# ASCE 41 Tier 1 Seismic Evaluation
# Municipal Services Building
# South San Francisco, California

# FINAL REPORT


Prepared For:
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**APPENDICES**

## EXECUTIVE SUMMARY

The purpose of the preliminary seismic evaluation described in this report is to determine whether the lateral load-resisting system of the Municipal Services Building (MSB) complies with the seismic performance requirements for CBC Seismic Risk Categories II, III, and IV, and if not, determine which lateral system elements are potentially deficient, provide qualitative recommendations for the required seismic strengthening and develop a rough-order-of-magnitude (ROM) conceptual-level construction cost estimate. The method used to evaluate the building for the three Risk Categories was the Tier 1 procedure per ASCE 41-17.

The MSB is a 2-story concrete tilt-up wall structure with a wood-framed roof, a cast-in-place/precast concrete-framed second floor, a slab-on-grade first floor, and a shallow spread-footing foundation system. It has concrete walls at its perimeter and numerous plywood-sheathed, wood-framed walls at the second floor. The overall plan dimensions are approximately 169’ x 363’ at its footprint and 158’ x 363’ at the second floor.

The building was originally designed and constructed in 1969 as a retail store. It was subsequently purchased by the City. In 1979, the building was upgraded and remodeled to serve as the Municipal Services Building. The 1979 seismic upgrade was designed per the Uniform Building Code (UBC) using seismic loads based on Seismic Zone 4 and an Importance Factor, I = 1.5, which is applicable to buildings that are Essential Facilities. A voluntary, partial seismic retrofit was completed for the small fire station area of the building in 2011 to achieve compliance with the then-current seismic codes/standards.

Horizontal elements of the building’s lateral load-resisting system comprise of the plywood roof diaphragm and second floor concrete-slab diaphragm. Vertical elements of the lateral system consist of shear walls: a combination of interior plywood-sheathed walls and the exterior concrete walls at perimeter of the building at the second story and exterior concrete walls and one interior concrete wall at the first story. The roof and second floor diaphragms deliver the lateral loads to the shear walls, which transfer then to the underlying/surrounding soil via the foundation system.

Per ASCE 41, the Tier 1 procedure is intended to quickly identify potential deficiencies in a building’s lateral load-resisting system via use of a series of Checklists. Based on the results of the Tier 1 evaluation and our experience with buildings of similar size, age and construction type, it is our opinion that the existing Municipal Services Building has significant potential deficiencies in its lateral force-resisting system, and therefore, does not meet the seismic performance requirements for any of the three Risk Categories based on the ASCE 41-17 seismic design criteria.

Based on the findings of this preliminary seismic evaluation, the following structural/seismic elements are potentially deficient:

1. Concrete wall anchorage system to the roof and second floor diaphragms (anchors, crossties, and sub-diaphragms) to resist out-of-plane wall loads.
2. In-plane shear capacity of the roof and second floor diaphragms.
3. Connections for in-plane shear transfer from roof and second floor diaphragms to the exterior concrete walls.
4. Plywood shear walls between the roof and second floor are discontinuous below the second floor. The walls are potentially deficient in their in-plane shear and uplift capacities. The threaded holdown rods do not have washers/bearing plates at the concrete beams below the second floor, a condition that potentially limits their effectiveness for resisting overturning loads.
5. The west (Arroyo, Gridline B) concrete wall below the roof and the south (Fire Station, Gridline 12) concrete wall below the roof are not continuous below the second floor (out-of-plane horizontal offset).
6. Precast concrete wall panels are attached to the foundation via welded embed plates (vs. embedded rebar dowels).
7. The exterior concrete wall panels do not have adequate out-of-plane flexural strength.
8. The exterior concrete wall panels do not have adequate in-plane shear strength.

The proposed seismic retrofit work to remedy the potential deficiencies outlined above is depicted conceptually in the sketches included in Appendix 1.

The ROM conceptual-level construction costs, determined using historical construction cost data for similar buildings, to strengthen the existing MSB to the current seismic code/standards based on this preliminary evaluation are as below:

| | |
|---|---|
| Risk Category II | $5,575,000 |
| Risk Category III | $6,500,000 |
| Risk Category IV | $7,575,000 |

It should be noted that these estimated costs are preliminary and have been developed based on limited structural information and preliminary analytical work as required by the ASCE 41 Tier 1 methodology; the actual construction cost could vary substantially.

**Recommended Further Actions**

The findings of our preliminary seismic evaluation based on the ASCE 41-17 Tier 1 procedure indicate that the Municipal Services Building has significant potential seismic deficiencies and does not comply with its seismic resistance requirements. We recommend that the City select one of the following two options for the building.

Option 1 – Perform Voluntary Seismic Upgrade to Comply with Current Building Code

If the City elects to upgrade the MSB to the current seismic code/standards in order to improve its potential performance during a major seismic event, we recommend the following further steps to implement a voluntary seismic retrofit program for the building. These steps will help define fully the scope of required seismic retrofit work and the associated construction costs:

1. Perform a more detailed ASCE 41 Tier 2 Deficiency-Based Seismic Evaluation of the building, based on the Risk Category selected by the City, to fully define the building's seismic retrofit needs.
2. Using the seismic deficiencies identified and verified via the Tier 2 evaluation, develop at least one conceptual seismic retrofit scheme to remedy those deficiencies.
3. Prepare sketches for the proposed seismic retrofit scheme(s) to indicate the nature and extent of required seismic retrofit work.
4. Prepare a more detailed estimate of the probable construction costs. This estimate should be prepared by a third-party professional cost estimating firm.

After approval of the proposed seismic retrofit work and its anticipated costs by the City, the project would then proceed to the final design phase in order to prepare the construction documents.

Option 2 – Use MSB for Any Permissible Occupancy without Seismic Retrofit

The as-built structural drawings for the seismic upgrade work performed in 1979 indicate that the entire Municipal Services Building was retrofitted to comply with the Essential Facility requirements of the Uniform Building Code in effect at that time. Given this, it is our opinion that the City may choose to use the MSB for any permissible occupancy type without any requirement to seismically retrofit the overall building per the current building code as long as any structural modifications or non-structural renovations that may be undertaken for the selected building use/occupancy do not exceed the various thresholds in the building code or adopted by the City of South San Francisco Building Department (SSFBD). In the event at least one of these thresholds is exceeded, a mandatory seismic evaluation and retrofit (if required) of the overall building, per the current building code, is triggered.

If the City elects to use the MSB essentially "as is" with only minor structural modifications and/or limited non-structural renovation required for the selected use/occupancy that do not trigger a mandatory seismic evaluation/retrofit of the overall building, we recommend undertaking the following further steps:

1. Confirm with SSFBD that the 1979 seismic retrofit work was indeed permitted to upgrade the building to an Essential Facility and that the work was fully implemented during construction.
2. Consult with SSFBD to determine the thresholds for all applicable triggers (structural modifications, non-structural renovation, etc.) that, if exceeded, would require seismic evaluation and, possibly, retrofit of the overall building per the current building code.
3. Modify/renovate the building per requirements of the selected use/occupancy while ensuring that none of the applicable trigger thresholds is exceeded.

## PROJECT OVERVIEW

Biggs Cardosa Associates has been retained by the City of South San Francisco to provide a Tier 1 seismic assessment and conceptual seismic retrofit recommendations for the Municipal Services Building (MSB) located at 33 Arroyo Drive, South San Francisco, California. The seismic assessment was performed for Risk Categories II, III and IV using the Tier 1 methodology in ASCE 41-17. The Tier 1 methodology in ASCE 41 is used to quickly identify potential lateral system deficiencies based on a series of Checklists. The procedure is intended to screen a large number of buildings quickly in order to identify potential seismic risk to each structure, prioritize the structures based on potential seismic risk, and select potentially high-risk structures for further, more-detailed evaluation and upgrade them, as required, to comply with the current seismic codes and standards, if desired.

This report contains the structural/seismic findings based on our Tier 1 assessment, our limited field observation of the existing structural conditions, and our experience with buildings of similar size, age and construction type. Potential seismic deficiencies are identified and conceptual recommendations are outlined for remedial work. A rough-order-of-magnitude (ROM) conceptual-level cost estimate is provided for the seismic retrofit work anticipated for each Rick Category.

The findings and recommendations outlined in this report pertain only to the existing building's lateral load-resisting system. The assessment does not cover seismic anchorage and/or bracing of non-structural items such as electrical/mechanical equipment, ceilings, partitions, or other architectural elements. Further, an assessment of other building systems/features such as mechanical, electrical, plumbing, fire protection, accessibility, egress, drainage, waterproofing, etc. is beyond the scope of this report.

The scope of our services for the structural/seismic assessment described in this report is summarized below:

1. Review available as-built structural drawings and calculations for original design and subsequent additions/modifications, previous seismic assessment reports, geotechnical reports, etc. for the building.
2. Perform a site visit to observe the general physical condition of the building and to verify general conformance of in-place construction with as-built structural drawings. Building finishes will not be disturbed during the site visit and our observation will be limited to the readily visible structural elements.
3. Prepare calculations necessary for completing the structural checklists required by the ASCE 41 Tier 1 seismic evaluation methodology.
4. Complete applicable structural checklists for ASCE 41 Tier 1 seismic evaluation.

