Rating form completed by:

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Date: 06/25/19

Text in green is to be part of UCSF building database and may be part of UCOP database.

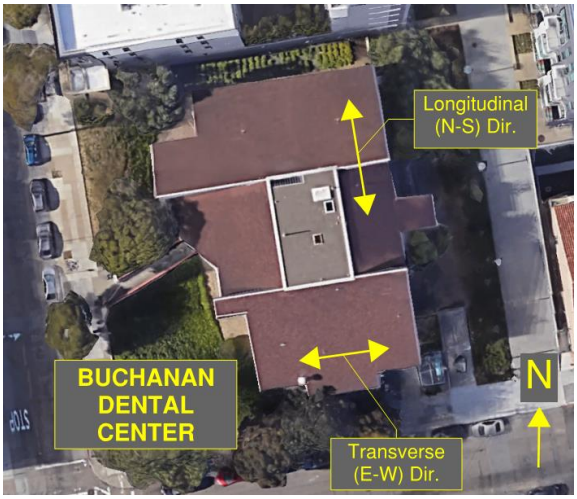
DATE: 2019-06-25

UCSF building seismic ratings

Buchanan Dental Center

CAAN #3010
100 Buchanan, San Francisco, CA 94102
UCSF Campus: Outlying Area

Plan



West elevation (looking northeast)

Rating summary	Entry	Notes
UC Seismic Performance Level (rating)	IV	Findings based on drawing review, site visit, and ASCE 41-17 Tier 1 evaluation[1]
Rating basis	Tier 1	ASCE 41-17
Date of rating	2019	
Recommended UCSF priority category for retrofit	None	Priority A=Retrofit ASAP Priority B=Retrofit at next permit application for modification
Ballpark total project cost to retrofit to IV rating	N/A	See recommendations on further evaluation and retrofit.
Is 2018-2019 rating required by UCOP?	Yes	Does not have a documented previous review
Further evaluation recommended?	No	Tier 2 deficiency-based check of the shear walls

[1] The evaluations at UCSF translate the Tier 1 evaluation to a Seismic Performance Level rating using professional judgment discussed among the Seismic Review Committee. Non-compliant items in the Tier 1 evaluation do not automatically put a building into a particular rating category, but such items are evaluated along with the combination of building features and potential deficiencies, focused on the potential for collapse or serious damage to the gravity supporting structure that may threaten occupant safety.

Building information used in this evaluation

- Architectural drawings by Bell-Grimes Architects A Joint Venture, "Community Dental Clinic San Francisco Extension Center University of California, San Francisco, California," as-builts dated 15 October 1979, Sheets A1.1 to A1.5, A2.1 to A2.3, A3.1 to A3.3, A4,1 to A4.7, A5.1, A6.1, A7.1, A8.1 to A8.3, A9.1 to A9.5.
- Structural drawings by Leong-Razzano & Associates, Inc. Consulting Civil and Structural Engineers, "Community Dental Clinic San Francisco Extension Center University of California, San Francisco, California," as-builts dated 15 October 1979, Sheets S0.1, S1.1, S2.1, S2.2, S3.1 to S3.9.
- Architectural drawings by Wolf & Bergen Architects, "Buchanan Dental Clinic Room 230 Sterilization Systems Upgrade," dated 17 August 2012, Sheets A-1 to A-9.
- Structural drawings by Maryann Phipps, "Buchanan Dental Clinic Room 230 Sterilization Systems Upgrade," dated 17 August 2012, Sheets S-1 to S-6.

Additional building information known to exist

- Geotechnical report by Woodward-Clyde Consultants, "Geotechnical Investigation for the Proposed Community Dental Clinic University of California Extension Center San Francisco California," dated 27 October 1975.

Scope for completing this form

The structural drawings for the original 1978 construction and the 2012 renovation were reviewed, and these drawings were used as the basis for the completed ASCE 41-17 Tier 1 evaluation. A site visit was made on 14 June 2019 where the building exterior and portions of the interior were observed.

Brief description of structure

The Buchanan Dental Center is located at the corner of Buchanan Street and Hermann Street in San Francisco, California. The building functions as a training facility for UCSF students and as a dental clinic for the community. On a daily basis, it is occupied by approximately 20 staff members, 28 UCSF students, and between 20 to 24 patients. The Buchanan Dental Center is a two-story wood framed structure that was designed by Leong-Razzano & Associates in 1978, and construction was completed in 1979. It is approximately 20,000 square feet and has outer dimensions measuring 120'-0" in the north-south direction by 101'-0" in the east-west direction. It is framed with a trapezoid shaped roof that contains a flat portion in the building center and slopes downwards to the exterior walls. A small mechanical room is located in the tall story below the flat portion of the roof. A pedestrian bridge is located on the west elevation and connects the main entry at the second floor to the Buchanan Street sidewalk.

In 2011, small portions of the interior were renovated. The structural work at that time was limited to the anchorage of major pieces of equipment.

Identification of levels: The building levels are designated as the first floor (EL. 137.0 ft), second floor (EL. 151.5 ft), mechanical room floor (EL. 163.5 ft), and the roof (EL. 175.5 ft at the high point and 154.33 ft at the low point). The site slopes from a high point located on the west elevation to a low point located at the east elevation. Although the surrounding grade slopes, the building pad is flat and is located at the first floor.

Foundation system: The Buchanan Dental Center contains a 4" thick reinforced concrete slab-on-grade poured over a 2" thick layer of sand, a waterproofing membrane, and a 4" thick layer of pea gravel. The slab is reinforced with #3 bars spaced at 18" o.c. in each direction. Continuous reinforced concrete strip footings are poured below the wood stud walls. They are 1'-6" wide and vary in depth from 3'-0" to 4'-0" below the top of slab. They are reinforced with 1-#6 continuous horizontal bars at the top and bottom and #4 bars spaced at 18" o.c in between. The vertical reinforcing consists of #4 bars spaced at 18" o.c.

Structural system for vertical (gravity) load: The roof is sheathed with ½" thick plywood that is supported by 2 x 14 and 2 x 16 joints spaced at 12" and 16" o.c. They span to a combination of wood stud walls and glulam girders. The glulams are 5 1/8 x 27, 5 1/8 x 30, 6 ¾ x 21, and 6 ¾ x 27. The walls contain 2 x 6 studs spaced at 16" o.c. The second floor framing is similar to the roof, except it contains a 1 ½" lightweight concrete topping slab over ¾" plywood. The mechanical room floor contains a 2.5" thick lightweight concrete topping slab over ¾" plywood. Along the exterior walls, 3"x 3"x ¼" tube steel columns are used between window openings. Finally, the pedestrian bridge is framed with 3 ½" concrete fill over W3 metal deck that spans between the bottom flange of two upturned W36x135 girders.

Structural system for lateral forces: The lateral force-resisting system is comprised of plywood sheathed shear walls on the exterior and interior of the building. They are framed with ½" thick plywood nailed to 2 x 6 wood stud walls. In select locations, plywood is located on both sides of the wood studs. The capacity of these walls is doubled when calculating the wall length for the Tier 1 shear stress check. The nailing along panel edges consists of 10d nails spaced at 4" o.c., and the field nailing consists of 10d nails spaced at 12" o.c. The walls are bolted to the foundation strip footings using 5/8" and ¾" diameter bolts spaced at 16", 24", and 32" o.c. The ends of the walls are framed with 6 x 6 posts and tie down anchors. The tie down consists of 2-3/4" diameter bolts oriented horizontally through the 6 x 6 posts. They are connected to an 8" x 4" x ¾" steel angle which is joined with a ¾" diameter by 3''-6" long anchor bolt that is cast into the concrete foundation. A number of the interior stud walls are discontinuous and do not align with stud walls below. They are connected to 6 x 10 blocking or glulams at the second floor. In addition, the exterior walls located on the south and east elevation step inwards in the lower story.

