IPRO 335

Design of a Stadium

Fall 2006

PROJECT PLAN

Advisers: Eduardo DeSantiago & Ralph Muehleisen

1. Objectives

This semester IPRO 335, Capstone Design, continues placing its efforts in designing the most innovative and creative architectural and structural design from senior undergraduate and graduate students. The same project from last semester, the New United Center, will be analyzed, explored, and redesigned in detail to meet new requirements. The primary goal in this semester long project is to implement the knowledge and new techniques learned at IIT along with the experience from individual members in order to create a unique and superior product. Most of the basic design was completed last semester; nevertheless there are many areas that must be designed or some portions that will be modified.

2. Background

IPRO 335 or Capstone Design is an opportunity to CAE students to demonstrate what we have learned at IIT. This course had produced different types of building designs raging from an airport terminal to an office building. Even though this course is required for CAE students, all disciplines are required in order to create a complete product including architectural, civil (structural/nonstructural), electrical, and mechanical engineering. The primary focus is to apply the new methods in design on original projects produced by IIT architectural students.

The private firms or municipal governments might be possible customers or sponsors for the projects depending on the focus of the design. For our design, a private firm would be the most interested in reviewing the project. Nevertheless, many societies/organizations are involved from the respective members' fields like AIA, ASCE, AISC, LEED, etc. Our goal in designing the most advanced and economical structures requires us to research for recent modifications to standardized codes and breakthroughs in technology.

A professional atmosphere is necessary in order to maintain order. Formal procedures used in everyday companies are implemented to facilitate changes on the project. Communication becomes the most important factor for successfully completing the required tasks. Few ethical issues may arise most of them related the professional procedures.

3. Methodology/Brainstorm/Work Breakdown

In today's world it's necessary to design or to update all structures to meet new codes in order to maintain the highest standards of safety. From an engineering perspective, the primary goal is the general welfare of society at the most economical cost, on that basis project designs compete to meet these two objectives. Our task for this semester is to design a competitive design for a new stadium that will meet the desired criteria using the most recent technology available backed by the methods of planning and designing learned at IIT.

The design of a stadium is an enormous challenge due to the time constraint to complete it in less than sixteen weeks, for that reason we are picking up last semester's work and continue with the basic design. An embedded problem that appears from this decision is the need of time to become acquainted with the

design. However, we are able to fulfill all the tasks that were not completed last semester and accomplish a better-quality design. Five teams had been created to target the necessary tasks that a design project requires which are: architectural, civil, electrical, management, and mechanical. Each team is required to complete their duties according to their fields. For all teams except management, the plan of action will be as follows: Research is the initial step to select the best approach in designing the stadium, and then calculations will be the ongoing tasks for the rest of the semester. Management team is responsible to coordinate the other four teams and remind/meet the deadlines drawn by the project plan schedule and the IPRO office. Management team will also be responsible to provide the required materials, arrange meetings, delegate tasks not expressly designated, contacting advisors and faculty, and generate IPRO deliverables. This team is composed by the team leaders from the other four design teams.

4. Expected Results

The expected results of IPRO 335 are to advance the design of the stadium focusing on the integration of work between the different project teams in order to create a well designed building. The communication between these different teams hinges the projects success and completion. Each team has its on set of goals in order to ensure the further development of the semester project. The work carried out by each team communicated to architectural team will guaranty the success of our semester goal.

1) Architectural

The process of examining, understanding, and ultimately redesigning or furthering the existing the design is the primary focus of the architectural team. An important task for the architectural team is completing the necessary design element to allow for the other groups to complete their work. The architectural team has been split into two sub categories to manage most appropriately the tasks laid before them.

Interior and Concourse Design-

Meant to focus on the design the bulk of the interior space on the building furthering the programmatic design started by the last semesters architects. This team strives to utilize LEED standards, as well as, create a design to deal with the security measures in public meeting spaces. The team will be creating floor plans as well as diagrams to demonstrate their progress in the aforementioned areas.

Landscape and Exterior Design-

Meant to focus on the development of the exterior envelope and handling a comprehensive site plan addressing several primary issues. The envelope will be developed with respect to sustainable design techniques and LEED standards. This will also test the ascetic at a large scale of these practices. A

primary focus is also being placed on the development of a comprehensive landscape design. This is to handle a means of egress as well as greening of urban space. The completion of site plans and exterior elevations with emphasis on materials and specifications will be this teams primary deliverable.

