Rating form completed by:

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

07-24-2019

REGISTERED PROFESSIONAL ENGINEER
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No. 2995
EXP. 6/30/20
STRUCTURAL
STATE OF CALIFORNIA

7/24/2019

UCSF Building Seismic Ratings

Post Street Parking Garage

CAAN #3033
2325 Post Street, San Francisco, CA 94115
UCSF Campus: Mount Zion

Plan

North Elevation

Rating summary	Entry	Notes
UC Seismic Performance Level (rating)	IV	Findings based on drawing review and ASCE 41-17 Tier 1 evaluation[1]
Rating basis	Tier 1	ASCE 41-17
Date of rating basis	2019	
Recommended list UCSF priority category for retrofit	N/A	
Ballpark total project cost to retrofit to IV rating	N/A	
Is 2018-2019 rating required by UCOP?	Yes	
Further evaluation recommended?	No	

[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 Raiser Architectural Group, "Divisadero Business Center," dated 1985-05-28 (4 sheets).

Additional building information known to exist

- None

Scope for completing this form

Structural drawings for original construction were reviewed and an ASCE 41-17 Tier 1 evaluation was performed.

Brief description of structure

The building has an area of approximately 15,000 square feet. It was designed in 1985 by the Raiser Architectural Group. The building is 1-story and serves as parking on both the ground floor and roof. The building does not contain a ramp as the building is on a sloping site. Parking on the roof is accessed from Garden Street, while parking on the ground floor is accessed from Post Street. The main floor plate is rectangular in plan 125 ft by 61 ft east-west.

Identification of Levels: Ground floor and roof deck. The roof deck is identified on the existing structural drawings as "Parking Deck".

Foundation system: The foundation consists of concrete strip footings at locations of concrete masonry unit (CMU) walls and concrete spread footings at locations of concrete columns.

Structural system for vertical (gravity) load: The roof consists of a 6½" concrete post-tensioned slab supported by 8" CMU walls and 12" square concrete columns.

Structural system for lateral forces: The lateral-force-resisting system consists of 8" CMU shear walls on three sides of the building.

Building Code: This building was designed in accordance with the 1979 UBC.

Building Condition: Good. No significant structural distress or damage observed.

Building Response in 1989 Loma Prieta Earthquake: Unknown.

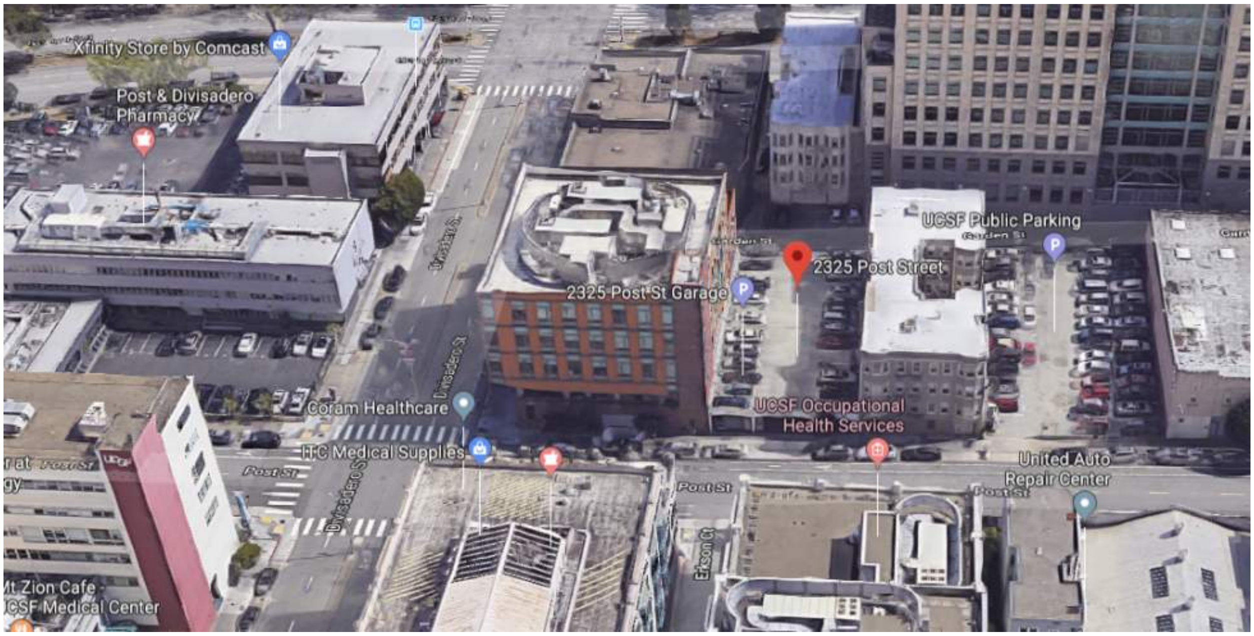
Brief description of seismic deficiencies and expected seismic performance including structural behavior modes

Potential seismic deficiencies identified by the Tier 1 procedure include the following:

- Torsional Irregularity: There are walls located primarily on three sides of the building (Post Street side open), creating a torsional irregularity.
- Adjacent Buildings: The parking structure was constructed against a 3-story wood building on the west side without much separation. After construction of the parking garage, the OSHER building was constructed with a 4" gap between it and the east side of the garage.

Further evaluation of the 1-story building was conducted using a relative rigidity analysis accounting for torsion. Based on the further evaluation (Tier 2, m=3), the maximum shear stress in the CMU walls is 86 psi. The shear capacity of the walls including steel is 131 psi. The expected displacement at the open side of the building is approximately 1/4". The 12" square concrete columns at the front consist of 4 - #9 vertical bars and #3 closed ties @ 6" at the top and bottom of the column. The column has a displacement capacity of approximately ½" based on its shear and bending capacities. Therefore, the initial torsional irregularity is judged to be compliant.

