IPRO It takes a team INTERPROFESSIONAL PROJECTS PROGRAM

IPRO 335
Design of a Stadium

Midterm Progress Report-
For Non-Structural Teams
Fall 2006

Faculty Advisors
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Architectural Group	Civil Group	Mechanical Group	Electrical Group
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Jarog, Arkadiusz	Ramirez, Julio	Kennedy, Thomas	Dantapalli,Sushma
Johnson, Drew	Sanchez, Gerardo	Marcus, Zander	Kuyken, Scott
Leingang, Sarah J.	Tam, Chi Hang	Parikh, Harshill M	Wang, Nathan
Uchanski, Artur			

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.

1. Revised Objectives

This semester IPRO 335, Capstone Design/Design of a Stadium, continues placing its efforts in designing the most innovative and creative architectural and structural design from senior undergraduate and graduate students. The primary objective of the semester has not changed; we are still striving 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.

The underlying goals that this entails are:

- The exploration of new materials in order to create a more efficient design
- To advance our knowledge of these different systems we are addressing.
- To integrate and communicate on the parts of the building and the project within the team.
- Utilize the project completed last semester in order to further or work this semester.
- To complete all required systems designs laid out below in section 4 Task/Event Schedule.
- Meet all code requirements set forth in the International Building Code(IBC) as well as all subsidiary codes AISC, Electric Requirements, etc.

During the second half of the semester IPRO 335 will continue to strive to complete all of the given objectives.

2. Summary of results to date

Describe the results to date including progress made in achieving goals, tasks accomplished, analyses completed, data gathered and any other measurable results that the team has produced.

Architectural Group

The completed tasks done so far for the **Interior/Concourse Team** is as follows:

- Study last semester Plans.
- Redesigned first floor completely.
- Designed security systems.
- Checked egress code.
- Created new egress pathways.
- Collaborated with Civil Team for column Grid.

The completed tasks done so far for the **Exterior/Landscape Team** is as follows:

- Examined last semester's parking garage design and landscaping plan.
- Examined local plants, flowers, and rain index.
- Established new parking garage plan.
- Researched Exterior building materials
- Changed primary landscaping to meet specifications of Interior Architecture Team
- Collaborated with Civil and Plumbing Team on Grey water System and Retention Pond design.
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Electrical Group

The completed tasks done so far for the **Lighting Team** is as follows:

- Learned about how to do basic lighting calculations.
- Created a spreadsheet to input dimensions of rooms for easier calculations.
- Finished Lighting Calculations for 1st floor.
- Collaborated with Architecture Team finding out basic design specifications and room sizes
- Approval of typical light fixtures

The completed tasks done so far for the **Audio/ Visual Team** is as follows:

- Research in video formats, display technology, and transmission.
- Selected LED (Light Emitting Diode) technology for the main screens due to its energy efficiency, brightness, and lightness in weight.

- Collaborated of design of central screens for stadium with Architecture Team.

Mechanical Group

The completed tasks done so far for the **HVAC system Team** of the underground parking garage is as follows:

- Researched the types of ventilation systems for various situations that arise in parking garages.
- Done some basic calculations on how many air exchanges per hour one of the parking garages need in order to keep to EPA standards.
- Researched fan design, construction, and placement.
- Picked a fan control system so a maximum amount of energy can be saved.
- Collaborated with the Architectural Team on the size and volume of the parking garage.

The completed tasks done so far for the **Plumbing Team** is as follows:

- Study last semester initial calculations.
- Collaborated with the Civil Group on the grey water loads for the building.
- Started water optimization plan for building.

The completed tasks done so far for the **Building Energy Model Team** is as follows:

- Examine last semester's program.
- Research.

