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STRUCTURAL DESIGN CRITERIA (DRAFT-3)

DATE: July 28, 2011

PROJECT: ALUMNI HOUSE,
California Alumni Association
University of California
Berkeley, California

ARCHITECT: Knapp VerPlanck Preservation Architects
235 Montgomery Street, Suite 747
San Francisco, CA 94104-2918

I. GENERAL CONDITIONS FOR DESIGN

A. Existing Site Conditions
1. Geotechnical Report: (TBD)
2. Relatively flat site with various thicknesses of fill over Bay Mud (TBD)
3. Existing liquefaction potential (TBD)
4. Significant long-term and seismic-induced settlement (TBD)
5. Groundwater Elevation: (TBD)

B. Existing Foundations
1. Existing Foundations for the East Wing and the Lobby is spread footings, and the ground floor slab is 4 inch thick concrete reinforced with 6X6-#10/10 welded wire fabric. The Lobby foundation is also spread footing with a crawl space, however the Lobby foundation is integral with the West (Office) Wing, which is scheduled to be demolished and which is on drilled pier foundation and is once story lower. The east basement wall of the office wing retains lobby structure foundation and the soils up to the grade that leads to the entry and needs to be retained. Thus this needs to be retained and integrated with the new West Wing structure.
2. The existing foundation of the West Wing consist of 18 inch diameter drilled piers with the bell bottom, bearing diameter of 3'-6 " interconnected at the basement slab level with tie beams 6 inches wide and 8 inches of depth integrated with the 4 inch concrete slab reinforced with welded wire mesh.
3. Demolishing of the West Wing will leave the existing east side basement and retaining wall unsupported at the top and will deflect laterally due to the soil pressures. Therefore, this wall will need to be shored by installation of temporary braces and a whaler at the top and for which the existing piers may be used for

foundation of the temporary braces if the contractor's engineer finds it of usefulness.

4. The existing foundations in both the East Wing and the Lobby are spread continuous footings. In the East Wing these support the concrete end reinforced concrete shear walls in the N-S direction and the center bearing and shear wall in the E-W direction. The columns on the north and south sides are supported on continuous concrete footings that run the whole length of the building. In the Lobby, the exterior walls are supported on stem walls which in turn are supported on continuous reinforced concrete footings, and a center continuous footing under the crawl space columns.

C. Existing Ground Floor Slab

1. Nominal 4 inches thick concrete slab on grade in the East Wing with 6x6-10/10 WWF reinforcing. Entry Lobby is supported 4 inch thick reinforced concrete slab and spanning from exterior stem wall and footing to a beam at the center spanning in the E-W direction to 10 inch square reinforced concrete column supported on a continuous footing five fee below the ground floor slab to provide a crawl space. The crawl space has 6 inch thick reinforced concrete slab which slopes up to the exterior wall footing. Concrete strength is unknown. (TBD)

D. Roof Framing Systems

1. Both the East Wing and Lobby are framed using steel framing systems, employing pipe columns, steel girders, and 10 inches deep open web steel bar joists, which in turn support the roof 'Steel-Tex' lath, and 2 inches a to 2 to 3 inches varying thickness light weight concrete fill. The strengths of the concrete and unit weight of the concrete are unknown. (TBD)
2. Mechanical Mezzanine: In the East wing there is approximately 500 square feet mezzanine supported in wood stud walls and framed using 6 inch deep light gage metal joists and two layers of ¾ inch thick tongue & groove wood decking. Lateral force resistance to the seismic forces for the mechanical mezzanine is provided by the lath and plaster wood stud walls of the corridor, powder room, and toilets on the floor directly below the mezzanine. These are not qualified lateral force resisting systems for new building under the current code. (TBD)

