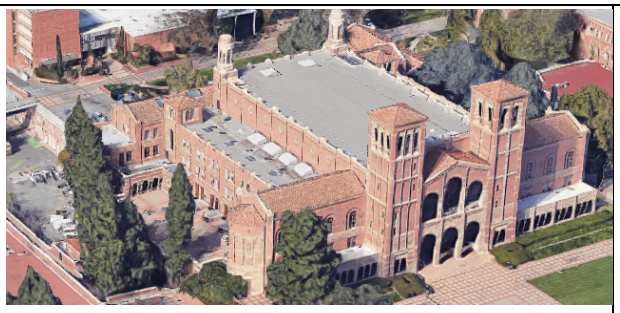
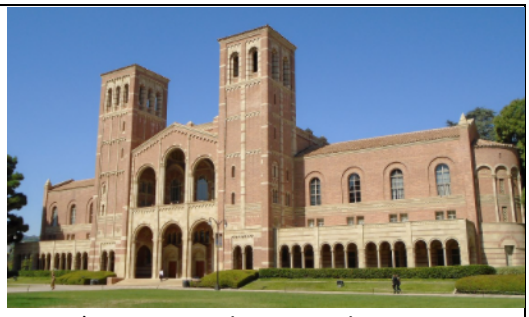
UNIVERSITY OF CALIFORNIA

BUILDING REPORT

1) UC Campus: UCLA
2) Building Name: Royce Hall
3) Building CAAN ID: 4375
4) Auxiliary Building ID[1]: N/A
5) Date of Evaluation: 11/06/20
6) Evaluation by (Firm, Evaluator Name, Signature, Stamp)
John A. Martin & Associates, Inc., EH, JL
7) Seismic Performance Rating[2] and Basis of Rating: VI, UC Seismic Safety Policy and ASCE 41-17 Tier 1 evaluation. A Tier 3 analysis is recommended due to the building's age, highly irregular configuration, and complexity of the lateral system.

11/6/2020


8) Plan Image or Aerial Photo


9) Exterior Elevation Photo

10) Site Location
(a) Latitude Decimal Coordinates: 34.07282492
(b) Longitude Decimal Coordinates: -118.4421591

11) ASCE 41-17 Model Building Type and Description[3]
(a) Longitudinal Direction: Building Type: Building Type C2 (Concrete Shear Walls with Stiff Diaphragms)
(b) Transverse Direction: Building Type C2 (Concrete Shear Walls with Stiff Diaphragms)

Royce Hall's original construction consisted of a reinforced concrete waffle slab system supported by reinforced concrete frames with infill masonry walls, and unreinforced brick masonry at the exterior walls. The foundation system consists of reinforced concrete spread footings under the concrete columns and a perimeter basement wall that extends up to the underside of the first floor level. The original design and construction preceded modern seismic design. Therefore, the original structure did not have a seismic force resisting system other than the inherent strength and stiffness of its gravity force resisting elements. The 1998 retrofit primarily added concrete shear walls around the 50-foot tall auditorium in the center of the building.

12) Number of Stories

[1] Applicable only for individual buildings that are structurally separate units within a building complex. Each auxiliary building shall be designated with the main building CAAN ID with a decimal number suffix (i.e. main building CAAN ID 5534; auxiliary building CAAN ID 5534.1). Auxiliary building ID is null for a single building or the main building in a building complex.
[2] The designated Seismic Performance Rating shall be a Roman numeral associated with the most applicable performance description from Table 1 of the UC Facilities Manual, UC Seismic Program Guidelines.
[3] If a building has multiple building types in one story, the model building type should be designated based on engineering judgement as the lateral system that would have the most predominantly negative effect on the seismic behavior of the building in that respective direction.

(a) Above grade: 3
(b) Below grade: 1

13) Original Building Design Code & Year: Building design preceded an official building code

14) Retrofit Building Design Code & Year (if applicable): 1991 Uniform Building Code, 1994 Seismic Repairs following the Northridge Earthquake; 1991 Uniform Building Code, 1998 Seismic Improvement Project.