The roof sheathing is blocked using 2 x 3 flat blocking at a minimum. The floor framing appears well-tied together with continuous chords that are comprised of joists and top plates spliced using nailed steel plates.

The Buchanan Street Dental Center contains a pedestrian bridge on its west elevation. The bridge is tied to the structure at its west end and has a slotted connection at its east end which allows for slip in the east-west direction. The provided joint is 1" wide. It was observed in the field that the bolt installed in the slotted hole is located at the east side of the slot so movement of the bridge to the west will be impeded.

Building code: The structural design drawings are dated 15 March 1978, there is a state fire marshal approval stamp dated 30 September 1977, and the as-built date is 15 October 1979. The design code is not noted on either the architectural or structural drawings. The Authority Having Jurisdiction at the time of design is not known. The title block lists both a San Francisco project number and a University project number. A 2016 history of building codes in San Francisco is provided in "Abridged History of San Francisco's Bureau of Building Inspection: 1944 to 1992," by Lonnie Haughton of Richard Avelar & Associates and informs the following. If the Dental Center had City of San Francisco jurisdiction, the City issued a 1969 San Francisco Building Code (SFBC), produced revisions in 1973 but did not publish them, and issued a 1975 San Francisco Building Code in June 1975 and a second edition in April 1978. It was not until the 1979 that the SFBC became directly based on the Uniform Building Code (UBC) that formed the basis of the California Building Code. Thus, it is unlikely that the 1976 UBC used as the benchmark code for W2 buildings in UCOP Guidebook Version 1.3 would have been used for design of the Dental Center. In 1978, the State Building Standards Commission was given responsibility for state building codes. The 1981 State Building Code used the 1979 UBC as the basis. It was not until 1989 that the California Building Code (CBC) title was used. The UC system currently uses the CBC as the basis of its building codes. Details regarding UC system requirements at the time of the Dental Center design are not known. If UC had jurisdiction, then possible building codes include the 1970 UBC, 1973 UBC, or 1976 UBC. Either the 1973 UBC or 1976 UBC may have been likely; the 1973 UBC is assumed. For the purpose of this evaluation, it is assumed that the structure is not benchmarked, and an ASCE 41 Tier 1 evaluation was completed.

Building condition: Good. Minor cracking and staining of the exterior stucco were observed, and there is no evidence of settlement or on-going leaks. The building director indicates that other than typical maintenance the structure is in good condition.

Building response in 1989 Loma Prieta Earthquake: The 17 November 1989 report "Performance of UCSF Buildings During the October 17, 1989 Loma Prieta Earthquake," by Impell Corporation states "The areas inspected included the exterior and interior. There was no structural damage observed. Minor architectural cracks were observed in the exterior stucco and in the interior sheetrock drywalls at both levels. Older concrete slab cracks were also noted on the slabs surrounding the building. Based on the inspection, the building was determined safe for occupancy."

Brief description of seismic deficiencies and expected seismic performance including mechanism of nonlinear response and structural behavior modes

Identified seismic deficiencies of the building include the following:

- The Tier 1 Quick Check indicates that the wood shear walls lack sufficient capacity to resist the forces associated with the BSE-2E ground motion. The calculated shear in the north-south direction is 949 plf and 1,004 plf in the first to second floor walls and the second floor to roof walls, respectively. These values are below and nominally at the Tier 1 limit of 1,000 plf. In the east-west direction, the calculated shear is 1,204 plf, and 1,138 plf in the first to second floor and the second floor to roof respectively. The walls in this direction are moderately overstressed.
- A number of the interior shear walls are discontinuous.
- Exterior buildings walls shift inwards at the lower story on the east and south elevation.
- The pedestrian bridge contains a 1" wide expansion joint in the slab on its east end which is smaller than the 2.6" wide joint required by the Tier 1 Quick Check. However, the bridge slab aligns in elevation with the building floor level. Therefore, pounding damage is expected to be limited.
- The slip connection installed for the bridge allows for movement towards the east, but not towards the west. The bolt is incorrectly located at the east end of the horizontal slot in the steel connection plate which impedes the bridge movement in one direction. The ends of bridge girders run over the top of the support piers and are not likely to become unseated during an earthquake with up to 6" of lateral displacement which is well beyond any likely value in a major event.

Structural deficiency	Affects rating?	Structural deficiency	Affects rating?
Lateral system stress check (wall shear, column shear or flexure, or brace axial as applicable)	Y	Openings at shear walls (concrete or masonry)	N
Load path	N	Liquefaction	N
Adjacent buildings	N	Slope failure	N
Weak story	N	Surface fault rupture	N
Soft story	N	Masonry or concrete wall anchorage at flexible diaphragm	N
Geometry (vertical irregularities)	Y	URM wall height-to-thickness ratio	N
Torsion	N	URM parapets or cornices	N
Mass – vertical irregularity	N	URM chimney	N
Cripple walls	N	Heavy partitions braced by ceilings	N
Wood sills (bolting)	N	Appendages	N
Diaphragm continuity	N		

Summary of review of nonstructural life-safety concerns, including at exit routes. [2]

Equipment is typically anchored and/or restrained in the mechanical rooms. However, one water heater was observed to be unrestrained in the central mechanical room. Natural gas is supplied to each dental station. The bracing of the gas lines is unknown. The structure was partially renovated in 2011, and major pieces of equipment were braced at that time. Ceiling bracing was observed in the field.

UCOP non-structural checklist item	Life safety hazard?	UCOP non-structural checklist item	Life safety hazard?
Heavy ceilings, feature or ornamentation above large lecture halls, auditoriums, lobbies or other areas where large numbers of people congregate	None observed	Unrestrained hazardous materials storage	None observed
Heavy masonry or stone veneer above exit ways and public access areas	None observed	Masonry chimneys	None observed
Unbraced masonry parapets, cornices or other ornamentation above exit ways and public access areas	None observed	Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc.	Unrestrained water heater in

[2] For these Tier 1 evaluations, we do not visit all spaces of the building; we rely on campus staff to report to us their understanding of if and where nonstructural hazards may occur.

			mechanical room

Basis of Seismic Performance Level rating

The Buchanan Dental Center is well-proportioned and well-tied together. The diaphragms have length-to-width aspect ratio of 1.2L:1W, and building walls have an overall width-to-height ratio of 1.73H:1.0V. As such, the diaphragm forces and wall overturning forces are not expected to be unreasonably high. The walls are bolted to the foundations, and posts containing tie downs are located at the wall ends. The sheathing is nailed around its boundaries with closely spaced nails at 4" o.c. Where discontinuous walls are present, they are bolted into wood blocking or glulams below. The diaphragms contain blocked sheathing, continuous chords, and do not contain significant opening or irregularities.

However, the walls are at capacity in the north-south direction (DCR = 1.0) and moderately overstressed in the east-west direction (DCR = 1.20). There are also numerous discontinuous walls, and a horizontal set back at two exterior elevations. In addition, the pedestrian bridge lacks sufficient seismic separation; however, due to the alignment of the floor slabs and the small area of concrete with pounding potential, pounding damage is expected to be limited and localized. Although these deficiencies exist, the building is assigned a Seismic Performance Level rating of IV because the building is well-tied together, contains a significant number of redundant shear wall lines, and does not have a soft or weak story or plan irregularities. Building performance in the nonlinear range is expected to be reasonably stable.

