

ASCE 41-17 Tier 1 Seismic Evaluation

Building Name: Genetics and Plant Biology

CAAN ID: 1789

Auxiliary Building ID: N/A

Address: Core Campus, Berkeley, CA 94720

Site location coordinates: Latitude 37.8734 Longitudinal -122.2648



Plan Image or Aerial Photo



South Elevation Photo



UCOP SEISMIC PERFORMANCE LEVEL (OR "RATING") BASED ON TIER 1 EVALUATION FINDINGS: V

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: 30,585 sf (129,124 sf total with Parking NW CAAN# 1218)

Building Length: 290 ft overall length

Building Width: 160 ft overall width

Building Height: 52 ft

Story Height: 13'-0"

Number of stories *above* grade: 4 Stories (2 stories GPB Building, 2 stories Parking NW)

Number of basement stories *below* grade: None (The garage daylights at West 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): Low: less than \$50 per square foot

BUILDING DESCRIPTION

General

Genetics and Plant Biology with Parking NW is a four story concrete shear wall building located on a sloping site with a two story parking garage below the building and a mechanical penthouse. The Entry Level serves as the podium for the building above. There is a horizontal set back above the Entry Level in all directions. It is connected to the Koshland Hall at the Foundation Level and has a 2" separation from it at the Ground and Entry Levels.

A tunnel structure at the west of the building serves as an entrance to the Parking garage at the Foundation Level. The building houses various teaching labs and classrooms.

Structural System

The gravity system of the building is composed of 24" deep concrete beam and waffle slab system at the top two levels and flat slab at the subterranean parking levels, supported over concrete columns and walls, founded on spread footings. The mechanical level consists of 6" concrete fill over 2" metal deck supported on steel beams, over the central portion of the building, with horizontal steel trusses that transfer lateral loads to the perimeter walls. A 10" thick flat slab with 7 ½" thick drop occurs at the Entry Level and 8 ½" thick slab with 2 ½" drops occurs at the Ground Level.

The lateral system of the building is composed of perimeter reinforced concrete shear walls that are 14" thick. Shear walls along Lines N.1 and D.9 above the Entry level are discontinuous. Other shear walls have very large openings.

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 Sciences, Project II, University of California, Berkeley, dated April 8, 1987, by Hellmuth, Obata & Kassabaum, Inc.](#)

Structural Drawings: [Biological Sciences, 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:	14" thick reinforced concrete shear walls.	Opening(s)?	Yes
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Exterior Longitudinal Walls:	Similar to Transverse Walls	Opening(s)?	Yes
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Roof Materials/Framing: [Clay tile on bare metal deck supported on steel beams.](#)

Intermediate Floors/Framing: [24" thick waffle slab with 4 ½" thick slab spanning between joists spaced at 48" o.c. supported on beams and columns.](#)

Ground Floor: [5" thick slab on grade w/#4@18" o.c. EW](#)

Columns:	16"x26", 14"x24" reinforced concrete columns.	Foundation:	Spread footings at columns and continuous footings at walls.
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General Condition of Structure: [Good](#)

Evidence of Settling?: No

Special Features & Comments: 160' horizontal setback at the Entry Level.
Separated from Koshland Hall with 2" seismic joint at ground and entry level.

