E. STRUCTURAL DESIGN NARRATIVE

Overview

Design Criteria

Design for the structure will be based on the requirements of the 2003 International Building Code (IBC). For purposes of wind, snow and seismic loading the structure is designated Category II per IBC Table 1604.5. Category II as stated in Section C Design Requirements. The following loading criteria will be utilized in the design of the structure.

Wind Loading

Basic wind speed: 130 MPH
Exposure: D (Waterfront with exposure to a fetch exceeding 1 mile)
Importance factor: 1.0

Seismic Loading

The site is located in a seismically active area. Seismic hazards such as ground rupture and liquefaction, if any, will be identified in the geotechnical report. The site class will also be established in the geotechnical report. The maximum considered earthquake spectral response accelerations for short (0.2 second) and long-term (1.0 second) periods are as follows:

S_s = 178.6%g
S_1 = 66.5%g
Importance factor: 1.0

The values are subject to adjustment based on the final geotechnical findings:

Snow Loading

Ground snow load: 50 PSF
Snow exposure factor (C_e): 1.0 (Terrain category C, partially exposed)
Importance factor: 1.0

Live Loading

Administration office facility will be designed for a live load of 50 PSF in addition to a 20 PSF load for partitions. The live load is a code requirement for office spaces. The addition of 20 PSF load for partitions should provide partition flexibility through out the area. Lobbies and first floor corridors will be designed to 100 PSF while corridors above the first floor will be designed for 80 PSF.

To maximize the flexibility and future space planning options for the conference/visitor facility floor areas will be designed for 100 PSF live load in addition to a 20 PSF load for partitions. The live load is a code requirement for lobbies, assembly areas and theaters. The addition of 20 PSF load for partitions should provide flexibility. Areas designated as storage areas will be designed for light storage (125 PSF) unless otherwise directed.

Deflection Criteria

Live and snow load deflections will be limited to the following:

Roofs: Span/360
Floors: Span/480 or 1 inch whichever is less

Foundations

Design of foundations and slab on grade elements will be based on the recommendations of a geotechnical engineer. It is anticipated that piling will not be required. All footings will bear a minimum of 3 feet below finish grade.

Design Narrative

The Mary Lowell Center is anticipated to be a combined use structure comprised of a conference/visitor center and an administration office area. The conference/visitors center will be a two-story structure located mainly on the south and west sides of the building. The center contains conference rooms on the second floor, exhibit areas and an auditorium on the first floor. In addition, this facility will utilize a raised floor to provide mechanical and electrical service. Floor-to-floor heights are anticipated to be roughly 17'-0".

The administration office area will be three stories plus basement located mainly on the east and north sides of the building. In order to provide flexibility column spacing will be limited but spaced regularly where possible. This facility will utilize in-floor radiant heating which will require a cementitious topping. Floor-to-floor heights are anticipated to be limited to roughly 12'-0".

Alternatives to Address the Percentage of Available Budget

100% Alternative:

The objective of the 100% Alternative is to provide as much interior free space as possible. This requires long beam and girder spans for the floor and roof framing. In order to provide the long spans while maintaining high floor-to-ceiling clearance, the beam and girder depths were kept relatively shallow. To do this heavy steel sections will have to be sized, roughly 3 to 4 times heavier than conventional framing. Schematic Design Phase structural plans for the 100% Alternative can be found in the S-100 series of plans.

- Office area roof framing will consist of 4" concrete slab over a 2" metal deck supported by W12 composite beams spaced at 6'-0" o.c. Interior girders supporting beams will be W16 along Grids D and 13. Girders located along the perimeter of the building will be W16.
- Conference/Visitors Center roof framing will consist of 4" concrete slab over a 2" metal deck supported by W12 or W16 composite beams (depending on the span) spaced at 6'-0" o.c. Interior girders supporting beams will be W16 along Grids B.6 and C. Girders located along the perimeter of the building will be W16.

- Office area typical floor framing will consist of 4" concrete slab over a 2" metal deck supported by W12 composite beams spaced at 6'-0" o.c. Interior girders supporting the beams will be W16 along Grids D and 13. Girders located along the perimeter of the building will be W16.
- Conference/Visitors Center typical floor framing will consist of 4" concrete slab over a 2" metal deck supported by W18, W14, or W12 composite beams (depending on the span) spaced at 6'-0" o.c. Interior girders supporting the beams will be W18 along Grids B.6 and C. Girders located along the perimeter of the building will be W18.
- The basement located under the office area would be constructed out of 12" thick concrete perimeter walls with an 8" concrete slab on grade. Interior columns would be supported by isolated concrete spread footings.
- The lateral force resisting system will consists of concrete rigid diaphragm that will distribute lateral loads to special concentrically braced steel frames along the perimeter of the building and 12" thick special reinforced concrete shear walls that separate the office area from the conference/visitors center.

Advantages of this alternative include open floor space for future expansion or changes in program, durability, and high ceiling height.