Recommendations for further evaluation or retrofit

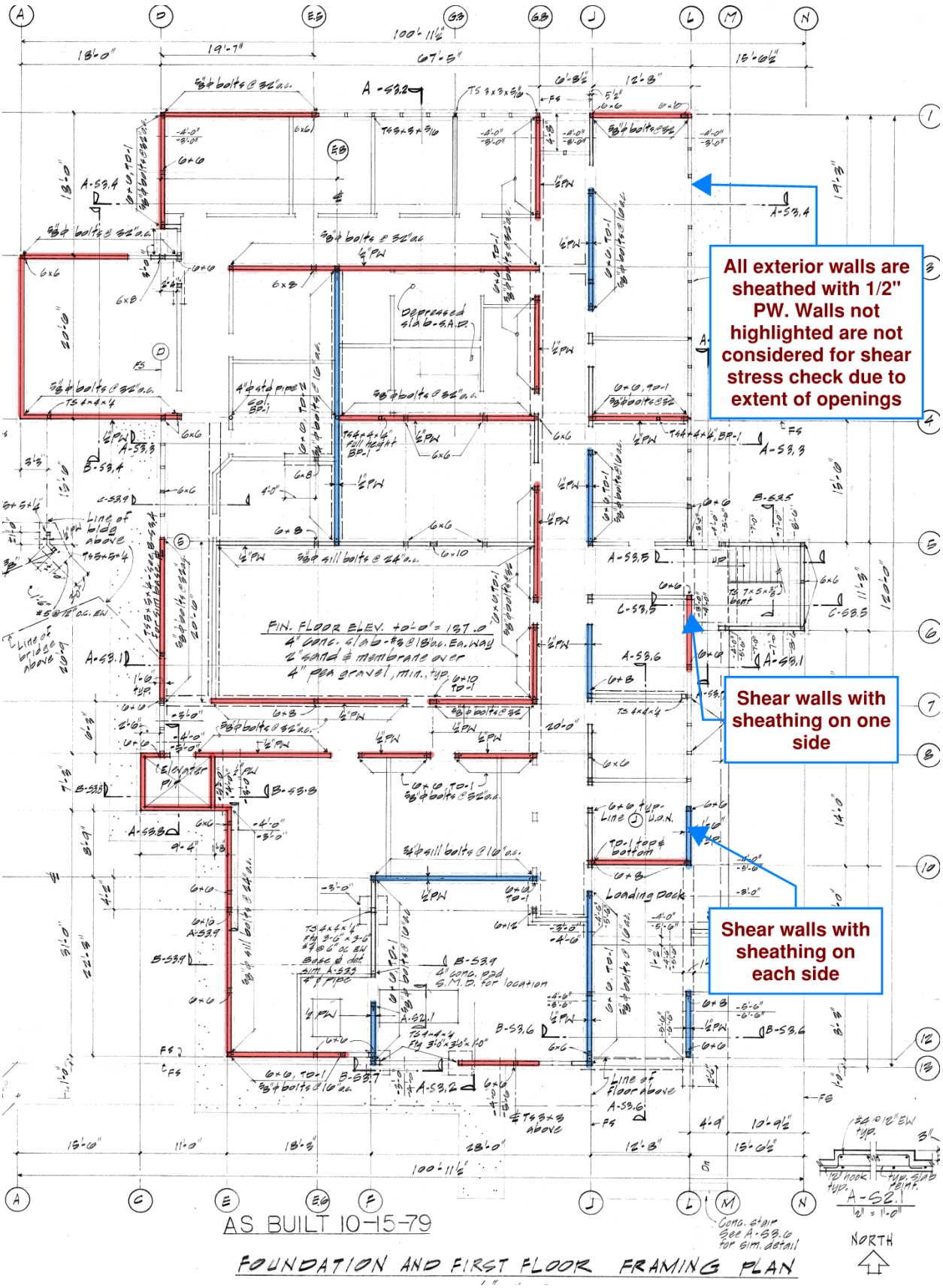
No additional evaluation is required.

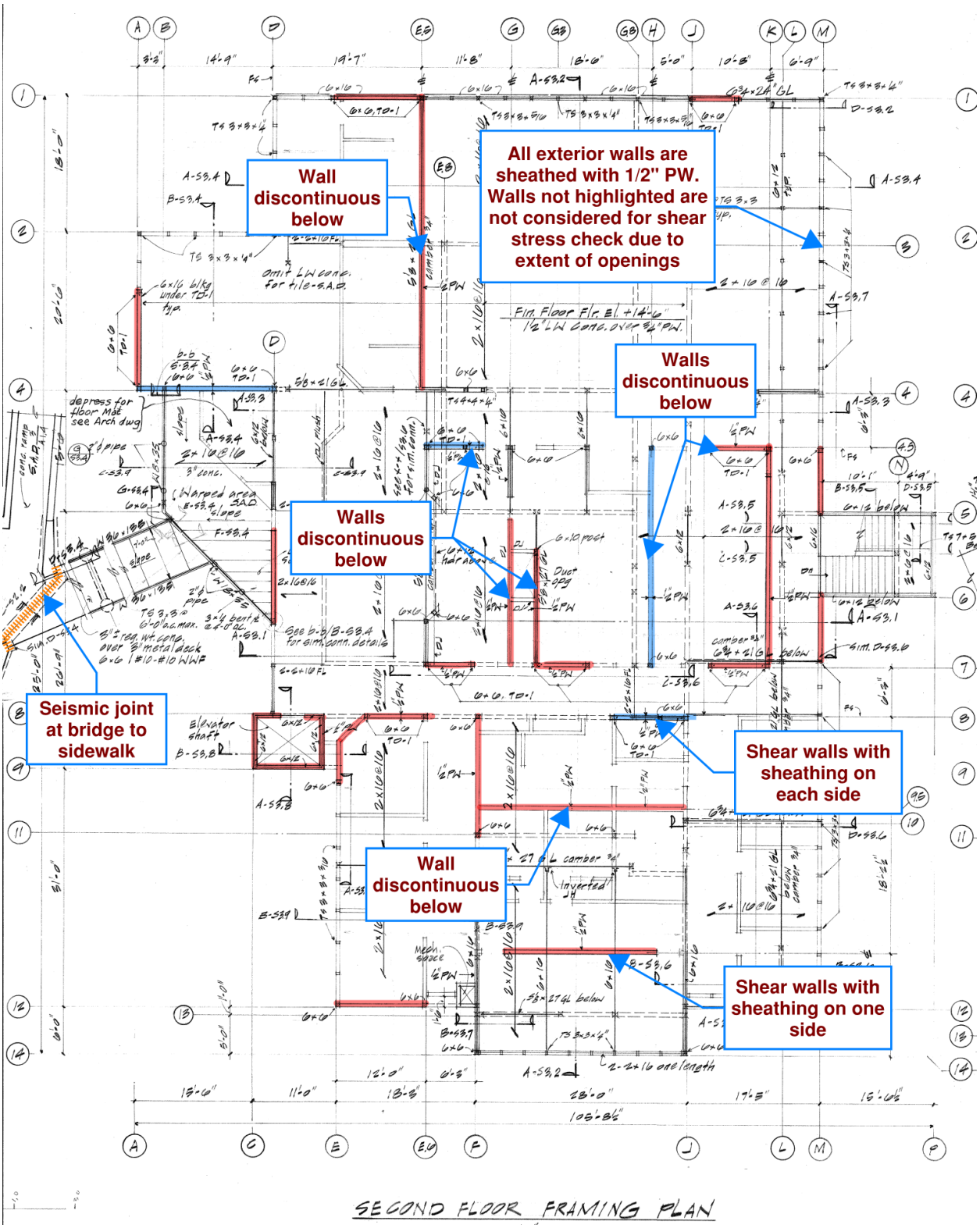
Peer review comments on rating

The structural members of the UCSF Seismic Review Committee (SRC) reviewed the evaluation on 25 June 2019 and were unanimous that the Seismic Performance Level Rating is Level IV and no further study is required.

