Campus: UCSF
Building Name: 2130 Post Street
CAAN ID: 3113
Auxiliary Building ID: NA

UNIVERSITY OF CALIFORNIA

Date: 7/30/2020

FORM 1
CERTIFICATE OF SEISMIC PERFORMANCE LEVEL
☐ **UC-Designed & Constructed Facility**
☒ **Campus-Acquired or Leased Facility**

BUILDING DATA
Building Name: 2130 Post Street
Address: 2130 Post Street, San Francisco 94115
Site location coordinates: Latitude 37.7849 Longitudinal -122.4370

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

ASCE 41-17 Model Building Type:
a. Longitudinal Direction: C2: Concrete Shear Walls
b. Transverse Direction: C2: Concrete Shear Walls

Gross Square Footage: 97,000
Number of stories *above* grade: 7
Number of basement stories *below* grade: 1

Year Original Building was Constructed: 1969
Original Building Design Code & Year: UBC-1967
Retrofit Building Design Code & Code (if applicable): ASCE 41-13

SITE INFORMATION
Site Class: D Basis: Langan, 3/7/2019
Geologic Hazards:
Fault Rupture: No Basis: Langan, 3/7/2019
Liquefaction: No Basis: Langan, 3/7/2019
Landslide: No Basis: Langan, 3/7/2019

ATTACHMENT
Original Structural Drawings: Convalescent Hospital by L.F. Robinson and Associates Structural Enigneers (S1-S15) dated September 3, 1968
Renovation Drawings: University of the Pacific Student Housing by Leong/Razzano & Associates, Inc. (S1) dated November 9, 1981
Seismic Evaluation: Interim Seismic Review 2130 Post Street, by Estructure, dated 1/19/2018 (ASCE 41-13 Tier 2)
Retrofit Structural Drawings: UCSF 2130 Post Street, Tipping Structural Engineers, (S1.1-S5.2, 26 sheets) dated 10/15/2019. Sheet S1.2 attached
Retrofit Structural Calculations: UCSF 2130 Post Street, Tipping Structural Engineers, dated 10/29/2018. Excerpt of seisimc design parameters attached.

CERTIFICATION & PRESUMPTIVE RATING VERIFICATION STATEMENT

I, Maryann T. Phipps, 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 comprehensive[1] 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.

Basis of Presumptive Rating

A comprehensive retrofit was undertaken, which included the addition of new reinforced concrete shear walls and collectors, fiber wrap of gravity columns and protection against punching shear failure. Performance objectives for the retrofit were consistent with UC Seismic Policy Seismic Performance Level IV. BSC-C and BSE-R ground motion parameters were reviewed by John Egan. The design was peer reviewed by Estructure and Maffei Structural Engineers.

CERTIFICATION SIGNATURE

AFFIX SEAL HERE

REGISTERED PROFESSIONAL ENGINEER
MARYANN T. PHIPPS
No. 2995
EXP. 6/30/22
STRUCTURAL
STATE OF CALIFORNIA
7/30/2020

Maryann T. Phipps	President
Print Name	Title
S2995	6/30/2022
CA Professional Registration No.	License Expiration Date
	7/30/2020
Signature	Date

Estructure, (510) 235-3116, 1144 65th St Suite A, Oakland
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.

Design basis and ground motion selection - Proposed approach

The required basis of design is UC Seismic Safety Policy performance level IV. The Seismic Safety Policy references CBC performance criteria; 2016 CBC criteria for existing State-Owned buildings are summarized below for two sets of analyses (Level 1 and Level 2):

PerformanceRequirements

PerformanceLevel	*IV*	*Notes*
Level 1 hazard	BSE-R	20% in 50 years
Level 1 structural performance	S-3, Life safety	
Level 1 non-structural performance	N-C, Life safety	
Level 2 hazard	BSE-C	5% in 50 years
Level 2 structural performance	S-5, Collapse prevention	
Level 2 non-structural performance	N-D, Not considered	

Hazard levels, prescriptive design spectra, and acceptance criteria for life safety and collapse prevention performance levels are defined in ASCE41-13.

Our analysis will be based on the following:

1. Nonlinear response history analysis is the primary design basis.
2. Response spectrum analysis during schematic design to provide a performance benchmark for building drift and initial wall proportioning.
3. **Ground motion selection and scaling** based on ASCE41-17, which generally refers to ASCE7-16 but modifies the period range of interest.
    1. 11 ground motions, amplitude scaled (we will document and present the dispersion of ground motions for review).
    2. Period range from 0.2 T_{min} to 1.5 T_{max}, where T_{min} and T_{max} are the smallest and largest first mode periods in the two principal horizontal directions.
    3. Scale ground motions so that the average maximum-direction spectrum from all ground motions generally matches or exceeds the target spectrum and does not fall below 90% of the target spectrum within the period range.
    4. Ground motion scaling will be based on the BSE-R spectrum. The same group of ground motions will be scaled up to match the BSE-C spectrum.

