UCSF

Rating form completed by:

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Date: 10/10/19

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

BRET LIZUNDIA
No. S3950
Exp. 12-31-20
STRUCTURAL
10-10-19

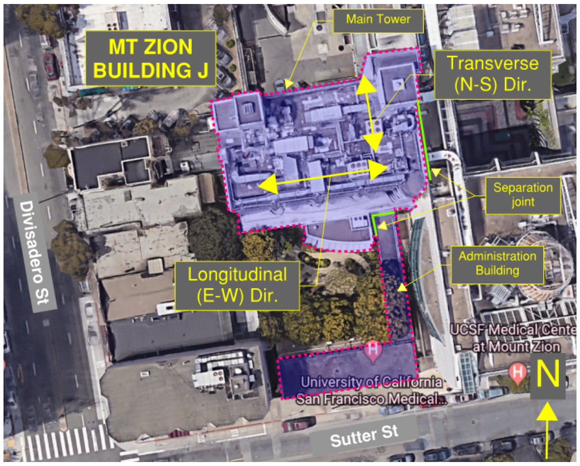
DATE: 2019-10-10

UCSF building seismic ratings

Mount Zion, Building J

CAAN #2031
2356 Sutter Street, San Francisco, CA 94115
UCSF Campus: Mount Zion

Plan



South elevation (looking north)

Rating summary	**Entry**	**Notes**
UC Seismic Performance Level (rating)	V	Findings based on drawing review 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	Priority B	Priority A=Retrofit ASAP Priority B=Retrofit at next permit application for modification
Ballpark total project cost to retrofit to IV rating	High ($200-$400/sf)	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?	Yes	

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[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

- Structural drawings by I. Thompson Structural Engineer, "Maimonides Health Center, San Francisco, California," dated 14 April 1948, structural Sheets S1 to S15.

Additional building information known to exist

- Architectural drawings by Eric Mendolsohn Architect, "Maimonides Health Center, San Francisco, California," dated 14 April 1948.

Scope for completing this form

The structural drawings provided by UCSF were reviewed, and these drawings are primarily used as the basis for the completed ASCE 41-17 Tier 1 evaluation. A site visit was made on 23 September 2019 where the building exterior and portions of the interior were observed. During a visit to the site, original architectural drawings were found onsite in a UCSF Mt. Zion drawing archive room. Photographs of selected drawings were taken and were also used for reference.

Brief description of structure

Building J is located near the corner of Divisadero Street and Sutter Street in San Francisco, California. It is a reinforced concrete structure that was designed in 1948 by I. Thompson. Building J is comprised of two distinct, seismically separated sections. The first is a L-shaped one-story structure named the Administration Building. It is located on the southern side of the site on Sutter Street. The second section is an eight-story rectangular structure located on the northern portion of the site. For the purpose of this seismic evaluation, this portion is referred to herein as the "Main Tower." A courtyard is located at the ground floor between the two buildings. Building J is currently utilized as a Women's Health Center and functions as a medical office building offering services such as such as obstetrics, mammography, and radiology.

<u>Identification of levels:</u> The building levels are designated as the first floor (reference EL. 0.00 ft), second floor (reference EL. 9.67 ft), third floor (reference EL. 29.00 ft), fourth floor (reference EL. 38.67 ft), fifth floor (reference EL. 48.34 ft), sixth floor (reference EL. 58.00 ft), seventh floor (reference EL. 67.67 ft), eighth floor (reference EL. 77.34 ft), and the roof (87.00 ft). A mezzanine is located between the second and third floor, and small two-story tall penthouses are located on the roof. The overall site slopes down from the north, but the pad below Building J appears to be flat.

<u>Foundation system:</u> The Administration Building contains reinforced concrete strip footing centered below the concrete walls. The footings are 12", 18", and 22" wide by 8" deep and are located a minimum of 2'-0" below the 4" thick slab-on-grade. They are not restrained in the direction perpendicular to the walls.

The Main Tower contains a grid of 4'-10" tall reinforced concrete stem walls oriented in both directions. The stem walls coincide with the structural walls above; however, additional walls were added to form ties across the building width. These walls are 10" and 12" thick and are reinforced with ½" and 5/8" diameter horizontal bars one each face spaced at 12" o.c. The vertical reinforcing consists of ½" diameter bars spaced at 9" o.c. on each face. The core walls that are situated around the stair and elevator shafts are supported by a 30" thick reinforced concrete mat. Walls that are isolated from these cores span between isolated spread footings that are centered below the building columns.

<u>Structural system for vertical (gravity) load:</u> The Administration Building is an L-shaped building that contains two wings. The south wing measures 81'-1" in the east-west direction by 40'-0" in the north-south direction, and the north wing measures 9'-1" in the east-west direction by 60'-4" in the north-south direction. The north wing serves as a corridor to connect the south wing to the Main Tower. In the south wing, the reinforced concrete roof slab spans in the north-south direction between a central vertical load-bearing concrete wall and a row of light steel framing located on the north and south elevation. This steel framing is comprised of window mullions on the north elevation and of 4 I 9.2 steel members on the south elevation. The slab is tapered and varies in thickness from 5" to 10". In the north wing, the slab spans in the east-west direction between a row of window mullions located on the west elevation and a concrete wall on the east elevation.

The Main Tower is an eight-story rectangular reinforced concrete structure. The reinforced concrete floor slabs span in the north-south direction between load-bearing concrete walls and reinforced concrete beams. The slab thickness is 4 ½”, 5 ½”, and 7”, and the slabs span up to 22’-6”. The beams are oriented in the east-west direction and are centered on the column lines. They are 1’-9” deep by 3’-0” wide and contain heavy 1” x 1” square longitudinal reinforcing with light 3/8” diameter ties spaced at 18” o.c. The building columns are large sections measuring 36” x 15” and similarly contain heavy longitudinal bars with light shear ties. The longitudinal reinforcing is comprised of between 8 to 20 - 1” x 1 “ or 1.125” x 1.125” square bars with ¼” diameter ties spaced at 12” o.c. Since the beams only frame into the columns in the east-west direction, the columns rely on the slab for lateral bracing in the north-south direction. Large upturned beams are located on the north elevation and span approximately 57’-0” feet. They are 7” thick by 5’-8” tall and contain 3/8” diameter horizontal bars spaced at 7 ½” o.c. On the west end, these upturned beams are supported by the shear walls located around the stair core, and on the east end they frame into a perpendicular wall.

Structural system for lateral forces: The lateral force-resisting system for both the Administration Building and the Main Tower is comprised from reinforced concrete diaphragms that span to reinforced concrete shear walls in both directions. The walls vary in thickness from 6” to 14”, and the reinforcing ratio is approximately ρ = 0.0025 in both directions.

The Administration Building contains one wall oriented in the east-west direction and two walls oriented in the north-south direction. The east-west direction wall is located at the center of the south wing, while the north-south direction walls are located at the west and east elevations of the structure. No lateral resistance is located on the north end of the north wing adjacent to the Main Tower. As such, the north wing diaphragm either cantilevers 60’-4” from the south wing or is supported by the east shear wall acting as a cantilevered wall in the out-of-plane direction.

At the upper stories, the Main Tower contains three lines of wall oriented in the east-west direction and eight lines of wall oriented in the north-south direction. At the lower stories, the Main Tower contains five lines of wall oriented in the east-west direction and eight lines of wall oriented in the north-south direction. The walls are primarily short segments located around the stair and elevator cores situated on the northern side of the structure. At these cores, slab openings are positioned on one side of the wall, while the slab on the other side of the wall is doweled directly into the wall. No collector elements, beams, or thickened slabs were provided to transfer diaphragm loads into the walls adjacent to slab openings. The Main Tower also contains two walls oriented in the north-south direction that are discontinuous below the second floor. One of these walls does not contain any vertical support in the story below as it cantilevers out from the structure. In general, the structure does not contain a robust vertical load-carrying system. The columns are shear-controlled, and the load-bearing walls typically do not contain embedded column reinforcing or boundary zones. A series of secondary components that may serve as a back-up gravity system are not present.

Building condition: The building engineer noted on-going maintenance issues with leaks in the roof. Significant bubbling and patching of the roof membrane was observed. Corrosion was observed at the base of multiple pieces of roof equipment. Water staining along with minor cracking and spalling was observed in the exterior concrete walls. Otherwise, the structure is in generally good condition.

Building response in 1989 Loma Prieta Earthquake: Unknown.

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:

Main Tower

- The shear walls are overstressed at in both directions per the Tier 1 Quick Check assessment. When checked using ASCE 7-10, the walls are overstressed in shear in the east-west direction.

- Discontinuous shear walls are located on Line 10 and Line 7.
- The shear walls are primarily located around stair and elevator cores. The floor diaphragms contain openings that match the wall lengths at these locations. The load transfer into these walls relies on the typical slab-to-wall connection as no collectors were provided.
- The building does not contain a secondary vertical load-carrying system. The slabs are supported by the walls and the walls typically do not contain embedded column reinforcing.
- The building columns are shear-controlled.

Administration Building

- There is no lateral resistance located on the north end of this structure and only one shear wall oriented in the east-west direction.
- The strip footings are located below the building walls. No lateral restraint is present in the direction perpendicular to the walls.
- The roof slab is located at different elevations.
- There is inadequate seismic separation between the Administration Building and the Main Tower.

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)	Y
Load path	N	Liquefaction	N
Adjacent buildings	Y	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]

The structure does not contain hazardous materials apart from some small portable cylinders of nitrogen and oxygen. Gas-fueled equipment is located in an off-site mechanical room to the north of the structure. A gas line in located adjacent to the west side of the structure, but it does not enter the building.

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[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.

UCOP nonstructural checklist item	Life safety hazard?	UCOP nonstructural 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	Small portable cylinders of oxygen and nitrogen were observed. These are not considered a life safety hazard.
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.	Natural gas is supplied to an exterior mechanical room and does not enter Building J.

Basis of Seismic Performance Level rating

The Main Tower of Building J is an eight-story rectangular structure constructed in 1948. It contains reinforced concrete slabs that are supported by load bearing reinforced concrete shear walls and minimal interior columns. The shear walls are primarily located around stair and elevator cores on the north side of the structure. As such, they are situated adjacent to openings in the slabs that match the length of the core walls. The load transfer in these locations relies on the typical slab-to-wall connection; no discrete collectors were provided. In addition, the walls over overstressed. In the north-south direction, the average shear stresses range between 42 psi to 153 psi. All stories located below the sixth floor exceed the ASCE 41-17 Tier 1 limit of 100 or 110 psi. In the east-west direction, the average stresses range from 65 psi to 242 psi. All stories located below the eighth floor exceed the ASCE 41-17 limit of 100 psi or 110 psi. The walls were subsequently checked using ASCE 7-10 and are overstressed in the north-south direction only (DCR = 1.15). Finally, two walls in the north-south direction are discontinuous below the second floor.

The walls also do not typically contain embedded column reinforcing and the structure does not have a secondary vertical load-carrying system. The provided columns are shear-controlled (with an induced shear demand / capacity = 3.16 when flexural hinges form at each end of the column) and contain minimal ¼” and 1/2'” diameter ties spaced at 12” o.c. with heavy 1”x 1” longitudinal reinforcing. Assuming a fixed-fixed end condition, the columns can drift approximately 1/8” before failing in shear.

The Administration Building is a one-story L-shaped reinforced concrete structure. Although the walls are not overstressed, they are poorly configured. The corridor that connects the Administration Building to the Main Tower contains one wall oriented in the north-south direction. It does not contain lateral support in the east-west direction at the north end of the structure. In addition, a construction joint was noted in the field at the interface of the Main Tower and the Administration Building. It does not appear to contain a separation gap between the two structures. Although no gap is present, it is expected that pounding damage would be minimal as the slabs of the two structures align.

The Main Building is assigned a Seismic Performance Level Rating of V because the Main Tower lacks sufficient shear capacity in both directions, contains non-ductile shear-controlled columns with no secondary vertical load-carrying components, contains discontinuous shear walls, and relies on the typical slab-to-wall connection to transfer forces into the walls adjacent to significant slab openings. The Administration Building is assigned a Seismic Performance Rating of V because of the lack of lateral resistance at its north end and the poorly located interior shear walls.

Recommendations for further evaluation or retrofit

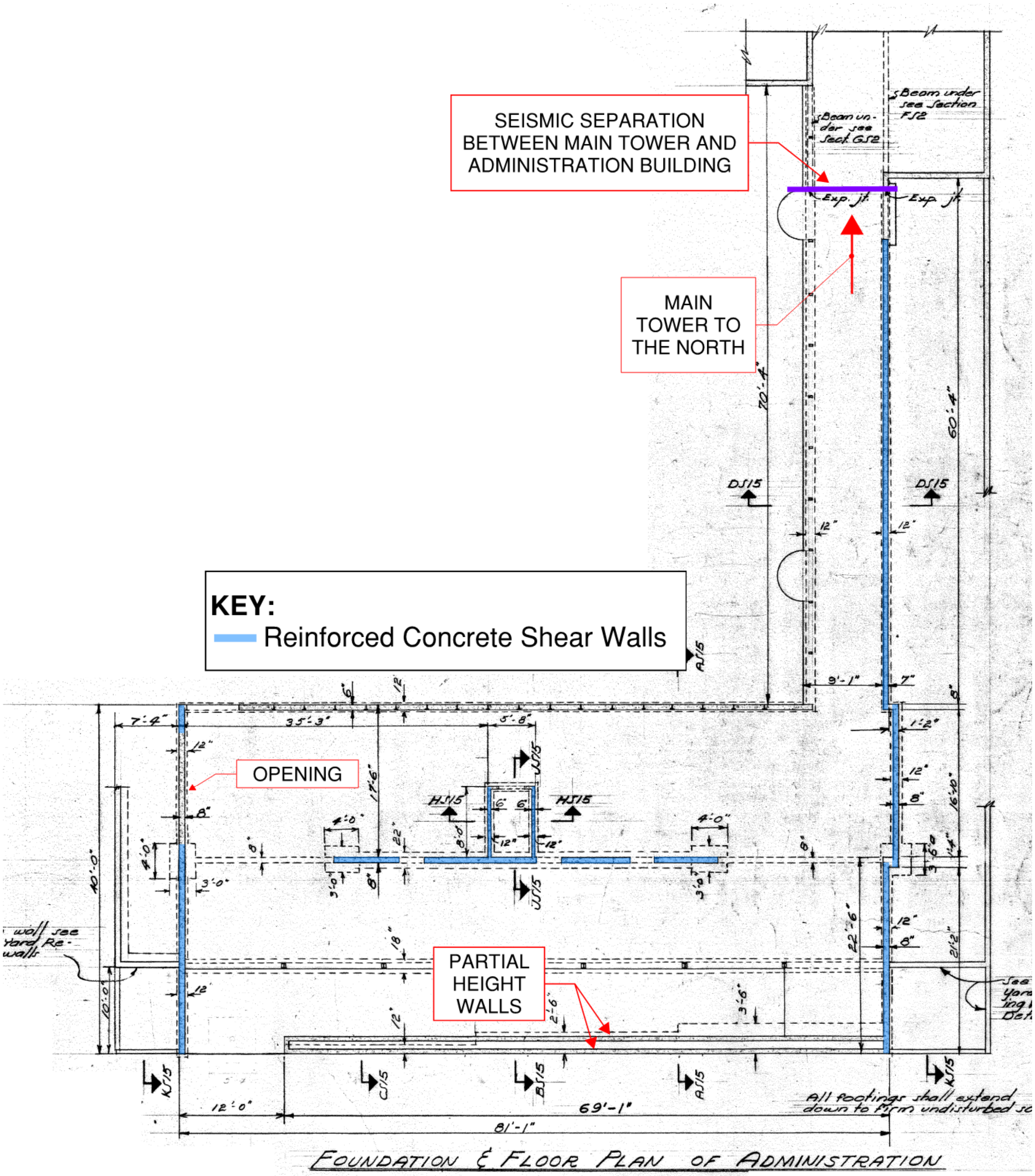
Further analysis is recommended using the ASCE 41-17 Tier 3 nonlinear methodology. A displacement-based approach would be beneficial to a stiff shear wall structure such as Building J. Prior to the evaluation, material testing should be performed to establish the strength of the concrete and its reinforcing.

Peer review comments on rating

The structural members of the UCSF Seismic Review Committee (SRC) reviewed the evaluation on 10 October 2019 and were unanimous that the Seismic Performance Level Rating is Level V and agreed that, if further evaluation is done, it should use an ASCE 41-17 Tier 3 nonlinear methodology.

