Degenkolb Berkeley UNIVERSITY OF CALIFORNIA

Evaluator: TAB
Date: 6/6/19

ASCE 41-17 Tier 1 Seismic Evaluation

Building Name: Clark Kerr Campus 24 – Recreation Maintenance
CAAN ID: 2037
Auxiliary Building ID: N/A
Address: Clark Kerr Campus, Berkeley, CA 94720
Site location coordinates: Latitude 37.8650 Longitudinal -122.2475
Evaluator Name: Ray Pugliesi/Torrey Bolden

Aerial Photo

East Elevation Photo

UCOP *SEISMIC PERFORMANCE LEVEL* (OR "RATING") BASED ON TIER 1 EVALUATION: IV

BUILDING DATA

ASCE 41-17 Model Building Type (Governing Building Type bolded for Seismic Risk Model when multiple types exist):

a. Longitudinal Direction: C2: Concrete shear wall
b. Transverse Direction: C2: Concrete shear wall

Square Footage: 3,755 ft^2
Building Length: 58'-8"
Building Width: 32'-0"
Building Height: 22'-9"
Story Height: 9'-3" (1st), 13'-6" (2nd)
Number of stories *above* grade: 2
Number of basement stories *below* grade: 0

Year of Original Construction and Code Year: 1968, 1964 UBC (Assumed)
Year of Later Constuction and Code Year: N/A

COST RANGE TO RETROFIT (if applicable): N/A

BUILDING DESCRIPTION

General

This building was built in 1968 and is situated on an East to West sloping site. The building is two stories with three of the first story walls functioning as retaining walls on the North, South and East sides. The building is rectangular in shape with a footprint of about 59 feet in the NS direction and 32 feet in the EW direction and has a total building height of 23 feet. The building area is approximately 3,750 square feet and orginially housed an automotive garage but currently is recreational activities office space.

Structural System

The gravity load structural system consists of a concrete pan joist system that spans the transverse direction to the perimeter concrete shear walls at the roof. At the second level, the pan joist system spans from the perimeter concrete walls to a concrete column line half way through the building which has 12" square concrete columns. The concrete walls on the North, South and East elevation at the first story function as retaining walls. The ground level is a 5" concrete slab on grade. The lateral force resisting system consists of a perimeter concrete shear wall at both levels. The longitudinal walls have openings to accommodate windows and doors. At the second level there are roll up garage doors resulting in no wall on the eastern elevation. The pan joist system acts as a horizontal diaphragm to transfer forces to the concrete shear walls. The walls and the columns are founded on spread footings.

Building Condition

Good, moderate through thickness cracks in concrete slab and roofing resulting in leaking during rain storms. See Figure 2

Date of Site Visit: 05/31/2019, Torrey Bolden & Ray Pugliesi, Degenkolb Engineers
Limitations of walk-through: none

SITE INFORMATION

Site Class (A-F): D Basis: Default assumption per ASCE 41-17
Site Specific Ground Motion Study? No
BSE-1N Spectral Accelerations: Basis: USGS Design Summary Report ASCE 41-17 (see Appendix D)
S_{DS}: 1.517 S_{D1}: 0.996
BSE-2E Spectral Accelerations: Basis: USGS Design Summary Report ASCE 41-17 (see Appendix D)
S_{XS}: 2.03 S_{X1}: 1.28
Level of Seismicity: High
Performance Level: Collapse Prevention Structural Performance

Geologic Hazards:
Fault Rupture Yes Basis:
http://gmw.conservation.ca.gov/SHP/EZRIM/Maps/OAKLAND_EAST_EZRIM.pdf
Liquefaction No Basis:
http://gmw.conservation.ca.gov/SHP/EZRIM/Maps/OAKLAND_EAST_EZRIM.pdf
Landslide No Basis:
http://gmw.conservation.ca.gov/SHP/EZRIM/Maps/OAKLAND_EAST_EZRIM.pdf

PREVIOUS RATINGS SUMMARY

N/A

DOCUMENTATION

Architectural Drawings: "Addition to Vocational Education Building (Auto Body Shop)", Department of General Services, 12/08/1966, 1-4

Structural Drawings: "Addition to Vocational Education Building (Auto Body Shop)", Department of General Services, 12/08/1966, 1-8

Seismic Evaluations: N/A

Geotechnical Reports: N/A

Other Documents: Note: Property was acquired by UC Berkeley and the design and construction was not managed by UC Berekley following UC policies.