Per direction from the SRC:

1. The design spectra will be based on mapped ASCE41-17 design values.
2. Spectra will be developed using F_a and F_v values from ASCE7-16 (referenced in ASCE41-17). However, the footnote in ASCE7-16 referring to Section 11.4.8 will be deleted.

Response Spectra

Seismic Response Parameters:

$SC = D$ Site Class

$F_a = \text{if } SC = D$
$\quad \text{interptbl}(tblSiteCoeff, S_S, S_S, F_a)$
$\quad \text{Error}$

$F_v = \text{if } SC = D$
$\quad \text{interptbl}(tblSiteCoeff, S_1, S_1, F_v)$
$\quad \text{Error}$

$S_{XS} = F_a \cdot S_S$

$S_{X1} = F_v \cdot S_1$

$$T_S = \frac{S_{X1}}{S_{XS}}$$

$T_0 = 0.2 \cdot T_S$

$T_L = 12$

tblSiteCoeff (Site class D)

S_S	F_a	S_1	F_v
0.25	1.6	0.1	2.4
0.5	1.4	0.2	2.2
0.75	1.2	0.3	2
1	1.1	0.4	1.9
1.25	1	0.5	1.8
1.5	1	0.6	1.7
3	1	3	1.7

Parameters (Except BSE-1N)

Hazard	S_S	S_1	F_a	F_v	S_{XS}	S_{X1}	T_S	T_0	*Notes*
BSE-R	0.738	0.266	1.210	2.068	0.893	0.550	0.616	0.123	20% in 50 years
BSE-C	1.428	0.556	1.000	1.744	1.428	0.970	0.679	0.136	5% in 50 years

Note: S_S and S_1 are mapped USGS spectral values for ASCE41-17.

Spectra per ASCE41:

$\beta = 0.05$ (damping)

$$B_1 = \frac{4}{5.6 - \ln(100 \cdot \beta)} \rightarrow 1$$

$$S_a = \begin{cases} T \le T_0: & S_{XS} \cdot \left(\left(\frac{5}{B_1} - 2 \right) \cdot \frac{T}{T_S} + 0.4 \right) \\ \text{and}(T > T_0, T \le T_S): & \frac{S_{XS}}{B_1} \\ \text{and}(T > T_S, T \le T_L): & \frac{S_{X1}}{B_1 \cdot T} \\ T > T_L: & \frac{T_L \cdot S_{X1}}{B_1 \cdot T^2} \end{cases}$$

These values are consistent with the values for this site summarized in the geotechnical and geohazards characterization Table I developed for for UCSF buildings by John Egan; excerpted values for 2130 Post Street are shown below.

BSE-C(oo)			BSE-R(oo)		
S_S = 1.433 S_1 = 0.558	F_a = 1.000 F_v = 1.742	S_{CS} = 1.433 S_{C1} = 0.972	S_S = 0.738 S_1 = 0.266	F_a = 1.209 F_v = 2.069	S_{RS} = 0.893 S_{R1} = 0.550

Excerpt from TSE Structural Calculations

STRUCTURAL NOTES

DIVISION 01: GENERAL CONDITIONS

SECTION A: GENERAL REQUIREMENTS

1. These Structural Notes supplement the Project Specifications, and provide design loads and material properties not listed in the Project Specifications.

2. These structural drawings are copyrighted instruments of service of Tipping Structural Engineers (TSE), for sole use for this project.

3. The Structural Drawings show the structural features. Some dimensions and elevations are defined on the Architectural Drawings. See Architectural and other project drawings for finishes, depressions, curbs, openings, inserts and other features that need to be coordinated with these drawings.

4. Bound specifications have been prepared for this project. These notes complement the project specifications that will, among other things, define responsibilities, products, and workmanship issues. Reading these notes without reading the specifications can result in misunderstandings. There is not a one-to-one correspondence between these notes and the specifications, i.e., some numbered sections appear in the notes but not the specifications and vice versa.

5. In the event of conflict between these structural notes, the project specifications and the drawings, consult with the Architect before proceeding.

6. 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. In the case of conflict between the drawings and the specifications, the most costly option to the Contractor applies unless otherwise expressly allowed by the Architect's response to RFI.

7. Do not scale the drawings to determine dimensions, instead use written dimensions. Where no dimension is provided, consult with the Architect for clarification before proceeding with the work. Where member locations are not specifically dimensioned, members are either located on column lines, or equally spaced between members on column lines or between members otherwise located.

8. Unless otherwise shown or noted, all typical details shall be used where applicable. All details shall be considered typical at similar conditions.