Additional building data	**Entry**	**Notes**
Latitude	37.78546	
Longitude	-122.43926	
Are there other structures besides this one under the same CAAN#	No	
Number of stories above lowest perimeter grade	8	Not including 2 penthouse levels
Number of stories (basements) below lowest perimeter grade	0	
Building occupiable area (OGSF)	53,000	
Risk Category per 2016 CBC 1604.5	II	
Building structural height, h_n	87'-0" ft Main Tower 9'-8" Admin. Building	Structural height defined per ASCE 7-16 Section 11.2
Coefficient for period, C_t	0.020	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	0.57 sec Main Tower 0.11 sec Admin. Building	Estimated using ASCE 41-17 Equation 4-4 and 7-18. Use Main Tower for UCOP spreadsheet.
Site data		
975-year hazard parameters S_s, S_1	1.431g, 0.557g	UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards, Egan (2019)
Site class	D	UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards, Egan (2019)
Site class basis	Estimated	
Site parameters F_a, F_v	1.0, 1.743	UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards, Egan (2019)
Ground motion parameters S_{cs}, S_{c1}	1.431g, 0.971g	UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards, Egan (2019)
S_a at building period	1.43g Main Tower 1.43g Admin. Building	W = 10,419 k, V base = 14,909 k, Main Tower W = 518 k, V base = 1,038 k, Admin. Building
Site V_{s30}	308 m/s	UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards, Egan (2019)
V_{s30} basis	Estimated	
Liquefaction potential/basis	No	UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards, Egan (2019)
Landslide potential/basis	No	UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards, Egan (2019)

Active fault-rupture hazard identified at site?	No	UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards, Egan (2019)
Site-specific ground motion study?	No	
Applicable code		
Applicable code or approx. date of original construction	Built: 1948 Code: 1946 UBC	Applicable 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	C2 Concrete Shear Walls	
Model building type east-west	C2 Concrete Shear Walls	
FEMA P-154 score	N/A	Not applicable as an ASCE 41 Tier 1 evaluation was performed
Previous ratings		
Most recent rating	IV	
Date of most recent rating	2013	
2nd most recent rating	-	
Date of 2nd most recent rating	-	
3rd most recent rating	-	
Date of 3rd most recent rating	-	
Appendices		
ASCE 41 Tier 1 checklist included here?	Yes	Refer to attached checklist file


SEISMIC SEPARATION BETWEEN MAIN TOWER AND ADMINISTRATION BUILDING

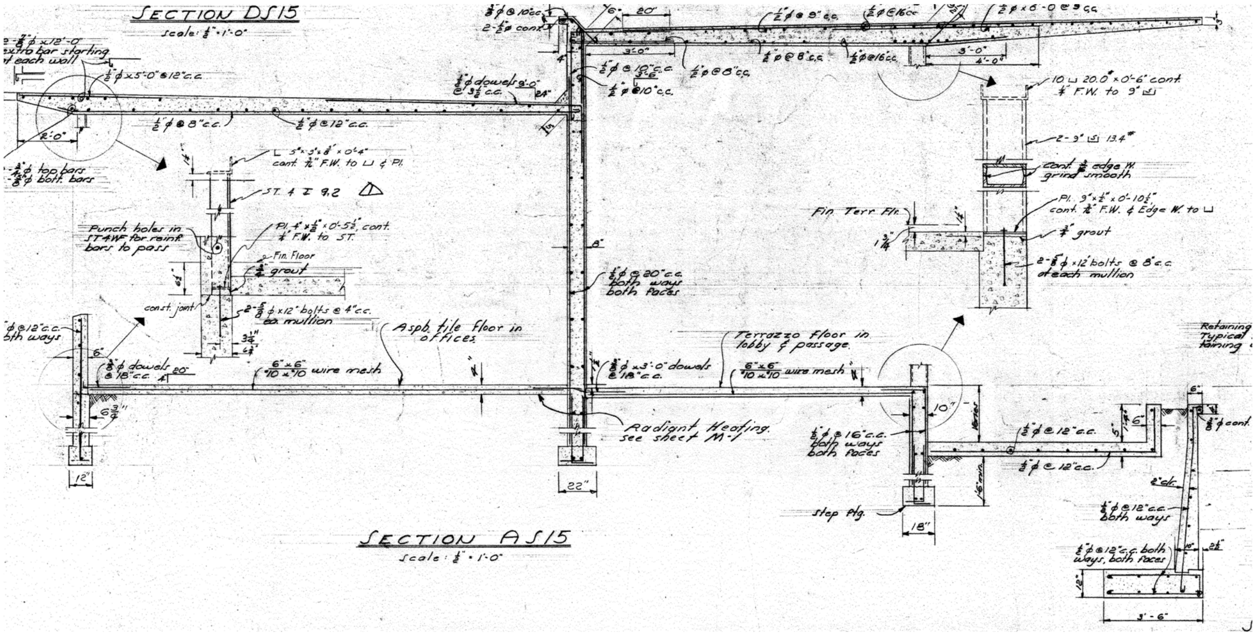
MAIN TOWER TO THE NORTH

KEY:
▬ Reinforced Concrete Shear Walls

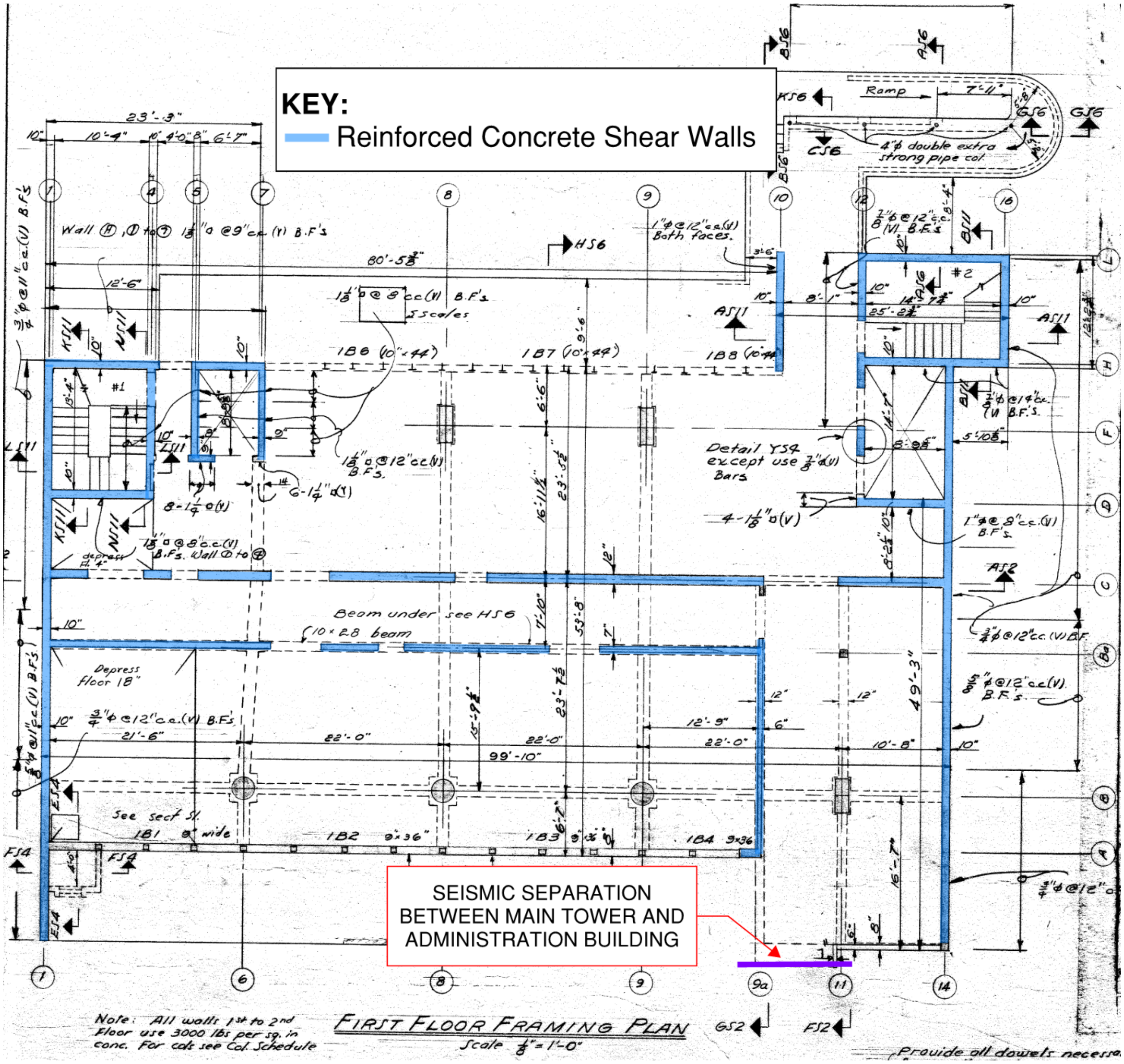
OPENING

PARTIAL HEIGHT WALLS

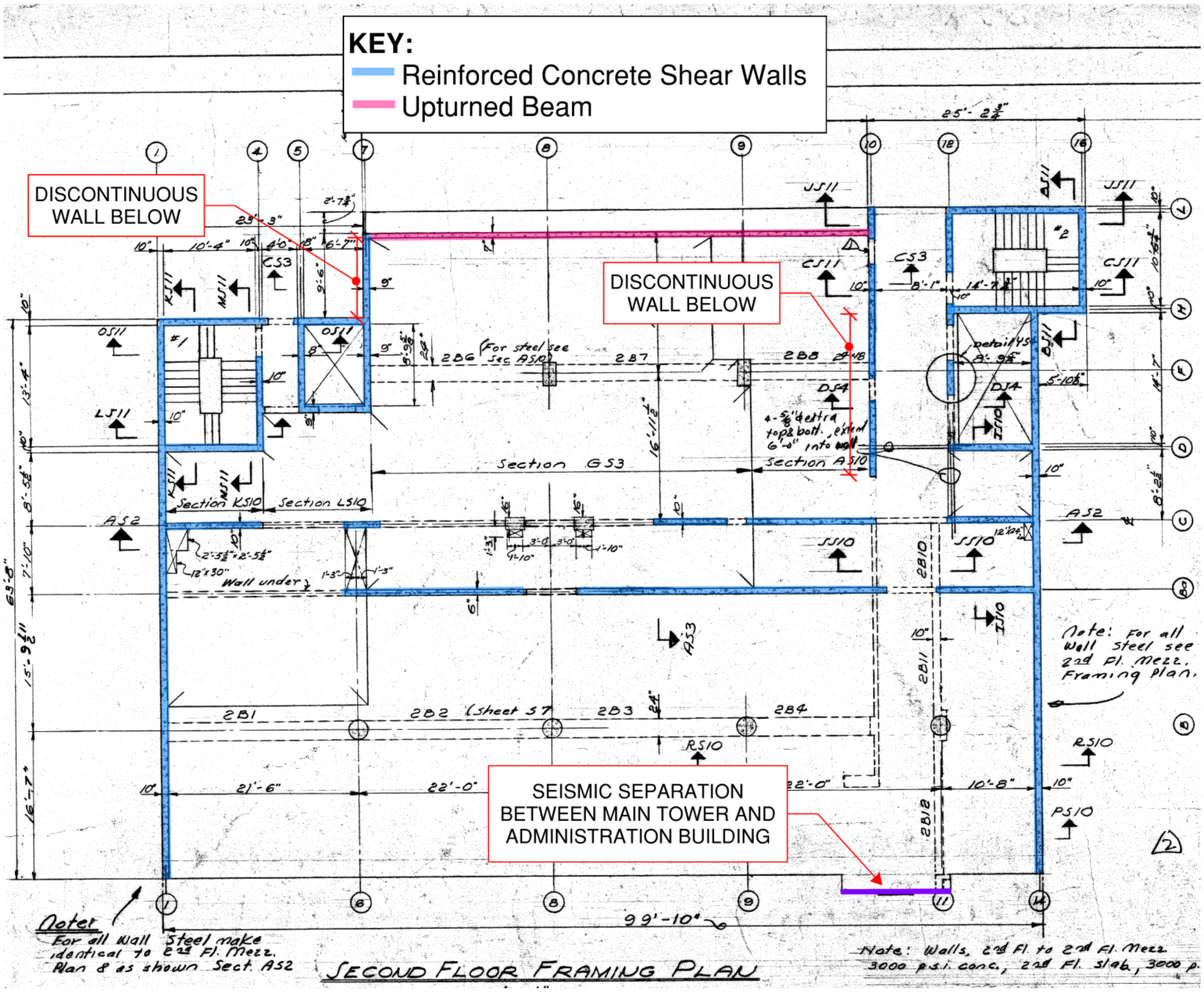
Lateral force-resisting system at the first floor (Administration Building)



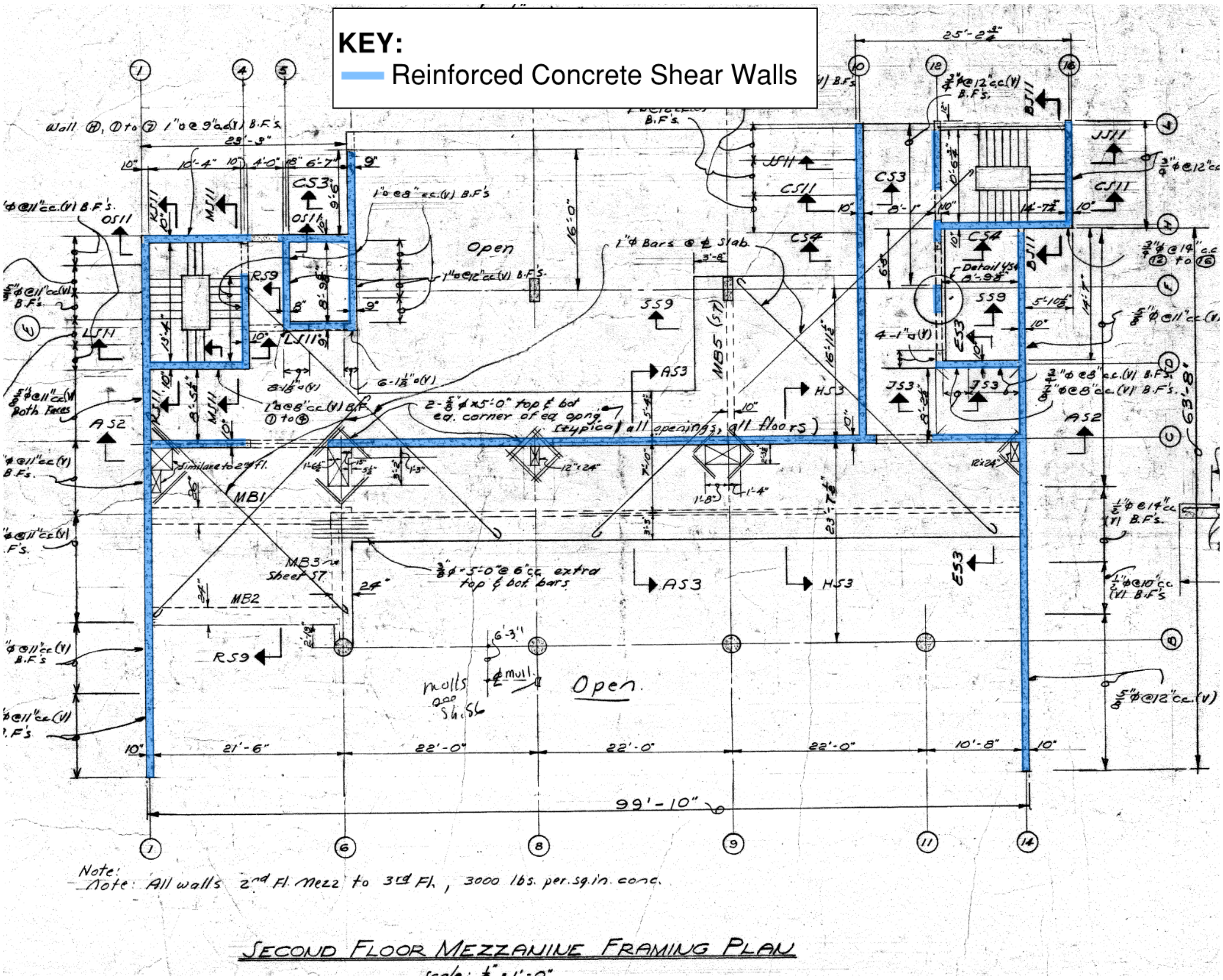
Section of the Administration Building in the north-south direction (looking east)



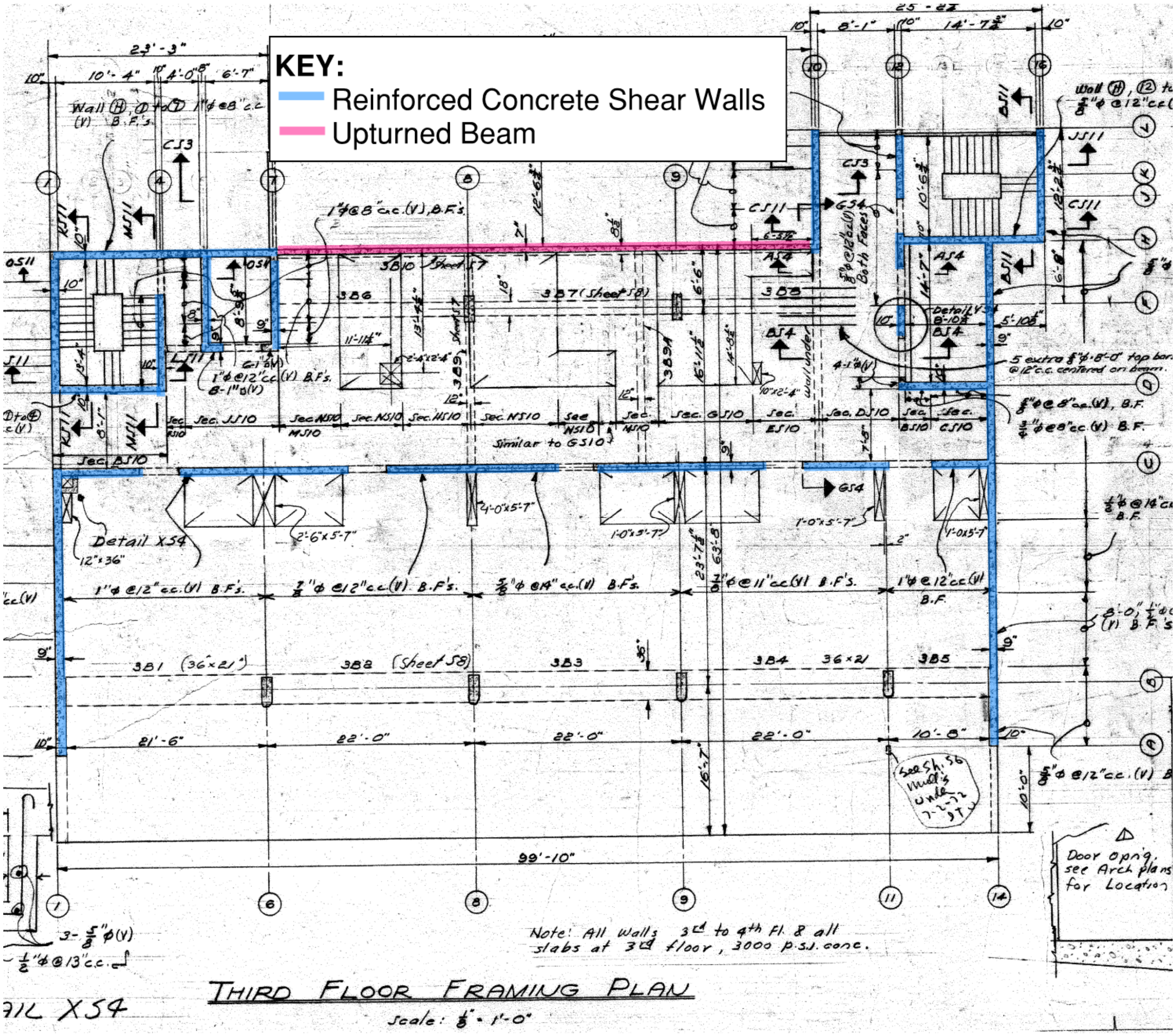
Lateral force-resisting system at the first floor (Main Tower)