Additional building data	Entry	Notes
Latitude	37.77103	
Longitude	-122.42651	
Are there other structures besides this one under the same CAAN#	No	
Number of stories above lowest perimeter grade	2	
Number of stories (basements) below lowest perimeter grade	0	Building pad is flat
Building occupiable area (OGSF)	20,000	Calculated
Risk Category per 2016 CBC 1604.5	II	
Building structural height, h_n	31.25 ft	Structural height defined per ASCE 7-16 Section 11.2
Coefficient for period, C_t	0.02	Estimated using ASCE 41-17 equation 4-4 and 7-18
Coefficient for period, β	0.75	Estimated using ASCE 41-17 equation 4-4 and 7-18
Estimated fundamental period	0.26 sec	Estimated using ASCE 41-17 equation 4-4 and 7-18
Site data		
975-year hazard parameters S_s, S_1	1.434g, 0.559g	Applied Technology Council website
Site class	C	

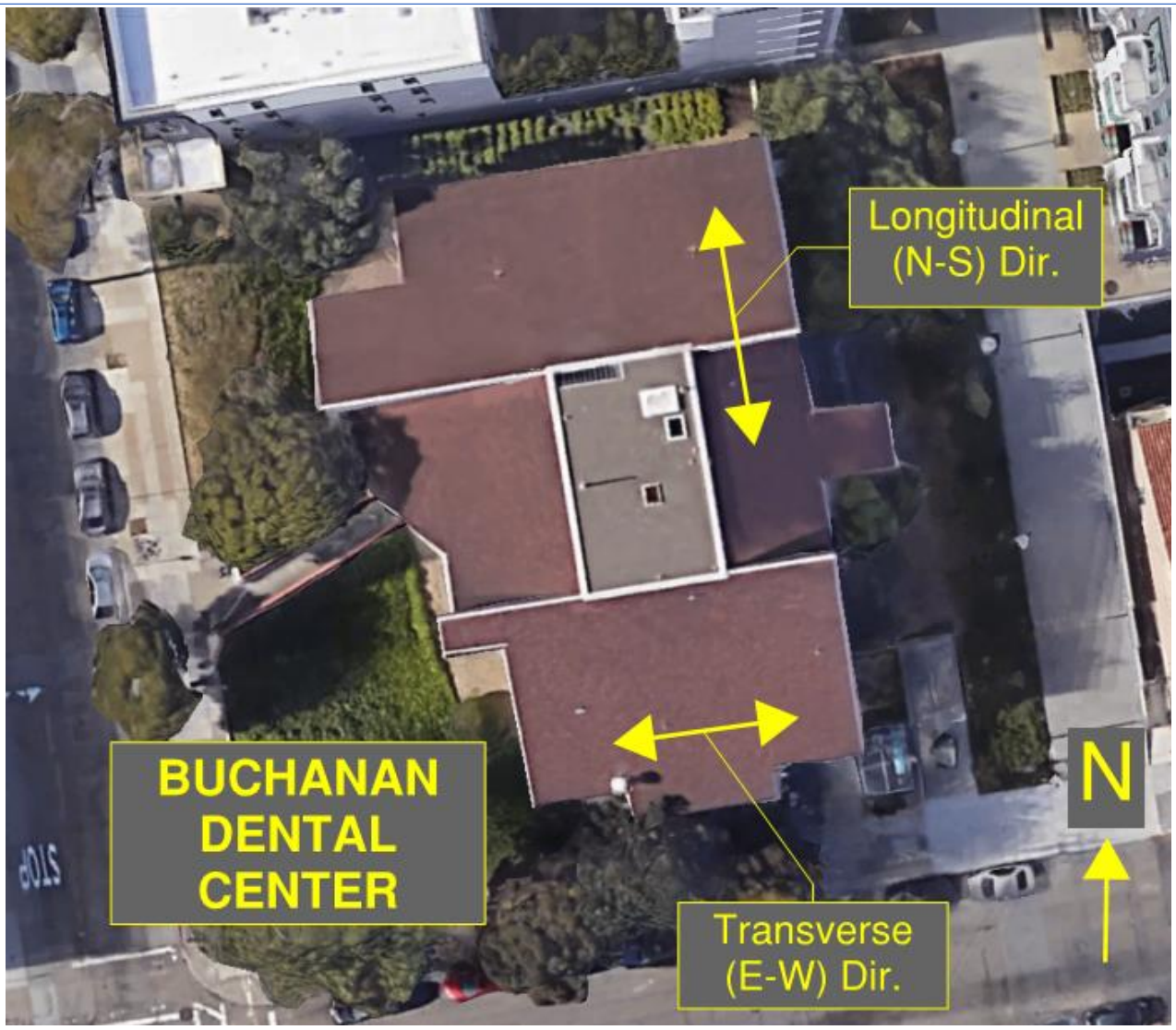
Site class basis	.	UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019)
Site parameters F_a, F_v	1.2, 1.441	Applied Technology Council website
Ground motion parameters S_{cs}, S_{c1}	1.721g, 0.805g	UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019)
S_a at building period	1.72g	W = 897 kips, V base = 1,697 kips
Site V_{s30}	610 m/s	
V_{s30} basis	Estimated	UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019)
Liquefaction potential/basis	No	UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019)
Landslide potential/basis	No	UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019)
Active fault-rupture hazard identified at site?	No	UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019)
Site-specific ground motion study?	No	
Applicable code		
Applicable code or approx. date of original construction	Built: 1979 Code: 1973 UBC	Code assumed
Applicable code for partial retrofit	None	No partial retrofit known
Applicable code for full retrofit	None	No full retrofit known
Model building data		
Model building type North-South	W2 Wood Frame	
Model building type East-West	W2 Wood Frame	
FEMA P-154 score	N/A	Not included here because we performed ASCE 41 Tier 1 evaluation.
Previous ratings		
Most recent rating	IV	
Date of most recent rating	2013	2013 “UCSF Building Seismic Survey and Ratings”
2nd most recent rating	Good	Referenced in
Date of 2nd most recent rating	Unknown	2013 “UCSF Building Seismic Survey and Ratings”
3rd most recent rating	-	
Date of 3rd most recent rating	-	
Appendices		
ASCE 41 Tier 1 checklist included here?	Yes	Refer to attached checklist file


All exterior walls are sheathed with 1/2" PW. Walls not highlighted are not considered for shear stress check due to extent of openings
Shear walls with sheathing on one side
Shear walls with sheathing on each side
AS BUILT 10-15-79
FOUNDATION AND FIRST FLOOR FRAMING PLAN
NORTH


