Degenkolb | Berkeley UNIVERSITY OF CALIFORNIA

Evaluator: HK
Date: 02/08/19

ASCE 41-17 Tier 1 Seismic Evaluation

Building Name: Koshland Hall
CAAN ID: 1796
Auxiliary Building ID: N/A
Address: Core Campus, Berkeley, CA 94720
Site location coordinates: Latitude 37.8737 Longitudinal -122.2649

REGISTERED PROFESSIONAL ENGINEER RAYMOND S. PUGLIESI No. 3968 STRUCTURAL STATE OF CALIFORNIA

Plan Image or Aerial Photo

North Elevation Photo

UCOP *SEISMIC PERFORMANCE LEVEL* (OR "RATING") BASED ON TIER 1 EVALUATION FINDINGS: 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 – rigid diaphragm
b. Transverse Direction: **C2**, Concrete Shear Wall – rigid diaphragm

Square Footage: 154,257 sf
Building Length: 180 ft overall length
Building Width: 165 ft overall width
Building Height: 78 ft
Story Height: 13'-0"
Number of stories *above* grade: 6 Stories
Number of basement stories *below* grade: None (The basement daylights at South elevation, so it has been considered a story)
Year of Original Construction and Code Year: 1990, 1982 UBC
Year of Later Constuction and Code Year: None

COST RANGE TO RETROFIT (if applicable): None

BUILDING DESCRIPTION

General

Koshland Hall is a six story concrete shear wall building located on a sloping site with a cross shaped configuration and re-entrant corners on all sides. It has a mechanical penthouse and a partially subterranean level. It is functionally connected to the Genetics and Plant Biology building at the Foundation Level structurally separated with a 2" joint at the Ground and Entry Levels.

This building houses plant research labs at all floors and storage and freezers in the basement.

Structural System

The gravity system of the building is composed of 20" deep concrete beam and waffle slab system supported over concrete columns and walls, founded on spread footings. The mecahnical level consists of 6" concrete fill over 2" metal deck supported on steel beams, over the central portion of the building. A large floor opening with a helical steel stair is located in the south side of the building, rigidly connected at all levels. Other floor openings for mechanical ducts and elevator shafts also occur at all levels.

The lateral system of the building is composed of perforated perimeter reinforced concrete shear walls that are 18" thick at the bottom and progressively reduce in thickness to 12 ¾" at the top level. At the Mechanical Level, horizontal steel trusses act as diaphragms and transfer lateral loads to the perimeter shear walls.

Building Condition

Good, no visible structural or non-structural damage.

Date of Site Visit: 3/26/2019, Ray Pugliesi and Heavenz Kaur, Degenkolb Engineers
Limitations of walk-through: None

SITE INFORMATION

Site Class (A-F): C Basis: Geologic Hazards and Site Classification Map of UC Berkeley by Geomatrix.
Site Specific Ground Motion Study? Yes, 2015 Update to the Site-Specific Seismic Hazard Analyses and Development of Seismic Design Ground Motions
BSE-1N Spectral Accelerations: Basis: 2015 Site Specific Report Table 5 for 36-75 ft Soil
S_{DS}: 2.40 S_{D1}: 0.71
BSE-2E Spectral Accelerations: Basis: 2015 Site Specific Report Table 6 for 36-75 ft Soil
S_{XS}: 3.15 S_{X1}: 1.05
Level of Seismicity: High
Performance Level: Collapse Prevention Structural Performance (Risk category II, ASCE 41-17 Table 2-1)

Geologic Hazards:
Fault Rupture No Basis: Earthquake Zones of Required Investigation- Oakland West Quadrangle https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/
Liquefaction No Basis: Earthquake Zones of Required Investigation- Oakland West Quadrangle https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/

Landslide No Basis: Earthquake Zones of Required Investigation- Oakland West Quadrangle https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/

PREVIOUS RATINGS SUMMARY

1. Good – 1997 Preliminary Seismic Evaluation (SAFER), Degenkolb Engineers.

DOCUMENTATION

Architectural Drawings: Biological Sceinces, Project II, University of California, Berkeley, dated April 8, 1987, by Hellmuth, Obata & Kassabaum, Inc.

Structural Drawings: Biological Sceinces, Project II, University of California, Berkeley, dated April 8, 1987, by Martin, Middlebrook & Nishkian Structural Engineers.