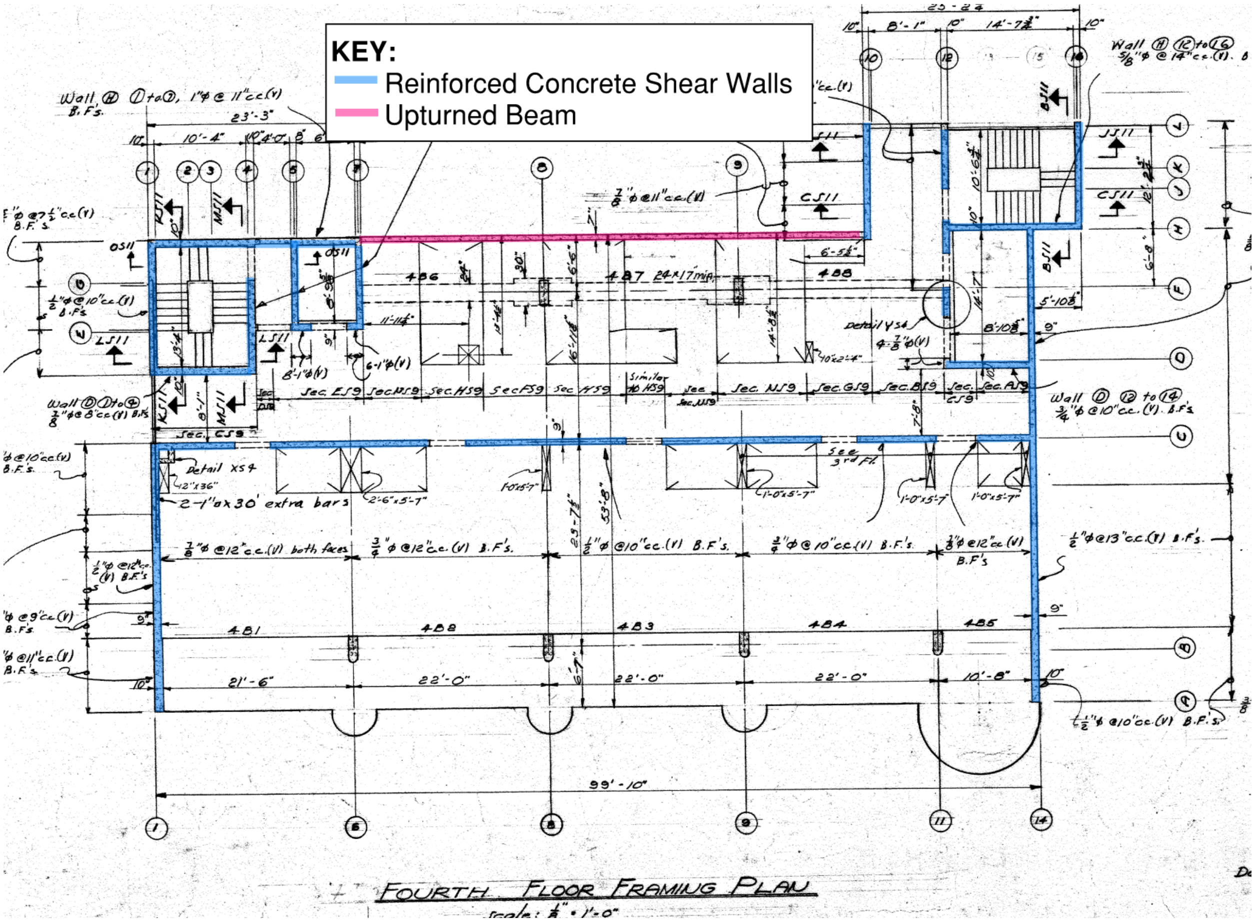
Lateral force-resisting system at the second floor (Main Tower)



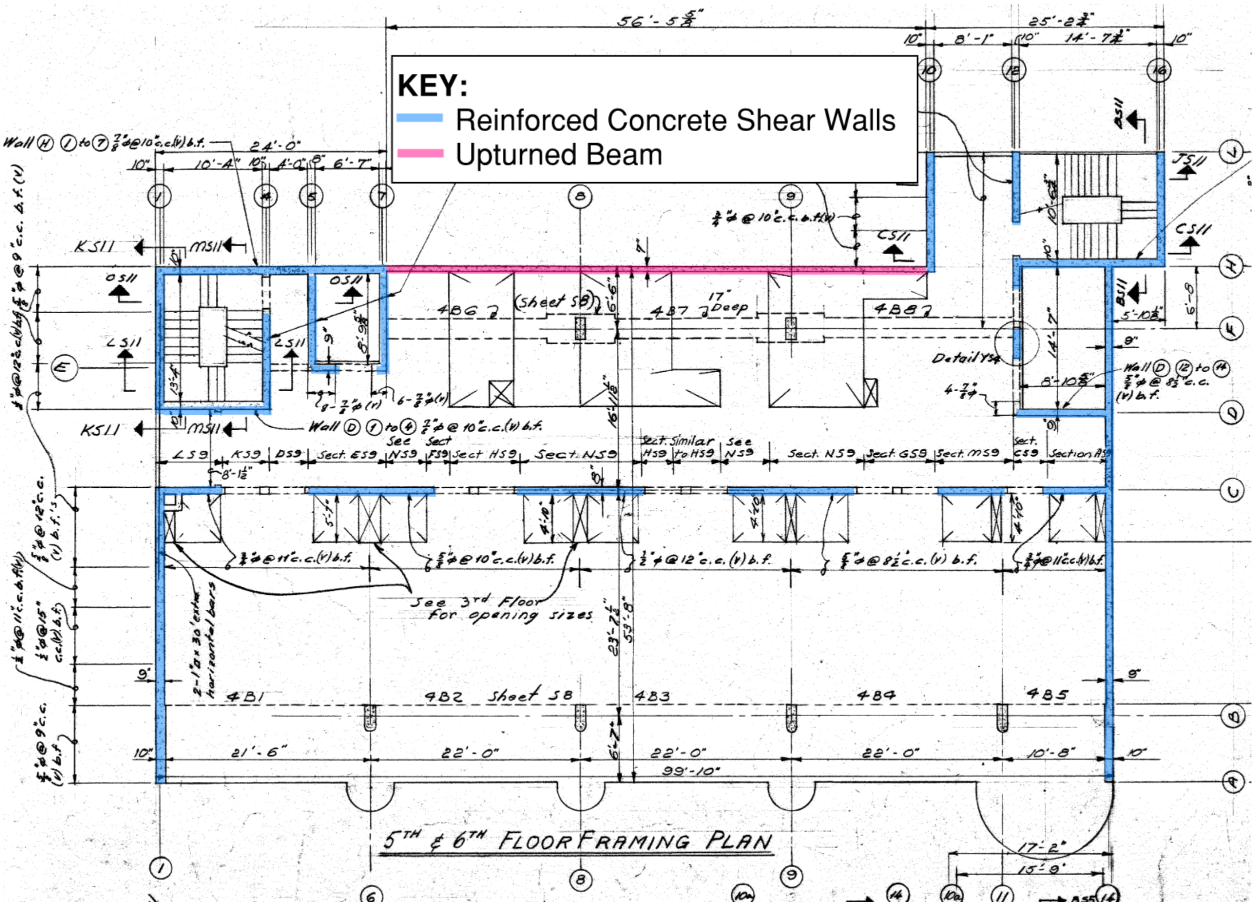
Lateral force-resisting system at the mezzanine (Main Tower)



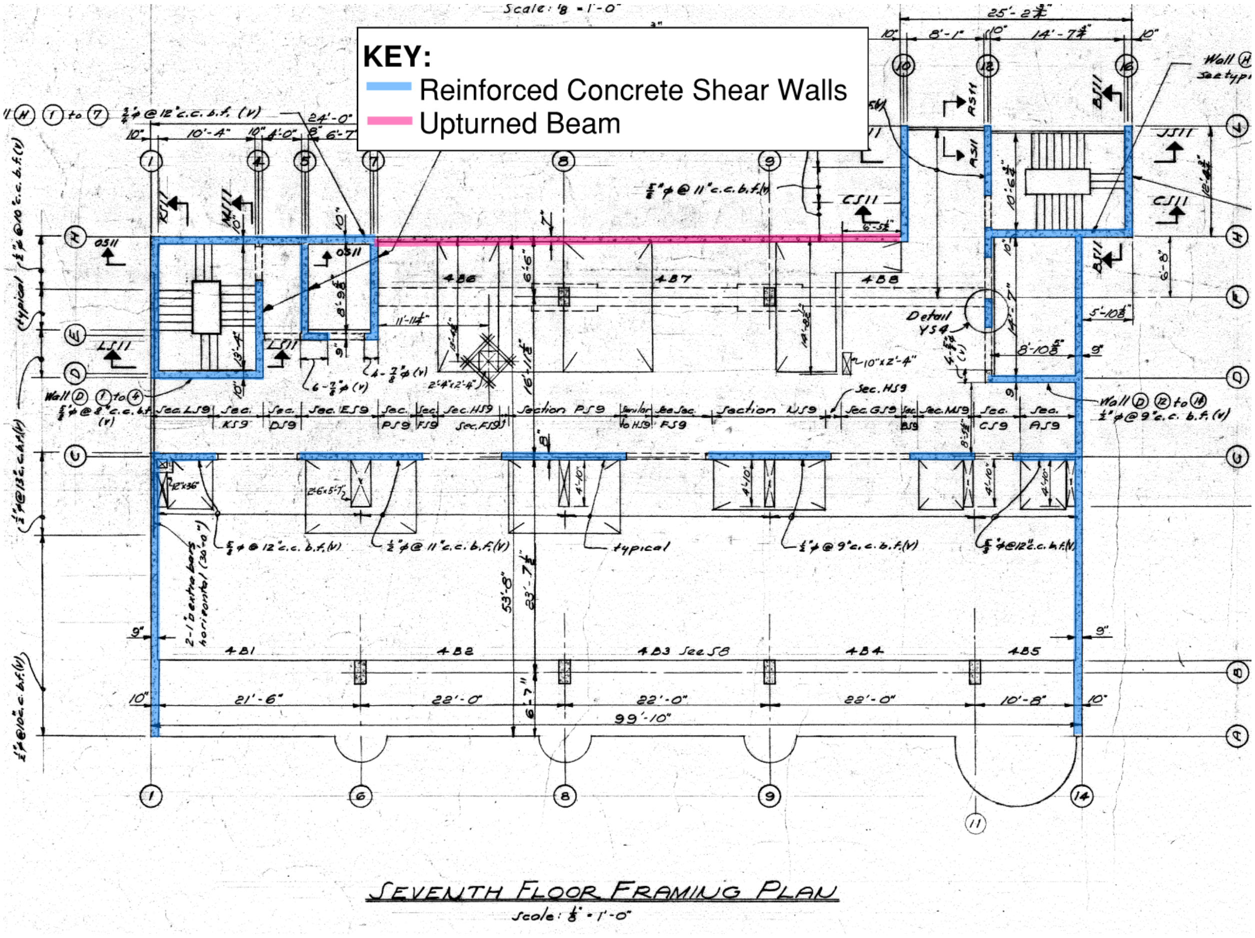
Lateral force-resisting system at the third floor (Main Tower)



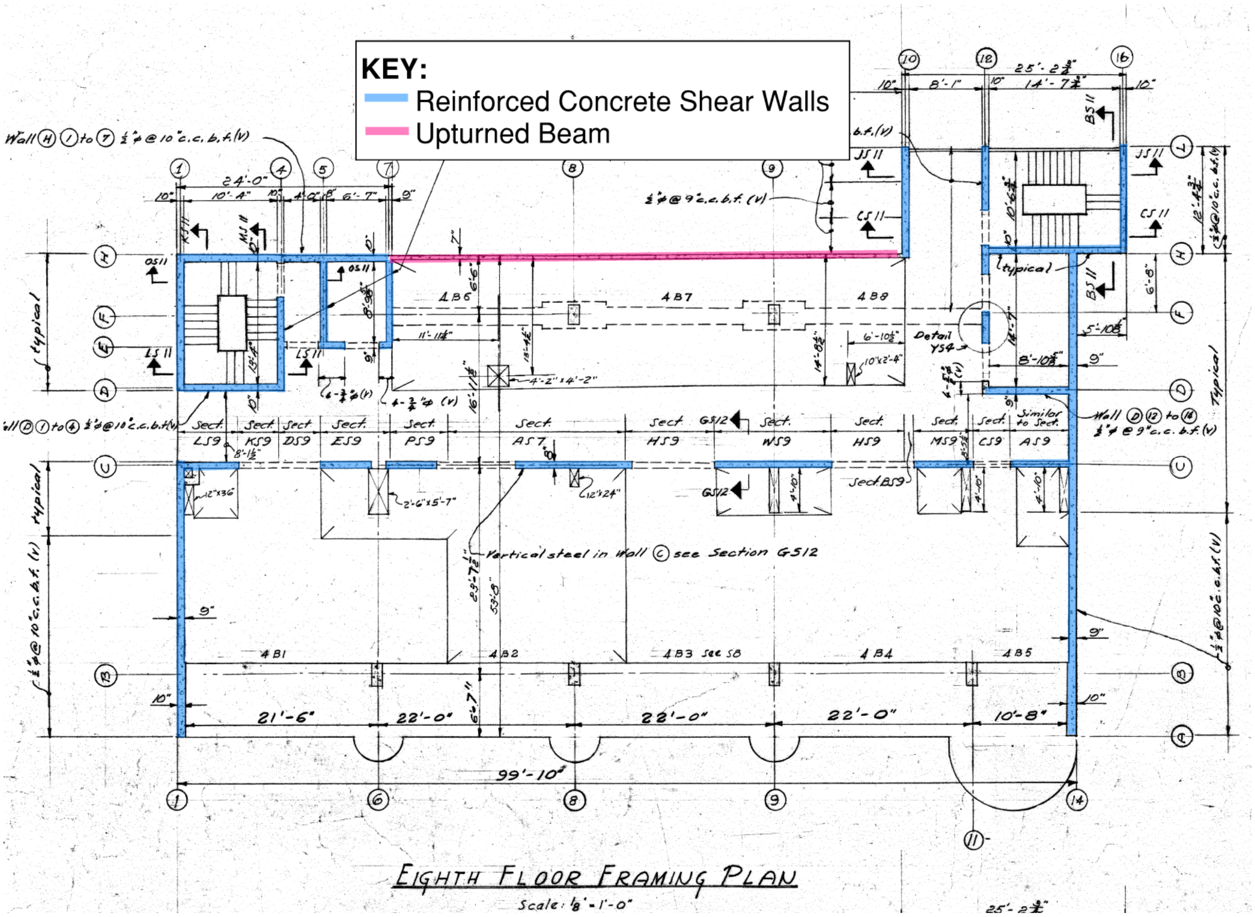
Lateral force-resisting system at the fourth floor (Main Tower)



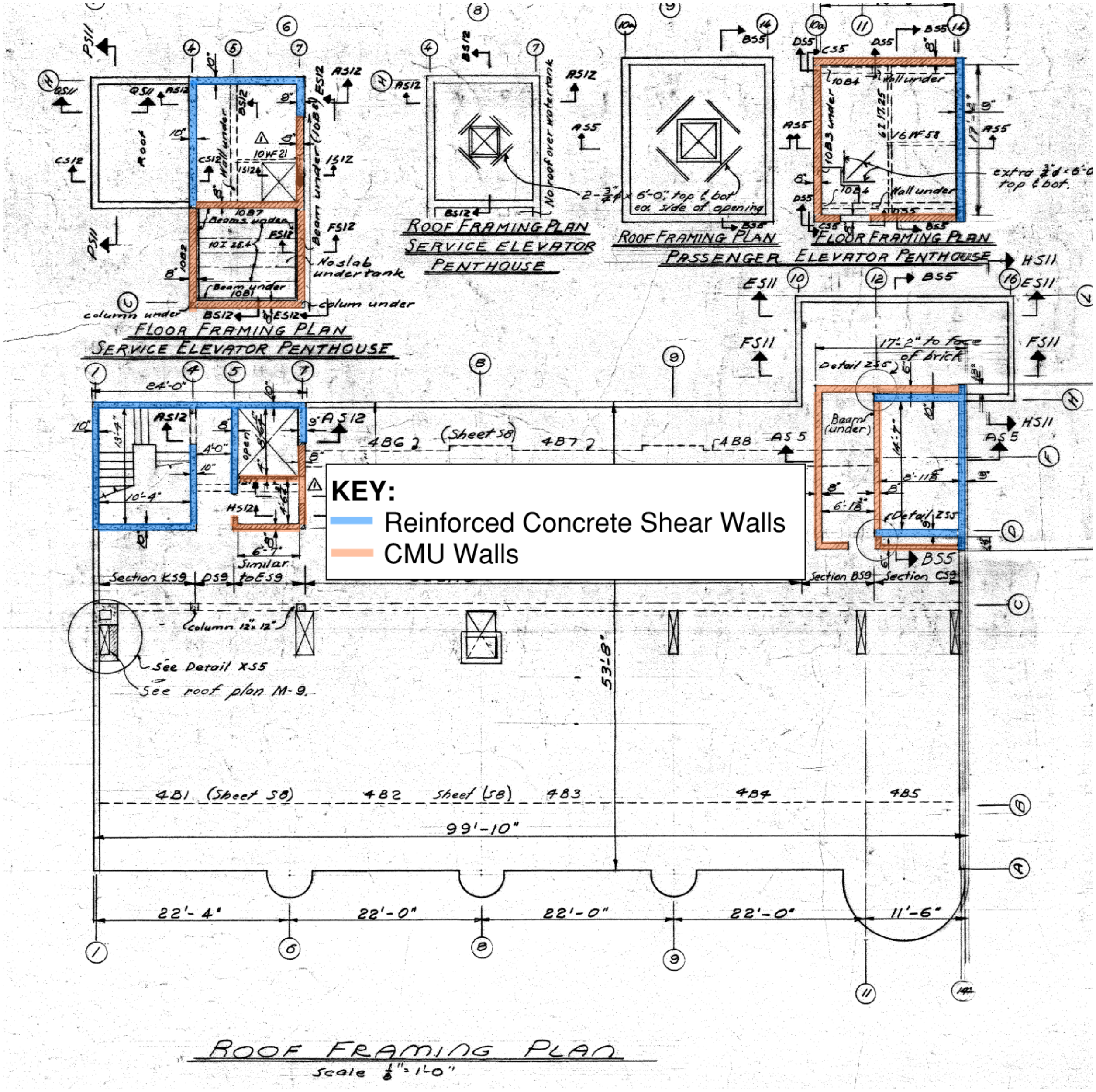
Lateral force-resisting system at the fifth and sixth floor (Main Tower)



