OUT EXIST. CONC. & PATCH SMOOTH & FLUSH

EXIST. FND.

SECTION 1/2" = 1'-0"

SECTION 1/2" = 1'-0"

EXIST. CONC. WALL

NEW 8" CONC. WALL

#5 @ 12" O.C. E.W.

DWLS. TO MATCH VERT. WALL REINF. LAP 2'-0"

(2) #5 BOTTOM

(4) #5 DWLS. DRILL 1/4" Ø HOLE IN EXIST. FTG. & SET W/ POROCK GROUT

(4) #5

8" 2'-0" LAP

EXIST. FTG.
#5 Dwl @ 12" O.C. Drill 1 1/4" Ø
Hole in Exist. Conc. & Set Dwl. W/ Porock or Equal

SIMPSON PAT 18 W/ (2) 1/2" Ø
M.B. - INSTALL ON EVERY THIRD JOIST

(2) 3/4" A.B. @ 1 1/2" O.C.
W/ 6" MIN. EMBED.

EXIST. 2 x 14 JST @ 16" OC
SIMPSON U 214 W/ C&D NAILS
NEW 3 x 14 LEDGER CONT.

SECTION
3/4" = 1'-0"
X-746

NEW 2 x RIM JOIST

3/4" Ø A.B. @ 1 1/2" O.C.
W/ 6" MIN. EMBED.

2 x BLKG @ 2 1/2" O.C.
IN FIRST TWO JOIST SPACES

SEE FOR CALLOUTS IN COMMON

SECTION
3/4" = 1'-0"
X-746

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PT.S.D. #50
#6 x 1'-0" long rebar @ 12" o.c. set in rock grout - typ.

New Col. ----- New Col.

Exist. Col.

Drill 1/4" Ø x 6" deep hole @ 12" o.c. in each side of exist. col. offset one side 6" from other.

Note:
Column reinf. not shown for clarity.

Section 3/4" = 1'-0"

Beam top reinf. exist. beam

Beam bottom reinf. beam M/85

Col. vert. reinf.
See X-747 for beam reinf.
See X-746 for col. reinf.

Section 3/4" = 1'-0"

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SIMPSON HOLDOWN W/ BOLTS AS REQ'D. SEE PLAN FOR LOCATION & SIZE

2 x STUD WALL

1" Ø A.B.

SECTION
N.T.S.

*5 @ 12" O.C. EACH WAY - TYP.

*5 x 3¼" DOHLS. TO MATCH VERT. REINF.

½" PLYWOOD

CONC. BEAM SEE 1 x 14

SEE 1 x 14 FOR CALLOUTS IN COMMON

SECTION
N.T.S.

#4 @ 12" O.C. = 3½"/4½" ALTERNATE

#6 @ 12" O.C.

#4 @ 16" O.C.

1½" CLR

2½"

1½"

2½"
**SECTION**

3/4" = 1'-0"

---

1. **EXIST BRICK MAS.**
   - #4 @ 12" O.C. EACH WAY
   - 1x2 NOM. KEY
   - 1/2" PLWD.
   - EXIST. SHIPLAP

2. **SIMPSON PAT 18 @ 32" O.C.**
   - (2) 3/4" Ø A.B. @ 16" O.C. W/ 5" EMBED.

3. **(2) #4 CONT. SLOPE W/ FLOOR**
4. **(2) #6 CONT. EXTEND INTO CONC. SLAB - SEE PLAN**
5. **NEW CONC. WALL**

---

**SECTION**

3/4" = 1'-0"

---

1. **EXIST. JST.**
   - SIMPSON U214
   - W/ 12d NAILS
   - 4x14 LEDGER

---

2. **SIMPSON PA 18 @ 4'-0" O.C.**
   - 1/2" PLWD.
   - EXIST. SHIPLAP

3. **(4) 16d/ PIECE OF BLKG.**
   - EXIST. JST.
   - 2 x 14 BLKG.
   - 2 JST. SPACES

4. **3/4" Ø A.B. @ 4'-0" O.C. W/ 5" MIN. EMBED.**

---

**SECTION**

3/4" = 1'-0"

---

1. **EXIST. JST.**
   - (2) #6 CONT. EXTEND INTO CONC. SLAB - SEE PLAN
   - 2 x 14 LEDGER

2. **EXIST. JST.**
   - (2) #4 CONT. SLOPE W/ FLOOR
   - #5 @ 12" O.C. E.W.