9. Submit shop drawings, design-build calculations, and product data for review as required by specifications prior to fabrication. Do not fabricate prior to receiving review comments. Each shop drawing submittal to the Engineer shall be submitted electronically:
    1. Except for mock-ups, samples, and as otherwise specified, all submittals to be in electronic form (Adobe Portable Document Format).
    2. Submit shop drawings, design-build calculations, and product data for review as required by specifications prior to fabrication. Do not fabricate prior to receiving review comments. In addition submit the following:
        1. Survey of existing column centerlines, wall lines and floor elevations.
        2. Shop drawings and structural calculations for lateral and vertical support of any equipment exceeding 400 pounds.
        3. Penetration plans, using structural drawings as backgrounds, showing the size and location of all slab openings, sleeves, cores and penetrations, including HVAC, electrical, telephone, fire sprinkler, plumbing and any other utilities. This includes pipes or conduits routed through or embedded within structural elements such as beams, slabs or walls.

10. Safety Measures:
    1. Contractor is solely and completely responsible for job site conditions including safety of people and property, and for all necessary independent engineering reviews of these conditions.
    2. Install shoring and bracing of soil, and of existing and new structures, where needed to adequately support imposed vertical and lateral loads. Maintain shoring and bracing until the new structure can support the anticipated loads. Submit shoring calculations by independent engineer for information only.
    3. Underpinning and/or shoring is required at all excavations adjacent to, and to elevations below, existing foundations, and where partial removal of existing foundations is called for on the drawings. Submit underpinning calculations by independent engineer for information only.
    4. Engineer's job site visits are not intended to include review of adequacy of Contractor's safety measures.

11. Any openings, holes, cuts or discontinuities not shown on the structural drawings and extending into or through structural elements require Engineer's prior approval and may require special structural detailing.

SECTION B: STRUCTURAL TESTING, INSPECTION, AND OBSERVATION

1. Tests and inspections for all items will be provided as required by California Building Code and all applicable local ordinances.

2. The University will retain an independent testing agency to perform all required testing and inspections.

3. The Contractor is responsible for coordinating with University's Testing Agency and Special Inspector to schedule all required tests and inspections. See specifications for specific items requiring testing and inspection.

4. Structural Observation: In addition to inspection by Special Inspector, Structural Engineer will review construction for general conformance with Structural Drawings. Contractor shall notify Architect and Structural Engineer at least five working days prior to concealing structural elements. Structural Engineer will then determine if a site visit is appropriate. Notification shall include the following items:
    1. Reinforcement, post-tensioning tendons, and embedded items, prior to concrete or shotcrete placement.
    2. Structural framing and shear walls, prior to concealment by fireproofing or finish surfaces.

SECTION C: STRUCTURAL DESIGN BASIS

1. Design is based on the 2016 California Building Code and applicable local ordinances.

2. Design vertical live loads (unfactored loads not including live load reductions):

    1. Residential
        1. Typical Floors — 40 psf
        2. Corridors — 100 psf
        3. Public rooms — 100 psf

    2. Parking Garages
        1. Passenger Vehicles — 40 psf (3,000 lbs on 4.5" x 4.5" area)
        2. Vehicle Barriers — 6,000 lbs at 1'-6"height over 12"x12"area

    3. Driveways and Sidewalks Accessible to Vehicles
        1. Truck Loading — 250 psf (8,000 lbs on 4.5" x 4.5" area)

    4. Stairs
        1. Treads and Landings — 100 psf (300 lbs on 2" x 2" area)
        2. Railings — 50 plf (200 lbs any direction)
        3. Balusters & Panels — 50 psf horiz

    5. Roofs
        1. Ordinary — 20 psf (300 lbs on 2'-6"x2'-6" area)

3. Design lateral loads are based on the following criteria:

    1. Risk Category — II

    2. Wind
        1. Basic Wind Speed — 110 mph (3-second gust)
        2. Exposure Category — D
        3. Importance Factor, Iw — 1.00
        4. Internal Pressure Coef — +/- 0.18 for main bldg; +/- 0.55 for penthouse

    3. Seismic
        1. Importance Factor, I — 1.00
        2. S-s — 1.500g (0.2 sec site specific response)
        3. S-1 — 0.661g (1.0 sec site specific response)
        4. Site Soil Class — D
        5. S-ds — 1.000g (0.2 sec site specific response)
        6. S-d1 — 0.661g (1.0 sec site specific response)
        7. SDC — D (Seismic Design Category)
        8. Basic Lateral System:
            1. Existing Lateral System: Reinforced Concrete Shear Walls
            2. Existing Lateral System (Mechanical Penthouse): Light-framed walls with steel strapping
            3. New Lateral Elements: Special Reinforced Concrete Shear Walls
            4. New Lateral System (Mechanical Penthouse): Light-framed walls sheathed with steel structural panels
        9. T-a — 0.62 sec (Approximate Fundamental Period)
        10. Design Base Shear — 6500 kips
        11. Analysis Procedure — Nonlinear Response History Analysis

4. Seismic Design Basis:

    1. The basis of the design is UC Seismic Safety Policy Performance Level IV, which references 2016 California Existing Building Code requirements for state-owned structures in risk categories I-III. The associated hazard levels and performance requirements are:
        1. BSE-R hazard level
            1. Structural performance of life safety (S-3)
            2. Nonstructural performance of life safety (N-C)
        2. BSE-C hazard level
            1. Structural performance of collapse prevention (S-5)
            2. Nonstructural performance not considered (N-D)

    2. Key retrofit measures include:
        1. Added FRP wrap at interior columns for shear strengthening.
        2. Added slab support angles at interior columns.
        3. Added ductile concrete columns at existing shear controlled exterior columns.
        4. Added shear walls to reduce drift, protect against possible failure in existing walls, and prevent concentration of nonlinear lateral deformation.
        5. Added collector elements to transfer loads to new and existing shear walls.

