Environmentally Conscious Structural Design
Cordoba Cultural Complex

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DESIGN & DEVELOPMENT

Design Motivation

The Cordoba Cultural Complex aims to promote social interaction, cultural diffusion and skill cultivation. This structural system will consist of two buildings standing 65 feet above ground connected by a bridge. The guitar-shaped design of the Cordoba Complex was inspired by its intended use, which is centered around performing arts. The design was also influenced by MAJISA's aim to reduce the negative impact of development and promote urban sustainability. In order to achieve these goals, the Cordoba Cultural Complex will feature a green roof and solar panels.

Design Approach

- Schematic renderings created to portray Architectural concept
- Concept transferred into AutoCAD for Construction Documents
- Floor occupancies & live loads were assigned based on ASCE 7-10[1]
- Dead Loads were assigned based on various structural resources
- Steel/Composite members were designed based on AISC Steel Manual[2]
- Foundation and Seismic design to meet constraints required by the site location

CONSTRAINTS & PARAMETERS

In Structural Engineering, there exists many parameters and constraints that must be considered in practice. Gravity design is constrained by the placement of structural elements like beams and columns, as well as the capacity of the metal decking that supports the loads above. Earthquake design parameters are set by the location of our structure. Since our location is in California, more stringent seismic constraints are being implemented. Foundation design is constrained by the present soil conditions found on site and reported by the Geotechnical engineer. Based on these parameters, the foundation will be designed so the structure's load is distributed efficiently onto the subgrade.

ALTERNATIVES CONSIDERED

- **Round "Acoustic Guitar" Building**
  This alternative to our structure required for a polar coordinate system implemented in our design. This alternative was rejected through consultation with KPFF due to the future complexity of the seismic constraints.
- **Timber Wall surrounding Structure**
  This alternative was considered to reconcile the rejected alternative above, but was also rejected due to seismic parameters and fire restrictions

STRUCTURAL DRAWING & RENDERING

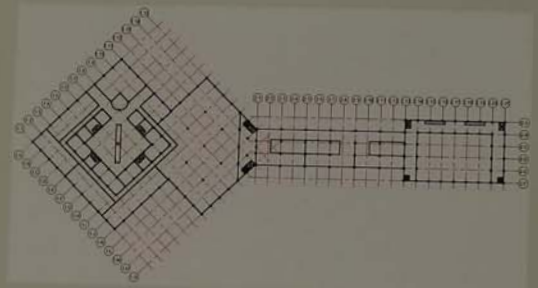

Figure 1. AutoCAD Structural Drawing – 1st Floor Plan View

Figure 2. Sketch Up Architectural Rendering

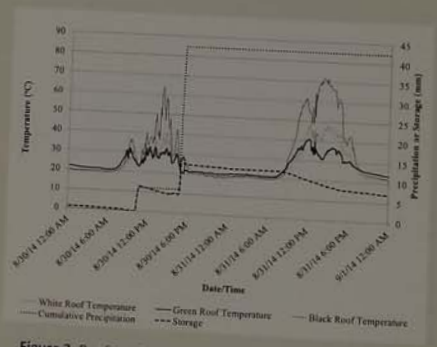

Figure 3. Roof section properties for two rainstorm events[3]

GREEN ROOF ADVANTAGES

The future of structural building design will heavily coexist with green roof design to mitigate environmental impacts that new structures impose. Green roofs will assess stormwater runoff and urban heat island effects while providing energy solutions for buildings.

In traditional structure construction, a parcel becomes impermeable creating heat islands. Green roofs mitigate heat island effects through evapotranspired water: dissipating heat while cooling the structure below. In the winter, green roofs provide an insulative boundary for the structure. This results in a lessened energy demand for the structure through the management of its internal temperature.

Green Roofs also allow for runoff reduction and peak flow attenuation. Figure 3[3] shows how the Precipitation and storage are directly correlated to temperature through the type of roof that exists in the structure. Peak flow attenuation allows for a lag time to exist between the rainfall hydrograph and the runoff hydrograph. This lessens additional stress placed on existing stormwater infrastructure by new structures.

PROJECTED DELIVERABLES

- Structural Framing Design.....April 1st
- Foundation Design.....May 1st
- Structural Modeling/Analysis.....June 1st
- Construction Documents.....June 1st
- Estimated Project Cost with Contingency: $300 million

REFERENCES

1. ASCE. 2010. Minimum Design Loads for Buildings and Other Structures. ASCE/SEI Standard 7-10.
2. American Institute of Steel Construction, Manual of Steel Construction, 15th Edition. Chicago: AISC, 2017
3. Gibler, M. R. "Comprehensive Benefits of Green Roofs." World Environmental and Water Resources Congress 2015, 14 May 2015
4. Zaremba, Gerald J., et al. "Impact of Drainage on Green Roof Evapotranspiration." Journal of Irrigation and Drainage Engineering, vol. 142, no. 7, 29 Mar. 2016