Structural Seismic Evaluation Report

for the

Rogue River Elementary School

Prepared for:

Rogue River School District #35

October, 2010

Prepared by:

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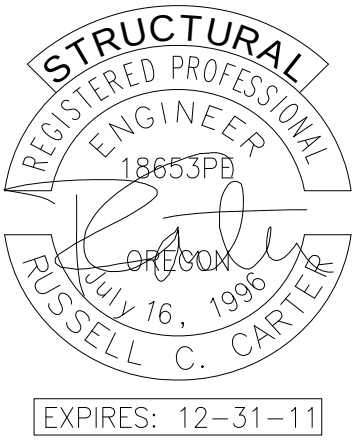

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October, 2010

Rogue River School District #35
Attn: Dr. Harry Vanikiotis
1898 East Evans Creek Road
Rogue River, Oregon 97537

Reference: Rogue River Elementary School

Subject: Structural Seismic Evaluation Report

Dear Dr. Harry Vanikiotis,

Please accept this report outlining our findings and recommendations for the structural seismic evaluation of the Rogue River Elementary School located at 300 Pine Steet in Rogue River, Oregon. The purpose of our investigation was to verify the existing structural systems and perform a structural seismic assessment based on current building code requirements for an essential facility. In the enclosed report, we have outlined the findings of our structural seismic evaluation.

If you have any questions or concerns, please do not hesitate to call me at (541) 479-3865 or email me at SyA@ZCSengineering.com.

Sincerely,

Sylas E. Allen, PE
Branch Manager

Enc: Structural Seismic Evaluation Report and Support Drawings provided by ZCS Engineering, Inc.

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Appendix 'A'

ASCE 31 – Screening Phase (Tier 1) Checklists

Appendix 'B'

Previous Structural Evaluation Reports

1.0 Introduction

We have been directed by Dr. Harry Vanikiotis, Superintendant for the Rogue River School District # 35, to investigate the existing Rogue River Elementary School buildings currently occupied by elementary school students located at 300 Pine Street in the City of Rogue River, Oregon. The purpose of our investigation is to verify the existing structural systems and to perform a structural seismic assessment based on current building code requirements for an essential facility.

The following scope of work has been developed using information provided, rapid visual screening reports, ASCE 31, and visual observations of the structural systems throughout the building. We have performed site verification of all structural systems through non-destructive and localized destructive measures. We have modeled and analyzed the existing systems based on current code loading configurations. Within this report we have attempted to outline a facility assessment based on the building status and clearly define upgrades required to meet current code for seismic performance of an essential facility.

As part of this scope of work, schematic level drawings have been provided to illustrate the level of understanding the applicant has with regards to the effort that will be required to seismically rehabilitate the buildings. These schematic drawings have been prepared using the current Oregon Structural Specialty Code (OSSC) and the ASCE 41 (Seismic Rehabilitation of Existing Buildings) as references for prescribed loading and building performance level ratings.

It is the understanding of the applicant that once rehabilitation efforts have been completed the buildings will be able to achieve a level of performance of Life Safety Occupancy based on the OSSC and ASCE 41 for essential facilities.

The following is a brief project description of the buildings as observed. Preliminary assessments have been included.

2.0 Project Overview

The facilities in question include four single story buildings built at-grade in a High Seismicity Zone. The buildings cover approximately 32,000 SF, and are used for classrooms, cafeteria, administration, and gymnasium purposes.

- **Building 'A'** consists of partially grouted CMU walls with a flexible diaphragm (RM1). This structure houses classrooms/cafeteria, is approximately 12,300 SF, and was constructed in 1960.
- **Building 'B'** consists of unreinforced masonry walls with a flexible diaphragm (URM). This structure houses the gymnasium, is approximately 6,000 SF, and was constructed in 1909.
- **Building 'C'** consists of partially grouted CMU walls with a flexible diaphragm (RM1). This structure houses classrooms, is approximately 5,000 SF, and was constructed in 1960.
- **Building 'D'** consists of wood framed walls and a flexible diaphragm (W2). This structure houses classrooms/admin., is approximately 8,500 SF, and was constructed in approximately 1950.

3.0 Building 'A' Observation

3.1 Overall Description

It is our understanding that no repair work or structural upgrades have been done to date. The structure measures approximately 42' wide and 296' long (Figure 3.1). The structure has a peak roof height measuring approximately 12'-8". A canopy is attached to the front of the structure over the walkway (Figure 3.2). The area uses within this structure include: classrooms, cafeteria, kitchen, restrooms, mechanical room, and associated storage rooms.

3.2 Construction (RM1)

The roof framing consists of wood beams spaced at 6' on-center with a glue-laminated ridge beam forming a gable end, and spanning from CMU wall to CMU wall (Figure 3.3). Positive connection between the beams and the top of the CMU wall was outlined in the

construction documents provided for our reference. The canopy roof consists of beams forming a shed roof running from the interior CMU wall down to steel pipe columns (Figure 3.4). All roof sheathing consists of 2x Tongue & Groove decking (straight). Refer to schematic plans for additional information.

3.3 Seismic Deficiency and Damage Assessment

The following list summarizes the structural seismic deficiencies noted during analysis.

- Aspect ratio of roof diaphragms/lack of sheathing (straight sheathing)
- Lateral system for walkway canopy
- Chord splice of window wall in cafeteria

By observation, no structural damage was discovered.

3.4 Scope of Rehabilitation Work

The length to width ratio of the building creates the need to provide plywood sheathing over the existing 2x T&G. This will cut the aspect ratios down to code acceptable levels (4:1 max). We also recommend installing a drag strut strap in line with the window wall top plate splice to provide continuity of the diaphragm chord. A moment frame needs to be installed at the end of the walkway canopy in order to form an adequate lateral force resisting system. See sheet 'S1.0' illustrating all proposed solutions.

4.0 Building 'B' Observation

4.1 Overall Description

It is our understanding the building has undergone repair work and limited structural upgrades over the past 100 years. Most of the work has been done without documentation. Some areas of the exterior brick have been re-grouted and the truss bottom chord splices have been strapped per report by Marquees and Associates dated August 2004. The structure measures approximately 62' wide and 82' long (Figures 4.1 & 4.2). The structure has a peak roof height measuring approximately 28'-3". The area is used for gymnasium purposes only.

4.2 Construction (URM)

The roof framing consists of wood joist at 24" on-center spanning from URM walls to heavy timber girder trusses. The built-up trusses are supported by cast-in-place concrete pilasters. The wall construction between pilasters consists of 12" wide concrete stem walls extending 6' above grade. The remaining wall height consists of three wythe clay bricks (URM). It appears the pilasters have been reinforced with the addition of concrete buttresses since original construction (Figure 4.4). It appears the buttresses were not doweled or caste directly against the original pilasters rendering their usefulness suspect. It appears diagonal steel rods were added to brace the walls to the trusses and resist overturning. The rods only served to induce forces on the bottom chord of the truss, worsening the loading conditions of the truss (Figure 4.7). In addition, the strap repair outlined the report by Marquess was not installed at the center of the joint splices, but at the cent of the trusses and therefore are not providing any benefit to the integrity of the truss. No positive connection between the joist and the top of the URM wall was observed (Figure 4.10 & 4.11). All roof sheathing consists of 1x tongue & groove decking (straight). Refer to schematic plans for additional information.

4.3 Seismic Deficiency and Damage Assessment

The following list summarizes the structural seismic deficiencies noted during analysis.

- Connection of roof framing to top of wall
- Lateral force resistance in URM walls and concrete walls
- Out of plane bracing at top of URM walls
- Aspect ratio of floor and roof diaphragms/lack of sheathing (straight sheathing)
- Roof diaphragm tension chord around perimeter of building
- Out of plane connection of girder trusses to pilasters
- Stability and condition of built-up trusses
- Lateral system load path and anchorage of front entry canopy

By observation, structural damage to exterior URM walls was evident at select locations. Weathering and cracking of brick and mortar joints was observed at several locations (Figure 4.3, 4.4, & 4.5). We also observed separation of the truss bottom chords (Figure 4.8).

4.4 Scope of Rehabilitation Work

The horizontal seismic force transfer mechanism located on top of the rafters and floor level is not attached to the perimeter walls resulting in an interrupted load path to the primary lateral load resisting system. A new layer of plywood sheathing would need to be applied to the entire upper floor and roof surface to resolve the current deficiency. See details '2' & '3' on sheet 'S2.2' for the attachment of the new plywood sheathing to the exterior perimeter walls and lateral load resisting elements.

Once the connection between the trusses, rafters, joists, and perimeter walls is resolved, a level of redundancy would be recommended to meet the expected performance level identified above. Due to the unknown performance level of the URM walls during a seismic event it would be recommended that a secondary gravity system be implemented. See sheet 'S2.1' and associated details illustrating the proposed secondary gravity system implementation consisting of perimeter structural steel beams and columns. The addition of a gravity system allows for the requested level of performance of the building if the URM walls were to fail during a seismic event. We also recommend a strengthening program for connections and bottom chord spices of the built-up trusses to upgrade the performance to a life safety level (Figure 4.12 & 4.13). See sheet 'S2.1'.

Currently, the perimeter URM walls resist the lateral loads. Due to the unknown reliability of the URM walls during a seismic event, it is the intent of the rehabilitation that new lateral load resisting elements be implemented to provide the required level of performance. We propose providing a system of steel braced frames placed at strategic locations. See sheets 'S2.0', 'S2.1' & 'S2.2' illustrating the proposed solutions.

As referenced above, additional secondary gravity resisting elements have been provided to increase the level of performance required for the building. These gravity elements have also been included into the new recommended lateral load resisting systems. These new systems will require new foundation elements to transmit these forces into the bearing strata below. See sheet 'S2.0'.

5.0 Building 'C' Observation

5.1 Overall Description

It is our understanding that no repair work or structural upgrades have been done to date. The structure measures approximately 60' wide and 82' long (Figures 5.1 & 5.2). The structure has a peak roof height measuring approximately 10'-8". The area is used for classroom purposes only.

5.2 Construction (RM1)

The roof framing consists of wood joist at 16" on-center spanning from exterior CMU wall to interior CMU wall. No positive connection between the beams and the top of the CMU wall was outlined in the construction documents provided for our reference. All roof sheathing consists of 5/8" plyscord sheathing. Refer to schematic plans for additional information.

5.3 Seismic Deficiency and Damage Assessment

The following list summarizes the structural seismic deficiencies noted during analysis.

- Connection of roof framing to top of wall
- Out of plane bracing at top of CMU walls
- Lateral force resisting system (story drift to protect glazing)
- Aspect ratio of roof diaphragms/unblocked (plyscord)

By observation, no structural damage was discovered.

5.4 Scope of Rehabilitation Work

The length to width ratio of the building creates the need to inspect nailing of plyscord sheathing and provide blocking/edgenailing over shearwalls. We also recommend installing (4) 8 FT lengths of new reinforced 8" CMU shear piers to reinforce the lateral system. Additional blocking, strapping, and wall anchors will be used in specific areas to collect forces into the top of shearwalls and restrain the top of the CMU walls against out-of-plane forces. See sheet 'S3.0' illustrating all proposed solutions.

6.0 Building 'D' Observation

6.1 Overall Description

It is our understanding that no repair work or structural upgrades have been done to date. The structure measures approximately 60' wide and 141' long (Figures 6.1, 6.2, & 6.3). The structure has a peak roof height measuring approximately 25'-0". The area is primarily used for classrooms with associated restrooms, front office, storage, and mechanical room.

6.2 Construction (W2)

The roof framing consists of wood gang-nailed trusses at 24" on-center spanning from exterior 2x6 stud walls to interior 2x6 stud walls (Figure 6.5). No positive connection between the trusses and the top of stud walls was observed (Figure 6.6). Wall sheathing appears to be 1x diagonal sheathing with plaster finish. Exterior walls support full height brick veneer. All roof sheathing consists of 1x diagonal sheathing. Refer to schematic plans for additional information.