    3. The existing structure and retrofit design were evaluated using nonlinear response history analysis. Analysis indicates that the retrofitted structure may exhibit the following nonlinear behavior during a seismic event:
        1. Shear wall rocking at the foundation level, and localized collector yielding.
        2. Slab failure and punching at existing interior columns (resulting in backup gravity support from slab support angles).
        3. Shear failure at existing exterior columns (resulting in backup gravity support from new columns).
        4. Shear cracking at existing coupling beams and select existing shear walls, particularly at the basement level.

5. The seismic load resisting system (SLRS) of the structure comprises the following elements described in the drawings:
    1. Shear walls, collectors, and associated connections; and
    2. Other elements labeled "COLL" and "SLRS" in the drawings.

SECTION D: DESIGN-BUILD CRITERIA

1. General:
    1. Submit shop drawings and structural calculations for all design-build items, stamped and signed by a California-licensed Civil or Structural Engineer.

2. Cladding and glazing:
    1. Shall accommodate interstory seismic drifts of at least 2.2 percent without damage that could result in falling hazards or injuries. At half this drift limit, the cladding and glazing must remain weathertight and be substantially free of damage.
    2. Design-build metal stud and mullion out-of-plane deflections shall not exceed L/240 for exterior facades under code minimum design loads, unless designer demonstrates that facade can accommodate greater deflections without loss of watertightness.

3. Interior partitions:
    1. Out-of-plane deflection shall not exceed L/240.
    2. Elevator shaft walls shall be designed for elevator "piston effect" pressures defined by the elevator manufacturer.

4. Mechanical, electrical, plumbing and fire protection systems and equipment:
    1. Contractor is responsible for vertical and lateral support and anchorage of all equipment and utilities, and transfer of such forces back to primary structural elements shown on the structural drawings.
    2. Support and bracing shall be designed to comply with CBC and ASCE 7, Chapter 13.
    3. Lateral seismic design forces on all life-safety systems and equipment shall be increased by an importance factor of 1.50.
    4. Shop drawings and structural calculations shall be submitted for support and bracing of all floor-mounted equipment over 400 pounds and all ceiling-hung equipment over 100 pounds.
    5. Pipes, conduits and ducts: Unless specifically designed by a California-licensed Civil or Structural Engineer, bracing shall conform to Seismic Hazard Level A in SMACNA "Seismic Restraint Manual: Guidelines for Mechanical Systems," most recent edition, except:
        1. Bracing of life-safety systems and components shall be increased by 50% (importance factor = 1.50).
        2. Hangers 12 inches or less in length shall be capable of swaying at least 30 degrees out of plumb in either direction without losing strength, unless augmented by seismic bracing.
        3. Ducts four square feet or greater in cross-sectional area shall be braced.
        4. Pipes:
            1. Brace all pipes containing gas or liquid fuel.
            2. Brace all pipes 1-1/4 inch nominal diameter or greater in boiler, electrical and mechanical rooms.
            3. Brace all other pipes 2-1/2-inch nominal diameter or greater.
            4. Fire sprinkler pipe bracing shall comply with both ASCE 7, Chapter 13, and NFPA 13.

DIVISION 31: EARTHWORK

SECTION 31 60 00: FOUNDATIONS

1. The foundation design is based on a Geotechnical Report prepared by Langan dated March 7, 2019.

2. Except where otherwise shown, excavations shall be made as near as possible to the neat lines required by the size and shape of the structure. Foundations may be poured without the use of side forms where possible. If the trenches cannot stand, fully form sides to dimensions shown.

3. Do not allow water to stand in trenches. If bottoms of trenches become softened due to rain or other water before concrete is cast, excavate softened material and replace with properly compacted backfill or concrete at no cost to the University.

4. Notify the University ten days prior to excavation and subgrade preparation work to allow University to schedule observation by the Geotechnical Engineer. Excavations and subgrade preparation will be observed by the Geotechnical Engineer.

DIVISION 03: CONCRETE

SECTION 03 20 00: REINFORCING STEEL

1. All mild-steel reinforcing steel shall have a minimum yield stress (Fy) of 60 ksi (420 MPa). For additional requirements see Specifications.

2. All mild-steel reinforcing in new concrete shear walls & collector shall be A706.

3. T-heads:
    1. T1-Head: End anchorage plate with net area at least 4 times reinforcing bar area.
    2. T2-Head: End anchorage plate with net area at least 9 times reinforcing bar area.
    3. T2-heads shall be used unless otherwise noted on the drawings.
    4. See specifications for additional T-head requirements.

