FORELL/ELSESSER ENGINEERS, INC.
Structural Engineers

SEISMIC HAZARD EVALUATION REPORT

SANTA ROSA CITY HALL

SANTA ROSA, CA

PREPARED FOR:
CITY OF SANTA ROSA
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SANTA ROSA, CA 95404

Prepared by

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Executive Summary

This report summarizes the findings of the Seismic Hazard Evaluation of Santa Rosa City Hall, located in Santa Rosa, California. The evaluation is based on the criteria of "*Seismic Evaluation of Existing Buildings*" – ASCE/SEI 41-13 using the Tier 1 and Tier 2 Deficiency Only procedures. The Performance Objective selected for the evaluation is the Basic Performance Objective for Existing Buildings (BPOE). The building has only been evaluated for structural performance. Nonstructural items have not been reviewed or evaluated.

Based on our review of the structural drawings, completion of the checklists, and associated structural calculations, a number of potentially deficient items were identified using the Tier 1 procedure for the Life Safety Performance Level at the BSE-1E hazard level. Additional calculations were completed for these potentially deficient items using the ASCE 41-13 Tier 2 procedure to better assess their seismic performance. Based on the Tier 2 results, Santa Rosa City Hall has been identified to have the following seismic deficiencies:

- Liquefaction: The site is located on soil that has a medium potential for liquefaction. Liquefaction can result in large total and differential settlements of on-grade foundations and slabs. A geotechnical engineer should be consulted to determine the likelihood and magnitudes of potential settlements.
- Adjacent Buildings – There are 1-inch seismic joints between Buildings 2&3, 4&5, 7&8, and 10&11, which are significantly smaller than the anticipated building movement. Consequently, pounding between buildings is likely to occur, resulting in localized damage to the wood roof and concrete walls. Loss of vertical support is not anticipated for the BSE-1E hazard but is likely for the BSE-2E hazard.
- Overturning: Several deficiencies were noted. Lack of overturning capacity reduces the building's ability to resist lateral forces, resulting in larger displacements and damage.
    - The existing foundations for Buildings 2 to 5 are not sufficient to resist the anticipated global overturning from the plywood shear walls above for both the BSE-1E and BSE-2E hazards.
    - Several plywood shear walls in Buildings 6, 7 and 9 have insufficient hold downs to resist the anticipated overturning forces for Life Safety in the BSE-1E hazard. All hold downs in all buildings are insufficient for Collapse Prevention in the BSE-2E hazard.
    - The anchorage of the steel moment frames added in Buildings 2, 3 and 5 to 10 during the 1990 renovation do not have sufficient strength to resist the anticipated combination of tension and shear for both the BSE-1E and BSE-2E hazards.
- Plywood Shear Wall Stress: Several of the plywood shear walls on the interior of Buildings 6, 7 and 9 do not have sufficient shear capacity to resist the anticipated loads for Life Safety in the BSE-1E hazard. All plywood shear walls in all buildings are insufficient for Collapse Prevention in the BSE-2E hazard.
- Uplift at Pile Caps: Concrete columns and pilasters support discontinuous walls in Buildings 7, 8 and 10. The pile caps in these locations do not have top reinforcing which limits their ability to resist uplift forces.
- Transfer to Shear Walls: It was determined that the braces added at the roof for all buildings are sufficient to transfer loads to the shear walls in the BSE-1E hazard but not in the BSE-2E hazard.
- Diaphragm Discontinuity: Near the intersection of Buildings 10 and 11 at level 2, the connection between Building 11 and the exterior walkway is insufficient to allow

Buildings 10 and 11 to act as a single unit as is intended.

- Courtyard Tower Entry: The out-of-plane strength of the tall entry walls is just sufficient to resist the anticipated lateral forces for the BSE-1E hazard but is inadequate for the BSE-2E hazard and may result in collapse.
- Exterior Canopies: At the seismic joint locations between Buildings 5 and 6, the canopy structure has insufficient stiffness to prevent loss of gravity support at the slide bearings. The canopy is also tied into the tower entry structure effectively connecting this structure with Building 5; however, the canopy cannot accommodate the resulting forces.

Based on these findings, Santa Rosa City Hall does not currently meet the requirements for the Basic Performance Objective for Existing Buildings in accordance with ASCE 41-13. A seismic retrofit would be required to remediate the deficient items noted above to bring the building into compliance.

Introduction

The seismic evaluation utilizes the ASCE 41-13 Standard to evaluate the seismic performance of the structural system, geotechnical hazards and foundation system. ASCE 41-13 contains three procedures of increasing complexity that can be used to perform the seismic evaluation, Tier 1, Tier 2 deficiency-only, and Tier 3. This study uses the Tier 1 screening process to rapidly evaluate the structural, foundation, and geologic hazard elements of the building and site conditions. The Tier 1 process requires completion of checklists of evaluation statements that are meant to quickly identify potential deficiencies in a building based on the performance of similar buildings in past earthquakes. Where deficiencies were identified using the checklists, we performed a more detailed Tier 2 evaluation of these components to better assess their seismic performance.

Evaluation Criteria

The Performance Objective for this evaluation is the Basic Performance Objective for Existing Buildings (BPOE) as defined in ASCE 41-13 Section 2.2.1. The BPOE accepts a lower level of safety and a higher risk of collapse than would be provided by similar standards for new buildings. Buildings meeting the BPOE are expected to experience little damage from relatively frequent to moderate earthquakes but significantly more damage and potential economic loss from infrequent large to severe earthquakes.

Performance Objectives consist of one or more pairings of a selected Hazard Level with a target Structural and Nonstructural Performance Level, as defined in Section 2.4 and Section 2.3 of ASCE 41-13. The BOPE requires the following Hazard Level and Performance Level combinations to be evaluated:

Life Safety at the BSE-1E Hazard Level
Collapse Prevention at the BSE-2E Hazard Level

The BSE-1E Hazard Level is taken as the 20%/50-year (275-year return period) maximum direction spectral acceleration but not greater than the BSE-1N values. The BSE-2E Hazard Level is taken as the 5%/50-year (975-year return period) maximum direction spectral acceleration but not greater than the BSE-2N values. For further discussion, see ASCE 41-13 Section 2.4.

The Tier 1 screening procedure directly evaluates the Life Safety Performance Level for the

BSE-1E Hazard level. There are no explicit checks for the Collapse Prevention Performance Level at the BSE-2E Hazard Level; however, if a building satisfies all the requirements of the Tier 1 screening procedure, it is deemed to comply with the full requirements of the BPOE.

Items that are identified as deficient in the Tier 1 process are evaluated fort both Life Safety in the BSE-1E hazard and Collapse Prevention in the BSE-2E hazard. If any building component fails the Tier 2 checks, then the entire building is classified as not meeting the standard.

Site Location and Seismic Setting

Santa Rosa City Hall is located at 100 Santa Rosa Avenue, Santa Rosa, California. The site lies approximately 1 mile from the Rodgers Creek Fault, which presents the largest seismic hazard to region (See Figure 1 and Figure 2). Maps from the United States Geological Survey indicate the soil site class to be Soil Type C (See Figure 5) with a "Medium" chance of soil liquefaction (See Figure 6) There were no geotechnical reports available for the specific site.

The spectral response acceleration parameters for the BSE-1E and BSE-1N Hazard Levels are:

BSE-1N: S_{DS} = 1.537, S_{D1} = 0.830 (demands used for design of new buildings)
BSE-1E: S_{XS} = 0.962, S_{X1} = 0.377 (demands used for Tier 1/2 evaluation)

Based on the acceleration parameters, the seismic forces used for this evaluation are approximately 63% of the demands used for design of new buildings.

The spectral response acceleration parameters for the BSE-2E and BSE-2N Hazard Levels are:

BSE-2N: S_{DS} = 2.307, S_{D1} = 1.245 (demands used for design of new buildings)
BSE-2E: S_{XS} = 2.161, S_{X1} = 1.138 (demands used for Tier 2 evaluation)

The expected ground shaking for the BSE-2E hazard is more than double that of the BSE-1E hazard.

Existing Conditions

Santa Rosa City Hall is a complex of ten buildings originally construction in 1967 (See Figure 3). The map and building numbering are based on previous renovation drawings. Some of the buildings are connected to form a continuous structure resulting in five independent buildings separated by 1-inch seismic joints. It is unclear why the original building numbering starts at 2, but we have keep this nomenclature for convenience. Based on the as-built condition, our evaluation treated each of the five independent structures separately.

All the buildings have continuous roof skylights running around a majority of the building perimeter to let natural light into the spaces below.

Available Building Documentation

The building has undergone several renovations and seismic upgrades since its original construction. Our seismic evaluation considered the following documents:

> Original structural drawings dated 1967 produced by Gilbert Forsberg and Diekmann Schmidt Structural Engineers, which used the 1964 Edition of the Uniform Building

Code. The available sheets include:

S1-S19
S21
SX1-SX3

In 1990, steel moment frames and additional plywood shear walls were added throughout the structures to enhance the overall lateral performance. The available sheets include:

S1-S4

In 1997, concrete shear walls were added at the east side of Building 9 on lower level to align with the moment frame above. Horizontal bracing was also added in Building 11 to connect the wood roof diaphragms to the original concrete shear walls. The available sheets include:

S1-S3

In 2000, a seismic upgrade was done that added braces to connect the wood roof diaphragms to the original concrete shear walls as well as to provide supplementary vertical support for vulnerable beams. The available sheets include:

S1-S3

In 2005, two seismic upgrades were completed to improve the connection of the wood roof to the braces added in 2000, upgrade targeted joist connections to the concrete walls, and upgrade plywood roof diaphragm nailing. The available sheets include:

S1-S4 (Seismic Upgrade 1)
S1-S2 (Seismic Upgrade 2)

Structural System Descriptions

See Figure 3 for Building layout and numbering. See Figure 6 through Figure 10 for elevations of the buildings and structures. See Figure 11 through Figure 24 and Figure 28 for typical plan views of the buildings. See Figure 25 through Figure 27 for typical details on the lateral force resisting systems of the buildings.

Building 2 Description

The building is a rectangular one-story structure with approximate plan dimensions of 66 feet x 40 feet. Overall, there is approximately 2,600 square feet of usable space. The building height is approximately 12 feet above grade.

The building's gravity system consists of 3/8" plywood over 2x6 T&G straight sheathing supported by open-web steel joists spaced at 6 feet on-center spanning in the short direction. The joists are connected to 12-inch thick perimeter reinforced concrete bearing walls which are support on concrete strip footings. The ground floor is a 5-inch reinforced concrete slab-on-grade. There is a 1-inch seismic gap at the north end with

Building 3.

The lateral system consists of wood roof diaphragm spanning between the longitudinal reinforced concrete shear walls on the perimeter and transverse non-bearing plywood shear walls on the interior.

In the 1990 retrofit, a steel moment frame was added at the south facade. Several of the plywood shear walls on the north end were also upgraded. In the 2005 retrofit, the load path between the plywood roof and concrete shear walls was upgraded by adding steel bracing through the skylights as well as other framing clips. The shear capacity of the plywood roof diaphragm was also enhanced by adding additional nailing.

Building 3/4 Description

The structure consists of both Buildings 3 and 4 with a shared wall between the two. Buildings 3 and 4 are both rectangular with plan dimensions of 40 feet x 112 feet and 40 feet x 66 feet, respectively. Each building consists of one level; however, the ground floor and roof levels of Building 4 are approximately 3 feet higher than Building 3. Overall, there is approximately 7,100 square feet of space. Each building height is approximately 12 feet above grade.

The original building construction is essentially identical to Building 2. There is a 1-inch seismic gap at the south end with Building 3 and at the north end with Building 5.

In the 1990 retrofit, a steel moment frame was added at the west façade of Building 3. Several of the plywood shear walls were also upgraded in both buildings. In the 2000 and 2005 retrofits, the load path between the plywood roofs and concrete shear walls were upgraded by adding steel bracing through the skylights as well as other framing clips. The shear capacity of the plywood roof diaphragm was also enhanced by adding additional nailing.

Building 5/6/7 Description

The structure consists of Buildings 5, 6, and 7, which are all rectangular in plan with approximate dimensions of 40 feet x 80 feet, 40 feet x 105 feet and 40 feet x 70 feet, respectively. The building consists of two levels. The lower level is partially below grade and serves as parking, storage and office space. The three buildings are interconnected at this level. At the second level, Buildings 6 and 7 share a common wall; however, there is an approximately 30-foot gap between the Buildings 5 and 6. Overall, the footprint of the building is approximately 10,200 square feet. The story height at each level is approximately 12 feet.