The seismic separation at the adjacent 4 story building appears insufficient to avoid pounding. However, damage to the parking garage is not expected to pose a safety concern. Local damage to the wood frame building is expected.



Structural deficiency	Affects rating?	Structural deficiency	Affects rating?
Lateral system stress check (wall shear, column shear or flexure, or brace axial as applicable)	N	Openings at shear walls (concrete or masonry)	N
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)	N	URM wall height-to-thickness ratio	N
Torsion	Y	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 non-structural life-safety concerns, including at exit routes. [2]

None present.

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

[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 non-structural hazards may occur.

Basis of Seismic Performance Level Rating

The garage contains a substantial amount of shear wall that limits the seismic drift imposed on the columns. The walls are expected to protect the columns from damage that could impact the gravity load system. Drop panels and reinforcement protect against punching shear concerns at the slab.

Recommendations for further evaluation or retrofit

No further evaluation or retrofit is recommended.

Peer review comments on rating

The structural members of the UCSF Seismic Review Committee (SRC) reviewed the evaluation on June 5, 2019 and are unanimous that the rating is IV.

Additional building data	Entry	Notes
Latitude	37.7841	
Longitude	-122.4402	
Are there other structures besides this one under the same CAAN#	No	
Number of stories above lowest perimeter grade	1	
Number of stories (basements) below lowest perimeter grade	0	
Building occupiable area (OGSF)	15000	Calculated
Risk Category per 2016 CBC 1604.5	II	
Building structural height, h_n	10 ft	Structural height defined per ASCE 7-16 Section 11.2
Coefficient for period, C_t	0.02	Per ASCE 41-17 equation 4-4
Coefficient for period, β	0.75	Per ASCE 41-17 equation 4-4
Estimated fundamental period	0.11 sec	Per ASCE 41-17 equation 4-4
Site data		
975 yr hazard parameters S_s, S_1	1.436,0.973	
Site class	D	
Site class basis	Geotech Parameters	UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019)
Site parameters F_a, F_v	1.000, 1.741	
Ground motion parameters S_{cs}, S_{c1}	1.436,0.973	
S_a at building period	1.436	
Site V_{s30}	305 m/s	
V_{s30} basis	Estimated	UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019)
Liquefaction potential/basis	No	UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019)
Landslide potential/basis	No	UCSF Group 2 Buildings – Tier 1 Geotechnical Assessment, Egan (2019)
Active fault-rupture hazard identified at site?	No	

Site-specific ground motion study?	No	
Applicable code		
Applicable code or approx. date of original construction	1979 UBC	Code identified on Sheet S0.1
Applicable code for partial retrofit	None	
Applicable code for full retrofit	None	
Model building data		
Model building type North-South	RM2 Reinforced Masonry Walls w/Stiff Diaphragms	
Model building type East-West	RM2 Reinforced Masonry Walls w/Stiff Diaphragms	
FEMA P-154 score	N/A	Not included here because an ASCE 41-17 Tier 1 evaluation was conducted.
Previous ratings		
Most recent rating	IV	2013 UCSF SRC Rating
Date of most recent rating	10/7/2013	
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

Appendix A

Additional Images

Figure 1. – 3-story wood building adjacent to parking garage.