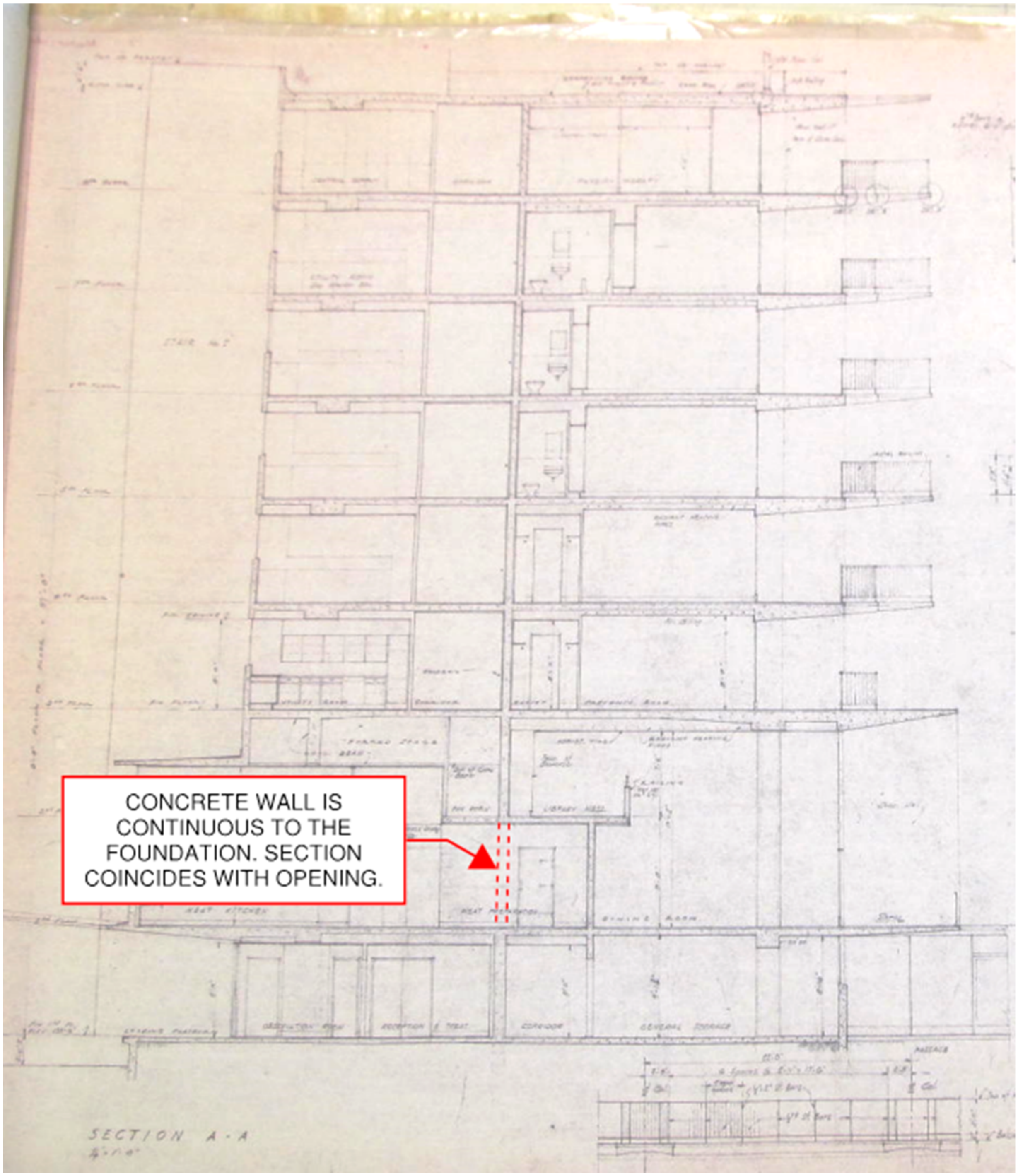
Lateral force-resisting system at the seventh floor (Main Tower)



Lateral force-resisting system at the eighth floor (Main Tower)



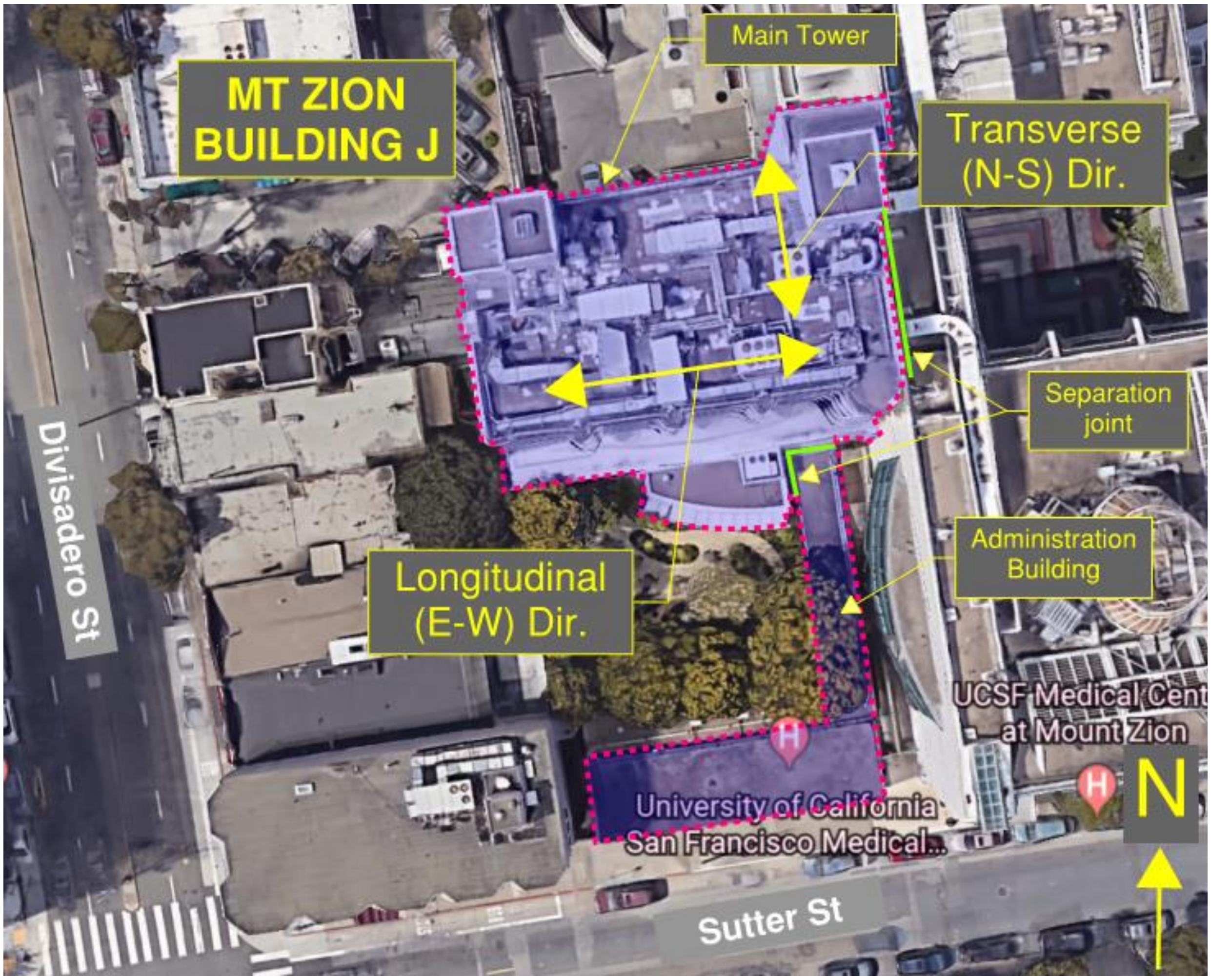
Lateral force-resisting system at the roof (Main Tower)



Building section of the Main Tower (looking east)

APPENDIX A

Additional Images



MT ZION BUILDING J
Main Tower
Transverse (N-S) Dir.
Separation joint
Administration Building
Longitudinal (E-W) Dir.
Divisadero St
Sutter St
UCSF Medical Cent at Mount Zion
University of California San Francisco Medical...
N

Plan

South elevation. Administration Building in the foreground and Main Tower in the background (looking north)

West elevation (looking southeast)

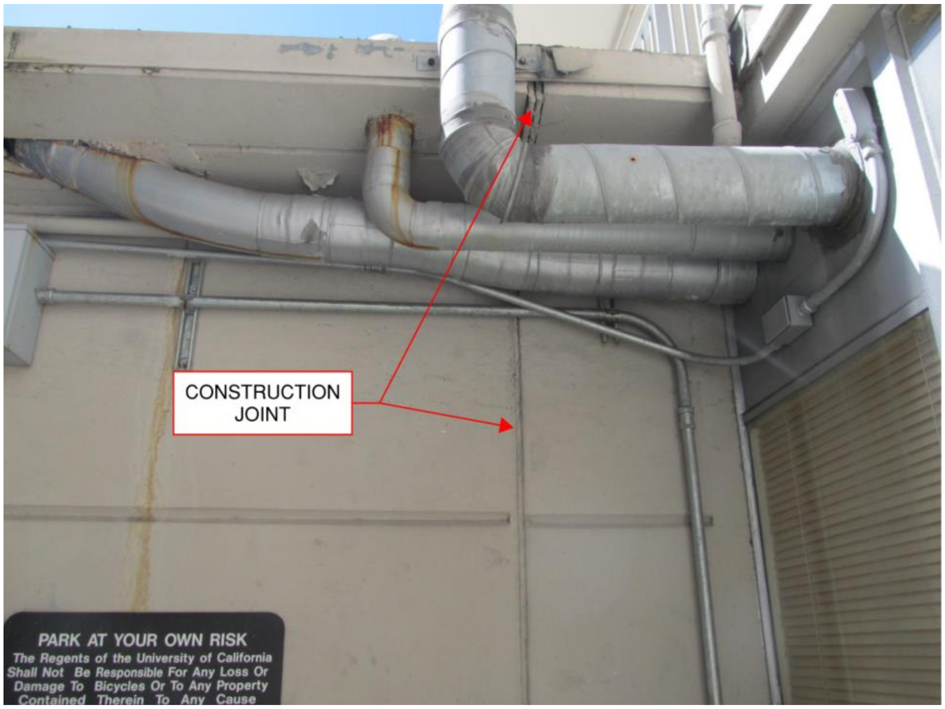
North elevation (looking south)

Discontinuous wall at north elevation (looking south)

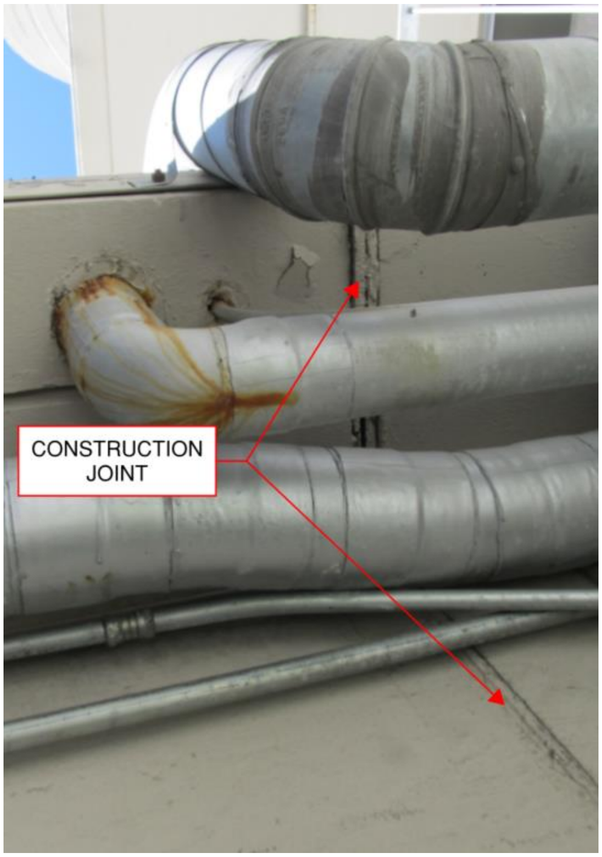
Seismic joint between Building J and the Cancer Research Building (looking southeast)

Central courtyard between the Administration Building and the Main Tower (looking west)

West elevation of the Administration Building (looking east)

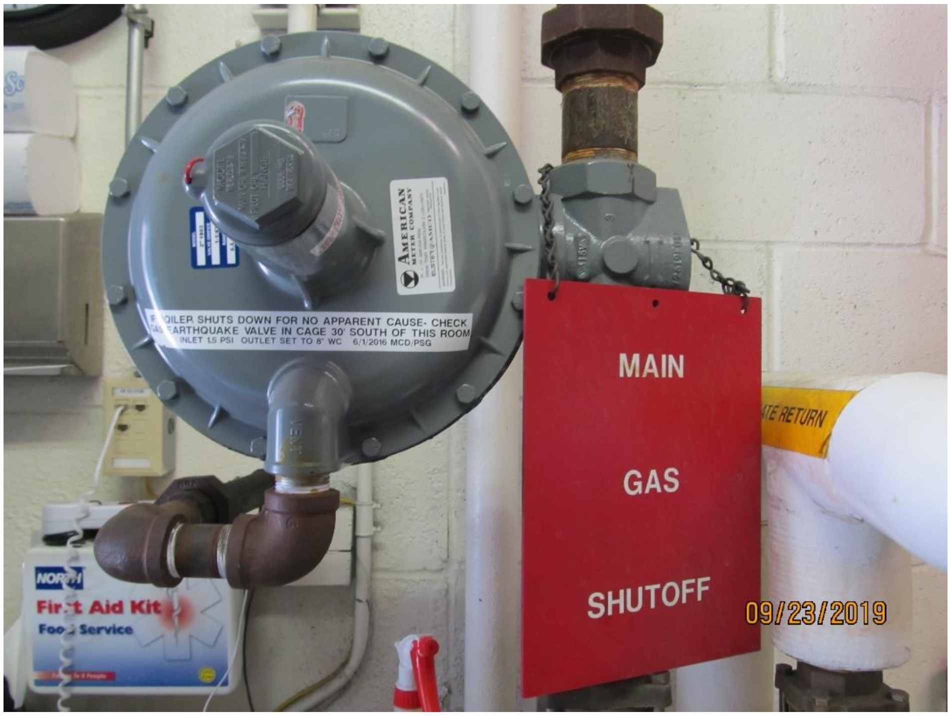


Construction joint between the Administration Building and the Main Tower (looking west)



Construction joint between the Administration Building and the Main Tower on the underside of the roof slab (looking up)

Exterior mechanical room with gas-fueled equipment (looking northwest)



Gas shut off in exterior mechanical room

Mechanical equipment at the Main Tower roof (looking west)

Tar-and-gravel roofing at the Administration Building
(looking southwest)

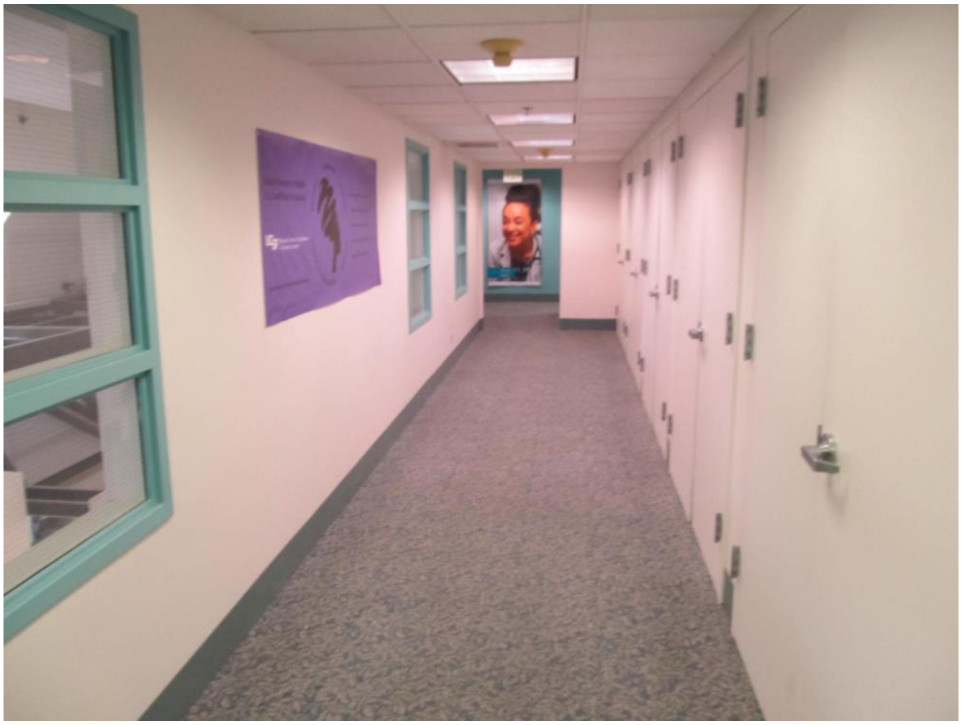
Corridor in the Administration Building leading to the Main Tower.
The primary shear wall is on the right (looking north)

Corridor in the Administration Building. The concrete shear wall is on the left (looking west)

Typical patient waiting room in the Main Tower (looking northwest)

Two-story tall concrete columns at the second floor of the Main Tower (looking southwest)

CMU walls above at elevator penthouse



Hallway at mezzanine (looking west)

Mechanical room at the first floor (looking northwest)

Typical MEP hung from the underside of the slab

Covered balcony at second floor (looking west)

Cafeteria at first floor (looking north)

APPENDIX B

ASCE 41-17 Tier 1 Checklists (Structural)

UC Campus:	**San Francisco**			Date:	**10/10/2019**		
Building CAAN:	**2031**	Auxiliary CAAN:		By Firm:	**RUTHERFORD + CHEKENE**		
Building Name:	**UCSF Mt. Zion Building J**			Initials:	**EGM**	Checked:	**BL**
Building Address:	**2356 Sutter St, San Francisco, CA 94115**			Page:	**1**	of	**4**

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

	Description
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. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1) **Comments:** In the Main Tower, concrete flat slabs function as floor diaphragms and deliver load to concrete shear walls. The foundations consist of isolated and strip footings aligned with columns and walls, respectively. In the Administration Building, concrete flat slabs function as floor diaphragms and deliver load to concrete shear walls. The foundations consist of strip footings aligned with the walls.
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. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2) **Comments:** The eight-story tall main tower is located to the north of the one-story tall Administration Building. A seismic gap between these two structures is not shown on the structural drawings; however, a construction joint (without any gap) was observed in the field. The Main Tower is located to the west of the Cancer Research Center. The construction type and height of this building is unknown, as is the width of the seismic separation between the two buildings.
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. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3) **Comments:** In the Main Tower, a C-shaped mezzanine is located between the second and third floor. It is connected to shear walls on all sides. There is no mezzanine in the Administration Building.