5. Identify potential structural/seismic deficiencies in the building's lateral system based on our field observations and the Tier 1 seismic assessment.
6. Prepare qualitative recommendations for the retrofit work required to alleviate the identified potential seismic deficiencies.
7. Prepare a ROM conceptual-level cost estimate for the proposed seismic retrofit work based on historical seismic retrofit cost data for similar buildings.
8. Prepare a brief report describing the findings of structural/seismic assessment and a conceptual construction cost estimate to remedy the identified seismic deficiencies.

## AVAILABLE DOCUMENTS

The following documents were available for our review for this seismic assessment:

- Original building structural drawings, "Department Store for U.S.E. South San Francisco" by David Alan Welisch, dated November 4, 1968.
- Seismic upgrade and tenant improvement structural drawings of "South San Francisco Municipal Services Building" by Robinson Meier Juilly and Associates, dated January 21, 1980.
- Structural drawings for City of South San Francisco Fire Station #63 voluntary partial seismic retrofit, by Biggs Cardosa Associates, dated April 8, 2011.
- Soils report titled "Foundation Investigation-Proposed Department Store Building: Arroyo Drive and El Camino Real, South San Franscico, CA for U.S.E. Stores" by Dames & Moore, Consulting Engineers, dated September 4, 1968.
- Letter and site notes regarding additional soils information for the same site by Dames & Moore, dated February 14, 1980.
- Structural calculations (32 pages) for the U.S.E. Store, by David Alan Welisch-Structural Engineers, dated 1969.
- Structural calculations for S.S.F. Muni Services Building, by Robinson.Meier.Juilly & Associates-Structural Engineers, dated 1979.

## BUILDING DESCRIPTION

The Municipal Services Building (MSB) is located at 33 Arroyo Drive in South San Francisco, California. Until recently, the building was used as the South San Francisco City Hall. The second floor (located at Arroyo Drive street-level) housed the City government offices, including the Police Department, while the first floor served as a parking garage and housed the Fire Department in a small area (30' x 123') at the building's south end. Except for the Fire Department, all building functions were recently moved to the new City government complex nearby, located on northside of El Camino Real; the Fire Department is expected to be relocated in the near future. The MSB is therefore currently vacant, except for the small area used by the Fire Department.

The MSB is a 2-story concrete tilt-up wall structure with a wood-framed roof, a cast-in-place/precast concrete-framed second floor, a slab-on-grade first floor, and a shallow spread-footing foundation system. The overall plan dimensions at its footprint (the lower level) are approximately 169' x 363' while the upper level dimensions are approximately 158' x 363'. Until the building was vacated recently, the lower level was used as a parking garage and the upper floor housed offices, community rooms, and restrooms. An out-of-use firing range is also located in the former police department area of the garage.

The building was originally designed and constructed in 1969 as a retail store. It was subsequently purchased by the City (purchase date unknown). In 1979, the building was upgraded and remodeled to serve as the Municipal Services Building. The 1979 seismic upgrade was designed for seismic loads based on Seismic Zone 4 and an Importance Factor, I = 1.5. Per the 1979 UBC, Seismic Zone 4 was a seismic zone for coastal California and I = 1.5 was the Importance Factor for an Essential Facility. A voluntary, partial seismic retrofit was completed for the small fire station area of the building in 2011 to achieve compliance with the then-current seismic codes/standards, with the understanding and City's expectation that the overall building would also be voluntarily upgraded per the current seismic codes/standards in the near future in order to ensure improved building performance during a seismic event.

It should be noted that while the building was seismically upgraded in 1979 to the then-applicable seismic standards for Essential Facilities, it is highly improbable that the building in its current configuration would meet current code requirements for a Risk Category IV structure (equivalent to Essential Facility) or for Risk Categories II and III. This is because seismic requirements in the building codes have changed significantly since 1979, with the current building codes being significantly more stringent.

For reference purposes, this report uses the following conventions when discussing the building orientation:

| Direction | Street | Building Gridline |
|---|---|---|
| North side | El Camino Real | Gridline 1 |
| South side | Camaritas Ave (Fire Station) | Gridline 12 |
| West side | Arroyo Drive (Front/Main Entrance) | Gridline A |
| East side | Rear side | Gridline F |

See building plans in Appendix 1 for gridline numbering.

Vertical (Gravity) Load-Resisting System

The roof level framing consists of plywood sheathing over sawn lumber joists (east-west direction) supported by glulam beams (north-south direction) and glulam girders (east-west direction). The glulam girders are supported on interior steel pipe columns and the west and east exterior concrete walls.

The second floor (the upper level) consists of a concrete topping slab over precast concrete joists (east-west direction) which span between precast concrete girders (north-south direction). The girders are supported by interior concrete columns and the exterior concrete walls. The interior columns are supported by isolated spread footings while the concrete walls are supported by continuous spread footings. The ground floor slab of the parking garage is a concrete slab-on-grade. It should be noted that at the south (Fire Station) side of the building, the exterior concrete wall between the roof and second floor is offset approximately 30 feet south of the concrete wall which occurs at the second to first floor.

Because of the site grading, the concrete wall (on gridline A) at the parking garage level at the front (west side) of the building is a retaining wall and is offset horizontally by 11'-6" from the concrete wall above (on gridline B). The upper level exterior concrete wall (on gridline B) on this side of the building is supported on a line of precast concrete girders and concrete columns below, a condition that creates a discontinuous shear wall system at gridline B. A cast-in-place concrete slab spans between the precast girders and the front basement (lower level) retaining wall. This exterior slab supports the landscaping located at the front (Arroyo Drive side) ground level of the building.

Lateral Load-Resisting System

The roof diaphragm consists of 1/2" plywood sheathing while the second floor (the upper level) diaphragm consists of the 3.5" concrete floor slab. Vertical elements of the building's lateral load-resisting system consist of shear walls: a combination of interior wood-framed, plywood-sheathed, walls and the exterior concrete walls at perimeter of the building at the second (upper) story and exterior concrete walls and one interior concrete wall at the first (lower) story. The roof and second floor diaphragms deliver the lateral loads to the shear walls, which transfer then to the underlying/surrounding soil via the foundation system.

## FIELD OBSERVATION

On March 10, 2025, engineers from Biggs Cardosa Associates performed a limited site visit to observe physical condition of the readily visible structural elements of the building and to verify general conformance of the in-place construction with the available structural drawings. Existing building finishes were not disturbed during this field observation.

In general, the building was observed to be in relatively good condition and appears to have been maintained reasonably well. No signs of water intrusion or significant structural distress (such as large cracks or spalls in concrete elements) were visible in the building areas observed. Observation of the roof framing was not possible as it was concealed by ceilings in nearly all areas of the upper level.

The interior plywood shear walls at the second floor (constructed as part of the 1979 seismic upgrade) have threaded holdown rods that extend through the concrete beams added below the second floor slab. Some of the rods have missing washers and some of the nuts appear not have been properly installed at the bottom face of concrete beams. This condition may adversely impact the overturning capacity of the plywood shear walls above.

A previous report for this building (prepared by Biggs Cardosa Associates in 2009) noted signs of water damage in the former police station area of the parking garage. The report also noted that some repair work appeared to have been done in that area, including installation of steel beams and columns, and epoxy injection in cracks. Based on photos from 2009, the installed structural steel framing appeared to have been covered by the building finishes. Therefore, we were unable to confirm those conditions during the site visit for this report but we assume that the framing is still in place.

## SEISMIC EVALUATION AND FINDINGS

### Evaluation Basis

Seismic rehabilitation of existing buildings is typically performed either on a voluntary basis or is mandated by the building code under certain conditions. The scope for a voluntary upgrade can be for a complete or partial seismic retrofit, or no retrofit at all – all at the building owner's discretion.

The 2022 California Existing Building Code (CEBC) includes the following criteria that trigger mandatory seismic evaluation of a building and, if found deficient, a mandatory seismic upgrade:

1. Modifications to the building that increase its seismic weight by more than 10%.
2. Modifications to the building that decrease strength of any element of the lateral load-resisting system by more than 10%.
3. Any change in use of the building that results in a change to a higher Seismic Risk Category.
4. Any combination of the above triggers.

In addition to the above CEBC triggers for a mandatory seismic evaluation/retrofit, each City/jurisdiction typically has other local requirements (such as extents of structural or non-structural modifications or renovation and the percentage of total building area they encompass, cost of renovation as percentage of the building replacement cost, etc.) that if exceeded usually trigger a mandatory seismic evaluation and retrofit (if required). These triggers vary from City/jurisdiction to City/jurisdiction.

After a seismic evaluation is complete, any elements found to be deficient require seismic upgrade to the current code level for a mandatory seismic retrofit.

At the City's request, this report includes evaluation of the Municipal Services Building's lateral load-resisting system for three California Building Code (CBC) Risk Categories (seismic performance levels):

- Risk Category II
- Risk Category III
- Risk Category IV

In general, these three Risk Categories can be described as follows:

*Risk Category II*
Most common category that includes residential, office, and commercial buildings other than those in Risk Category III or IV.

*Risk Category III*
Buildings and other structures used for public assembly, schools and education facilities, structures with limited quantities of toxic or hazardous substances and other structures where failure poses a substantial threat to human life and/or substantial economic impact.