4. Anchor Bolts and Rods (unless otherwise noted on the drawings):
    1. Steel Framing:
        1. Anchor rods for typical base plates and steel connections: F1554, Gr. 55.
        2. Anchor rods for columns and collector ties: ASTM F1554 Gr. 105.
    2. Nuts and Washers: see Specifications.

5. Concrete Cover: Unless otherwise shown on the drawings, maintain coverage to face of reinforcing bars as follows:

Location	Clear Cover
Cast against earth:	3 in.
Slab-on-grade over earth or VB:	2 in.
Exposed to earth or weather:	
Slabs, Walls	2 in. (1-1/2 in. for #5 & smaller)
Beam ties	1-1/2 in.
Beam primary reinf.	1-1/2 in.
Not exposed to earth or weather:	
Slabs, walls, joists	3/4 in. (1 in. for shotcrete)
Beam & column ties	1-1/2 in.
Beam & column primary reinf.	1-1/2 in.

Notes:

1. Tolerances per ACI 117, except that clear cover may not be reduced in fire-rated members or assemblies.

6. Pipes, Conduits and Other Embedded Items: See Specifications.

SECTION 03 24 00: FIBER-REINFORCED POLYMER (FRP) REINFORCEMENT

Ultimate Tensile Strength in Primary Fabric Direction: 66 ksi (design value).

SECTION 03 25 00: CONCRETE AND MASONRY ANCHORS

1. Epoxy dowels in concrete:

    1. Epoxy dowels are not permitted for shear wall holdown or braced frame anchor rods.

    2. University's Testing Agency to verify diameter, depth and cleanliness of drilled holes.

    3. University's Testing Agency to test 25% of the first 100 dowels installed in direct tension to the following values:

#3 bar	5,000	3/8" Thrd. Rod	3,500 #
#4 bar	9,000	1/2" Thrd. Rod	6,000 #
#5 bar	14,000	5/8" Thrd. Rod	9,000 #
#6 bar	20,000	3/4" Thrd. Rod	12,000 #
#7 bar	27,000	7/8" Thrd. Rod	18,000 #
#8 bar	36,000	1" Thrd. Rod	22,000 #

    4. If testing of the first 100 dowels results in a "pass" rate of 95% or better, sampling may be reduced to 10% of the remaining work. Of the 10% of remaining work, wall/column dowels must account for a minimum of 5% of total dowels tested. The remaining 5% of work tested can be other dowels on the project.

2. Mechanical anchors: University's Testing Agency to make periodic inspections during anchor installation to verify anchor type and dimensions, concrete thickness and type (normal weight vs. lightweight), anchor embedment, and adherence to manufacturer's installation instructions.

SECTION 03 30 00: CAST-IN-PLACE CONCRETE

1. Concrete Mix Schedule:

Location	f'c (psi)	Age (days)	Aggr. Aggr. Type	Aggregate Max. Size (inches)	Max. Portland (lb/cy)	SCM* SCM (%)
Fdn./S.O.G.	3,000	56	Normal	3/4-1.5	200	50-70
Landscaping	3,000	56	Normal	3/4-1.5	200	50-70
CIP Walls	6,000	56	Normal	3/4-1.5	200	50-70
(E) Wall Infill	3,750	56	Normal	3/4-1.5	200	50-70
Elevated Slabs	6,000	56	Normal	3/4-1.5	300	30-60
Metal Deck Fill	3,000	56	Ltwt.	3/8-1/2	200	50-70
Shotcrete	6,000	56	Normal	1/2	300	30-60

* SCM = Supplementary Cementitious Material content, measured as percentage of total cementitious material by weight. See Specifications for further SCM requirements.

2. Water-to-cementitious material (W/CM) ratio not to exceed 0.45. Use water-reducing admixtures as needed.

CONCRETE REHABILITATION

1. GENERAL
    1. Summary
        1. This Section describes the removal of spalled and loose material in existing concrete, cleaning and coating of exposed reinforcement, and installation of patching materials.
        2. Related Sections:
            1. Section 03 20 00, Concrete Reinforcement.
            2. Section 03 30 00, Cast-in-Place Concrete
        3. For repair of tight cracks using pressure-injection of epoxy, consult with a subcontractor specializing in concrete repair.

    2. References
        1. Published specifications, standards, test methods or other documents listed below are invoked where cited by abbreviations noted below. Latest editions of references apply unless a specific date or edition is listed.
            1. California Building Code (CBC), California Code of Regulations, Title 24, Part 2.
            2. American Concrete Institute (ACI):
                1. ACI 117, "Standard Tolerances for Concrete Construction and Materials."
                2. ACI 301, "Specification for Structural Concrete for Buildings."
                3. ACI 308.1, "Standard Specification for Curing Concrete."
                4. ACI 318, "Building Code Requirements for Structural Concrete."
                5. ACI 503R, "Use of Epoxy Compounds with Concrete."
                6. ACI 546R, "Concrete Repair Guide"
            3. American Society for Testing and Materials (ASTM):
                1. ASTM C109/C109M, "Compressive Strength of Hydraulic Cement Mortars (Using 2-in. 50 mm Cube Specimens."
                2. ASTM C293, "Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)."
                3. ASTM C496, "Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens."
                4. ASTM C882/C882M, "Standard Test Method for Bond Strength of Epoxy-Resin Systems used with Concrete by Slant Shear."