Wall discontinuous below
All exterior walls are sheathed with 1/2" PW. Walls not highlighted are not considered for shear stress check due to extent of openings
Walls discontinuous below
Walls discontinuous below
Seismic joint at bridge to sidewalk
Shear walls with sheathing on each side
Wall discontinuous below
Shear walls with sheathing on one side
SECOND FLOOR FRAMING PLAN

APPENDIX A

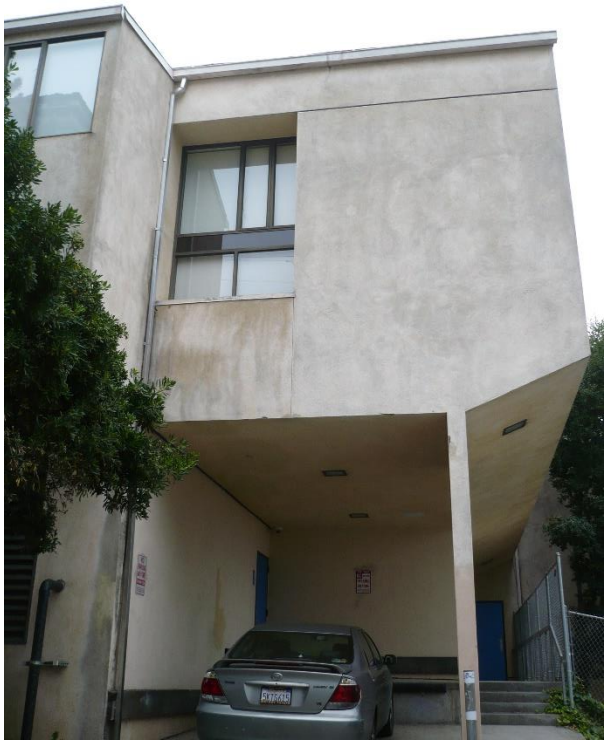
Additional Images


Longitudinal
(N-S) Dir.
BUCHANAN
DENTAL
CENTER
N
Transverse
(E-W) Dir.

Plan

West elevation (looking northeast)

Pedestrian bridge at main entry (looking northeast)



Partial south elevation (looking north)

East elevation (looking northwest)

North elevation (looking northwest)

Typical dental station

Ceiling bracing

Small classroom on the first floor

Hazardous chemical storage cabinet

Mechanical room (looking west)

Overhang on east elevation

Seismic joint cover on the west end of the pedestrian bridge

Bridge connection bolt at end of slotted hole. Seismic joint is to the right (west).

APPENDIX B

ASCE 41-17 Tier 1 Checklists (Structural)

UC Campus:	San Francisco			Date:	06/25/2019		
Building CAAN:	3010	Auxiliary CAAN:		By Firm:	RUTHERFORD + CHEKENE		
Building Name:	Buchanan Dental Center			Initials:	EGM	Checked:	BL
Building Address:	100 Buchanan St, San Francisco, CA 94102			Page:	1	of	3

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

C	NC	N/A	U	Description
●	○	○	○	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. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1) **Comments:** Plywood sheathing over wood framing functions as the diaphragm that delivers load to exterior and interior wood-frame shear walls. The structural elements contain nails and blocking members to facilitate load transfer. The wood shear walls include sills that are bolted to the foundation.
○	●	○	○	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. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2) **Comments:** A 1" wide expansion joint is provided at the west end of the pedestrian bridge. Based upon a story height of 14'-6", the required gap is 2.6".
○	○	●	○	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) **Comments:** There are no mezzanines.

BUILDING SYSTEMS - *BUILDING CONFIGURATION*

C	NC	N/A	U	Description
●	○	○	○	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) **Comments:** The number and length of stud walls with plywood sheathing increases in both directions from the roof down to the 1st floor.
●	○	○	○	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) **Comments:** The stories are 14'-6", 12'-0", and 11'-0" tall for the stories between the 1st and 2nd floor, 2nd floor and mechanical room level, and mechanical room level and high roof, respectively. Even though the height of the lower story increases its flexibility, it also has the largest amount of wood-frame shear walls in both directions, thus, a soft story is not likely to occur.

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

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ASCE 41-17
Collapse Prevention Basic Configuration Checklist

C	NC	N/A	U	
○	●	○	○	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) **Comments:** Shear walls located on Grids E.5, G, G.3, H, 4.5, 9.5, and 11.8 between the second floor and the roof are discontinuous. In addition, the building has setbacks on the south and east elevation.
●	○	○	○	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) **Comments:**
●	○	○	○	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. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5) **Comments:** Effective mass is reduced by approximately 30% from the first to the second story.
●	○	○	○	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) **Comments:** The building floor plan is approximately rectangular, and shear walls are located around the perimeter of the structure and are well-spaced at the interior.

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

GEOLOGIC SITE HAZARD

C	NC	N/A	U	Description
●	○	○	○	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 (15.2m) under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1) **Comments:** Per the UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019).
●	○	○	○	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. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1) **Comments:** Per the UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019).
●	○	○	○	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) **Comments:** Per the UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019).

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ASCE 41-17
Collapse Prevention Basic Configuration Checklist

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN addition TO THE ITEMS FOR MODERATE SEISMICITY)

FOUNDATION CONFIGURATION

C	NC	N/A	U	Description
●	○	○	○	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) **Comments:** The building width is B = 67'-5" from Grids D to L in the E-W direction. The building height is H = 39'-0" to the roof high point, B/H = 1.73. Sa = 1.72g at BSE-2E 0.6x Sa = 1.03 B/H > 0.6 Sa.
●	○	○	○	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) **Comments:** The soil is classified as Site Class C.

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ASCE 41-17
Collapse Prevention Structural Checklist For Building Type W2

LOW AND MODERATE SEISMICITY

SEISMIC-FORCE-RESISTING SYSTEM

C	NC	N/A	U	Description
◉	○	○	○	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) **Comments:** The building has 7 lines of shear walls in the longitudinal (N-S) direction, and 7 lines of shear walls in the transverse (E-W) direction.
○	◉	○	○	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: (Commentary: Sec. A.3.2.7.1. Tier 2: Sec. 5.5.3.1.1) Structural panel sheathing: 1,000 lb/ft Diagonal sheathing: 700 lb/ft Straight sheathing: 100 lb/ft All other conditions: 100 lb/ft **Comments:** The calculated wall demands are 949 lb/ft, and 1,004 lb/ft in the N-S direction for the stories between the 1st floor and 2nd floor, and 2nd floor and high roof, respectively; and 1,204 lb/ft, and 1,138 lb/ft in the E-W direction for the stories between the 1st floor and 2nd floor, and 2nd floor and high roof, respectively. These exceed the ASCE 41 limit of 1,000 lb/ft for buildings with structural panel sheathing.
◉	○	○	○	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) **Comments:** Wood-frame shear walls do have a plaster finish; however, plywood sheathing is the primary element that resists seismic forces.
◉	○	○	○	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. (Commentary: Sec. A.3.2.7.3. Tier 2: Sec. 5.5.3.6.1) **Comments:** Interior walls contain plywood sheathing.
◉	○	○	○	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) **Comments:** Considering the story heights of 14'-6" and 12'-0" for the stories between the 1st and 2nd floor, and 2nd floor and mechanical room, the minimum shear wall lengths required are 7'-3" and 6'-0", respectively. All of the wood shear walls that are considered as seismic force-resisting elements are longer than these dimensions.