*Risk Category IV*
Buildings and other structures designated (per code, by the jurisdiction, or the owner) as essential facilities and/or facilities with higher quantities of toxic or hazardous substances.

The seismic evaluations for this report were performed for the above CBC performance levels per the ASCE 41 Tier 1 procedure. ASCE 41 provides methods for determining equivalent CBC evaluations based on two different earthquake levels (BSE-1E and BSE-2E) and varying performance levels. Table 1 below shows the evaluations for each CBC Risk Category based on ASCE 41 Table 2-2.

| **Table 1: ASCE 41 Evaluation Matrix** | | |
|---|---|---|
| CBC Risk Category | Response Accelerations | |
| | BSE-1E | BSE-2E |
| II | N/A | CP |
| III | N/A | CP |
| IV | IO | LS |
| BSE - Basic safety earthquake<br>N/A - Not applicable<br>CP - Collapse Prevention<br>IO - Immediate Occupancy<br>LS - Life Safety | | |

It should be noted that for Risk Category IV, a Life Safety evaluation is performed using the Quick Check checklists for Collapse Prevention level but with an Ms load reduction factor for Life Safety level applied (ASCE 41 Table 2-2, Note d).

The initial request from the City was for an evaluation of the overall MSB for Risk Category II and III, and an evaluation of only the Fire Station portion at the first floor for Risk Category IV. However, the Fire Station area is structurally connected to the second floor rigid diaphragm of the overall building and also to the exterior concrete walls on three sides. This type and configuration of structural framing does not allow for the Fire Station area to respond independently from the rest of the building during an earthquake. So, a seismic evaluation of a portion (i.e., the fire station area) of the building is deemed to be of limited value. For those reasons, we considered it more appropriate to evaluate the overall building for the Risk Category IV performance level.

The seismic analysis of the MSB has been conducted in accordance with ASCE 41 for the performance levels (Risk Categories) described above. The ASCE 41 analysis consisted of a Tier 1 evaluation, which represents a preliminary seismic evaluation approach to quickly identify the potential seismic deficiencies in the building's lateral load-resisting system.

Analyses performed as part of the ASCE 41 Tier 1 evaluation process are limited to Quick Checks, which are mostly qualitative with some (limited) quantitative evaluations of the various lateral system components and their configuration. The Tier 1 analysis uses seismic forces calculated per ASCE 41 for determining whether the building complies with the evaluation criteria. Since this evaluation is preliminary, a Linear Static Procedure (LSP) utilizing hand calculations and spreadsheets was used to identify potential seismic deficiencies in the building.

The seismic load distribution utilizes a method similar to that prescribed in the CBC in which the base shear is distributed vertically to each level (roof and second floor in the case of MSB) based on each level's weight and its height above the building base.

The MSB can be generally categorized (per ASCE 41) as a Concrete Shear Wall Type C2 (stiff diaphragms) building as well as a Concrete Shear Wall C2a (flexible diaphragms) building. The concrete-slab diaphragm at the second floor of MSB is considered to be rigid in-plane while the wood-framed diaphragm at the roof is considered to be flexible. Rigid roof/floor diaphragms distribute lateral forces to the vertical elements (such as shear walls, braced frames, etc.) based on the latter's relative stiffness whereas flexible roof/floor diaphragms do so based on the roof/floor area tributary to each vertical lateral load-resisting element. The Tier 1 procedure followed for this seismic evaluation utilized combined Checklists applicable to both Type C2 and C2a buildings.

The interior plywood shear walls at second story of the MSB do not continue down to the first floor below. Due to these shear walls taking a significant portion of the east-west (transverse) roof seismic loads, their presence needs to be accounted for in the evaluation. For this evaluation, we therefore also utilized the Checklists for Wood Frame (Commercial) Type W2 buildings in addition to the evaluation Checklists for Type C2/C2A buildings.

**Seismic Evaluation Results**

The following is a list of potentially deficient or otherwise non-compliant items identified in our ASCE 41 evaluation of the MSB's structural/lateral system. See Appendix 2 for Tier 1 Checklists. The deficiency titles below (all caps) are taken directly from ASCE 41 Checklists. The descriptions following the title use terminology similar to that used in the Checklists.

Due to the building's vertical lateral elements being concrete walls and its wood-framed roof, most of the potential deficiencies for this type of building are common across Risk Categories II, III, and IV. Further, the ASCE 41 Collapse Prevention checklists are applicable to the evaluations for all three Risk Categories. The Immediate Occupancy Checklists have additional checks that are not included with the Collapse Prevention checklists. However, most of these additional items are not applicable to the MSB building. For these reasons, most of the identified seismic deficiencies are generally common across all three Risk Categories.

<u>Building Types C2 and C2a:</u>

- VERTICAL IRREGULARITIES: The concrete shear walls at Gridline 11 and Gridline B are not continuous to the foundation.

- SHEAR STRESS CHECK: The shear stress in the concrete shear walls calculated using the Tier 1 Quick Check procedure exceeds the capacity provided in ASCE 41 for concrete shear walls.
- WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: The exterior concrete walls are not anchored adequately for out-of-plane forces at the (flexible) roof diaphragm level.
- FOUNDATION DOWELS: Wall reinforcement is anchored to the foundation with welded embed plates. ASCE 41 requires concrete walls to be doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing directly above the foundation.
- CROSS TIES: There are not adequate continuous cross ties between diaphragm chords at the roof level.
- TRANSFER TO SHEAR WALLS: Diaphragms are not adequately connected for transfer of loads to the shear walls, and the connections are unable to develop the lesser of the shear strength of the walls or diaphragms.
- MASS IRREGULARITY: The weight of the second floor is more than 60% heavier than the roof level.

<u>Building Type W2:</u>

- VERTICAL IRREGULARITIES: The plywood shear walls at the second floor are not continuous to the foundation.
- SHEAR STRESS CHECK: The shear stress in the plywood shear walls (between the roof and second floor) calculated using the Tier 1 Quick Check procedure exceeds the capacity provided in ASCE 41 for plywood shear walls.
- MASS IRREGULARITY: The weight of the second floor is more than 60% heavier than the roof level.

The following deficiencies are part of Tier 2 methodology in ASCE 41, which was not within the scope of this report. However, we believe they merit inclusion in the deficiency list due to their impact on seismic performance of the building.

- DIAPHRAGMS (C2 and C2a): The wood diaphragm at the roof and the concrete diaphragm at the second floor do not have adequate in-plane shear capacity.
- WALL THICKNESS AND PROPORTIONS (C2 and C2a): The exterior concrete walls do not have adequate out-of-plane bending capacity to span between floors at both levels.

- WALL CONNECTIONS (C2 and C2a): The out-of-plane connections of the concrete walls to the second floor concrete diaphragm do not have adequate capacity.

Based on our visual review of the structure and an evaluation of the building in accordance with ASCE 41 Tier 1 procedure, it is our opinion that the MSB does not meet the requirements for Risk Category II, III, or IV. Therefore, in the event of a major earthquake, the building is anticipated to be susceptible to significant structural damage and may not remain fully operational immediately following a major seismic event.

## SEISMIC RETROFIT RECOMMENDATIONS

In order to remedy the potential seismic deficiencies identified above, the following retrofit work would be required.

1. Increase capacity of the concrete wall anchorage system at the roof, both for shear and out-of-plane loads, by installing wall anchors, crossties, and sub-diaphragms.
2. Increase in-plane shear capacity of the roof diaphragm by additional nailing and second floor diaphragm by adding carbon fiber in overstressed areas or by installing new vertical shear resisting elements (e.g., shear walls) below the second floor to reduce shear demands on the diaphragm.
3. Increase the in-plane shear transfer capacity of the connections of the roof and second floor diaphragms to the concrete walls.
4. Increase shear capacity of the second-story plywood shear walls by adding nailing to existing plywood and/or adding plywood to the opposite side of the walls. Upgrades will also include improving fastenings of the shear walls to the roof and second floor for shear transfer and upgrades to holdowns and anchorage to the second floor. Install longer threaded rods with nuts and bearing plates below the second floor at shear walls.
5. Install new concrete shear walls or steel braced frames below the discontinuous second-story concrete walls on the west (Arroyo, Gridline B) and south (Fire Station, Gridline 12) sides of the building. Upgrade existing collectors along the wall to transfer loads to the new shear walls or braced frames.
6. Increase capacity of exterior concrete wall anchorage to the foundations and second floor, both for shear and out-of-plane loads.
7. Strengthen the exterior concrete walls at both stories for out-of-plane loads by adding steel framing attached to the walls or by adding carbon fiber to both wall faces.
8. Install shotcrete or carbon fiber over selected existing exterior concrete walls to increase their in-plane shear capacity, at both stories.

The proposed seismic retrofit work outlined above is depicted conceptually in the sketches included in Appendix 1.

