



FORM 1
CERTIFICATE OF SEISMIC PERFORMANCE LEVEL

- UC-Designed & Constructed Facility**
 Campus-Acquired or Leased Facility

BUILDING DATA

Building Name: Lewis Hall
Address: Core Campus, Berkeley, CA 94720
Site location coordinates: Latitude 37.8728 Longitudinal -122.2550

UCOP SEISMIC PERFORMANCE LEVEL (OR "RATING"): IV

ASCE 41-17 Model Building Type:

- a. Longitudinal Direction: C2: Reinforced Concrete Shear Walls – Stiff Diaphragms
- b. Transverse Direction: C2: Reinforced Concrete Shear Walls – Stiff Diaphragms

Gross Square Footage: 68,146 sq. ft.
Number of stories *above* grade: 4
Number of basement stories *below* grade: 1

Year Original Building was Constructed: 1948
Original Building Design Code & Year: Unknown
Retrofit Building Design Code & Year (if applicable): 2012, CBC 2007

SITE INFORMATION

Site Class: B Basis: Geologic Hazards and Site Classification, Geomatrix Plate 2
Geologic Hazards:
Fault Rupture: No Basis: California Geological Survey website – Oakland West Quadrangle
Liquefaction: No Basis: California Geological Survey website – Oakland West Quadrangle
Landslide: No Basis: California Geological Survey website – Oakland West Quadrangle

ATTACHMENT

Retrofit Structural Drawings: Seismic Retrofit U.C. Berkeley Lewis Hall, Berkeley, CA 94720, Tipping Mar, 4/30/2012, S1.0 Notes & Site Map



CERTIFICATION & PRESUMPTIVE RATING VERIFICATION STATEMENT

I, { **David Mar** }, a California-licensed structural engineer, am responsible for the completion of this certificate, and I have no ownership interest in the property identified above. My scope of review to support the completion of this certificate included both of the following ("No" responses must include an explanation):

- a) the review of structural drawings indicating that they are as-built or record drawings, or that they otherwise are the basis for the construction of the building: Yes No
- b) visiting the building to verify the observable existing conditions are reasonably consistent with those shown on the structural drawings: Yes No

Based on my review, I have verified that the UCOP Seismic Performance Level (SPL) is presumptively permitted by the following UC Seismic Program Guidebook provision (choose one of the following):

- 1) Contract documents indicate that the original design and construction of the aforementioned building is in accordance with the benchmark design code year (or later) building code seismic design provisions for UBC or IBC listed in Table 1 below.
- 2) The existing SPL rating is based on an acceptable basis of seismic evaluation completed in 2006 or later.
- 3) Contract documents indicate that a comprehensive¹ building seismic retrofit design was fully-constructed with an engineered design based on the 1997 UBC/1998 **or later** CBC, and (choose one of the following):
 - the retrofit project was completed by the UC campus. Further, the design was based on ground motion parameters, at a minimum, corresponding to BSE-1E (or BSE-R) and BSE-2E (or BSE-C) as defined in ASCE 41, or the full design basis ground motion required in the 1997 UBC/1998 CBC **or later** for EXISTING buildings, and is presumptively assigned an SPL rating of IV.
 - the retrofit project was completed by the UC campus. Further, the design was based on ground motion parameters, at a minimum, corresponding to BSE-1 (or BSE-1N) and BSE-2 (or BSE-2N) as defined in ASCE 41, or the full design basis ground motion required in the 1997 UBC/1998 **or later** CBC for NEW buildings, and is presumptively assigned an SPL rating of III.
 - the retrofit project was not completed by the UC campus following UC policies, and is presumptively assigned an SPL rating of IV.

¹ A comprehensive retrofit addresses the entire building structural system as indicated by the associated seismic evaluation, as opposed to addressing selective portions of the structural system.