The original building construction of the second level is essentially identical to Building 2. The lower level consists of a concrete one-way joist system spanning to 12-inch thick concrete perimeter concrete walls and interior concrete beams. The interior concrete beams align with the perimeter concrete walls of Building 6 above. The beams are supported by concrete columns within the parking area. The walls and columns are founded on a combination of strip and spread footings as well as pile caps. The ground floor is a 5-inch reinforced concrete slab-on-grade.

At the second level, there is a 1-inch seismic gap at the west end of Building 5

separating it from Building 4 and a 1-inch seismic gap at both levels at the south end of Building 7 separating it from Building 8.

In the 1990 retrofit, steel moment frames were added at the north façades of Buildings 5 and 6. Several of the plywood shear walls were also upgraded in Buildings 6 and 7. In the 2000 and 2005 retrofits, the load path between the plywood roofs and concrete shear walls were upgraded by adding steel bracing through the skylights as well as other framing clips. The shear capacity of the plywood roof diaphragm was also enhanced by adding additional nailing.

Building 8/9/10 Description

The structure consists of Buildings 8, 9, 10, which are all rectangular with plan approximate dimensions of 40 feet x 91 feet, 40 feet x 58 feet and 40 feet x 91 feet, respectively. Buildings 8 and 10 are each two levels. Building 9 is one story above the second level with a breezeway at the level below. The buildings are interconnected at both the second floor and roof levels; however, there is a large opening at the second level that creates a light well to the ground floor. Overall, the footprint of the building is approximately 12,450 square feet. The story height at each level is approximately 12 feet.

The original building construction is essentially identical to Building 5/6/7. At both levels, there is a 1-inch seismic gap at the north end of Building 8 separating it from Building 7 and another at the west end of Building 10 separating it from Building 11.

In the 1990 retrofit, steel moment frames were added at the west façades of Buildings 8 and 10 and at the east façade of building 9. Several plywood shear walls were also upgraded in all buildings. In the 1997 retrofit, concrete shear walls were added below the moment frame in building 9 to complete the load path. In the 2000 and 2005 retrofits, the load path between the plywood roofs and concrete shear walls were upgraded by adding steel bracing through the skylights as well as other framing clips. The shear capacity of the plywood roof diaphragm was also enhanced by adding additional nailing.

Building 11 Description

Building 11 is the town council chamber and is rectangular in plan with approximate dimensions of 60 feet x 60 feet. The building consists of two levels. The first story is approximate 12 feet tall and the upper level 20 feet tall. Overall, the footprint of the building is approximately 3,500 square feet.

The roof is constructed of 2x6 T&G straight sheathing supported on deep glue-laminated beams that span the entire building width. The beams are supported by a concrete ring beam around the perimeter which is connected to concrete fin walls that are spaced at 8.5 feet on-center on all sides of the building. The second level consists of 6-inch suspended concrete slab supported by interior and perimeter concrete walls. The slab terraces to the ground level below creating “bowl” seating in the chamber.

The lateral system in both orthogonal direction consists of the wood diaphragm spanning between reinforced concrete fin walls. The walls are 12-inch thick. The walls are well distributed in both directions but are relatively narrow (7 feet long).

At both levels, there is a 1-inch seismic gap at the east end of Building 11 separating it from Building 10.

Courtyard Tower Description

In the middle of the courtyard, there is a tall entry tower structure comprised of two 50-foot tall concrete walls supported by a pile foundation. The walls are 18-inches thick at the base and taper to 12-inches thick at the top. This structure relies on out-of-plane bending of the walls in the transverse direction.

Courtyard Canopy Description

A steel framed canopy runs around the perimeter of buildings 5 through 10. The canopy consists of metal decking supported by steel HSS framing. The HSS beams are connected to the perimeter concrete building walls where possible and on HSS posts at other locations. The posts are founded on the concrete walkway below. The canopies are jointed at the seismic gaps between buildings.

Structural Building Evaluations and Conclusions

The buildings have been evaluated per the ASCE Tier 1 screening procedure using the structural checklists and quick check calculations. The structural items that do not meet the requirements for the Life Safety Performance Level are noted below.

Building 2 Evaluation Results

Tier 1 Structural Deficiencies:

- Adjacent Buildings – There is only a 1-inch joint between this building and adjacent building. This distance between adjacent buildings is less than the 4% building height requirement.
- Liquefaction – The building site is in an area that has a medium susceptibility to soil liquefaction.
- Overturning – Plywood shear walls are non-bearing, which limits overturning resistance.
- Shear Stress Check – The plywood shear demands are higher than the Tier 1 threshold.
- Transfer to Shear Walls – The diaphragm is not directly connected to the concrete shear walls.
- Diaphragm Continuity – The diaphragm has a large gap around the perimeter to allow for light.
- Openings at Shear Walls – The diaphragm has a large gap around the perimeter to allow for light.

After using the ASCE 41-13 Tier 1 screening procedure, the items listed above were investigated using ASCE 41-13 Tier 2 procedures. Below are the findings.

Tier 2 Structural Deficiency-Only Checks:

- Adjacent Buildings – Building drift calculations show that the existing 1-inch joint between buildings is insufficient. Consequently, pounding between Buildings 2 and 3 is likely to occur. This may result in localized damage to the wood roof and concrete walls. Loss of vertical roof support is not anticipated for the BSE-1E hazard but is likely for the north end of the roof in the BSE-2E hazard. This item remains noncompliant.
- Liquefaction – No additional information is available to assess the liquefaction potential of the site soils. We recommend that the City retain a geotechnical engineer to assess this issue. Soil liquefaction can result in large settlement of on grade buildings. This item remains noncompliant.
- Overturning – The foundations lack sufficient strength and stiffness to resist overturning from the plywood shear walls above nor do the steel roof joists above. In addition, the base connections for the steel moment frames added in 1990 are insufficient to transfer the required combination of tension and shear. This item is considered noncompliant.
- Plywood Stress Check - The plywood shear walls are sufficient for Life Safety in the BSE-1E hazard but are insufficient for Collapse Prevention in the BSE-2E hazard. This item remains noncompliant.
- Transfer to Shear Walls – Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls. It was determined that the added braces are sufficient to transfer loads to the shear walls in the BSE-1E hazard but not in the BSE-2E hazard. This item is remains noncompliant.
- Diaphragm Continuity –Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls. This item is considered compliant.
- Openings at Shear Walls –Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls. This item is considered compliant.

Building 3/4 Evaluation Results

Tier 1 Structural Deficiencies:

- Adjacent Buildings – There is only a 1-inch joint between this building and adjacent buildings. This distance between adjacent buildings is less than the 4% building height requirement.
- Liquefaction – The building site has medium susceptibility to liquefaction.
- Overturning – Plywood shear walls are non-bearing, which limits overturning resistance.
- Shear Stress Check – The plywood shear demands are higher than the Tier 1 threshold.
- Reinforcing Steel – Wall meets volumetric requirements; however, large vertical cracks were observed in both walls over their entire height. Based on the size of the cracks it is likely that the wall horizontal reinforcing is no longer continuous through the cracks. See Figure 29.
- Transfer to Shear Walls – The diaphragm is not directly connected to the concrete shear walls.
- Diaphragm Continuity – The diaphragm has a large gap around the perimeter to allow for light.
- Openings at Shear Walls – The diaphragm has a large gap around the perimeter to

allow for light.

After using the ASCE 41-13 Tier 1 screening procedure, the items listed above were investigated using ASCE 41-13 Tier 2 procedures. Below are the findings.

Tier 2 Structural Deficiency-Only Checks:

- Adjacent Buildings – Building drift calculations show that the existing 1-inch joint between buildings is insufficient. Consequently, pounding between Buildings 3/4 and Buildings 2 and 5 is likely to occur. This may result in localized damage to the wood roof and concrete walls. Loss of vertical support is not anticipated for the BSE-1E hazard but is likely for the east end of the Building 4 roof in the BSE-2E hazard. This item remains noncompliant.
- Liquefaction – No additional information is available to assess the liquefaction potential of the soils on site. We recommend that the City retain a geotechnical engineer to assess this issue. Soil liquefaction can result in large settlement of on grade buildings. This item remains noncompliant.
- Overturning – The foundations lack sufficient strength and stiffness to resist overturning from the plywood shear walls above nor do the steel roof joists above. In addition, the base connections for the steel moment frames added in 1990 are insufficient to transfer the required combination of tension and shear. This item is considered noncompliant.
- Plywood Stress Check - The plywood shear walls are sufficient for Life Safety in the BSE-1E hazard but are insufficient for Collapse Prevention in the BSE-2E hazard. This item remains noncompliant.
- Reinforcing Steel – There is sufficient length of wall when the cracks are considered. There is also diaphragm bracing in this area. This item is considered compliant.
- Transfer to Shear Walls – Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls. It was determined that the added braces are sufficient to transfer loads to the shear walls in the BSE-1E hazard but not in the BSE-2E hazard. This item is remains noncompliant.
- Diaphragm Continuity –Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls. This item is considered compliant.
- Openings at Shear Walls –Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls. This item is considered compliant.

Building 5/6/7 Evaluation Results

Tier 1 Structural Deficiencies:

- Adjacent Buildings – There is only a 1-inch joint between this building and adjacent buildings. This distance between adjacent buildings is less than the 4% building height requirement.
- Vertical Irregularities – There are concrete shear walls above the second level on GL 5, 7, and 12 that are discontinuous below.
- Liquefaction – There building site has medium susceptibility to liquefaction.
- Overturning - Plywood shear walls are non-bearing, which limits overturning resistance.
- Shear Stress Check – The plywood shear demands are higher than the Tier 1 threshold.

- Reinforcing Steel – Wall meets volumetric requirements; however, large vertical cracks were observed in both walls over their entire height. Based on the size of the cracks it is likely that the wall horizontal reinforcing is no longer continuous through the cracks. See Figure 30.
- Uplift at Pile Caps – There is no top reinforcement at the pile caps.
- Transfer to Shear Walls – The diaphragm is not directly connected to the concrete shear walls.
- Diaphragm Continuity – The diaphragm has a large gap around the perimeter to allow for light.
- Openings at Shear Walls – The diaphragm has a large gap around the perimeter to allow for light.

After using the ASCE 41-13 Tier 1 screening procedure, the items listed above were investigated using ASCE 41-13 Tier 2 procedures. Below are the findings.

Tier 2 Structural Deficiency-Only Checks:

- Adjacent Buildings – Building drift calculations show that the existing 1-inch joint between buildings is insufficient. Consequently, pounding between Buildings 4 and 5 and between Buildings 7 and 8 is likely to occur. Loss of vertical support is not anticipated for the BSE-1E hazard but is likely for the south end of the Building 7 roof in the BSE-2E hazard. This item remains noncompliant.
- Vertical Irregularities – Columns beneath discontinuous walls were checked for axial and tension loads applied due to the discontinuity. Columns are considered sufficient to resist applied loads.
- Liquefaction – No additional information is available to assess the liquefaction potential of the soils on site. We recommend that the City retain a geotechnical engineer to assess this issue. Soil liquefaction can result in large settlement of on grade buildings. This item remains noncompliant.
- Shear Stress Check – Most plywood shear walls are sufficient for Life Safety in the BSE-1E hazard; however, some interior walls are overstressed. All walls are insufficient for Collapse Prevention in the BSE-2E hazard. This item remains noncompliant.
- Overturning – Several plywood shear walls lack sufficient hold downs to resist overturning demands for Life Safety in the BSE-1E hazard and all hold downs are insufficient for Collapse Prevention in the BSE-2E hazard. In addition, the base connections for the steel moment frames added in 1990 are insufficient to transfer the required combination of tension and shear. This item is remains noncompliant.
- Reinforcing Steel – There is sufficient length of wall when the cracks are considered. There is also diaphragm bracing in this area. This item is considered compliant.
- Uplift at Pile Caps – At line 12, pile caps supporting discontinuous walls above are not sufficiently reinforced to transfer uplift forces to the piles below. This item remains noncompliant.
- Transfer to Shear Walls – Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls. It was determined that the added braces are sufficient to transfer loads to the shear walls in the BSE-1E hazard but not in the BSE-2E hazard. This item is remains noncompliant.
- Diaphragm Continuity –Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls. This item is considered compliant.
- Openings at Shear Walls –Braces were added in a previous retrofit to transfer the

diaphragm forces to the shear walls. This item is considered compliant.