**COST ESTIMATE**

The preliminary construction cost estimates for the retrofit work required to upgrade the building to Risk Category II, III and IV per the current building code, as outlined above, are shown in the table below**.** These amounts are rough-order-of magnitude (ROM) conceptual-level estimates that were developed using historical cost data for buildings of this type and our experience with similar structures. The estimates should be used for preliminary budgeting purposes only (actual retrofit costs may vary substantially from these preliminary estimates).

| | |
|---|---|
| Risk Category II | $5,575,000 |
| Risk Category III | $6,500,000 |
| Risk Category IV | $7,575,000 |

The recommended modifications noted in this report are based on our preliminary structural evaluation, the type and condition of the existing lateral system, engineering judgment, and experience obtained from evaluating and retrofitting similar buildings, and available historical construction cost data. It should be noted that there could be concealed structural deficiencies that are typically not possible to identify in this type of limited preliminary seismic evaluation. These types of unforeseen conditions can increase the actual retrofit construction costs substantially.

The estimates of probable construction cost provided above are intended to serve only as a measure of cost feasibility. The estimated costs are preliminary in nature as they are based on limited analytical work and on historical cost data and may vary significantly depending on the final design, the condition of the structure when exposed during construction, the construction cost and bidding climate, and future code requirements. Therefore, the estimates should be used only for preliminary budgeting purposes and for assessing the relative feasibility of retrofitting the building to the desired Risk Category.

The preliminary estimates include the structural work necessary to seismically retrofit the building. Costs necessary to replace and upgrade architectural finishes and ADA upgrades, as well as mechanical, electrical, plumbing, and data systems are not included. The cost estimates also assume that the building is free of hazardous materials. The estimates also do not include soft costs, such as consultant design fees and permit fees.

Since the above estimates of probable construction cost are preliminary and are based on limited structural information, the actual construction cost as stated above could vary substantially. In order to develop a more realistic construction cost estimate, we recommend that a more complete seismic evaluation, such as ASCE 41 Tier 2, be performed. Such an evaluation would confirm some of the potential deficiencies indicated by the Tier 1 methodology while eliminate others and develop one or more conceptual seismic retrofit schemes to remedy the confirmed deficiencies in the building's lateral system. The work will include performing a detailed evaluation of the existing structural framing, exposing and inspecting selected concealed structural elements and their connections, conducting material testing (if required), performing more detailed analysis, preparing conceptual sketches depicting the nature and extent of retrofit work for each conceptual seismic retrofit scheme, and developing a detailed cost estimate (prepared by a professional cost estimating firm).

After a conceptual seismic retrofit scheme and its anticipated construction costs for strengthening the Municipal Services Building are approved by the City, the project then could move forward to the development of final construction documents. As is the case for nearly all seismic upgrade projects, the construction documents phase of the project would require a multi-disciplinary team of consultants that can address architectural, structural, mechanical, electrical, plumbing and cost estimating aspects of the project.

## RECOMMENDED FURTHER ACTIONS

The findings of our preliminary seismic evaluation based on the ASCE 41-17 Tier 1 procedure indicate that the Municipal Services Building has significant potential seismic deficiencies and is susceptible to substantial damage during a major seismic event. We recommend that the City select one of the following two options for the building.

### Option 1 – Perform Voluntary Seismic Upgrade to Comply with Current Building Code

If the City elects to upgrade the MSB to the current seismic code/standards in order to improve its potential performance during a major seismic event, we recommend the following further steps to implement a voluntary seismic retrofit program for the building. These steps will help define fully the scope of required seismic retrofit work and the associated construction costs:

1. Perform a more detailed ASCE 41 Tier 2 Deficiency-Based Seismic Evaluation of the building, based on the Risk Category selected by the City, to fully define the building's seismic retrofit needs.
2. Using the seismic deficiencies identified and verified via the Tier 2 evaluation, develop at least one conceptual seismic retrofit scheme to remedy those deficiencies.
3. Prepare sketches for the proposed seismic retrofit scheme(s) to indicate the nature and extent of required seismic retrofit work.
4. Prepare a more detailed estimate of the probable construction costs. This estimate should be prepared by a third-party professional cost estimating firm.

The implementation of these actions will help determine the full extent of structural/seismic upgrade required in order for the building to comply with the current building code requirements and its expected construction costs. After approval by the City, the project would then proceed to the final design phase in order to prepare the construction documents.

**Option 2 – Use MSB for Any Permissible Occupancy without Seismic Retrofit**

The as-built structural drawings for the seismic upgrade work performed in 1979 indicate that the entire Municipal Services Building was retrofitted to comply with the Essential Facility requirements of the Uniform Building Code in effect at that time. Given this, it is our opinion that the City may choose to use the MSB for any permissible occupancy type without any requirement to seismically retrofit the overall building per the current building code as long as any structural modifications or non-structural renovations that may be undertaken for the selected building use/occupancy do not exceed the various thresholds in the building code or adopted by the City of South San Francisco Building Department (SSFBD). In the event at least one of these thresholds is exceeded, a mandatory seismic evaluation and retrofit (if required) of the overall building, per the current building code, is triggered.

If the City elects to use the MSB essentially "as is" with only minor structural modifications and/or limited non-structural renovation required for the selected use/occupancy that do not trigger a mandatory seismic evaluation/retrofit of the overall building, we recommend undertaking the following further steps:

1. Confirm with SSFBD that the 1979 seismic retrofit work was indeed permitted to upgrade the building to an Essential Facility and that the work was fully implemented during construction.
2. Consult with SSFBD to determine the thresholds for all applicable triggers (structural modifications, non-structural renovation, etc.) that, if exceeded, would require seismic evaluation and, possibly, retrofit of the overall building per the current building code.
3. Modify/renovate the building per requirements of the selected use/occupancy while ensuring that none of the applicable trigger thresholds is exceeded.

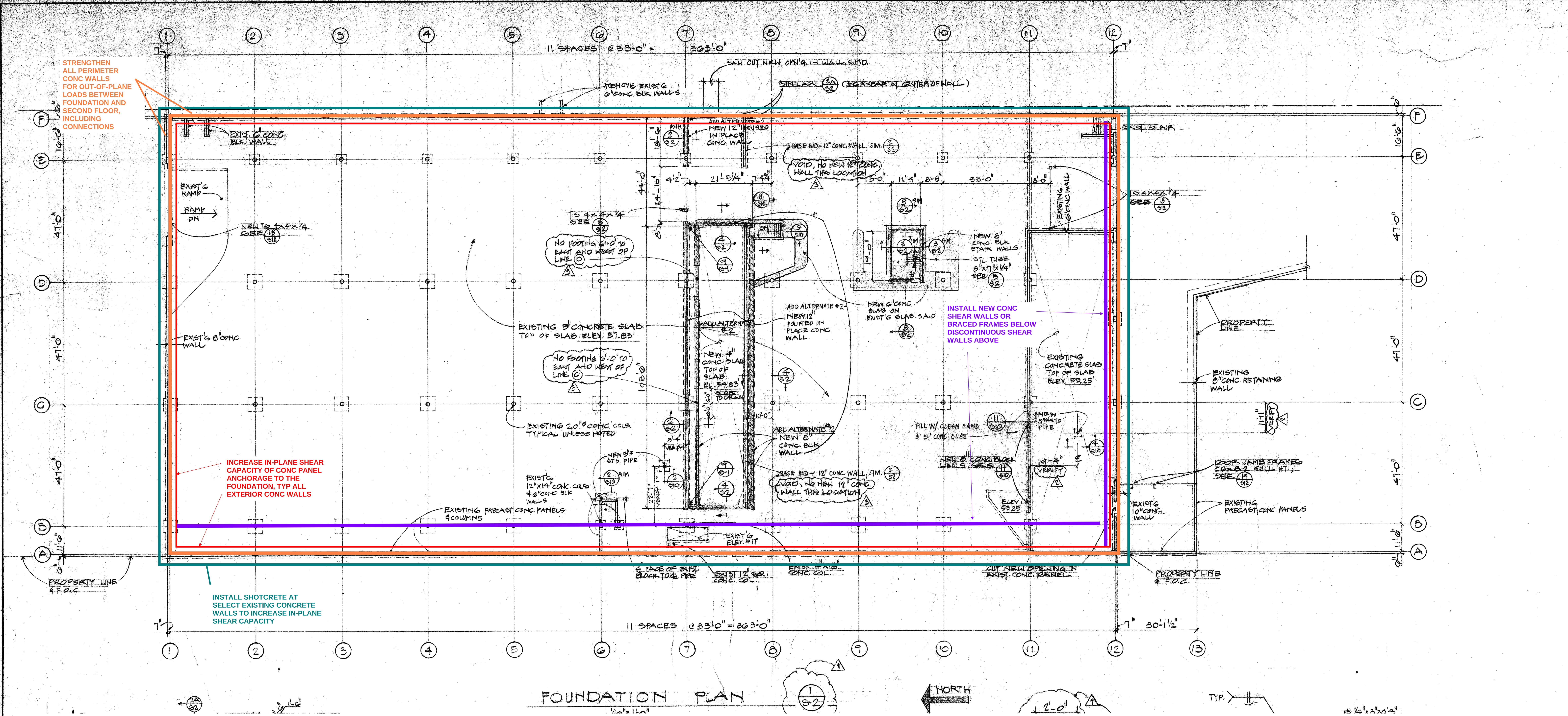
**LIMITATIONS AND DISCLAIMERS**

The evaluation, findings, conclusions and recommendations outlined in this report were based on limited information and preliminary analytical work per requirements of the ASCE 41 Tier 1 methodology. This report has been prepared using the same degree of care and skill ordinarily exercised for this type of professional service by structural engineers practicing in this area at this time. No other warranty, expressed or implied, is made as to the professional advice in this report.