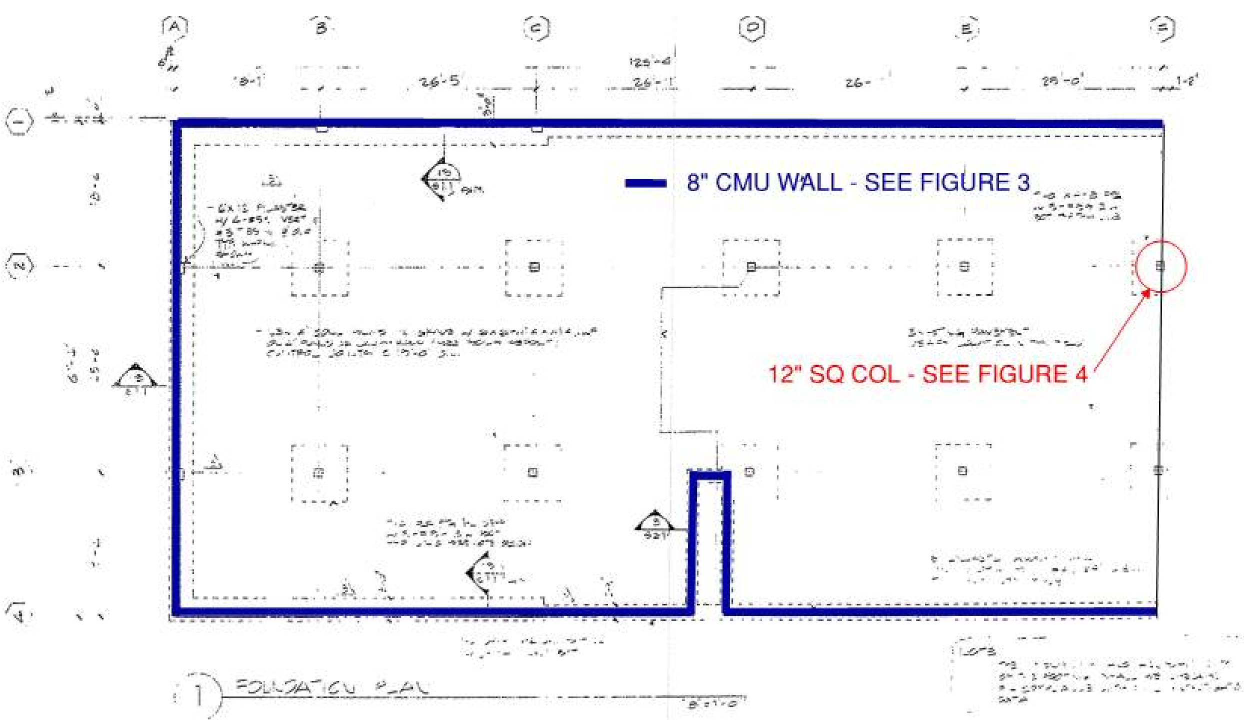


Figure 2. – Garage floor plan

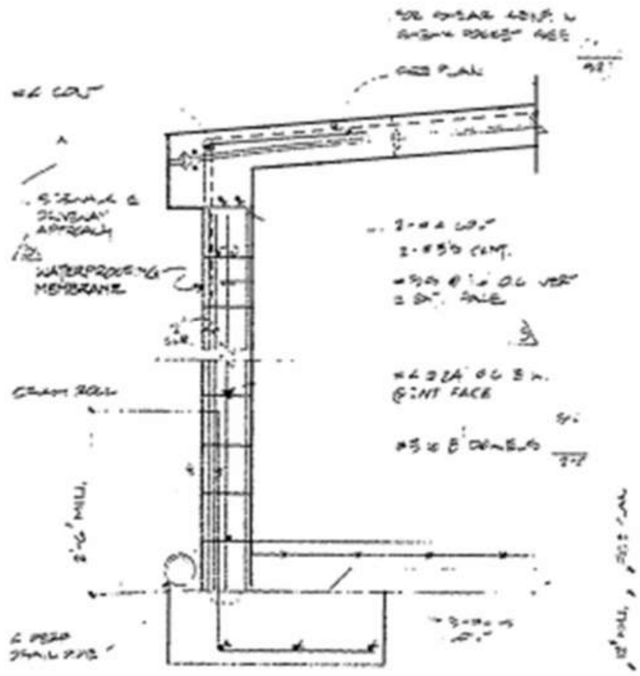


Figure 3. – Building section of 8" CMU wall

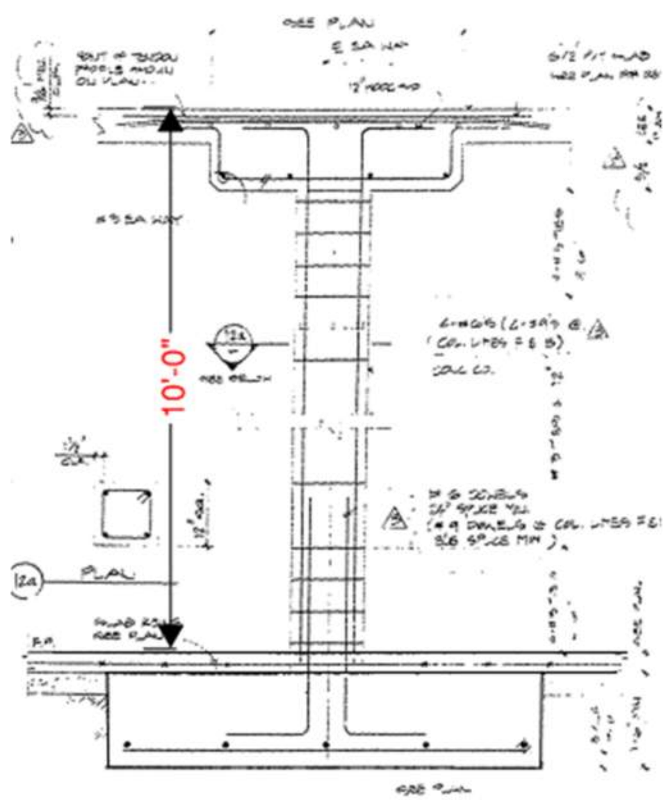


Figure 4. – Building section of 12" concrete column

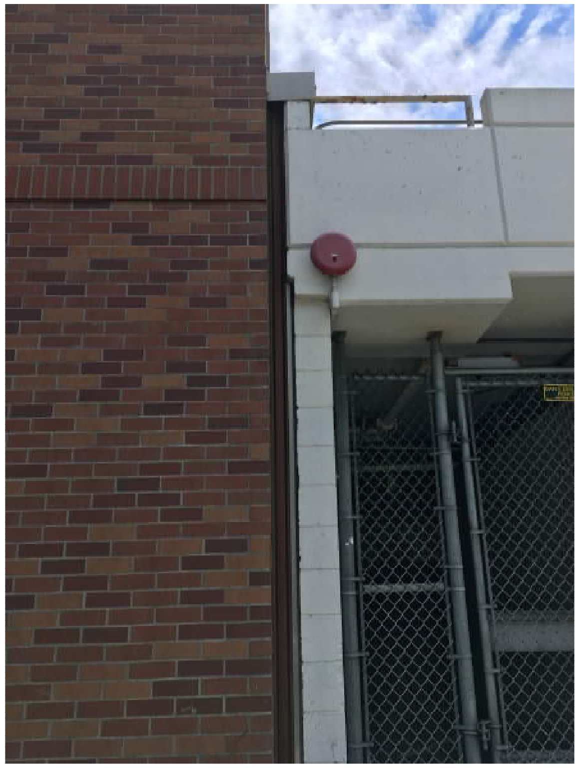


Figure 5. – Adjacent building on east side

Figure 6.– Garage interior

Appendix B

ASCE 41- 17 Tier 1 Checklists (Structural)

UC Campus:	Mount Zion		Date:	June 20, 2019		
Building CAAN:	3033	Auxiliary CAAN:	By Firm:	Estructure		
Building Name:	Post Street Parking Garage		Initials:	*DBH*	Checked:	*MTP*
Building Address:	2325 Post Street; San Francisco, CA 94115		Page:	1	of	3

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

	Description
C (selected) **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:**
C **NC** **N/A** (selected) **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: 4” gap between structure and OSHER building. Building was constructed against 3-story wood building on west side, gap is unknown.**
C **NC** **N/A** (selected) **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:**

BUILDING SYSTEMS - *BUILDING CONFIGURATION*

	Description
C **NC** **N/A** (selected) **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:**
C **NC** **N/A** (selected) **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:**

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

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

C NC N/A U	
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:**
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:**
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:**
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: Further evaluation of the structure using relative rigidity demonstrates walls are adequate to resist seismic demands. A column displacement check was performed at the open side (Post Street) and found that displacement is small enough such that the columns have adequate bending and shear capacity to accommodate expected roof displacement.**