6.3 Seismic Deficiency and Damage Assessment

The following list summarizes the structural seismic deficiencies noted during analysis.

- Connection of roof framing to top of wall
- Lateral force resisting system (story drift to protect glazing)
- Aspect ratio of roof diaphragms (diagonal sheathing)
- Lateral system load path and anchorage of front entry cover

- Bracing of URM chimney
- Brick veneer attachment

By observation, no structural damage was discovered.

6.4 Scope of Rehabilitation Work

The length to width ratio of the building creates the need to remove the roofing to inspect/nail the existing 1x diagonal sheathing and provide blocking/edgenailing over shearwalls. We also recommend installing (5) 8 FT lengths of new plywood shearwalls along exterior wall lines and (4) 20 FT lengths interior. This will cut the aspect ratios down to code acceptable levels (4:1 max). Additional blocking, strapping, and wall anchors will be used in specific areas to collect forces into the top of shearwalls. We also recommend that brick ties are installed to fasten brick to wood backing.

It is our understanding the existing URM chimney is still in operation and has historical value to the building's appearance. Therefore we recommend the chimney is demolished and replaced with a reinforced CMU chimney with brick veneer to match the original construction (Figures 6.4). See sheet 'S3.0' illustrating all proposed solutions.

7.0 Evaluation of Incidental Items

It is not uncommon for incidental, non-structural items to play a major role in the expense of rehabilitating an existing building. These costs can sometimes be significant, and can also be very difficult to estimate.

A gas powered heating unit was observed hanging from the trusses in Building 'B', and not adequately braced to resist seismic load during an event. This creates a potential falling hazard, exacerbated by its proximity to a door (Figure 4.9). It is recommended that the unit be braced off more adequately to the structure, or removed and replaced with a unit that is not required to be hung overhead. The boiler eqpuipment and piping in Building 'D' is not properly attached to the floor or braced to resist seismic loading

(Figures 6.7 & 6.8). Storage cabinets, book shelves, overhead projection equipment, lens cover, and ceiling tiles also pose a potential falling hazard, and we recommend these be braced or clipped as required.

It is our understanding that buildings from this era often contain some form of hazardous material. These materials would need to be dealt with on a case-by-case basis as they were encountered during the project.

8.0 Conclusion

The findings described in this report have been limited to the seismic lateral force resisting structural system. Based on our visual observations, we find the structure in good condition and generally safe for occupancy. No significant damage to the existing structural system was discovered.

Given the current condition of the structure, the current code section on existing buildings does not mandate that upgrades are required unless the building is scheduled for repairs, alterations, additions, or change in occupancy. However, it is our understanding the goal of the District is to continue utilizing the existing building as a facility for education, and the District wants the seismic structural system to be compliant with the current code. To clarify, upgrades outlined in this report are strictly at the discretion of the District.

We have attempted to identify all areas requiring upgrades to achieve a scope of work for current code compliance, associated estimated costs, and project schedule.

Please contact our office if you would like to discuss our findings. Please review the attached upgrade schematic drawings that can be used to refine a scope and budget. This may give you enough information to make a decision on how to proceed.