BUILDING SYSTEMS - *BUILDING CONFIGURATION*

	Description
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. (Commentary: Sec. A2.2.2. Tier 2: Sec. 5.4.2.1) **Comments:** In the Main Tower, the structural shear wall area remains the same or increases from the roof down to the first floor. The Administration Building is a one-story structure; this check is not applicable.

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

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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. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)

Comments: In the Main Tower, the structural shear wall area remains the same or increases from the roof down to the first floor. The story heights are uniform from the roof down to the first floor.

The Administration Building is a one-story structure; this check is not applicable.

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: In the Main Tower, a portion of the shear wall located on Grid 10 is discontinuous below the second floor. The wall located on Grid 7 is discontinuous below the second floor.

The Administration Building is a one-story structure; this check is not applicable.

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. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)

Comments: In the Main Tower, the overall dimension of the seismic force-resisting system does not change significantly between stories.

The Administration Building is a one-story structure; this check is not applicable.

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. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)

Comments: In the Main Tower, the mass does not change significantly from floor to floor.

The Administration Building is a one-story structure; this check is not applicable.

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. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)

Comments: In the Main Tower, the northeast stair tower is situated north of the typical slab edge. This mass will shift the center of mass to the north. However, it is not expected to result in a 20% offset between the center of mass and the center of rigidity.

The Administration Building is a L-Shaped building that contains no wall on its north end and the majority of the walls are located near its south end. As such, the center of rigidity will shift to the south. However, the majority of the structure mass is also located to the south, and it is not expected that the center or mass and center of rigidity will be offset by 20%.

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

GEOLOGIC SITE HAZARD

	Description
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 (15.2m) under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1) **Comments:** Per "Table 1 - UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards" by Egan (2019), the site is not susceptible to liquefaction.
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. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1) **Comments:** Per "Table 1 - UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards" by Egan (2019), the site is not susceptible to slope failure.
C NC N/A U ● ○ ○ ○	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 "Table 1 - UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards" by Egan (2019), the site is not susceptible to surface fault rupture.

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

FOUNDATION CONFIGURATION

	Description
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. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3) **Comments:** The width of the Main Tower is B = 63’-8” and the height is H = 87’-0”. B/H = 0.73 Sa = 1.43g for at BSE-2E 0.6x Sa = 0.87 B/H < 0.6 Sa. The width of the Administration Building is B = 60’-4” and the height is H = 9’-8”. B/H = 6.23 Sa = 1.43g for at BSE-2E 0.6x Sa = 0.87 B/H > 0.6 Sa.
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. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4) **Comments:** Per “Table 1 - UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards” by Egan (2019), the soil is classified as Site Class D. In the Main Tower, the foundation consists of spread footings that are interconnected by a grid of 4’-10” tall reinforced concrete stem walls. In the Administration Building, the foundations consist of strip footings below the walls. These footings are not restrained in the direction perpendicular to the walls.

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Collapse Prevention Structural Checklist For Building Type C2-C2A

Low And Moderate Seismicity

Seismic-Force-Resisting System

	Description
C NC N/A U ○ ● ○ ○	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1) **Comments:** In the Main Tower, the building has interior gravity columns; however, the walls do not have embedded column reinforcing. In the Administration Building, the slab is supported by concrete walls. The walls do not contain embedded column reinforcing.
C NC N/A U ○ ● ○ ○	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:** In the Main Tower, at the first floor, there are 5 lines of walls in the E-W direction and 8 lines of walls in the N-S direction. At the eighth floor, there are 3 lines of walls in the E-W direction and 8 lines of walls in the N-S direction. In the Administration Building, there is only 1 line of wall in the E-W direction, and 2 lines of walls in the N-S direction.
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 $2\sqrt{f'_c}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1) **Comments:** In the Main Tower, the calculated wall stresses exceed the ASCE 41 limit of 100 psi for f'c = 2,500 psi at the stories between the first and fourth floor, and the limit 110 psi for f'c = 3,000 psi at the stories between the fourth and seventh floor. The average shear stresses in the longitudinal (E-W) direction are 133 psi (first floor to second floor), 242 psi (second floor to third floor), 191 psi (third floor fourth floor), 172 psi (fourth floor to fifth floor), 180 psi (fifth floor to sixth floor), 147 psi (sixth floor to seventh floor), 109 psi (seventh floor to eighth floor), and 65 psi (eighth floor to roof). The average shear stresses in the transverse (N-S) direction are 147 psi (first floor to second floor), 124 psi (second floor to third floor), 153 psi (third floor fourth floor), 139 psi (fourth floor to fifth floor), 120 psi (fifth floor to sixth floor), 98 psi (sixth floor to seventh floor), 72 psi (seventh floor to eighth floor), and 42 psi (eighth floor to roof). Walls are also overstressed when checked using ASCE 7-10. In the Administration Building, the calculated wall stresses are below the ASCE 41 limit of 100 psi for f'c = 2,500 psi at all stories. The average shear stress in the longitudinal (E-W) direction is 68 psi (first floor to roof). The average shear stress in the transverse (N-S) direction is 19 psi (first floor to roof).

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Collapse Prevention Structural Checklist For Building Type C2-C2A

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. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)

Comments: Typical wall steel schedule is specified on Sheet S13 in the 1948 structural drawings. All the reinforcement ratios are greater than the 0.0012 and 0.0020 limits.

Wall Thickness (in)	Wall Reinforcing	Reinforcement ratio, ρ
6	#4 @ 13" o.c., e.w.	0.00256
7	#3 @ 8" o.c., e.w., e.f.	0.00393
8	#3 @ 11" o.c., e.w., e.f.	0.00250
9	#3 @ 10" o.c., e.w., e.f.	0.00244
10	#4 @ 15" o.c., e.w., e.f.	0.00267
12	#4 @ 13" o.c., e.w., e.f.	0.00256
14	#5 @ 11.5" o.c., e.w., e.f.	0.00248

These wall reinforcing is applicable for the Main Tower and the Administration Building.

Connections

Description

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. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)

Comments: The building has rigid diaphragms in the Main Tower and the Administration Building.

C NC N/A U
● ○ ○ ○

TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)

Comments: In the Main Tower, the beam and slab details on Sheets S7 to S10 show the longitudinal bars in the slab hooked at the back of the concrete walls.

In the Administration Building, Sheets S14 and S15 show the longitudinal bars in the slab hooked at the back of the concrete walls.

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. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)

Comments: Section DS1 on Sheet S1 in 1948 drawings specify dowels with the same spacing and size as vertical wall reinforcing. This detail is applicable to the Main Tower and the Administration Building.

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Collapse Prevention Structural Checklist For Building Type C2-C2A

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

Seismic-Force-Resisting System

	Description
C NC N/A U ○ ● ○ ○	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2) **Comments:** In the Main Tower, the typical interior gravity columns are shear-controlled at all stories. They typically contain minimal ties (¼" diameter bars) spaced at 12" o.c. and have heavy longitudinal reinforcing (18 -1" square bars). In the Administration Building, this check is not applicable as the building does not contain gravity columns.
C NC N/A U ○ ○ ● ○	FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3) **Comments:** In the Main Tower, the beams are located at the column lines oriented in one direction. The slabs are not supported directly by the columns. In the Administration Building, a steel beam is located at the underside of the slab and spans between steel columns.
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. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1) **Comments:** In the Main Tower, the walls are often punched for window openings and the ends of the walls do not contain embedded columns. In the Administration Building, there are no coupling beams.

Diaphragms (Stiff Or Flexible)

	Description
C NC N/A U ○ ● ○ ○	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:** In the Main Tower, there are no split-level diaphragms. In the Administration Building, per Section AS15 in the 1948 drawings, the roof slab is located at different elevations.

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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. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3) **Comments:** In the Main Tower, the stair and elevator openings on the northwest and northeast corners of the building have the same dimensions as the shear walls. In the Administration Building, there are no openings.

Flexible Diaphragms

	Description
C NC N/A U ○ ○ ● ○	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2) **Comments:** The building has rigid diaphragms in the Main Tower and the Administration Building.
C NC N/A U ○ ○ ● ○	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:** The building has rigid diaphragms in the Main Tower and the Administration Building.
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. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2) **Comments:** The building has rigid diaphragms in the Main Tower and the Administration Building.
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. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2) **Comments:** The building has rigid diaphragms in the Main Tower and the Administration Building.
C NC N/A U ○ ○ ● ○	OTHER DIAPHRAGMS: 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:** The building has rigid diaphragms in the Main Tower and the Administration Building.

Connections

	Description
C NC N/A U ○ ○ ● ○	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5) **Comments:** In the Main Tower and the Administration Building, the building has spread footings and strip footings.

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APPENDIX C

UCOP Seismic Safety Policy Falling Hazards Assessment Summary

UC Campus:	**San Francisco**			Date:	**10/10/2019**		
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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.
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:** Lab spaces contain small portable canisters of oxygen and nitrogen. These are not considered a falling hazard.
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:** A gas supplied emergency generator and boiler are located in an exterior mechanical room located to the north of the structure. The gas supply contains a shut-off inside the mechanical room and in a service yard adjacent to Building J. The gas line does not enter Building J.
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

APPENDIX D

Quick Check Calculations

Flat Load Tables - Main Tower

	Seismic Weight	Dead Load	
HIGH ROOF	**psf**	**psf**	**Remarks**
Roofing, waterproofing, and insulation	10	10	
Slab	81	81	6.5" NWC slab
Beams/girders	0	0	Concrete beams below slab
MEP	3	3	MEP hung from underside of roof slab
Lighting and misc.	2	2	Lighting and misc. hung from underside of roof slab
Columns	0	0	
Partitions	0	0	
Total	96	96	

1 - The flat load is a reinforced concrete slab assembly that takes place above the passenger elevator and service elevator between Grids C-H/1-7 and H-L/10.a-14.

2 - Per Det. AS5 & BS5, concrete slab is typically 6.5" for roof above passenger elevator and service elevator.

3 - The concrete slab is directly supported by concrete walls. No columns extend to the roof.

	Seismic Weight	Dead Load	
ROOF - 5.5" THICK SLAB	**psf**	**psf**	**Remarks**
Mechanical equipment	25	50	Estimated equipment weight
Concrete pads	10	10	4"-high NWC pads below heavy mechanical equipment
Roofing, waterproofing, and insulation	10	10	
Slab	69	69	5.5" NWC slab
Beams/girders	8	8	Concrete beams below slab
MEP	7	7	MEP hung from underside of roof slab
Ceiling, lighting and misc.	5	5	Lay-in ceiling, lighting, and misc. hung from underside of roof slab
Columns	1	0	Reinforced concrete columns
Partitions	5	0	
Total	140	159	

1 - The flat load is a reinforced concrete slab assembly that takes place at the roof between Grids C-L/1-16.

2 - 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.

3 - Per Det. BS9, CS9 & FS9, concrete slab is typically 5.5" between Grids C-H.

4 - Concrete pads are assumed to be distributed on 25% of the total roof area.

5 - Flat load includes weight of (2) 15"x24" concrete columns below roof in a 2,626 ft^2 area. Column trib. height is 4'-10".

	Seismic Weight	Dead Load	
ROOF - 7" THICK SLAB	**psf**	**psf**	**Remarks**
Mechanical equipment	25	50	Estimated equipment weight
Concrete pads	10	10	4"-high NWC pads below heavy mechanical equipment
Roofing, waterproofing, and insulation	10	10	
Slab	88	88	7" NWC slab
Beams/girders	0	0	Concrete beams below slab
MEP	7	7	MEP hung from underside of roof slab
Ceiling, lighting and misc.	5	5	Lay-in ceiling, lighting, and misc. hung from underside of roof slab
Columns	3	0	Reinforced concrete columns
Partitions	5	0	
Total	153	170	

1 - The flat load is a reinforced concrete slab assembly that takes place at the roof between Grids B-C/1-14.

2 - 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.

3 - Per Det. BS9, CS9 & FS9, concrete slab is typically 7" between Grids B-C.

4 - Beams on Grid B are completely embedded in concrete slab. Slab is also supported by exterior walls.

5 - Concrete pads are assumed to be distributed on 25% of the total roof area.

6 - Flat load includes weight of (3) 15"x36" and (1) 15"x30" concrete columns below roof in a 3,128 ft^2 area. Column trib. height is 4'-10".

	Seismic Weight	Dead Load	
ROOF - BALCONY	**psf**	**psf**	**Remarks**
Mechanical equipment	25	50	Estimated equipment weight
Concrete pads	10	10	4"-high NWC pads below heavy mechanical equipment
Roofing, waterproofing, and insulation	10	10	
Slab	150	150	NWC slab
Beams/girders	0	0	Concrete beams below slab
MEP	7	7	MEP hung from underside of roof slab
Ceiling, lighting and misc.	5	5	Lay-in ceiling, lighting, and misc. hung from underside of roof slab
Columns	3	0	Reinforced concrete columns
Partitions	5	0	
Total	215	232	

1 - The flat load is a reinforced concrete slab assembly that takes place at the roof between Grids A-B/1-14.

2 - 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.

3 - Per Det. BS9 & FS9, concrete slab thickness varies from 19" to ±9". An homogeneous thickness of 12" is adequate to represent this area.

4 - The slab corresponding to the semicircle areas in plan view have a reduced thickness. Per Det. CS9, the slab on the southeast corner is 2" thick. However, this region is small and is considered under this flat load table for simplicity.

5 - Beams on Grid B are completely embedded in concrete slab. Slab is also supported by exterior walls.

6 - Concrete pads are assumed to be distributed on 25% of the total roof area.

7 - Flat load includes weight of (3) 15"x36" and (1) 15"x30" concrete columns below roof in a 3,128 ft^2 area. Column trib. height is 4'-10".

	Seismic Weight	Dead Load	
TYPICAL FLOOR - 5.5" THICK SLAB	**psf**	**psf**	**Remarks**
Flooring	5	5	Carpet and vinyl composition tiles
Slab	69	69	5.5" NWC slab
Beams/girders	8	8	Concrete beams below slab
MEP	7	7	MEP hung from underside of floor slab
Ceiling, lighting and misc.	5	5	Lay-in ceiling, lighting, and misc. hung from underside of floor slat
Columns	4	0	Reinforced concrete columns
Partitions	10	10	
Total	108	104	

1 - The flat load is a reinforced concrete slab assembly that takes place between Grids B-L/1-16 at second floor, and between C-L/1-16 from mezzanine to eighth floor.

2 - Per Det. BS9, CS9 & FS9, concrete slab is typically 5.5" between Grids C-H.

5 - Flat load includes weight of (1) 16"x40" and (1) 16"x36" concrete columns below and (2) 16"x30" concrete columns above floor in a 2,626 ft^2 area. Column trib. height is 9'-8".

	Seismic Weight	Dead Load	
TYPICAL FLOOR - 7" THICK SLAB	**psf**	**psf**	**Remarks**
Flooring	5	5	Carpet and vinyl composition tiles
Slab	88	88	7" NWC slab
Beams/girders	0	0	Concrete beams below slab
MEP	7	7	MEP hung from underside of floor slab
Ceiling, lighting and misc.	5	5	Lay-in ceiling, lighting, and misc. hung from underside of floor slat
Columns	7	0	Reinforced concrete columns
Partitions	10	10	
Total	121	115	

1 - The flat load is a reinforced concrete slab assembly that takes place between Grids B-C/1-14 from third floor to eighth floor.

2 - Per Det. BS9, CS9 & FS9, concrete slab is typically 7" between Grids B-C.

3 - The beams on Grid B are completely embedded in concrete slab. Slab is also supported by exterior walls.

4 - Flat load includes weight of (4) 15"x36" concrete columns below and (3) 15"x36" and (1) 15"x30" concrete columns above floor in a 3,128 ft^2 area. Column trib. height is 9'-8".

	Seismic Weight	Dead Load	
TYPICAL FLOOR - BALCONY	**psf**	**psf**	**Remarks**
Flooring	5	5	Carpet and vinyl composition tiles
Slab	150	150	NWC slab
Beams/girders	0	0	Concrete beams below slab
MEP	7	7	MEP hung from underside of floor slab
Ceiling, lighting and misc.	5	5	Lay-in ceiling, lighting, and misc. hung from underside of floor slat
Columns	7	0	Reinforced concrete columns
Partitions	10	10	
Total	184	177	

1 - The flat load is a reinforced concrete slab assembly that takes place between Grids A-B/1-14 from third floor to eighth floor.

2 - Per Det. BS9 & FS9, concrete slab thickness varies from 19" to ±9". An homogeneous thickness of 12" is adequate to represent this area.

3 - The slab corresponding to the semicircle areas in plan view have a reduced thickness. Per Det. CS9, the slab on the southeast corner is 2" thick. However, this region is small and is considered under this flat load table for simplicity.

4 - Beams on Grid B are completely embedded in concrete slab. Slab is also supported by exterior walls.

5 - Flat load includes weight of (4) 15"x36" concrete columns below and (3) 15"x36" and (1) 15"x30" concrete columns above floor in a 3,128 ft^2 area. Column trib. height is 9'-8".

6 - The concrete columns on this flat load table extend from the second floor to the third floor without interacting with the mezzanine slab. However, this weight is distributed between the aforementioned floors in the "Story weight" section.

	Seismic Weight	Dead Load	
MEZZANINE - 4.5" THICK SLAB	**psf**	**psf**	**Remarks**
Flooring	5	5	Carpet and vinyl composition tiles
Slab	56	56	4.5" NWC slab
Beams/girders	16	16	Concrete beams below slab
MEP	7	7	MEP hung from underside of floor slab
Ceiling, lighting and misc.	5	5	Lay-in ceiling, lighting, and misc. hung from underside of floor slat
Columns	16	0	Reinforced concrete columns
Partitions	0	0	
Total	106	90	

1 - The flat load is a reinforced concrete slab assembly that takes place between Grids B-C/1-14 at the mezzanine.

2 - Per Det. ES3 and JS3, concrete slab is 4.5" thick on the south side of Grid C at mezzanine level.

3 - Partition weight is considered in typical floor load tables.

4 - Flat load includes weight of (4) 26"ϕ concrete columns below and above floor in a 1,304 ft^2 area. Column trib. height is 9'-8".

	Seismic Weight	Dead Load	
2ND FLOOR - ENTRANCE CANOPY AND CAFETERIA	**psf**	**psf**	**Remarks**
Flooring and waterproofing	5	5	Carpet and vinyl composition tiles
Slab	92	92	NWC slab
Beams/girders	19	19	Concrete beams below slab
MEP	7	7	MEP hung from underside of floor slab
Ceiling, lighting and misc.	5	5	Lay-in ceiling, lighting, and misc. hung from underside of floor slat
Columns	14	0	Reinforced concrete columns
Partitions	5	0	
Total	146	127	

1 - The flat load is a reinforced concrete slab assembly that takes place between Grids A-B/1-14 at the second floor, including the roof of the cafeteria.