CONSTRUCTION DATA

Gravity Load Structural System:	Concrete Pan-Joist System		
Exterior Transverse Walls:	Exposed Structural Concrete	Opening(s)?	Yes
Exterior Longitudinal Walls:	Exposed Structural Concrete	Opening(s)?	Yes
Roof Materials/Framing:	Concrete pan-joist slab system		
Intermediate Floors/Framing:	Concrete pan-joist slab system		
Ground Floor:	5" concrete slab on grade		
Columns:	12" Square Concrete Column	Foundation:	Spread footings
General Condition of Structure:	Good		
Evidence of Settling?:	No		
Special Features & Comments:			

LATERAL-FORCE-RESISTING SYSTEM

	Longitudinal	Transverse
ASCE 41-17 Building Type:	C2: Concrete Shear Wall	C2: Concrete Shear Wall
Diaphragms:	Concrete Slab	Concrete Slab
Vertical Elements:	Concrete Shear Wall	Concrete Shear Wall
Connections:	Spliced Rebar	Spliced Rebar
Details:	Ex. Sheet 6	Ex. Sheet 6
Estimated Fundamental Period, T (sec):	.208	.208
BSE-2E Spectral Acceleration, S_a:	2.03g	2.03g
Modification Factor, C:	1.2 (C2 – Table 4-7)	1.2 (C2 – Table 4-7)
Building Weight, W (kips):	605	605
Seismic Base Shear, V (kips):	1,475	1,475
System Modification Factor, M_s:	4.5	4.5

Significant Structural Deficiencies, Potentially Affecting *Seismic Performance Level* Designation:

- ☐ Lateral System Stress Check (wall shear, column shear or flexure, or brace axial as applicable)
- ☐ Load Path
- ☐ Adjacent Buildings
- ☐ Weak Story
- ☐ Soft Story
- ☐ Geometry (vertical irregularities)
- ☑ Torsion
- ☐ Mass – Vertical Irregularity
- ☐ Cripple Walls
- ☐ Wood Sills (bolting)
- ☐ Diaphragm Continuity
- ☐ Openings at Shear Walls (concrete or masonry)
- ☐ Liquefaction
- ☐ Slope Failure
- ☑ Surface Fault Rupture
- ☐ Masonry or Concrete Wall Anchorage at Flexible Diaphragm
- ☐ URM wall height to thickness ratio
- ☐ URM Parapets or Cornices
- ☐ URM Chimney
- ☐ Heavy Partitions Braced by Ceilings
- ☐ Appendages

OVERALL SEISMIC DEFICIENCIES & EXPECTED SEISMIC PERFORMANCE

The below items have been identified as non-compliant:

1. *Torsion:* The second story of the structure has an inherent torsional response in the longitudinal direction. This is cause by the garage openings on the East elevations. This is not considered to be a serious deficiency due to the significant amount of wall on the three sides of the structure, and the diaphragms ability to act rigidly and distribute the torsional forces to the perimeter walls.
2. *Complete Frames:* A complete secondary gravity system is not present in this structure. This is not a significant deficiency for this structure because there is little axial load in the walls due to the small size of the floor plan. This is not expected to significantly affect the performance of this structure.
3. *Surface Fault Rupture:* This structure is located within the Hayward Fault Zone. There is the potential for differential movement to occur in the surface soils.
   Note: This deficiency is not considered in the rating of this structure.

As a result of these deficiencies having a limited influence on the expected performance of this structure, this structure has been assigned a SPL IV rating.

During the site visit, which was conducted on May 31st, 2019, cracking in the roof slab was observed that was causing water leaks in the second story when it rains outside. No other significant deterioration was observed. This is not expected to affect the seismic performance of the structure at this time.

Seismic Retrofit Concept Sketches/Description (only if above-listed rating is V or greater):