FIGURES

Figure 3.1 – Bldg. 'A' South Elevation

Figure 3.2A - Bldg. 'A' East Elevation

Figure 3.2B - Bldg. 'A' West Elevation

Figure 3.3 – Beam framed roof with T&G decking

Figure 3.4 – Covered patio at walkway

Figure 4.1 – Bldg. 'B' West Elevation

Figure 4.2A – Bldg. 'B' Northeast Elevation

Figure 4.2B – Bldg. 'B' East Elevation

Figure 4.3 – Cracks in URM shearwalls

Figure 4.4 – Cracks is URM shearwalls and buttress

Figure 4.5 – Cracks in URM shearwalls

Figure 4.6 – Canopy attachment at entry

Figure 4.7 – Concrete pilasters with diagonal rods through truss

Figure 4.8 – Truss bottom chord separation

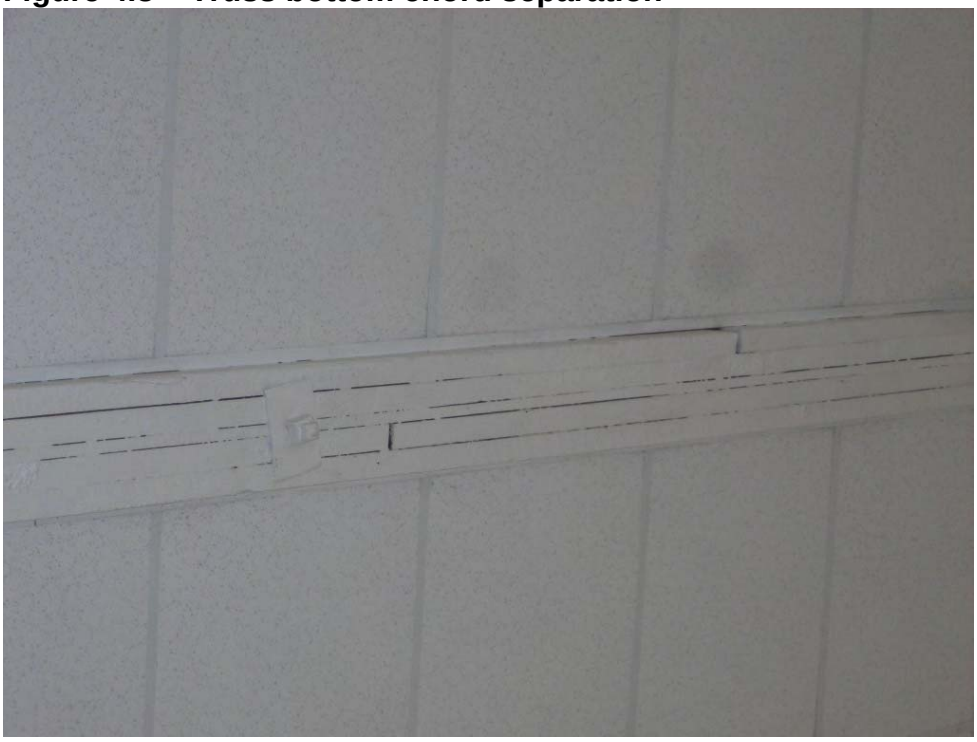

Figure 4.9 – Unbraced hanging equipment and ceiling

Figure 4.10 – Framing connection at top of URM walls

Figure 4.11 – Framing connection at top of URM walls

Figure 4.12 – Framing connections at girder truss

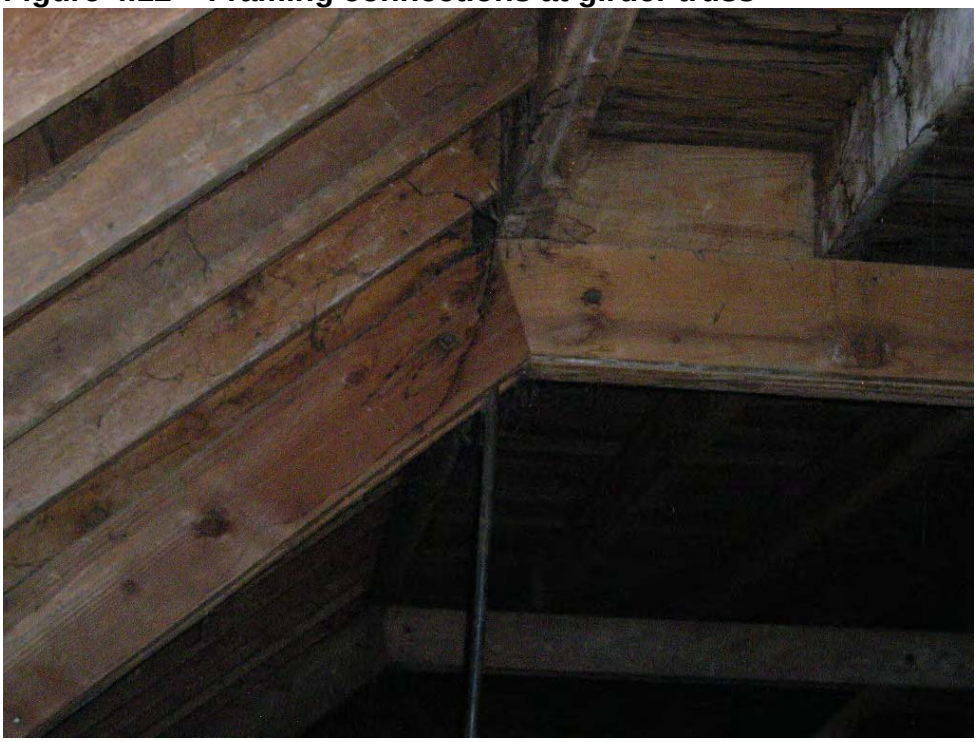

Figure 4.13 – Framing connections at girder truss

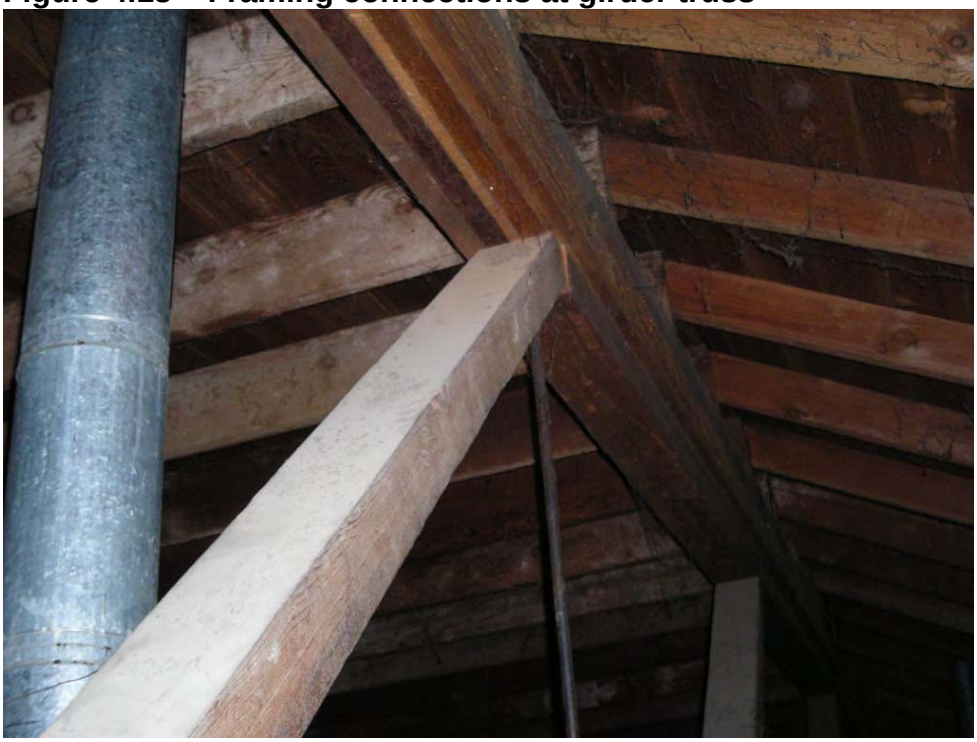

Figure 5.1 – Bldg. 'C' East Elevation

Figure 5.2A – Bldg. 'C' South Elevation

Figure 5.2B – Bldg. 'C' North Elevation

Figure 6.1 – Bldg. 'D' South Elevation

Figure 6.2– Bldg. 'D' North Elevation

Figure 6.3 – Bldg. 'D' West Elevation

Figure 6.4 – URM Chimney

Figure 6.5 – Wood framed trusses with diagonal sheathing

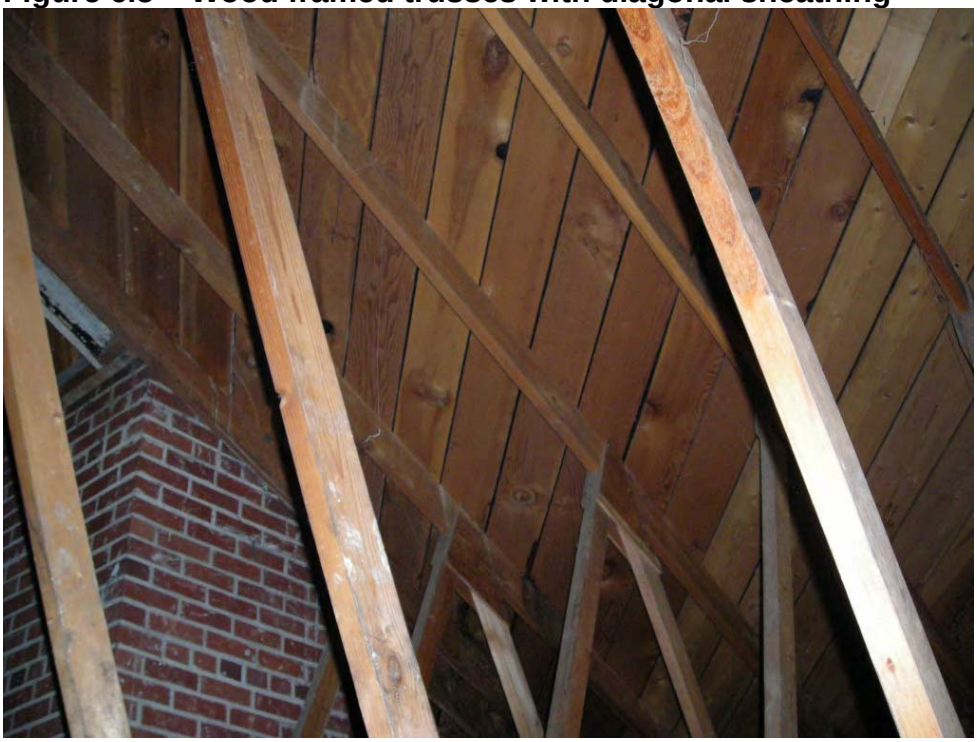

Figure 6.6 – Connection of wood framed trusses

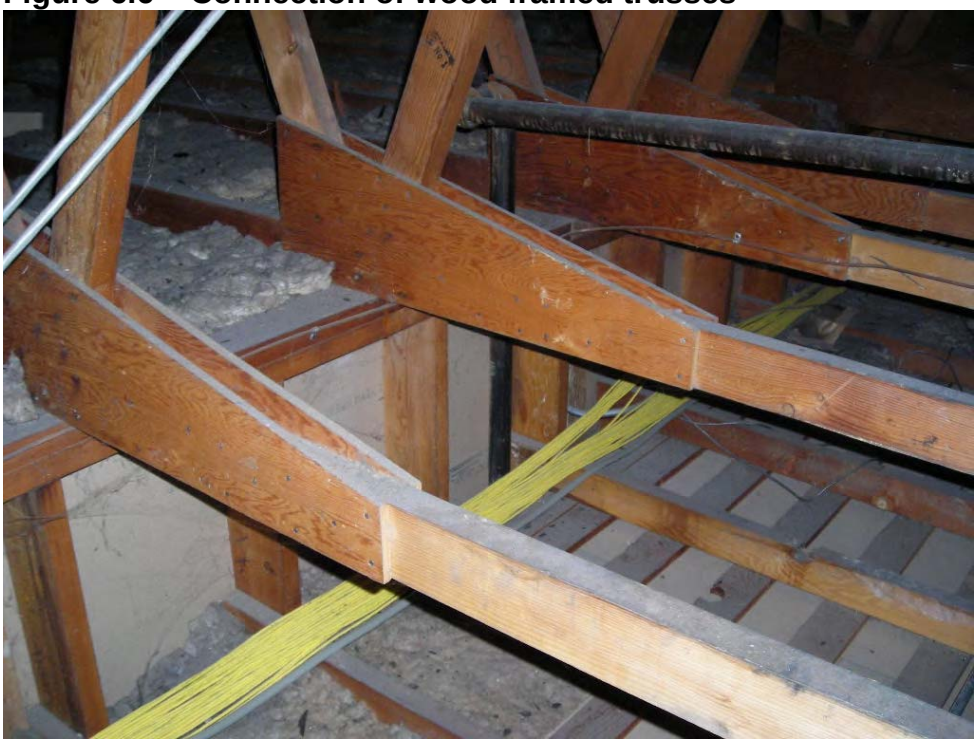

Figure 6.7 – Attachment of boiler equipment

Figure 6.8 – Attachment of boiler piping

Appendix 'A'

ASCE 31
Screening Phase (Tier 1)
Evaluation Checklists

C3.3 Selection and Use of Checklists

The evaluation statements provided in the checklists form the core of the Tier 1 Evaluation methodology. These evaluation statements are based on observed earthquake structural damage during actual earthquakes. The checklists do not necessarily identify the response of the structure to ground motion; rather, the design professional obtains a general sense of the structure's deficiencies and potential behavior during an earthquake. By quickly identifying the potential deficiencies in the structure, the design professional has a better idea of what to examine and analyze in a Tier 2 or Tier 3 Evaluation.

The General Structural Checklists are a complete listing of all evaluation statements used in the Common Building Type checklists. They should be used for buildings with structural systems that do not match the Common Building Types. While the general purpose of the Tier 1 Checklists is to identify potential weak links associated with structures of a specific type that have been observed in past significant earthquakes, the General Checklists, by virtue of their design, do not accomplish this. They only represent a listing of possible deficiencies. The design professional must consider first the applicability of the potential deficiency to the building system being considered. Generally, only the deficiencies applicable to the primary lateral-force-resisting elements of the building need be considered.

While the section numbers in parentheses following each evaluation statement correspond to Tier 2 Evaluation procedures, they also correspond to commentary in Chapter 4 regarding the statement's purpose. If additional information on the evaluation statement is required, please refer to the commentary in the Tier 2 procedure for that evaluation statement.

Table 3-2. Checklists Required for a Tier 1 Evaluation

		Required Checklists[1]						
Level of Seismicity[3]	Level of Performance[2]	Level of Low Seismicity (Sec. 3.6)	Basic Structural (Sec. 3.7)	Supplemental Structural (Sec. 3.7)	Geologic Site Hazard and Foundation (Sec. 3.8)	Basic Nonstructural (Sec. 3.9.1)	Intermediate Nonstructural (Sec. 3.9.2)	Supplemental Nonstructural (Sec. 3.9.3)
Low	LS	▶						
	IO		▶		▶	▶		
Moderate	LS		▶		▶	▶		
	IO		▶	▶	▶	▶	▶	
High	LS		▶	▶	▶	▶	▶	
	IO		▶	▶	▶	▶	▶	▶

[1]A checkmark (▶) designates the checklist that must be completed for a Tier 1 Evaluation as a function of the level of seismicity and level of performance.

[2]LS = Life Safety; IO = Immediate Occupancy (defined in Section 2.4).

[3]Defined in Section 2.5.

BLDGS 'A' & 'C' RM

3.7.13 Basic Structural Checklist for Building Type RM1: Reinforced Masonry Bearing Walls with Flexible Diaphragms

This Basic Structural Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

C3.7.13 Basic Structural Checklist for Building Type RM1

These buildings have bearing walls that consist of reinforced brick or concrete block masonry. Wood floor and roof framing consists of wood joists, glulam beams, and wood posts or small steel columns. Steel floor and roof framing consists of steel beams or open web joists, steel girders, and steel columns. Lateral forces are resisted by the reinforced brick or concrete block masonry shear walls. Diaphragms consist of straight or diagonal wood sheathing, plywood, or untopped metal deck, and are flexible relative to the walls. Foundations consist of brick or concrete spread footings or deep foundations.

CANOPY

Building System

C (NC) N/A BLDG. 'A' — LOAD PATH: The structure shall contain a minimum of one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)

(C) NC N/A — ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building shall be greater than 4 percent of the height of the shorter building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.1.2)

C NC (N/A) — MEZZANINES: Interior mezzanine levels shall be braced independently from the main structure, or shall be anchored to the lateral-force-resisting elements of the main structure. (Tier 2: Sec. 4.3.1.3)

C NC (N/A) — WEAK STORY: The strength of the lateral-force-resisting system in any story shall not be less than 80 percent of the strength in an adjacent story, above or below, for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.1)

C NC (N/A) — SOFT STORY: The stiffness of the lateral-force-resisting system in any story shall not be less than 70 percent of the lateral-force-resisting system stiffness in an adjacent story above or below, or less than 80 percent of the average lateral-force-resisting system stiffness of the three stories above or below for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.2)

C NC (N/A) — GEOMETRY: There shall be no changes in horizontal dimension of the lateral-force-resisting system of more than 30 percent in a story relative to adjacent stories for Life Safety and Immediate Occupancy, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 4.3.2.3)

(C) NC N/A — VERTICAL DISCONTINUITIES: All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)

C NC N/A MASS: There shall be no change in effective mass more than 50 percent from one story to the next for Life Safety and Immediate Occupancy. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 4.3.2.5)

C NC N/A DETERIORATION OF WOOD: There shall be no signs of decay, shrinkage, splitting, fire damage, or sagging in any of the wood members, and none of the metal connection hardware shall be deteriorated, broken, or loose. (Tier 2: Sec. 4.3.3.1)

C NC N/A MASONRY UNITS: There shall be no visible deterioration of masonry units. (Tier 2: Sec. 4.3.3.7)

C NC N/A MASONRY JOINTS: The mortar shall not be easily scraped away from the joints by hand with a metal tool, and there shall be no areas of eroded mortar. (Tier 2: Sec. 4.3.3.8)

C NC N/A REINFORCED MASONRY WALL CRACKS: All existing diagonal cracks in wall elements shall be less than 1/8 inch for Life Safety and 1/16 inch for Immediate Occupancy, shall not be concentrated in one location, and shall not form an X pattern. (Tier 2: Sec. 4.3.3.10)

Lateral-Force-Resisting System

C NC N/A REDUNDANCY: The number of lines of shear walls in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.1.1)

C NC N/A SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 3.5.3.3, shall be less than 70 psi for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.4.1)

C NC N/A REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls shall be greater than 0.002 for Life Safety and Immediate Occupancy of the wall with the minimum of 0.0007 for Life Safety and Immediate Occupancy in either of the two directions; the spacing of reinforcing steel shall be less than 48 inches for Life Safety and Immediate Occupancy; and all vertical bars shall extend to the top of the walls. (Tier 2: Sec. 4.4.2.4.2)

BLDG. C
BLDG. A

Connections

C NC N/A WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support shall be anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 3.5.3.7. (Tier 2: Sec. 4.6.1.1)

BLDG. C

C NC N/A WOOD LEDGERS: The connection between the wall panels and the diaphragm shall not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 4.6.1.2)

C NC N/A TRANSFER TO SHEAR WALLS: Diaphragms shall be connected for transfer of loads to the shear walls for Life Safety and the connections shall be able to develop the lesser of the shear strength of the walls or diaphragms for Immediate Occupancy. (Tier 2: Sec. 4.6.2.1)

BLDG. C

C NC N/A FOUNDATION DOWELS: Wall reinforcement shall be doweled into the foundation for Life Safety, and the dowels shall be able to develop the lesser of the strength of the walls or the uplift capacity of the foundation for Immediate Occupancy. (Tier 2: Sec. 4.6.3.5)

C NC N/A GIRDER/COLUMN CONNECTION: There shall be a positive connection utilizing plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 4.6.4.1)

3.7.13S Supplemental Structural Checklist for Building Type RM1: Reinforced Masonry Bearing Walls with Flexible Diaphragms

This Supplemental Structural Checklist shall be completed where required by Table 3-2. The Basic Structural Checklist shall be completed prior to completing this Supplemental Structural Checklist.

