

I PRO 315
Design of a Large-Scale Bridge Structure

Midterm Report

Advisor: Jeffrey Budiman

1.0. Revised Objectives

The objectives of this IPRO are to design and build a steel bridge to the specifications given by AISC and, using teamwork, to win this year's ASCE/AISC Regional Steel Bridge Competition.

The current objectives of IPRO 315 are to finish manufacturing the bridge in order to begin testing and practicing assembly for the competition on April 27.

This differs from the original objectives stated above because the design is complete, and construction has begun.

2.0. Results to Date

The design team developed a design, and the design was tested in SAP, looking for a Safety Rating of 3.

The fundraising team sent out over sixty letters in search of funding. For construction purposes, the bridge has been broken down into three truss designs which need to be assembled and replicated before being joined to complete the bridge. The team decided to use outside welders to assemble the pieces in order to complete each individual truss.

Because of this, in an effort to maintain uniformity between these trusses, each of the three trusses needs its own set of templates. These templates have been designed and were assembled while the cutting team cut the individual pieces for the trusses. The templates and the cut pieces for each truss are then taken to the welder for assembly. At this point, all templates have been produced, and all cutting is complete.

Construction team will practice to build the bridge for two or more weeks before the competition on April 27th. The goal is to construct the bridge in 5 minutes or less.

T-Shirt almost done, want it to go the press on 4/10/07.

The Poster sub-team has the goal to finalize the posters by mid-April.

The presentation team needs to finalize the presentation by April 22nd, 2007 so as to be able to practice and be ready by IPRO day April 29th, 2007.

For this Inter-professional project, our objective is to design and build a steel bridge that can compete in the ASCE/AISC Regional Steel Bridge Competition. The

overall performance of the bridge is based on two categories, and as expected, the goal is to obtain the highest score through a combination of the two scores. Construction Economy is based essentially on the amount of “person-minutes” needed to correctly assemble the bridge. Succeeding in this area requires a bridge designed with simplicity in mind. A huge bridge with complicated trusses could be incredibly strong; if it takes an outrageous time period to build, then failure could result on that basis alone. The next category, Structural Efficiency, is based on a rather simple calculation—weight times 5000\$/lb added to the deflection times 500,000\$/inch. The project team aspires to design and construct a bridge that is light, stiff, and simple. If those criteria are met, then we will have a steel bridge that can easily vie for first place in the regional competition.

Personal Accomplishments

Gbadebo Atewologun:

- Worked with the design team on the structural elements of the bridge.
- Developed a rudimentary design for truss number two on which Danny Hernandez based the main geometry for his design of truss two.
- Helped with cutting the various steel sections.
- Used the grinder to smooth the edges of pieces that had imperfections after they were cut.
- Wrote the Expected Results portion of the Project Plan.
- Before the end of the semester
 - Will help the fabrication team finish cutting the steel.

Christina Barrett:

- In charge of putting together the project plan.
- Obtained login and password for the website.
- Started designing the website with John.
- Has uploaded a basic website with deliverables on it.
- In charge of putting together the midterm report.
- Before the end of the semester
 - Plans to work with John and finish the Website.
 - Will participate in the bridge building practices.
 - Hopes to be on the construction team for the competition.
 - Plans to go to the competition.

John Brilla

- Involved in updating the list of necessary pieces for the construction of the bridge, although we simply updated the original order sheet.
- Has been working on an animation of the building process for the bridge, so that both the general audience and the build team understand how the bridge must

ultimately be constructed. Has created the initial scenes for the animation, and has begun to render them.

- Looked through the questions posted to the competition officials, and ran across a rule which our construction process is in violation. Thus, having alerted the design leader, the project is subsequently being addressed.

- Has been going through some of the initial brain-storming steps toward the visual design of the IPRO website.

- Before the end of the semester

 - In the process of editing and rendering each of the scenes in the animation. After the completion of this, the team can use it as their build template. Thus, it must be complete before mid-April.

 - The visual design of the website must be completed, and paired with the code, in order to truly represent the project.

 - For the Poster, the images that have been composed for the animation must be arranged and compounded with other information on the project in order to clearly represent it at the competition, as well as at IPRO day.

 - Will prepare the IPRO Day presentation to clearly represent both the construction process and the website to the general IPRO day public.

David Fahs

- Attended all IPRO testings and meetings

- Contributed to the design of the bridge's overall geometry.

- Contributed to the designing of individual bridge members

- Contributed to the fabrication of bridge members.

- Before the end of the semester

 - Plans on helping to finish bridge fabrication and to assist in the construction phase also.

Patrick Fong

- Worked on template fabrication for steel bridge.

- Before the end of the semester

 - Will work on the posters for the competition and IPRO Day.