CERTIFICATION SIGNATURE

AFFIX SEAL HERE

David Mar _____ President, MSD
 Print Name _____ Title

S 3951 _____ 03/31/2020
 CA Professional Registration No. _____ License Expiration Date

David Mar _____ 07/12/2019
 Signature _____ Date



Mar Structural Design
 510-991-1101
 2332 5th Street, Suite D
 Berkeley, CA 94710

 Firm Name, Phone Number, and Address

Table 1: Benchmark Building Codes and Standards

Building Type ^{a,b}	Building Seismic Design Provisions	
	UBC	IBC
Wood frame, wood shear panels (Types W1 and W2)	1976	2000
Wood frame, wood shear panels (Type W1a)	1976	2000
Steel moment-resisting frame (Types S1 and S1a)	1997	2000
Steel concentrically braced frame (Types S2 and S2a)	1997	2000
Steel eccentrically braced frame (Types S2 and S2a)	1988 ^g	2000
Buckling-restrained braced frame (Types S2 and S2a)	f	2006
Metal building frames (Type S3)	f	2000
Steel frame with concrete shear walls (Type S4)	1994	2000
Steel frame with URM infill (Types S5 and S5a)	f	2000
Steel plate shear wall (Type S6)	f	2006
Cold-formed steel light-frame construction—shear wall system (Type CFS1)	1997 ^h	2000
Cold-formed steel light-frame construction—strap-braced wall system (Type CFS2)	f	2003
Reinforced concrete moment-resisting frame (Type C1) ⁱ	1994	2000
Reinforced concrete shear walls (Types C2 and C2a)	1994	2000
Concrete frame with URM infill (Types C3 and C3a)	f	f
Tilt-up concrete (Types PC1 and PC1a)	1997	2000
Precast concrete frame (Types PC2 and PC2a)	f	2000
Reinforced masonry (Type RM1)	1997	2000
Reinforced masonry (Type RM2)	1994	2000
Unreinforced masonry (Type URM)	f	f
Unreinforced masonry (Type URMa)	f	f
Seismic isolation or passive dissipation	1991	2000

Note: This table has been adapted from ASCE 41-17 Table 3-2. Benchmark Building Codes and Standards for Life Safety Structural Performed at BSE-1E.

Note: UBC = Uniform Building Code. IBC = International Building Code.

^a Building type refers to one of the common building types defined in Table 3-1 of ASCE 41-17.

^b Buildings on hillside sites shall not be considered Benchmark Buildings.

^c not used

^d not used

^e not used

^f No benchmark year; buildings shall be evaluated in accordance with Section III.J.

^g Steel eccentrically braced frames with links adjacent to columns shall comply with the 1994 UBC Emergency Provisions, published September/October 1994, or subsequent requirements.

^h Cold-formed steel shear walls with wood structural panels only.

ⁱ Flat slab concrete moment frames shall not be considered Benchmark Buildings.

DIVISION 01: GENERAL CONDITIONS

SECTION A: GENERAL REQUIREMENTS

- These notes apply to all drawings and govern unless otherwise noted. All work shall conform to the 2007 California Building Code, as modified by state and local jurisdiction.
- These structural drawings are copyrighted instruments of service of Tipping Mar (TM), for sole use for this project. TM CAD files may only be used as backgrounds for shop drawings after TM receives a signed waiver from each party using the files, addressing the limitations and proper use of these CAD files.
- Verify all existing conditions and proposed dimensions at the job site. Compare structural drawings with architectural, mechanical, and electrical and plumbing drawings before commencing work. Notify Architect of any discrepancies and do not proceed with affected work until they are resolved. Do not scale drawings.
- Unless otherwise shown or noted, install, test, and inspect manufactured structural products in accordance with manufacturer's recommendations and applicable evaluation service reports.
- The Contractor and Special Inspector shall contact the Structural Engineer regarding any questions of interpretation of these specifications and drawings.
- Submittal Protocol:
 - Shop drawings, design-build calculations, and product data shall be submitted to and reviewed by General Contractor, Architect, and Engineer before fabrication. All submittals shall have a clear 3.5-inch by 7-inch space reserved for shop drawing stamps by General Contractor, Architect and Engineer. If submitted sheets do not have sufficient room, a cover sheet with a table of contents and sufficient space for stamps may be submitted.
 - Submittal review is of a general nature only, and responsibility for conformance with drawing intent shall remain with the contractor. Review does not imply or state that Contractor has correctly interpreted the Contract Documents.
 - Satisfactory review of shop drawings and product data must be obtained prior to fabrication or delivery of material to the site. The following items shall be submitted:
 - Material to fill articulations in existing columns (grout or concrete).
 - Product data for proposed GFRP, including:
 - Specific products proposed,
 - Manufacturer's recommendations for surface preparation and installation,
 - Guarantee that the GFRP product will bond with existing surface (with proposed preparation) and with new finishing materials.