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:**
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:**

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

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

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

GEOLOGIC SITE HAZARD

C NC N/A U	
(●) 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:**

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:**
(●) 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:**

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

UC Campus:	Mount Zion		Date:	June 20, 2019		
Building CAAN:	3033	Auxiliary CAAN:	By Firm:	Estructure		
Building Name:	Post Street Parking Garage		Initials:	*DBH*	Checked:	*MTP*
Building Address:	2325 Post Street; San Francisco, CA 94115		Page:	1	of	4

ASCE 41-17
Collapse Prevention Structural Checklist For Building Type RM1-RM2

LOW AND MODERATE SEISMICITY

SEISMIC-FORCE-RESISTING SYSTEM

C NC N/A U	Description
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:**
C: ◉ NC: ○ N/A: ○ U: ○	SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 70 $lb/in.^2$ (0.48 MPa). (Commentary: Sec. A.3.2.4.1. Tier 2: Sec. 5.5.3.1.1) **Comments: Max shear stress transverse direction = 86 psi, in longitudinal direction = 29 psi**
C: ◉ NC: ○ N/A: ○ U: ○	REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in. (1220 mm), and all vertical bars extend to the top of the walls. (Commentary: Sec. A.3.2.4.2. Tier 2: Sec. 5.5.3.1.3) **Comments:**

STIFF DIAPHRAGMS

C NC N/A U	Description
C: ○ NC: ○ N/A: ◉ U: ○	TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (Commentary: Sec. A.4.5.1. Tier 2: Sec. 5.6.4) **Comments:**

CONNECTIONS

C NC N/A U	Description
C: ◉ NC: ○ N/A: ○ U: ○	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have 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:**

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

UC Campus:	Mount Zion			Date:	June 20, 2019		
Building CAAN:	3033	Auxiliary CAAN:		By Firm:	Estructure		
Building Name:	Post Street Parking Garage			Initials:	DBH	Checked:	MTP
Building Address:	2325 Post Street; San Francisco, CA 94115			Page:	2	of	4

ASCE 41-17
Collapse Prevention Structural Checklist For Building Type RM1-RM2

C NC **N/A (selected)** U	WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Commentary: Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3) **Comments:**
C (selected) 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:**
C NC **N/A (selected)** U	TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (Commentary: Sec. A.5.2.3. Tier 2: Sec. 5.7.2) **Comments:**
C (selected) NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4) **Comments:**
C NC **N/A (selected)** U	GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1) **Comments:**

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

STIFF DIAPHRAGMS

	Description
C NC **N/A (selected)** 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:**
C NC **N/A (selected)** U	OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long. (Commentary: Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3) **Comments:**

UC Campus:	Mount Zion		Date:	June 20, 2019		
Building CAAN:	3033	Auxiliary CAAN:	By Firm:	Estructure		
Building Name:	Post Street Parking Garage		Initials:	DBH	Checked:	MTP
Building Address:	2325 Post Street; San Francisco, CA 94115		Page:	3	of	4

ASCE 41-17
Collapse Prevention Structural Checklist For Building Type RM1-RM2

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:**
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:**
C NC N/A U ○ ○ ◉ ○	OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long. (Commentary: Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3) **Comments:**
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:**
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:**
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:**
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:**

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

UC Campus:	Mount Zion		Date:	June 20, 2019		
Building CAAN:	**3033**	Auxiliary CAAN:	By Firm:	**Estructure**		
Building Name:	Post Street Parking Garage		Initials:	*DBH*	Checked:	*MTP*
Building Address:	2325 Post Street; San Francisco, CA 94115		Page:	4	of	4

ASCE 41-17
Collapse Prevention Structural Checklist For Building Type RM1-RM2

CONNECTIONS

	Description
C NC N/A U (N/A selected)	STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. (3 mm) before engagement of the anchors. (Commentary: Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2) **Comments:**

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

Appendix C

UCOP Seismic Safety policy Falling Hazards Assessment Summary

UC Campus:	UCSF Mount Zion		Date:	07/24/2019		
Building CAAN:	3303	Auxiliary CAAN:	By Firm:	Estructure		
Building Name:	Post Street Parking Garage		Initials:	*JP*	Checked:	*MTP*
Building Address:	2325 Post Street, San Francisco, CA 94115		Page:	1	of	1

UCOP SEISMIC SAFETY POLICY
Falling Hazard Assessment Summary

	Description
P ☐ N/A ☒	**Heavy ceilings, features or ornamentation above large lecture halls, auditoriums, lobbies, or other areas where large numbers of people congregate (50 ppl or more)** **Comments:**
P ☐ N/A ☒	**Heavy masonry or stone veneer above exit ways or public access areas** **Comments:**
P ☐ N/A ☒	**Unbraced masonry parapets, cornices, or other ornamentation above exit ways or public access areas** **Comments:**
P ☐ N/A ☒	**Unrestrained hazardous material storage** **Comments:**
P ☐ N/A ☒	**Masonry chimneys** **Comments:**
P ☐ N/A ☒	**Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc.** **Comments:**
P ☐ N/A ☒	**Other:** **Comments:**
P ☐ N/A ☒	**Other:** **Comments:**
P ☐ N/A ☒	**Other:** **Comments:**

Falling Hazards Risk: *Low*

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

Appendix D

Quick Check Calculations

WEIGHT TAKEOFF

SLAB	6.5" CONC SLAB	81.3 psf
M/E/P/FP		2 psf
CEILING		4 psf
MISC.		2.7 psf
		90 psf