Seismic Evaluations: 1997 Preliminary Seismic Evaluation (SAFER), dated September 3, 1997, by Degenkolb Engineers.

Geotechnical Reports: Not available

Other Documents: None

CONSTRUCTION DATA

Gravity Load Structural System:	Two-way waffle beam slab system supported on concrete columns and perimeter concrete walls.		
Exterior Transverse Walls:	Reinforced concrete shear walls ranging from 18” thick at the bottom to 12 ¾” thick at the top.	Opening(s)?	Yes
Exterior Longitudinal Walls:	Similar to Transverse Walls	Opening(s)?	Yes
Roof Materials/Framing:	Clay tile on bare metal deck supported on steel beams.		
Intermediate Floors/Framing:	20” thick waffle slab with 4 ½” thick slab spanning between joists spaced at 36” o.c. supported on beams and columns.		
Ground Floor:	8” thick slab on grade w/#5@12” o.c. EW		
Columns:	20”x24” columns at the bottom, reducing to 20”x20” columns at the top.	Foundation:	Spread footings at columns and continuous footings at walls.
General Condition of Structure:	Good		
Evidence of Settling?:	No		
Special Features & Comments:	Cross shaped plan with re-entrant corners at all sides.		
	Separated from GPB building with 2” seismic joint at ground and entry level.		

LATERAL-FORCE-RESISTING SYSTEM

	Longitudinal	Transverse
ASCE 41-17 Building Type:	C2: Concrete SW	C2: Concrete SW
Diaphragms:	20" thick waffle slab w/ joists @ 36" o.c.	20" thick waffle slab w/ joists @ 36" o.c.
Vertical Elements:	12"-18" thick concrete perimeter walls 20"x24" – 20"x20" concrete columns w/ ties @ 12"o.c.	12"-18" thick concrete perimeter walls 20"x24" – 20"x20" concrete columns w/ ties @ 12"o.c.
Connections:	Dowelled in cast in place concrete	Dowelled in cast in place concrete
Details:	Dwg 341-372	Dwg 341-372
Estimated Fundamental Period, T (sec):	0.525	0.525
BSE-2E Spectral Acceleration, S_a:	2.00g	2.00g
Modification Factor, C:	1.0	1.0
Building Weight, W (kips):	32,220	32,220
Seismic Base Shear, V (kips):	64,448	64,448
System Modification Factor, M_s:	4.5 for reinforced concrete shear wall at CP, per Table 4-8 of ASCE 41-17	4.5 for reinforced concrete shear wall at CP, per Table 4-8 of ASCE 41-17

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

No Tier 1 deficiencies discovered. Some elements prone to damage because of a seismic event are:

1. The reentrant may suffer diaphragm cracking due to offset collectors.
2. Stairs may suffer damage due to inter story drift in case of lateral movement.
3. Unanchored, large storage cabinets were spotted in the lower levels that may pose a falling hazard and require anchoring.

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

Not applicable

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 A.1 Typical waffle slab at floors

Figure A.2 Roof deck supported on steel framing

Figure A.3 Unanchored heavy cabinets

APPENDIX B

ASCE 41-17 Tier 1 Checklists (Structural)

UC Campus:	BERKELEY			Date:	03/28/2019		
Building CAAN:	1796	Auxiliary CAAN:	N/A	By Firm:	DEGENKOLB ENGINEERS		
Building Name:	KOSHLAND HALL			Initials:	*HK*	Checked:	
Building Address:	BERKELEY, CA 94720			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:** 2" seismic joint at the ground and entry levels.
●	○	○	○	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:**

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

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ASCE 41-17
Collapse Prevention Basic Configuration Checklist

C	NC	N/A	U	
●	○	○	○	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:**

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:**

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

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ASCE 41-17
Collapse Prevention Basic Configuration Checklist

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

FOUNDATION CONFIGURATION

	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:** Base/Height = 160'/78'=2.05>0.6*2.00 (Sa)=1.2
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:** 8" concrete slab on grade ties the spread footings together.

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

UC Campus:	BERKELEY			Date:	03/28/2019		
Building CAAN:	1796	Auxiliary CAAN:	N/A	By Firm:	DEGENKOLB ENGINEERS		
Building Name:	KOSHLAND HALL			Initials:	HK	Checked:	
Building Address:	BERKELEY, CA 94720			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:**
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 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:** Average shear stress in the walls is maximum 70 psi.
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:** 18" thick walls: 2 curtains of #5@6" o.c. EF EW 16 ¾" thick walls: 2 curtains #5@6" o.c. EF EW 12 ¾" thick walls: 2 curtains #5@12" o.c. EF EW

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:** Horizontal truss connects the steel mechanical level to perimeter shear walls.