N/A

Appendices

A. Additional Photos

B. ASCE 41-17 Tier 1 Checklists (Structural)

C. UCOP Seismic Safety Policy Falling Hazards Assessment Summary

D. Quick Check Calculations

APPENDIX A
Additional Photos

Figure 1 North Elevation

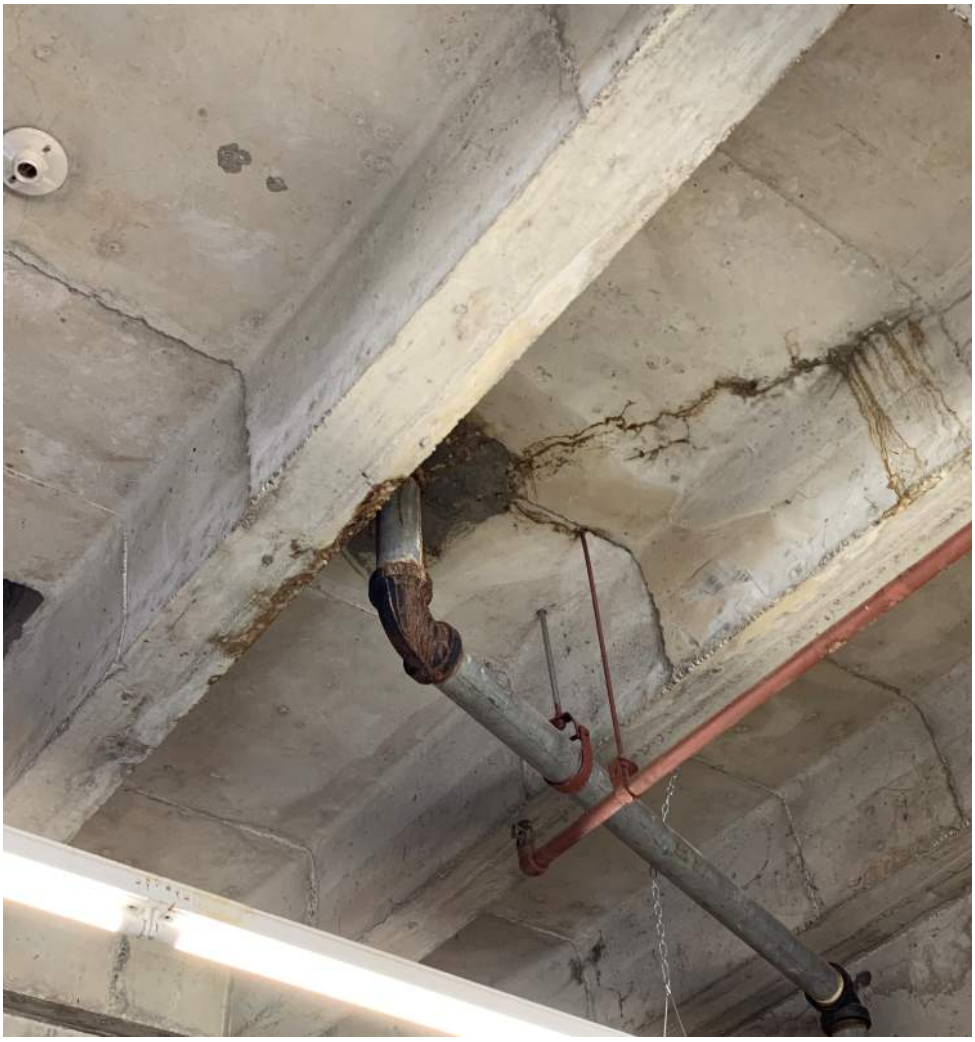

Figure 2 Cracking and leaking in the roof slab

Figure 3 First story interior

Figure 4 Non-load bearing CMU partition wall at the second story

APPENDIX B
ASCE 41-17 Tier 1 Checklist (Structural)

UC Campus:	Berkeley			Date:	6/5/19		
Building CAAN:	2037	Auxiliary CAAN:	-	By Firm:	Degenkolb Engineers		
Building Name:	Clark Kerr Campus, Building 24			Initials:	TAB	Checked:	
Building Address:	Clark Kerr Campus, Building 24			Page:	1	of	3

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

C	NC	N/A	U	Description
◉	○	○	○	LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1) **Comments:**
○	○	◉	○	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:**
○	○	◉	○	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*

C	NC	N/A	U	Description
◉	○	○	○	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A2.2.2. Tier 2: Sec. 5.4.2.1) **Comments:**
◉	○	○	○	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:**
◉	○	○	○	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:** All walls continuous to the foundation

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

UC Campus:	Berkeley			Date:	6/5/19		
Building CAAN:	2037	Auxiliary CAAN:	-	By Firm:	Degenkolb Engineers		
Building Name:	Clark Kerr Campus, Building 24			Initials:	TAB	Checked:	
Building Address:	Clark Kerr Campus, Building 24			Page:	2	of	3

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

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:**
◉	○	○	○	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:**
○	◉	○	○	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6) **Comments:** The top story of the structure is torsionally irregular in the longitudinal direction.