3. Revised schedule of events or tasks

Week	Approximate Timeline	Tasks and Deliverables
Oct 23 – Week 10	**Architectural** • 1 week • 1 week **Electrical** • 2 weeks • 2 weeks **Mechanical** • 2 weeks • 1 weeks	**Architectural** • Finish building egress and floor to floor heights (Artur & Arkadiusz) • Design Parking Garage and Egress Design (Natalie & Sarah) **Electrical** • lighting Calcs (Nathan, Sushma, Scott) • Screen Selection (Keith) **Mechanical** • Duct Work (Tim) • Selecting Pipes (Tom)
Oct 30– Week 11	**Architectural** • 1-2 Weeks	**Architectural** • Second – Forth Floor Interior and Concourse Design (Artur & Arkadiusz)

	• 2 Weeks • 2-3 Weeks **Electrical** • 2 week **Mechanical** • 2 weeks	• Landscape design (Natalie & Sarah) • Begin Modeling (Drew) **Electrical** • Select medium and path for video transmission (Keith) **Mechanical** • Grey Water Optimization (Tom)
Nov 6 – Week 12	**Architectural** • 1 week • 1 week **Electrical** • 1 week • 1 week **Mechanical** • 1-2 Weeks	**Architectural** • Finalize Design Work to Complete Drawings (Artur & Arkadiusz) • Elevations (Natalie & Sarah) **Electrical** • AV load calculations. (Nathan, Sushma, Scott) • Determine placement for video room(s) (Keith) **Mechanical** • Selection of pumps (Tim)
Nov 13 – Week 13	**Architectural** • 2 Weeks • 2 Weeks • 2 Weeks **Electrical** • 1 week • 1 week **Mechanical** • 1-2 weeks • 1-2 weeks	**Architectural** • Finish Plans and Material Selection(Artur & Arkadiusz) • Complete Site and Specification (Natalie & Sarah) • Animation Development (Drew) **Electrical** • Work Presentation (Nathan, Sushma, Scott, Keith) • select driving equipment (Keith) **Mechanical** • Sound and vibration control (Tim) • Security Concerns(Tim) • Work on Presentation (Tim & Tom)
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 • **Presentation Due** 11/29 • **Final Report Due** 11/30 • **CD Due** 12/01

		All • Summit All Reports • Upload all files to I-Groups **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

4. Updated individual assignments and team organization

Architectural Group

For the rest of the semester the architecture group will set aside the old project plans and work on coordinating its work with the rest of the IPRO team to finish the design. Making sure that quintessential decisions get made in time in order for other processes to move forward is its foremost concern. Adapting the design to work with the systems being completed by other groups as well as providing aid to groups who need graphic expertise will be the teams main role moving into the presentation stage of the semester.

Interior and Concourse Design(Artur & Arkadiusz)**-**

Focus on the design the interior space on the building furthering the design of the interior space. Selecting materials and meeting all code requirements will be a focus as the design work is finished. The team will finish floor plans and sections for the clearest understanding of the building.

Landscape and Exterior Design (Natalie & Sarah)-

Focus on the development of the exterior envelope and a landscaping plan. A redesign of the parking garage surface as well as egress will be inputted into the comprehensive landscape design. Completing drawings of the elevations of the building and creating comprehensive drawings of landscaping will be the main focus for the remainder of the semester. There will also be a continued communication between the mechanical and civil teams will be integral for the completion of the project.

3-D Visualizations and Walkthrough (Drew)-

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.

Electrical Group

For the remainder of the semester the Electrical Group will be focusing on completing calculations and hardware selection based on code requirements. Working closely with the architectural group will be an important part of accomplishing the remaining tasks this semester.

Lighting Design Team (Nathan, Sushma, Scott)-

After completing a Lighting design format based on zonal cavity method the lighting design team will calculate the total number of required fixtures and ultimately calculate the load for the stadium design. Working with the architecture team for assistance with auto-CAD as well as approval of lighting fixtures will ultimately result in success.

A/V Team (Keith)-

This team will start by selecting a main screen for the stadium and associated mounting hardware. Calculation of the required loads will then be calculated and equipment will be sized and placed working with the architectural team.

Mechanical Group

Working to meet the code requirements in conjunction with other design teams will be the most important aspect of completing all design goals.