SECTION B: STRUCTURAL TESTING, INSPECTION, AND OBSERVATION

- Provide tests and inspections for all items as required by the 2010 California Building Code and all applicable local ordinances.
- The Owner shall retain an independent testing agency to perform all required testing and inspections.
- The Contractor is responsible for coordinating with Owner's Testing Agency and Special Inspector to schedule all required tests and inspections.
- The following specific items shall be inspected and/or tested by the testing lab:
 - Placement of GFRP.
 - Compressive strength of concrete or grout used to fill articulations.
- Structural Observation: In addition to inspection by Special Inspector, Structural Engineer will review construction for general conformance with structural drawings. Contractor shall notify Structural Engineer at least five working days prior to concealing any structural items. Structural Engineer will then determine if a site visit is appropriate. Notification shall include the following items:
 - Placement of GFRP.

SECTION C: STRUCTURAL DESIGN BASIS

- Construct in conformance with the 2010 California Building Code and all applicable local ordinances.
- The design of the GFRP relies upon nonlinear response history analysis, which suggests that the selected columns are vulnerable in shear. The design is intended to bring the structure up to a rating of "FAIR" in the context of the UC seismic rating.

DIVISION 03: CONCRETE

SECTION 03240: FIBER-REINFORCED POLYMER (FRP) REINFORCEMENT

- Fiberglass wrap shall be Tyfo Fibwrap System (Fyfe Company) or SikaWrap Hex Fabrics (Sika Corp) in accordance with ICC-ES report ER-5282, or approved equal or better substitution.
 - Tyfo Fibwrap System consists of:
 - Surface leveling: Sika Top 123 Plus polymer modified Portland cement mortar or approved equal.
 - SEH 51 Fabric: glass and aramid hybrid weave
 - Epoxy saturant: Tyfo S epoxy
 - Primer/Filler: Tyfo S thickened epoxy
 - Finish: Tyfo S thickened epoxy (15-20 mil minimum thickness) with coarse washed sand broadcast onto the surface to act as a key coat.
 - Finish paint: Tyfo A or U paint, color per architect
 - SikaWrap Hex Fabrics by Sika Corp, Lyndhurst, NJ
 - Surface leveling: Sika Top 123 Plus polymer modified Portland cement mortar.
 - Concrete surface primer: Sikadur 300.
 - Reinforcement fabric: SikaWrap Hex 1006
 - Fabric saturant: Sikadur Hex 300.
 - Bonding agent over fabric: Sikadur 32 HI-Mod LPL, epoxy resin adhesive.
 - Finish over bonding agent: Sika Top 123 Plus polymer modified Portland cement mortar.

- Concrete contact surfaces shall be prepared as follows:
 - Sand blasted to achieve 1/16-inch minimum amplitude (not required where fiberglass wraps 360 degrees around columns).
 - Free from fins, sharp edges and protrusions.
 - Uneven surfaces, including damaged concrete and other surface voids greater than 1/2-inch diameter, filled with thickened epoxy filler.
 - Dry and clean.
 - Sharp and chamfered corners rounded to 1 inch radius, plus or minus 1/4 inch (grind or form with thickened epoxy). Maximum variation in the radius along the edge shall not exceed 1/2 inch per foot.
 - Primed with one coat of epoxy, cured for one hour minimum.
- Installation shall be per manufacturer's recommendations, and shall be installed by a subcontractor certified by the manufacturer. Inspector shall observe fiber installation and curing in accordance with ICC-ES AC108. Inspection shall include verification of: fiber materials, surface preparation, resin mixing, application of laminates, fiber alignment and layers, fiber orientation, curing.
- There shall be no direct contact between fiber composite and metallic parts, including structural steel. If condition exists, the engineer shall be notified.