8/9/10 Evaluation Results

Tier 1 Structural Deficiencies:

- Adjacent Buildings – There is only a 1-inch joint between this building and adjacent buildings. This distance between adjacent buildings is less than the 4% building height requirement.
- Vertical Irregularities – The concrete shear wall on GL E above level 2 is discontinuous below.
- Liquefaction – There building site has medium susceptibility to liquefaction.
- Shear Stress Check – The plywood shear demands are higher than the Tier 1 threshold.
- Overturning - Plywood shear walls are non-bearing, which limits overturning resistance.
- Uplift at Pile Caps – There is no top reinforcement at the pile caps.
- Transfer to Shear Walls – The diaphragm is not directly connected to the concrete shear walls.
- Diaphragm Continuity – The diaphragm has a large gap around the perimeter to allow for light.
- Openings at Shear Walls – The diaphragm has a large gap around the perimeter to allow for light.

After using the ASCE 41-13 Tier 1 screening procedure, the items listed above were investigated using ASCE 41-13 Tier 2 procedures. Below are the findings.

Tier 2 Structural Deficiency-Only Checks:

- Adjacent Buildings – Building drift calculations show that the existing 1-inch joint between buildings is insufficient. Consequently, pounding between Buildings 7 and 8 and between Buildings 10 and 11 is likely to occur. This may result in localized damage to the wood roof and concrete walls; however, these buildings do not rely on the adjacent structures for vertical support. Consequently, we do not consider this to be a significant Life Safety hazard.
- Vertical Irregularities – Columns beneath discontinuous walls were checked for axial and tension loads applied due to the discontinuity. Columns are not sufficient to resist applied loads. This item remains noncompliant
- Liquefaction – No additional information is available to assess the liquefaction potential of the soils on site. We recommend that the City retain a geotechnical engineer to assess this issue. Soil liquefaction can result in large settlement of on grade buildings. This item remains noncompliant.
- Plywood Stress Check - Most plywood shear walls are sufficient for Life Safety in the BSE-1E hazard; however, some interior walls are overstressed. All walls are insufficient for Collapse Prevention in the BSE-2E hazard. This item remains noncompliant.
- Overturning – Several plywood shear walls lack sufficient hold downs to resist overturning demands for Life Safety in the BSE-1E hazard and all hold downs are insufficient for Collapse Prevention in the BSE-2E hazard. In addition, the base connections for the steel moment frames added in 1990 are insufficient to transfer

the required combination of tension and shear. This item is remains noncompliant.

- Uplift at Pile Caps – At line E, pile caps for columns supporting discontinuous walls above are not sufficiently reinforced to transfer uplift forces to the piles below. This item remains noncompliant.
- Transfer to Shear Walls – Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls. It was determined that the added braces are sufficient to transfer loads to the shear walls in the BSE-1E hazard but not in the BSE-2E hazard. This item is remains noncompliant.
- Diaphragm Continuity –Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls; however, there is a lack of sufficient collector at grids E&11 to connect the two halves of the building to function as one unit. The roof bracing is considered compliant, but the collector is considered noncompliant.
- Openings at Shear Walls –Braces were added in a previous retrofit to transfer the diaphragm forces to the shear walls. This item is considered compliant.

Building 11 Evaluation Results

Tier 1 Structural Deficiencies:

- Adjacent Buildings – There is only a 1-inch joint between this building and adjacent buildings. This distance between adjacent buildings is less than the 4% building height requirement.
- Liquefaction – There building site has medium susceptibility to liquefaction.
- Overturning -The overturning of the walls was shown to exceed the limits of ASCE 41-13 Section 5.4.3.3.
- Uplift at Pile Caps – There is no top reinforcement at the pile caps.

After using the ASCE 41-13 Tier 1 screening procedure, the items listed above were investigated using ASCE 41-13 Tier 2 procedures. Below are the findings.

Tier 2 Structural Deficiency-Only Checks:

- Adjacent Buildings – Building drift calculations show that the existing 1-inch joint between buildings is insufficient. Consequently, pounding between Buildings 10 and 11 is likely to occur. This may result in localized damage to the wood roof and concrete walls. Since neither building relies on the other for vertical support, we do not consider this a significant Life Safety hazard.
- Liquefaction – No additional information is available to assess the liquefaction potential of the soils on site. We recommend that the City retain a geotechnical engineer to assess this issue. Soil liquefaction can result in large settlement of on grade buildings. This item remains noncompliant.
- Overturning – The connecting slab at the second level provides sufficient restraint to limit the overturning moment. This item is considered compliant.
- Uplift at Pile Caps – Wall and pile reinforcement sufficiently overlap. This item is considered compliant.

Courtyard Tower Evaluation Results

Tier 2 Structural Deficiency-Only Checks:

- The tower structure has been evaluated for stability and strength. The walls are just sufficient to resist the anticipated lateral forces for the BSE-1E hazard but are inadequate for the BSE-2E hazard and may result in collapse.

It is recommended that the tower walls be retrofitted or removed.

Courtyard Canopy Evaluation Results

Tier 2 Structural Deficiency-Only Checks:

- The canopy structure has been evaluated for stability and strength. At the seismic joint locations between Buildings 5 and 6, there is insufficient stiffness to prevent loss of gravity support. The canopy is also tied into the tower entry structure effectively connecting this structure with Building 5.

It is recommended that these portions of the canopy be retrofitted or removed.