3-D Visualizations and Walkthrough-

Focus on creating a 3-d model for creating a walk through to most accurately portray the outcome of the work and material selection for the building. High lighting concepts of design and engineering in an animation is primary output.

2) Civil

Analysis of the preexisting structure previously designed will be a jumping off point for this semester's comprehensive analysis and design. The tasks have been split into two primary objectives but the team will be participating in all aspects of the work.

Seismic Design of Stadium-

Designing of the stadium for earthquake loading, assuming the stadium is located in the New Madrid earthquake zone. Detailed design of critical connections, also a dynamic response of the stadium will be performed on SAP 2000 (or equivalent software).

Drainage system for site-

Design of drainage system includes calculations of runoff, sewer and catch basin design, and integration with the plumbing design with the non-CAE students. Students will also integrate the drainage system with any pre-existing systems located near the site.

3) Electrical

Starting by doing preliminary research of the how commercial and sports electrical systems are designed. We will be using reference books provided by both the instructor and from the library. Then we will calculate the individual loads and the total load of the stadium and then choose the proper transformer. After choosing the transformer we will design a basic distribution system for the stadium.

Lighting Design Team-

This team will be selecting the most suitable fixtures for each area of the stadium. Then we will calculate the number of fixtures and luminance levels for the interior and exterior areas of the stadium. After deciding on the number of lights we will give the Electrical System Design Team the calculations of the lighting loads.

A/V Team-

This team will start by selecting a main screen for the stadium and associated mounting hardware. The video equipment needed to drive this screen will then be selected, followed by the integration of an audio system as time allows.

4) Mechanical

Starting with analyzing drawings and calculations from last semester we will calculate and create appropriate systems as to maximize energy efficiency and environmental design. To handle the different components of the project we have divided in to teams handling different areas of this vast project.

HVAV systems for underground parking-

For the implementation of the HVAC systems in the underground parking garage, the amount of air exchanged will need to be researched and calculated. Design and calculation of each component in the system documented and presented. Meeting EPA standards and striving for maxim energy efficiency will ensure the designs success in improving air quality inside and outside the building.

Building Energy Modeling-

The focus is to develop a more complete building model for energy analysis and estimating the energy use of the stadium. An energy modeling program, development of the building model and estimation of expected heating and cooling loads for several different types of heating or cooling systems will be selected for presentation.

High efficiency plumbing design-

The basic load requirements and designing a new plumbing system that reduces water use by at least 50%. Focus on low flow toilets and faucets, using storm water storage systems, on-site filtering and reuse of waste water.

5. Project Deliverables and Milestones

IPRO Deliverable	Due Date		Teams
Project Plan & Budget		September 22	All
Mid-term Report		October 20.	All
Website	draft: final:	November 13-27	Architectural, Management
Poster	draft: final:	November 21	All, Management
Abstract	draft: final:	November 22	Management
Final Report	draft: final:	November 22	All

Team CD	daft: final:	December 1	Architectural, Management
Presentation		December 1	All

Weekly Tasks

Week	Tasks and **Deliverables**
Aug 23– Week 1	Meet with team and review last semester • Begin project plan
Aug 28 – Week 2	All • Discussed goals for entire IPRO as well as each individual group • Make everyone aware of last year's progress • Get acquainted with the project • Brainstorm new designs • Acquaint new members with previous work Management • Distribute Project Plan Work Load • Show New People How to Use IGroups and IKnow
Sept 4 – Week 3	All • Divide members into teams • Go over work done last semester. Management • Begin To Research • Begin Project Plan
Sept 11 - Week 4	All • Research complete Management • Continue Weekly meeting • Remind People of Memo

Sept 18 – Week 5	All • Finalize Project Plan Management • Summit Project Plan Civil • New Load Calculations Mechanical • Air Exchange Calculations
Sept 25 – Week 6	Architectural • Program planning for interior spaces • Exterior envelope development Civil • Complete truss Analysis • Rainfall Calculations Electrical • Electrical Load Calculations Mechanical • Calculation of speed of exhaust air
Oct 2 – Week 7	Architectural • Egress planning • Site plan Civil • Primary Drainage Design Electrical • Lighting Loads Mechanical • Fan placement and control