2 - The cafeteria framing is not specified in the 1948 structural drawings. Since this information is unknown, it is assumed that its flat load is the same as the entrance canopy.

3 - Per Det. AS10, concrete slab thickness varies from 5" to 8.5". An homogeneous thickness of 7.33" is adequate to represent this area.

4 - Flat load includes weight of (3) 26"ϕ and (1) 16"x42" concrete columns below and (4) 26"ϕ concrete columns above floor in a 1,578 ft^2 area. Column trib. height is 9'-8".

Flat Load Tables - Administration Building

	Seismic Weight	Dead Load	
ADMINISTRATION ROOF	**psf**	**psf**	**Remarks**
Roofing, waterproofing, and insulation	10	10	
Slab	75	75	6" NWC slab
Beams/girders	0	0	
MEP	7	7	MEP hung from underside of administration roof
Ceiling, lighting and misc.	5	5	Lay-in ceiling, lighting, and misc. hung from underside of administration roof
Columns	0	0	
Partitions	5	0	
Total	102	97	

1 - The flat load is a reinforced concrete slab assembly that takes place at the administration building roof (where the main entrance is located) and the roof of the hallway connecting to the main tower.

2 - Per sheets S14 and S15 in the 1948 drawings, the structural slab at the administration roof varies from 3" in the tapered sections, up to 15". An homogeneous 6" thickness is considered as representative for this area for seismic weight purposes.

3 - The concrete beam specified in Section GS15 in 1948 structural drawings is embedded in concrete slab.

4 - The concrete slab is directly supported by concrete walls. No columns extend to the roof.

Story Weight

Main Tower

wconcrete = 150 pcf

wclad&glass = 15 psf

	Floor Area (ft^2)[1,2]									Floor Weight (psf)									Height	Wall Weight [3,4]				Exterior Cladding & Glass Weight [5]				
Floor Levels	**HIGH ROOF**	**ROOF - 5.5" THICK SLAB**	**ROOF - 7" THICK SLAB**	**ROOF - BALCONY**	**TYPICAL FLOOR - 5.5" THICK SLAB**	**TYPICAL FLOOR - 7" THICK SLAB**	**TYPICAL FLOOR - BALCONY**	**MEZZANINE - 4.5" THICK SLAB**	**2ND FLOOR - ENTRANCE CANOPY AND CAFETERIA**	**HIGH ROOF**	**ROOF - 5.5" THICK SLAB**	**ROOF - 7" THICK SLAB**	**ROOF - BALCONY**	**TYPICAL FLOOR - 5.5" THICK SLAB**	**TYPICAL FLOOR - 7" THICK SLAB**	**TYPICAL FLOOR - BALCONY**	**MEZZANINE - 4.5" THICK SLAB**	**2ND FLOOR - ENTRANCE CANOPY AND CAFETERIA**	**Height below floor level (ft)**	**Wall height tributary to each floor level (ft)**	**Wall Area below (ft^2)**	**Wall Weight below (kips)**	**Wall Seismic Weight (kips)**	**Length (ft)**	**Trib. Wall Height [above & below] (ft)**	**Glass Seismic Weight (kips)**	**Additional Weight (kips) [6]**	**Total Seismic Weight (kips)**
Roof	693	2,626	2,172	956	0	0	0	0	0	96	140	153	215	108	121	184	106	146	9.67	4.83	235	341	170	157	4.83	11	187	1,341
Eighth Floor	0	0	0	0	2,626	2,172	956	0	0	96	140	153	215	108	121	184	106	146	9.67	9.67	238	345	343	157	9.67	23		1,088
Seventh Floor	0	0	0	0	2,626	2,172	956	0	0	96	140	153	215	108	121	184	106	146	9.67	9.67	239	346	346	157	9.67	23		1,090
Sixth Floor	0	0	0	0	2,626	2,172	956	0	0	96	140	153	215	108	121	184	106	146	9.67	9.67	239	346	346	157	9.67	23		1,091
Fifth Floor	0	0	0	0	2,626	2,172	956	0	0	96	140	153	215	108	121	184	106	146	9.67	9.67	257	372	359	157	9.67	23		1,104
Fourth Floor	0	0	0	0	2,626	2,172	956	0	0	96	140	153	215	108	121	184	106	146	9.67	9.67	258	374	373	157	9.67	23		1,118
Third Floor	0	0	0	0	3,633	2,342	1,600	652	0	96	140	153	215	108	121	184	106	146	19.33	14.50	307	889	631	155	14.50	34		1,704
Second Floor	0	0	0	0	6,776	0	0	652	2,104	96	140	153	215	108	121	184	106	146	9.67	14.50	335	486	688	180	14.50	39		1,833
First Floor																												

10,370 **kips**

Administration Building

wconcrete = 150 pcf

wclad&glass = 15 psf

	Floor Area (ft^2)[1]	Floor Weight (psf)	Height	Wall Weight [3]				Exterior Cladding & Glass Weight [5,7]			
Floor Levels	**ADMINISTRATION ROOF**	**ADMINISTRATION ROOF**	**Height below floor level (ft)**	**Wall height tributary to each floor level (ft)**	**Wall Area below (ft^2)**	**Wall Weight below (kips)**	**Wall Seismic Weight (kips)**	**Length (ft)**	**Trib. Wall Height [above & below] (ft)**	**Glass Seismic Weight (kips)**	**Total Seismic Weight (kips)**
Second Floor	4,164	102	9.67	4.83	108	157	78	211	4.83	15	518
First Floor											

518 **kips**

Notes:

1 - The seismic base for the Main Tower and the Administration Building is set at the first floor.

2 - The mezzanine weight at the Main Tower is distributed equally between the second floor and third floor.

3 - The wall weight includes area of exterior and interior concrete walls.

4 - A sample calculation for the wall seismic weight at the fifth floor is provided below:

Wall ID	Thickness (in)	Length (ft)	oncrete/Total area	Area (ft^2)
L4 - 1X	9	8.8	1.00	6.6
L4 - 2X	9	18.0	1.00	13.5
L4 - 3X	9	18.0	1.00	13.5
L4 - 4X	9	18.0	1.00	13.5
L4 - 5X	9	9.3	1.00	6.9
L4 - 6X	9	6.3	1.00	4.7
L4 - 7X	10	11.0	1.00	9.2
L4 - 8X	10	9.5	1.00	7.9
L4 - 9X	9	2.3	1.00	1.7
L4 - 10X	10	15.0	1.00	12.5
L4 - 1XC	10	23.3	0.70	13.6
L4 - 2XC	7	58.0	0.70	23.8
L4 - 1Y	10	9.8	1.00	8.1
L4 - 2Y	8	10.3	1.00	6.8
L4 - 3Y	9	10.0	1.00	7.5
L4 - 4Y	9	3.5	1.00	2.6
L4 - 5Y	9	3.3	1.00	2.4
L4 - 6Y	9	6.8	1.00	5.1
L4 - 1YC	10	8.5	1.00	7.1
L4 - 2YC	9	22.0	1.00	16.5
L4 - 3YC	10	14.3	1.00	11.9
L4 - 4YC	10	12.3	1.00	10.2
L4 - 5YC	10	8.5	1.00	7.1
L4 - 6YC	9	45.5	1.00	34.1
L4 - 7YC	10	12	1.00	10.0
			Σ =	256.8

Wall ID	Thickness (in)	Length (ft)	ncrete/Total are	Area (ft^2)
L5 - 1X	8	6.8	1.00	4.6
L5 - 2X	8	13.5	1.00	9.0
L5 - 3X	8	14.0	1.00	9.3
L5 - 4X	8	13.5	1.00	9.0
L5 - 5X	8	7.3	1.00	4.8
L5 - 6X	8	7.0	1.00	4.7
L5 - 7X	10	11.3	1.00	9.4
L5 - 8X	9	9.5	1.00	7.1
L5 - 9X	9	2.3	1.00	1.7
L5 - 10X	10	15.0	1.00	12.5
L5 - 1XC	10	23.3	0.70	13.6
L5 - 2XC	7	58.0	0.70	23.8
L5 - 1Y	10	9.8	1.00	8.1
L5 - 2Y	8	10.3	1.00	6.8
L5 - 3Y	9	10.0	1.00	7.5
L5 - 4Y	9	3.5	1.00	2.6
L5 - 5Y	9	3.3	1.00	2.4
L5 - 6Y	9	6.8	1.00	5.1
L5 - 1YC	10	8.5	1.00	7.1
L5 - 2YC	9	22.0	1.00	16.5
L5 - 3YC	10	14.3	1.00	11.9
L5 - 4YC	10	12.3	1.00	10.2
L5 - 5YC	10	8.5	1.00	7.1
L5 - 6YC	9	45.5	1.00	34.1
L5 - 7YC	10	12	1.00	10.0
			Σ =	238.9

*Solid / Total area factor accounts for percentage of wall that is solid compared to the total area including openings.

Wall height above = 9.67 ft
Wall height below = 9.67 ft

Wall area above = 238.9 ft^2
Wall area below = 256.8 ft^2

$w_{concrete}$ = 0.15 kcf

$$Wall\ seismic\ weight\ = w_{concrete} \times \left(Area_{belox} \times \frac{Height_{belox}}{2} + Area_{above} \times \frac{Height_{above}}{2} \right)$$

Wall seismic weight = 359 kips

5 - Exterior cladding and glass weight includes area of exterior nonstructural components with an assumed weight of 15 psf. This weight is representative when combining glass framing and stucco nonstructural walls weighing 10 psf and 20 psf, respectively.

6 - Additional weight includes the reinforced concrete and concrete block walls above the passenger and service elevators at the roof. An unit weight of 55 pcf was considered for the concrete block walls assuming medium weight with vertical cores grouted at 32" o.c.

7 - The exterior cladding and glass weight for the Administration Building includes the nonstructural walls on the north and south elevations, and the glass partition at the hallway on the west elevation.

8 - The cafeteria at the first floor on the south elevation of the Main Tower is an addition that was not included in the available drawings. For these calculations, it is assumed that this flat load of this roof is similar to the entrance canopy at the Main Tower.

Period

Main Tower

C_t=	0.02
h_n (ft)=	87.00
B=	0.75

T=	0.57	sec

Administration Building

C_t=	0.02
h_n (ft)=	9.67
B=	0.75

T=	0.11	sec

Notes:

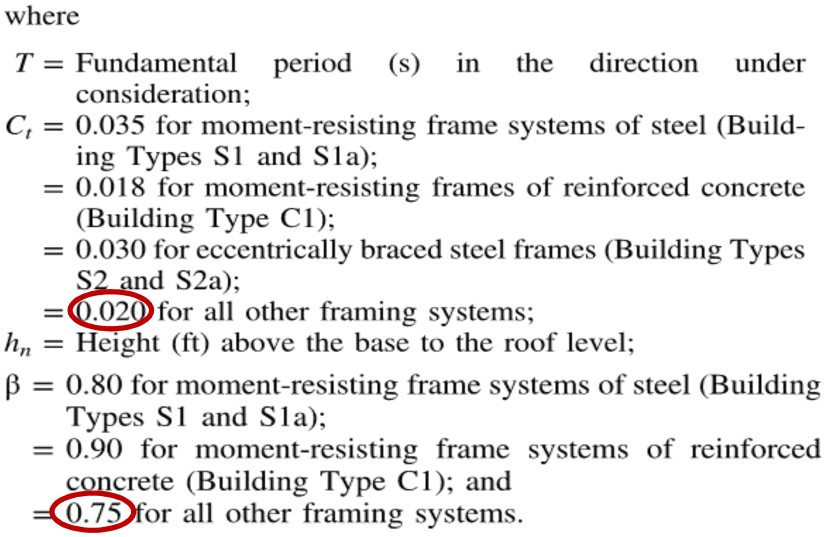
1- The period is calculated per ASCE 41-17 Equation 4-4.

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

2- For the Main Tower and Administration Building, The parameters 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 roof.

4- For the Administration Building, the roof elevation coincides with the second floor of the Main Tower.



where

T = Fundamental period (s) in the direction under consideration;

C_t = 0.035 for moment-resisting frame systems of steel (Building Types S1 and S1a);

= 0.018 for moment-resisting frames of reinforced concrete (Building Type C1);

= 0.030 for eccentrically braced steel frames (Building Types S2 and S2a);

= 0.020 for all other framing systems;

h_n = Height (ft) above the base to the roof level;

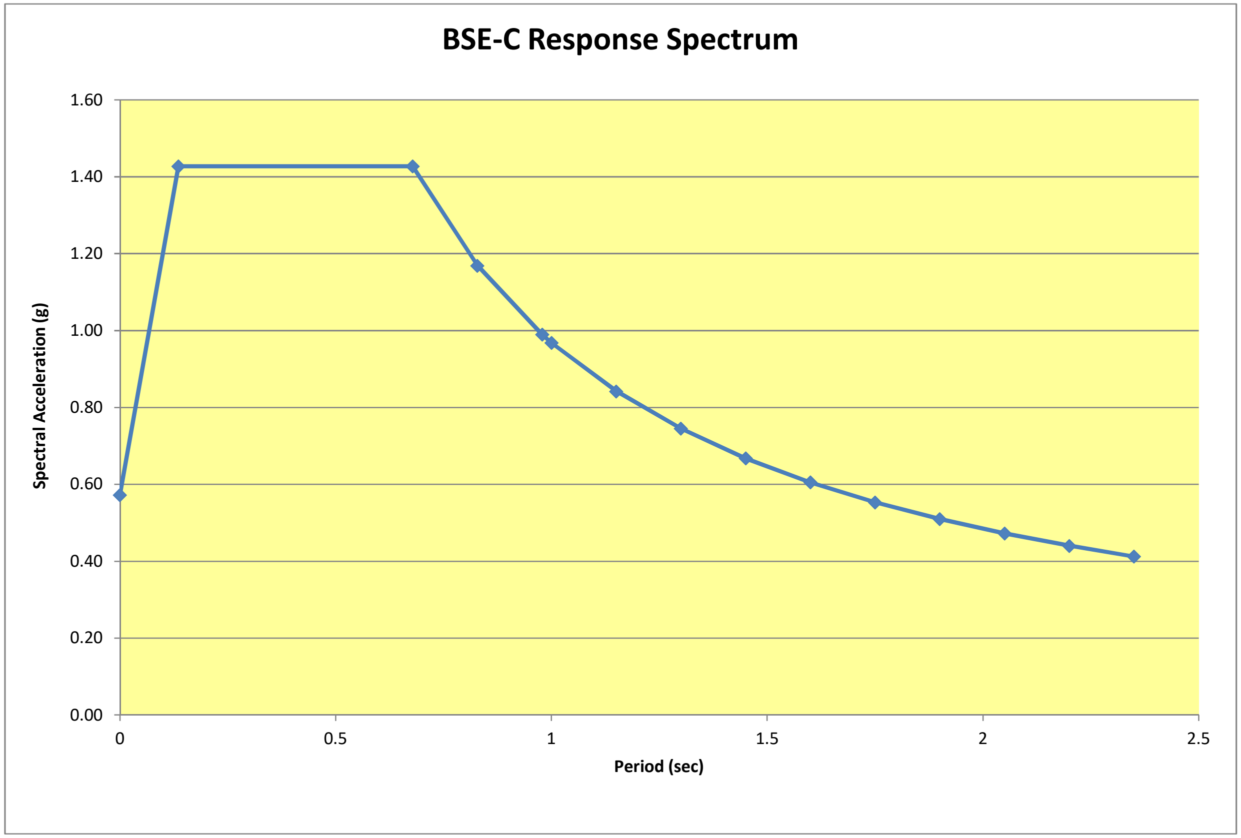
β = 0.80 for moment-resisting frame systems of steel (Building Types S1 and S1a);

= 0.90 for moment-resisting frame systems of reinforced concrete (Building Type C1); and

= 0.75 for all other framing systems.

Site Parameters

Period (s)	Sa (g)
0	0.57
0.14	1.43
0.68	1.43
0.83	1.17
0.98	0.99
1.00	0.97
1.15	0.84
1.30	0.75
1.45	0.67
1.60	0.61
1.75	0.55
1.90	0.51
2.05	0.47
2.20	0.44
2.35	0.41



BSE-C

$\beta =$ 0.05

$B_1 =$ 1.00

$S_S =$ 1.431 g

$S_1 =$ 0.557 g

$F_a =$ 1.000 g

$F_v =$ 1.743 g

Site Class = D

$S_{CS} =$ 1.431 g

$S_{C1} =$ 0.971 g

$T_0 =$ 0.14 s

$T_s =$ 0.68 s

Main Tower

T = 0.57 s

$S_a =$ 1.43 g (See Note 2)

Tier 1 S_a = 1.43 g (See Note 3)

Administration Building

T = 0.11 s

$S_a =$ 1.26 g (See Note 2)

Tier 1 S_a = 1.43 g (See Note 3)

Notes:

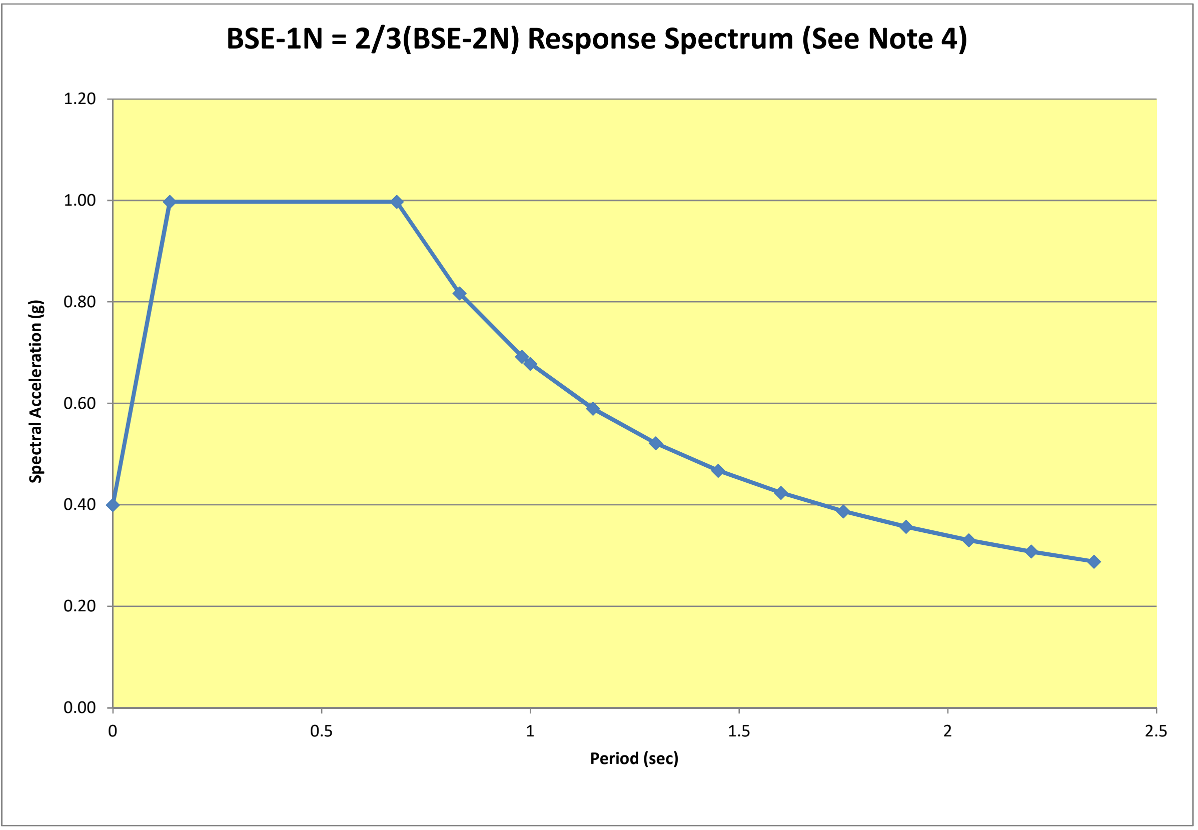
1- Spectral accelerations based upon site class provided in report "UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards". Procedure as specified in ASCE 41-17, Section 2.4.1.7 is used to develop General Response Spectrum shown above.