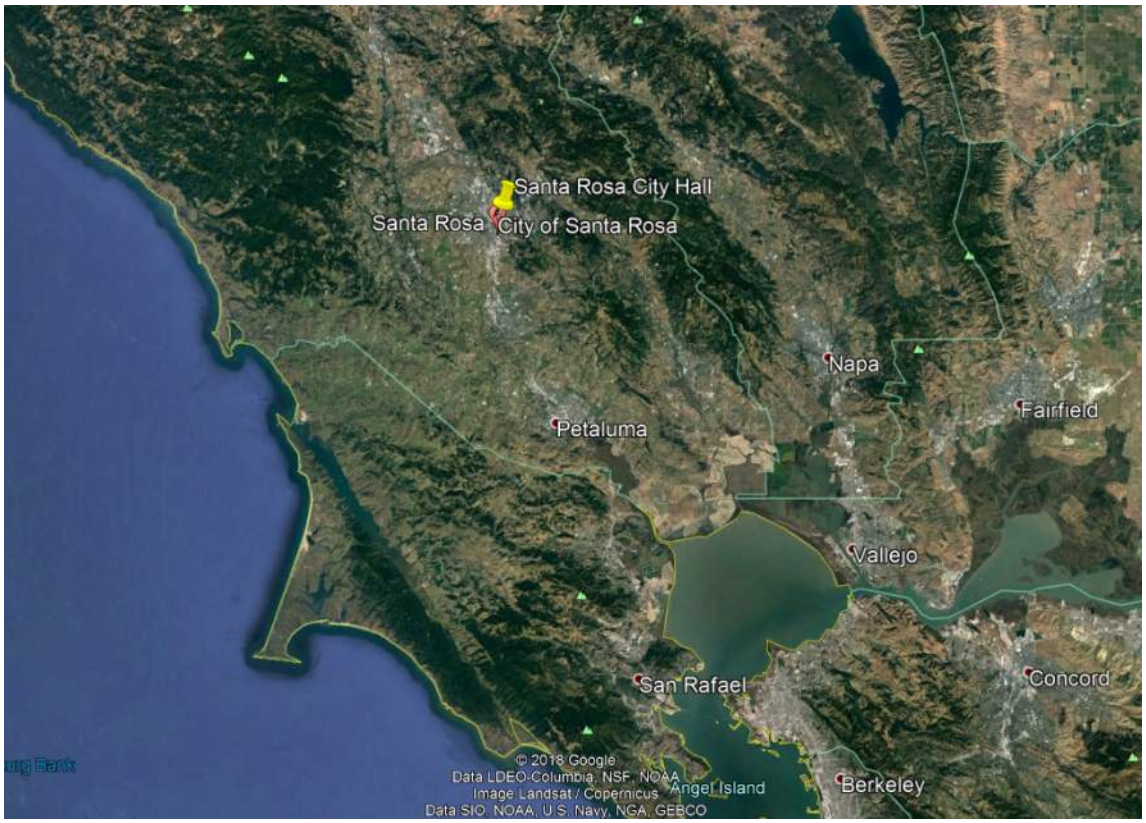

Figure 1: Santa Rosa City Hall Overall Location

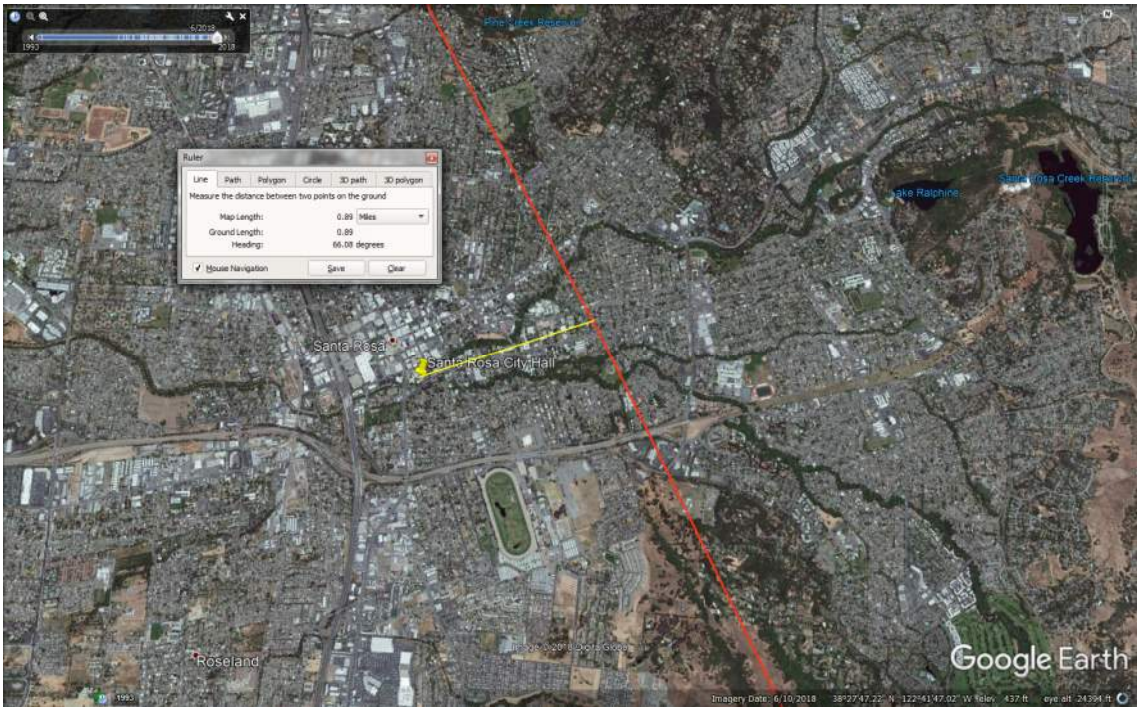

Figure 2: Santa Rosa City Hall and Nearby Fault Locations

Figure 3: Santa Rosa City Hall - Aerial View

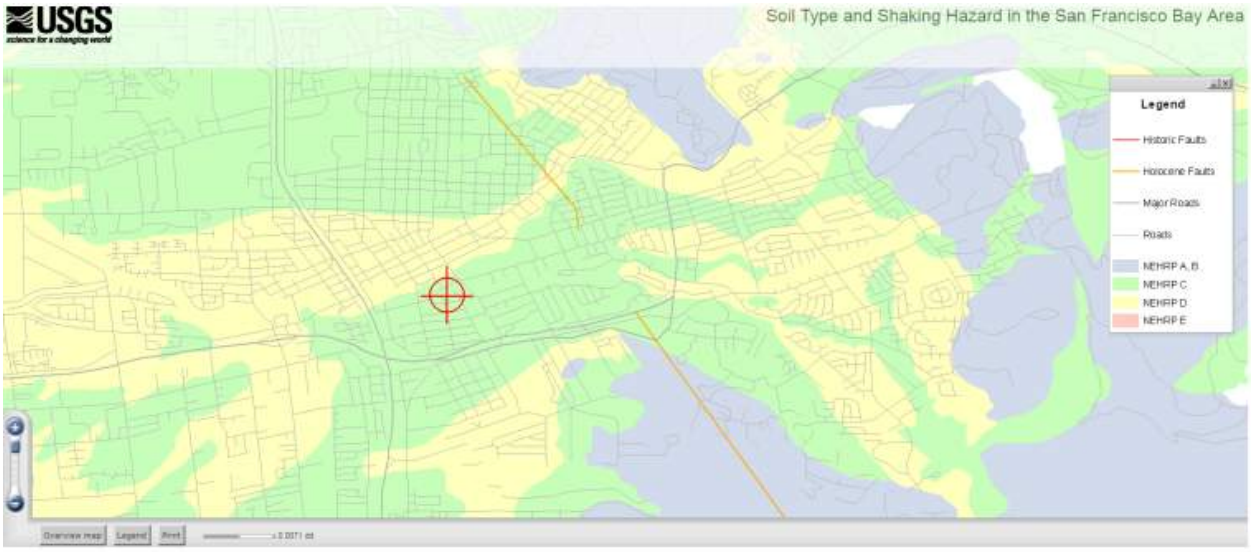

Figure 4: Soil Site Class

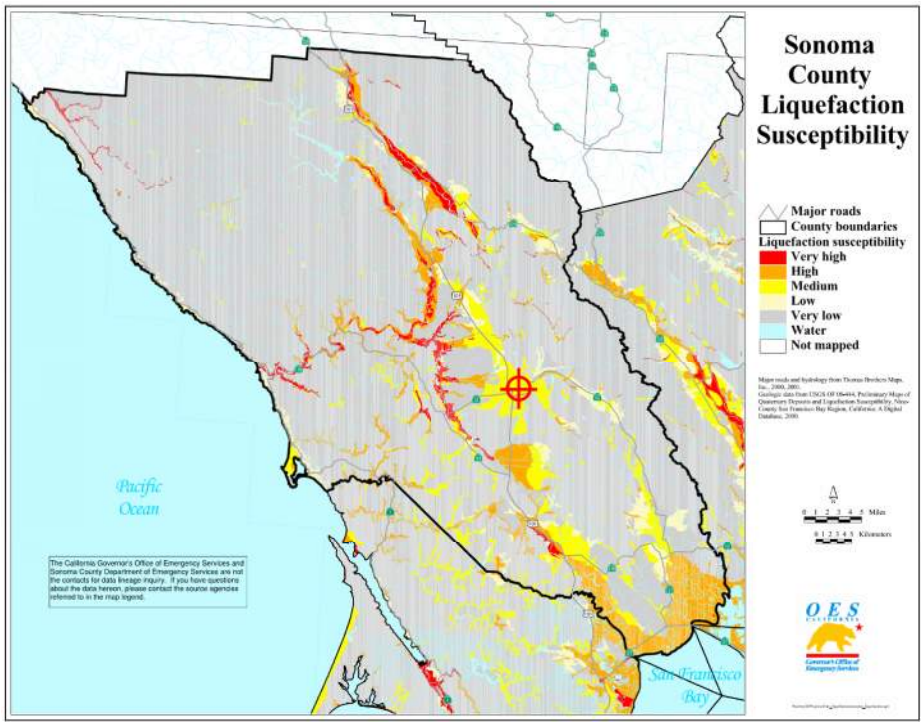

Figure 5: Site Liquefaction Susceptibility


Figure 6: Building 2 (Left) Elevation

Figure 7: Building 3 (Right) and Building 4 (Left) Elevation

Figure 8: Building 5 (Right) and Building 6 (Left) Elevation. Building 7 to the Left of Building 6

Figure 9: Building 8 (Right), Building 9 (Center) and Building 10 (Left) Elevation