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

GEOLOGIC SITE HAZARD

C	NC	N/A	U	Description
◉	○	○	○	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2m) under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1) **Comments:**
◉	○	○	○	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:**
○	◉	○	○	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:** Structure is located within the fault zone. Source: https://maps.conservation.ca.gov/cgs/EQZApp/app/

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

UC Campus:	Berkeley			Date:	6/5/19		
Building CAAN:	2037	Auxiliary CAAN:	-	By Firm:	Degenkolb Engineers		
Building Name:	Clark Kerr Campus, Building 24			Initials:	TAB	Checked:	
Building Address:	Clark Kerr Campus, Building 24			Page:	3	of	3

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

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

FOUNDATION CONFIGURATION

C	NC	N/A	U	Description
◉	○	○	○	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3) **Comments:**
◉	○	○	○	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:** Continuous strip footings underneath foundation

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

UC Campus:	Berkeley			Date:	6/5/19		
Building CAAN:	2037	Auxiliary CAAN:	-	By Firm:	Degenkolb Engineers		
Building Name:	Clark Kerr Campus, Building 23			Initials:	TAB	Checked:	
Building Address:	Clark Kerr Campus, Building 23			Page:	1	of	3

ASCE 41-17
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:** There is not a complete frame to support gravity loads. No columns cast into or adjacent to the wall.
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:** There is only 1 shear wall in the longitudinal direction at the second level.
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:** See quick checks
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:** See quick checks

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:**
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:** Dowels provided from slab to walls.

ASCE 41-17
Collapse Prevention Structural Checklist For Building Type C2-C2A

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:**

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

Seismic-Force-Resisting System

C	NC	N/A	U	Description
◉	○	○	○	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:** See quick checks
○	○	◉	○	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:** Pan joist system used
○	○	◉	○	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:** No coupling beams are present

Diaphragms (Stiff Or Flexible)

C	NC	N/A	U	Description
◉	○	○	○	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1) **Comments:** No split level diaphragms
○	○	◉	○	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:**

UC Campus:	Berkeley			Date:	6/5/19		
Building CAAN:	2037	Auxiliary CAAN:	-	By Firm:	Degenkolb Engineers		
Building Name:	Clark Kerr Campus, Building 23			Initials:	TAB	Checked:	
Building Address:	Clark Kerr Campus, Building 23			Page:	3	of	3

ASCE 41-17
Collapse Prevention Structural Checklist For Building Type C2-C2A

Flexible Diaphragms

C	NC	N/A	U	Description
○	○	◉	○	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2) **Comments:**
○	○	◉	○	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:**
○	○	◉	○	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:**
○	○	◉	○	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:**
○	○	◉	○	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:**

Connections

C	NC	N/A	U	Description
○	○	◉	○	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:** Spread and strip footings utilized

APPENDIX C
UCOP Seismic Safety Policy Falling Hazards Assessment Summary

UC Campus:	Berkeley			Date:	6/5/2019		
Building CAAN:	2037	Auxiliary CAAN:	-	By Firm:	Degenkolb Engineers		
Building Name:	Clark Kerr Campus, Building 24			Initials:	TAB	Checked:	
Building Address:	Clark Kerr Campus, Building 24			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 Hazard Risk: Low

Note: P= Present, N/A = Not Applicable

APPENDIX D
ASCE 41-17 Quick Check Calculations

Degenkolb Engineers
375 Beale St. Ste. 500
San Francisco, CA 94105

Subject:	Weight Take Off	**Job Number:**	B8114004.00	**Date:**	6/7/2019
Job:	Clark Kerr, Building 24	**By:**	TAB	**Section:**	
		Checked By:		**Page/of:**	

Superimposed Floor DL	
Material	Area Weight
Ceiling	3
Flooring	4
Partions	5
MEP	5
Misc	3
Σ	**20**

Superimposed Roof DL	
Material	Area Weight
Ceiling	3
Roofing	9
Partions	5
MEP	5
Misc	3
Σ	**25**

First Floor

L = 58.67 ft
W = 32 ft
A = 1877.3 ft^2

Item	Total #	Area ft^2	Length ft	Height ft	Area Weight psf	Weight lbf	
4" LWC Slab		1877			36.7	68836	
Superimposed Floor DL		1877			20	37547	
Column BMs	2	4	32		110	26400	
Pan Joist		1589			25	39733	
12" sq Col, Below	3	1		4.63	110	1526	
CMU Wall Above			32	4.625	70	10360	
8" Wall, Above			123	6.75	100.0	82800	
10" Wall, Below			173	4.625	91.7	73380	
					Σ W_{floor}	**341**	**kip**