Disadvantages of this alternative include inefficient structural member framing sizes which add significant cost to the structure.

<u>90% Alternative:</u>

The 90% Alternative differs from the 100% Alternative by keeping the long spans but using efficient steel beam depths. As with the 100% Alternative the long spans will provide as much interior free space as possible. Schematic Design Phase structural plans for the 90% Alternative can be found in the S-200 series of plans.

- Office area roof framing will consist of 4" concrete slab over a 2" metal deck supported by W12 and W18 composite beams (depending on the span) spaced at 6'-0" o.c. Interior girders supporting beams will be W18 or W24 (depending on the span) along Grids D and 13. Girders located along the perimeter of the building will be W18 or W24 (depending on the span).
- Conference/Visitors Center roof framing will consist of 4" concrete slab over a 2" metal deck supported by W12 or W24 composite beams (depending on the span) spaced at 6'-0" o.c. Interior girders supporting beams will be W24 or W16 (depending on the span) along Grids B.6 and C. Girders located along the perimeter of the building will be W24.

- Office area typical floor framing will consist of 4" concrete slab over a 2" metal deck supported by W14 or W18 composite beams (depending on the span) spaced at 6'-0" o.c. Interior girders supporting the beams will be W21 or W24 (depending on the span) along Grids D and 13. Girders located along the perimeter of the building will be W21 or W24 (depending on the span).
- Conference/Visitors Center typical floor framing will consist of 4" concrete slab over a 2" metal deck supported by W24, W18, or W12 composite beams (depending on the span) spaced at 6'-0" o.c. Interior girders supporting the beams will be W27 along Grids B.6 and C. Girders located along the perimeter of the building will be W22 or W27 (depending on the spans).
- The basement located under the office area would be constructed out of 12" thick concrete perimeter walls with an 8" concrete slab on grade. Interior columns would be supported by isolated concrete spread footings.
- The lateral force resisting system will consists of concrete rigid diaphragm that will distribute lateral loads to special concentrically braced steel frames along the perimeter of the building and 12" thick special reinforced concrete shear walls that separate the office area from the conference/visitors center.

Advantages of this alternative include open floor space for future expansion or changes in program, durability, and reasonable steel framing cost.

Disadvantages of this alternative include low floor-to-ceiling height.

75% Alternative:

The 75% Alternative differs from the 90% by adding an additional line of columns in the Office area to shorten the framing spans. As with the 90% Alternative, steel framing will be sized efficiently thus decreasing the floor-to-ceiling height. In addition, the dividing wall between the conference/visitors center and the office area changes from concrete to masonry. The Conference/Visitor Center steel framing will be identical to the 90% Alternative. Schematic Design Phase structural plans for the 90% Alternative can be found in the S-300 series of plans.

- Office area roof framing will consist of 4" concrete slab over a 2" metal deck supported by W12 composite beams spaced at 6'-0" o.c. Interior girders supporting beams will be W14 or W16 (depending on the span) along Grids D, E, 13, and 14. Girders located along the perimeter of the building will be W14.
- Conference/Visitors Center roof framing will consist of 4" concrete slab over a 2" metal deck supported by W12 or W24 composite beams

(depending on the span) spaced at 6'-0" o.c. Interior girders supporting beams will be W24 or W16 (depending on the span) along Grids B.6 and C. Girders located along the perimeter of the building will be W24.

- Office area typical floor framing will consist of 4" concrete slab over a 2" metal deck supported by W12 or W14 composite beams (depending on the span) spaced at 6'-0" o.c. Interior girders supporting the beams will be W14 or W16 (depending on the span) along Grids D, E, 13, and 14. Girders located along the perimeter of the building will be W14.
- Conference/Visitors Center typical floor framing will consist of 4" concrete slab over a 2" metal deck supported by W24, W18, or W12 composite beams (depending on the span) spaced at 6'-0" o.c. Interior girders supporting the beams will be W27 along Grids B.6 and C. Girders located along the perimeter of the building will be W22 or W27 (depending on the spans).
- The basement located under the office area would be constructed out of 12" thick concrete perimeter walls with an 8" concrete slab on grade. Interior columns would be supported by isolated concrete spread footings.
- The lateral force resisting system will consists of concrete rigid diaphragm that will distribute lateral loads to special concentrically braced steel frames along the perimeter of the building and 12" thick solid grouted special reinforced masonry shear walls that separate the office area from the conference/visitors center.

Advantages of this alternative include an efficient framing system that lowers the cost of structure and durability.

Disadvantage of this alternative is interior columns decrease open floor space and lower floor-to-ceiling height.

Conclusion

The structural system for this project will be selected from one of the proposed systems indicated or any combination thereof. The selected system should provide the best balance of durability, flexibility for future expansion or changes in program, cost effectiveness and fire resistance. To the extent possible, structural systems will incorporate regular shaped plan geometry, uniformly distributed stiffness, and repetitive member sizes and lengths in order to achieve an economical structure that performs well in this seismically active location.

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