Figure 10: Building 11 Elevation

Figure 11: Courtyard Tower Structure Elevation

Figure 12: Entry Canopy Between Building 5 and 6

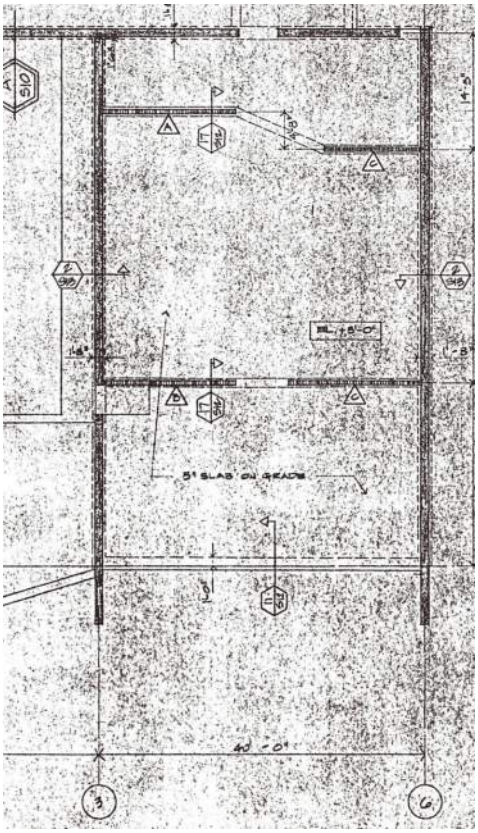

Figure 13: Building 2 Typical Floor Plan

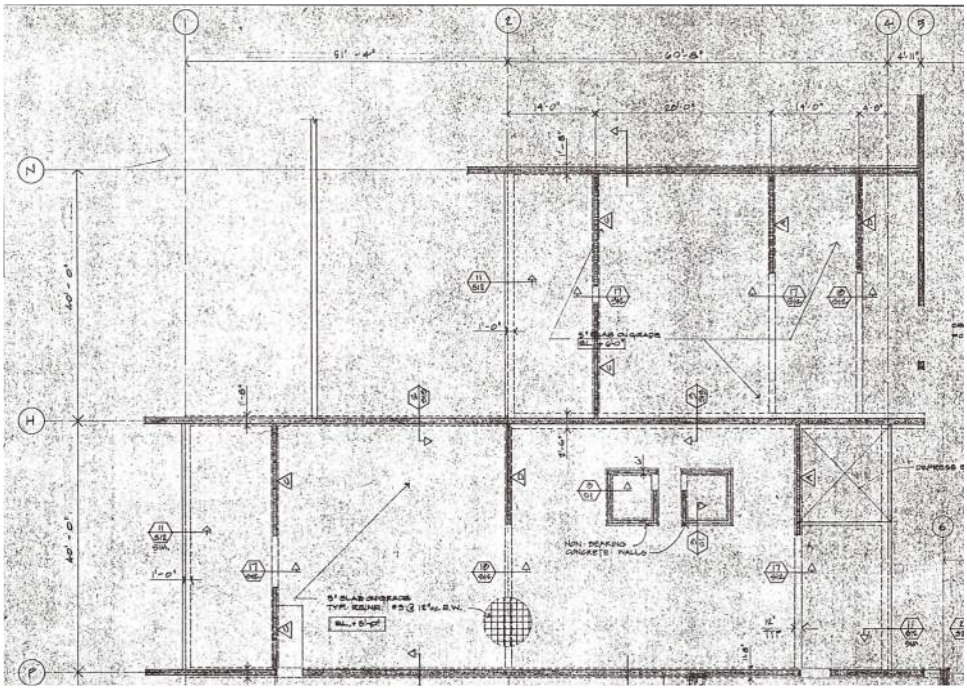

Figure 14: Building 3 & 4 Typical Floor Plan

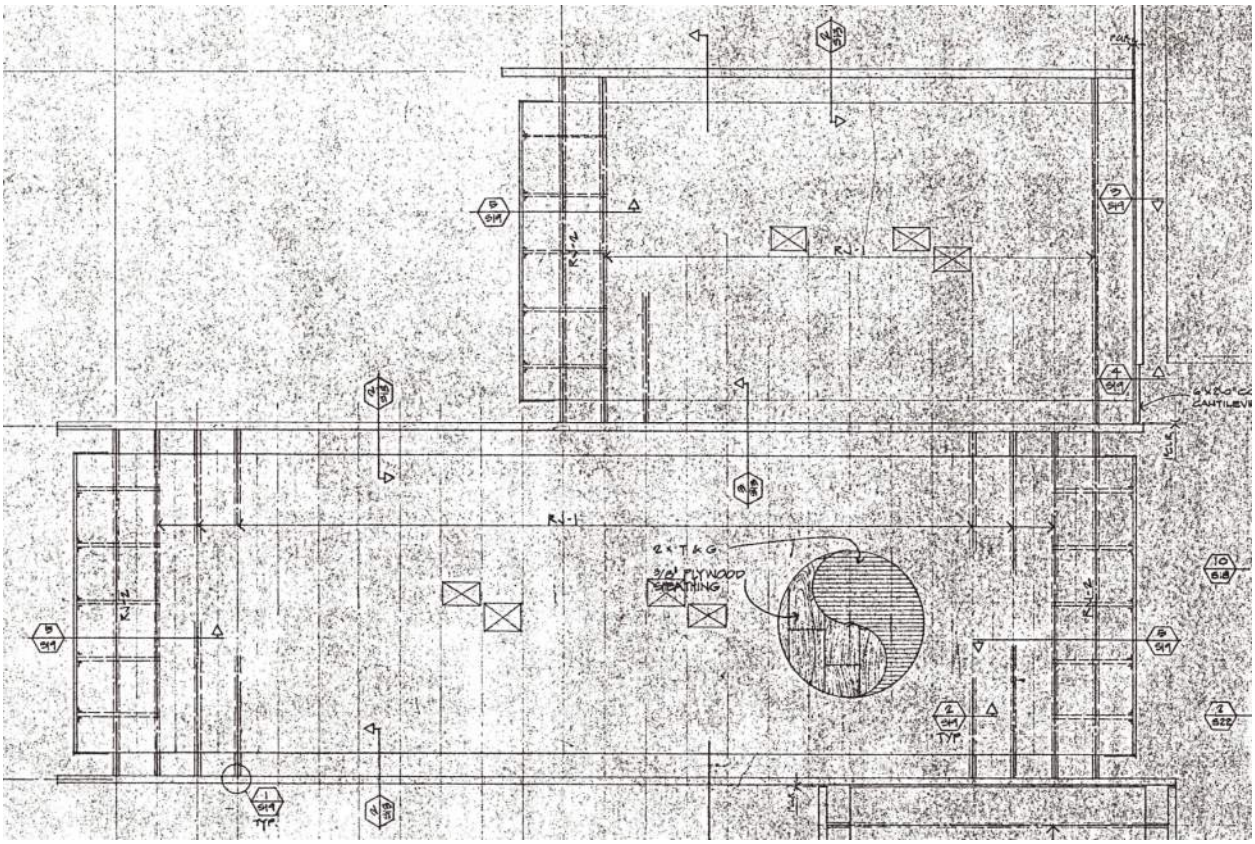

Figure 15: Building 3 & 4 Typical Roof Plan

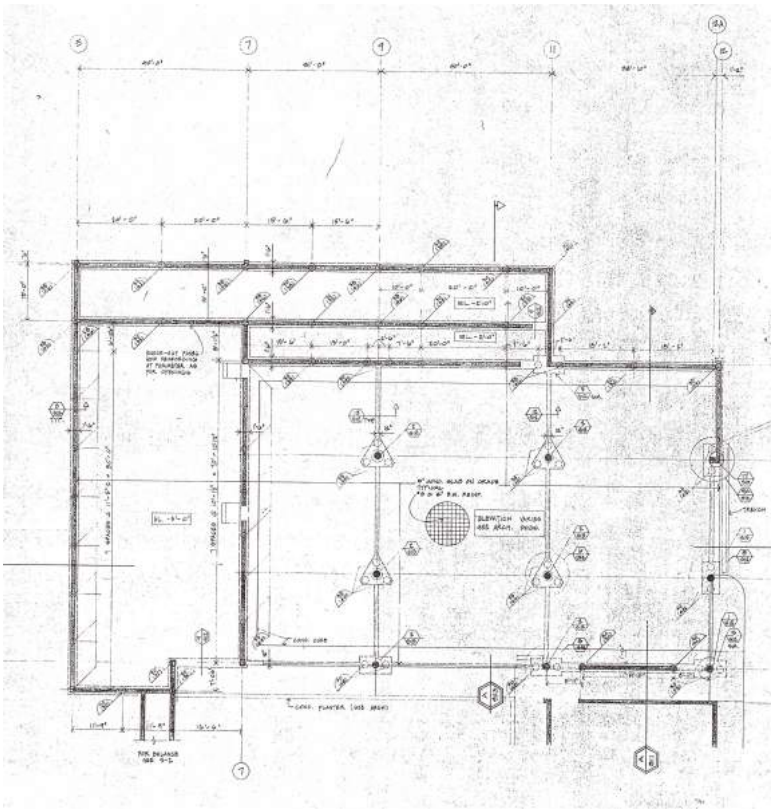

Figure 16: Building 5 & 6 & 7 Typical Ground Floor Plan

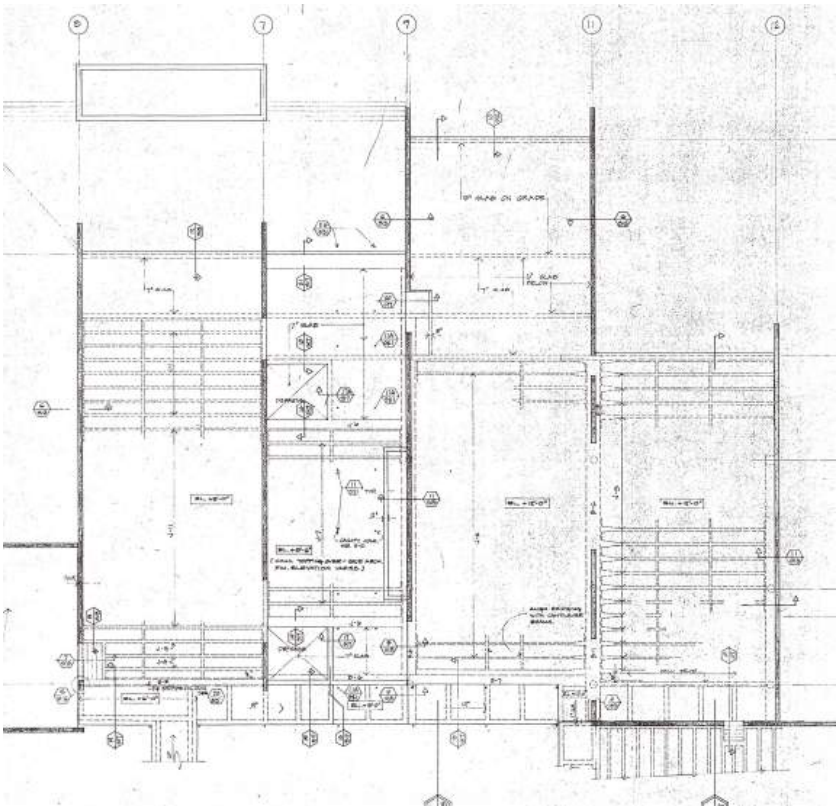

Figure 17: Building 5 & 6 & 7 Typical Floor Plan

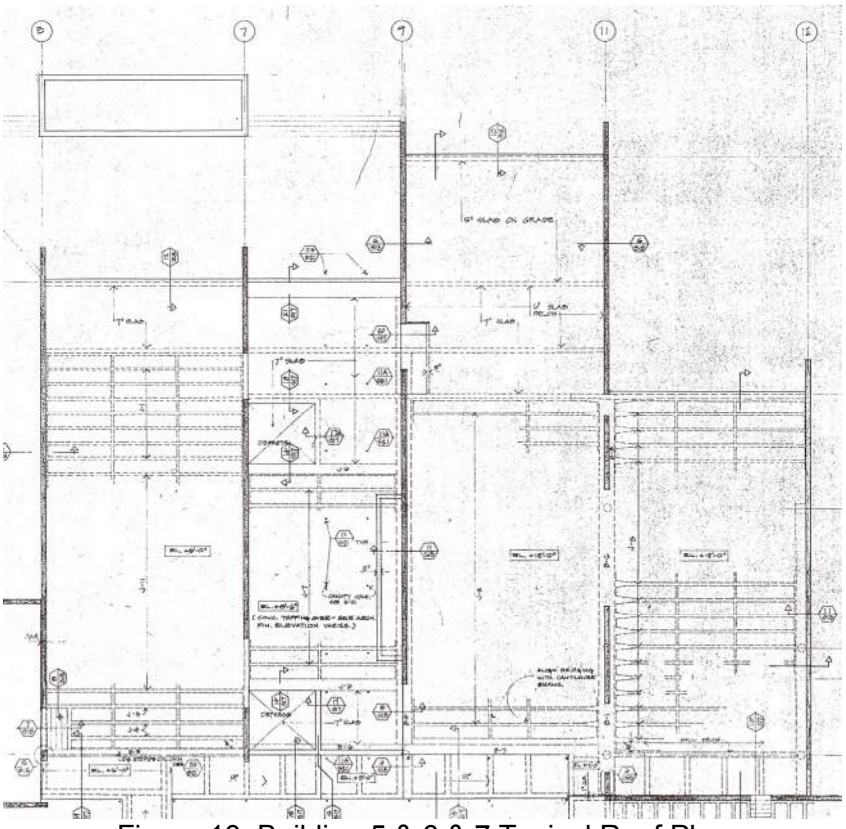

Figure 18: Building 5 & 6 & 7 Typical Roof Plan

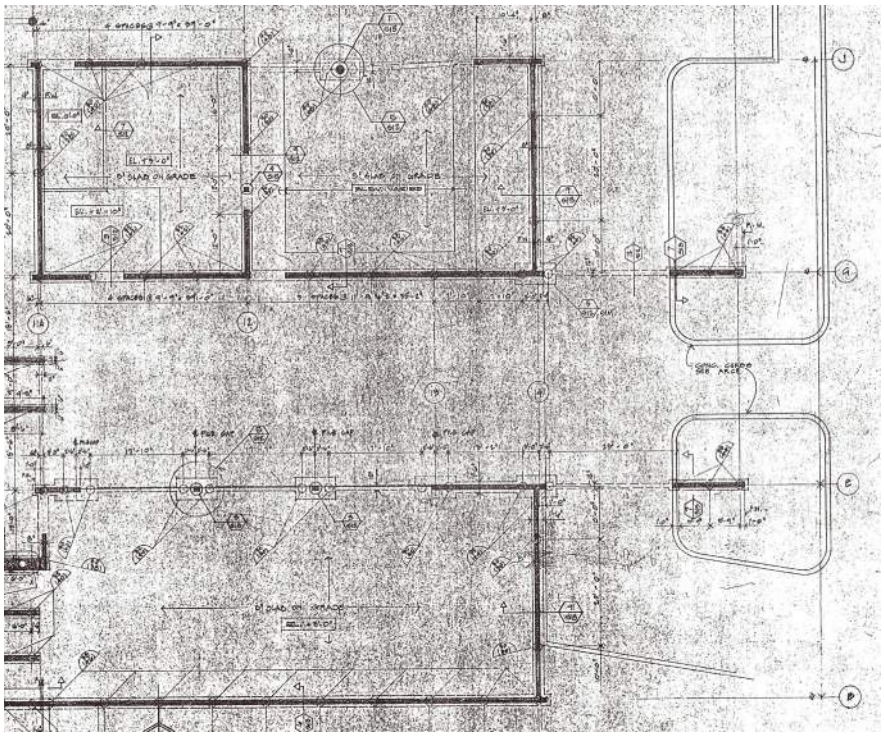

Figure 19: Building 8 & 9 & 10 Typical Ground Floor Plan

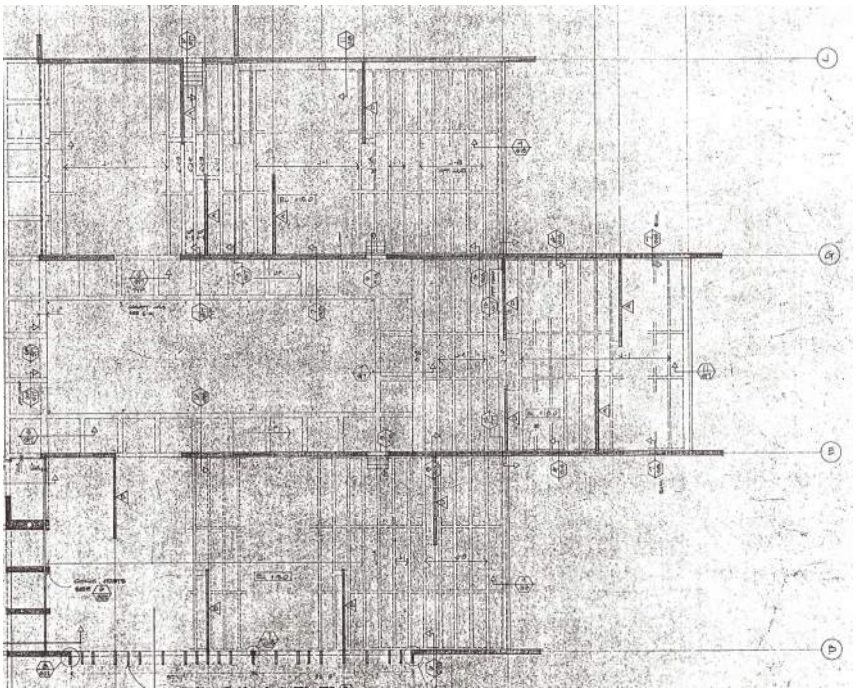

Figure 20: Building 8 & 9 & 10 Typical Floor Plan

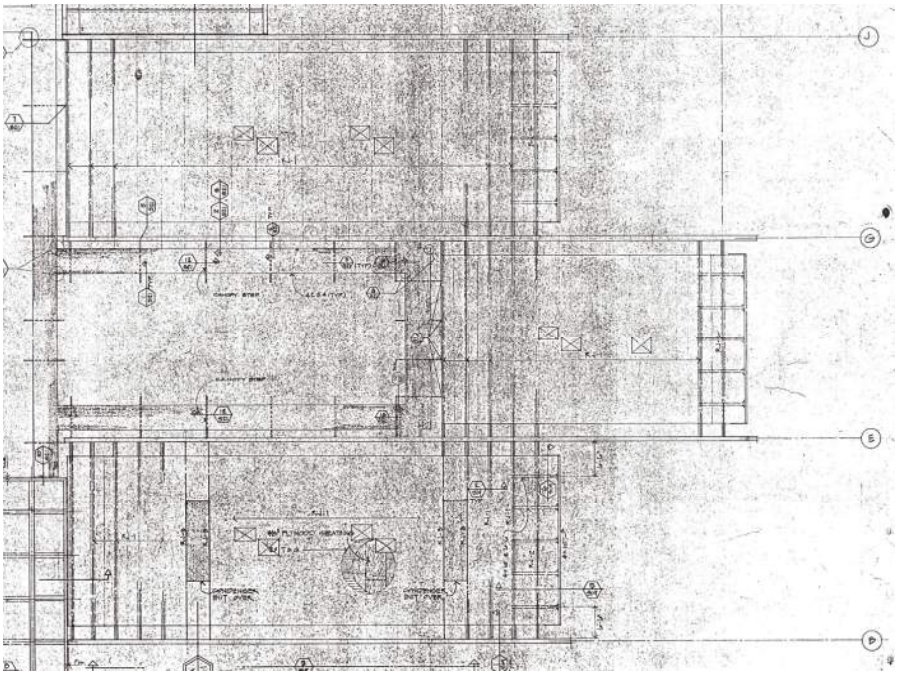

Figure 21: Building 8 & 9 & 10 Typical Roof Plan

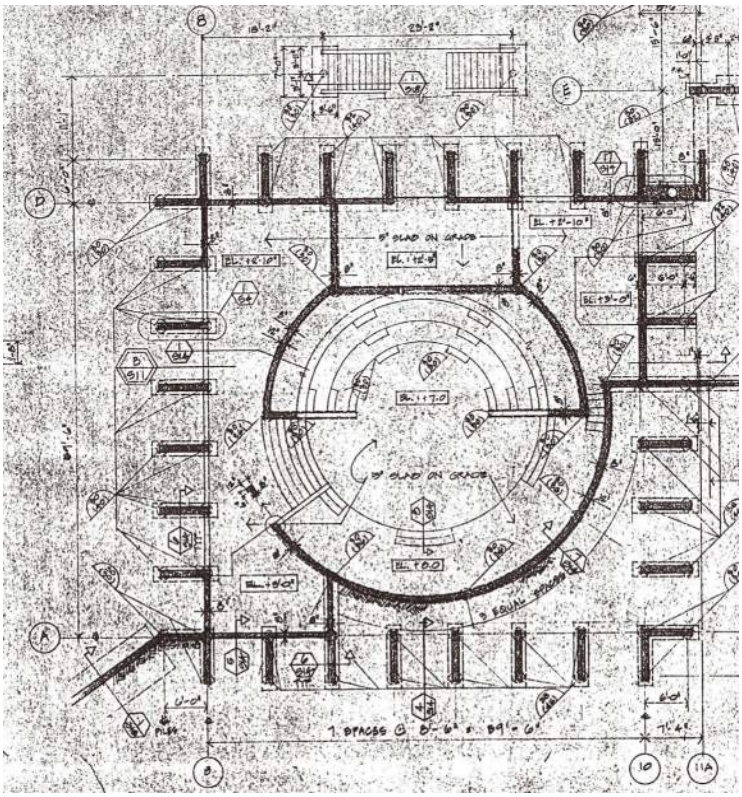

Figure 22: Building 11 Typical Ground Floor Plan

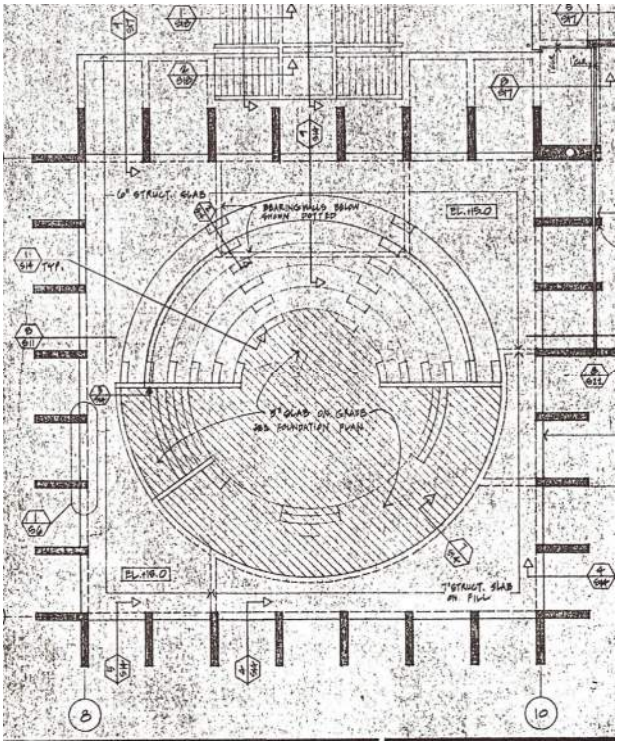

Figure 23: Building 11 Typical Floor Plan

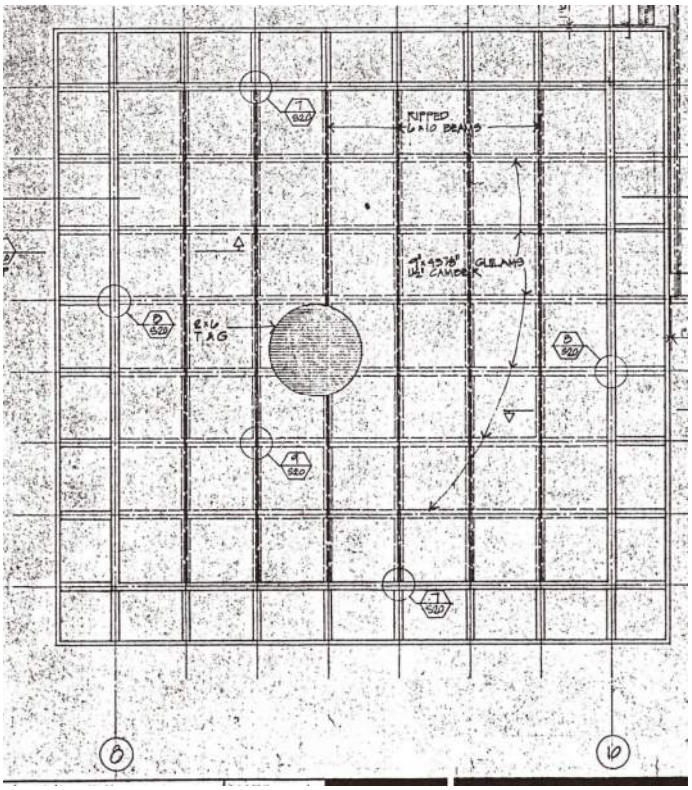

Figure 24: Building 11 Typical Roof Plan

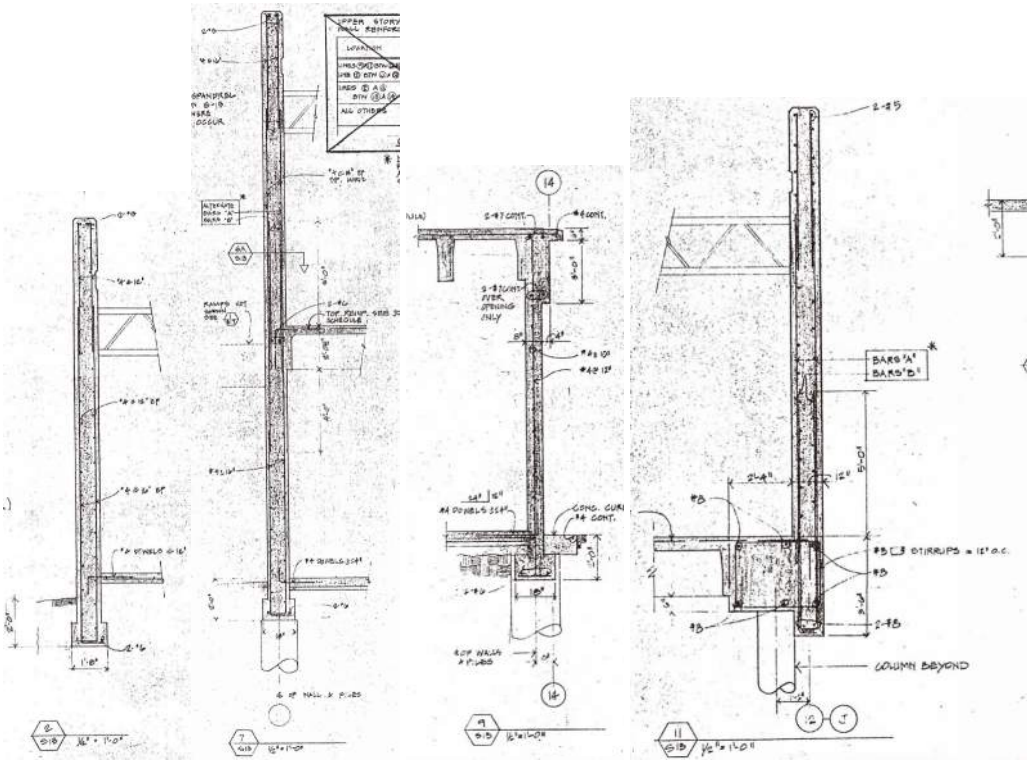

Figure 25: Concrete Shear Wall Sections

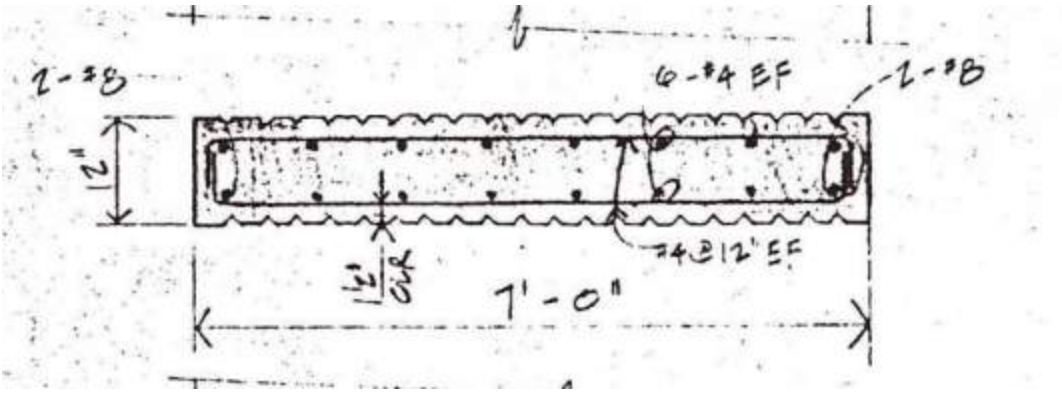

Figure 26: Building 11 Concrete Shear Wall Section

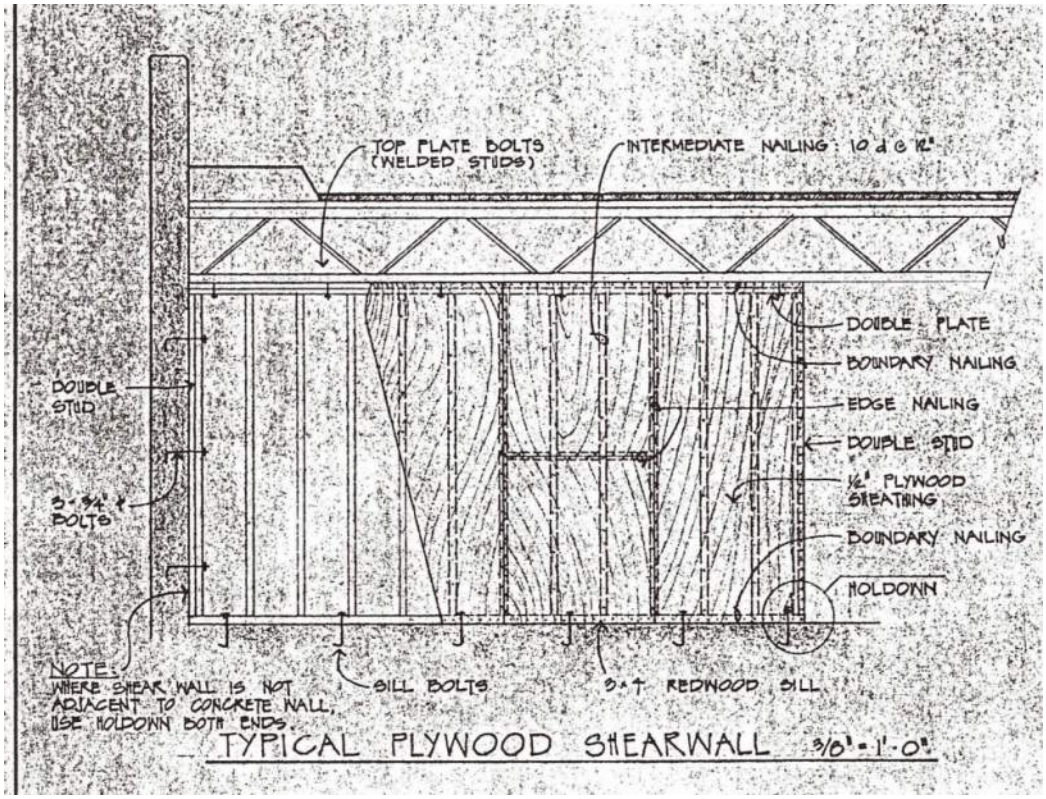

Figure 27: Typical Wood Shear Wall Elevations

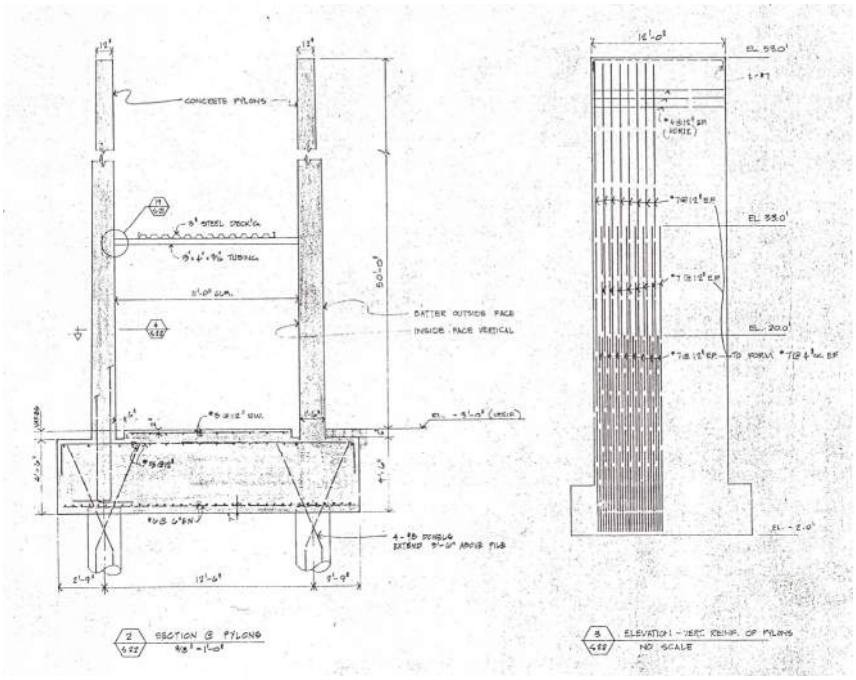

Figure 28: Courtyard Tower Structure

Figure 29: Large Crack Found in Building 3/4

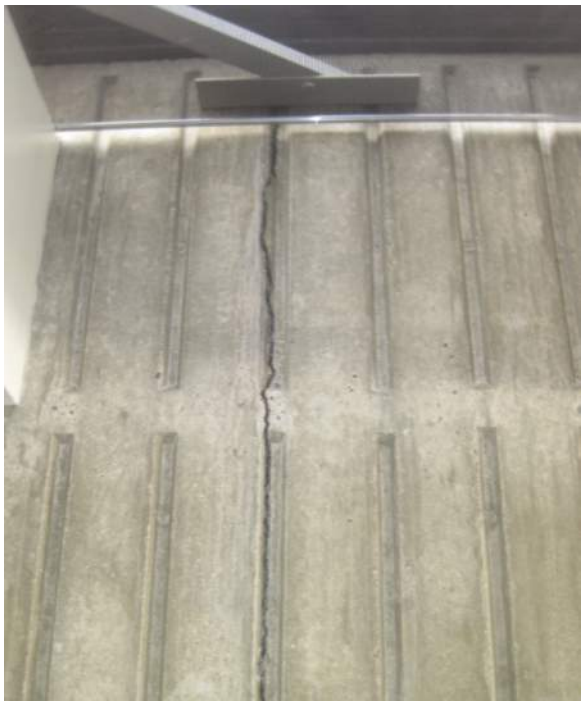

Figure 30: Large Crack Found in Building 5/6/7

Tier 1 Checklists – Building 2

ASCE 41-13 - LS Basic - Building 2

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	LOAD PATH: The structure shall contain a complete well-defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)	
☐	☒	☐	☐	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)	Adjacent buildings only have a 1" spacing. This is insufficient.
☐	☐	☒	☐	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)	

BUILDING SYSTEMS - *BUILDING CONFIGURATION*

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A2.2.2. Tier 2: Sec. 5.4.2.1)	
☒	☐	☐	☐	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)	
☒	☐	☐	☐	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)	
☒	☐	☐	☐	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)	
☒	☐	☐	☐	MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)	

ASCE 41-13 - LS Basic - Building 2

☒	☐	☐	☐	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)	

MODERATE SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW SEISMICITY)

GEOLOGIC SITE HAZARD

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	LIQUIFACTION: 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 ft under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1)	Site is located at an area with medium liquefaction susceptibility.
☒	☐	☐	☐	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1)	
☒	☐	☐	☐	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: 5.4.3.1)	

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW AND MODERATE SEISMICITY)

FOUNDATION CONFIGURATION

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)	
☒	☐	☐	☐	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)	

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ASCE 41-13 - LS Type C2-C2a - Building 2

Low And Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)	
☒	☐	☐	☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	Two concrete walls in longitudinal direction. Concrete shear walls in one direction, wood shear walls in the orthogonal direction
☒	☐	☐	☐	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in.^{2} or $2\sqrt{f'_{ci}}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)	
☒	☐	☐	☐	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)	

Connections

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	
☐	☒	☐	☐	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)	There is no connection between the diaphragm to the walls directly. There is only a connection and load path through open web joists.
☒	☐	☐	☐	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)	

High Seismicity (Complete The Following Items In Addition To The Items For Low And Moderate Seismicity)

Seismic-Force-Resisting System

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)	

ASCE 41-13 - LS Type C2-C2a - Building 2

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	FLAT SLABS: Flat slabs or plates not part of the seismic- force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)	
☐	☐	☒	☐	COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than *d*/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1)	

Connections

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)	

Diaphragms (Flexible Or Stiff)

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	There is no connection between the diaphragm to the walls directly.
☐	☒	☐	☐	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)	There is no connection between the diaphragm to the walls directly.

Flexible Diaphragms

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)	
☒	☐	☐	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	

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ASCE 41-13 - LS Type W1-W1a - Building 2

LOW AND MODERATE SEISMICITY