This report has been prepared for exclusive use of the City of South San Francisco and may not be used by any other individual or entity without the express written approval of Biggs Cardosa Associates, Inc.

## Appendix 1

# Conceptual Seismic Retrofit Plans




SOUTH SAN FRANCISCO MUNICIPAL SERVICES BUILDING

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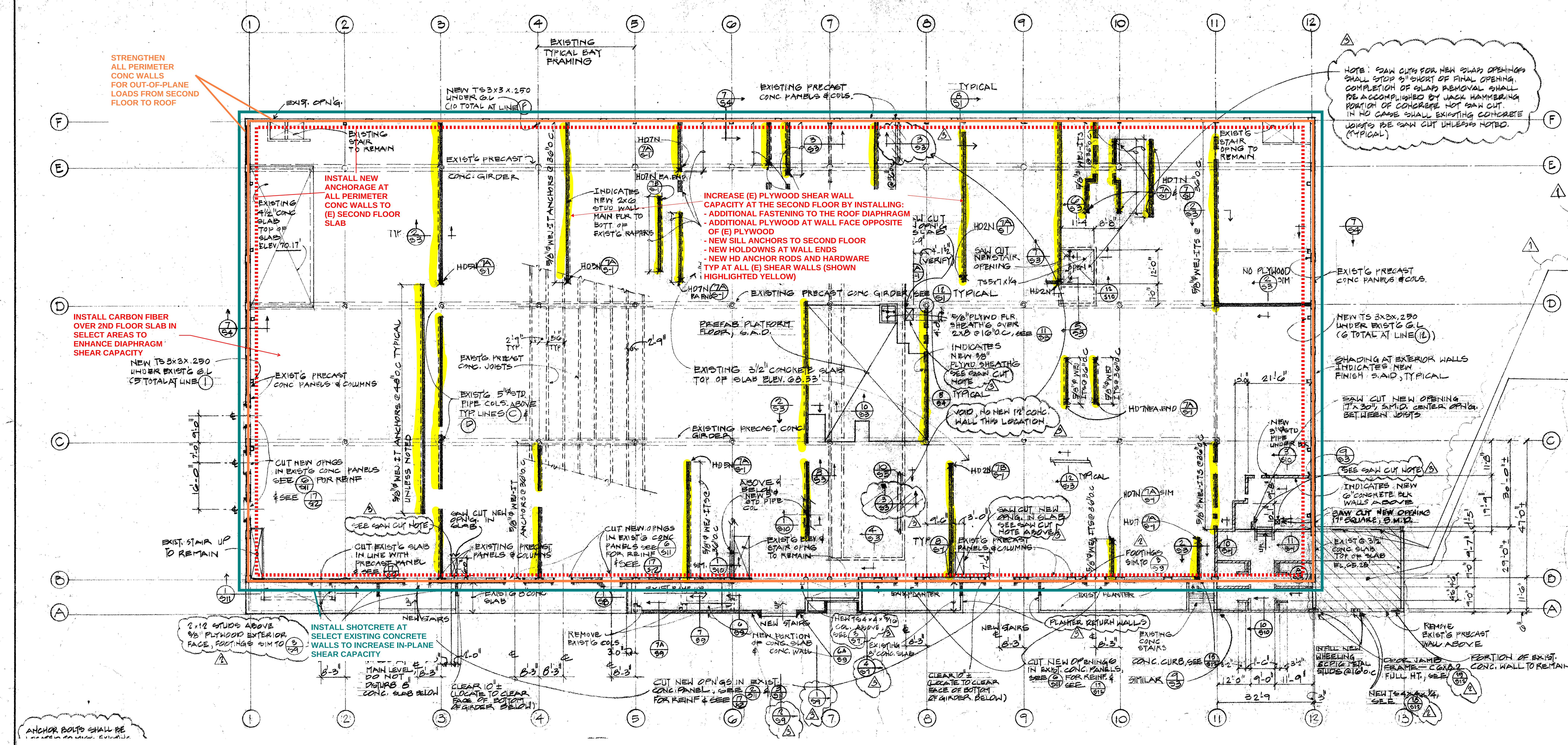
SOUTH SAN FRANCISCO MUNICIPAL SERVICES BUILDING

FOUNDATION PLAN & SECTIONS

| JOB | SHEET | DATE | REV |
|---|---|---|---|
| 78-28 | S2 | 8-20-79 | |

CONCEPTUAL SEISMIC RETROFIT
BIGGS CARDOSA ASSOCIATES, INC.
04-23-2025

REVISED-ADDENDUM 3




SECOND FLOOR FRAMING PLAN

NOTES:

1. WALLS SHOWN SHADED WITH PLYWD SHEATH'G ARE SHEAR WALLS & EXTEND FROM MAIN FLOOR SLAB TO BOTTOM OF EXISTING ROOF RAFTERS
2. LINE UP FACE OF NEW SHEAR WALL WITH FACE OF EXISTING GLULAM BM. SEE PLAN FOR LOCATION
3. CONTRACTOR TO VERIFY LOCATION OF HOLDOWNS WITH RESPECT TO EXISTING PRECAST JOIST & SLAB. PER DTL. 7/S1
4. EXTEND WALL PLYWOOD OVER ALL OPN'GS. AND TO ROOF RAFTERS, SEE 2/S4
5. SEE 1/S4 FOR PLYWOOD SHEAR WALL NAILING

NOTE: SALLY PORT ROOM SHALL BE POSTED WITH TWO PERMANENT SIGNS: "MAXIMUM VEHICLE WEIGHT: 6000 POUNDS".

SIGNS SHALL BE CONSTRUCTED IN ACCORDANCE TO UNIFORM SIGN CODE AND BE APPROVED BY THE ENGINEER

2" STRUCTURAL TOPPING CONSTRUCTION SEQUENCE:

1.) LIGHTLY SANDBLAST EXISTING CONCRETE SURFACE.
2.) PLACE CONCRESIVE 1001-LPL IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. CONCRESIVE 1001-LPL IS MANUFACTURED BY ADHESIVE ENGINEERING COMPANY, SAN CARLOS, CALIF. THE CONTRACTOR SHALL PAY CLOSE ATTENTION TO THE "OPEN TIME" DESCRIBED IN THE MANUFACTURER'S INSTRUCTIONS.
3.) PLACE W.W.F. 6x6 W1.4xW1.4 AT CENTER OF TOPPING AND #3 @ 18" O.C. x 3'-0" CENTERED OVER EXISTING JOISTS.
4.) PLACE 2" CONCRETE TOPPING:
   a.) CONCRETE STRENGTH f'c = 4000 P.S.I. AT 28 DAYS
   b.) MAX. SIZE AGGREGATE SHALL BE ¾"
   c.) SLUMP SHALL BE 3" MAX.
5.) PLACING OF EPOXY AND CONCRETE SHALL BE COMPLETED WITHIN THE ABOVE-MENTIONED "OPEN TIME".

CONCEPTUAL SEISMIC RETROFIT
BIGGS CARDOSA ASSOCIATES, INC.
04-23-2025

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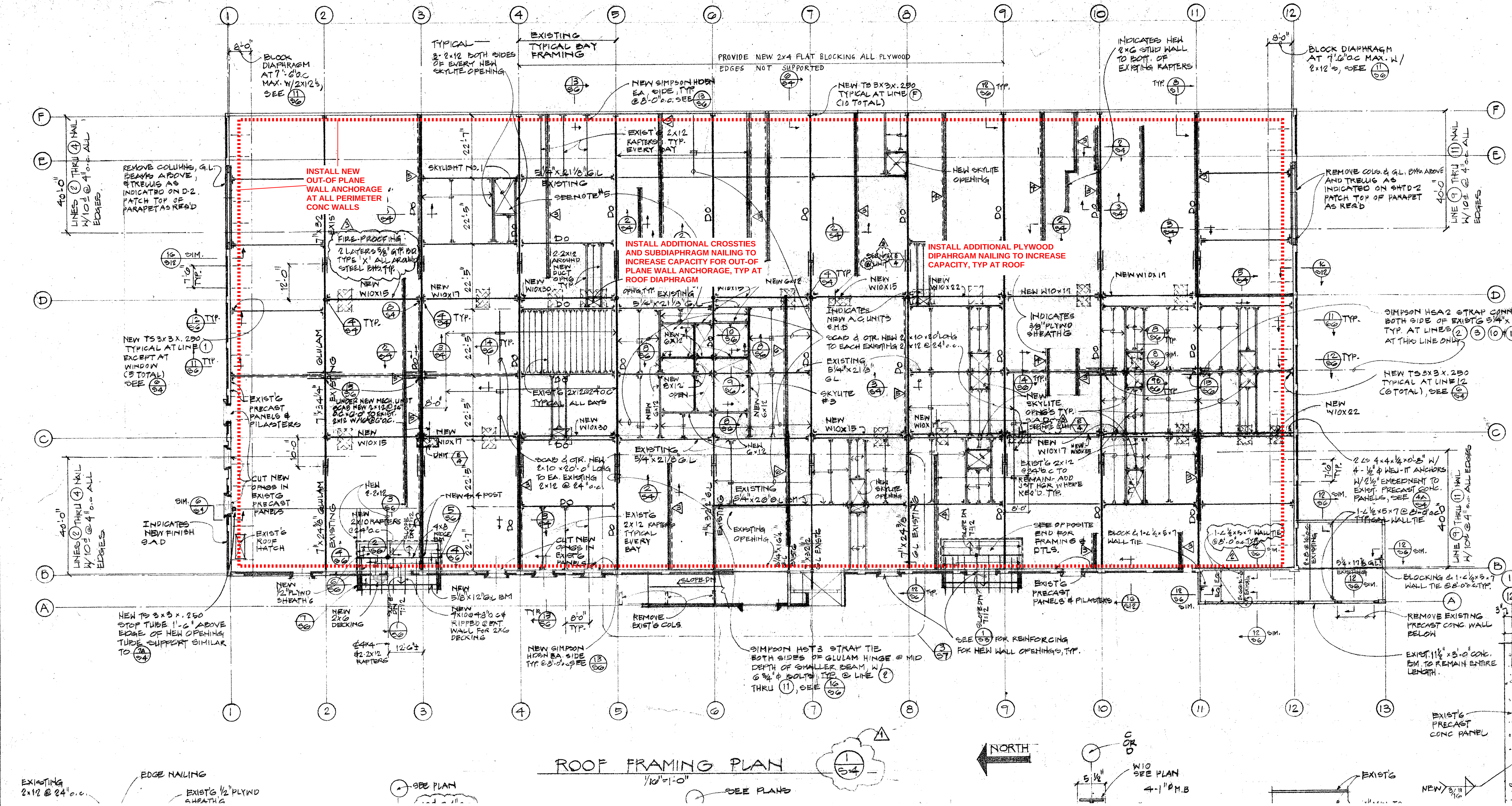
SOUTH SAN FRANCISCO MUNICIPAL SERVICES BUILDING