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

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:**
○	○	◉	○	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:**
○	○	◉	○	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:**

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:**
◉	○	○	○	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:**

Flexible Diaphragms

	Description

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

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:**
○	○	◉	○	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

				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:**

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

APPENDIX C

UCOP Seismic Safety Policy Falling Hazards Assessment Summary

UC Campus:	BERKELEY			Date:	3/28/2019		
Building CAAN:	1796	Auxiliary CAAN:	N/A	By Firm:	DEGENKOLB ENGINEERS		
Building Name:	KOSHLAND HALL			Initials:	*HK*	Checked:	
Building Address:	BERKELEY, CA 94720			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:** Unanchored, large storage/ research cabinets were spotted in the lower levels of the building.
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

Degenkolb Engineers
1300 Clay St, 9th Floor
Oakland, CA 94612-2047
Phone: 510.272.9040
Fax: 510.272.9526

Degenkolb

Subject:	Weight Take Off	**Job Number:**	B8114004.00	**Date:**	3/28/2019
Job:	UCB, KOSHLAND HALL	**By:**	HK	**Section:**	
		Checked By:		**Page/of:**	

Ground Level

Total Flat Load: (Slab)*(Area - Open)+Beams+Girder+Col+Ext.Panel+5 psf			6050	kips
Effective Flat Dead Load (includes 10psf Partition)			262	psf

Entry Level

Total Flat Load: (Slab)*(Area - Open)+Beams+Girder+Col+Ext.Panel+5 psf			6050	kips
Effective Flat Dead Load (includes 10psf Partition)			262	psf

Level 2

Total Flat Load: (Slab)*(Area - Open)+Beams+Girder+Col+Ext.Panel+5psf			6013	kips
Effective Flat Dead Load (includes 10psf Partition)			261	psf

Level 3

Total Flat Load: (Slab)*(Area - Open)+Beams+Girder+Col+Ext.Panel+5psf			5700	kips
Effective Flat Dead Load (includes 10psf Partition)			247	psf

Level 4

Total Flat Load: (Slab)*(Area - Open)+Beams+Girder+Col+Ext.Panel+5psf			5480	kips
Effective Flat Dead Load (includes 10psf Partition)			238	psf

Mechanical Level+Roof

Total Flat Load: (Slab)*(Area - Open)+Beams+Girder+Col+Ext.Panel+5psf			2928	kips
Effective Flat Dead Load (includes 10psf Partition)			132	psf

Total Building Weight 32220 kips

Degenkolb

Subject:	Base forces	**Job Number:** B8114004.00	**Date:** 01-Jul-2019
Job:	UCB, KOSHLAND HALL	**By:** HK	
	Tier 1 evaluation, RC shear walls	**Checked By:**	

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

INPUT DATA

C:	Modification factor (Table 4-7) =	1.0			
S_1:	Spectral Response Acceleration @ 1 sec. =	1.03			(from MCE maps or Site Specific)
S_s:	Short Period Response Acceleration =	2.47			(from MCE maps or Site Specific)
SC:	Soil Class =	C			(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 C	1.5	1.5	1.5	1.5	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 C	1.3	1.3	1.2	1.2	1.2
F_a	-	-	-	-	1.20

F_a:	Site Coefficient for S_s =	1.20			(Table 11.4-2)
S_{X1}:	Spectral Response Acceleration @ 1 sec. =	1.050			Table 6, Site Specific
S_{xs}:	Short Period Acceleration =	3.150			Table 6, Site Specific
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 =	32220	kips		
hn:	Total Building Height =	78	feet		
n:	Number of Stories =	6			

CALCULATE BASE SHEAR FOR BSE-2E (MCE)

T:	Fundamental Period of Vibration = $C_t * h_n^{\beta}$ =	0.525	sec.	(4-4)
S_a:	Spectral Acceleration at Building Period =	2.00		(4-3)
V:	Pseudo Seismic Force =	64448	kips	(4-1)

CALCULATE BASE SHEAR FOR BSE-2E (MCE) Tier 2

C_1C_2:	Modification Factors =		1.1	(Table 7-3)
C_m:	Effective Mass Factor =		0.8	(Table 7-4)
V:	Pseudo Seismic Force =	56714	kips	