3. **NO FLOOR THIS SIDE @ SIM. CONDITION**

---

**P.T.S.D. **

---

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---

**Date**

**TMA-3581**

---

**Sheet**

**X-749**
EXIST. BRICK MAS.

NEW CONC. WALLS

1/2" FLWD.

EXIST. SHIPLAP

EXIST. FLR. JST.

2x14 BLKG. @ 4'-0" O.C.

1ST JST. SPACE

NEW 3x14

3/4" Ø THD'D. ROD @ 4'-0" O.C.

*4@ 12" O.C. E.W. TYP.

SECTION

3/4" = 1'-0"

NEW CONC.

ADD 2x14 SOLID BLKG. @ 4'-0" O.C.

EXIST. JST.

2 4x1/4 x 0'-4"

3/4" Ø THD'D. ROD @ 4'-0" O.C

STD. WASHER & NUT

3x14 LEDGER

SECTION

3/4" = 1'-0"
3'-6" / 4'-6" ALTERNATE

#4 @ 12" O.C.

(1) #4 CONT.

EXIST. SLAB

(2) #4 EXTEND 2'-0" OVER WALL @ EACH END

#4 x 2'-0"

@ 12" O.C.

EXIST. BM

1" CLR.

DRILL 1-1/4" Ø HOLE 8" DEEP & SET REBAR W/ FOROCK GROUT

EXIST. BRICK MASONRY

NEW CONC. SLAB

Bldg. Line Beyond

EXIST. CONC. CANOPY

SECTION

3/4" = 1'-0"

Sheet X-751

P.T.S.D. #50
SECTION
3/4" = 1'-0"

EXIST. BRICK MAS.

G 3/4 x 19 1/2 G.L.

6 3/4 x 18 G.L.
P. G x 3/8 EA. SIDE

(2) 3/4" Ø M.B. C'BORE 1 1/2" DEEP

1/2" TYP.

SECTION
3/4" = 1'-0"

EXIST 10 x 10 TIMBER COL.

G 3/4 G.L.

3/4" Ø M.B. THRU

T5 4 x 4

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P.T.S.D. #50

Sheet X-752
SECTION

3/4" = 1'-0"

X-753
EXIST. 2x6 JST.

2x6 CONT. PL.

2x6 @ 16" O.C. STUD WALL
DBL. STUD BELOW EACH
EXIST. 8x20 BEAM

CORRIDOR FACE
OF WALL

SECTION
3/4" = 1'-0"

EXIST. PLASTER
CEILING

EXIST. FLR. JST. (APPROX.
LOCATION ONLY -
CONTRACTOR VERIFY)

1/4" Ø x 4" L.S. - TYP.

2x4 @ 4'-0" O.C.

SIMPSON A34 EACH
SIDE - TYP.

2x4 BRACE @
4'-0" O.C. - TYP.

4x12 HORIZ.

BRACE @ 4'-0" O.C. MAXIMUM

FOLDING DOOR HEADER BRACE
3/4" = 1'-0"

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P.T. S.D. #50

Sheet X-757
10d @ 6" O.C.
1/2" PLWD.
(2) 1/2" Ø M.B.

ADD BLKG.

EXIST. 8x8 ROOF PURLINS

SIMPSON A35 @ 1'-0" O.C.

EXIST. STUD CRIPPLE WALL

1/2" PLWD.

EXIST. 2x10 ROOF JST.

1/2" PLWD.

- NOTCH @ 8x8
2x6 CONT.

16d @ 6" O.C. STAGGER

ADD BLKG.

EXIST. TRUSS CHORD

2x8 @ 16" O.C. STUD WALL INFILL - CUT & FIT AS NECESSARY AROUND TRUSS DIAGONALS

EXIST. TRUSS CHORD

(2) *8 PER LAYER

NEW 8" CONC. PROSCENIUM

(2) *4 (3 PLACES)

1/2" Ø x 12" L.S. @ 2'-0" O.C. (EMBED. 4" IN TRUSS)

(2) #7

#3 TIES @ 1'-2"
O.C. U.O.N.