HVAV systems for underground parking (Tim)-

This team will focus on the calculating of the basic loads in the system so that the Electrical team can finish their requirements. Also the calculating of the fan size and speed of rotation required for the air exchange per hour and finishing the air exchange calculations for the other parking garages will allow for the equipment with the highest efficiency to be chosen. Additionally the designing of the basic ducting system in the garage will complete the requirements laid down in the code.

Building Energy Modeling (Zander, Harshill)-

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 (Tom)-

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. Working

closely with the Civil team for a comprehensive calculation of storm water system will create opportunity for highest success in completion.

5. Barriers and Obstacles

Architectural Group

The architectural Group is under constant stress due to the rest of the IPRO's dependence on the decisions being made. A constant communication has been required also tailor making the schedule to fit the other groups needs into their own process.

Interior and Concourse Design(Artur & Arkadiusz)**-**

Understanding and modifying last semester plans has been the greatest challenge. This group has undergone issues dealing with the column grid that need to be established for the Civil group to complete its primary design. Also dealing with the code requirements has been an extensive challenge. Design of the egress is a complex thing and this group has had to unite the work with the landscape group in order to create a functioning building.

This group has done all of this through diligence and hard work. They have communicated well with the Architect of Record and facilitated the progress of the IPRO thus far this semester. They also have been very adaptive to the responses and work of other. Meeting deadlines when ever a different group requires a change in there current tasks.

Landscape and Exterior Design (Natalie & Sarah)-

This group has done extensive research and design work on the landscape and parking aspects of the project. Striving for energy efficient green design in the landscape and on the building has lead to many hours of research. A complete redesign of last semesters parking structure has been the greatest problem facing this group since the work of HVAC Mechanical Group depends solely on its design. Also personal commitments relating to other classes has separated this group and pushed them to work through a digital interface to accomplish there tasks on time.

The Group has worked diligently and done an extensive amount of research on the landscape to further its design. The group still has a lot of work firming up the final designs but is striving for the superior project the whole IPRO team is confident that we can achieve.

3-D Visualizations and Walkthrough (Drew)-

This group has been barred from being able to begin work due to the dependence on both of the other architecture teams to complete their design work and since that progress has been slowed all of the rendering and animation work will be completed in the later part of the semester.

Drew- **Architect of Record**

He has faced the coordination of all aspects of the IPRO facilitating and meeting with each individual group to help them understand their design roles. Additionally has been plagued with late communicated responses and pushing those in different groups to complete their tasks in a timeline that allows the teams to move forward with design work. Persistence and patience have been imperative aspects to insuring that the IPRO moves forward with little to no resistance.

Electrical Group

The Electrical Group has dealt with learning the process of designing as this is first time these particular designs have been done by its members. Similar to the Mechanical and Civil Groups have had delays based on the coordinating information Architectural group.

Lighting Design Team (Nathan, Sushma, Scott)-

Learning the zonal cavity method of calculating lights was the first barrier undergone by the lighting design team. The additional problems hinging around using the program auto CAD to calculate all areas given within the building have been only one area that the lighting design team is waiting for the architecture groups to finish up the floor plan layouts so finished electrical loads can be calculated.

Patience and persistent communication have lead to the greatest results in the advancement of the lighting design. The group has also undergone a large amount of research to learn the ins and outs of comprehensive lighting design.

A/V Team (Keith)-

Dissecting and understanding last semesters report about what was required for the Audio and Visual components of the stadium. The audio system design will likely be pushed off to the next semester since the architecture needs to be better defined for acoustics modeling. Coordination with the architecture team on understanding the plans furthermore a selection and design specifications are an important communication issue that has had to be overcome.

Researching the systems required and understanding the complexity of design will be building blocks necessary to completing this design and integrating it fully into the building.

Mechanical Group

HVAV systems for underground parking (Tim)-

The greatest barrier to the advancement of the HVAC systems has been long wait for the design of the garage structure itself to surface. Without this no progress past the point of research was possible.