SLAB 90psf (125.3')(61.3') = 692^k

8" CMU WALLS 90psf(5')(350') = 158^k

6" PARAPET 75psf(3.5')(180') = 47^k

TOTAL 897^k

SEISMIC FORCES

$V = C_1 C_2 C_m S_a W$

$S_a = \frac{S_{D1}}{T} < S_{DS}$

$S_{D1} = 0.559$

$S_{DS} = 1.436$

$T = 0.02(10)^{.75} = 0.11\,s$

$S_a = \frac{S_{D1}}{T} = \frac{0.559}{0.11} = 4.97 \Rightarrow$ USE 1.436

$C_1 C_2 = 1.4$ TABLE 7-3 $T < 0.3$ $2 \leq m_{max} < 6$

$C_m = 1.0$ TABLE 7-4 OTHER

$V = (1.4)(1.0)(1.436)(897^k) = 1803^k$

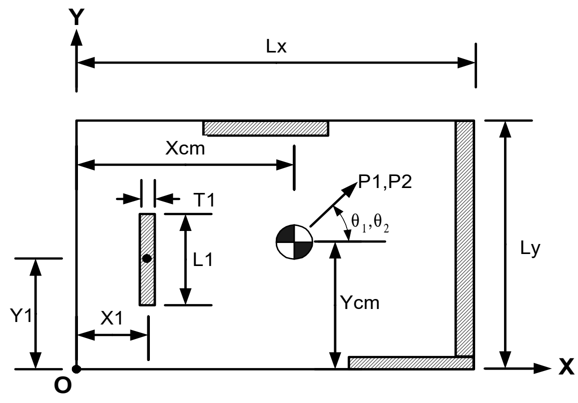
Subject	Prepared by	Page
ASCE 41-17 Tier 2 Evaluation	DBH	1
Project	**Reviewed by**	**Date**
UCSF Tier 1 Seismic Ratings	MTP	6/5/19

INPUT DATA

Center of Mass from Origin:

Lx:	Building overall plan dimension X-dir =	125.33	feet
Ly:	Building overall plan dimension Y-dir =	61.33	feet
Xcm:	Center of mass X-dir =	61.92	feet
Ycm:	Center of mass Y-dir =	29.24	feet

Consider accidental torsion? (Y)es or (N)o = **Y**



Loads (Enter up to 2):

P1:	First Load =	1803.00	kips
Theta1:	Angle of first load from X-axis =	0.00	degrees
P2:	Second load =		kips
Theta2:	Angle of second load from X-axis =		degrees

Location of Walls:

Are walls fixed at stories? (Y,N) **N**

FF: Fixity Factor for Flexural Rigidity = 3

	If Known:*	Input if Stiffness is not Known						
	Local Stiffness	Thickness	Length	Height	Modulus of Elasticity	Angle from X-Dir.	Center of Mass from Origin	
	K	T	L	H	E	An	X	Y
Wall #	k/in	in.	ft.	ft.	ksi	deg.	ft.	ft.
1		8.0	65.3	10.0	630.0	0.0	32.7	0.0
2		8.0	55.5	10.0	630.0	0.0	97.6	0.0
3		8.0	4.5	10.0	630.0	0.0	67.6	17.3
4		8.0	125.3	10.0	630.0	0.0	62.7	61.3
5		8.0	61.3	10.0	630.0	90.0	0.0	30.7
6		8.0	18.3	10.0	630.0	90.0	65.3	9.2
7		8.0	18.3	10.0	630.0	90.0	69.8	9.2

* If wall is pierced or has other irregularities, enter the combined shear and flexural stiffness.

CALCULATIONS

Compute Relative Rigidity of Walls Along Major Building Axes

	Local Area (Al)	RIGIDITY Shear		RIGIDITY Flexural		RIGIDITY Total		Rigidity Moments	
Wall #	Al sf	RvX k/in	RvY k/in	RfX k/in	RfY k/in	RtX k/in	RtY k/in	RtX*Y kips	RtY*X kips
1	43.6	10976	0	351378	0	10644	0	0	0
2	37.0	9324	0	215402	0	8937	0	0	0
3	3.0	756	0	115	0	100	0	20634	0
4	83.6	21056	0	2480678	0	20879	0	15366783	0
5	40.9	0	10304	0	290710	0.0	9951.3	0	0
6	12.2	0	3080	0	7764	0.0	2205.2	0	1728882
7	12.2	0	3080	0	7764	0.0	2205.2	0	1847964
						40559	14362	15387416	3576846
						(A)	(B)	(C)	(D)

Ay & Ax:	Wall area tributary to X or Y direction =	T(L)sin(An) or T(L)cos(An)
RvX & RvY:	Wall shear rigidity =	Ax(0.4E)/(1.2H) or Ay(0.4E)/(1.2H)
RfX & RfY:	Wall flexural rigidity =	(FF)E (I / H^3)
I:	Moment of Inertia =	T(Ax/T)^3 or T(Ay/T)^3
RtX & RtY:	Total wall rigidity =	K or, if unknown, (RvX)(RfX)/(RvX + RfX) and (RvY)(RfY)/(RvY + RfY)
RtX*Y & RtY*X:	Wall rigidity * Moment arm =	(Y)RtX or (X)RtY

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CALCULATIONS (cont)

Compute Torsional Coefficients:

Xcr:	Center of Rigidity =	(D/B) =	20.8	feet
Ycr:		(C/A) =	31.6	feet
Xt:	Torsional Eccentricity =	(Xcr - Xcm) =	-41.2	feet
Yt:		(Ycr - Ycm) =	2.4	feet
XAt:	Accidental Torsion =	(0.05Lx) if considered =	-6.3	feet
YAt:		(0.05Ly) if considered =	3.1	feet
Px:	Resultant Forces =	(L1cos(q1))+(L2cos(q2)) =	1803.0	kips
Py:		(L1sin(q1))+(L2sin(q2)) =	0.0	kips
Xme+:	Maximum Eccentricity w/ + Acc. Torsion =	(Xt + XAt) =	-47.4	feet
Yme+:		(Yt + YAt) =	5.4	feet
Xme-:	Maximum Eccentricity w/ - Acc. Torsion =	(Xt - XAt) =	-34.9	feet
Yme-:		(Yt - YAt) =	-0.7	feet
+Mt:	+ Maximum Torsional Moment =	Px(Yme+)-Py(Xme+) =	9812	kip-feet
-Mt:	- Maximum Torsional Moment =	Px(Yme-)-Py(Xme-) =	-1247	kip-feet