ASCE 41-17
Collapse Prevention Structural Checklist For Building Type W2

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. (Commentary: Sec. A.3.2.7.5. Tier 2: Sec. 5.5.3.6.2) **Comments:**
○	○	◉	○	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) **Comments:** Even though the natural terrain is sloping down toward the east, the site is level at the building pad, and grade is located at the first floor.
○	○	◉	○	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) **Comments:** Plywood sheathing at exterior walls extends to the top of the foundation.
○	◉	○	○	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) **Comments:** Exterior shear walls contain long window openings which exceed 80% of the wall length. These walls typically do not have shear wall panels. However, the exterior walls do not comprise the majority of the shear walls in the building. The interior walls serve as the primary lateral system.

CONNECTIONS

C	NC	N/A	U	Description
◉	○	○	○	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) **Comments:** Tie downs are located at the base of wood posts, typically.
◉	○	○	○	WOOD SILLS: All wood sills are bolted to the foundation. (Commentary: Sec. A.5.3.4. Tier 2: Sec. 5.7.3.3) **Comments:** Sill contain 5/8” diameter anchors spaced at 16”, 24”, and 32” o.c.
◉	○	○	○	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) **Comments:** Girder-to-post connections typically use steel hardware (plates with bolts) and strapping.

ASCE 41-17
Collapse Prevention Structural Checklist For Building Type W2

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

CONNECTIONS

C	NC	N/A	U	Description
●	○	○	○	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. (Commentary: A.5.3.7. Tier 2: Sec. 5.7.3.3) **Comments:**

DIAPHRAGMS

C	NC	N/A	U	Description
●	○	○	○	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) **Comments:** The diaphragms are continuous throughout floors.
●	○	○	○	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) **Comments:** Joists and top plates are spliced using steel strap plates that are nailed into the adjoining members.
●	○	○	○	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Commentary: Sec. A.4.1.8. Tier 2: Sec. 5.6.1.5) **Comments:** There are no large diaphragm openings in building.
○	○	●	○	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) **Comments:** There are no straight-sheathed diaphragms. All the diaphragms are composed of plywood sheathing.
●	○	○	○	SPANS: All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2) **Comments:** The largest span is located at the main clinic area at the 2nd floor, between Grids 1 and 4, which is 38'-6" long. The wood diaphragm for this area is sheathed with ¾" plywood.

UC Campus:	San Francisco			Date:	06/25/2019		
Building CAAN:	3010	Auxiliary CAAN:		By Firm:	RUTHERFORD + CHEKENE		
Building Name:	Buchanan Dental Center			Initials:	EGM	Checked:	BL
Building Address:	100 Buchanan St, San Francisco, CA 94102			Page:	4	of	4

ASCE 41-17
Collapse Prevention Structural Checklist For Building Type W2

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. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2) **Comments:** Neither diagonally sheathed nor unblocked wood structural panels are located within the building.
◉	○	○	○	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) **Comments:** All diaphragms consist of plywood sheathing over wood framing.

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

APPENDIX C

UCOP Seismic Safety Policy Falling Hazards Assessment Summary

UC Campus:	San Francisco			Date:	06/25/2019		
Building CAAN:	3010	Auxiliary CAAN:		By Firm:	Rutherford+Chekene		
Building Name:	Buchanan Dental Center			Initials:	*EGM*	Checked:	*BL*
Building Address:	100 Buchanan Street, San Francisco, CA 94102			Page:	1	of	1

UCOP SEISMIC SAFETY POLICY
Falling Hazard Assessment Summary

	Description
P ☐ N/A ☒	**Heavy ceilings, features or ornamentation above large lecture halls, auditoriums, lobbies, or other areas where large numbers of people congregate (50 ppl or more)** **Comments:** No areas of congregation of over 50 people are located within the building. There is one smaller meeting room/classroom in the basement.
P ☐ N/A ☒	**Heavy masonry or stone veneer above exit ways or public access areas** **Comments:** No masonry or stone veneer is located near exit ways or public access areas.
P ☐ N/A ☒	**Unbraced masonry parapets, cornices, or other ornamentation above exit ways or public access areas** **Comments:** There are no masonry parapets, cornices, or other ornamentation.
P ☐ N/A ☒	**Unrestrained hazardous material storage** **Comments:** A small amount of hazardous chemicals are located in the wet lab in a short storage cabinet on the first floor. These are not considered a significant risk.
P ☐ N/A ☒	**Masonry chimneys** **Comments:** No masonry chimneys are in the building.
P ☒ N/A ☐	**Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc.** **Comments:** The building director indicates that natural gas is supplied to each dental station and to the wet lab. Bracing of the supply line is unknown as it was not observed, and no documentation is available. One water heater in the central mechanical room was unrestrained.
P ☐ N/A ☐	**Other:** **Comments:**
P ☐ N/A ☐	**Other:** **Comments:**
P ☐ N/A ☐	**Other:** **Comments:**

Falling Hazards Risk: *Low*

Note: P= Present, N/A = Not Applicable; Falling Hazards Risk: Low, Moderate, or High

APPENDIX D

Quick Check Calculations

Flat Load Tables

	Seismic Weight	Dead Load	
HIGH ROOF	**psf**	**psf**	**Remarks**
Roofing	6.0	6.0	Tar and gravel roof
Waterproofing / insulation	1.8	1.8	6" batt insulation and waterproofing membrane assumed
Sheathing	1.7	1.7	1/2" plywood sheathing
Wood framing	4.8	4.8	2x16" wood joists at 16" o.c. plus 1 psf for misc. blocking and bridging
MEP	5.0	5.0	MEP hung from underside of floor slab
Lighting and misc.	2.0	2.0	No ceiling
Columns	0.0	0.0	Additional wood posts are included in wood walls
Wood-frame shear walls and partitions	0.0	0.0	Stud walls below wood framing
Total	21.3	21.3	

1 - Flat load is a wood-framed assembly that occurs at roof between Grids E.9-J / 4-8.

2 - Wood-frame shear walls and partitions weight is considered in 'pitched roof' and 'mechanical room' flat load tables.

	Seismic Weight	Dead Load	
PITCHED ROOF	**psf**	**psf**	**Remarks**
Roofing	3.0	3.0	Asphalt shingles roofing
Waterproofing / insulation	1.8	1.8	6" batt insulation and waterproofing membrane assumed
Sheathing	1.7	1.7	1/2" plywood sheathing
Wood framing	3.9	3.9	2x12" wood joists at 16" o.c. plus 1 psf for misc. blocking and bridging
Glulam beams	0.3	0.3	5.125x30" glulam beams
MEP	5.0	5.0	MEP hung from underside of floor slab
Ceiling, lighting and misc.	4.0	4.0	Gypsum board ceiling, lighting, and misc. hung from underside of floor slab
Columns	0.0	0.0	Additional wood posts are included in wood walls
Wood-frame shear walls and partitions	10.1	0.0	Stud walls over wood framing
Total	29.8	19.7	

1 - Flat load is a wood-framed assembly that occurs at entire roof, except for area between Grids E.9-J / 4-8, which correspond to the high roof.

2 - Wood-frame shear walls and partitions flat load includes exterior sheathed walls with plaster finishes, interior sheathed walls, and nonstructural partition walls. Exterior sheathed wall weight of 15 psf, interior sheathed wall weight of 10 psf, and nonstructural partition wall weight of 9 psf are assumed on their vertical face. Tributary wall height is 8'-9".