Oct 9 – Week 8	Architectural • Develop Security Plans • Landscape Circulation Civil • Structural Framework Complete Electrical • HVAC & A/V Systems Mechanical • Fan placement and control
Oct 16 – Week 9	Architectural • Research Security Systems • Research Materials for Exterior Civil • Foundation design Complete (Seismic) • Pipe System Design (Elevations & Slope) Electrical • Concession Areas Mechanical • Duct Work **Midterm Report Due- October 20**
Oct 23 – Week 10	Architectural • Systems selection • Material Selection Civil • Test Superstructure • Recheck Connections • (Pump system/Retention Pond) Electrical • Transformer Selection Mechanical • Duct Work

Oct 30– Week 11	Architectural • Interior and Concourse Design • Complete Exterior Design • Begin Modeling Civil • Load Non-structural Components Electrical • Transformer Selection Mechanical • Selection of pumps
Nov 6 – Week 12	Architectural • Finalize Design Work to Complete Drawings • Landscape Design • Begin Animation Civil • Retest Superstructure • Final Drainage Design Electrical • Work Final Report Mechanical • Selection of pumps
Nov 13 – Week 13	Architectural • Finish Plans and Material Selection • Complete Site and Specification • Animation Development Civil • Parking Design (Optional) Electrical • Work Presentation Mechanical • Sound and vibration control • Security Concerns

Nov 20 – Week 14	All • Prepare for IPRO Day • Prepare Reports Management • Start Team CD • **Abstract Due** 11/22 • **Poster Due** 11/22
Nov 27 - Week 15	Management: • Collect Any Papers for Filing • **Website Due** 11/27 • **Presentation Due** 11/29 • **Final Report Due** 11/30 • **CD Due** 12/01 All • Summit All Reports • Upload all files to IGroups **IPRO Day 9:00-4:00 12/1**
Dec 4 – Week 16	**IPRO Debriefing** Management • Final Preparations Other • Peer evaluations online
Dec 11 – Week 17	IPRO Debriefing

6. Individual Team Member Assignments

Architectural Team:

Drew Johnson	Architect of Record (Responsible for organizing teams and tasks)
Natalie Clemens	Architect (Exterior & Landscape) Exterior of Building
Arkadiusz Jarog	Architect (Interior & Concourse) Interior Design and Security
Sarah Leingang	Architect (Exterior & Landscape) Landscape and Site Development
Artur Uchanski	Architect (Interior & Concourse) Concourse and Circulation

Civil Team:

Jorge Medina	Civil (Structures & Cons. Management) Team Leader

Julio Ramirez Civil (Structures & Cons. Management)

Gerardo Sanchez Civil (Construction Management & Surveying)

Chi Hang Tam Civil (Structures) Strengths: Fluid Mechanics

Electrical Team:

Nathan Wang EE major Team Leader (Electric and Lighting Design)

Sushma Dantapalli EE major (Electric and Lighting Design)

Scott Kuyken EE major (Electric and Lighting Design)

Keith Campbell EE major (Audio Visual Design)

Mechanical Team:

Timothy Griffin Mechanical Team Leader (Underground Parking HVAC)

Thomas Kennedy Mechanical (Plumbing Design)

Zander Marcus Mechanical (Building Energy Modeling)

Harshill Parikh Mechanical (Building Energy Modeling)

Management Team:

Drew Johnson Architect of Record

Jorge Medina Civil Team Leader

Timothy Griffin Mechanical Team Leader

Nathan Wang Electrical Team Leader

7. Designation of Roles

	Architectural	Civil	Electrical	Mechanical
Minute Taker:	Sarah Leingang	Julio Ramirez	Scott Kuyken	Harshill Parikh
Agenda Maker:	Drew Johnson	Jorge Medina	Nathan Wang	Timothy Griffin
Time Keeper	Artur Uchanski	Chi Hang Tam	Sushma Dantapalli	Zander Marcus
Weekly Timesheet Collector/Summarizer:	Arkadiusz Jarog	Gerardo Sanchez	Keith Campbell	Thomas Kennedy
Master Schedule Maker	Natalie Clemens	Jorge Medina	Nathan Wang	Timothy Griffin