SOUTH SAN FRANCISCO MUNICIPAL SERVICES BUILDING

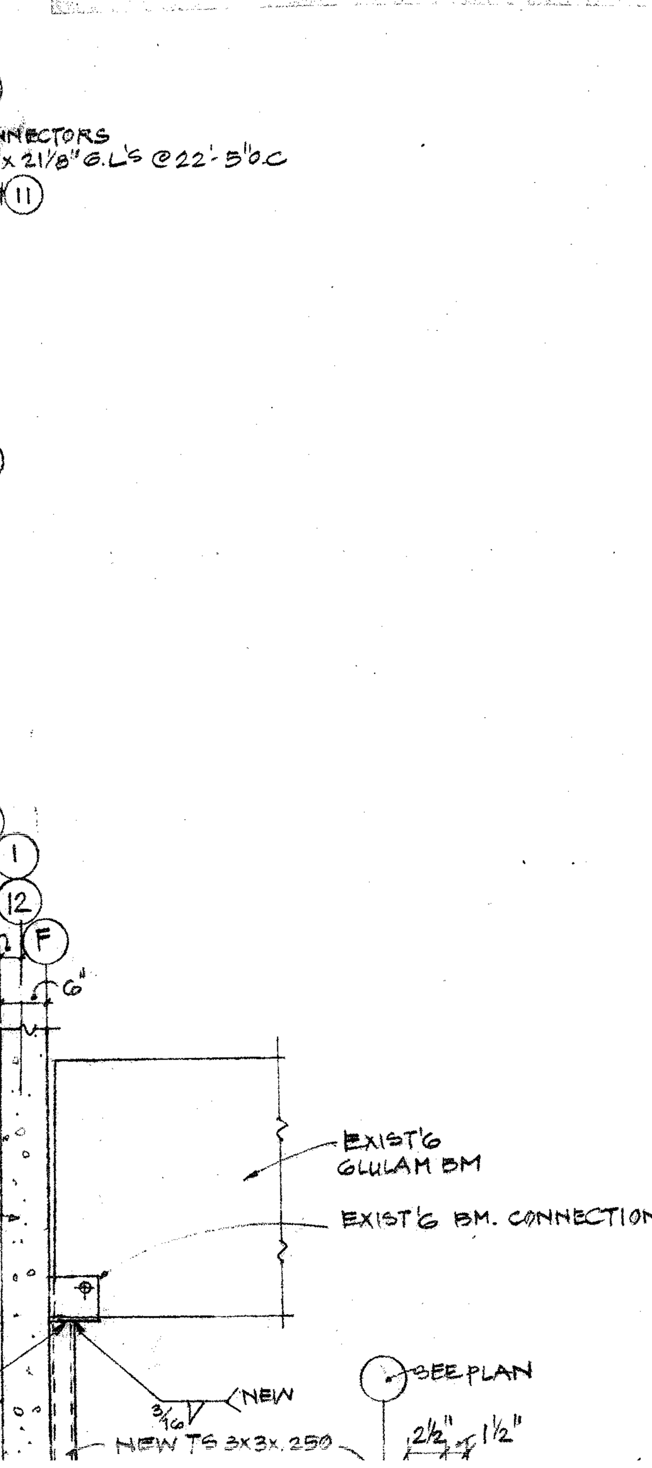
MAIN FLOOR FRAMING PLAN & SECTIONS

| JOB | SHEET | DATE | REV |
|---|---|---|---|
| 78-28 | S-3 | 8-30-79 | 1 10-24-79; 2 10-10-79; 3 1-21-80 |




NOTES:

1. Remove existing roofing and add additional roof plywoodnailing so the existing nailing and the additional nailing provides nailing as shown on the roof plans.
2. The Engineer shall determine which of the existing roof plywood shall be replaced; upon completion of the removal of the existing roofing. It is estimated that approximately ten - 4x8 sheets of 1/2" plywood D.F. Structural I will be required to replace the existing damaged plywood. The replacement of existing plywood as full sheets or portions of full sheets shall be determined by the Engineer.
3. The new roofing shall weigh no more than 190 pounds per square. All future re-roofings shall require removing the existing roofing before re-roofing with an acceptable roofing weighing no more than 190 pounds per square.
4. All the existing gypsum board ceiling at the soffit of the existing roof rafters shall be removed. A new suspended ceiling shall be installed where and as noted on the plans. A new suspended ceiling shall weigh no more than 60 pounds per square.
5. If Add Alternate 1 (See sheet A-4) is not accepted the Contractor shall frame skylight openings No.1 & No.3 in the East-West direction with 2x10 @ 16" o.c. with Simpson LU210 joist hangers between framing shown. Framing shall be covered with 1/2" plywood and roofing as specified for the remainder of the roof. Nailing shall be as specified.



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ROOF FRAMING PLAN & SECTIONS

| JOB | SHEET | DATE |
|---|---|---|
| 78-28 | S-4 | 8-30-79 |

CONCEPTUAL SEISMIC RETROFIT
BIGGS CARDOSA ASSOCIATES, INC.
04-23-2025

# Appendix 2

# ASCE 41 Tier 1 Checklists

**Table 17-1. Very Low Seismicity Checklist**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Structural Components** | | | |
| C NC N/A U | LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. | 5.4.1.1 | A.2.1.1 |
| C NC N/A U | WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. | 5.7.1.1 | A.5.1.1 |

*Note:* C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

**Table 17-2. Collapse Prevention Basic Configuration Checklist**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Low Seismicity** | | | |
| **Building System—General** | | | |
| C NC N/A U | LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. | 5.4.1.1 | A.2.1.1 |
| C NC N/A U | ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity. | 5.4.1.2 | A.2.1.2 |
| C NC N/A U | MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. | 5.4.1.3 | A.2.1.3 |
| **Building System—Building Configuration** | | | |
| C NC N/A U | 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. | 5.4.2.1 | A.2.2.2 |
| C NC N/A U | 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. | 5.4.2.2 | A.2.2.3 |
| C NC N/A U | VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. | 5.4.2.3 | A.2.2.4 |
| C NC N/A U | 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. | 5.4.2.4 | A.2.2.5 |
| C NC N/A U | MASS: There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. | 5.4.2.5 | A.2.2.6 |
| C NC N/A U | 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. | 5.4.2.6 | A.2.2.7 |

*continues*

**Table 17-2 *(Continued)*. Collapse Prevention Basic Configuration Checklist**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Moderate Seismicity (Complete the Following Items in Addition to the Items for Low Seismicity)** | | | |
| **Geologic Site Hazards** | | | |
| C NC N/A U | LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building. | 5.4.3.1 | A.6.1.1 |
| C NC N/A U | SLOPE FAILURE: The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. | 5.4.3.1 | A.6.1.2 |
| C NC N/A U | SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. | 5.4.3.1 | A.6.1.3 |
| **High Seismicity (Complete the Following Items in Addition to the Items for Moderate Seismicity)** | | | |
| **Foundation Configuration** | | | |
| C NC N/A U | 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 $0.6S_a$. | 5.4.3.3 | A.6.2.1 |
| C NC N/A U | 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. | 5.4.3.4 | A.6.2.2 |