Lateral-Force-Resisting System

C NC N/A REINFORCING AT OPENINGS: All wall openings that interrupt rebar shall have trim reinforcing on all sides. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.3)

C NC N/A PROPORTIONS: The height-to-thickness ratio of the shear walls at each story shall be less than 30. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.4)

Diaphragms

C NC N/A CROSS TIES: There shall be continuous cross ties between diaphragm chords. (Tier 2: Sec. 4.5.1.2)
BLDG 'C'

C NC N/A OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls shall be less than 25 percent of the wall length for Life Safety and 15 percent of the wall length for Immediate Occupancy. (Tier 2: Sec. 4.5.1.4)

C NC N/A OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls shall not be greater than 8 feet long for Life Safety and 4 feet long for Immediate Occupancy. (Tier 2: Sec. 4.5.1.6)

C NC N/A PLAN IRREGULARITIES: There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.7)

C NC N/A DIAPHRAGM REINFORCEMENT AT OPENINGS: There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.8)

C NC N/A STRAIGHT SHEATHING: All straight sheathed diaphragms shall have aspect ratios less than 2-to-1 for Life Safety and 1-to-1 for Immediate Occupancy in the direction being considered. (Tier 2: Sec. 4.5.2.1)
BLDG 'A'

C NC N/A SPANS: All wood diaphragms with spans greater than 24 feet for Life Safety and 12 feet for Immediate Occupancy shall consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 4.5.2.2)
BLDG 'A' & 'C'

C NC N/A UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate Occupancy. (Tier 2: Sec. 4.5.2.3)
BLDG. 'A' & 'C'

C NC N/A NON-CONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete shall consist of horizontal spans of less than 40 feet and shall have span/depth ratios less than 4-to-1. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.3.1)

C NC N/A OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 4.5.7.1)

Connections

C NC N/A STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements shall be installed taut and shall be stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 inch prior to engagement of the anchors. (Tier 2: Sec. 4.6.1.4)

BLDG. 'A' & 'C'

BLDG: "D"

3.7.2 Basic Structural Checklist for Building Type W2: Wood Frames, Commercial and Industrial

This Basic Structural Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

C3.7.2 Basic Structural Checklist for Building Type W2

These buildings are commercial or industrial buildings with a floor area of 5,000 square feet or more. There are few, if any, interior walls. The floor and roof framing consists of wood or steel trusses, glulam or steel beams, and wood posts or steel columns. Lateral forces are resisted by wood diaphragms and exterior stud walls sheathed with plywood, oriented strand board, stucco, plaster, straight or diagonal wood sheathing, or braced with rod bracing. Wall openings for storefronts and garages, where present, are framed by post-and-beam framing.

Building System

C NC N/A — LOAD PATH: The structure shall contain a minimum of one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)

C NC N/A — MEZZANINES: Interior mezzanine levels shall be braced independently from the main structure, or shall be anchored to the lateral-force-resisting elements of the main structure. (Tier 2: Sec. 4.3.1.3)

C NC N/A — WEAK STORY: The strength of the lateral-force-resisting system in any story shall not be less than 80 percent of the strength in an adjacent story, above or below, for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.1)

C NC N/A — SOFT STORY: The stiffness of the lateral-force-resisting system in any story shall not be less than 70 percent of the lateral-force-resisting system stiffness in an adjacent story above or below, or less than 80 percent of the average lateral-force-resisting system stiffness of the three stories above or below for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.2)

C NC N/A — GEOMETRY: There shall be no changes in horizontal dimension of the lateral-force-resisting system of more than 30 percent in a story relative to adjacent stories for Life Safety and Immediate Occupancy, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 4.3.2.3)

C NC N/A — VERTICAL DISCONTINUITIES: All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)

C NC N/A — MASS: There shall be no change in effective mass more than 50 percent from one story to the next for Life Safety and Immediate Occupancy. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 4.3.2.5)

C NC N/A DETERIORATION OF WOOD: There shall be no signs of decay, shrinkage, splitting, fire damage, or sagging in any of the wood members, and none of the metal connection hardware shall be deteriorated, broken, or loose. (Tier 2: Sec. 4.3.3.1)

C NC N/A WOOD STRUCTURAL PANEL SHEAR WALL FASTENERS: There shall be no more than 15 percent of inadequate fastening such as overdriven fasteners, omitted blocking, excessive fastening spacing, or inadequate edge distance. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.3.3.2)

Lateral-Force-Resisting System

C NC N/A REDUNDANCY: The number of lines of shear walls in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.1.1)

C NC N/A SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 3.5.3.3, shall be less than the following values for Life Safety and Immediate Occupancy (Tier 2: Sec. 4.4.2.7.1):

Structural panel sheathing	1,000 plf
Diagonal sheathing	700 plf
Straight sheathing	100 plf
All other conditions	100 plf

C NC N/A STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings shall not rely on exterior stucco walls as the primary lateral-force-resisting system. (Tier 2: Sec. 4.4.2.7.2)

C NC N/A GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard shall not be used as shear walls on buildings over one story in height with the exception of the uppermost level of a multi-story building. (Tier 2: Sec. 4.4.2.7.3)

C NC N/A NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 for Life Safety and 1.5-to-1 for Immediate Occupancy shall not be used to resist lateral forces developed in the building in levels of moderate and high seismicity. Narrow wood shear walls with an aspect ratio greater than 2-to-1 for Immediate Occupancy shall not be used to resist lateral forces developed in the building in levels of low seismicity. (Tier 2: Sec. 4.4.2.7.4)

C NC N/A WALLS CONNECTED THROUGH FLOORS: Shear walls shall have interconnection between stories to transfer overturning and shear forces through the floor. (Tier 2: Sec. 4.4.2.7.5)

C NC N/A HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story due to a sloping site, all shear walls on the downhill slope shall have an aspect ratio less than 1-to-1 for Life Safety and 1-to-2 for Immediate Occupancy. (Tier 2: Sec. 4.4.2.7.6)

C NC N/A CRIPPLE WALLS: Cripple walls below first-floor-level shear walls shall be braced to the foundation with wood structural panels. (Tier 2: Sec. 4.4.2.7.7)

C NC N/A OPENINGS: Walls with openings greater than 80 percent of the length shall be braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or shall be supported by adjacent construction through positive ties capable of transferring the lateral forces. (Tier 2: Sec. 4.4.2.7.8)

Connections

C NC N/A WOOD POSTS: There shall be a positive connection of wood posts to the foundation. (Tier 2: Sec. 4.6.3.3)

C NC N/A WOOD SILLS: All wood sills shall be bolted to the foundation. (Tier 2: Sec. 4.6.3.4)

C NC N/A GIRDER/COLUMN CONNECTION: There shall be a positive connection utilizing plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 4.6.4.1)

3.7.2S Supplemental Structural Checklist for Building Type W2: Wood Frames, Commercial and Industrial

This Supplemental Structural Checklist shall be completed where required by Table 3-2. The Basic Structural Checklist shall be completed prior to completing this Supplemental Structural Checklist.

Lateral-Force-Resisting System

C NC N/A HOLD-DOWN ANCHORS: All shear walls shall have hold-down anchors constructed per acceptable construction practices, attached to the end studs. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.7.9)

Diaphragms

C NC N/A DIAPHRAGM CONTINUITY: The diaphragms shall not be composed of split-level floors and shall not have expansion joints. (Tier 2: Sec. 4.5.1.1)

C NC N/A ROOF CHORD CONTINUITY: All chord elements shall be continuous, regardless of changes in roof elevation. (Tier 2: Sec. 4.5.1.3)

C NC N/A PLAN IRREGULARITIES: There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.7)

C NC N/A DIAPHRAGM REINFORCEMENT AT OPENINGS: There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.8)

C NC N/A STRAIGHT SHEATHING: All straight sheathed diaphragms shall have aspect ratios less than 2-to-1 for Life Safety and 1-to-1 for Immediate Occupancy in the direction being considered. (Tier 2: Sec. 4.5.2.1)

C NC N/A SPANS: All wood diaphragms with spans greater than 24 feet for Life Safety and 12 feet for Immediate Occupancy shall consist of wood structural panels or diagonal sheathing. Wood commercial and industrial buildings may have rod-braced systems. (Tier 2: Sec. 4.5.2.2)

C NC N/A UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate Occupancy. (Tier 2: Sec. 4.5.2.3)

C NC N/A OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 4.5.7.1)

Connections

C NC N/A WOOD SILL BOLTS: Sill bolts shall be spaced at 6 feet or less for Life Safety and 4 feet or less for Immediate Occupancy, with proper edge and end distance provided for wood and concrete. (Tier 2: Sec. 4.6.3.9)

3.8 Geologic Site Hazards and Foundations Checklist

This Geologic Site Hazards and Foundations Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

Geologic Site Hazards

The following statements shall be completed for buildings in levels of high or moderate seismicity.

C NC N/A LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 feet under the building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.1.1)

C NC N/A SLOPE FAILURE: The building site shall be sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or shall be capable of accommodating any predicted movements without failure. (Tier 2: Sec. 4.7.1.2)

C NC N/A SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site is not anticipated. (Tier 2: Sec. 4.7.1.3)

Condition of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

C NC N/A FOUNDATION PERFORMANCE: There shall be no evidence of excessive foundation movement such as settlement or heave that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.1)

The following statement shall be completed for buildings in levels of high or moderate seismicity being evaluated to the Immediate Occupancy Performance Level.

C NC N/A DETERIORATION: There shall not be evidence that foundation elements have deteriorated due to corrosion, sulfate attack, material breakdown, or other reasons in a manner that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.2)

Capacity of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

C NC N/A POLE FOUNDATIONS: Pole foundations shall have a minimum embedment depth of 4 feet for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.3.1)

The following statements shall be completed for buildings in levels of moderate seismicity being evaluated to the Immediate Occupancy Performance Level and for buildings in levels of high seismicity.

C NC N/A OVERTURNING: The ratio of the horizontal dimension of the lateral-force-resisting system at the foundation level to the building height (base/height) shall be greater than $0.6S_a$. (Tier 2: Sec. 4.7.3.2)

C	NC	N/A	TIES BETWEEN FOUNDATION ELEMENTS: The foundation shall have ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Class A, B, or C. (Section 3.5.2.3.1, Tier 2: Sec. 4.7.3.3)
C	NC	N/A	DEEP FOUNDATIONS: Piles and piers shall be capable of transferring the lateral forces between the structure and the soil. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.4)
C	NC	N/A	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another shall not exceed one story in height. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.5)

3.9 Nonstructural Checklists

The following checklists are included in this section:

- Basic Nonstructural Component Checklist (Section 3.9.1)
- Intermediate Nonstructural Component Checklist (Section 3.9.2)
- Supplemental Nonstructural Component Checklist (Section 3.9.3)

These checklists shall be completed where required by Table 3-2. The Basic Nonstructural Component Checklist shall be completed prior to completing the Intermediate Nonstructural Component Checklist. The Intermediate Nonstructural Component Checklist shall be completed prior to completing the Supplemental Nonstructural Component Checklist.