Danny Hernandez

- Has been around throughout.

- Worked with the design team to help finish up the design as soon as possible, worked most extensively with truss 3.

- Has helped with the cutting, grinding, and sanding over the past couple weeks.

- Before the end of the semester

 - Will continue to help cut steel.

 - Will help practice and hopefully make the construction team for the competition.

Ei Sheng Hong

- Took part in designing Truss 1 and Truss 3 together with other members in the design sub-team.

- Helped find out which kind of truss would deflect the least and be the lightest.
- Helped check for buckling in compression members and yielding in tension members.
- Helped measure the dimensions of templates and cut them in the model shop in crown hall.
- Helped cut steel for truss members.
- Did the finishing of each truss member and plate
- Before the end of the semester
 - Will continue to work on the templates if there are any left to be finished.
 - Will regularly come to help the fabrication sub-team finish cutting the steel members.

Thomas Huang:

- Showed up to all the template meetings
- Made at least 60-70% of the templates.
- Before the end of the semester
 - Will help with posters.
 - May attend the competition.

Mohamad Khudeira

- Helped the design team by participating in scheduled meetings.
- Helped with the fundraising efforts by sending out letters to sponsors.
- Worked hard on constructing the trusses and needed pieces for constructing the bridge.
- Has been thinking of ways to make the bridge lighter than projected.

Yong-Wan Kim

- Worked on the design sub-team and fabrication sub-team.
- Attended almost every design team meeting, and discussed about the design of truss and connections.
- Performed load test with 'bridge option 2' by SAP and concluded that it was worse than other two options.
- Checked the maximum deflection of truss 1, 2, and 3 with design team members
- Put labels on the drawing of truss 1.
- Worked on making templates of truss 2 and 1.
- Helped cut wood and carry it.
- Currently working on cutting steel as a member of the fabrication sub-team.
- Has helped cut and grind some of the steel beams.
- Labeled truss members in order to identify the position of them.
- Before the end of the semester
 - Will keep working on cutting steel pieces.
 - Plans to work on the construction team for the competition.
 - Will participate in the practice of building the bridge.

Linda Lee

- Helped make the templates in and outside of class.

Man Leung

- Personally did the design and analysis of truss 3
- Helped grind the steel pieces once the steel was cut.
- Before the end of the semester
 - Plans to go to the competition and construct the bridge and support the construction team members.

Heather Mahoney

- Worked on fundraising.
- Coordinated steel material order and delivery.
- Helped coordinate fabrication, brought material and templates to the fabricator, contacted them with our progress, and met with them at the school to go over our plans.
- Before the end of the semester
 - Will continue coordinating with fabricator.
 - Will help with fundraising thank you notes.
 - Plans to attend the competition.

Jinit Patel

- Involved in the design of the bridge
- Designed the T-Shirt for the competition
- Is in charge of cutting steel and getting the pieces ready for the fabricators.
- He did most of the cutting in the lab.
- Before the end of the semester
 - Will be looking, with Luke, for the fastest people for the construction team for the competition.
 - Will help finish cutting the steel.
 - Will help put all the pieces together for the fabricators.
 - Will help get all the pieces back from the fabricators and pre-assemble the bridge to make sure it fits well.

Robert Pershey:

- Sent out letters and made phone calls in search of funding.
- Double-checked the bridge against the specifications set out in the rules with Jorge, Naomi, and Christina.
- Reviewed rules for timed construction with Jorge and Christina.
- Edited Project Plan
- Edited Midterm Report
- Took delivery of the steel with Lee and Heather
- Before the end of the semester
 - Plans to be on the construction team for the competition.

Sotiel Sam Polena:

- Involved in the design process of the bridge.

- Worked on sap analysis for trusses 2 and 3, along with other members of the design sub-team.
- Involved in the fabrication of the bridge, cutting of several members of the bridge as well as grinding and finishing of the members.
- Helped write the Research Methodology section of the project plan.
- Currently working on the Poster that will be displayed at the Bridge Competition
- Continuing work on the cutting of the bridge pieces.
- Before the end of the semester
 - Will be working on the poster. This includes designing the poster, including information about the analysis of the bridge, the design, and fabrication process.
 - Plans to be involved in placing the bridge together.
 - Will be presenting on IPRO Day, will start preparing the presentation, as well as coordinating with other members of the sub-team to finalize the order of people for the IPRO day presentations.

Fuzel Shethwala

- Helped cut the templates out for welding the steel together.
- Was part of the CAD team.
- Before the end of the semester
 - Will help design and make the posters for IPRO Day
 - Will help with the IPRO Day presentation.