E. Exterior Wall Construction and Support

1. Glass Curtain Wall: mullions supported at edge of slab

F. Lateral Load Resisting Systems

1. East Wing
   i. Load bearing exterior reinforced concrete shear walls in the N-S direction and one interior reinforced concrete shear wall in the E-W direction. Concrete strength is unknown. (TBD)

ii. Roof diaphragm is 2-1/2 inches thick vermiculite concrete with very light reinforcing (STEELTEX - an old product used in 1950s, with light gage steel mesh and heavy paper that spans 24 inches to the open web joists and provides formwork and reinforcing for the vermiculite concrete deck (unit weight generally of 20 to 35 PCF with 28 day compressive strengths in 100 PSI to 275 PSI range) attached to the walls with wall dowels into the slab. The adequacy of attachment of concrete deck to open web steel joists is unknown. (TBD) Vermiculite concrete strength is unknown as well as the STEELTEX as a reinforcement in concrete is an unknown. (TBD)

2. Lobby Building
   i. The bolted connection between the pipe columns and the steel W8 girder and its relatively rigid connection with the slab and foundation wall in the N-S direction provides for a moment frame not conforming to current standards in the code and is not a qualified system. In the E-W direction the columns act as cantilevered columns in the inverted pendulum system. This is not a qualified lateral system in the current code of standards.
   ii. Roof diaphragm for this lobby structure is vermiculite concrete varying in thickness from 2 inch to 3 inches with STEELTEX lath and paper as formwork and light reinforcing. The attachment of the deck concrete to the open web steel joists is unknown. (TBD)

All three structures, West Wing, Lobby and East Wing that together constitute Alumni House presently, i.e., as of 2009 are rated as "Good" in the University of California's four category rating system (Good, Fair, Poor & Very Poor).

3. Replacement West Wing Building design Criteria

   a. Local Building Code
      i. 2010 California Building Code
      ii. Foundations: Drilled reinforced concrete piers and grade beams
      iii. Gravity floor and roof framing system: Steel framed construction with composite metal deck and concrete floors and roof.
      iv. Lateral Load resisting Systems: All qualified systems appropriate to the design may be used per ASCE 7-05 Table 12.14-1 in the following list: B.1, B.2, B.3, B.5, B.14, B.15, B.25, B.26 or B.27.

   b. Referenced Codes and Standards

i. ACI 318-05, Building Code Requirements for Structural Concrete
ii. American Institute of Steel Construction (AISC)
    1. AISC 360-05, Specification for Structural Steel Buildings
    2. AISC 341-05, Seismic Provisions for Structural Steel Buildings
    3. AISC 358-05, Pre-qualified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications
    4. Steel Design Guide Series 11, Floor Vibration Due to Human Activities
iii. ASCE 7-05, Minimum Design Loads for Buildings and Other Structures

iii. LOAD CRITERIA AND DESIGN LOADS

a. Dead and Live Loads
    i. All Loads as per code requirements
    ii. M/E/P shafts: design for slab to be removed in future; apply slab dead load and live load; model as non-composite deck
    iii. Stairs: Apply line load around stair opening for tributary dead and live load of stairs; assume stair may span either direction

b. Seismic Loads and Parameters
    i. Seismic Mass for calculations by hand or computer modeling:
        1. Uniform dead loads and self-weight: uniform masses applied at each level
        2. Exterior walls: line masses applied at each level
        3. Equipment: Assumed equipment weights plus concrete pads applied as uniform masses at specific areas
        4. Penthouses: dead loads and self-weights applied at roof level as uniform masses at specific areas
        5. Soil pressures and retaining wall masses if part of the lateral load resisting system.