Second Floor

L = 58.67 ft
W = 32 ft
A = 1877.3 ft^2

Item	Total #	Area ft^2	Length ft	Height ft	Area Weight psf	Weight lbf	
4" LWC Slab		2112			36.7	77440	
Superimposed Roof DL		1877			25	46933	
Pan Joist		1877			25	46933	
CMU Wall Below			32	4.625	70	10360	
8" Wall, Below			123	6.75	100.0	82800	
					Σ W_{floor}	**264**	**kip**

W_{total}	**605**	kip

Degenkolb

Subject:	Base forces	**Job Number:** B8114004	**Date:** 6/7/2019
Job:	Clark Kerr, Building 24	**By:** TAB	
		Checked By:	

ASCE 41-17 Linear Static Base Shear & Vertical Force Distribution
Tier 1

INPUT DATA

C:	Modification factor (Table 4-7) =	1.2		
S_1:	Spectral Response Acceleration @ 1 sec. =	0.75		(from MCE maps or Site Specific)
S_s:	Short Period Response Acceleration =	2.03		(from MCE maps or Site Specific)
SC:	Soil Class =	D		(A through F), 1.6.1.4.1

Table 1-5:	S_1 <= 0.1	S_1 = 0.2	S_1 = 0.3	S_1 = 0.4	S_1 >= 0.5
Soil Class D	2.4	2.0	1.8	1.6	1.5
F_v	-	-	-	-	1.50

F_v:	Site Coefficient for S_1 =	1.50		(Table 11.4-1)

Table 1-4:	S_s <= 0.25	S_s = 0.50	S_s = 0.75	S_s = 1.00	S_s >= 1.25
Soil Class D	1.6	1.4	1.2	1.1	1.0
F_a	-	-	-	-	1.00

F_a:	Site Coefficient for S_s =	1.00		(Table 11.4-2)
S_{X1}:	Spectral Response Acceleration @ 1 sec. =	1.28		(2-2)
S_{xs}:	Short Period Acceleration = F_a*S_s =	2.03		(2-1)
β:	Building System Exponent =	0.75		(4.4.2.4)
C_t:	Building System Coefficient =	0.02		(4.4.2.4)
W:	Total Building Weight =	605	kips	
hn:	Total Building Height =	22.8	feet	
n:	Number of Stories =	2		

CALCULATE BASE SHEAR FOR BSE-2 (MCE)

T:	Fundamental Period of Vibration = C_t * h^{β} =	0.208	sec.	(4-4)
S_a:	Spectral Acceleration at Building Period =	2.03	g	(4-3)
V:	Pseudo Seismic Force =	1475	kips	(4-1)

Story	w	h	w x h	Cx	Fx	Vx
Second	264	22.75	6017	0.66	968	968
First	341	9.25	3150	0.34	507	1475
Σ	605	Σ	9167	Σ	1475	

OSHPD

Latitude, Longitude: 37.865, -122.2475

Date	6/7/2019, 1:09:00 PM
Design Code Reference Document	ASCE41-17
Custom Probability	
Site Class	D - Stiff Soil

Type	Description	Value
Hazard Level		BSE-2N
S_S	spectral response (0.2 s)	2.278
S_1	spectral response (1.0 s)	0.88
S_{XS}	site-modified spectral response (0.2 s)	2.278
S_{X1}	site-modified spectral response (1.0 s)	1.496
F_a	site amplification factor (0.2 s)	1
F_v	site amplification factor (1.0 s)	1.7
ssuh	max direction uniform hazard (0.2 s)	2.919
crs	coefficient of risk (0.2 s)	0.904
ssrt	risk-targeted hazard (0.2 s)	2.637
ssd	deterministic hazard (0.2 s)	2.278
s1uh	max direction uniform hazard (1.0 s)	1.116
cr1	coefficient of risk (1.0 s)	0.893
s1rt	risk-targeted hazard (1.0 s)	0.997
s1d	deterministic hazard (1.0 s)	0.88

Type	Description	Value
Hazard Level		BSE-1N
S_{XS}	site-modified spectral response (0.2 s)	1.519
S_{X1}	site-modified spectral response (1.0 s)	0.997

Type	Description	Value
Hazard Level		BSE-2E
S_S	spectral response (0.2 s)	2.031
S_1	spectral response (1.0 s)	0.751
S_{XS}	site-modified spectral response (0.2 s)	2.031
S_{X1}	site-modified spectral response (1.0 s)	1.276
f_a	site amplification factor (0.2 s)	1
f_v	site amplification factor (1.0 s)	1.7