Degenkolb

Subject:	ASCE 41 Shear Stress check, Section 4.4.3.3	**Job Number:**	B8114004.00	**Date:**	07/01/19
Job:	UCB, KOSHLAND HALL	**By:**	HK	**Section:**	
Model:	ASCE 41, TIER 1	**Checked By:**		**Page**	of

Story Shears

Base Shear V **64448** kips
k 1
Ms 4.5 for RC wall, Collapse Prevention

x	w_x	h_x	$w_x h_x^k$	F_x	V_j
Roof	2928	78	228346	10890	10890
Level 4	5480	65	356176	16986	27877
Level 3	5700	52	296390	14135	42012
Level 2	6013	39	234492	11183	53195
Entry Level	6050	26	157300	7502	60697
Ground	6050	13	78650	3751	64448
	32220		1351354	64448	

Level	Wall Length N/S	Wall Length E/W	Average Wall thickness	f'c	2sqrt(f'c) (psi)	Demand (psi) N/S	Demand (psi) E/W	D/C- Tier 1 N/S	D/C- Tier 1 E/W
Roof	196.00	236.00	12.75	5000.00	141.42	80.70	67.02	0.57	0.47
Level 4	196.00	236.00	12.75	5000.00	141.42	206.6	171.56	1.46	1.21
Level 3	196.00	236.00	16.75	5000.00	141.42	237.0	196.81	1.68	1.39
Level 2	196.00	236.00	16.75	5000.00	141.42	300.1	249.20	2.12	1.76
Entry Level	364.00	408.00	18.00	5000.00	141.42	171.6	153.05	1.21	1.08
Ground	364.00	408.00	18.00	5000.00	141.42	182.2	162.51	1.29	1.15

Tier 2

Base Shear V **56714** kips
k 1
m 3 (Table 10-22)

x	w_x	h_x	$w_x h_x^k$	F_x	V_j
Roof	2928	78	228346	9583	9583
Level 4	5480	65	356176	14948	24531
Level 3	5700	52	296390	12439	36970
Level 2	6013	39	234492	9841	46812
Entry Level	6050	26	157300	6602	53413
Ground	6050	13	78650	3301	56714
	32220		1351354	56714	

Level	Wall Length N/S	Wall Length E/W	Average Wall thickness	Ast	2sqrt(f'cE)+Ash	Demand (psi) N/S	Demand (psi) E/W	D/C- Tier 2 N/S	D/C- Tier 2 E/W
Roof	196.00	236.00	12.75	#5@12 EF EW	477.13	107	88	0.22	0.19
Level 4	196.00	236.00	12.75	#5@12 EF EW	477.13	273	226	0.57	0.47
Level 3	196.00	236.00	16.75	#5@6 EF EW	635.89	313	260	0.49	0.41
Level 2	196.00	236.00	16.75	#5@6 EF EW	635.89	396	329	0.62	0.52
Entry Level	364.00	408.00	18.00	#5@6 EF EW	603.76	226	202	0.38	0.33
Ground	364.00	408.00	18.00	#5@6 EF EW	603.76	240	215	0.40	0.36

Degenkolb

Subject:	Column Deflection Compatability	**Job Number:** B8114004	**Date:** 3/28/2019
Job:	UCB, KOSHLAND HALL	**By:** HK	
		Checked By:	

Material Properties

f_y =	60	ksi	f'_c =	6000	psi
f_{ye} =	75	ksi	f'_{ce} =	9000	psi

Section Moment Capacity

Using Expected Material Properties

M_{max} =	459	k-ft	@ 435 k Axially
l =	11	ft	
Vlsa =	83.5	kip	

Ø 12"x24"

Shear Capacity

Shear Design @ Hinge

#3 @ 6" oc

Av =	0.44	in^2	
s =	6	in	
d =	10.3125	in	
fyE =	75	ksi	
λ =	1		
knl =	1	displacement ductility factor	
Mud/Vud*d =	4		
αcol =	1		
Ag =	288	in^2	
V steel=	57	kips	
V conc=	63	kips	
Vcol =	119.4	kip	ASCE 41-17, EQ (10-3)

Axial Load

			psf
	Weight	1402	psf
L1	11	ft	
L2	11	ft	
A_{trib}	310	ft^2	
Total Load	435	kips	