*Note:* C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

**Table 17-3. Immediate Occupancy Basic Configuration Checklist**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Very Low Seismicity** | | | |
| **Building System—General** | | | |
| C NC N/A U | LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. | 5.4.1.1 | A.2.1.1 |
| C NC N/A U | ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 0.5% of the height of the shorter building in low seismicity, 1.0% in moderate seismicity, and 3.0% in high seismicity. | 5.4.1.2 | A.2.1.2 |
| C NC N/A U | MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. | 5.4.1.3 | A.2.1.3 |
| **Building System—Building Configuration** | | | |
| C NC N/A U | 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. | 5.4.2.1 | A.2.2.2 |
| C NC N/A U | 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. | 5.4.2.2 | A.2.2.3 |
| C NC N/A U | VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. | 5.4.2.3 | A.2.2.4 |
| C NC N/A U | 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. | 5.4.2.4 | A.2.2.5 |
| C NC N/A U | MASS: There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. | 5.4.2.5 | A.2.2.6 |

*continues*

Table 17-3 *(Continued)*. Immediate Occupancy Basic Configuration Checklist

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| C NC N/A U | 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. | 5.4.2.6 | A.2.2.7 |
| **Low Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)** | | | |
| **Geologic Site Hazards** | | | |
| C NC N/A U | LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building. | 5.4.3.1 | A.6.1.1 |
| C NC N/A U | SLOPE FAILURE: The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. | 5.4.3.1 | A.6.1.2 |
| C NC N/A U | SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. | 5.4.3.1 | A.6.1.3 |
| **Moderate and High Seismicity (Complete the Following Items in Addition to the Items for Low Seismicity)** | | | |
| **Foundation Configuration** | | | |
| C NC N/A U | 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 $0.6S_a$. | 5.4.3.3 | A.6.2.1 |
| C NC N/A U | 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. | 5.4.3.4 | A.6.2.2 |

*Note:* C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Table 17-4. Collapse Prevention Structural Checklist for Building Types W1 and W1a

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Low and Moderate Seismicity** | | | |
| **Seismic-Force-Resisting System** | | | |
| C NC N/A U | REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. | 5.5.1.1 | A.3.2.1.1 |
| C NC N/A U | SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the following values:<br>Structural panel sheathing — 1,000 lb/ft (14.6 kN/m)<br>Diagonal sheathing — 700 lb/ft (10.2 kN/m)<br>Straight sheathing — 100 lb/ft (1.5 kN/m)<br>All other conditions — 100 lb/ft (1.5 kN/m) | 5.5.3.1.1 | A.3.2.7.1 |
| C NC N/A U | STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. | 5.5.3.6.1 | A.3.2.7.2 |
| C NC N/A U | GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard is not used for shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. | 5.5.3.6.1 | A.3.2.7.3 |
| C NC N/A U | NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. | 5.5.3.6.1 | A.3.2.7.4 |
| C NC N/A U | WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. | 5.5.3.6.2 | A.3.2.7.5 |
| C NC N/A U | 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. | 5.5.3.6.3 | A.3.2.7.6 |

*continues*

**Table 17-24. Collapse Prevention Structural Checklist for Building Types C2 and C2a**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Low and Moderate Seismicity** | | | |
| **Seismic-Force-Resisting System** | | | |
| C NC N/A U | COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. | 5.5.2.5.1 | A.3.1.6.1 |
| C NC N/A U | REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. | 5.5.1.1 | A.3.2.1.1 |
| C NC N/A U | SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.$^2$ (0.69 MPa) or $2\sqrt{f'_c}$. | 5.5.3.1.1 | A.3.2.2.1 |
| C NC N/A U | 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. | 5.5.3.1.3 | A.3.2.2.2 |
| **Connections** | | | |
| C NC N/A U | 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 strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. | 5.7.1.1 | A.5.1.1 |
| C NC N/A U | TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. | 5.7.2 | A.5.2.1 |
| C NC N/A U | FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing directly above the foundation. | 5.7.3.4 | A.5.3.5 |
| **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 | DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. | 5.5.2.5.2 | A.3.1.6.2 |
| 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. | 5.5.2.5.3 | A.3.1.6.3 |
| C NC N/A U | COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. | 5.5.3.2.1 | A.3.2.2.3 |
| **Diaphragms (Stiff or Flexible)** | | | |
| C NC N/A U | DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. | 5.6.1.1 | A.4.1.1 |
| C NC N/A U | OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. | 5.6.1.3 | A.4.1.4 |
| **Flexible Diaphragms** | | | |
| C NC N/A U | CROSS TIES: There are continuous cross ties between diaphragm chords. | 5.6.1.2 | A.4.1.2 |
| C NC N/A U | STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. | 5.6.2 | A.4.2.1 |
| C NC N/A U | SPANS: All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. | 5.6.2 | A.4.2.2 |
| C NC N/A U | DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4-to-1. | 5.6.2 | A.4.2.3 |
| C NC N/A U | OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. | 5.6.5 | A.4.7.1 |
| **Connections** | | | |
| C NC N/A U | UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. | 5.7.3.5 | A.5.3.8 |

*Note:* C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

**Table 17-25. Immediate Occupancy Structural Checklist for Building Types C2 and C2a**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Very Low Seismicity** | | | |
| **Seismic-Force-Resisting System** | | | |
| C NC N/A U | COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. | 5.5.2.5.1 | A.3.1.6.1 |
| C NC N/A U | REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. | 5.5.1.1 | A.3.2.1.1 |
| C NC N/A U | SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.$^2$ (0.69 MPa) or $2\sqrt{f'_c}$. | 5.5.3.1.1 | A.3.2.2.1 |
| C NC N/A U | 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. The spacing of reinforcing steel is equal to or less than 18 in. (457 mm). | 5.5.3.1.3 | A.3.2.2.2 |
| **Connections** | | | |
| C NC N/A U | 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 strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. | 5.7.1.1 | A.5.1.1 |
| C NC N/A U | TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms. | 5.7.2 | A.5.2.1 |
| C NC N/A U | FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation. | 5.7.3.4 | A.5.3.5 |
| **Foundation System** | | | |
| C NC N/A U | DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil. | | A.6.2.3 |
| C NC N/A U | SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story. | | A.6.2.4 |
| **Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)** | | | |
| **Seismic-Force-Resisting System** | | | |
| C NC N/A U | DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items in Table 17-23: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOKS. | 5.5.2.5.2 | A.3.1.6.2 |
| C NC N/A U | FLAT SLABS: Flat slabs or plates not part of seismic-force-resisting system have continuous bottom steel through the column joints. | 5.5.2.5.3 | A.3.1.6.3 |
| C NC N/A U | COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall. | 5.5.3.2.1 | A.3.2.2.3 |
| C NC N/A U | OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered. | 5.5.3.1.4 | A.3.2.2.4 |
| C NC N/A U | CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$. | 5.5.3.2.2 | A.3.2.2.5 |
| C NC N/A U | WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall. | 5.5.3.1.5 | A.3.2.2.6 |
| C NC N/A U | WALL THICKNESS: Thicknesses of bearing walls are not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 in. (101 mm). | 5.5.3.1.2 | A.3.2.2.7 |

*continues*

**Table 17-25 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types C2 and C2a**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Diaphragms (Stiff or Flexible)** | | | |
| C NC N/A U | DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. | 5.6.1.1 | A.4.1.1 |
| C NC N/A U | OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length. | 5.6.1.3 | A.4.1.4 |
| C NC N/A U | PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities. | 5.6.1.4 | A.4.1.7 |
| C NC N/A U | DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. | 5.6.1.5 | A.4.1.8 |
| **Flexible Diaphragms** | | | |
| C NC N/A U | CROSS TIES: There are continuous cross ties between diaphragm chords. | 5.6.1.2 | A.4.1.2 |
| C NC N/A U | STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered. | 5.6.2 | A.4.2.1 |
| C NC N/A U | SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing. | 5.6.2 | A.4.2.2 |
| C NC N/A U | DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1. | 5.6.2 | A.4.2.3 |
| C NC N/A U | NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1. | 5.6.3 | A.4.3.1 |
| C NC N/A U | OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. | 5.6.5 | A.4.7.1 |
| **Connections** | | | |
| C NC N/A U | UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles. | 5.7.3.5 | A.5.3.8 |

*Note:* C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

categorized as Noncompliant or Unknown. For evaluation statements classified as Noncompliant or Unknown, the design professional is permitted to choose to conduct further investigation using the corresponding Tier 2 evaluation procedure listed next to each evaluation statement.

## 17.13 STRUCTURAL CHECKLISTS FOR BUILDING TYPES C3: CONCRETE FRAMES WITH INFILL MASONRY SHEAR WALLS AND C3A: CONCRETE FRAMES WITH INFILL MASONRY SHEAR WALLS AND FLEXIBLE DIAPHRAGMS

For building systems and configurations that comply with the C3 or C3a building type description in Table 3-1, the Collapse Prevention Structural Checklist in Table 17-26 shall be completed where required by Table 4-6 for Collapse Prevention Structural Performance, and the Immediate Occupancy Structural Checklist in Table 17-27 shall be completed where required by Table 4-6 for Immediate Occupancy Structural Performance. Tier 1 screening shall include on-site investigation and condition assessment as required by Section 4.2.1.

Where applicable, each of the evaluation statements listed in this checklist shall be marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U) for a Tier 1 screening. Items that are deemed acceptable to the design professional in accordance with the evaluation statement shall be categorized as Compliant, whereas items that are determined by the design professional to require further investigation shall be categorized as Noncompliant or Unknown. For evaluation statements classified as Noncompliant or Unknown, the design professional is permitted to choose to conduct further investigation using the corresponding Tier 2 evaluation procedure listed next to each evaluation statement.