SEISMIC-FORCE-RESISTING SYSTEM

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	Two wood walls in longitudinal direction. Concrete shear walls in one direction, wood shear walls in the orthogonal direction
☐	☒	☐	☐	SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the following values (Commentary: Sec. A.3.2.7.1. Tier 2: Sec. 5.5.3.1.1)	Average stress of 1660 plf

Structural panel sheathing	1,000 lb/ft
Diagonal sheathing	700 lb/ft
Straight sheathing	100 lb/ft
All other conditions	100 lb/ft

☐	☐	☒	☐	STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (Commentary: Sec. A.3.2.7.2. Tier 2: Sec. 5.5.3.6.1)
☐	☐	☒	☐	GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard are not used as shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (Commentary: Sec. A.3.2.7.3. Tier 2: Sec. 5.5.3.6.1)
☐	☐	☒	☐	NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. (Commentary: Sec. A.3.2.7.4. Tier 2: Sec. 5.5.3.6.1)
☐	☐	☒	☐	WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (Commentary: Sec. A.3.2.7.5. Tier 2: Sec. 5.5.3.6.2)
☐	☐	☒	☐	HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-1. (Commentary: Sec. A.3.2.7.6. Tier 2: Sec. 5.5.3.6.3)
☐	☐	☒	☐	CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (Commentary: Sec. A.3.2.7.7. Tier 2: Sec. 5.5.3.6.4)
☐	☐	☒	☐	OPENINGS: Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (Commentary: Sec. A.3.2.7.8. Tier 2: Sec. 5.5.3.6.5)

ASCE 41-13 - LS Type W1-W1a - Building 2

CONNECTIONS

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	WOOD POSTS: There is a positive connection of wood posts to the foundation. (Commentary: Sec. A.5.3.3. Tier 2: Sec. 5.7.3.3)	
☒	☐	☐	☐	WOOD SILLS: All wood sills are bolted to the foundation. (Commentary: Sec. A.5.3.4. Tier 2: Sec. 5.7.3.3)	
☐	☐	☒	☐	GIRDER/COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)	

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW AND MODERATE SEISMICITY)

CONNECTIONS

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WOOD SILL BOLTS: Sill bolts are spaced at 6 ft or less with proper edge and end distance provided for wood and concrete. (Commentary: Sec. A.5.3.7. Tier 2: Sec. 5.7.3.3)	

DIAPHRAGMS

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	
☒	☐	☐	☐	ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. (Commentary: Sec. A.4.1.3. Tier 2: Sec. 5.6.1.1)	
☒	☐	☐	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and shall have aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	

Tier 1 Checklists – Building 3 & 4

ASCE 41-13 - LS Basic - Building 3 & 4

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	LOAD PATH: The structure shall contain a complete well-defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)	
☐	☒	☐	☐	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)	Adjacent buildings only have a 1" spacing. This is insufficient.
☐	☐	☒	☐	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)	

BUILDING SYSTEMS - *BUILDING CONFIGURATION*

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A2.2.2. Tier 2: Sec. 5.4.2.1)	
☒	☐	☐	☐	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)	
☒	☐	☐	☐	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)	
☒	☐	☐	☐	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)	
☒	☐	☐	☐	MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)	

ASCE 41-13 - LS Basic - Building 3 & 4

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)	

MODERATE SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW SEISMICITY)

GEOLOGIC SITE HAZARD

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	LIQUIFACTION: 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 ft under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1)	Site is located at an area with medium liquefaction susceptibility.
☒	☐	☐	☐	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1)	
☒	☐	☐	☐	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: 5.4.3.1)	

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW AND MODERATE SEISMICITY)

FOUNDATION CONFIGURATION

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)	
☒	☐	☐	☐	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)	

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ASCE 41-13 - LS Type C2-C2a - Building 3 & 4

Low And Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)	
☒	☐	☐	☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	Two concrete walls in longitudinal direction. Concrete shear walls in one direction, wood shear walls in the orthogonal direction
☒	☐	☐	☐	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in.^{2} or $2\sqrt{f'_{ci}}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)	
☐	☒	☐	☐	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)	Large vertical cracks were observed in walls over their entire height

Connections

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	
☐	☒	☐	☐	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)	There is no connection between the diaphragm to the walls directly. There is only a connection and load path through open web joists.
☒	☐	☐	☐	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)	

High Seismicity (Complete The Following Items In Addition To The Items For Low And Moderate Seismicity)

Seismic-Force-Resisting System

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)	

ASCE 41-13 - LS Type C2-C2a - Building 3 & 4

C	NC	N/A	U		
☐	☐	☒	☐	FLAT SLABS: Flat slabs or plates not part of the seismic- force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)	