SECTION 03200: REINFORCING STEEL

- All reinforcing steel bars shall conform with the Standard Specifications for Deformed Billet-Steel for Concrete Reinforcement, ASTM A615, Grade 60, unless otherwise noted.
- Concrete cover: 3/4" clear, minimum.

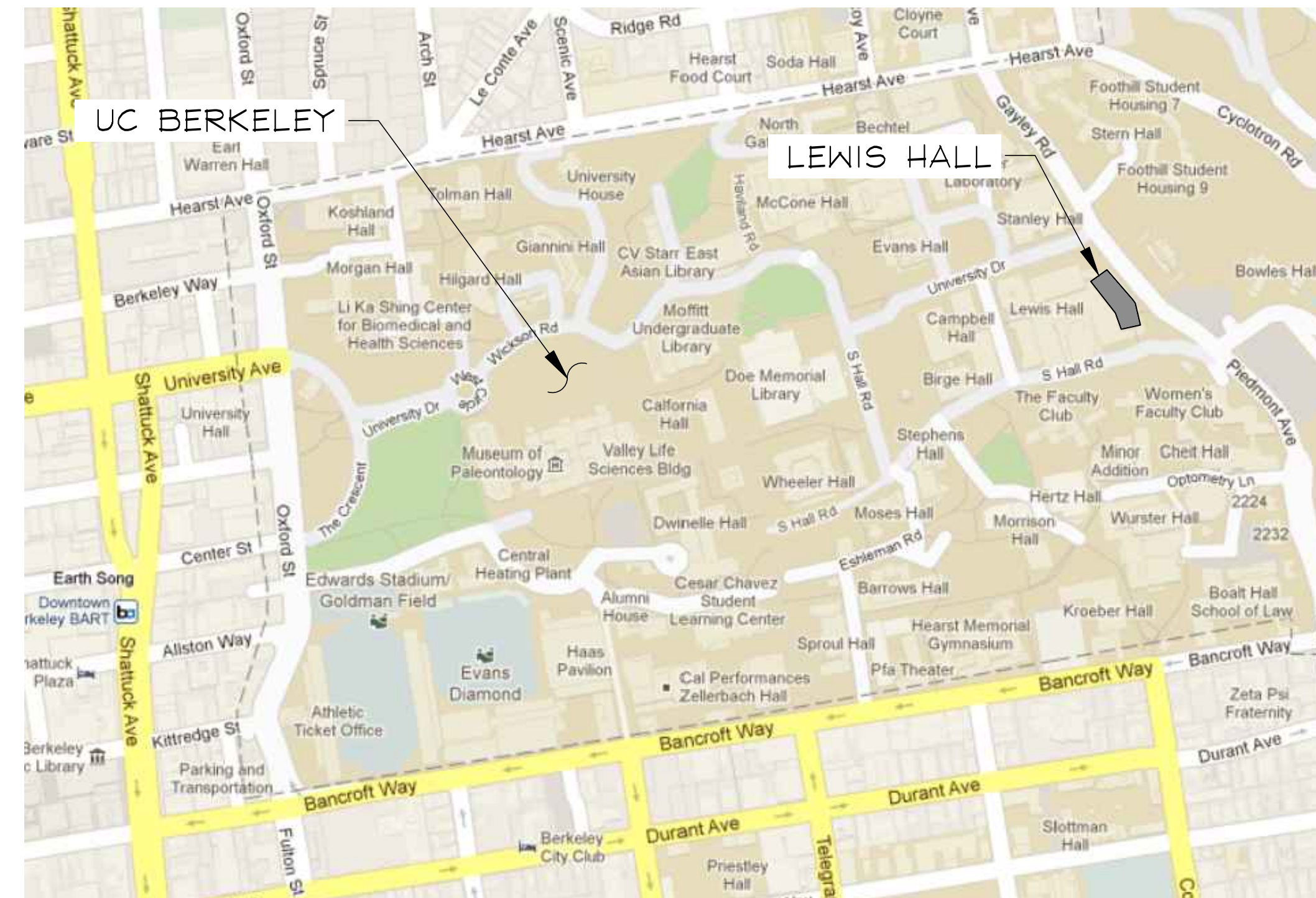
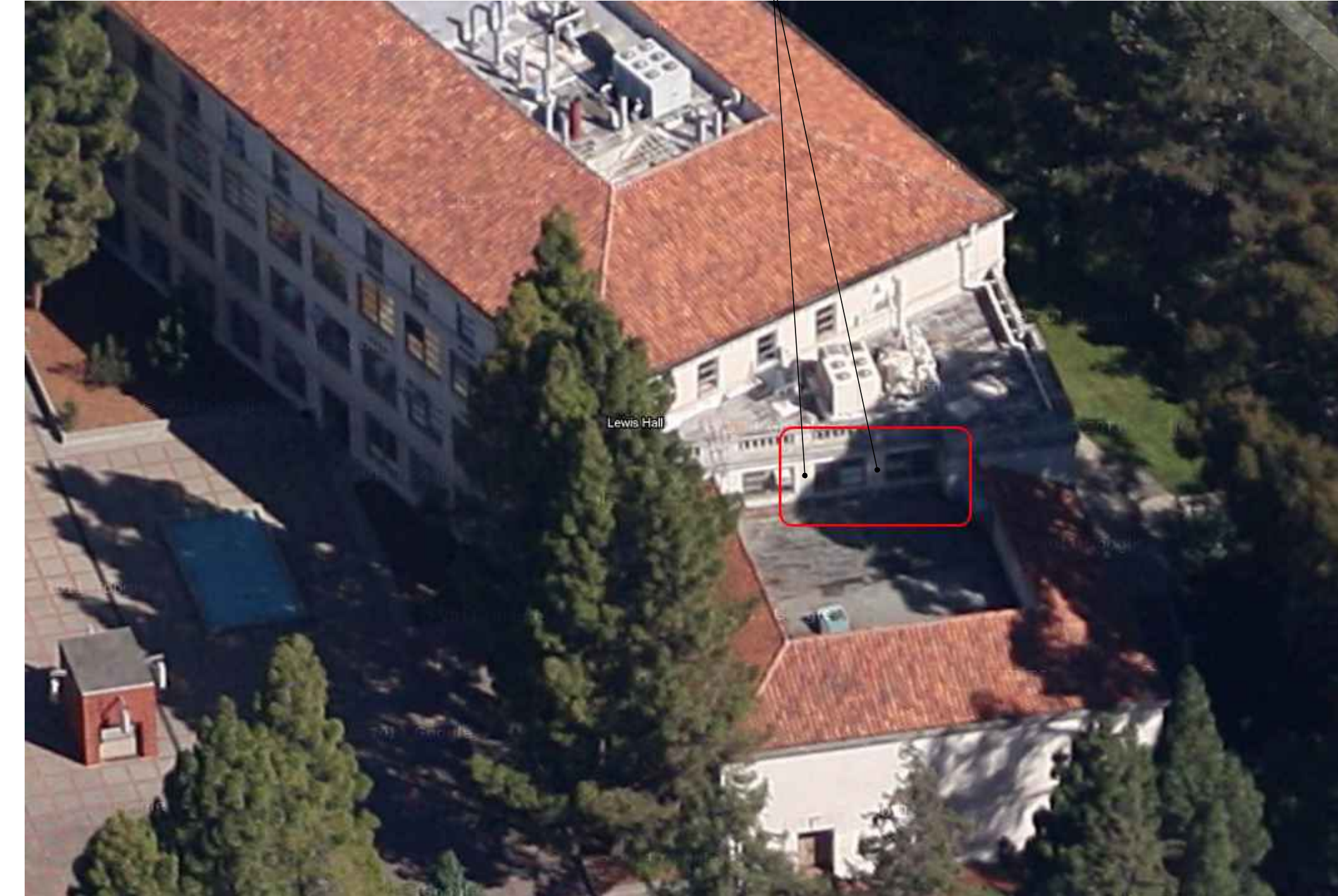
SECTION 03250: CONCRETE ANCHORS

