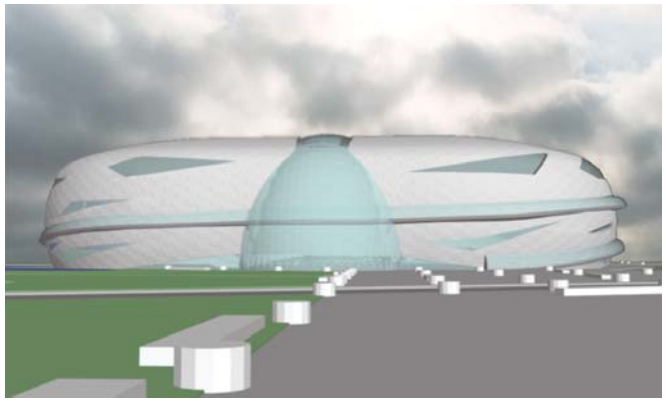
I-PRO 335

CapStone Design/ Design of a Stadium
Fall 2006



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Goal:

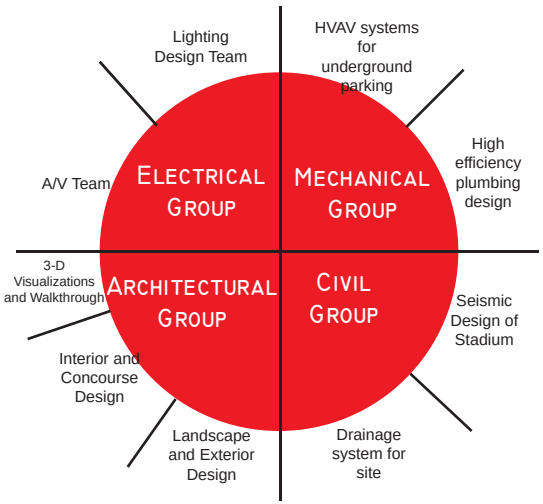
IPRO 335 or Capstone Design pursued designing an advanced and economical Public Stadium. Capstone Design's primary focus was to apply new methods in design derived through researching the most recent modifications to standardized codes and breakthroughs in technology. This course has already produced building designs for large-scale projects ranging from an airport terminal to an office building. Several professional disciplines were required to complete this unique and superior structure including architecture, civil (structural/nonstructural) engineering, electrical engineering, and mechanical. This semester, Capstone Design's senior undergraduate and graduate students continued to strive toward a Public Stadium with the most innovative and creative architectural and structural designs. All objectives necessary to successful completion of this project will be pursued in the future.

Organization:

Capstone Design divided into four teams: Architectural Design, Electrical Systems, Mechanical Systems, and Structural Design. Subgroups formed to address specific project areas.

Tasks:

- **Architectural Design:** The team's task was to upgrade and modify last semester's design to create a more attractive and functional building. This included redesigning the property to complement the new stadium while reclaiming land for park space, rejuvenating the neighborhood, and eliminating above ground parking facilities.
- **Electrical Systems:** This team's objective was to calculate the electrical loads and select light fixtures. They were also assigned the task of designing an audio/video system for the stadium.
- **Mechanical Systems:** The team's task was to address the needs of several mechanical systems. One objective centered on reducing stadium water usage by 50%. Another objective focused on creating a HVAC system that meets EPA Standards and attains sufficient efficiency to be considered "green".
- **Structural Design:** This team's task was to structurally design the stadium for earthquake loading. Drainage was also to be addressed by designing a retention basin and drainage system to collect rainwater. This system would be incorporated into a "green" system that uses rainwater water for differing purposes.



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Accomplishments:

- The **Architectural Design team** modified the prior design to be more aesthetically pleasing and coordinate better with its environment. Revisions were made to bring the stadium into compliance with all obligatory building codes. The team also created a very pleasant and neighborhood friendly site. Mass parking was placed in two underground lots off of the central site. One small VIP green lot was sited adjacent to the stadium. Vendor lots, playing courts, and playgrounds were placed on site. Approximately half the available land was devoted to an easy access park and retention pond that will double as a fountain and signage.

- The **Electrical System team** chose the light fixtures to be used as well as calculating the lighting loads. Additionally, a network based video system utilizing digital video transmission was designed.

- The **Mechanical Systems** team maintained the "green" image of the stadium by significantly reducing stadium water usage through the employment of low flow water fixtures (toilets, urinals, showerheads, faucets, drinking fountains). A significant amount of research regarding the qualifications for a "green" HVAC system was completed. After calculating the minimum amount of times for air exchange, the inlet air speed was determined. Different types and positions of ducts and air vents were studied to minimize the necessary work for fans to circulate air to the floor area. The size of ducts needed to supply the air to the garage was also determined.

- The **Structural Design team** completed essential structural design elements that included all the trusses, floor beams, girders, and columns. Various loads (including dead, live, snow, and seismic loading) were taken into account. A piping drainage network to collect and transport collected water to the retention basin was designed.

Outcome:

Through the concerted efforts of Capstone Design team members, the stadium project underwent substantial development. Communication, professionalism, and dedication contributed to the successful efforts of the team to move the project forward.

Future Development:

Capstone Design must persist in further developing each component of the project to fulfill its unique vision. Most specifically, sketches or 3D representations of the site and stadium focusing on details such as the main fountain need to be completed. Additionally, the foundation design, including the foundation walls and concrete design on the floors need to be addressed. Further development of the electrical systems in the areas of HVAC, audio/video, concessions lighting, exterior lighting, and building transformers must be undertaken. Selections of plumbing pumps and designing a system to integrate the rainwater into the plumbing must be priorities for mechanical system efforts. Modifications of preliminary drainage design will need to be evaluated to ensure that the piping network remains fully functional. The effects of thermal differences due to temperature need to be calculated to ensure assumptions regarding mechanical engineering are correct. Ventilation of the garage area needs to be completed