- ii. Code Parameters
  1. S_{ds} = 1.318 seconds
  2. S_1 = 0.512 seconds
  3. Distance to Seismic Fault = 0.5 km
  4. Dynamic linear elastic response spectrum analysis procedure; if applicable, Code spectrum **(2010 CBC)**

c. Wind Loads and Parameters
  - i. Basic wind speed, V = 85 mph (TBC)
  - ii. Importance factor, I_w = 1.0
  - iii. Exposure = B
  - iv. Mean Roof Height = (TBD)
  - v. Mean Parapet/Roof Screen Height = (TBD)
  - vi. Method 2; projected area method
  - vii. Lateral Earth Pressure: As per geotechnical Report (TBD)

d. Elevator Loads: traction elevator (TBD)
  - i. Machine beam reactions – ***Total loads (including impact)***
  - ii. Guide rail support reactions – ***Tube columns designed for seismic loads with ¼” deflection limit***
  - iii. Pit buffer reaction – ***To be designed for pit reactions***

e. Window Washing System: (TBD)

f. Load Combinations: CBC 2010 – Chapter 2.

iv. DETAILED DESIGN CRITERIA

a. Concrete Strength: Minimum 3,000 PSI at 28 days

b. Reinforcing steel: ASTM A615 and ASTM A706 Deformed and Plain Reinforcing bars.

c. Sustainable Design:
  - i. Recycled Aggregate for Concrete:
  - ii. Cement Substitution:

d. Analysis and Design Methods
  - i. Gravity Load Analysis and Design
    1. Concrete Slab and Grade Beams: Computer standard software or manual calculations.
    2. Post-tensioned Two Way Concrete Slab: Standard Computer software. Balance a

maximum of 80% of concrete slab weight by post tensioning.

3. Concrete Columns: Manual or standard computer software.

e. Lateral Load Systems & Analysis and Design – Option - A
   1. Use Concrete Shear Wall for Lateral Load Resistance
   2. Use concrete slabs for diaphragms and collectors.
   3. ETABS or SAP or RISA computer software
      a. Fixed base model
      b. Dynamic linear elastic response spectrum analysis
   4. Spreadsheets and manual calculations

ii. Deflection Limits
   1. Interior Slabs, Beams and Girders: Live Load deflections = Span/360;
   2. Framing Supporting Exterior Walls: Live Load = Span/360; Maximum = One-Half (½) inches; Total load Deflection = Span/240, Maximum One (1) inch.

iii. Columns
   1. Standard Computer Software verified by manual calculations
   2. Skip live load around columns
   3. Deformation Compatibility: manual calculation; seismic moment equal to the axial load times the story drift is to be added to the controlling load case from computer modeling;

iv. Reference geotechnical report: “Geotechnical Investigation, Alumni House, California,” by -------------------------(TBD)

f. Lateral Load Systems & Analysis and Design – Option - B

   1. Concrete Slab and Grade Beams: Computer standard software or manual calculations.
   2. Composite metal deck and concrete on steel beams and girders floor system.

3. Steel braced frame: Either (a) Special steel concentrically braced frames, (b) Steel eccentrically braced frame, (c) Buckling restrained braced frames, or (d) Special steel moment frames

ii. Composite Flooring Framing
1. LRFD design by RAMSTEEL or other standard software or manual calculations
2. Assume Un-shored Deck
3. Construction LL = 20 PSF
4. Camber: 80% of Construction DL; ¾” minimum; ¼” increments
5. Floor Vibration: Human comfort for vibrations due to human activities based on ASIC Design Guide Series 11; by RAMSTEEL or similar standard software

iii. Deflection Limits
1. Interior Beams and Girders: post-composite LL = L/360; post-composite superimposed load = ¾”; net total load = L/240
2. Framing Supporting Exterior Walls: post-composite LL = L/360; post-composite superimposed load = ½”; net total load = L/240

iv. Columns
1. Standard Computer Software verified by manual calculations
2. Skip live load around columns
3. Deformation Compatibility: manual calculation; seismic moment equal to the axial load times the story drift is to be added to the controlling load case from computer modeling;

g. Buckling Restrained Braced Frames (BRBF) if used
i. AISC 341-05, Seismic Provisions for Structural Steel Buildings
ii. Buckling restrained braces placed in chevron configuration

h. Steel Special Moment Resisting Frames (SMRF)
   i. AISC 341-05, Seismic Provisions for Structural Steel Buildings
   ii. AISC 358-05, Pre-qualified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications

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