SECTION

3/4" = 1'-0"

DATE

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PT.SD. #50

SHEET

X-759

X-759

X-159
SECTION

TYPICAL ON ROOF PURLINS SUPPORTING STAGE RIGGING (LOFT BLOCKS). VERIFY NUMBER, LOCATION & WT. TO BE SUPPORTED W/ STAGE EQUIPMENT SUPPLIER.

SECTION

3/4" = 1'-0"

EXIST. MAS.
6 3/4 x 19 1/2 G.L.
1/2" MAX.

EXIST. MAS.
1 1/4"

(2) 1/2" Ø x 5" L.S.

4 x 4 x 1/2

(2) 3/4" Ø PARABOLTS W/ 5" MIN. EMBED.

EXIST. CONC.

SECTION

1" = 1'-0"

P.T. S.D. #50

Sheet X-761
(2) 2 x 10. IF HANGER OCCURS ADJACENT TO EXIST. 2 x 10 ROOF JOIST—ADD ONE NEW JOIST. IF NOT ADD TWO NEW JOISTS.

TS 2 x 2 x 1/4
@ 8" O.C.

1/4

E 8 x 13.75 CONT.

1/4" STIFFENER P @ 4'-0" O.C. @ END

1/4" SAFETY P

E 3 x 6 CONT.

E 3 x 6 @ 4'-0" O.C.

(2) 1/2" Ø x 3" L.S. @ EACH ANGLE

BOTTOM CHORD OF EXIST. TRUSS

SECTION

1 1/2' = 1'-0"
2 ROWS 10d NAILS EA. ROW @ 6" O.C.
1/2" PLWD.

2 x FLAT BLKG. @ 2'-0" O.C.
EXIST. 2x6 ROOF JST.

TYPICAL SPLICE

 SECTION 1
1" = 1'-0"
X-771

 SECTION 2
1" = 1'-0"
X-771

 SECTION 3
1" = 1'-0"
X-771

1-1/2" 3/4" Ø M.B. EA. SIDE OF JT. & ON Q. OF 4x6

4x6 JOINT

3" 3" 6" 3" 6" 3" 3"

SPlice 4x6

3/4" Ø A.B. @ 16" O.C. W/ 8" MIN. EMBED.
(2) ROWS 10d @ 6" O.C.
EACH ROW

1/2" PLWD.
EXIST. SHIPLAP

3/4" Ø M.B. - TYP

4 x 12

TYPICAL 4 x 12 SPLICE DETAIL
3/4" Ø THD'D. ROD

4 x 4 x 1/4 BENT P. CONT.

4 x 4 @ 8'-0" O.C.

5/8" Ø M.B. C'BORE
FOR FLUSH HD.- TYP.

4 x 4 x 1/4 BENT P. - X O'- 8"

(2) 5/8" Ø M.B.
(4) 1/2d TYP.

VARIABLE
(1/2", MIN.)

SECTION

3/4" = 1'-0"

SECTION
3'0" LONG DOWEL TO MATCH SIZE & SPACING OF CMU. VERT. REIN. EMBED. 18"

EXIST. BRICK MASONRY

EXIST. CONC. FDN.

#4 @ 16" O.C. VERT. EACH FACE

#4 @ 16" O.C. HORIZ. EACH FACE

(3) #4

#4 @ 48" O.C.

EXIST. DIMENSIONS FIELD VERIFY

SECTION

1/2" = 1'-0"

SEE 1 FOR CALLOUTS IN COMMON

SECTION

1/2" = 1'-0"
SECTION 1
1/2" = 1'-0"

SECTION 2
1/2" = 1'-0"

C.M.U. WALL

G.L. COL.

SEE ARCH. FOR WOOD FLR. SYSTEM

SEE 2 X 12 FOR CONN. TYP.

TYP. WALL FOR EON. REIN. CONT. THROUGHOUT.

SPREAD FLG. SEE FOR DIM. & REINF.

COL. ON ONE SIDE ONLY & SIMILAR CONDITION

4" BRICK VENEER

2 x 8 @ 16" O.C. STUD WALL

3/4" Ø A.B. @ 4'-0" O.C. W/ 8" MIN. EMBED.