- EPOXY GROUTED DOWELS
 - Epoxy for epoxy-grouted dowels (reinforcing bars or all-thread rods) shall be:
 - Hilti HIT-RE 500-SD, in accordance with ICC ESR-2322,
 - Powers PE1000+, in accordance with ICC-ESR-2583,
 - Simpson SET-XP, in accordance with ICC ESR-2508, or
 - Approved equal or better substitution.
 - Epoxy shall be in two-part cartridges dispensed through proprietary mixing nozzles. Polyester or acrylic resins shall not be substituted for epoxy.
 - Install dowels in existing concrete as follows:
 - Locate rebar tendons with non-destructive means prior to drilling. Do not damage any reinforcement.
 - Clean hole with wire bottle-type brush and blow out with oil-free compressed air. Dowels shall be clean, dry and free of oil, grease and dirt. Inspect holes and dowels before filling holes with epoxy.
 - After inspection, place measured amount of epoxy in hole with applicator equipped with an extension nozzle.
 - Insert dowel slowly while rotating about 90 degrees. Secure it in the center of the hole.
 - Remove excess epoxy from around hole before it hardens.
 - Do not disturb, bolt up, or apply load to embedded anchor until the epoxy is fully cured (see manufacturer for cure time).

SECTION 03300: CAST-IN-PLACE CONCRETE

- Submit proposed concrete mix design conforming to the following:
 - Portland cement to conform to ASTM C150 and C595, and shall be Type II. Type I cement may be used in areas not in contact with earth.
 - Conform to Portland cement and Supplementary Cementitious Material (SCM) limits in Concrete Mix Schedule below.
 - Aggregate shall be free of alkali-silica reactivity per ASTM C33 Appendix XI.
 - Water-to-cementitious material (W/CM) ratio not to exceed 0.45.
 - Acid-soluble chloride content shall not exceed 0.2 percent of cement weight. Chloride-free admixtures and plasticizers for workability may be used if approved by the testing laboratory and Structural Engineer.
- Concrete mix for filling articulations:
 - f'c = 3,000 psi at 28 days
 - Aggregate: Normal weight, 3/8" maximum size
- Nonshrink and Drypack Grout:
 - ASTM Standard C1107, non-metallic.
 - Minimum compressive strength of:
 - 2,400 psi in 48 hours, and
 - 5,000 psi in 28 days.
 - Add only enough water to meet both strength and consistency requirements. Do not add excess water.
 - Nonshrink Grout:
 - Use where high fluidity and/or increased placing time are required; pour into void contained by permanent or temporary forms.
 - Products:
 - "Five Star Grout" by U.S. Grout Corporation,
 - "MasterFlow 713 Plus" by Chemrex/BASF,
 - "MasterFlow 928" by Chemrex/BASF, or
 - Approved equal or better substitution.
 - Drypack Grout:
 - Mix to a stiff plastic consistency and pack firmly into place.
 - Products:
 - "Embeco 636 Grout" by Master Builders,
 - "Euco Dry Pack Grout" by Euclid Chemical Company,
 - "MasterFlow Dry Pack" by Master Builders, or
 - Approved equal or better substitution.

(E) COLUMNS TO RETROFIT



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REVISIONS	DATE	BY

SEISMIC RETROFIT
U.C. BERKELEY
LEWIS HALL

NOTES & SITE MAP

DATE:	2012-04-30
SCALE:	AS NOTED
DRAWN:	MJK
CHECKED:	DCM
JOB NO.:	2010,120,01

SHEET

S1.0