LATERAL-FORCE-RESISTING SYSTEM

	Longitudinal	Transverse
ASCE 41-17 Building Type:	<u>C2: Concrete SW</u>	<u>C2: Concrete SW</u>
Diaphragms:	<u>24" thick waffle slab w/ joists @ 48" o.c. at the top two levels and 10" thick and 8 ½" thick flat slab at the subterranean levels.</u>	<u>24" thick waffle slab w/ joists @ 48" o.c. at the top two levels and 10" thick and 8 ½" thick flat slab at the subterranean levels.</u>
Vertical Elements:	<u>14" thick concrete perimeter walls 16"x26" – 14"x24" concrete columns w/ ties @ 12" o.c.</u>	<u>14" thick concrete perimeter walls 16"x26" – 14"x24" concrete columns w/ ties @ 12" o.c.</u>
Connections:	<u>Dowelled in cast in place concrete</u>	<u>Dowelled in cast in place concrete</u>
Details:	<u>Dwg 341-372</u>	<u>Dwg 341-372</u>
Estimated Fundamental Period, T (sec):	<u>0.387</u>	<u>0.387</u>
BSE-2E Spectral Acceleration, S _a :	<u>2.71g</u>	<u>2.71g</u>
Modification Factor, C:	<u>1.0</u>	<u>1.0</u>
Building Weight, W (kips):	<u>28,460</u>	<u>28,460</u>
Seismic Base Shear, V (kips):	<u>77,168</u>	<u>77,168</u>
System Modification Factor, M _s :	<u>4.5 for reinforced concrete shear wall at CP, per Table 4-8 of ASCE 41-17</u>	<u>4.5 for reinforced concrete shear wall at CP, per Table 4-8 of ASCE 41-17</u>

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

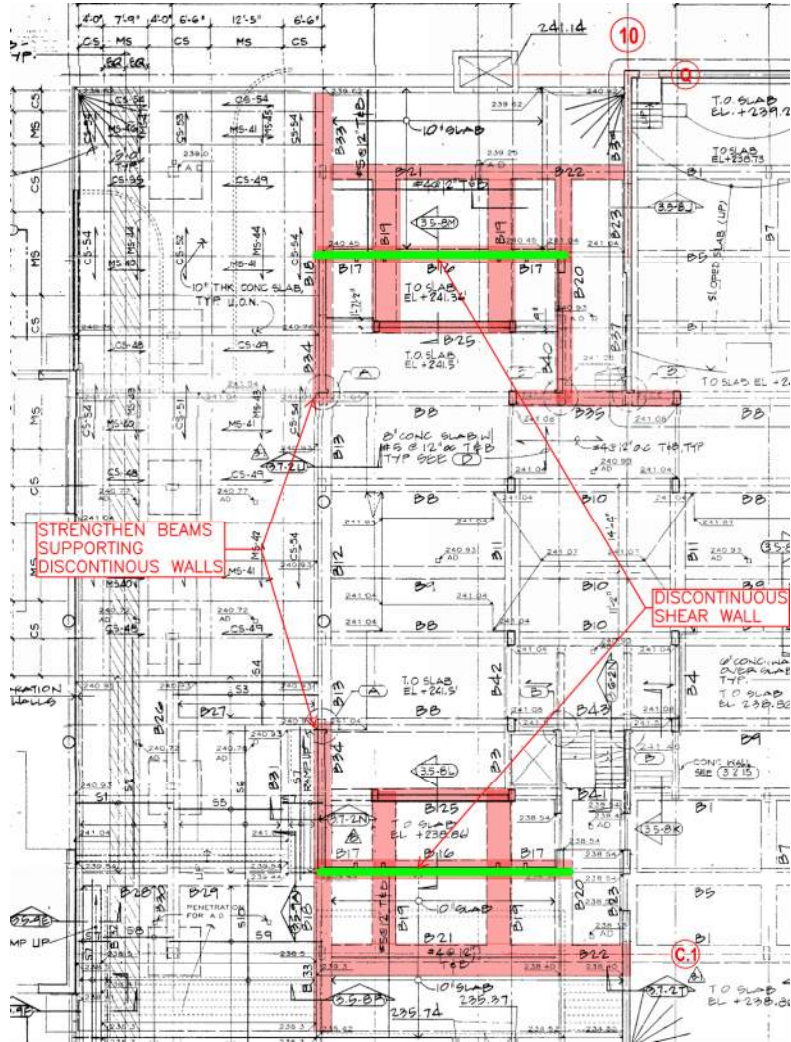
The following structural deficiencies have been identified in the building:

1. Discontinuous walls: Columns supporting the discontinuous walls may suffer damage during a seismic event. However, the low shear stresses due to the length of wall available will reduce the potential of damage to the supporting columns.
2. Geometry: The seismic-force -resisting system of the building is less than 30% in horizontal dimension above Entry Level. Such a geometric irregularity introduces unexpected higher mode effects that may lead to concentration of loads in certain shear walls.
3. Mass: The effective mass of Leve 2 is less than 50% of the Entry Level. This irregular vertical mass distribution will cause unexpected higher mode effects that may lead to concentration of demands in certain shear walls.
4. Re-entrant corners: There might be some diaphragm cracking at the re-entrant corners at the Second Level, during a seismic event.

Despite the above-mentioned deficiencies, the building has sufficient shear wall length so that shear stresses are low and concentration of demands in certain walls may not overstress them beyond capacity. A more detailed Tier 2 analysis will provide a better understanding of the force distribution and ductility demands to better evaluate the importance of the current identified deficiencies, which may improve the current building rating.

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

Strengthen concrete beams supporting the discontinuous shear walls at Entry Level, with FRP overlay.



Partial plan of Entry Level (North End) showing discontinuous shear walls supported on concrete beams that may need strengthening

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 Flat slab at parking levels

APPENDIX B

ASCE 41-17 Tier 1 Checklists (Structural)

UC Campus:	BERKELEY			Date:	03/28/2019		
Building CAAN:	1789	Auxiliary CAAN:	N/A	By Firm:	DEGENKOLB ENGINEERS		
Building Name:	GENETICS AND PLANT BIOLOGY			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

	Description
C NC N/A U <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	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: Discontinuous shear walls along lines N.1 and D.9
C NC N/A U <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	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.
C NC N/A U <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	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 U <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	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. A.2.2.2. Tier 2: Sec. 5.4.2.1) Comments:
C NC N/A U <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	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:
C NC N/A U <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	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: Discontinuous shear walls along lines 8,13, N.1 and D.9

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

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Building Address:	BERKELEY, CA 94720			Page:	2	of	3

ASCE 41-17 Collapse Prevention Basic Configuration Checklist

C <input checked="" type="checkbox"/> NC <input type="checkbox"/> N/A <input type="checkbox"/> U <input type="checkbox"/>	<p>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)</p> <p>Comments: The seismic -force-resisting system is less than 30% in area above the Entry Level</p>
C <input checked="" type="checkbox"/> NC <input type="checkbox"/> N/A <input type="checkbox"/> U <input type="checkbox"/>	<p>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)</p> <p>Comments: The building is less than 50% in mass above the Entry Level</p>
C <input checked="" type="checkbox"/> NC <input type="checkbox"/> N/A <input type="checkbox"/> U <input type="checkbox"/>	<p>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)</p> <p>Comments:</p>

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

GEOLOGIC SITE HAZARD

	Description
C <input checked="" type="checkbox"/> NC <input type="checkbox"/> N/A <input type="checkbox"/> U <input type="checkbox"/>	<p>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)</p> <p>Comments:</p>
C <input checked="" type="checkbox"/> NC <input type="checkbox"/> N/A <input type="checkbox"/> U <input type="checkbox"/>	<p>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)</p> <p>Comments:</p>
C <input checked="" type="checkbox"/> NC <input type="checkbox"/> N/A <input type="checkbox"/> U <input type="checkbox"/>	<p>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)</p> <p>Comments:</p>

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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 <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<p>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)</p> <p>Comments: Base/Height = $160'/52'=3 > 0.6 * 2.00 (S_a)=1.2$</p>
C NC N/A U <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<p>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)</p> <p>Comments: 5" concrete slab on grade ties the spread footings together.</p>

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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)			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	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)			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	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)			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comments: Average shear stress in the walls is maximum 60% of $2\sqrt{f'_c}$			
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)			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comments: 14" thick walls: 2 curtains of #5@12" o.c. (V) EF, #5@14" o.c. (H) EF			
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)			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	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)			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comments: Horizontal truss connects the steel mechanical level to perimeter shear walls.			