#4 @ 12" VERT. EACH FACE

(3) #4 CONT.

8" C.M.U.

3'-0" DWL. TO MATCH SIZE & SPACING OF VERT. REINF.

#5 @ 12" HORIZ. EACH FACE

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P.T.S.D. #50
EXIST. BRICK MASONRY

G.L. COL.

SEE FOR COL. CONN.

W/ (4) #4 VERT. & #3 TIES @ 3" O.C.

12" x 12" CONC. PIER

SPREAD FTG. - SEE

*EXIST. DIMENSION - FIELD VERIFY

SECTION

1/2" = 1'-0"

SECTION

1/2" = 1'-0"

G.L. COL.

7 1/2 x 3/8 KERF P

3/16

P 8 1/2 x 3/4 x 0'-8 1/2"

(4) 5/8" Ø HOOKED ANCHOR BOLTS

1" TYP.

PLUG & SAND SLOT FOR SMOOTH FINISH

C' BORE FOR FLUSH HEAD & NUT

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P.T.S.D. #50
SAWCUT & CHIP OUT CONCRETE AS SHOWN

# 4 @ 12" O.C. TOP

1/2" EXP LT

EXT. PAVING SLAB

EXIST. STAIRWELL WALL - BREAK TOP DOWN AS REQ'D

SECTION
1" = 1'-0"

# 4 @ 12" O.C. BOTTOM

# 4 @ 16" O.C. TEMP. STL.

EXIST. CONC. SLAB

EXIST. LOWER FLOOR WALL

CAP BLOCK

8" C.M.U. W/ # 4 @ 2'-0" O.C. VERT. SOLID GROUT WALL SEE 1 X-719 FOR TYP. DET.

# 4 @ 18" O.C. VERT.

# 4 @ 12" O.C. HORIZ.

EXTEND VERT. BARS AS REQ'D TO MATCH MAS. REINF. LAP 24"

SECTION
3/4" = 1'-0"

2 X-719

# 4 DWL. @ 2'-0" O.C. DRILL 1/4" Ø HOLE 6" DEEP IN FACE OF EXIT. FOOTING & SET DWL. W/ POROCK GROUT

SEE 1 X-724 FOR CALLOUTS IN COMMON

SECTION
3/4" = 1'-0"

2 X-719

P.T.S.D. #50

Sheet X-779
NEW 2x BLKG

SIMPSON A35 EVERY OTHER JST. SPACE
3/4" TAND.D ROD

EXIST. 2x JST.
SIMPSON HD 5
W/(2) 3/4" @ M.B.

SECTION
N.T.S.
X-785

NEW 2x BLKG.

EXIST. 2x JST.
SIMPSON A35 - ONE PER JST. INSTALL PRIOR TO BLKG.

1/2" FLWD.
4x4 CONT.

SECTION
N.T.S.
X-785

NEW 2x BLKG.

3/4" PARABOLTS
@ 4'-0" O.C.

SECTION
N.T.S.
X-785

SECTION
N.T.S.
X-785

SECTION
N.T.S.
X-785

P.T.S.D. #50

Sheet
X-785
NOTE: SEE STRUCT. PLANS & ARCH. ELEVATIONS FOR LOCATIONS.

EXIST. MASONRY

EXIST. 2 x 4
ROOF JST'S

2 x 4
BLKG.

3/4" THD'D ROD

1 1/2" WARE 1 1/2" 1 1/4"

3' 6" 3' 6"

2 x 6 BLKG.

EXIST. 2 x 12
CLG. JST'S

1/4" ROSEATE WASHER 4" 2 1/4" 3' 6"

6 3/4" 1 1/4"

SECTION
N.T.S.

(4) 1/2" x 1 1/2" L.S.

(16) 10d NAILS (2 LINES)

4 x 4 BLKG.

Ps 4 x 4 1/2

3/4" NUT

Ps 12" x 1/4"

8 3/4"

3' 6"

1/4" 3/4"

2 x 4

SECTION
N.T.S.