Type	Description	Value
Hazard Level		BSE-1E
S_S	spectral response (0.2 s)	0.972
S_1	spectral response (1.0 s)	0.336
S_{XS}	site-modified spectral response (0.2 s)	1.08
S_{X1}	site-modified spectral response (1.0 s)	0.66
F_a	site amplification factor (0.2 s)	1.111
F_v	site amplification factor (1.0 s)	1.964

Type	Description	Value
Hazard Level		T-Sub-L Data
T-Sub-L	Long-period transition period in seconds	8

Ms = **4.5** *TBL 4-8*, Collapse Prevention

f'c =	3000	psi
2 √ f'c =	110	psi

TBL 10-2 Default Lower Bound Value

East West

Story	Thickness	Thickness	Aw	V	σ_v	DCR_n
	8	10	in^2	kip	psi	
Second	61		5856	968	37	0.34
First		64	7680	1475	43	0.39

North South

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Story	Thickness	Thickness	Aw	V	σ_v	DCR_n
	8	10	in^2	kip	psi	
Second	34		3264	968	66	0.60
First		107.75	12930	1475	25	0.23

Degenkolb

Subject:	Wall Steel Reinforcement Ratio	**Job Number:**	B8114004	**Date:**	6/7/2019
Job:	Clark Kerr, Building 24	**By:**	TAB		
		Checked By:			

Concrete Walls

8" Wall

Vertical: #4 @ 12" oc

twall =	8	in	
Abar =	0.2	in2	
spacing =	12	in	
rho =	0.0021	OK	> 0.0012 vertical minimum ratio

Horziontal #4 @ 8" oc

twall =	8	in	
Abar =	0.2	in2	
spacing =	8	in	
rho =	0.0031	OK	> 0.02 horizontal minimum ratio

10" Wall

Vertical: #4 @ 18" oc EF

twall =	10	in	
Abar =	0.40	in2	
spacing =	18	in	
rho =	0.0022	OK	> 0.0012 vertical minimum ratio

Horziontal #4 @ 14" oc EF

twall =	10	in	
Abar =	0.40	in2	
spacing =	14	in	
rho =	0.0029	OK	> 0.02 horizontal minimum ratio

Degenkolb

Subject:	Column Deflection Compatability	**Job Number:**	B8114004	**Date:**	6/7/2019
Job:	Clark Kerr, Building 24	**By:**	TAB		
		Checked By:			

1st Story Column

Material Properties

f_y =	40	ksi	f'_c =	3000	psi
f_{ye} =	50	ksi	f'_{ce} =	4500	psi

Section Moment Capacity

Using Expected Material Properties

M_{max} =	59	k-ft	Max Moment Capacity
l =	7.5	ft	
Vlsa =	15.7	kip	
d=	12	in	

Shear Capacity

Shear Design @ Hinge

3 #3 @ 12" oc

Av =	0.11	in^2	
s =	12	in	
d =	9.6	in	
fyE =	50	ksi	
λ =	1		
knl =	1	displacement ductility factor	
Mud/Vud*d =	4		
αcol =	1		
Ag =	144	in^2	
Vcol =	31.1	kip	ASCE 41-17, *EQ (10-3)*

Axial Load

Slab DL	100	psf	Live =	100	psf

L1	16	ft
L2	15.5	ft
A_{trib}	248	ft^2
W_{colum}	30	kip

2nd Story Pier

Material Properties

f_y =	40	ksi	f'_c =	3000	psi
f_{ye} =	50	ksi	f'_{ce} =	4500	psi

Section Moment Capacity

Using Expected Material Properties

M_{max} =	80	k-ft	Max Moment Capacity
l =	12.5	ft	
Vlsa =	12.8	kip	
b=	10	in	
d=	18	in	

Shear Capacity

Shear Design @ Hinge

3 #3 @ 12" oc

Av =	0.11	in^2	
s =	8	in	
d =	14.4	in	
fyE =	50	ksi	
λ =	1		
knl =	1	displacement ductility factor	
Mud/Vud*d =	4		
αcol =	1		
Ag =	180	in^2	
Vcol =	32.4	kip	ASCE 41-17, *EQ (10-3)*

Axial Load

Slab DL	86.7	psf	Live =	20	psf
L1	16	ft			
L2	15.5	ft			
A_{trib}	248	ft^2			
W_{colum}	24	kip			