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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)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comments:

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)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comments:
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)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comments:
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)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comments:

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)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	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)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	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 <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<p>CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)</p> <p>Comments:</p>
C NC N/A U <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<p>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)</p> <p>Comments:</p>
C NC N/A U <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<p>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)</p> <p>Comments:</p>
C NC N/A U <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<p>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)</p> <p>Comments:</p>
C NC N/A U <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<p>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)</p> <p>Comments:</p>
Connections	
	Description
C NC N/A U <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<p>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)</p> <p>Comments:</p>

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APPENDIX C

UCOP Seismic Safety Policy Falling Hazards Assessment Summary

UC Campus:	BERKELEY			Date:	3/28/2019		
Building CAAN:	1789	Auxiliary CAAN:	N/A	By Firm:	DEGENKOLB ENGINEERS		
Building Name:	GENETICS AND PLANT BIOLOGY			Initials:	HK	Checked:	
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UCOP SEISMIC SAFETY POLICY Falling Hazard Assessment Summary

		Description
P <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	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 <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	Heavy masonry or stone veneer above exit ways or public access areas Comments:
P <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	Unbraced masonry parapets, cornices, or other ornamentation above exit ways or public access areas Comments:
P <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	Unrestrained hazardous material storage Comments:
P <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	Masonry chimneys Comments:
P <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc. Comments:
P <input type="checkbox"/>	N/A <input type="checkbox"/>	Other: Comments:
P <input type="checkbox"/>	N/A <input type="checkbox"/>	Other: Comments:
P <input type="checkbox"/>	N/A <input type="checkbox"/>	Other: Comments:

Falling Hazards Risk: Low

APPENDIX D

Quick Check Calculations



Degenkolb Engineers

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Subject: Weight Take Off	Job Number: B8114004 00	Date: 3/28/2019
Job: UCB, GENETICS & PLANT BIOLOGY (GPB)	By: HK	Section:
	Checked By:	Page/of:

Ground Level

Total Flat Load: (Slab)*(Area - Open)+Beams+Girder+Col+Ext.Panel+5 psf	8110 kips
Effective Flat Dead Load	174 psf

Entry Level

Total Flat Load: (Slab)*(Area - Open)+Beams+Girder+Col+Ext.Panel+120 psf	14684 kips
Effective Flat Dead Load	316 psf

Level 2

Total Flat Load: (Slab)*(Area - Open)+Beams+Girder+Col+Ext.Panel+5psf	3920 kips
Effective Flat Dead Load (includes 10psf Partition)	337 psf

Mechanical Level+Roof

Total Flat Load: (Slab)*(Area - Open)+Beams+Girder+Col+Ext.Panel+5psf	1749 kips
Effective Flat Dead Load (includes 10psf Partition)	156 psf

Total Building Weight 28463 kips



Subject: Base forces	Job Number: B8114004.00	Date: 01-Jul-2019
Job: UCB, GENETICS & PLANT BIOLOGY (GPB)	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
 S₁: 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 _s <=	S ₁ =	S ₁ =	S ₁ =	S ₁ =	S ₁ >=
	0.1	0.2	0.3	0.4	0.5	
Soil Class C	1.5	1.5	1.5	1.5	1.5	1.5
F _v	-	-	-	-	-	1.50

F_v: Site Coefficient for S₁ = 1.50 (Table 11.4-1)

Table 1-4:	S _s <=	S ₁ =	S _s =	S _s =	S _s >=
	0.25	0.50	0.75	1.00	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_{X5}: Short Period Acceleration = 3.150 (Table 6, Site Specific)
 β: Building System Exponent = 0.75 (4.4.2.4)
 C_f: Building System Coefficient = 0.02 (4.4.2.4)
 W: Total Building Weight = 28463 kips
 hn: Total Building Height = 52 feet
 n: Number of Stories = 4