2

Ps 4 x 4 x 1/2

3/4" THD'D ROD

3 1/2" WARE 3 1/2" 3/4"
NEW 2x4 STUD SHEAR WALL
3/4" 8 x 14" THD'ED ROD @ 2'-0" O.C.
CROUT EXIST. MASONRY LEVEL.
EXIST. MASONRY WALL

SECTION 1
X-187

NEW 2x4 STUD SHEAR WALL
(3) 3/4" x PARABOLTS
EQUALLY SPACED PER WALL SECTION
EXIST. CONC. SLAB

SECTION 2
X-187
SIMPSON HU410TF

6 1/4" Ø ROSEATE WASHER (3) REQ'D.
3/4" Ø THD'D. ROD (3) REQ'D.

4 x 10 LEDGER

EXIST. MASONRY WALL

(2) 1/2" Ø M.B.

2 4 x 4 x 1/4 EACH SIDE

(2) 3/8" Ø x 3" L.S. EACH ANGLE

EXIST. TRUSS BOTTOM CHORD (2) 4 x 12

GYM BASKET SUPPORTS
3/4" = 1'-0"

P.E. STATION BASKET SUPPORTS
3/4" = 1'-0"

See 2 4 - 787

SOLID GROUT 10'-0" LONG SECTION CENTERED ON P.E. STATION

(2) #5

SIMPSON HU410TF

4 x 10

3/4" Ø A.B. @ 2'-0" O.C.
MAX. - 6" FROM EA. END

(2) 1/2" Ø M.B.

4 x 10 LEDGER - LENGTH AS REQ'D.
FOR BASKETBALL BACKBOARD SUPPORT.
BEAMS - CONTRACTOR VERIFY

P.T.S.D. #30 Sheet X-788
SECTION
3/4" = 1'-0"

SEE 2 FOR CALLOUTS IN COMMON

SECTION
3/4" = 1'-0"

SECTION
3/4" = 1'-0"

SECTION
3/4" = 1'-0"

10d @ 6" O.C.
(STAGGERED)

1/2" PLWD.

3/4" Ø A.B. @ 4'-0" O.C.
W/ 6" MIN. EMBED.

3 x 8 P. - C'BORE FOR FLUSH NUT

TJI 35 - TYP.
CLG. - SEE ARCH.
8" C.M.U.

83/4" G.L.

HANGER & NAILS
BY TRUSSJOIST

TJI 35 - TYP. U.O.N.

3/4" Ø A.B. @ 4'-0" O.C.
(6" MIN. EMBED.)

SIMPSON ST 2115
@ 4'-0" O.C.

3 x 8 P. W/ 3/4" Ø A.B. @ 6" MIN. EMBED.

2 x 12 BLKG.
@ 4'-0" O.C.

1/2" PLWD.

2 x 6 STUD WALL

CLG. - SEE ARCH.

4 x 8 LEDGER
SIMPSON U26 JST. HGR.

2 x 10 JST.
8" C.M.U.

2 x 8 JST.

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P.T.S.D. #50
Sheet X-790

Date
TMA-3581
Project No.
**SECTION**

3/4" = 1'-0"

---

**SECTION**

3/4" = 1'-0"

---

**SEE** FOR CALLOUTS IN COMMON

---

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P.T.S.D. #50

Sheet X-793
SIMPSON A35 @ 16" O.C.

1/2" Ø x 5" L.S. @ 16" O.C.

2 x 6 LEDGER

1/2" PLWD.

2 x 4 STUDS @ 16" O.C.

2 x 6 LEDGER

SIMPSON A35 @ 16" O.C.

(5) 2 x 10

1/2" Ø M.B. @ 2' 0" O.C. C'BORE.
MIN. DEPTH. FOR FLUSH HD
& NUT.

6 x 6 - SHIM AS NECESSARY

SECTION

3/4" = 1'-0"

---

NOTCH G.L. FOR 3 x 8 P.E.

1/2" CLR.

1/2" PLWD.

6 3/4" G.L.

(2) 3/4" Ø M.B.

P 3 x 1/4 EA. SIDE

P 6 x 1/2 x 0'-9"

(2) #5 @ 4'-0" TYP.
UNLESS BOND BEAM

(2) 3/4" Ø A.B. @ 6" O.C.

#5 VERT. IN 4 ADJACENT CELLS

8" CMU.