☐	☐	☒	☐	COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than *d*/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1)	

Connections

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)	

Diaphragms (Flexible Or Stiff)

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	There is no connection between the diaphragm to the walls directly.
☐	☒	☐	☐	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)	There is no connection between the diaphragm to the walls directly.

Flexible Diaphragms

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)	
☒	☐	☐	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	

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ASCE 41-13 - LS Type W1-W1a - Building 3 & 4

LOW AND MODERATE SEISMICITY

SEISMIC-FORCE-RESISTING SYSTEM

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	Concrete shear walls in one direction, wood shear walls in the orthogonal direction
☐	☒	☐	☐	SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the following values (Commentary: Sec. A.3.2.7.1. Tier 2: Sec. 5.5.3.1.1)	Average stress of 1400 plf

Structural panel sheathing	1,000 lb/ft
Diagonal sheathing	700 lb/ft
Straight sheathing	100 lb/ft
All other conditions	100 lb/ft

☐	☐	☒	☐	STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (Commentary: Sec. A.3.2.7.2. Tier 2: Sec. 5.5.3.6.1)
☐	☐	☒	☐	GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard are not used as shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (Commentary: Sec. A.3.2.7.3. Tier 2: Sec. 5.5.3.6.1)
☐	☐	☒	☐	NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. (Commentary: Sec. A.3.2.7.4. Tier 2: Sec. 5.5.3.6.1)
☐	☐	☒	☐	WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (Commentary: Sec. A.3.2.7.5. Tier 2: Sec. 5.5.3.6.2)
☐	☐	☒	☐	HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-1. (Commentary: Sec. A.3.2.7.6. Tier 2: Sec. 5.5.3.6.3)
☐	☐	☒	☐	CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (Commentary: Sec. A.3.2.7.7. Tier 2: Sec. 5.5.3.6.4)
☐	☐	☒	☐	OPENINGS: Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (Commentary: Sec. A.3.2.7.8. Tier 2: Sec. 5.5.3.6.5)

CONNECTIONS

C	NC	N/A	U	Description	Comments

ASCE 41-13 - LS Type W1-W1a - Building 3 & 4

C	NC	N/A	U		
☐	☐	☒	☐	WOOD POSTS: There is a positive connection of wood posts to the foundation. (Commentary: Sec. A.5.3.3. Tier 2: Sec. 5.7.3.3)	
☒	☐	☐	☐	WOOD SILLS: All wood sills are bolted to the foundation. (Commentary: Sec. A.5.3.4. Tier 2: Sec. 5.7.3.3)	
☐	☐	☒	☐	GIRDER/COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)	

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW AND MODERATE SEISMICITY)

CONNECTIONS

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WOOD SILL BOLTS: Sill bolts are spaced at 6 ft or less with proper edge and end distance provided for wood and concrete. (Commentary: Sec. A.5.3.7. Tier 2: Sec. 5.7.3.3)	

DIAPHRAGMS

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	
☒	☐	☐	☐	ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. (Commentary: Sec. A.4.1.3. Tier 2: Sec. 5.6.1.1)	
☒	☐	☐	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and shall have aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	

Tier 1 Checklists – Building 5 &6 & 7

ASCE 41-13 - LS Basic - Building 5 & 6 & 7

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	LOAD PATH: The structure shall contain a complete well-defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)	
☐	☒	☐	☐	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)	Adjacent buildings only have a 1" spacing. This is insufficient.
☐	☐	☒	☐	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)	

BUILDING SYSTEMS - *BUILDING CONFIGURATION*

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A2.2.2. Tier 2: Sec. 5.4.2.1)	
☒	☐	☐	☐	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)	
☐	☒	☐	☐	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)	The concrete shear wall on GL 12 is discontinuous
☒	☐	☐	☐	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)	
☒	☐	☐	☐	MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)	

ASCE 41-13 - LS Basic - Building 5 & 6 & 7

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)	

MODERATE SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW SEISMICITY)

GEOLOGIC SITE HAZARD

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	LIQUIFACTION: 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 ft under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1)	Site is located at an area with medium liquefaction susceptibility.
☒	☐	☐	☐	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1)	
☒	☐	☐	☐	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: 5.4.3.1)	

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW AND MODERATE SEISMICITY)

FOUNDATION CONFIGURATION

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)	
☒	☐	☐	☐	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)	

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ASCE 41-13 - LS Type C2-C2a - Building 5 & 6 & 7

Low And Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)	
☒	☐	☐	☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	
☒	☐	☐	☐	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in.^{2} or $2\sqrt{f'_{ci}}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)	
☐	☒	☐	☐	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)	Large vertical cracks were observed in walls over their entire height.