CALCULATE BASE SHEAR FOR BSE-2E (MCE)

T: Fundamental Period of Vibration = C_t * h^{0.9} = 0.387 sec. (4-4)
 S₂: Spectral Acceleration at Building Period = 2.71 (4-3)
 V: Pseudo Seismic Force = 77168 kips (4-1)

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

C₁C₂: Modification Factors = 1.1 (Table 7-3)
 C_m: Effective Mass Factor = 0.8 (Table 7-4)
 V: Pseudo Seismic Force = 67908 kips



Subject:	ASCE 41 Shear Stress check, Section 4.4.3.3	Job Number:	B8114004.00	Date:	07/01/19
Job:	UCB, GENETICS & PLANT BIOLOGY (GPB)	By:	HK	Section:	
Model:	ASCE 41, TIER 1	Checked By:		Page	of

Story Shears

Base Shear V **77168** kips
 k 1
 Ms 4.5 for RC wall, Collapse Prevention

x	w _x	h _x	w _x h _x ³	F _x	V _j
Roof	1749	52	90966	9602	9602
Level 2	3920	39	152896	16139	25741
Entry Level	14684	26	381772	40298	66040
Ground	8110	13	105425	11128	77168
	28463		731059	77168	

Level	Wall Length		Average Wall thickness	F _c	2sqrt(f _c E) (psi)	Demand (psi)		D/C- Tier 1	
	N/S	E/W				N/S	E/W	N/S	E/W
Roof	140.00	232.00	14.00	5000.00	141.42	90.72	54.75	0.64	0.39
Level 2	140.00	232.00	14.00	5000.00	141.42	243.21	146.76	1.72	1.04
Entry Level	580.00	530.00	14.00	5000.00	141.42	150.61	164.82	1.06	1.17
Ground	580.00	530.00	14.00	5000.00	141.42	175.99	192.59	1.24	1.36

Tier 2

Base Shear V **67908** kips
 k 1
 m 3 (Table 10-22)

x	w _x	h _x	w _x h _x ³	F _x	V _j
Roof	1749	52	90966	8450	8450
Level 2	3920	39	152896	14202	22652
Entry Level	14684	26	381772	35463	58115
Ground	8110	13	105425	9793	67908
	56926		731059	67908	

Level	Wall Length		Average Wall thickness	Ast	2sqrt(f _c E)+Asf	Demand (psi)		D/C- Tier 2	
	N/S	E/W				N/S	E/W	N/S	E/W
Roof	140.00	232.00	14.00	#5@14 (H) EF	410.45	120	72	0.29	0.18
Level 2	140.00	232.00	14.00	#5@14 (H) EF	410.45	321	194	0.78	0.47
Entry Level	580.00	530.00	14.00	#5@14 (H) EF	410.45	199	218	0.48	0.53
Ground	580.00	530.00	14.00	#5@14 (H) EF	410.45	232	254	0.57	0.62



Subject: Column Deflection Compatability	Job Number: B8114004	Date: 3/7/2019
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

$M_{max} = 605$ k-ft @ 590 k Axially
 $l = 11$ ft
 $V_{sa} = 110.0$ kip
Size 14x26

Shear Capacity

Shear Design @ Hinge

#3 @ 6" oc

$A_v = 0.44$ in²
 $s = 7$ in
 $d = 12.3125$ in
 $f_y E = 75$ ksi
 $\lambda = 1$
 $k_{nl} = 1$ displacement ductility factor
 $M_{ud}/V_{ud}d = 4$
 $\alpha_{col} = 1$
 $A_g = 288$ in²
 $V_{steel} = 58$ kips
 $V_{conc} = 70$ kips
 $V_{col} = 128.3$ kip ASCE 41-17, EQ (10-3)

Axial Load

Weight psf
 983 psf

L1 11 ft
L2 11 ft
 $A_{trib} = 600$ ft²

Total Load 590 kips