SECTION

3/4" = 1'-0"
EXIST. DECKING

(1) 2" Ø M.B.
(2) 3/4" Ø M.B.
3" I

EXIST 3x4 x 3'-0" SCAB

(2) 4 x 3 x 1/4 EXIST 4 x 12

SIMPSON HD 5-11 UNC 2A
S. E. WASH. 8" Ø STL. ROD

SIMPSON STG22A STRAP TIE TO REPLACE EXIST. SCAB.

SECTION 1/2" = 1'-0"
1-795

SECTION 1/2" = 1'-0"
2-795

SECTION 1/2" = 1'-0"

SECTION 1/2" = 1'-0"

SECTION 1/2" = 1'-0"

S. E. WASH. TYP.

3/4" Ø M.B.

5/8" Ø STL. ROD
SUPPLIED BY MECH. CONTRACTOR

4" WAFFER TYP.

ELEVATION 1/2" = 1'-0"
3-795

SECTION 1/2" = 1'-0"
4-795

SECTION 1/2" = 1'-0"
5-795

GENERAL NOTE: SPACERS TO BE PLACED @ 4'-0" O.C. MAX. IN ALL DOUBLE ANGLES & 4" MAX. FROM ENDS OF BEAMS.

SPACER - TYP.
3" = 1'-0"

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P.T.S.D. $50
Sheet X-795
NOTES

PLWD NOT SHOWN FOR CLARITY.

(15) 2\(\frac{1}{2}\) in x 7 in L.S. - Equally Spaced

ELEVATION

\(\frac{1}{8} = 1\' - 0\"

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P.T.S.D. #50

Sheet X-796
NEW 2 x 12
NEW 1/2" PLWD.
EXIST. 2 x ROOF JST.

CUT EXIST. 2 x 4 BRACING
EXIST. 2 x 6 STUD WALL

SECTION
3/4" = 1' - 0"
X-799

NEW 1/2" PLWD.
BOTH SIDES @ SIM.

3/4" NYLON BOLT @ 4' - 0" O.C.
EXIST. SUB-FLR OR NEW EQU. THK. PLWD
3 x 10 SILL
NEW 6" CONC. FDN. WALL

SECTION
3/4" = 1' - 0"
X-799
NEW 1/2" PLYWOOD

EXIST. SHIPLAP

EXIST. BLKG.

EXIST. FLOOR JOIST

EXIST... 2X6 STUD WALL

10d @ 6" O.C. - TYP.

ADD 2X6 BLKG. - TYP.

SECTION

1/2" = 1'-0"

X7001
SECTION \( \frac{1}{2}'' = 1' - 0'' \)

A  (2) 2x6's - Either side exist 2x12 @ 32'' @ c.c.

B  Install 2x6 roof jst. nailer flush w/ clerestory ridge high points. Shim level w/ p.lwd.
2 x 6 HIP RIDGE

2 x 4 STUD CRIPPLE WALL

SECTION

\[ \frac{\frac{1}{8}}{} = 1' - 0'' \]

SEE X7003 FOR SIM. CALLOUTS & DIMENSIONS.

P.T.S.D. #50
REMOVE EXIST. G.W.B. AS REQ'D.
FOR 5/8" Ø L.S. INSTALLATION.
PATCH & REPAIR FOR FINISHED
SURFACE.

EXIST. 5 1/4" G.L.
EXIST. 9/8" G.B.

3/8" Ø x 8" LAG
BOLTS @ 4'-0" OC
EXIST. 2 x 4
STUD WALL

SECTION
1" = 1'-0"

REMOVE EXIST. G.W.B. AS
REQ'D. FOR 3/4" Ø PARABOLT
INSTALLATION. PATCH & REPAIR
FOR FINISHED SURFACE.

EXIST. 2 x 4
STUD WALL
EXIST. G.W.B.

EXIST. 4"
CONC. SLAB
3/4" Ø
PARABOLTS
@ 4'-0" OC

SECTION
1" = 1'-0"

REMOVE EXIST. 7 x 16 1/8 G.L.
CUT END
OF EXIST. CANTILEVER SQUARE &
INSTALL NEW G.L. 6 1/2 x 15.

EXIST. 7 x 16 1/8 G.L.

SIMPSON HC7-5

NEW 6 1/2 x 15
G.L.