3 - 2x12 at 16" o.c. is the most typical framing condition for flat load. 2x12 at 12" o.c. and 2x14 at 16" o.c. also occurs at pitched roof.

	Seismic Weight	Dead Load	
MECHANICAL ROOM	**psf**	**psf**	**Remarks**
Mechanical equipment	25.0	50.0	Estimated equipment weight
Topping slab	24.0	24.0	2.5" LWC slab
Sheathing	2.5	2.5	3/4" plywood below 2.5" slab
Wood framing	4.8	4.8	2x16" wood joists at 16" o.c. plus 1 psf for misc. blocking and bridging
Glulam beams	0.7	0.7	5.125x21" glulam beam
MEP	5.0	5.0	MEP hung from underside of the floor
Ceiling, lighting & misc.	4.0	4.0	Hung from the underside of the floor
Columns	0.0	0.0	Additional wood posts are included in wood walls
Wood-frame shear walls and partitions	10.1	0.0	Stud walls over wood framing
Total	76.1	91.0	

1 - Flat load is a wood-framed assembly that occurs at elevation 26'-6" from T.O.C. at 1st floor, between Grids E.9-J / 4-8.

2 - Wood-frame shear walls and partitions flat load includes exterior sheathed walls with plaster finishes, interior sheathed walls, and nonstructural partition walls. Exterior sheathed wall weight of 15 psf, interior sheathed wall weight of 10 psf, and nonstructural partition wall weight of 9 psf are assumed on their vertical face. Tributary wall height is 8'-9".

3 - Equipment where it is located is assumed to weigh 50 psf. The equipment is located on approximately 1/2 of the room area and therefore, 25 psf is assumed for seismic mass.

4 - LW concrete unit weight of 115 psf is assumed.

	Seismic Weight	Dead Load	
STERILIZATION ROOM **2nd Floor**	**psf**	**psf**	**Remarks**
Topping Slab	14.4	14.4	1.5" LWC slab (assuming no additional floor covering)
Sheathing	2.5	2.5	3/4" plywood below 1.5" slab
Wood framing	4.8	4.8	2x16" wood joists at 16" o.c. plus 1 psf for misc. blocking and bridging
Additional microlam joists	3.3	3.3	1.75x14" microlam joints at 16" o.c. installed on either side of 2x16" joists
MEP	5.0	5.0	MEP hung from underside of floor slab
Ceiling, lighting and misc.	4.0	4.0	Gypsum board ceiling, lighting, and misc. hung from underside of floor slab
Columns	0.0	0.0	Additional wood posts are included in wood walls
Wood-frame shear walls and partitions	20.5	21.3	Stud walls over wood framing
Total	54.4	55.3	

1 - Flat load is a wood-framed assembly that occurs at elevation 14'-6" from T.O.C. at 1st floor, between Grids H-K / 3-7, where the sterilization room is located.

2 - Wood-frame shear walls and partitions flat load includes exterior sheathed walls with plaster finishes, interior sheathed walls, and nonstructural partition walls. Exterior sheathed wall weight of 15 psf, interior sheathed wall weight of 10 psf, and nonstructural partition wall weight of 9 psf are assumed on their vertical face. Tributary wall height is 16'-0".

3 - LW concrete unit weight of 115 psf is assumed.

	Seismic Weight	Dead Load	
TYPICAL FLOOR	**psf**	**psf**	**Remarks**
Topping Slab	16.4	16.4	1.5" LWC slab plus 2 psf for carpet or vinyl tile
Sheathing	2.5	2.5	3/4" plywood below 1.5" slab
Wood framing	4.8	4.8	2x16" wood joists at 16" o.c. plus 1 psf for misc. blocking and bridging
Glulam beams	0.7	0.7	glulam beams
MEP	5.0	5.0	MEP hung from underside of floor slab
Ceiling, lighting and misc.	4.0	4.0	Gypsum board ceiling, lighting, and misc. hung from underside of floor slab
Columns	0.0	0.0	Additional wood posts are included in wood walls
Wood-frame shear walls and partitions	20.5	21.3	Stud walls over wood framing
Total	53.8	54.7	

1 - Flat load is a wood-framed assembly that occurs at elevation 14'-6" from T.O.C. at 1st floor on entire second floor, except for area between Grids H-K / 3-7, where the sterilization room is located.

2 - Wood-frame shear walls and partitions flat load includes exterior sheathed walls with plaster finishes, interior sheathed walls, and nonstructural partition walls. Exterior sheathed wall weight of 15 psf, interior sheathed wall weight of 10 psf, and nonstructural partition wall weight of 9 psf are assumed on their vertical face. Tributary wall height is 16'-0".

3 - LW concrete unit weight of 115 psf is assumed.

4 - Glulam beam sizes are: 5.125x21", 5.125x24", 5.125x27", 6.75x21", and 6.75x27" glulam beams at typical floor are included in flat load.

Story Weight

	Floor Area (ft^2)[1,2,3,4]					Floor Weight (psf)					Height[5]			
Floor Levels	HIGH ROOF	PITCHED ROOF	MECHANICAL ROOM	STERILIZATION ROOM 2nd Floor	TYPICAL FLOOR	HIGH ROOF	PITCHED ROOF	MECHANICAL ROOM	STERILIZATION ROOM 2nd Floor	TYPICAL FLOOR	Elevation (ft)	Height below floor level (ft)	Additional Weight (kips)[6]	Total Seismic Weight (kips)
Roof	1,150	8,820	1,150	0	0	21	30	76	54	54	168.25	17.50		375
Second Floor	0	0	0	448	8,992	21	30	76	54	54	151.50	14.50	13	522
First Floor											137.00			

Total Weight = **897** **kips**

Notes:

1 - Seismic base is set at First floor.

2 - Wood-frame wall weight contribution is included in flat load tables

3 - Roof area is increased by 5% to account for slope toward the exterior walls

4 - Mechanical room and roof are lumped together for seismic weight calculation.

5 - For weight distribution calculations, the story height between the second floor and the roof is defined as the height from the second floor to the mechanical room (12'-0") plus half the height from the mechanical room to the high roof (11'-0"/2 = 5'-6").

6 - Additional weight includes half of the mass of the pedestrian bridge located between the Dental Center and the sidewalk on the west side at the 2nd floor.