Compute Rigidity Distribution:

	Total Rigidity		Distance from C.R. to C.M. of Wall		Rigidity * Distance		Rigidity * Distance Sqrd.	
	RtX	RtY	X"	Y"	Rtx*Y"	Rty*X"	Rtx*Y"2	Rty*X"2
Wall #	k/in.	k/in.	ft.	ft.	kips	kips	k ft.	k ft.
1	10644	0	11.9	-31.6	-4037966	0	127661079	0
2	8937	0	76.8	-31.6	-3390594	0	107194267	0
3	100	0	46.8	-14.4	-17183	0	246835	0
4	20879	0	41.9	29.7	7445743	0	221273634	0
5	0.0	9951.3	-20.8	-0.9	0	-2478412	0	51438316
6	0.0	2205.2	44.6	-22.4	0	1179666	0	52588064
7	0.0	2205.2	49.1	-22.4	0	1298747	0	63740920
							456375815	167767299
							(E)	(F)

J = Tosional Moment of Inertia = (E) + (F) = 624143115 kip-foot

Compute Resultant Forces:

WALLFORCES + ACCIDENTAL TORSION

		Direct		From Moment		Total (Global Axes)		Maximum Force of Direct, From Moment, Total		
	Wall	Fpx	Fpy	Fmx	Fmy	Ftx	Fty	Fx	Fy	Total
Wall #	Orientation	kips	kips	kips	kips	kips	kips	kips	kips	kips
1	Principal	473.1	0.0	63.5	0.0	536.6	0.0	536.6	0.0	536.6
2	Principal	397.3	0.0	53.3	0.0	450.6	0.0	450.6	0.0	450.6
3	Principal	4.4	0.0	0.3	0.0	4.7	0.0	4.7	0.0	4.7
4	Principal	928.1	0.0	-117.0	0.0	811.1	0.0	928.1	0.0	928.1
5	Principal	0.0	0.0	0.0	-39.0	0.0	-39.0	0.0	39.0	39.0
6	Principal	0.0	0.0	0.0	18.5	0.0	18.5	0.0	18.5	18.5
7	Principal	0.0	0.0	0.0	20.4	0.0	20.4	0.0	20.4	20.4

WALLFORCES - ACCIDENTAL TORSION

		Direct		From Moment		Total (Global Axes)		Maximum Force of Direct, From Moment, Total		
	Wall	Fpx	Fpy	Fmx	Fmy	Ftx	Fty	Fx	Fy	Total
Wall #	Orientation	kips	kips	kips	kips	kips	kips	kips	kips	kips
1	Principal	473.1	0.0	-8.1	0.0	465.1	0.0	473.1	0.0	473.1
2	Principal	397.3	0.0	-6.8	0.0	390.5	0.0	397.3	0.0	397.3
3	Principal	4.4	0.0	0.0	0.0	4.4	0.0	4.4	0.0	4.4
4	Principal	928.1	0.0	14.9	0.0	943.0	0.0	943.0	0.0	943.0
5	Principal	0.0	0.0	0.0	5.0	0.0	5.0	0.0	5.0	5.0
6	Principal	0.0	0.0	0.0	-2.4	0.0	-2.4	0.0	2.4	2.4
7	Principal	0.0	0.0	0.0	-2.6	0.0	-2.6	0.0	2.6	2.6

Fpx & Fpy:	Direct force from P only =	(Px(RtX / Sum RtX)) or (Py(RfY / Sum RfY)
Fmx & Fmy:	Force resultant from torsional moment =	(Mt(Rx(Y) / J)) or (Mt(Ry(X) / J))
Ftx & Fty:	Total actual force of direct and torsion =	(Fp+Fm)
Fx & Fy:	Design force - Maximum of three forces above =	(Max of (Fp, Fm, Ft))
Total:	Resultant force along axis of wall (Walls Orientated to Principal Axes) =	((Fx^2+Fy^2)^.5)
Total:	Resultant force along axis of wall (Walls Orientated to Skewed Axes) =	Fx/Cos(q)+Fy/Sin(q)

Estructure

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Wall Forces Summary

Wall #	Wall Orientation	+ Accident. Torsion Total kips	- Accident. Torsion Total kips	Design Maximum Total kips	Design Maximum Total plf	Capacity Total plf	Demand/ Capacity Ratio
1	Principal	537	473	537	8214	12587	0.65
2	Principal	451	397	451	8119	12587	0.65
3	Principal	5	4	5	1045	12587	0.08
4	Principal	928	943	943	7524	12587	0.60
5	Principal	39	5	39	635	12587	0.05
6	Principal	19	2	19	1012	12587	0.08
7	Principal	20	3	20	1114	12587	0.09

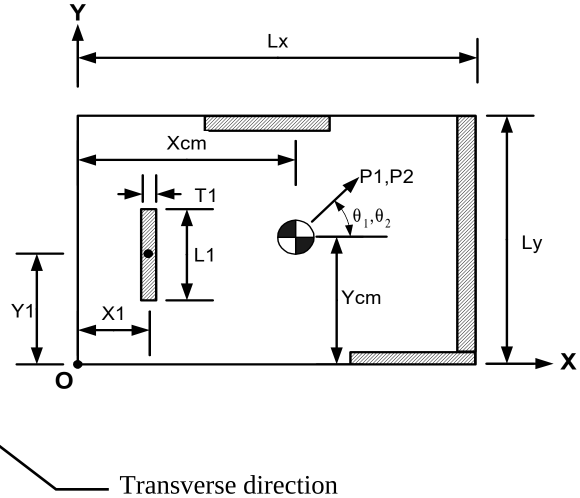
INPUT DATA

Center of Mass from Origin:

Lx:	Building overall plan dimension X-dir =	125.33	feet
Ly:	Building overall plan dimension Y-dir =	61.33	feet
Xcm:	Center of mass X-dir =	61.92	feet
Ycm:	Center of mass Y-dir =	29.24	feet
	Consider accidental torsion? (Y)es or (N)o =	Y	

Loads (Enter up to 2):

P1:	First Load =	1803.00	kips
Theta1:	Angle of first load from X-axis =	90.00	degrees
P2:	Second load =		kips
Theta2:	Angle of second load from X-axis =		degrees



Location of Walls:

Are walls fixed at stories? (Y,N) N

FF: Fixity Factor for Flexural Rigidity = 3

Wall #	If Known:* Local Stiffness K k/in	Input if Stiffness is not Known: Thickness T in.	Length L ft.	Height H ft.	Modulus of Elasticity E ksi	Angle from X-Dir. An deg.	Center of Mass from Origin X ft.	Y ft.
1		8.0	65.3	10.0	630.0	0.0	32.7	0.0
2		8.0	55.5	10.0	630.0	0.0	97.6	0.0
3		8.0	4.5	10.0	630.0	0.0	67.6	17.3
4		8.0	125.3	10.0	630.0	0.0	62.7	61.3
5		8.0	61.3	10.0	630.0	90.0	0.0	30.7
6		8.0	18.3	10.0	630.0	90.0	65.3	9.2
7		8.0	18.3	10.0	630.0	90.0	69.8	9.2

* If wall is pierced or has other irregularities, enter the combined shear and flexural stiffness.

Estructure

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CALCULATIONS

Compute Relative Rigidity of Walls Along Major Building Axes

	Local	R I G I D I T Y							
	Area (Al)	Shear		Flexural		Total		Rigidity Moments	
	Al	RvX	RvY	RfX	RfY	RtX	RtY	RtX*Y	RtY*X
Wall #	sf	k/in	k/in	k/in	k/in	k/in	k/in	kips	kips
1	43.6	10976	0	351378	0	10644	0	0	0
2	37.0	9324	0	215402	0	8937	0	0	0
3	3.0	756	0	115	0	100	0	20634	0
4	83.6	21056	0	2480678	0	20879	0	15366783	0
5	40.9	0	10304	0	290710	0.0	9951.3	0	0
6	12.2	0	3080	0	7764	0.0	2205.2	0	1728882
7	12.2	0	3080	0	7764	0.0	2205.2	0	1847964
						40559	14362	15387416	3576846
						(A)	(B)	(C)	(D)

Ay & Ax:	Wall area tributary to X or Y direction =	T(L)sin(An) or T(L)cos(An)
RvX & RvY:	Wall shear rigidity =	Ax(0.4E)/(1.2H) or Ay(0.4E)/(1.2H)
RfX & RfY:	Wall flexural rigidity =	(FF)E (I / H^3)
I:	Moment of Inertia =	T(Ax/T)^3 or T(Ay/T)^3
RtX & RtY:	Total wall rigidity =	K or, if unknown, (RvX)(RfX)/(RvX + RfX) and (RvY)(RfY)/(RvY + RfY)
RtX*Y & RtY*X:	Wall rigidity * Moment arm =	(Y)RtX or (X)RtY

CALCULATIONS (cont)

Compute Torsional Coefficients:

Xcr:	Center of Rigidity =	(D/B) =	20.8	feet
Ycr:		(C/A) =	31.6	feet
Xt:	Torsional Eccentricity =	(Xcr - Xcm) =	-41.2	feet
Yt:		(Ycr - Ycm) =	2.4	feet
XAt:	Accidental Torsion =	(0.05Lx) if considered =	-6.3	feet
YAt:		(0.05Ly) if considered =	3.1	feet
Px:	Resultant Forces =	(L1cos(q1))+(L2cos(q2)) =	0.0	kips
Py:		(L1sin(q1))+(L2sin(q2)) =	1803.0	kips
Xme+:	Maximum Eccentricity w/ + Acc. Torsion =	(Xt + XAt) =	-47.4	feet
Yme+:		(Yt + YAt) =	5.4	feet
Xme-:	Maximum Eccentricity w/ - Acc. Torsion =	(Xt - XAt) =	-34.9	feet
Yme-:		(Yt - YAt) =	-0.7	feet
+Mt:	+ Maximum Torsional Moment =	Px(Yme+)-Py(Xme+) =	85520	kip-feet
-Mt:	- Maximum Torsional Moment =	Px(Yme-)-Py(Xme-) =	62923	kip-feet

Compute Rigidity Distribution:

	Total Rigidity		Distance from C.R. to C.M. of Wall		Rigidity * Distance		Rigidity * Distance Sqrd.	
	RtX	RtY	X"	Y"	Rtx*Y"	Rty*X"	Rtx*Y"2	Rty*X"2
Wall #	k/in.	k/in.	ft.	ft.	kips	kips	k ft.	k ft.
1	10644	0	11.9	-31.6	-4037966	0	127661079	0
2	8937	0	76.8	-31.6	-3390594	0	107194267	0
3	100	0	46.8	-14.4	-17183	0	246835	0
4	20879	0	41.9	29.7	7445743	0	221273634	0
5	0.0	9951.3	-20.8	-0.9	0	-2478412	0	51438316
6	0.0	2205.2	44.6	-22.4	0	1179666	0	52588064
7	0.0	2205.2	49.1	-22.4	0	1298747	0	63740920
							456375815	167767299
							(E)	(F)

J = Tosional Moment of Inertia = (E) + (F) = 624143115 kip-foot

Compute Resultant Forces:

WALLFORCES + ACCIDENTAL TORSION

		Direct		From Moment		Total (Global Axes)		Maximum Force of Direct, From Moment, Total		
Wall #	Wall Orientation	Fpx kips	Fpy kips	Fmx kips	Fmy kips	Ftx kips	Fty kips	Fx kips	Fy kips	Total kips
1	Principal	0.0	0.0	553.3	0.0	553.3	0.0	553.3	0.0	553.3
2	Principal	0.0	0.0	464.6	0.0	464.6	0.0	464.6	0.0	464.6
3	Principal	0.0	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4
4	Principal	0.0	0.0	-1020.2	0.0	-1020.2	0.0	1020.2	0.0	1020.2
5	Principal	0.0	1249.3	0.0	-339.6	0.0	909.7	0.0	1249.3	1249.3
6	Principal	0.0	276.8	0.0	161.6	0.0	438.5	0.0	438.5	438.5
7	Principal	0.0	276.8	0.0	178.0	0.0	454.8	0.0	454.8	454.8

WALLFORCES - ACCIDENTAL TORSION

		Direct		From Moment		Total (Global Axes)		Maximum Force of Direct, From Moment, Total		
Wall #	Wall Orientation	Fpx kips	Fpy kips	Fmx kips	Fmy kips	Ftx kips	Fty kips	Fx kips	Fy kips	Total kips
1	Principal	0.0	0.0	407.1	0.0	407.1	0.0	407.1	0.0	407.1
2	Principal	0.0	0.0	341.8	0.0	341.8	0.0	341.8	0.0	341.8
3	Principal	0.0	0.0	1.7	0.0	1.7	0.0	1.7	0.0	1.7
4	Principal	0.0	0.0	-750.6	0.0	-750.6	0.0	750.6	0.0	750.6
5	Principal	0.0	1249.3	0.0	-249.9	0.0	999.4	0.0	1249.3	1249.3
6	Principal	0.0	276.8	0.0	118.9	0.0	395.8	0.0	395.8	395.8
7	Principal	0.0	276.8	0.0	130.9	0.0	407.8	0.0	407.8	407.8

Fpx & Fpy:	Direct force from P only =	(Px(RtX / Sum RtX)) or (Py(RfY / Sum RfY)
Fmx & Fmy:	Force resultant from torsional moment =	(Mt(Rx(Y) / J)) or (Mt(Ry(X) / J))
Ftx & Fty:	Total actual force of direct and torsion =	(Fp+Fm)
Fx & Fy:	Design force - Maximum of three forces above =	(Max of (Fp, Fm, Ft))
Total:	Resultant force along axis of wall (Walls Orientated to Principal Axes) =	((Fx^2+Fy^2)^.5)
Total:	Resultant force along axis of wall (Walls Orientated to Skewed Axes) =	Fx/Cos(q)+Fy/Sin(q)

Wall Forces Summary

Wall #	Wall Orientation	+ Accident. Torsion Total kips	- Accident. Torsion Total kips	Design Maximum Total kips	Design Maximum Total plf	Capacity Total plf	Demand/ Capacity Ratio
1	Principal	553	407	553	8469	12587	0.67
2	Principal	465	342	465	8371	12587	0.67
3	Principal	2	2	2	523	12587	0.04
4	Principal	1020	751	1020	8140	12587	0.65
5	Principal	1249	1249	1249	20369	12587	1.62
6	Principal	438	396	438	23917	12587	1.90
7	Principal	455	408	455	24807	12587	1.97

CHECK SHEARWALL STRESS

LONGITUDINAL DIRECTION

BASED ON RELATIVE RIGIDITY SPREADSHEET

MAX FORCE IN WALL IS 8214plf IN WALL ①

SHEAR STRESS = $537^k/8''/65.3'/3 = 29$ PSI ($3 \leftarrow \tau_m$)

TRANSVERSE DIRECTION

BASED ON RELATIVE RIGIDITY SPREADSHEET

MAX FORCE IN WALL IS 24807plf IN WALL ⑦

SHEAR STRESS = $455^k/8''/18.3'/3 = 86$ PSI ($3 \leftarrow \tau_m$)

SHEAR CAPACITY $= 2\sqrt{f'_m} + \rho f_y$

$= 2\sqrt{2000} + \frac{0.2}{8(24)}(40000) = 131$ PSI (#4@24"o.c.)

D/C MAX = $86/131 = 0.66 < 1.0$ OK

CHECK DEFORMATION CAPATIBILITY OF COLUMNS ON OPEN SIDE

ESTIMATE DEFORMATION AT OPEN SIDE

AT WALL ⑤ $V = 1249^k$

$$\Delta = \frac{VL^3}{3EI} = \frac{1249000(120)^3(12)}{3(0.35)(1800000)(8)(736)^3} = 0.0043''$$

(0.35 ← CRACKED)

AT WALL ⑦ $V = 455^k$

$$\Delta = \frac{455000(120)^3(12)}{3(0.35)(1800000)(8)(220)^3} = 0.059''$$

AT OPEN SIDE

$$\Delta = (0.059 - 0.0043)\frac{(125.3')}{69.83'} = 0.10''$$

TO ACCOUNT FOR DIAPHRAGM FLEXIBILITY MULTIPLY BY 2

$\Delta_{ex} = 2(0.10'') = 0.20''$ SAY 1/4"

SHEAR CAPACITY OF COLUMN #3 TIES @ 12" O.C.

$$V_m = 2\sqrt{5000}(12)(10) + \frac{0.22(40000)(10)}{12} = 24304\ \#$$

BENDING CAPACITY OF COLUMN

4 - #9 BARS (60 KSI)

$$M_m = 2(1)(60)\left(10 - \frac{2(60)}{1.7(5)(12)}\right) = 1059\ \text{k-in}$$

$$V_{CAP} = \frac{2M_e}{L} = \frac{2(1.25)(1059)}{120} = 22063\ \#$$

HOWEVER BENDING CAPACITY DOES NOT INCLUDE EFFECTS OF AXIAL LOAD, WHICH WILL MOST LIKELY MAKE COLUMN SHEAR CRITICAL

$$\Delta_{MAX} = \frac{V L^3}{12EI} = \frac{24304(120)^3(12)}{12(57000\sqrt{5000})(12)(12^3)} = 0.50" > 0.25"\ \text{OK}$$