SECTION
1" = 1'-0"
EXIST. DECK

1/2" Ø M.B. @ 2'-0" O.C.
CIPORE FOR FLUSH HEAD

2x8 @ 16" O.C.
STUD WALL

1/2" PLWD.
EA. SIDE

1/2" Ø PARABOLTS
@ 2'-0" O.C. - TYP.
@ END STUDS
AGAINST EXIST.
CONC. WALL (4" MIN. EMBED)

SECTION 1
3/4" = 1'-0"

SECTION 2
3/4" = 1'-0"

2x10 @ 16" O.C.
STUD WALL

1/2" PLWD.
EA. SIDE

3/4" Ø PARABOLTS
@ 4'-0" O.C.
(4" MIN. EMBED)

EXIST. DECK

EXIST. CONC. WALL

SECTION 3
3/4" = 1'-0"

SECTION 4
3/4" = 1'-0"

(2) 1/2" Ø M.B. @ 4'-0" O.C. - TY

4x4 x 1/4 x 0'-6"
BENT P.

4x4 x 1/4 x 0'-6"
BENT P.

(3) 2x10

SIMPSON
U210-3

2x10

5x5 x 1/4 x 0'-5"
BENT P.

6x1/4 x 0'-5"
BENT P.

FIELD

DETERMINE

P.T.S.D. #50

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X-7008
INSTALL THD'ED ROD & F.B. ASSEMBLY PRIOR TO ROOFING. SHEAR PANEL MAY BE INSTALLED LATER.

NOTE: PLWD. NOT SHOWN FOR CLARITY.

ELEVATION
\[ \frac{1}{2}'' = 1'-'0" \]
3x4 FILLER

EXIST. 2x4 CHANNEL

3/4" FABRIC TYP

SEE 1:100 FOR SIM. CALLOUTS & DIMENSIONS

ELEVATION

1/2" = 1' - 0"

P.T.S.D. #50
1/2" Ø PARABOLTS @ 2'-0" O.C.
6 x 6 - W1.4 x W1.4 WWF

TYP DECK TO
1/2" Ø PUDDLE WELD @ EA VALLEY
METAL DECK-SEE STRUCTURAL NOTES
7 3 x 3 x 3/8 CONT. EXIST. CONC. WALL

SECTION
3/4" = 1'-0"

SECTION
3/4" = 1'-0"

BENT P TO
STL. STUD RUNNER

7 x 3 x 3/8
BENT P

SEE ARCH. DWGS. FOR STL. STUD WALL
NO SLAB @ SIM. COND.

SEE 1 FOR CALLOUTS IN COMMON

SECTION
3/4" = 1'-0"

TYP DECK WELD
1/2" Ø PUDDLE WELD @ EA VALLEY OR 6" O.C. @ EDGES

G. WB. - SEE ARCH.
PILASTER REIN.: (4) #6 VERT. W/ #2 TIES @ 8" O.C.

SECTION
1/2" = 1'-0"

3/4" = 1'-0"

TYPICAL WALL RAKE DETAIL

GROUT
(2) #5 CONT.

PILASTER REIN.: (4) #6 VERT. W/ #2 TIES @ 8" O.C.
B" C.M.U. WALL BEYOND

(4) #2 TIES @ 11/2" IN TOP OF COLUMN

SECTION
3/4" = 1'-0"

(4) 1/2" Ø x 3" L.S. (2 EA. SIDE)

EXIST. BRICK MAS. WALL W/ 2 x STUD WALL INFILL...SEE

(2) 1/2" Ø M.B.

G.L. BEAM

G.L. COL.

SEE FOR BEAM TO COL. CONNECTION

SECTION
3/4" = 1'-0"

P.T.S.D. #50
EXIST. MAS. WALL

(3) EXIST. STL. LINTEL ANGLES
WOOD BLKG. CUT TO SNUG FIT
1/2" Ø x 3" L.S. @ 2'-0" O.C.
2 X STUD WALL INFILL

FACE OF EXIST.
MAS. WALL BEYOND
FACE OF EXIST. MAS.
MULLION @ WINDOWS

4 X 12
1" SHIM @
MAS. MULLION

2 X 6 STUD WALL INFILL W/ 1/2"
PLWD. SHTG. BOTH SIDES
4 X 6 CONT. BETWEEN MAS. MULLION
W/ 1/2" Ø x 6" L.S. @ EA. STUD

DRILL 1/4" Ø HOLE @ CENTER OF
MAS. MULLION. SET 3/4" Ø THDID.
ROD W/ POROCK GROUT. TYP. @
EA. MULLION & 6" FROM WINDOW
EDGES IN WALL SECTIONS &
4'-0" MAX. O.C. IN WALL SECTIONS

2 X STUD WALL INFILL

SEE 4 FOR ANCHORS @
SILL & SIDES

EXIST. MAS.