    3. Definitions
        1. Spalling: Concrete piece loose or missing from original concrete mass. Spalls require surface bonding agents and, unlike cracks, do not provide a key to adhere repair mortars.

    4. Submittals
        1. Product Data Sheets: submit product data showing compliance with project specifications, compliance with referenced standards, manufacturer's recommendations, application instructions, and known limitations.
        2. Appropriate Material Safety Data Sheets (MSDS)
        3. Concrete Spall Repair Plan: Submit materials and procedures addressing spall repair (see Products and Execution sections for related requirements).
        4. Concrete Crack Repair Plan: Submit materials and procedures addressing crack repair.

    5. Quality Assurance
        1. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.
        2. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

    6. Job Conditions
        1. Environmental Conditions: Do not apply material if it is raining or if such conditions appear to be imminent. Minimum application temperature 45°F (5°C) and rising.
        2. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.

    7. Delivery, Storage and Handling
        1. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
        2. Store materials in accordance with manufacturer's recommendations. Store all materials off the ground and protect from rain, freezing, or excessive heat until ready for use.
        3. Condition the specified product in accordance with manufacturer's recommendations.

    8. Warranty
        1. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with date of substantial completion of the project.

2. PRODUCTS

    1. Materials
        1. Bonding agent:
            1. Sika Armatec 110 EpoCem by Sika Corporatoin
            2. Sikadur 32 by Sika Corporation
            3. Approved equal or better substitution.
        2. Anti-corrosion coating:
            1. Sika Armatec 110 EpoCem by Sika Corporation
            2. Approved equal or better substitution
        3. Polymer-modified Portland cement mortar:
            1. Component A shall be a liquid polymer emulsion of an acrylic copolymer base and additives.
                1. PH: 4.5-6.5
                2. Film Forming Temperature: 73°F max.
                3. Tear Strength: 950-psi min.
                4. Elongation at Break: 500% min.
                5. Particle Size: less than 0.1 micron
            2. Component A shall contain an organic, penetrating corrosion inhibitor which has been independently proven to reduce corrosion in concrete via ASTM G3 (half-cell potential tests). The corrosion inhibitor shall not be calcium nitrate, and shall have a minimum of 5 years of independent field testing to document performance on actual construction projects.
            3. Component B shall be a blend of selected Portland cements, specially graded aggregates, admixtures for controlling setting time, water reducers for workability, and an organic accelerator.
            4. The materials shall be non-combustible, both before and after cure.
            5. The materials shall be supplied in a factory-proportioned unit.
            6. The polymer-modifed, Portland cement mortar must be placeable from 1/8" to 1-1/2" in depth per lift for vertical applications and 1/8" to 1" in depth for overhead applications.
            7. Products:
                1. SikaTop 123 PLUS by Sika Corporation (hand-pack).
                2. SikaTop 111 PLUS by Sika Corporation (form and pour).
                3. Approved equal or better substitution.
        4. Water: Clean, potable, free from impurities detrimental to concrete, and conforming to requirements of ACI 318 Section 3.4.
        5. Repair Accessories
            1. Drilled Concrete Anchors: Tapcon screw anchors by Elco Industries. Screw anchor shall be embedded 1-1/2" minimum into sound concrete.
            2. Patch Reinforcement: 16 gauge stainless steel annealed tie wire or stainless steel wire mesh.

    2. Performance Criteria
        1. Typical properties of the mixed polymer-modified, Portland cement mortar:
            1. Working time: approximately 15 minutes.
            2. Finishing time: 20 – 60 minutes.
            3. Color: Match existing concrete surface.
        2. Typical properties of the cured polymer-modified, Portland cement mortar:
            1. Compressive strength, ASTM C-109M
            2. 1 day: 2500 psi min. (17.2 Mpa)
            3. 7 day: 5500 psi min. (37.9 Mpa)
            4. 28 day: 7000 psi min. (48.3 Mpa)
            5. Flexural Strength @ 28 days: ASTM C293, 1500 psi min (10.3 Mpa)
            6. Splitting Tensile Strength @ 28 days: ASTM C496, 700 psi min (4.8 Mpa)
            7. Bond Strength @ 28 days: ASTM C882M, 2200 psi min (15.2 MPa)
            8. Portland cement mortar shall not produce a vapor barrier.
            9. Density (wet mix): 132 lbs./ cu. ft. (2.2 kg/L)
            10. Permeability @ 28 days: AASHTO T277, approximately 500 Coulombs.