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}.

Site Parameters

Period (s)	Sa (g) BSE-2N	2/3 x Sa (g)= BSE-1N
0	0.60	0.40
0.14	1.50	1.00
0.68	1.50	1.00
0.83	1.23	0.82
0.98	1.04	0.69
1.00	1.02	0.68
1.15	0.88	0.59
1.30	0.78	0.52
1.45	0.70	0.47
1.60	0.64	0.42
1.75	0.58	0.39
1.90	0.54	0.36
2.05	0.50	0.33
2.20	0.46	0.31
2.35	0.43	0.29



BSE-2N

β = 0.05

B_1 = 1.00

S_S = 1.500 g

S_1 = 0.600 g

F_a = 1.000 g

F_v = 1.700 g

Site Class = D

S_{2NS} = 1.500 g

S_{2N1} = 1.020 g

T_0 = 0.14 s

T_s = 0.68 s

Main Tower

T = 0.57 s

(2/3) S_a = 1.00 g (See Note 2)

Tier 1 (2/3) S_a = 1.00 g (See Note 3)

Administration Building

T = 0.11 s

(2/3) S_a = 0.88 g (See Note 2)

Tier 1 (2/3) S_a = 1.00 g (See Note 3)

Notes:

1- Spectral accelerations based upon site class provided in report "UCSF Group 3 Buildings 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}.

4- BSE-1N is the Performance Objective Equivalent to New Building Standards, taken as (2/3)BSE-2N.

5- BSE-2N represents the ground shaking based on the MCE_R, per ASCE 7.

Seismic Force Distribution - Main Tower

Horizontal Response Spectrum Seismic Parameters		
Hazard Level	BSE-C	
Site Class	D	
S_{CS}=	1.431 g	(See Note 2)
S_{C1}=	0.971 g	(See Note 2)

T=	0.57	s	
Sa=	1.43	g	(See Note 3)
W=	10,370	kips	
C=	1.0	Per ASCE 41-17 Table 4-7	

V=	14,839	kips

k= 1.03

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	Total Height, H	Weight, W	W x H^k	coeff	Fx	Story Shear, V
	(ft)	(ft)	(kips)			(kips)	(kips)
Roof	9.67	87.00	1,341	136,348	0.24	3,503	3,503
Eighth Floor	9.67	77.34	1,088	97,882	0.17	2,515	6,018
Seventh Floor	9.67	67.67	1,090	85,474	0.15	2,196	8,214
Sixth Floor	9.67	58.00	1,091	72,923	0.13	1,874	10,087
Fifth Floor	9.67	48.34	1,104	61,102	0.11	1,570	11,657
Fourth Floor	9.67	38.67	1,118	49,108	0.09	1,262	12,919
Third Floor	19.33	29.00	1,704	55,566	0.10	1,428	14,346
Second Floor	9.67	9.67	1,833	19,182	0.03	493	14,839
First Floor							
Σ =	87.0		10,370	577,585	1	14,839	

Notes:

1- Base of building is set at the 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 3 Buildings 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.

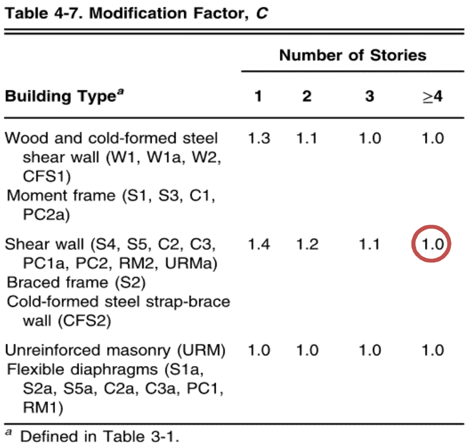


Table 4-7. Modification Factor, *C*

	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.

Seismic Force Distribution - Administration Building

Horizontal Response Spectrum Seismic Parameters		
Hazard Level	BSE-C	
Site Class	D	
S_{CS}=	1.431 g	(See Note 2)
S_{C1}=	0.971 g	(See Note 2)

T=	0.11	s	
Sa=	1.43	g	(See Note 3)
W=	518	kips	
C=	1.4	Per ASCE 41-17 Table 4-7	

V=	1,038	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**	**Total Height, H**	**Weight, W**	**W x H^k**	**coeff**	**Fx**	**Story Shear, V**
	(ft)	**(ft)**	**(kips)**			**(kips)**	**(kips)**
Second Floor	9.67	9.67	518	5,011	1.00	1,038	1,038
First Floor							
Σ =	9.7		518	5,011	1	1,038	

Notes:

1- Base of building is set at the 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 3 Buildings 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.

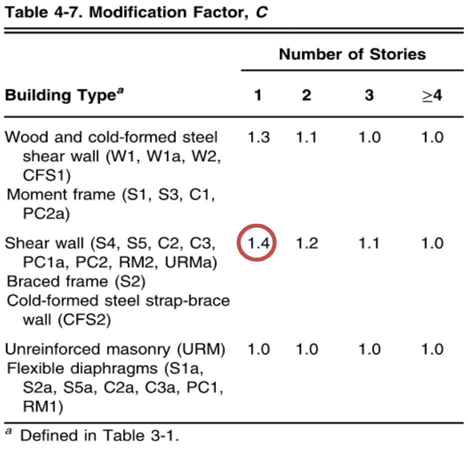


Table 4-7. Modification Factor, *C*

	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 - Main Tower

Average Stresses

Ms = 4.5

f'c = 2500 psi (From fourth floor to roof, see Note 3)

f'c = 3000 psi (From first floor to fourth floor, see Note 3)

Longitudinal (E-W direction)

Story	Story Shear	Wall Area	Average Shear Stress Demand	Tier 1 Shear Stress Limit	Wall OK?
	(kips)	(in^2)	(psi)	(psi)	
Roof - Eighth Floor	3,503	12,003	65	100	OK
Eighth Floor - Seventh Floor	6,018	12,288	109	100	NG
Seventh Floor - Sixth Floor	8,214	12,446	147	100	NG
Sixth Floor - Fifth Floor	10,087	12,446	180	100	NG
Fifth Floor - Fourth Floor	11,657	15,021	172	100	NG
Fourth Floor - Third Floor	12,919	15,021	191	110	NG
Third Floor - Second Floor	14,346	13,150	242	110	NG
Second Floor - First Floor	14,839	24,851	133	110	NG

Transverse (N-S direction)

Story	Story Shear	Wall Area	Average Shear Stress Demand	Tier 1 Shear Stress Limit	Wall OK?
	(kips)	(in^2)	(psi)	(psi)	
Roof - Eighth Floor	3,503	18,516	42	100	OK
Eighth Floor - Seventh Floor	6,018	18,642	72	100	OK
Seventh Floor - Sixth Floor	8,214	18,642	98	100	OK
Sixth Floor - Fifth Floor	10,087	18,642	120	100	NG
Fifth Floor - Fourth Floor	11,657	18,642	139	100	NG
Fourth Floor - Third Floor	12,919	18,804	153	110	NG
Third Floor - Second Floor	14,346	25,657	124	110	NG
Second Floor - First Floor	14,839	22,476	147	110	NG

Notes:

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

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

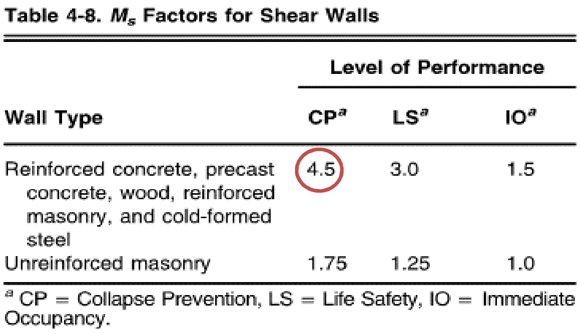


Table 4-8. M_s Factors for Shear Walls

	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 - Per the General Note on Sheet S1 in the 1948 drawings, 'All concrete to be 2,500 psi unless otherwise specified'. In the first, second, and third floor plans, all the walls from the first floor to the fourth floor are indicated with 3,000 psi concrete.

4 - Tier 1 shear stress limit for concrete shear walls is defined as the greater of 100 psi or 2√(f'c).

Average Wall Stress Check - Administration Building

Average Stresses

Ms = 4.5
f'c = 2500 psi (From first floor to roof, see Note 3)

Longitudinal (E-W direction)					
Story	**Story Shear**	**Wall Area**	**Average Shear Stress Demand**	**Tier 1 Shear Stress Limit**	**Wall OK?**
	(kips)	(in^2)	(psi)	(psi)	
Second Floor - First Floor	1,038	3,384	68	100	OK

Transverse (N-S direction)					
Story	**Story Shear**	**Wall Area**	**Average Shear Stress Demand**	**Tier 1 Shear Stress Limit**	**Wall OK?**
	(kips)	(in^2)	(psi)	(psi)	
Second Floor - First Floor	1,038	12,168	19	100	OK

Notes:

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

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

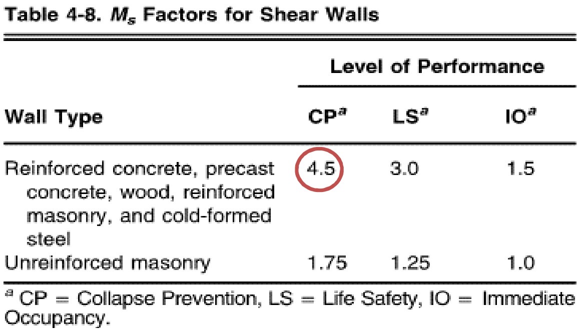


Table 4-8. M_s Factors for Shear Walls

	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 - Per the General Note on Sheet S1 in the 1948 drawings, 'All concrete to be 2,500 psi unless otherwise specified'.

4 - Tier 1 shear stress limit for concrete shear walls is defined as the greater of 100 psi or 2√(f'c).

Average Wall Stress Check Under BSE-1N Response Spectra - Main Tower

Note: BSE-1N = 2/3 BSE-2N

Sa (BSE-1N) = 1.00 (See Note 3)

Sa (BSE-C) = 1.43

Sa (BSE-1N) / Sa (BSE-C) = 0.70

R =	4	Detailing is equivalent to an Ordinary Bearing Wall System

Longitudinal (E-W direction)

Story	**BSE-C Story Shear**	**BSE-1N Story Shear**	**Wall Area**	**Average Shear Stress**	**Reinforcing Ratio**	**Shear Stress Limit**	**Wall OK?**
	(kips)	(kips)	(in^2)	(psi)			
Roof - Eighth Floor	3,503	2,448	12,003	51	0.0027	124	OK
Eighth Floor - Seventh Floor	6,018	4,205	12,288	86	0.0027	124	OK
Seventh Floor - Sixth Floor	8,214	5,740	12,446	115	0.0027	124	OK
Sixth Floor - Fifth Floor	10,087	7,049	12,446	142	0.0027	124	NG
Fifth Floor - Fourth Floor	11,657	8,146	15,021	136	0.0027	124	NG
Fourth Floor - Third Floor	12,919	9,028	15,021	150	0.0027	130	NG
Third Floor - Second Floor	14,346	10,025	13,150	191	0.0027	130	NG
Second Floor - First Floor	14,839	10,370	24,851	104	0.0027	130	OK

Transverse (N-S direction)

Story	**BSE-C Story Shear**	**BSE-1N Story Shear**	**Wall Area**	**Average Shear Stress**	**Reinforcing Ratio**	**Shear Stress Limit**	**Wall OK?**
	(kips)	(kips)	(in^2)	(psi)			
Roof - Eighth Floor	3,503	2,448	18,516	33	0.0027	124	OK
Eighth Floor - Seventh Floor	6,018	4,205	18,642	56	0.0027	124	OK
Seventh Floor - Sixth Floor	8,214	5,740	18,642	77	0.0027	124	OK
Sixth Floor - Fifth Floor	10,087	7,049	18,642	95	0.0027	124	OK
Fifth Floor - Fourth Floor	11,657	8,146	18,642	109	0.0027	124	OK
Fourth Floor - Third Floor	12,919	9,028	18,804	120	0.0027	130	OK
Third Floor - Second Floor	14,346	10,025	25,657	98	0.0027	130	OK
Second Floor - First Floor	14,839	10,370	22,476	115	0.0027	130	OK

Notes:

1 - Per 1948 drawings, f'c = 3ksi (first to fourth floor) and 2.5ksi (fourth floor to roof),Φ= 0.60, α_c x sqrt (f'c), α_c = 2.0 for given wall aspect ratios, intermediate grade (fy = 40) ksi for all reinforcing steel. Shear critical walls are assumed.

2 - Per Sheet 13 in 1948 Structural drawings, wall typical reinforcement according to thickness is as follows, where 10" thick walls are the most common condition

Wall Thickness (in)	Wall Reinforcing	Reinforcement ratio, ρ
6	#4 @ 13" o.c., e.w.	0.00256
7	#3 @ 8" o.c., e.w., e.f.	0.00393
8	#3 @ 11" o.c., e.w., e.f.	0.00250
9	#3 @ 10" o.c., e.w., e.f.	0.00244
10	#4 @ 15" o.c., e.w., e.f.	0.00267
12	#4 @ 13" o.c., e.w., e.f.	0.00256
14	#5 @ 11.5" o.c., e.w., e.f.	0.00248

3 - Spectral accelerations based upon site class provided in report "UCSF Group 3 Buildings Geotechnical Characteristics and Geohazards".

4 - BSE-1N is used as the hazard level for collapse prevention performance level for new structures. It is calculated as 2/3(BSE-2N).

COLUMN DEFORMATION COMPATIBILTY (0.9DL)

Material properties

- Concrete for columns	f'_c	varies	ksi	Based upon Column Schedule of 1948 drawings on Sheet S13 (See Note 1).
- Transv rebar, circular columns	f_y	40	ksi	Based upon Column Schedule of 1948 drawings on Sheet S13 (See Note 1).
- Transv rebar, rectangular columns	f_y	40	ksi	Based upon Column Schedule of 1948 drawings on Sheet S13 (See Note 1).