SECTION
3/4" = 1'-0"
EXIST. BRICK MAS. WALL

(2) 6 x 4 x 3/8

1½" = 1'-0"

EXIST. BRICK MAS.

3/4" THDID ROD @ 2'-0" O.C. & 4" FROM EACH END

EXIST. CONC. CANOPY TO BE REMOVED

STUD WALL & BRICK VENEER INFILL

(2) 6 x 4 x 3/8 - PRIOR TO REMOVING EXIST. CONC. CANOPY SAWCUT @ J.T. TO INSTALL STL. ANGLE. INSTALL ANGLE ON ONE SIDE BEFORE CUTTING OTHER SIDE. INSTALL THRU BOLTS BEFORE PROCEEDING W/ CANOPY REMOVAL. ANGLES TO EXTEND 8" MIN. INTO MAS. ON EA. SIDE OF OPNG. BEYOND CANOPY.

SECTION

1/2" = 1'-0"
SECTION

1" = 1'-0"

SHOP CEILING

SOLID GROUT (4) VERT. CELLS @ COL. BRG. PROVIDE (1) #5 VERT. IN EACH CELL

SECTION

1" = 1'-0"
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Appendix F: FEMA E-74 Nonstructural Seismic Bracing Excerpts
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Life Safety Systems

Figure G-1. Flexible Sprinkler Drop.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Figure G-2. End of Line Restraint.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)
Partitions

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

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

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)
See Example 5.3.2 for partition restraints. Detail to accommodate interstory drift.

Notes: Glazed partition shown in full-height nonbearing stud wall. Nonstructural surround must be designed to provide in-plane and out-of-plane restraint for glazing assembly without delivering any loads to the glazing.

Glass-to-frame clearance requirements are dependent on anticipated structural drift. Where partition is isolated from structural drift, clearance requirements are reduced. Refer to building code for specific requirements.

Safety glass (laminated, tempered, etc.) will reduce the hazard in case of breakage during an earthquake. See Example 6.3.1.4 for related discussion.

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

*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*
See figure 6.3.4.1-7 for connections of bracing & hanger wire to the structure above.

Compression strut (see Note)

12 gauge bracing wire w/min. 4 tight turns in 1-1/2" both ends of wire - connect to main runner (4 total at 90°)

45° max. typical

4' max.

Main runner

Cross runner

12 gauge vertical hanger wire at 4' - 0" each way with minimum 3 tight turns in 1-1/2" both ends (typical)

2" (max.) from bracing wires to compression strut and cross runner

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 ES80 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)*

*Note:* See California DSA IR 25-5 (06-22-09) for additional information.
Figure G-12. Gypsum Board Ceiling Applied Directly to Structure.  
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)
Figure G-13. Retrofit Detail for Existing Lath and Plaster.

*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*
Figure G-14. Diagrammatic View of Suspended Heavy Ceiling Grid and Lateral Bracing.

*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*
Figure G-15. Perimeter Details for Suspended Gypsum Board Ceiling.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)
Figure G-16. Details for Lateral Bracing Assembly for Suspended Gypsum Board Ceiling.

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

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**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 concrete. Size of strut is dependent on distance between ceiling and structure (V ≤ 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.
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)*

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

*Note:* Engineering required for all permanent floor-supported cabinets or shelving over 6 feet tall. Details shown are adequate for typical shelving 6 feet or less in height.
Figure G-24. Desktop Computers and Accessories.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)
Figure G-25. Equipment Mounted on Access Floor.

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

**Cantilevered Access Floor Pedestal**

**Braced Access Floor Pedestal**

*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-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)*
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)*

*Note*: Provide appropriate rustproofing, weatherproofing and flashing details.
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)*