3.9.1 Basic Nonstructural Component Checklist

This Basic Nonstructural Component Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

Partitions

C NC N/A UNREINFORCED MASONRY: Unreinforced masonry or hollow clay tile partitions shall be braced at a spacing equal to or less than 10 feet in levels of low or moderate seismicity and 6 feet in levels of high seismicity. (Tier 2: Sec. 4.8.1.1)

Ceiling Systems

C NC N/A SUPPORT: The integrated suspended ceiling system shall not be used to laterally support the tops of gypsum board, masonry, or hollow clay tile partitions. Gypsum board partitions need not be evaluated where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.2.1)

Light Fixtures

C NC N/A EMERGENCY LIGHTING: Emergency lighting shall be anchored or braced to prevent falling during an earthquake. (Tier 2: Sec. 4.8.3.1)

Cladding and Glazing

C NC N/A CLADDING ANCHORS: Cladding components weighing more than 10 psf shall be mechanically anchored to the exterior wall framing at a spacing equal to or less than 4 feet. A spacing of up to 6 feet is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.1)

C NC N/A DETERIORATION: There shall be no evidence of deterioration, damage or corrosion in any of the connection elements. (Tier 2: Sec. 4.8.4.2)

C NC N/A CLADDING ISOLATION: For moment frame buildings of steel or concrete, panel connections shall be detailed to accommodate a story drift ratio of 0.02. Panel connection detailing for a story drift ratio of 0.01 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.3)

C NC N/A MULTI-STORY PANELS: For multi-story panels attached at each floor level, panel connections shall be detailed to accommodate a story drift ratio of 0.02. Panel connection detailing for a story drift ratio of 0.01 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.4)

C NC N/A BEARING CONNECTIONS: Where bearing connections are required, there shall be a minimum of two bearing connections for each wall panel. (Tier 2: Sec. 4.8.4.5)

C NC N/A INSERTS: Where inserts are used in concrete connections, the inserts shall be anchored to reinforcing steel or other positive anchorage. (Tier 2: Sec. 4.8.4.6)

C NC N/A PANEL CONNECTIONS: Exterior cladding panels shall be anchored out-of-plane with a minimum of 4 connections for each wall panel. Two connections per wall panel are permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.7)

Masonry Veneer

C NC N/A SHELF ANGLES: Masonry veneer shall be supported by shelf angles or other elements at each floor 30 feet or more above ground for Life Safety and at each floor above the first floor for Immediate Occupancy. (Tier 2: Sec. 4.8.5.1)

C NC N/A TIES: Masonry veneer shall be connected to the back-up with corrosion-resistant ties. The ties shall have a spacing equal to or less than 24 inches with a minimum of one tie for every 2-2/3 square feet. A spacing of up to 36 inches is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.5.2)

BLDG 'D'

C NC N/A WEAKENED PLANES: Masonry veneer shall be anchored to the back-up adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 4.8.5.3)

C NC N/A DETERIORATION: There shall be no evidence of deterioration, damage, or corrosion in any of the connection elements. (Tier 2: Sec. 4.8.5.4)

Parapets, Cornices, Ornamentation, and Appendages

C NC N/A URM PARAPETS: There shall be no laterally unsupported unreinforced masonry parapets or cornices with height-to-thickness ratios greater than 1.5. A height-to-thickness ratio of up to 2.5 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.8.1)

C NC N/A CANOPIES: Canopies located at building exits shall be anchored to the structural framing at a spacing of 6 feet or less. An anchorage spacing of up to 10 feet is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.8.2)

BLDG. 'D'

Masonry Chimneys

C NC N/A URM CHIMNEYS: No unreinforced masonry chimney shall extend above the roof surface more than twice the least dimension of the chimney. A height above the roof surface of up to three times the least dimension of the chimney is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.9.1)

BLDG. 'D'

Stairs

C NC N/A URM WALLS: Walls around stair enclosures shall not consist of unbraced hollow clay tile or unreinforced masonry with a height-to-thickness ratio greater than 12-to-1. A height-to-thickness ratio of up to 15-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.10.1)

C NC N/A STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure shall not rely on shallow anchors in concrete. Alternatively, the stair details shall be capable of accommodating the drift calculated using the Quick Check procedure of Section 3.5.3.1 without including tension in the anchors. (Tier 2: Sec. 4.8.10.2)

Building Contents and Furnishing

C NC N/A TALL NARROW CONTENTS: Contents over 4 feet in height with a height-to-depth or height-to-width ratio greater than 3-to-1 shall be anchored to the floor slab or adjacent structural walls. A height-to-depth or height-to-width ratio of up to 4-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.11.1)

Mechanical and Electrical Equipment

C NC N/A EMERGENCY POWER: Equipment used as part of an emergency power system shall be mounted to maintain continued operation after an earthquake. (Tier 2: Sec. 4.8.12.1)

C NC N/A HAZARDOUS MATERIAL EQUIPMENT: HVAC or other equipment containing hazardous material shall not have damaged supply lines or unbraced isolation supports. (Tier 2: Sec. 4.8.12.2)

C NC N/A DETERIORATION: There shall be no evidence of deterioration, damage, or corrosion in any of the anchorage or supports of mechanical or electrical equipment. (Tier 2: Sec. 4.8.12.3)

C NC N/A ATTACHED EQUIPMENT: Equipment weighing over 20 lb that is attached to ceilings, walls, or other supports 4 feet above the floor level shall be braced. (Tier 2: Sec. 4.8.12.4)

Piping

C NC N/A FIRE SUPPRESSION PIPING: Fire suppression piping shall be anchored and braced in accordance with NFPA-13 (NFPA, 1996). (Tier 2: Sec. 4.8.13.1)

C NC N/A FLEXIBLE COUPLINGS: Fluid, gas, and fire suppression piping shall have flexible couplings. (Tier 2: Sec. 4.8.13.2)

Hazardous Materials Storage and Distribution

C NC N/A TOXIC SUBSTANCES: Toxic and hazardous substances stored in breakable containers shall be restrained from falling by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 4.8.15.1)

3.9.2 Intermediate Nonstructural Component Checklist

This Intermediate Nonstructural Component Checklist shall be completed where required by Table 3-2. The Basic Nonstructural Component Checklist shall be completed prior to completing this Intermediate Nonstructural Component Checklist.

Ceiling Systems

C NC N/A LAY-IN TILES: Lay-in tiles used in ceiling panels located at exits and corridors shall be secured with clips. (Tier 2: Sec. 4.8.2.2)

C NC N/A INTEGRATED CEILINGS: Integrated suspended ceilings at exits and corridors or weighing more than 2 pounds per square foot shall be laterally restrained with a minimum of four diagonal wires or rigid members attached to the structure above at a spacing equal to or less than 12 feet. (Tier 2: Sec. 4.8.2.3)

C NC N/A SUSPENDED LATH AND PLASTER: Ceilings consisting of suspended lath and plaster or gypsum board shall be attached to resist seismic forces for every 12 square feet of area. (Tier 2: Sec. 4.8.2.4)

Light Fixtures

C NC N/A INDEPENDENT SUPPORT: Light fixtures in suspended grid ceilings shall be supported independently of the ceiling suspension system by a minimum of two wires at diagonally opposite corners of the fixtures. (Tier 2: Sec. 4.8.3.2)

Cladding and Glazing

C NC N/A GLAZING: Glazing in curtain walls and individual panes over 16 square feet in area, located up to a height of 10 feet above an exterior walking surface, shall have safety glazing. Such glazing located over 10 feet above an exterior walking surface shall be laminated annealed or laminated heat-strengthened safety glass or other glazing system that will remain in the frame when glass is cracked. (Tier 2: Sec. 4.8.4.8)

Parapets, Cornices, Ornamentation, and Appendages

C NC N/A CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 shall have vertical reinforcement. (Tier 2: Sec. 4.8.8.3)

C NC N/A APPENDAGES: Cornices, parapets, signs, and other appendages that extend above the highest point of anchorage to the structure or cantilever from exterior wall faces and other exterior wall ornamentation shall be reinforced and anchored to the structural system at a spacing equal to or less than 10 feet for Life Safety and 6 feet for Immediate Occupancy. This requirement need not apply to parapets or cornices compliant with Section 4.8.8.1 or 4.8.8.3. (Tier 2: Sec. 4.8.8.4)

Masonry Chimneys

C NC N/A ANCHORAGE: Masonry chimneys shall be anchored at each floor level and the roof. (Tier 2: Sec. 4.8.9.2)

BLDG. D

Mechanical and Electrical Equipment

C NC N/A VIBRATION ISOLATORS: Equipment mounted on vibration isolators shall be equipped with restraints or snubbers. (Tier 2: Sec. 4.8.12.5)

Ducts

C NC N/A STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts shall be braced and shall have flexible connections at seismic joints. (Tier 2: Sec. 4.8.14.1)

BLDG. 'B RR

3.7.15 Basic Structural Checklist for Building Type URM: Unreinforced Masonry Bearing Walls with Flexible Diaphragms

This Basic Structural Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the Tier 2 Special Procedure for Unreinforced Masonry or the Tier 3 Evaluation Procedure.

C3.7.15 Basic Structural Checklist for Building Type URM

These buildings have bearing walls that consist of unreinforced (or lightly reinforced) brick, stone, or concrete block masonry. Wood floor and roof framing consists of wood joists, glulam beams, and wood posts or small steel columns. Steel floor and roof framing consists of steel beams or open web joists, steel girders, and steel columns. Lateral forces are resisted by the brick or concrete block masonry shear walls. Diaphragms consist of straight or diagonal lumber sheathing, structural wood panels, or untopped metal deck, and are flexible relative to the walls. Foundations consist of brick or concrete spread footings or deep foundations.

Building System

C	NC	N/A	LOAD PATH: The structure shall contain a minimum of one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)
C	NC	N/A	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building shall be greater than 4 percent of the height of the shorter building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.1.2)
C	NC	N/A	MEZZANINES: Interior mezzanine levels shall be braced independently from the main structure, or shall be anchored to the lateral-force-resisting elements of the main structure. (Tier 2: Sec. 4.3.1.3)
C	NC	N/A	WEAK STORY: The strength of the lateral-force-resisting system in any story shall not be less than 80 percent of the strength in an adjacent story, above or below, for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.1)
C	NC	N/A	SOFT STORY: The stiffness of the lateral-force-resisting system in any story shall not be less than 70 percent of the lateral-force-resisting system stiffness in an adjacent story above or below, or less than 80 percent of the average lateral-force-resisting system stiffness of the three stories above or below for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.2)
C	NC	N/A	GEOMETRY: There shall be no changes in horizontal dimension of the lateral-force-resisting system of more than 30 percent in a story relative to adjacent stories for Life Safety and Immediate Occupancy, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 4.3.2.3)
C	NC	N/A	VERTICAL DISCONTINUITIES: All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)

C NC N/A MASS: There shall be no change in effective mass more than 50 percent from one story to the next for Life Safety and Immediate Occupancy. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 4.3.2.5)

C NC N/A DETERIORATION OF WOOD: There shall be no signs of decay, shrinkage, splitting, fire damage, or sagging in any of the wood members, and none of the metal connection hardware shall be deteriorated, broken, or loose. (Tier 2: Sec. 4.3.3.1)

C NC N/A MASONRY UNITS: There shall be no visible deterioration of masonry units. (Tier 2: Sec. 4.3.3.7)

C NC N/A MASONRY JOINTS: The mortar shall not be easily scraped away from the joints by hand with a metal tool, and there shall be no areas of eroded mortar. (Tier 2: Sec. 4.3.3.8)

C NC N/A UNREINFORCED MASONRY WALL CRACKS: There shall be no existing diagonal cracks in the wall elements greater than 1/8 inch for Life Safety and 1/16 inch for Immediate Occupancy, or out-of-plane offsets in the bed joint greater than 1/8 inch for Life Safety and 1/16 inch for Immediate Occupancy, and shall not form an X pattern. (Tier 2: Sec. 4.3.3.11)

Lateral-Force-Resisting System

C NC N/A REDUNDANCY: The number of lines of shear walls in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.1.1)

C NC N/A SHEAR STRESS CHECK: The shear stress in the unreinforced masonry shear walls, calculated using the Quick Check procedure of Section 3.5.3.3, shall be less than 30 psi for clay units and 70 psi for concrete units for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.5.1)

Connections

C NC N/A WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support shall be anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 3.5.3.7. (Tier 2: Sec. 4.6.1.1)

C NC N/A WOOD LEDGERS: The connection between the wall panels and the diaphragm shall not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 4.6.1.2)

C NC N/A TRANSFER TO SHEAR WALLS: Diaphragms shall be connected for transfer of loads to the shear walls for Life Safety and the connections shall be able to develop the lesser of the shear strength of the walls or diaphragms for Immediate Occupancy. (Tier 2 Sec. 4.6.2.1)

C NC N/A GIRDER/COLUMN CONNECTION: There shall be a positive connection utilizing plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 4.6.4.1)

3.7.15S Supplemental Structural Checklist for Building Type URM: Unreinforced Masonry Bearing Walls with Flexible Diaphragms

This Supplemental Structural Checklist shall be completed where required by Table 3-2. The Basic Structural Checklist shall be completed prior to completing this Supplemental Structural Checklist.