3. EXECUTION

    1. Examination
        1. Locate spalled concrete and incipient spalls by tapping with a hammer or steel rod and listening for dull or hollow sounds.
        2. Examine surfaces to receive repair mortar. Notify engineer if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

    2. Surface Preparation
        1. Areas to be repaired must be clean, sound, and free of contaminants. All loose and deteriorated concrete shall be removed by mechanical means.
        2. Mechanically prepare concrete substrate to obtain a surface profile of +/- 1/8" (CSP-6 or greater as per ICRI Guidelines) with a new exposed aggregate surface.
        3. Area to be patched shall not be less than 1/8" in depth.
        4. Procedure:
            1. Sawcut edges of repair area as required to provide a neat patch and a minimum 1/4" deep concrete edge. Sawcut to 3/4" maximum depth. Locate reinforcement and determine depth prior to sawcutting. Do not cut existing reinforcing steel.
            2. Chip deteriorated concrete down to sound base material. Limit size of chipping hammer to 15 lbs. Thickness of profile shall be 1/4" minimum and face of substrate shall be roughened to a 1/8" amplitude beyond thickness.
            3. Where reinforcing steel with active corrosion is encountered, comply with the following:
            4. Locally remove concrete back to approximately half the bar diameter to determine extent of active corrosion. Where corrosion is found to extend beyond half of the bar diameter, remove concrete all around bar to 3/4" depth and length as required to remove rust and scale.
            5. Sandblast the steel to a black metal finish to remove all contaminants and rust. If more than 25% of the rebar diameter has been depleted, the affected part of the bar shall be removed and replaced with bar. The new bar shall be coupled with the existing bar using D250SCA Bar Lock couplers or approved equal.
            6. Light mill scale tightly adhered to reinforcement does not require repair.
            7. Where rebar is exposed, prime steel with approved anti-corrosion coating in accordance with manufacturer's recommendations.

    3. Mixing and Application
        1. Mix mortar per manufacturer's instructions. Mix only that amount of material that can be placed in 10 - 15 minutes. Do not retemper material.
        2. Placement Procedure:
            1. Install per manufacturer's instructions.
            2. At the time of application, the substrate shall be saturated surface dry with no standing water.
            3. At locations without exposed reinforcing steel:
                1. Prime substrate with approved bonding agent or a scrub coat of repair mortar per manufacturer's instructions.
                2. If repair area is too large to fill while scrub coat is still wet, use approved bonding agent in lieu of scrub coat.
            4. At locations with exposed reinforcing steel:
                1. Prime exposed reinforcing steel with a first coat of approved anti-corrosion coating per manufacturer's instructions.
                2. Either: Apply a second coat of approved anti-corrosion coating per manufacturer's instructions and then follow directions for locations without exposed reinforcing steel, or if using a products that acts both as and anti-corrosion coating and an approved bonding agent, apply a second coat of approved anti-corrosion coating and approved bonding agent to the reinforcing steel and substrate simultaneously.
            5. Where repair depth exceeds 1-1/2", install drilled anchors and stainless wire as shown in drawings prior to applying mortar.
            6. Mortar must be scrubbed into substrate filling all pores and voids.
            7. Install repair mortar while the scrub coat is still plastic or within the maximum recommended time allowed by the bonding agent manufacturer, as applicable.
            8. Force material against edge of repair, working toward center.
            9. After filling, consolidate then screed.
            10. Allow mortar to set to desired stiffness then finish with trowel for smooth surface. Wood float or sponge float for a rough surface.
            11. In areas where the depth of the repair area to sound concrete is greater than the maximum depth allowed by the repair mortar manufacturer, the repair shall be made in lifts of the maximum allowable thickness. The top surface of each lift shall be scored to produce a rough surface for the next lift. The preceding lift shall be allowed to reach final set before applying fresh material. The fresh mortar must be scrubbed into the preceding lift.
        3. Cure per manufacturer instructions and ACI recommendations. Moist cure with wet burlap and polyethylene, a fine mist of water or other manufacturer approved method. Moist curing should commence immediately after finishing and continue for 7 days. Protect newly applied material from rain, sun, and wind until compressive strength is 70% of the 28-day compressive strength.
        4. Adhere to all procedures, limitations and cautions for the polymer-modified Portland cement mortar in the manufacturer's current printed technical data sheet and literature.

    4. Cleaning and Protection
        1. Clean surface of exposed concrete of foreign material.
        2. Protect concrete from damage and discoloration.

    5. Field Quality Assurance
        1. General:
            1. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state, and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.
        2. Inspection:
            1. Check each repaired area for cracks, spalls, popouts and loss of bond between repaired area and surrounding concrete. Check each repaired area for voids by tapping with a hammer or steel rod and listening for dull or hollow sounds. Immediately repair defects.

DIVISION 05: METALS

SECTION 05 12 00: STRUCTURAL STEEL

1. Pipe sections shall conform to ASTM A53, Type E or S, Grade B (Fy = 35 ksi). Finish black, except where required to receive hot-dip galvanized coating.