Persistence and patience has been a critical trait when communicating and waiting for the design to be finished.

High efficiency plumbing design(Tom)-

Understanding the previous design and learning the calculations has been the greatest barriers to completion undergone by this team. A large amount of communication with the Civil team on the realization on a grey water system has been hindered waiting for them to complete their part of the process.

Tenacity when jumping into this project has yielded the greatest results in advancing the progress of this design team.

Building Energy Modeling (Zander, Harshill)-

Everything has gone as expected up until now.

Midterm Progress Report - Civil

1. Revised Objectives

The main focus of the civil design team was to produce a drainage system and to design a structure in accordance with prescribed seismic considerations. The drainage system is following the original schedule; this year's team was able to pick up where the previous team last worked. The structural team has had to include a column layout into the initial design steps. The addition of a column layout has set back the structural team two weeks.

Structural team objectives:

- Complete columns layout
- Research the appropriate live and dead loads
- Complete a seismic design
- Incorporate the use of dampeners
- Incorporate alternate bearing supports

Drainage team objectives:

- Research rainfall intensity for various period showers in the city of Chicago.
- Calculate the volume of rainfall per given surface area for the corresponding rainfall intensity.
- Design pipe diameters for given rainfall intensity.
- Produce a catch basin layout for entire site.
- Produce a retention area design for the given volume of rainfall.

2. Summary of results to date

Describe the results to date including progress made in achieving goals, tasks accomplished, analyses completed, data gathered and any other measurable results that the team has produced.

Structural

1. Read last year's final report, reviewed basic calculations.
2. Researched seismic requirements for steel and concrete structural. Found two good sources through school library.
3. Visited Iknow website and downloaded corresponding Autocad files. Revised the dome structure to conform to the shape of the supporting truss frames. The previous team made a error in with the exact height of the roof.
4. A column layout was created to support the truss members, seating area and walkways.
5. The emergency exits were enlarged, to comply with post September 11th requirements.

Drainage

1. Research for a 100 year storm in the City of Chicago, was conducted, appropriate information was derived.
2. Surface volume rainfall calculations were completed for the given project site.
3. An approximate volume of the retention basin was produced and given to the landscape architects.

4. Updated individual assignments and team organization

Structural

For the remaining portion of the semester, the structural team plans to focus their efforts on creating connection details, and a seismic friendly structure.

- Jorge has completed and posted the following items during the first half of the semester: columns layout for levels 0, 1 and 2, modified dome structure, acquired dome volume and area for drainage calculations, structural portion of midterm report

- Julio has completed and posted the following items during the first half of the semester: columns layout for levels 3 and 4, modified dome structure, acquired dome volume and area for drainage calculations, structural portion of midterm report

Drainage

In the second portion of the semester the drainage team will work closely with the plumbing team and coordinate the design of the drainage system with the sustainable indoor plumbing system.

- Jerry has completed and posted the following items during the first half of the semester: has sought the advice of professionals within the city of Chicago concerning rainfall information, public works policy. Posted the building code referring to drainage systems and co-wrote the civil design portion of the midterm report.

- Chi has completed and posted the following items during the first half of the semester: Has had meetings with various IIT professors concerning drainage design and rainfall intensity calculations. He produced runoff calculations for the stadium and the parking garage.

5. Barriers and Obstacles

Structural

The following are specific challenges that the structural portion of the civil design team has faced thus far.

- Reading and understanding the given AutoCad files. There was a slight learning curve in understanding what each file contained and what had been accomplished to date.
- Finding adequate information concerning the given structure and the seismic conditions. The school library was used but produced little information. The internet was also used but only a few articles that covered the needed material were located. The best source of information was the school library book share program. Two books were located and are being used.
- Locating the proper values for the loads that will be placed on the structure.

Drainage

Each team member suffered their own obstacles within this team.

- Coordination with other groups has been the only substantial problem. The required amount of water that will be used or diverted form the system was late in being given.