Lateral-Force-Resisting System

C NC N/A PROPORTIONS: The height-to-thickness ratio of the shear walls at each story shall be less than the following for Life Safety and Immediate Occupancy (Tier 2: Sec. 4.4.2.5.2):

Top story of multi-story building	9
First story of multi-story building	15
All other conditions	13

C NC N/A MASONRY LAY-UP: Filled collar joints of multi-wythe masonry walls shall have negligible voids. (Tier 2: Sec. 4.4.2.5.3)

Diaphragms

C NC N/A CROSS TIES: There shall be continuous cross ties between diaphragm chords. (Tier 2: Sec. 4.5.1.2)

C NC N/A OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls shall be less than 25 percent of the wall length for Life Safety and 15 percent of the wall length for Immediate Occupancy. (Tier 2: Sec. 4.5.1.4)

C NC N/A OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls shall not be greater than 8 feet long for Life Safety and 4 feet long for Immediate Occupancy. (Tier 2: Sec. 4.5.1.6)

C NC N/A PLAN IRREGULARITIES: There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.7)

C NC N/A DIAPHRAGM REINFORCEMENT AT OPENINGS: There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.8)

C NC N/A STRAIGHT SHEATHING: All straight sheathed diaphragms shall have aspect ratios less than 2-to-1 for Life Safety and 1-to-1 for Immediate Occupancy in the direction being considered. (Tier 2: Sec. 4.5.2.1)

C NC N/A SPANS: All wood diaphragms with spans greater than 24 feet for Life Safety and 12 feet for Immediate Occupancy shall consist of wood structural panels or diagonal sheathing (Tier 2: Sec. 4.5.2.2)

C NC N/A UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate Occupancy. (Tier 2: Sec. 4.5.2.3)

C NC N/A NON-CONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete shall consist of horizontal spans of less than 40 feet and shall have span/depth ratios less than 4-to-1. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.3.1)

C NC N/A OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 4.5.7.1)

Connections

C NC N/A STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements shall be installed taut and shall be stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 inch prior to engagement of the anchors. (Tier 2: Sec. 4.6.1.4)

C NC N/A BEAM, GIRDER, AND TRUSS SUPPORTS: Beams, girders, and trusses supported by unreinforced masonry walls or pilasters shall have independent secondary columns for support of vertical loads. (Tier 2: Sec. 4.6.4.5)

3.8 Geologic Site Hazards and Foundations Checklist

This Geologic Site Hazards and Foundations Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

Geologic Site Hazards

The following statements shall be completed for buildings in levels of high or moderate seismicity.

C NC N/A LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 feet under the building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.1.1)

C NC N/A SLOPE FAILURE: The building site shall be sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or shall be capable of accommodating any predicted movements without failure. (Tier 2: Sec. 4.7.1.2)

C NC N/A SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site is not anticipated. (Tier 2: Sec. 4.7.1.3)

Condition of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

C NC N/A FOUNDATION PERFORMANCE: There shall be no evidence of excessive foundation movement such as settlement or heave that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.1)

The following statement shall be completed for buildings in levels of high or moderate seismicity being evaluated to the Immediate Occupancy Performance Level.

C NC N/A DETERIORATION: There shall not be evidence that foundation elements have deteriorated due to corrosion, sulfate attack, material breakdown, or other reasons in a manner that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.2)

Capacity of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

C NC N/A POLE FOUNDATIONS: Pole foundations shall have a minimum embedment depth of 4 feet for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.3.1)

The following statements shall be completed for buildings in levels of moderate seismicity being evaluated to the Immediate Occupancy Performance Level and for buildings in levels of high seismicity.

C NC N/A OVERTURNING: The ratio of the horizontal dimension of the lateral-force-resisting system at the foundation level to the building height (base/height) shall be greater than $0.6S_a$. (Tier 2: Sec. 4.7.3.2)

C	NC	N/A	TIES BETWEEN FOUNDATION ELEMENTS: The foundation shall have ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Class A, B, or C. (Section 3.5.2.3.1, Tier 2: Sec. 4.7.3.3)
C	NC	N/A	DEEP FOUNDATIONS: Piles and piers shall be capable of transferring the lateral forces between the structure and the soil. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.4)
C	NC	N/A	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another shall not exceed one story in height. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.5)

3.9 Nonstructural Checklists

The following checklists are included in this section:

- Basic Nonstructural Component Checklist (Section 3.9.1)
- Intermediate Nonstructural Component Checklist (Section 3.9.2)
- Supplemental Nonstructural Component Checklist (Section 3.9.3)

These checklists shall be completed where required by Table 3-2. The Basic Nonstructural Component Checklist shall be completed prior to completing the Intermediate Nonstructural Component Checklist. The Intermediate Nonstructural Component Checklist shall be completed prior to completing the Supplemental Nonstructural Component Checklist.

3.9.1 Basic Nonstructural Component Checklist

This Basic Nonstructural Component Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

Partitions

C NC N/A UNREINFORCED MASONRY: Unreinforced masonry or hollow clay tile partitions shall be braced at a spacing equal to or less than 10 feet in levels of low or moderate seismicity and 6 feet in levels of high seismicity. (Tier 2: Sec. 4.8.1.1)

Ceiling Systems

C NC N/A SUPPORT: The integrated suspended ceiling system shall not be used to laterally support the tops of gypsum board, masonry, or hollow clay tile partitions. Gypsum board partitions need not be evaluated where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.2.1)

Light Fixtures

C NC N/A EMERGENCY LIGHTING: Emergency lighting shall be anchored or braced to prevent falling during an earthquake. (Tier 2: Sec. 4.8.3.1)

Cladding and Glazing

C NC N/A CLADDING ANCHORS: Cladding components weighing more than 10 psf shall be mechanically anchored to the exterior wall framing at a spacing equal to or less than 4 feet. A spacing of up to 6 feet is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.1)

C NC N/A DETERIORATION: There shall be no evidence of deterioration, damage or corrosion in any of the connection elements. (Tier 2: Sec. 4.8.4.2)

C NC N/A CLADDING ISOLATION: For moment frame buildings of steel or concrete, panel connections shall be detailed to accommodate a story drift ratio of 0.02. Panel connection detailing for a story drift ratio of 0.01 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.3)

C NC N/A MULTI-STORY PANELS: For multi-story panels attached at each floor level, panel connections shall be detailed to accommodate a story drift ratio of 0.02. Panel connection detailing for a story drift ratio of 0.01 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.4)

C NC N/A BEARING CONNECTIONS: Where bearing connections are required, there shall be a minimum of two bearing connections for each wall panel. (Tier 2: Sec. 4.8.4.5)

C NC N/A INSERTS: Where inserts are used in concrete connections, the inserts shall be anchored to reinforcing steel or other positive anchorage. (Tier 2: Sec. 4.8.4.6)

C NC N/A PANEL CONNECTIONS: Exterior cladding panels shall be anchored out-of-plane with a minimum of 4 connections for each wall panel. Two connections per wall panel are permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.7)

Masonry Veneer

C NC N/A SHELF ANGLES: Masonry veneer shall be supported by shelf angles or other elements at each floor 30 feet or more above ground for Life Safety and at each floor above the first floor for Immediate Occupancy. (Tier 2: Sec. 4.8.5.1)

C NC N/A TIES: Masonry veneer shall be connected to the back-up with corrosion-resistant ties. The ties shall have a spacing equal to or less than 24 inches with a minimum of one tie for every 2-2/3 square feet. A spacing of up to 36 inches is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.5.2)

C NC N/A WEAKENED PLANES: Masonry veneer shall be anchored to the back-up adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 4.8.5.3)

C NC N/A DETERIORATION: There shall be no evidence of deterioration, damage, or corrosion in any of the connection elements. (Tier 2: Sec. 4.8.5.4)

Parapets, Cornices, Ornamentation, and Appendages

C NC N/A URM PARAPETS: There shall be no laterally unsupported unreinforced masonry parapets or cornices with height-to-thickness ratios greater than 1.5. A height-to-thickness ratio of up to 2.5 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.8.1)

C NC N/A CANOPIES: Canopies located at building exits shall be anchored to the structural framing at a spacing of 6 feet or less. An anchorage spacing of up to 10 feet is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.8.2)

Masonry Chimneys

C NC N/A URM CHIMNEYS: No unreinforced masonry chimney shall extend above the roof surface more than twice the least dimension of the chimney. A height above the roof surface of up to three times the least dimension of the chimney is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.9.1)

Stairs

C NC N/A URM WALLS: Walls around stair enclosures shall not consist of unbraced hollow clay tile or unreinforced masonry with a height-to-thickness ratio greater than 12-to-1. A height-to-thickness ratio of up to 15-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.10.1)

C NC N/A STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure shall not rely on shallow anchors in concrete. Alternatively, the stair details shall be capable of accommodating the drift calculated using the Quick Check procedure of Section 3.5.3.1 without including tension in the anchors. (Tier 2: Sec. 4.8.10.2)

Building Contents and Furnishing

C NC N/A TALL NARROW CONTENTS: Contents over 4 feet in height with a height-to-depth or height-to-width ratio greater than 3-to-1 shall be anchored to the floor slab or adjacent structural walls. A height-to-depth or height-to-width ratio of up to 4-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.11.1)

Mechanical and Electrical Equipment

C NC N/A EMERGENCY POWER: Equipment used as part of an emergency power system shall be mounted to maintain continued operation after an earthquake. (Tier 2: Sec. 4.8.12.1)

C NC N/A HAZARDOUS MATERIAL EQUIPMENT: HVAC or other equipment containing hazardous material shall not have damaged supply lines or unbraced isolation supports. (Tier 2: Sec. 4.8.12.2)

C NC N/A DETERIORATION: There shall be no evidence of deterioration, damage, or corrosion in any of the anchorage or supports of mechanical or electrical equipment. (Tier 2: Sec. 4.8.12.3)

C NC N/A ATTACHED EQUIPMENT: Equipment weighing over 20 lb that is attached to ceilings, walls, or other supports 4 feet above the floor level shall be braced. (Tier 2: Sec. 4.8.12.4)

Piping

C NC N/A FIRE SUPPRESSION PIPING: Fire suppression piping shall be anchored and braced in accordance with NFPA-13 (NFPA, 1996). (Tier 2: Sec. 4.8.13.1)

C NC N/A FLEXIBLE COUPLINGS: Fluid, gas, and fire suppression piping shall have flexible couplings. (Tier 2: Sec. 4.8.13.2)

Hazardous Materials Storage and Distribution

C NC N/A TOXIC SUBSTANCES: Toxic and hazardous substances stored in breakable containers shall be restrained from falling by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 4.8.15.1)

3.9.2 Intermediate Nonstructural Component Checklist

This Intermediate Nonstructural Component Checklist shall be completed where required by Table 3-2. The Basic Nonstructural Component Checklist shall be completed prior to completing this Intermediate Nonstructural Component Checklist.