## 17.14 STRUCTURAL CHECKLISTS FOR BUILDING TYPES PC1: PRECAST OR TILT-UP CONCRETE SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS AND PC1A: PRECAST OR TILT-UP CONCRETE SHEAR WALLS WITH STIFF DIAPHRAGMS

For building systems and configurations that comply with the PC1 or PC1a building type description in Table 3-1, the Collapse Prevention Structural Checklist in Table 17-28 shall be completed where required by Table 4-6 for Collapse Prevention Structural Performance, and the Immediate Occupancy Structural Checklist in Table 17-29 shall be completed where required by Table 4-6 for Immediate Occupancy Structural Performance. Tier 1 screening shall include on-site investigation and condition assessment as required by Section 4.2.1.

**Table 17-6. Collapse Prevention Structural Checklist for Building Type W2**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Low and Moderate Seismicity** | | | |
| **Seismic-Force-Resisting System** | | | |
| **C NC N/A U** | REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. | 5.5.1.1 | A.3.2.1.1 |
| **C NC N/A U** | SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the following values:<br>Structural panel sheathing 1,000 lb/ft<br>Diagonal sheathing 700 lb/ft<br>Straight sheathing 100 lb/ft<br>All other conditions 100 lb/ft | 5.5.3.1.1 | A.3.2.7.1 |
| **C NC N/A U** | STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. | 5.5.3.6.1 | A.3.2.7.2 |
| **C NC N/A U** | GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard is not used for shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. | 5.5.3.6.1 | A.3.2.7.3 |
| **C NC N/A U** | NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. | 5.5.3.6.1 | A.3.2.7.4 |
| **C NC N/A U** | WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. | 5.5.3.6.2 | A.3.2.7.5 |
| **C NC N/A U** | 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. | 5.5.3.6.3 | A.3.2.7.6 |
| **C NC N/A U** | CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. | 5.5.3.6.4 | A.3.2.7.7 |
| **C NC N/A U** | 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. | 5.5.3.6.5 | A.3.2.7.8 |
| **Connections** | | | |
| **C NC N/A U** | WOOD POSTS: There is a positive connection of wood posts to the foundation. | 5.7.3.3 | A.5.3.3 |
| **C NC N/A U** | WOOD SILLS: All wood sills are bolted to the foundation. | 5.7.3.3 | A.5.3.4 |
| **C NC N/A U** | GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. | 5.7.4.1 | A.5.4.1 |
| **High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)** | | | |
| **Connections** | | | |
| **C NC N/A U** | WOOD SILL BOLTS: Sill bolts are spaced at 6 ft (1.8 m) or less with acceptable edge and end distance provided for wood and concrete. | 5.7.3.3 | A.5.3.7 |
| **Diaphragms** | | | |
| **C NC N/A U** | DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. | 5.6.1.1 | A.4.1.1 |
| **C NC N/A U** | ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. | 5.6.1.1 | A.4.1.3 |
| **C NC N/A U** | DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. | 5.6.1.5 | A.4.1.8 |
| **C NC N/A U** | STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. | 5.6.2 | A.4.2.1 |
| **C NC N/A U** | SPANS: All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. | 5.6.2 | A.4.2.2 |

*continues*

**Table 17-6 *(Continued)*. Collapse Prevention Structural Checklist for Building Type W2**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| C NC N/A U | DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and have aspect ratios less than or equal to 4-to-1. | 5.6.2 | A.4.2.3 |
| C NC N/A U | OTHER DIAPHRAGMS: The diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. | 5.6.5 | A.4.7.1 |

*Note:* C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

**Table 17-7. Immediate Occupancy Checklist for Building Type W2**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Very Low Seismicity** | | | |
| **Seismic-Force-Resisting System** | | | |
| C NC N/A U | REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. | 5.5.1.1 | A.3.2.1.1 |
| C NC N/A U | SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the following values:<br>Structural panel sheathing 1,000 lb/ft (14.6 kN/m)<br>Diagonal sheathing 700 lb/ft (10.2 kN/m)<br>Straight sheathing 100 lb/ft (1.5 kN/m)<br>All other conditions 100 lb/ft (1.5 kN/m) | 5.5.3.1.1 | A.3.2.7.1 |
| C NC N/A U | STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. | 5.5.3.6.1 | A.3.2.7.2 |
| C NC N/A U | GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard is not used for shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. | 5.5.3.6.1 | A.3.2.7.3 |
| C NC N/A U | NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. | 5.5.3.6.1 | A.3.2.7.4 |
| C NC N/A U | WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. | 5.5.3.6.2 | A.3.2.7.5 |
| C NC N/A U | 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-2. | 5.5.3.6.3 | A.3.2.7.6 |
| C NC N/A U | CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. | 5.5.3.6.4 | A.3.2.7.7 |
| C NC N/A U | 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. | 5.5.3.6.5 | A.3.2.7.8 |
| C NC N/A U | HOLD-DOWN ANCHORS: All shear walls have hold-down anchors attached to the end studs constructed in accordance with acceptable construction practices. | 5.5.3.6.6 | A.3.2.7.9 |
| **Connections** | | | |
| C NC N/A U | WOOD POSTS: There is a positive connection of wood posts to the foundation. | 5.7.3.3 | A.5.3.3 |
| C NC N/A U | WOOD SILLS: All wood sills are bolted to the foundation. | 5.7.3.3 | A.5.3.4 |
| C NC N/A U | GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. | 5.7.4.1 | A.5.4.1 |

*continues*

**Table 17-7 *(Continued)*. Immediate Occupancy Checklist for Building Type W2**

| Status | Evaluation Statement | Tier 2 Reference | Commentary Reference |
|---|---|---|---|
| **Foundation System** | | | |
| C NC N/A U | DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil. | | A.6.2.3 |
| C NC N/A U | SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story high. | | A.6.2.4 |
| **Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)** | | | |
| **Seismic-Force-Resisting System** | | | |
| C NC N/A U | NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 1.5-to-1 are not used to resist seismic forces. | 5.5.3.6.1 | A.3.2.7.4 |
| **Diaphragms** | | | |
| C NC N/A U | DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. | 5.6.1.1 | A.4.1.1 |
| C NC N/A U | ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. | 5.6.1.1 | A.4.1.3 |
| C NC N/A U | DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. | 5.6.1.5 | A.4.1.8 |
| C NC N/A U | STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered. | 5.6.2 | A.4.2.1 |
| C NC N/A U | SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing. | 5.6.2 | A.4.2.2 |
| C NC N/A U | DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and have aspect ratios less than or equal to 3-to-1. | 5.6.2 | A.4.2.3 |
| C NC N/A U | OTHER DIAPHRAGMS: The diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. | 5.6.5 | A.4.7.1 |
| **Connections** | | | |
| C NC N/A U | WOOD SILL BOLTS: Sill bolts are spaced at 4 ft or less with acceptable edge and end distance provided for wood and concrete. | 5.7.3.3 | A.5.3.7 |

*Note:* C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

professional to require further investigation shall be categorized as Noncompliant or Unknown. For evaluation statements classified as Noncompliant or Unknown, the design professional is permitted to choose to conduct further investigation using the corresponding Tier 2 evaluation procedure listed next to each evaluation statement.

## 17.4 STRUCTURAL CHECKLISTS FOR BUILDING TYPES S1: STEEL MOMENT FRAMES WITH STIFF DIAPHRAGMS AND S1A: STEEL MOMENT FRAMES WITH FLEXIBLE DIAPHRAGMS

For building systems and configurations that comply with the S1 or S1a building type description in Table 3-1, the Collapse Prevention Structural Checklist in Table 17-8 shall be completed where required by Table 4-6 for Collapse Prevention Structural Performance, and the Immediate Occupancy Structural Checklist in Table 17-9 shall be completed where required by Table 4-6 for Immediate Occupancy Structural Performance. Tier 1 screening shall include on-site investigation and condition assessment as required by Section 4.2.1.

Where applicable, each of the evaluation statements listed in this checklist shall be marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U) for a Tier 1 screening. Items that are deemed acceptable to the design professional in accordance with the evaluation statement shall be categorized as Compliant, whereas items that are determined by the design professional to require further investigation shall be categorized as Noncompliant or Unknown. For evaluation statements classified as Noncompliant or Unknown, the design professional is permitted to choose to conduct further investigation using the corresponding Tier 2 evaluation procedure listed next to each evaluation statement.

## 17.5 STRUCTURAL CHECKLIST FOR BUILDING TYPES S2: STEEL BRACED FRAMES WITH STIFF DIAPHRAGMS AND S2A: STEEL BRACED FRAMES WITH FLEXIBLE DIAPHRAGMS

For building systems and configurations that comply with the S2 or S2a building type description in Table 3-1, the Collapse Prevention Structural Checklist in Table 17-10 shall be completed where required by Table 4-6 for Collapse Prevention Structural Performance, and the Immediate Occupancy Structural Checklist in Table 17-11 shall be completed where required by Table 4-6 for Immediate Occupancy Structural Performance.