Connections

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	
☐	☒	☐	☐	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)	There is no connection between the diaphragm to the walls directly. There is only a connection and load path through open web joists.
☒	☐	☐	☐	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)	

High Seismicity (Complete The Following Items In Addition To The Items For Low And Moderate Seismicity)

Seismic-Force-Resisting System

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)	

ASCE 41-13 - LS Type C2-C2a - Building 5 & 6 & 7

C	NC	N/A	U		
☐	☐	☒	☐	FLAT SLABS: Flat slabs or plates not part of the seismic- force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)	
☐	☐	☒	☐	COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than *d*/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1)	

Connections

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)	No top reinforcement at pile caps.

Diaphragms (Flexible Or Stiff)

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	There is no connection between the diaphragm to the walls directly.
☐	☒	☐	☐	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)	There is no connection between the diaphragm to the walls directly.

Flexible Diaphragms

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)	
☐	☐	☒	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	

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ASCE 41-13 - LS Type W1-W1a - Building 5 & 6 & 7

LOW AND MODERATE SEISMICITY

SEISMIC-FORCE-RESISTING SYSTEM

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	Concrete shear walls in one direction, wood shear walls in the orthogonal direction
☐	☒	☐	☐	SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the following values (Commentary: Sec. A.3.2.7.1. Tier 2: Sec. 5.5.3.1.1)	Average stress of 2000 plf.
☐	☐	☒	☐	STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (Commentary: Sec. A.3.2.7.2. Tier 2: Sec. 5.5.3.6.1)	
☐	☐	☒	☐	GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard are not used as shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (Commentary: Sec. A.3.2.7.3. Tier 2: Sec. 5.5.3.6.1)	
☐	☐	☒	☐	NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. (Commentary: Sec. A.3.2.7.4. Tier 2: Sec. 5.5.3.6.1)	
☐	☐	☒	☐	WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (Commentary: Sec. A.3.2.7.5. Tier 2: Sec. 5.5.3.6.2)	
☐	☐	☒	☐	HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-1. (Commentary: Sec. A.3.2.7.6. Tier 2: Sec. 5.5.3.6.3)	
☐	☐	☒	☐	CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (Commentary: Sec. A.3.2.7.7. Tier 2: Sec. 5.5.3.6.4)	
☐	☐	☒	☐	OPENINGS: Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (Commentary: Sec. A.3.2.7.8. Tier 2: Sec. 5.5.3.6.5)	

Structural panel sheathing	1,000 lb/ft
Diagonal sheathing	700 lb/ft
Straight sheathing	100 lb/ft
All other conditions	100 lb/ft

ASCE 41-13 - LS Type W1-W1a - Building 5 & 6 & 7

CONNECTIONS

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	WOOD POSTS: There is a positive connection of wood posts to the foundation. (Commentary: Sec. A.5.3.3. Tier 2: Sec. 5.7.3.3)	
☒	☐	☐	☐	WOOD SILLS: All wood sills are bolted to the foundation. (Commentary: Sec. A.5.3.4. Tier 2: Sec. 5.7.3.3)	
☐	☐	☒	☐	GIRDER/COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)	

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW AND MODERATE SEISMICITY)

CONNECTIONS

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WOOD SILL BOLTS: Sill bolts are spaced at 6 ft or less with proper edge and end distance provided for wood and concrete. (Commentary: Sec. A.5.3.7. Tier 2: Sec. 5.7.3.3)	

DIAPHRAGMS

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	Buildings diaphragms are on split levels
☐	☐	☒	☐	ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. (Commentary: Sec. A.4.1.3. Tier 2: Sec. 5.6.1.1)	
☐	☐	☒	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and shall have aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	

Tier 1 Checklists – Building 8 & 9 & 10

ASCE 41-13 - LS Basic - Building 8 & 9 & 10

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	LOAD PATH: The structure shall contain a complete well-defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)	
☐	☒	☐	☐	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)	Adjacent buildings only have a 1" spacing. This is insufficient.
☐	☐	☒	☐	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)	

BUILDING SYSTEMS - *BUILDING CONFIGURATION*

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A2.2.2. Tier 2: Sec. 5.4.2.1)	
☒	☐	☐	☐	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)	
☐	☒	☐	☐	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)	There are discontinuous walls at GL E
☒	☐	☐	☐	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)	
☒	☐	☐	☐	MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)	

ASCE 41-13 - LS Basic - Building 8 & 9 & 10

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)	

MODERATE SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW SEISMICITY)

GEOLOGIC SITE HAZARD

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	LIQUIFACTION: 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 ft under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1)	Site is located at an area with medium liquefaction susceptibility.
☒	☐	☐	☐	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1)	
☒	☐	☐	☐	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: 5.4.3.1)	

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW AND MODERATE SEISMICITY)

FOUNDATION CONFIGURATION

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)	
☒	☐	☐	☐	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)	

ASCE 41-13 - LS Type C2-C2a - Building 8 & 9 & 10

Low And Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)	
☒	☐	☐	☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	
☒	☐	☐	☐	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in.^{2} or $2\sqrt{f'_{ci}}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)	
☒	☐	☐	☐	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)	

Connections

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	
☐	☒	☐	☐	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)	There is no connection between the diaphragm to the walls directly. There is only a connection and load path through open web joists.
☒	☐	☐	☐	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)	

High Seismicity (Complete The Following Items In Addition To The Items For Low And Moderate Seismicity)

Seismic-Force-Resisting System

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)	

ASCE 41-13 - LS Type C2-C2a - Building 8 & 9 & 10

C	NC	N/A	U		
☐	☐	☒	☐	FLAT SLABS: Flat slabs or plates not part of the seismic- force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)	
☐	☐	☒	☐	COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than *d*/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1)	

Connections

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)	There is no top reinforcement at the pile caps.

Diaphragms (Flexible Or Stiff)

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	There is no connection between the diaphragm to the walls directly.
☐	☒	☐	☐	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)	There is no connection between the diaphragm to the walls directly.

Flexible Diaphragms

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)	
☐	☐	☒	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	

ASCE 41-13 - LS Type W1-W1a - Building 8 & 9 & 10

LOW AND MODERATE SEISMICITY

SEISMIC-FORCE-RESISTING SYSTEM

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	Concrete shear walls in one direction, wood shear walls in the orthogonal direction
☐	☒	☐	☐	SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the following values (Commentary: Sec. A.3.2.7.1. Tier 2: Sec. 5.5.3.1.1)	Average stress of 1850 plf

Structural panel sheathing	1,000 lb/ft
Diagonal sheathing	700 lb/ft
Straight sheathing	100 lb/ft
All other conditions	100 lb/ft

☐	☐	☒	☐	STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (Commentary: Sec. A.3.2.7.2. Tier 2: Sec. 5.5.3.6.1)
☐	☐	☒	☐	GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard are not used as shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (Commentary: Sec. A.3.2.7.3. Tier 2: Sec. 5.5.3.6.1)
☐	☐	☒	☐	NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. (Commentary: Sec. A.3.2.7.4. Tier 2: Sec. 5.5.3.6.1)
☐	☐	☒	☐	WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (Commentary: Sec. A.3.2.7.5. Tier 2: Sec. 5.5.3.6.2)
☐	☐	☒	☐	HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-1. (Commentary: Sec. A.3.2.7.6. Tier 2: Sec. 5.5.3.6.3)
☐	☐	☒	☐	CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (Commentary: Sec. A.3.2.7.7. Tier 2: Sec. 5.5.3.6.4)
☐	☐	☒	☐	OPENINGS: Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (Commentary: Sec. A.3.2.7.8. Tier 2: Sec. 5.5.3.6.5)

CONNECTIONS

C	NC	N/A	U	Description	Comments

ASCE 41-13 - LS Type W1-W1a - Building 8 & 9 & 10

☐	☐	☒	☐	WOOD POSTS: There is a positive connection of wood posts to the foundation. (Commentary: Sec. A.5.3.3. Tier 2: Sec. 5.7.3.3)
☒	☐	☐	☐	WOOD SILLS: All wood sills are bolted to the foundation. (Commentary: Sec. A.5.3.4. Tier 2: Sec. 5.7.3.3)
☐	☐	☒	☐	GIRDER/COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW AND MODERATE SEISMICITY)

CONNECTIONS

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WOOD SILL BOLTS: Sill bolts are spaced at 6 ft or less with proper edge and end distance provided for wood and concrete. (Commentary: Sec. A.5.3.7. Tier 2: Sec. 5.7.3.3)	

DIAPHRAGMS

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	
☐	☐	☒	☐	ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. (Commentary: Sec. A.4.1.3. Tier 2: Sec. 5.6.1.1)	
☐	☐	☒	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and shall have aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	

Tier 1 Checklists – Building 11

ASCE 41-13 - LS Basic - Building 11

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	LOAD PATH: The structure shall contain a complete well-defined load path, including structural elements and connections that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)	
☐	☒	☐	☐	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)	Adjacent buildings only have a 1" spacing. This is insufficient.
☐	☐	☒	☐	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)	

BUILDING SYSTEMS - *BUILDING CONFIGURATION*

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A2.2.2. Tier 2: Sec. 5.4.2.1)	
☒	☐	☐	☐	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)	
☒	☐	☐	☐	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)	
☒	☐	☐	☐	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)	
☒	☐	☐	☐	MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)	

ASCE 41-13 - LS Basic - Building 11

☒	☐	☐	☐	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)	

MODERATE SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW SEISMICITY)

GEOLOGIC SITE HAZARD

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	LIQUIFACTION: 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 ft under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1)	Site is located at an area with medium liquefaction susceptibility.
☒	☐	☐	☐	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1)	
☒	☐	☐	☐	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: 5.4.3.1)	

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW AND MODERATE SEISMICITY)

FOUNDATION CONFIGURATION

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)	Per calculations, overturning is too large for this wall size.
☒	☐	☐	☐	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)	

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Low And Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)	
☒	☐	☐	☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	
☒	☐	☐	☐	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in.^{2} or $2\sqrt{f'_{ci}}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)	
☒	☐	☐	☐	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)	

Connections

C	NC	N/A	U	Description	Comments
☐	☐	☐	☒	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	Details regarding the transfer to shear walls are missing from the documents.
☐	☐	☐	☒	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)	Details regarding the transfer to shear walls are missing from the documents.
☒	☐	☐	☐	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)	

High Seismicity (Complete The Following Items In Addition To The Items For Low And Moderate Seismicity)

Seismic-Force-Resisting System

C	NC	N/A	U	Description	Comments
☐	☐	☒	☐	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)	

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C	NC	N/A	U		
☐	☐	☒	☐	FLAT SLABS: Flat slabs or plates not part of the seismic- force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)	
☐	☐	☒	☐	COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than *d*/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1)	

Connections

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)	Pile Caps do not have top reinforcement

Diaphragms (Flexible Or Stiff)

C	NC	N/A	U	Description	Comments
☐	☐	☐	☒	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	Details regarding the transfer to shear walls are missing from the documents.
☐	☐	☐	☒	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)	Details regarding the transfer to shear walls are missing from the documents.

Flexible Diaphragms

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)	
☒	☐	☐	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	