Other parameters

- Flexural ductility	k_{nl}	0.7
- Normal weight concrete	λ	1.0

spColumn Model	Col Location	Cross Section	Level	SIZE			CONCRETE	LONGITUDINAL [3]				TRANVERSE [3]						DIMENSION					CONFINEMENT		FLEX. YIELD			AXIAL			SHEAR			FLEXURE			SHEAR/FLEX. CONTROL		ADDITIONAL CHECK (LIMITED BY DRIFT)						MAXIMUM DRIFT [10]	
				b (in)	h (in) *	A_G (in^2) [2]	f'c (ksi)	n-#		(in)	A_S (in^2)	n - # - s (in)			D (in)	A_V (in^2)	$f_{y,t}$ (ksi)	d' (in)	d_c (in) [4]	h_b (in)	L (ft)	L_n (in)	s/d	a_{col}	$L_n/2d_c$	M_U/V_Ud	$6f^{0.5}/(M/Vd)$	N_{UG} (k) [5]	A_{trib} (ft^2)	$(1+N/6Af^{0.5})^{0.5}$	V_S (k)	V_C (k)	V_{col} (k) [6]	$M_{P=0}$ (k-ft) [7]	M (k-ft)[7]	2M/L (k)		Vp/Vcol	E (ksi)	I_g(in^4)	Δ (in)	L (in)	Vprob (k) [8]	Acceptance criteria [9]	Δ (in)	Vmax (k)
#B/8 (X-Dir)-8F-8#8 (sq)	B/8 (X-Dir)	Irregular	8	36	15	516	2.50	8	8 (sq)	1	8.0	4.0	#2	12	0.25	0.20	40	2.25	12.25	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.08	60	330.0	1.2	0.7	36.8	26.2	191.6	216.6	53.6	Shear	2.04	2850.0	9,248.0	0.5	116.0	50.7	NG	0.26	26.2
#B/8 (X-Dir)-7F-8#8 (sq)	B/8 (X-Dir)	Irregular	7	36	15	516	2.50	8	8 (sq)	1	8.0	4.0	#2	12	0.25	0.20	40	2.25	12.25	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.08	103	330.0	1.3	0.7	40.4	28.7	191.6	234.5	58.0	Shear	2.02	2850.0	9,248.0	0.5	116.0	50.7	NG	0.28	28.7
#B/8 (X-Dir)-6F-10#8 (sq)	B/8 (X-Dir)	Irregular	6	36	15	516	3.00	10	8 (sq)	1	10.0	6.0	#2	12	0.25	0.29	40	2.25	12.25	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.08	146	330.0	1.4	1.0	46.8	33.4	238.0	298.8	73.9	Shear	2.21	3122.0	9,248.0	0.5	116.0	55.5	NG	0.30	33.4
#B/8 (X-Dir)-5F-14#8 (sq)	B/8 (X-Dir)	Irregular	5	36	15	516	3.75	14	8 (sq)	1	14.0	7.0	#2	12	0.25	0.34	40	2.25	12.25	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.09	190	330.0	1.4	1.1	54.2	38.7	329.8	409.7	101.4	Shear	2.62	3490.5	9,248.0	0.5	116.0	62.0	NG	0.31	38.7
#B/8 (X-Dir)-4F-18#8 (sq)	B/8 (X-Dir)	Irregular	4	36	15	516	3.75	18	8 (sq)	1	18.0	10.0	#2	12	0.25	0.49	40	2.25	12.25	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.09	233	330.0	1.5	1.6	57.2	41.2	411.4	506.3	125.3	Shear	3.04	3490.5	9,248.0	0.5	116.0	62.0	NG	0.33	41.2
#B/8 (X-Dir)-3F-16#8&9 (sq)	B/8 (X-Dir)	Irregular	3	36	15	516	3.75	16	8&9 (sq)	1&1.125	18.1	8.0	#2	12	0.25	0.39	40	2.25	12.19	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.09	276	330.0	1.6	1.0	59.7	42.5	417.0	528.7	130.8	Shear	3.08	3490.5	9,248.0	0.5	116.0	62.0	NG	0.34	42.5
#B/8 (X-Dir)-2F-20#8 (sq)	B/8 (X-Dir)	Circular	2	26	26	531	3.75	20	8 (sq)	1	20.0	2.0	#2	2.75	0.25	0.10	40	2.25	20.80	19.0	19.33	213.0	0.13	1.0	5.1	4.0	0.09	325	330.0	1.6	29.7	63.7	65.4	743.7	887.4	100.0	Shear	1.53	3490.5	22,431.8	1.0	232.0	37.6	OK	1.74	65.4
#B/8 (X-Dir)-1F-18#9 (sq)	B/8 (X-Dir)	Circular	1	26	26	531	3.75	18	9 (sq)	1.125	22.8	2.0	#2	2.75	0.25	0.10	40	2.25	20.80	19.0	9.67	97.0	0.13	1.0	2.3	2.3	0.16	368	356.2	1.7	29.7	113.7	100.4	827.1	975.7	241.4	Shear	2.40	3490.5	22,431.8	0.5	116.0	150.5	NG	0.33	100.4
#B/8 (Y-Dir)-8F-8#8 (sq)	B/8 (Y-Dir)	Irregular	8	15	36	516	2.50	8	8 (sq)	1	8.0	2.0	#2	12	0.25	0.10	40	2.25	33.25	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.15	60	330.0	1.2	10.9	72.9	58.6	507.9	553.4	136.9	Shear	2.34	2850.0	51,441.9	0.5	116.0	281.8	NG	0.10	58.6
#B/8 (Y-Dir)-7F-8#8 (sq)	B/8 (Y-Dir)	Irregular	7	15	36	516	2.50	8	8 (sq)	1	8.0	2.0	#2	12	0.25	0.10	40	2.25	33.25	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.15	103	330.0	1.3	10.9	79.9	63.5	507.9	585.9	145.0	Shear	2.28	2850.0	51,441.9	0.5	116.0	281.8	NG	0.11	63.5
#B/8 (Y-Dir)-6F-10#8 (sq)	B/8 (Y-Dir)	Irregular	6	15	36	516	3.00	10	8 (sq)	1	10.0	2.0	#2	12	0.25	0.10	40	2.25	33.25	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.16	146	330.0	1.4	10.9	92.6	72.4	622.7	732.6	181.2	Shear	2.50	3122.0	51,441.9	0.5	116.0	308.6	NG	0.12	72.4
#B/8 (Y-Dir)-5F-14#8 (sq)	B/8 (Y-Dir)	Irregular	5	15	36	516	3.75	14	8 (sq)	1	14.0	2.0	#2	12	0.25	0.10	40	2.25	33.25	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.18	190	330.0	1.4	10.9	107.2	82.7	830.3	971.5	240.4	Shear	2.91	3490.5	51,441.9	0.5	116.0	345.1	NG	0.12	82.7
#B/8 (Y-Dir)-4F-18#8 (sq)	B/8 (Y-Dir)	Irregular	4	15	36	516	3.75	18	8 (sq)	1	18.0	2.0	#2	12	0.25	0.10	40	2.25	33.25	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.18	233	330.0	1.5	10.9	113.2	86.9	991.3	1115.7	276.0	Shear	3.18	3490.5	51,441.9	0.5	116.0	345.1	NG	0.13	86.9
#B/8 (Y-Dir)-3F-16#8&9 (sq)	B/8 (Y-Dir)	Irregular	3	15	36	516	3.75	16	8&9 (sq)	1&1.125	18.1	2.0	#2	12	0.25	0.10	40	2.25	33.19	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.18	276	330.0	1.6	10.9	118.9	90.8	999.7	1159.4	286.8	Shear	3.16	3490.5	51,441.9	0.5	116.0	345.1	NG	0.13	90.8
#B/8 (Y-Dir)-2F-20#8 (sq)	B/8 (Y-Dir)	Circular	2	26	26	531	3.75	20	8 (sq)	1	20.0	2.0	#2	2.75	0.25	0.10	40	2.25	20.80	19.0	19.33	213.0	0.13	1.0	5.1	4.0	0.09	325	330.0	1.6	29.7	63.7	65.4	743.7	887.4	100.0	Shear	1.53	3490.5	22,431.8	1.0	232.0	37.6	OK	1.74	65.4
#B/8 (Y-Dir)-1F-18#9 (sq)	B/8 (Y-Dir)	Circular	1	26	26	531	3.75	18	9 (sq)	1.125	22.8	2.0	#2	2.75	0.25	0.10	40	2.25	20.80	19.0	9.67	97.0	0.13	1.0	2.3	2.3	0.16	368	356.2	1.7	29.7	113.7	100.4	827.1	975.7	241.4	Shear	2.40	3490.5	22,431.8	0.5	116.0	150.5	NG	0.33	100.4

Notes:

1 - Per 1948 drawings, the columns' concrete compressive strength varies from 2.5 ksi to 3.75 ksi; the compressive strength decreases at the three upper stories . Per note above column schedule, all reinforcing steel in columns is intermediate grade steel (40 ksi).

2 - Column gross area, A_G, is based on column schedule on Sheet No. S13 in Structural Drawings.

X-Dir of analysis represents the shear force acting in the short direction; the bending moment capacity is calculated about the weak axis.

Y-Dir of analysis represents the shear force acting in the long direction; the bending moment capacity is calculated about the strong axis.

3 - Column schedule and column notes on Sheet No. S13 provide longitudinal and transverse reinforcement information.

4 - Effective depth d is computed as 0.8h for circular columns, where h is the dimension of the column in the direction of shear.

5 - Based on 0.9DL.

6 - Shear capacity of column is based on ASCE 41-17 Eq 10-3 using nominal material strengths with ϕ =1.0.

$$V_{Col} = k_{nl}\, V_{Col0} = k_{nl}\left[\alpha_{Col}\left(\frac{A_v\, f_{ytL/E}\, d}{s}\right) + \lambda\left(\frac{6\sqrt{f'_{cL/E}}}{M_{UD}/V_{UD}\, d}\sqrt{1+\frac{N_{UG}}{6A_g\sqrt{f'_{cL/E}}}}\right)0.8\, A_g\right]$$

a_{col} = 1.0 for s/d <= 0.75, 0.0 for s/d >=1.0

7 - Plastic moment capacity of the column is based upon expected flexural strength using 1.5 f'c and 1.25 fy.

8 - Shear induced due to drift of a fixed-fixed column.

$$V_{prob} = \frac{12E \cdot 0.5 \cdot I_g \cdot \Delta}{L^3}$$

9- Vprob is compared to Vcol. If Vprob <Vcol, Shear failure is not likely to occur.

10 - Maximum drift calculates lateral displacement to reach expected shear capacity, Vcol.

COLUMN DEFORMATION COMPATIBILTY (1.1DL + 0.275LL)

Material properties

- Concrete for columns	f'_c	varies	ksi	Based upon Column Schedule of 1948 drawings on Sheet S13 (See Note 1).
- Transv rebar, circular columns	f_y	40	ksi	Based upon Column Schedule of 1948 drawings on Sheet S13 (See Note 1).
- Transv rebar, rectangular columns	f_y	40	ksi	Based upon Column Schedule of 1948 drawings on Sheet S13 (See Note 1).

Other parameters

- Flexural ductility	k_{nl}	0.7
- Normal weight concrete	λ	1.0

spColumn Model	Col Location	Cross Section	Level	SIZE			CONCRETE	LONGITUDINAL [3]				TRANVERSE [3]						DIMENSION					CONFINEMENT		FLEX. YIELD			AXIAL			SHEAR			FLEXURE			SHEAR/FLEX. CONTROL		ADDITIONAL CHECK (LIMITED BY DRIFT)						MAXIMUM DRIFT [10]	
				b (in)	h (in) *	A_G (in^2) [2]	f'c (ksi)	n-#		(in)	A_S (in^2)	n - # - s (in)			D (in)	A_V (in^2)	$f_{y,t}$ (ksi)	d' (in)	d_c (in) [4]	h_b (in)	L (ft)	L_n (in)	s/d	a_{col}	$L_n/2d_c$	M_U/V_Ud	$6f^{0.5}/(M/Vd)$	N_{UG} (k) [5]	A_{trib} (ft^2)	$(1+N/6Af^{0.5})^{0.5}$	V_S (k)	V_C (k)	V_{col} (k) [6]	$M_{P=0}$ (k-ft) [7]	M (k-ft) [7]	2M/L (k)		Vp/Vcol	E (ksi)	I_g(in^4)	Δ (in)	L (in)	Vprob (k) [8]	Acceptance criteria [9]	Δ (in)	Vmax (k)
#B/8 (X-Dir)-8F-8#8 (sq)	B/8 (X-Dir)	Irregular	8	36	15	516	2.50	8	8 (sq)	1	8.0	4.0	#2	12	0.25	0.20	40	2.25	12.25	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.08	75	330.0	1.2	0.7	38.1	27.1	191.6	222.9	55.1	Shear	2.03	2850.0	9,248.0	0.5	116.0	50.7	NG	0.27	27.1
#B/8 (X-Dir)-7F-8#8 (sq)	B/8 (X-Dir)	Irregular	7	36	15	516	2.50	8	8 (sq)	1	8.0	4.0	#2	12	0.25	0.20	40	2.25	12.25	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.08	137	330.0	1.4	0.7	42.9	30.5	191.6	248.4	61.5	Shear	2.02	2850.0	9,248.0	0.5	116.0	50.7	NG	0.30	30.5
#B/8 (X-Dir)-6F-10#8 (sq)	B/8 (X-Dir)	Irregular	6	36	15	516	3.00	10	8 (sq)	1	10.0	6.0	#2	12	0.25	0.29	40	2.25	12.25	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.08	199	330.0	1.5	1.0	50.5	36.0	238.0	320.2	79.2	Shear	2.20	3122.0	9,248.0	0.5	116.0	55.5	NG	0.32	36.0
#B/8 (X-Dir)-5F-14#8 (sq)	B/8 (X-Dir)	Irregular	5	36	15	516	3.75	14	8 (sq)	1	14.0	7.0	#2	12	0.25	0.34	40	2.25	12.25	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.09	261	330.0	1.5	1.1	59.0	42.1	329.8	438.5	108.5	Shear	2.58	3490.5	9,248.0	0.5	116.0	62.0	NG	0.34	42.1
#B/8 (X-Dir)-4F-18#8 (sq)	B/8 (X-Dir)	Irregular	4	36	15	516	3.75	18	8 (sq)	1	18.0	10.0	#2	12	0.25	0.49	40	2.25	12.25	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.09	323	330.0	1.6	1.6	63.0	45.2	411.4	541.3	133.9	Shear	2.96	3490.5	9,248.0	0.5	116.0	62.0	NG	0.36	45.2
#B/8 (X-Dir)-3F-16#8&9 (sq)	B/8 (X-Dir)	Irregular	3	36	15	516	3.75	16	8&9 (sq)	1&1.125	18.1	8.0	#2	12	0.25	0.39	40	2.25	12.19	19.0	9.67	97.0	0.98	0.1	4.0	4.0	0.09	385	330.0	1.7	1.0	66.3	47.1	417.0	571.7	141.4	Shear	3.00	3490.5	9,248.0	0.5	116.0	62.0	NG	0.38	47.1
#B/8 (X-Dir)-2F-20#8 (sq)	B/8 (X-Dir)	Circular	2	26	26	531	3.75	20	8 (sq)	1	20.0	2.0	#2	2.75	0.25	0.10	40	2.25	20.80	19.0	19.33	213.0	0.13	1.0	5.1	4.0	0.09	453	330.0	1.8	29.7	71.1	70.6	743.7	933.5	105.2	Shear	1.49	3490.5	22,431.8	0.5	232.0	18.8	OK	1.88	70.6
#B/8 (X-Dir)-1F-18#9 (sq)	B/8 (X-Dir)	Circular	1	26	26	531	3.75	18	9 (sq)	1.125	22.8	2.0	#2	2.75	0.25	0.10	40	2.25	20.80	19.0	9.67	97.0	0.13	1.0	2.3	2.3	0.16	516	356.2	1.9	29.7	127.8	110.2	827.1	1017.3	251.7	Shear	2.28	3490.5	22,431.8	0.5	116.0	150.5	NG	0.37	110.2
#B/8 (Y-Dir)-8F-8#8 (sq)	B/8 (Y-Dir)	Irregular	8	15	36	516	2.50	8	8 (sq)	1	8.0	2.0	#2	12	0.25	0.10	40	2.25	33.25	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.15	75	330.0	1.2	10.9	75.4	60.4	507.9	564.8	139.7	Shear	2.31	2850.0	51,441.9	0.5	116.0	281.8	NG	0.11	60.4
#B/8 (Y-Dir)-7F-8#8 (sq)	B/8 (Y-Dir)	Irregular	7	15	36	516	2.50	8	8 (sq)	1	8.0	2.0	#2	12	0.25	0.10	40	2.25	33.25	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.15	137	330.0	1.4	10.9	85.0	67.1	507.9	610.6	151.1	Shear	2.25	2850.0	51,441.9	0.5	116.0	281.8	NG	0.12	67.1
#B/8 (Y-Dir)-6F-10#8 (sq)	B/8 (Y-Dir)	Irregular	6	15	36	516	3.00	10	8 (sq)	1	10.0	2.0	#2	12	0.25	0.10	40	2.25	33.25	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.16	199	330.0	1.5	10.9	100.0	77.6	622.7	770.7	190.7	Shear	2.46	3122.0	51,441.9	0.5	116.0	308.6	NG	0.13	77.6
#B/8 (Y-Dir)-5F-14#8 (sq)	B/8 (Y-Dir)	Irregular	5	15	36	516	3.75	14	8 (sq)	1	14.0	2.0	#2	12	0.25	0.10	40	2.25	33.25	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.18	261	330.0	1.5	10.9	116.9	89.4	830.3	1021.9	252.8	Shear	2.83	3490.5	51,441.9	0.5	116.0	345.1	NG	0.13	89.4
#B/8 (Y-Dir)-4F-18#8 (sq)	B/8 (Y-Dir)	Irregular	4	15	36	516	3.75	18	8 (sq)	1	18.0	2.0	#2	12	0.25	0.10	40	2.25	33.25	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.18	323	330.0	1.6	10.9	124.7	94.9	991.3	1154.2	285.6	Shear	3.01	3490.5	51,441.9	0.5	116.0	345.1	NG	0.14	94.9
#B/8 (Y-Dir)-3F-16#8&9 (sq)	B/8 (Y-Dir)	Irregular	3	15	36	516	3.75	16	8&9 (sq)	1&1.125	18.1	2.0	#2	12	0.25	0.10	40	2.25	33.19	19.0	9.67	97.0	0.36	1.0	1.5	2.0	0.18	385	330.0	1.7	10.9	132.0	100.0	999.7	1220.7	302.0	Shear	3.02	3490.5	51,441.9	0.5	116.0	345.1	NG	0.14	100.0
#B/8 (Y-Dir)-2F-20#8 (sq)	B/8 (Y-Dir)	Circular	2	26	26	531	3.75	20	8 (sq)	1	20.0	2.0	#2	2.75	0.25	0.10	40	2.25	20.80	19.0	19.33	213.0	0.13	1.0	5.1	4.0	0.09	453	330.0	1.8	29.7	71.1	70.6	743.7	933.5	105.2	Shear	1.49	3490.5	22,431.8	0.5	232.0	18.8	OK	1.88	70.6
#B/8 (Y-Dir)-1F-18#9 (sq)	B/8 (Y-Dir)	Circular	1	26	26	531	3.75	18	9 (sq)	1.125	22.8	2.0	#2	2.75	0.25	0.10	40	2.25	20.80	19.0	9.67	97.0	0.13	1.0	2.3	2.3	0.16	516	356.2	1.9	29.7	127.8	110.2	827.1	1017.3	251.7	Shear	2.28	3490.5	22,431.8	0.5	116.0	150.5	NG	0.37	110.2

Notes:

1 - Per 1948 drawings, the columns' concrete compressive strength varies from 2.5 ksi to 3.75 ksi; the compressive strength decreases at the three upper stories . Per note above column schedule, all reinforcing steel in columns is intermediate grade steel (40 ksi).

2 - Column gross area, A_G, is based on column schedule on Sheet No. S13 in Structural Drawings.

X-Dir of analysis represents the shear force acting in the short direction; the bending moment capacity is calculated about the weak axis.

Y-Dir of analysis represents the shear force acting in the long direction; the bending moment capacity is calculated about the strong axis.

3 - Column schedule and column notes on Sheet No. S13 provide longitudinal and transverse reinforcement information.

4 - Effective depth d is computed as 0.8h for circular columns, where h is the dimension of the column in the direction of shear.

5 - Based on 1.1DL + 0.275LL.

6 - Shear capacity of column is based on ASCE 41-17 Eq 10-3 using nominal material strengths with ϕ =1.0.

$$V_{Col} = k_{nl}\, V_{Col0} = k_{nl}\left[\alpha_{Col}\left(\frac{A_v\, f_{ytL/E}\, d}{s}\right) + \lambda\left(\frac{6\sqrt{f'_{cL/E}}}{M_{UD}/V_{UD}\, d}\sqrt{1+\frac{N_{UG}}{6A_g\sqrt{f'_{cL/E}}}}\right)0.8\, A_g\right]$$

a_{col} = 1.0 for s/d <= 0.75, 0.0 for s/d >=1.0

7 - Plastic moment capacity of the column is based upon expected flexural strength using 1.5 f'c and 1.25 fy.

8 - Shear induced due to drift of a fixed-fixed column.

$$V_{prob} = \frac{12E \cdot 0.5 \cdot I_g \cdot \Delta}{L^3}$$

9- Vprob is compared to Vcol. If Vprob <Vcol, Shear failure is not likely to occur.

10 - Maximum drift calculates lateral displacement to reach expected shear capacity, Vcol.