Ceiling Systems

C NC N/A LAY-IN TILES: Lay-in tiles used in ceiling panels located at exits and corridors shall be secured with clips. (Tier 2: Sec. 4.8.2.2)

C NC N/A INTEGRATED CEILINGS: Integrated suspended ceilings at exits and corridors or weighing more than 2 pounds per square foot shall be laterally restrained with a minimum of four diagonal wires or rigid members attached to the structure above at a spacing equal to or less than 12 feet. (Tier 2: Sec. 4.8.2.3)

C NC N/A SUSPENDED LATH AND PLASTER: Ceilings consisting of suspended lath and plaster or gypsum board shall be attached to resist seismic forces for every 12 square feet of area. (Tier 2: Sec. 4.8.2.4)

Light Fixtures

C NC N/A INDEPENDENT SUPPORT: Light fixtures in suspended grid ceilings shall be supported independently of the ceiling suspension system by a minimum of two wires at diagonally opposite corners of the fixtures. (Tier 2: Sec. 4.8.3.2)

Cladding and Glazing

C NC N/A GLAZING: Glazing in curtain walls and individual panes over 16 square feet in area, located up to a height of 10 feet above an exterior walking surface, shall have safety glazing. Such glazing located over 10 feet above an exterior walking surface shall be laminated annealed or laminated heat-strengthened safety glass or other glazing system that will remain in the frame when glass is cracked. (Tier 2: Sec. 4.8.4.8)

Parapets, Cornices, Ornamentation, and Appendages

C NC N/A CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 shall have vertical reinforcement. (Tier 2: Sec. 4.8.8.3)

C NC N/A APPENDAGES: Cornices, parapets, signs, and other appendages that extend above the highest point of anchorage to the structure or cantilever from exterior wall faces and other exterior wall ornamentation shall be reinforced and anchored to the structural system at a spacing equal to or less than 10 feet for Life Safety and 6 feet for Immediate Occupancy. This requirement need not apply to parapets or cornices compliant with Section 4.8.8.1 or 4.8.8.3. (Tier 2: Sec. 4.8.8.4)

Masonry Chimneys

C NC N/A ANCHORAGE: Masonry chimneys shall be anchored at each floor level and the roof. (Tier 2: Sec. 4.8.9.2)

Mechanical and Electrical Equipment

C NC N/A VIBRATION ISOLATORS: Equipment mounted on vibration isolators shall be equipped with restraints or snubbers. (Tier 2: Sec. 4.8.12.5)

Ducts

C NC N/A STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts shall be braced and shall have flexible connections at seismic joints. (Tier 2: Sec. 4.8.14.1)

Appendix 'B'

Previous Structural Evaluation Reports

Marquess & Associates, Inc. August 2004

Robert F. Taylor Structural Engineering, Inc. October 1996

MARQUESS & ASSOCIATES INC

YOUR PROFESSIONAL ENGINEERING TEAM SINCE 1957

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EMAIL: info@marquess.com WEB: www.marquess.com

August 10, 2004

Dick Handbury
Rogue River School District #35
P. O. Box 1045
Rogue River, Oregon 97537

RE: Rogue River Elementary School
Gymnasium Structural Investigation
MAI Job No. 04-1263

Dear Dick:

Pursuant to your request, I met with you and James Charleboix, Maintenance Supervisor, to investigate some exterior wall cracks on Wednesday, August 4, 2004. While investigating the wall cracks, I noticed the roof trusses bottom chords joints are showing signs of separation. Therefore, I made an investigation of both the wall cracks and the trusses. My investigations of the wall cracks and roof trusses were limited to visual examinations.

The gymnasium structure is a single story rectangular building with a wood framed roof supported by concrete pilaster columns. The lower section of the exterior walls, approximately seven feet high, is of concrete construction and supports a brick infill. The brick infill between the pilaster columns is believed to be of unreinforced multi-wythe construction.

The roof structure consists of four rod and segmented wood trusses supporting rafters and ceiling joists. The top and bottom truss chords are formed by two 2x10s (depth to be verified) on each side of a 1x spacer board. The 2x10 chord segments appear to be spliced by face nailing the outside 2x10 to the inside 2x10. The number and size of the nails could not be verified. For preliminary and approximate analysis purposes, the roof trusses are estimated to span 60 feet, with truss-to-truss spacing of 16 to 17 feet. The trusses support 2x10 rafters decked with 1x straight board sheathing and 2x6 ceiling joists, with a thin sheathing and a suspended t-bar ceiling.

The wall cracks in the brick and concrete are very common for buildings of similar age and construction. Most cracks occur at locations which are expected, such as radiating from the corners of openings or mid-span between pilasters. Most of these cracks probably occurred during the first couple years after original construction. These are due to thermal effects, concrete shrinkage, and possibly some minor settlement. One crack in the west wall just to the north side of the entry doors appears to be more recent. This is probably due to the recent paving project around the building. Due to the compaction and vibratory equipment working up tight

against the building it may have created a minor amount of settlement at the northwest corner of the building thus causing some additional cracking in this pre-existing crack. The maximum width of this crack that I measured was ¼ inch.

The bottom chords of the roof trusses appear to be degraded. I made a visual examination of the trusses from within the attic space. The top chord and web members appeared to be in good condition with tight joints. The bottom chord examination was very limited from the attic due to the nature of construction which concealed most bottom chord. In the limited areas which could be viewed, separation was noted between multiple lamination of the 2x10 segments and the end butt joints which are separated longitudinally ½ to ¾ inch. It is assumed that these were all tight when originally constructed and thus indicating nail slippage and creep between the laminations.

Conclusions

Concrete frame/brick infill structures such as the Rogue River Elementary School's gymnasium have historically performed poorly during seismic events. The concrete pilaster columns are likely to be under-reinforced in comparison to contemporary concrete design practices and will likely be non-ductile. The unreinforced masonry wall panels tend to buckle and fall out-of-plane during significant earthquake events. Failure of the masonry wall panels both degrades the structures lateral load resistance and represents falling hazards to the children both inside and outside the building.

The bottom chords of the roof trusses appear to have been weakened over time. The number and size of nails at the splices could not be verified, but the open gaps at the splice butt joints are a visible indication that the truss' load carrying capacity is degraded.

Robert F. Taylor, Structural Engineer, conducted a facilities study for the school district in 1996. His report included a section for the elementary gymnasium which I have reviewed (see copy enclosed). I agree with Robert Taylor's 1996 conclusions regarding the gymnasium. In addition, I recommend that the gymnasium not be occupied during heavy winds, snowfalls with more than a trace on the ground, and during or after an earthquake event. Snow loading requirement can be increased to a 6 inch depth after the installation of truss splice plates.

Recommendations

The exterior wall cracks should be grouted and sealed to prevent water infiltration and to restore shear capacity to the extent possible. The crack in the west wall should be epoxy grouted.

The bottom chords of the three westerly roof trusses should be reinforced at the butt splice joints. I have attached a suggested detail for your use. The east most truss, if it were to fail, will be carried by a wood stud wall, and need not be repaired.

Please let me know if you need any additional information.

Sincerely,

MARQUESS & ASSOCIATES, INC.

Randy C. Cleveland, P.E.

STRUCTURAL
REGISTERED PROFESSIONAL ENGINEER
12,451
OREGON
MAY 18, 1984
RANDOLPH C. CLEVELAND
EXPIRES 12-31-05

RCC/pma
Enclosures: Robert F. Taylor, P.E., Partial Report
Truss Splice Detail
S:/04-1263/04-1263RCCReport.doc

PRO weld
Jim Carbonell

Marquess & Associates, Inc.

CONSULTING ENGINEERS

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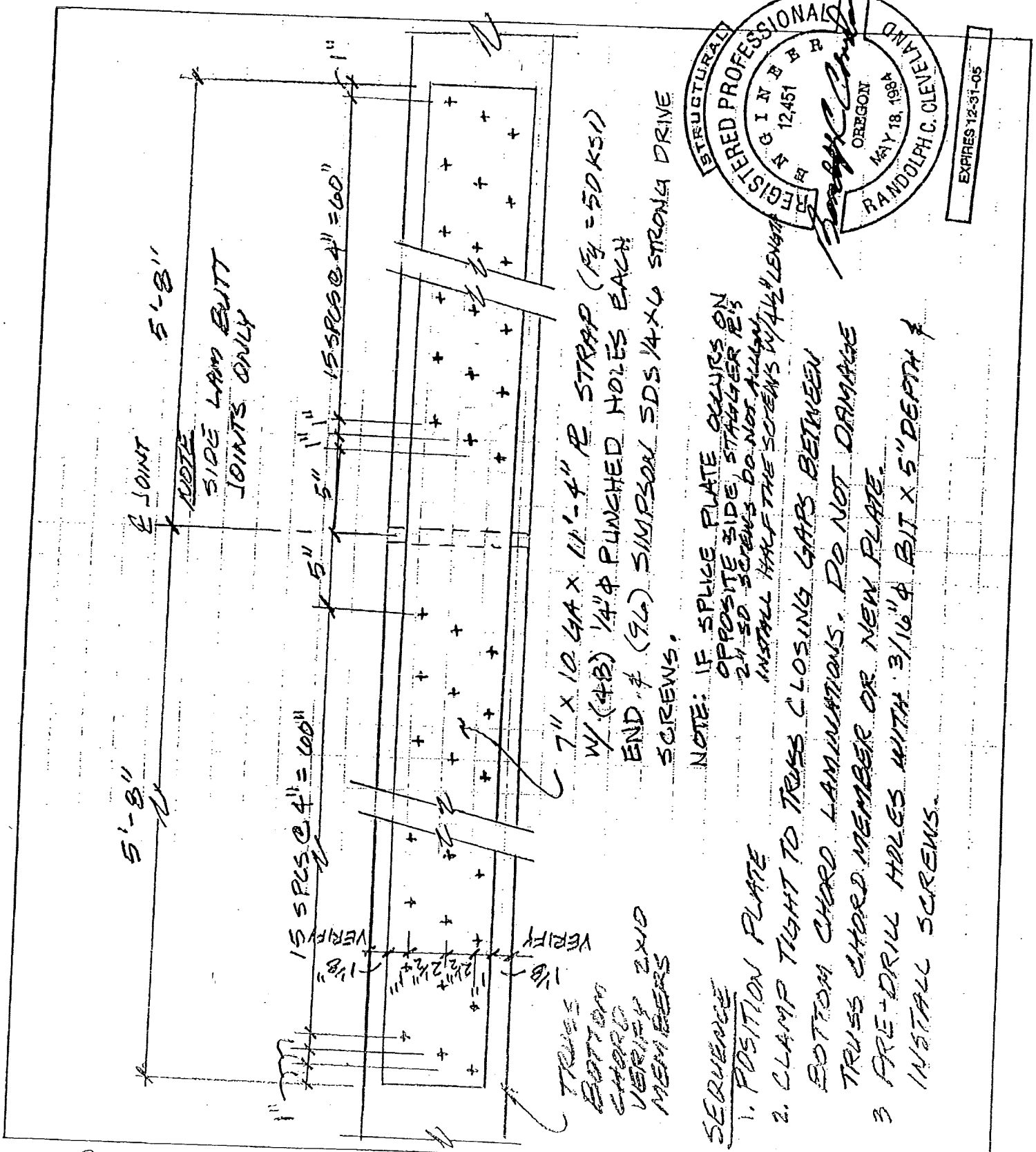
JOB ROGUE RIVER BRH, -4PM MAI NO. 04-126