15) Cost Range to Retrofit (if applicable)[4] (Low, Medium, High or Very High): Medium
Please assume a "Low" cost-range corresponds to a complete retrofit cost less than $50 per square foot (sf), a "Medium" cost-range corresponds to a complete retrofit cost greater than $50 per sf and less than $200 per sf, a "High" cost-range corresponds to a complete retrofit cost greater than $200 per sf and less than $400 per sf, and a "Very High" cost-range corresponds to a complete retrofit cost greater than $400 per sf.

[4] Assume a complete retrofit conforming to the current UC Seismic Safety Policy. Note this range includes all construction costs, including code upgrades (e.g., accessibility, fire and life safety, mechanical, electrical, plumbing) triggered by the seismic retrofit. No specific estimate is required to be supplied at this time (i.e., provide an approximate cost to retrofit using Low, Medium, High or Very High cost-range categories). It is acknowledged that such a cost range is assumed to be based only on the engineer's rough estimate and is not intended to require input from a professional cost estimator. For estimation purposes, CSEs may judgmentally determine an approximate cost range for seismic retrofits based on recent relevant experience, and then apply a multiplier to approximate total construction costs.

BACKGROUND INFORMATION

Site Information

16) Site Class (A – F) and Basis of Assessment: Site Class D (default site class per code, no geotechnical reports available)

17) Geologic Hazards
   (a) Fault Rupture (Yes, No or Unknown) and Basis of Assessment: No, based on "Fault Activity Map of California" from California Geological Survey.
   (b) Liquefaction (Yes, No or Unknown) and Basis of Assessment: No, based on "Earthquake Zones of Required Investigation Beverly Hills Quadrangle" map published by California Geological Survey, dated January 11, 2018.
   (c) Landslide (Yes, No or Unknown) and Basis of Assessment: No, based on "Earthquake Zones of Required Investigation Beverly Hills Quadrangle" map published by California Geological Survey, dated January 11, 2018.

18) Site-specific Ground Motion Study? (Yes or No): No

Seismic design acceleration parameters of interest:	
For BSE-2E	S_{XS}: 1.861 S_{X1}: 0.948
For BSE-1E	S_{XS}: 0.898 S_{X1}: 0.517

19) Estimated Fundamental Period (seconds)
   (a) Longitudinal: 0.40s
   (b) Transverse: 0.40s

20) Falling Hazards Assessment Summary: A structural observation could not be conducted as the campus is currently closed due to the Covid-19 Pandemic. Based on our review of the record drawings, the following falling hazards have been identified:
   (a) Heavy masonry or stone veneer above exit ways and public access areas: Parapets are unreinforced based on 1927 structural drawings.
   (b) Unbraced masonry parapets, cornices or other ornamentation above exit ways and public access areas: Ornate cornices and brick facades were not anchored into the primary structure. The two towers at the South end of the building (near the entrance) were retrofitted after the Northridge Earthquake.

21) Structural Non-Compliances/Findings Significantly Affecting Rating Determination Summary
Significant Structural Deficiencies, Potentially Affecting *Seismic Performance Rating* Designation:

   (a) Adjacent Buildings: The separation between Royce Hall and the 1982 Rehearsal Hall addition was determined to be inadequate based on a Tier 1 analysis.

   (b) Torsion: Based on the 1998 retrofit drawings, the shear wall configuration creates a torsional irregularity.

(c) Shear Wall Stress Checks: The average shear stress in the shear walls exceed the shear stress limits in both orthogonal directions. A Tier 3 analysis is recommended to evaluate if the walls meet the required acceptance criteria.

(d) Diaphragm Continuity: Large opening occurs in the diaphragm due to the main auditorium. Diaphragm steps in some areas.

(e) Deflection Compatibility: Nearly every concrete column in the structure is unique. Most columns do not meet the requirement of column tie spacing to ensure deformation compatibility and a ductile yielding of these gravity element. Calculations on some of the columns also indicate a potential shear and flexural failure.

22) Brief Description of Anticipated Failure Mechanism: Shear failure is anticipated in the concrete shear walls and concrete gravity columns due to insufficient column ties.

23) Seismic Retrofit Concept Sketches/Description (only required for buildings rated V or worse): Wrap the gravity columns with layers of fiber reinforced polymer (FRP), strengthen existing shear walls with FRP or shotcrete, and add supplemental connections for the unreinforced parapets to the primary structure.

Building Report Appendices

A) ASCE 41-17 Tier 1 Checklists (Structural only)
B) Quick Check Calculations