Period

C_t=	0.02
h_n (ft)=	31.25
B=	0.75

T=	0.26	sec

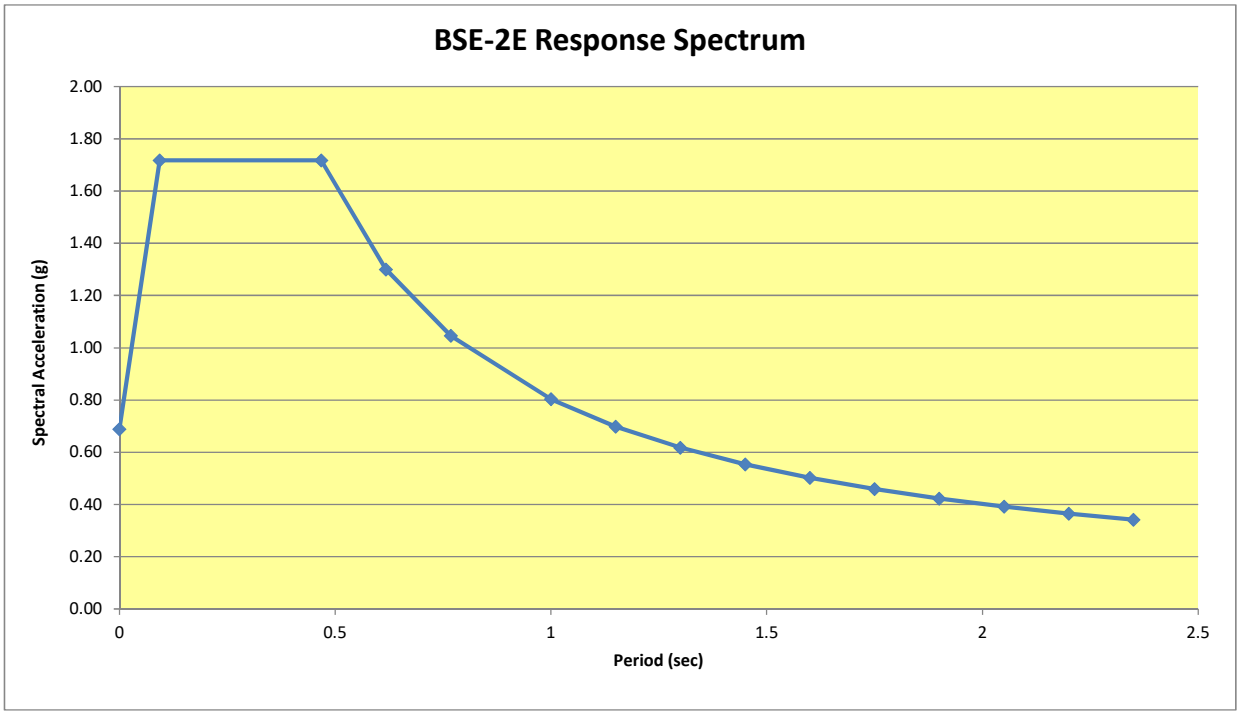
Notes:
1- The period is calculated per ASCE 41-17 Equation 4-4.

$$T = C_t \cdot h_n^{B}$$

2- Ct and B are for "all other framing system" per ASCE 41-17 Section 4.4.2.4.
3- The building height is taken from the First floor to the average roof height located midway between the elevation of the mechanical room floor and the roof high point.

Site Parameters

Period (s)	Sa (g)
0	0.69
0.09	1.72
0.47	1.72
0.62	1.30
0.77	1.05
1.00	0.80
1.15	0.70
1.30	0.62
1.45	0.55
1.60	0.50
1.75	0.46
1.90	0.42
2.05	0.39
2.20	0.37
2.35	0.34



β =	0.05	
B_1 =	1.00	
Site Class =	C	
S_{XS} =	1.721	g
S_{X1} =	0.805	g
T_0 =	0.09	s
T_s =	0.47	s
T =	0.26	s
S_a =	1.72	g (See Note 2)
Tier 1 S_a =	1.72	g (See Note 3)

Notes:

1- Spectral accelerations based upon site class provided in report "UCSF Group 2 Buildings - Assessment of Geotechnical Characteristics and Geohazards". Procedure as specified in ASCE 41-17, Section 2.4.1.7 is used to develop General Response Spectrum shown above.

2 - Per Section 2.4.1.7 of ASCE 41-17, use of spectral response acceleration in the extreme short-period range ($T < T_0$) shall only be permitted in dynamic analysis procedures and only for modes other than the fundamental mode.

3- Per Section 4.4.2.3 for Tier 1 screening in ASCE 41-17, the spectral acceleration, Sa, is computed as the least value of S_{x1}/T, and S_{XS}.

Seismic Force Distribution

ATC Horizontal Response Spectrum Seismic Parameters		
Hazard Level	BSE-2E	
Site Class	C	
S_{CS}=	1.721 g	(See Note 2)
S_{C1}=	0.805 g	(See Note 2)

T=	0.26	s
Sa=	1.72	g
W=	897	kips
C=	1.1	Per ASCE 41-17 Table 4-7

V=	1,697	kips

k= 1.00

Per ASCE 41-17 Section 4.4.2.2, K = 1.0 for periods less than 0.5 sec and K = 2.0 for T >2.5 sec. It varies linearly in between 0.5 sec and 2.5 sec period.

Floor Levels	Story Height (ft)	Total Height, H (ft)	Weight, W (kips)	W x H^k	coeff	Fx (kips)	Story Shear, V (kips)
Roof	17.50	32.00	375	11,994	0.61	1,041	1,041
Second Floor	14.50	14.50	522	7,565	0.39	656	1,697
First Floor							
	32.0		897	19,559	1	1,697	

Notes:

1- Base of building is set at first floor.

2- S_{XS} and S_{X1} refer to the spectral response at 0.2s and 1.0s, respectively, after applying site amplification factors Fa and Fv. These values match S_{CS} and S_{C1} for the building, per the table UCSF Group 2 Buildings - Assessment of Geotechnical Characteristics and Geohazards.

3- Per Section 4.4.2.3 in ASCE 41-17, the spectral acceleration, Sa, is computed as the least value of S_{X1}/T, and S_{XS}.

4- Modification Factor, C, per ASCE 41-17, Table 4-7.

Table 4-7. Modification Factor, *C*

	Number of Stories			
Building Type[a]	**1**	**2**	**3**	**≥4**
Wood and cold-formed steel shear wall (W1, W1a, W2, CFS1) Moment frame (S1, S3, C1, PC2a)	1.3	1.1	1.0	1.0
Shear wall (S4, S5, C2, C3, PC1a, PC2, RM2, URMa) Braced frame (S2) Cold-formed steel strap-brace wall (CFS2)	1.4	1.2	1.1	1.0
Unreinforced masonry (URM) Flexible diaphragms (S1a, S2a, S5a, C2a, C3a, PC1, RM1)	1.0	1.0	1.0	1.0

[a] Defined in Table 3-1.

Average Wall Stress Check

Average Stresses

Ms = 4.5

Longitudinal (N-S direction)					
Story	**Story Shear**	**Wall Length**	**Average Shear Demand**	**Tier 1 Shear Limit**	**Wall OK?**
	(kips)	(ft)	(lb/ft)	(lb/ft)	
Roof - Second Floor	1,041	230	1004	1000	NG
Second Floor - First Floor	1,697	397	949	1000	OK

Transverse (E-W direction)					
	Story Shear	**Wall Length**	**Average Shear Demand**	**Tier 1 Shear Limit**	**Wall OK?**
	(kips)	(ft)	(lb/ft)	(lb/ft)	
Roof - Second Floor	1,041	203	1138	1000	NG
Second Floor - First Floor	1,697	313	1204	1000	NG

Notes:

1 - Shear stress check is performed following the ASCE 41-17 Tier 1 screening criteria, and the BSE-2E site modified spectral response parameters.

2 - Ms factor per ASCE 41-17 Table 4-8.

Table 4-8. M_s Factors for Shear Walls

	Level of Performance		
Wall Type	**CP[a]**	**LS[a]**	**IO[a]**
Reinforced concrete, precast concrete, wood, reinforced masonry, and cold-formed steel	4.5	3.0	1.5
Unreinforced masonry	1.75	1.25	1.0

[a] CP = Collapse Prevention, LS = Life Safety, IO = Immediate Occupancy.

3 - Tier 1 shear stress limit of 1,000 lb/ft is defined for buildings with structural panel sheathing based upon Table 17-4/ASCE 41-17.

4 - Stud-frame shear walls with sheathing on both sides are estimated to have double the capacity to resist shear stress; thus, the length of these walls is doubled in the calculation.