2. Round HSS shall conform to ASTM A500 Grade B (Fy = 42 ksi); ASTM A847 (Fy = 50 ksi) may be substituted.

3. Square or rectangular HSS shall conform to ASTM A500 Grade B (Fy = 46 ksi); ASTM A847 (Fy = 50 ksi) may be substituted.

4. Structural steel channels, angles and miscellaneous iron shall conform to ASTM A36 (Fy = 36 ksi); ASTM A572 Grade 50 may be substituted.

5. Non-seismically loaded structural steel plates and bars:

    1. ASTM A36 (Fy = 36 ksi); ASTM A572 Grade 50 may be substituted.

    2. See Specifications for additional requirements where thickness exceeds 2 inches.

6. Seismically loaded structural steel plates and bars:
    1. ASTM A572 Grade 50 meeting minimum notch toughness requirements given in Specifications.
    2. Seismically loaded plates include, but are not limited to, gusset and connection plates in braced frames, splice plates in collectors, continuity plates in moment frames and any other plate designated "SLRS" or "CVN tough" on the drawings.

7. "Group A" or "A325" indicates a high-strength bolt assembly conforming to ASTM A325 Type 1 or F1852, with ASTM A563 heavy hex nuts and ASTM F436 or F959 Grade 325 washers as required by RCSC. ASTM A325 Type 3 bolts may be substituted only where hot-dip galvanizing is not required.

8. "Group B" or "A490" indicates a high-strength bolt assembly confirming to ASTM A490 or F2280, with ASTM A563 heavy hex nuts and ASTM F436 or F959 Grade 490 washers as required by RCSC.

9. All high-strength bolts shall be fully pretensioned unless otherwise noted. Bolts other than high-strength shall be installed snug-tight.

10. For anchor bolt material specifications, see Section 03 20 00, Reinforcing Steel.

11. Threaded studs and headed shear studs shall conform to AWS D1.1, and shall be carbon steel studs conforming to ASTM A108 Grades 1010 through 1020, unless otherwise noted. Stud bases shall be full-fusion arc welded. Stud welding through metal deck and all other configurations shall be qualified through tests per AWS D1.1, Section 7.6-7.8. Where stainless steel studs are required by the Notes or Drawings, studs to be post-annealed as required to prevent brittle failure.

SECTION 05 31 00: METAL DECKING

1. See the metal decking schedule in these drawings and the Metal Decking section of the specifications.

SECTION 05 40 00: COLD FORMED METAL FRAMING

1. Steel Studs, Joists, Tracks, and Channels: ASTM A1003.
    1. Grade 33 Type H, for all material 43 mils (18 ga) and thinner.
    2. Grade 50 Type H, for all material 54 mils (16 ga) and thicker.
    3. Zinc coating per ASTM A653, G60 minimum. Touch up abrasions and welds in the field after erection.
    4. Structural section properties to be computed in accordance with AISI S100, and meet or exceed those specified for the corresponding member size in Steel Stud Manufacturers Association (SSMA) Product Technical Information (ICC-ES Report No. ER-4943P).
    5. Provide punched webs for studs.
    6. Bottom and top track gauge to match stud gauge, except that 54-mil (16 ga) tracks may be used at 68- or 97-mil (12 or 14 ga) studs.
    7. Install stud and joist bridging in accordance with manufacturer's recommendations.

2. Straps: ASTM A1003 Grade 50 Class 1 or Class 3.

3. Fasteners:
    1. Screws: ASTM C1513 self-drilling/tapping, installed in accordance with AISI S200 Section D1.
    2. Welds: fillet, plug, butt or seam and made in accordance with AWS D1.3, "Structural Welding Code - Steel Sheet," and AISI S200 Section D2. Electrodes to be E6X or E7X unless otherwise noted.
    3. Bottom tracks at non-bearing walls to be attached to concrete with powder-driven fastener pins with unless otherwise noted.

4. Unless a larger gap is shown on the drawings, non-bearing walls shall allow at least vertical movement between floors, or between floor and roof, by use of nested top tracks or top tracks with vertical slots for screws.

5. Attach joist rim tabs or support clips to hard side of joist unless otherwise noted. Align joists, rafters and trusses with wall studs in accordance with AISI S200 section C1.

6. Corrugated Sheathing: Shallow Vercor deck as manufactured by Verco: ASTM A1003 Grade 50 Type H, with zinc coating per ASTM A653, G90 minimum.

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Key Plan

Drawing Record

Revision Number	Issues/Submission	Date
	100% SD	11/2/2018
	PLAN REVIEW SUBMITTAL	1/23/2019
	90% REVIEW SET	3/18/2019
1	SRC REVIEW RESPONSE	5/3/2019
2	90% CD BACK CHECK	5/20/2019
3	DCFM REVIEW RESPONSE	6/27/2019
	OUT TO BID SET	8/16/2019
	LUMP SUM BID	10/15/2019

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Sheet

STRUCTURAL NOTES

S1.2

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