CALCULATED BY RRC DATE 8/7/04

CHECKED BY _____ DATE _____

SCALE NONE



Subject ROGUE RIVER BRIDGE NUMBER 4PM TRUSSES BOTTOM CHORD SIDE PLATE SPLICE DETAIL

Sheet No. 1 of 1

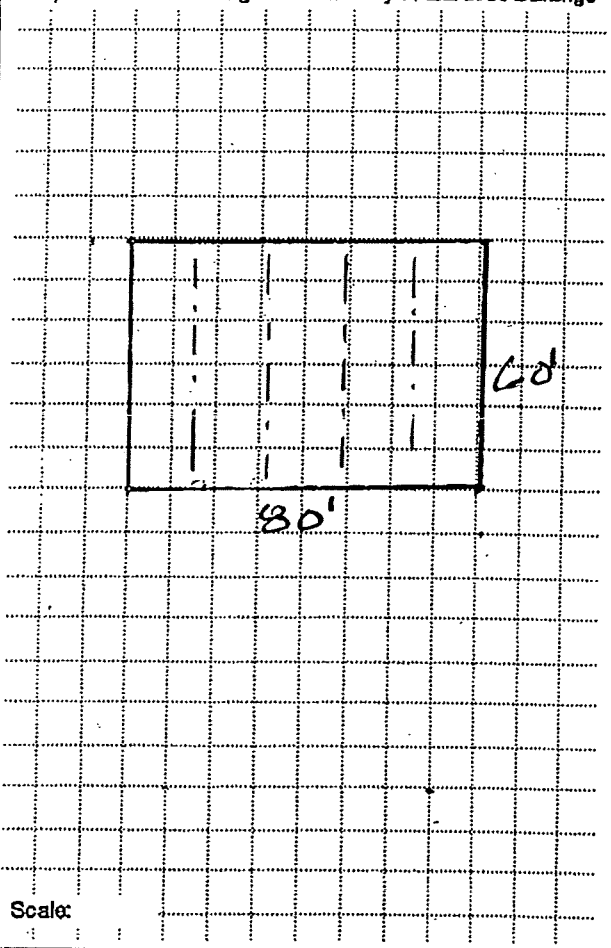
Marquess & Associates, Inc.

CONSULTING ENGINEERS
1120 EAST JACKSON STREET
P.O. BOX 490
MEDFORD, OREGON 97501
TELEPHONE: 772-7115
FAX: 779-4079

JOB Rogue River SD MAI NO. 04-1263
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

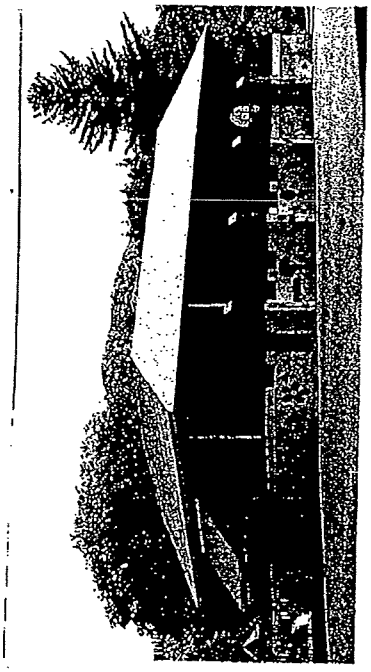
ATC-21/ (NEHRP Map Areas 5,6,7 High)

Rapid Visual Screening of Seismically Hazardous Buildings



Scale:

Address Rogue River Elem. Sch
Zip
Other Identifiers
No. Stories One Year Built
Inspector Date
Total Floor Area (sq. ft)
Building Name Gymnasium
Use Assembly
(Peel off label)



OCCUPANCY	No. Persons
Residential	0-10
Commercial	11-100
Office	100+
Industrial	
Pub. Assem.	
School	
Govt. Bldg.	
Emer. Serv.	
Historic Bldg.	

Non Structural Falling Hazard ☐

DATA CONFIDENCE
★ = Estimated, Subjective, or Unreliable Data
DNK = Do Not Know

STRUCTURAL SCORES AND MODIFIERS

BUILDING TYPE	W	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	C1 (MRF)	C2 (SW)	C3/S5 (URM INF)	PC1 (TU)	PC2	RM	URM
Basic Score	4.5	4.5	3.0	5.5	3.5	2.0	3.0	1.5	2.0	1.5	3.0	1.0
High Rise	N/A	-2.0	-1.0	N/A	-1.0	-1.0	-1.0	-0.5	N/A	-0.5	-1.0	-0.5
Poor Condition	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Vert. Irregularity	-0.5	-0.5	-0.5	-0.5	-0.5	-1.0	-0.5	-0.5	-1.0	-1.0	-0.5	-0.5
Soft Story	-1.0	-2.5	-2.0	-1.0	-2.0	-2.0	-2.0	-1.0	-1.0	-2.0	-2.0	-1.0
Torsion	-1.0	-2.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Plan Irregularity	-1.0	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-1.0	-1.0	-1.0	-1.0
Pounding	N/A	-0.5	-0.5	N/A	-0.5	-0.5	N/A	N/A	N/A	-0.5	N/A	N/A
Large Heavy Cladding	N/A	-2.0	N/A	N/A	N/A	-1.0	N/A	N/A	N/A	-1.0	N/A	N/A
Short Columns	N/A	N/A	N/A	N/A	N/A	-1.0	-1.0	-1.0	N/A	-1.0	N/A	N/A
Post Benchmark Year	+2.0	+2.0	+2.0	+2.0	+2.0	+2.0	+2.0	N/A	+2.0	+2.0	+2.0	N/A
SL2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
SL3	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
SL3 & 8 to 20 stories	N/A	-0.8	-0.8	N/A	-0.8	-0.8	-0.8	-0.8	N/A	-0.8	-0.8	-0.8

FINAL SCORE 0.7 < 2.0

COMMENTS Buildings with a Score < 2 are consider unreliable for areas of infrequent earthquake activity.

Detailed Evaluation Required? YES NO

ATC6794
30032.01

Subject _____ Sheet No. ____ of ____

ROBERT F. TAYLOR
STRUCTURAL ENGINEER, INC.

Post-it® Fax Note 7671	Date 8-3-04	# of pages ▶ 4
To RANDY CLEVELAND	From STEVE ENNIS	
Co./Dept. MAI	Co. OKA	
Phone #	Phone #	
RRES - GYM	Fax #	

CC: DICK HANOBURY

October 14, 1996

Mr. Ken Ogden
Jacobs & Schmitz
2950 East Barnett Road
Medford, Oregon 97504

Subject: Rogue River School District #35 - Facilities Plan
RFT Job #: 96078.00

Dear Ken,

Project Description

The project, as I understand it, consists of four school sites within the Rogue River School District that are being considered for renovation work. These sites include Evans Valley Elementary School, Rogue River High School, Rogue River Middle School, and Rogue River Elementary School. The renovation for each site would vary from resolving mechanical issues to constructing new facilities.

Scope of Work

Our scope of work included a visit to each site to gather information, review of existing building documents, and review of planned structural renovation work. The purpose of the site visit was to identify existing conditions, including any obvious structural deficiencies, generally evaluate existing building structural integrity, and consider the impact of the proposed new construction on the existing structure. It was not the purpose of this observation to identify specific structural problems not readily apparent, nor to formulate specific plans for solving structural problems.

Evaluation Criteria

It is my understanding that there are no requirements to update the existing buildings involved in this project to current structural code compliance. I am also not aware of any parameters set by the building authority for extent of modifications before being required to update a building to comply with current codes. Therefore, I adopt a standard used by other agencies that limits the effect new construction has on existing structure to 5%. This means that if the new construction increases the weight or mass of an existing building by more than 5%, or if new construction decreases the structural stiffness of an existing building by more than 5%, then the existing building needs to be updated to current code compliance.

Beyond this standard, the evaluation criteria for this project was to estimate structural integrity based on visual examination and review of the plans, if any.

Any calculations or opinions for preliminary evaluating purposes were performed using the 1994 Uniform Building Code (UBC) as a basis with local 25 psf snow loading and 80 mph wind loading, Exposure C.

EVANS VALLEY ELEMENTARY SCHOOL

Site Conditions

The existing (e) campus consists of 4 separate structures built at different times. There is a 2 level concrete building that currently houses classrooms and administration on the upper level, and the kitchen and media center on the lower level; a concrete gymnasium structure; a single story classroom structure with Concrete Masonry Unit (CMU) walls that links the 2 level building and the gymnasium; and a detached, single story CMU classroom building. There were existing structural drawings to be reviewed for the link structure and the detached strucnure, but not for the 2 level building or the gymnasium.

The 2 level building was the original structure on the site and is approximately 70 years old. The roof framing was covered and could not be examined. The structure has a wood 2nd floor, and a concrete slab floor at the lower level. Although there was some cracking observed in the concrete exterior walls, the cracks appeared to be generally a result of concrete shrinkage and the structure appeared sound. Exterior cracks at the front entry area appear to be of a differential settlement nature between the exterior porch and the building. More complete investigation would be required to determine the exact cause. The 2nd level wood floor joists were able to be examined at the boiler room and appeared to be sound. Wood posts supporting the 2nd floor and extending to the lower floor appeared to be sound. Some lower level floor fluctuations indicate the possibility of settlement.

The gymnasium structure is approximately 45 years old and consists of concrete walls and a wood floor. The roof structure was covered and could not be examined. The concrete walls generally showed little signs of distress (cracking) although there is a substantial crack in the south wall. This crack is vertical and maintains approximately the same width for it's length which suggests it is a shrinkage crack and not one caused by shear forces. There was no indication that the crack had ever been repaired. The wood framed proscenium wall over the stage had a major crack. Additional investigation regarding the roof framing and the foundation would be required to determine the cause of this crack. There are concerns about the wood floor stability. There are concrete canopies cantilevered off the concrete walls above door openings.

(PAGES 3-7 DO NOT INVOLVE RRES)

ROGUE RIVER ELEMENTARY SCHOOL

Site Conditions

The campus consists of a cafeteria/classroom building, an administration/classroom building, and a gymnasium building.

The cafeteria/classroom building has a wood frame roof, CMU walls and a concrete slab floor. The building is approximately 36 years old. There were no obvious structural deficiencies noted with this building either during the visit or on the drawings.

The administration/classroom building is comprised of an original wood frame structure that is approximately 45 years old and an extension to the east that was built at the same time as the cafeteria/classroom building. The building appears to have been well maintained and no obvious structural deficiencies were noted during the visit or on the drawings.

The gymnasium building is constructed from built-up wood roof trusses and what appears to be unreinforced masonry (URM) exterior walls. There were no drawings for this building. The roof framing was covered except for the bottom of the trusses and could not be examined. There are supplementary supports at the truss/wall locations that suggest the wall support is structurally suspect. The exterior wall URM appeared to be in poor condition, with partial mortar joints or missing mortar altogether in some locations.

Existing Building Evaluation

The cafeteria/classroom and the administration/classroom buildings indicated no structural defects and are probably adequate for continued use.

The gymnasium building is structurally suspect. The poor wall condition raises concern about ability to withstand in-out seismic loading. The built-up roof trusses also raise concern. These types of trusses this old typically have a life span of about 50 years.

Proposed Construction Impact

I am unaware at this time of any proposed new construction that would impact any of these buildings.

Opinions and Recommendations

The cafeteria/classroom and the administration/classroom buildings appear to be structurally adequate in their present state, although connections between the CMU walls and the roof framing should be checked as a prudent measure.

The gymnasium building, in my opinion, should be more closely examined to determine structural adequacy. The additional examination could reveal the extent of, or lack of structural problems with the trusses and the exterior walls.

Please call if you have any questions about any of these sites or if I can be of further service in this matter.

Very truly yours,

Robert F. Taylor

Robert F. Taylor, P.E.

330 Morley