Lucas Shorette:

- Helped with the templates that the welders will be using.
- Assisted in the fabrication of parts for the welders to weld together.
- Helped with the design of the t-shirts.
- Before the end of the semester
 - Will assist in finishing the cutting for the bridge.
 - Plans to be on the Bridge Construction Sub-Team.
 - Will be driving the bridge down to Purdue for the competition.

Milena Stopic:

- Participated in producing, laying out and printing the preliminary CAD drawings, shop drawings, as well as drawings for the planning and manufacture of welding templates for the steel parts.
- Participated in producing (cutting and assembly) of the templates.
- Before the end of the semester
 - Will help plan out and produce the presentation poster for the competition and for IPRO day.
 - Plans to participate in producing the PowerPoint presentation for IPRO day.

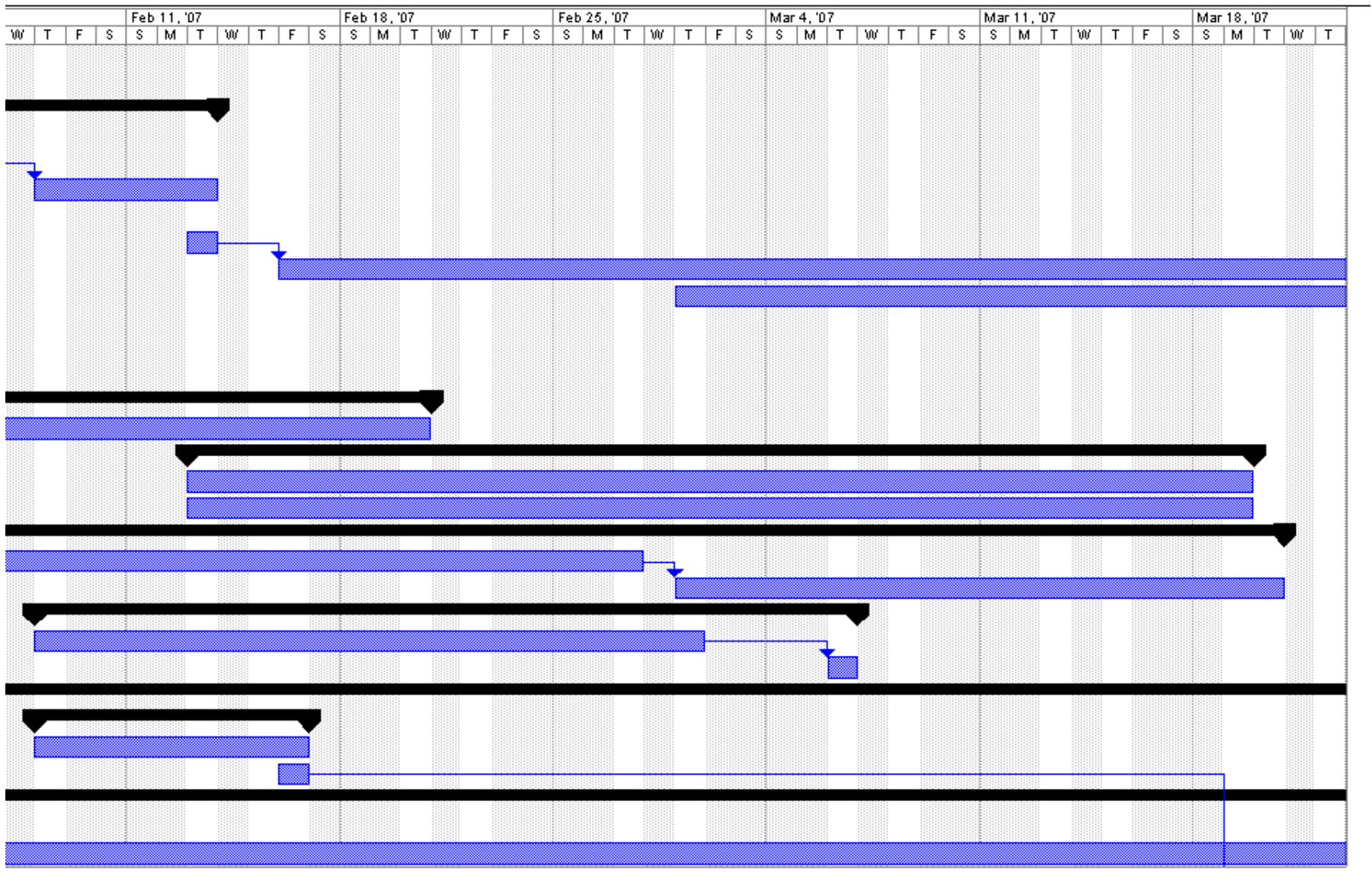
Melissa Swiderski:

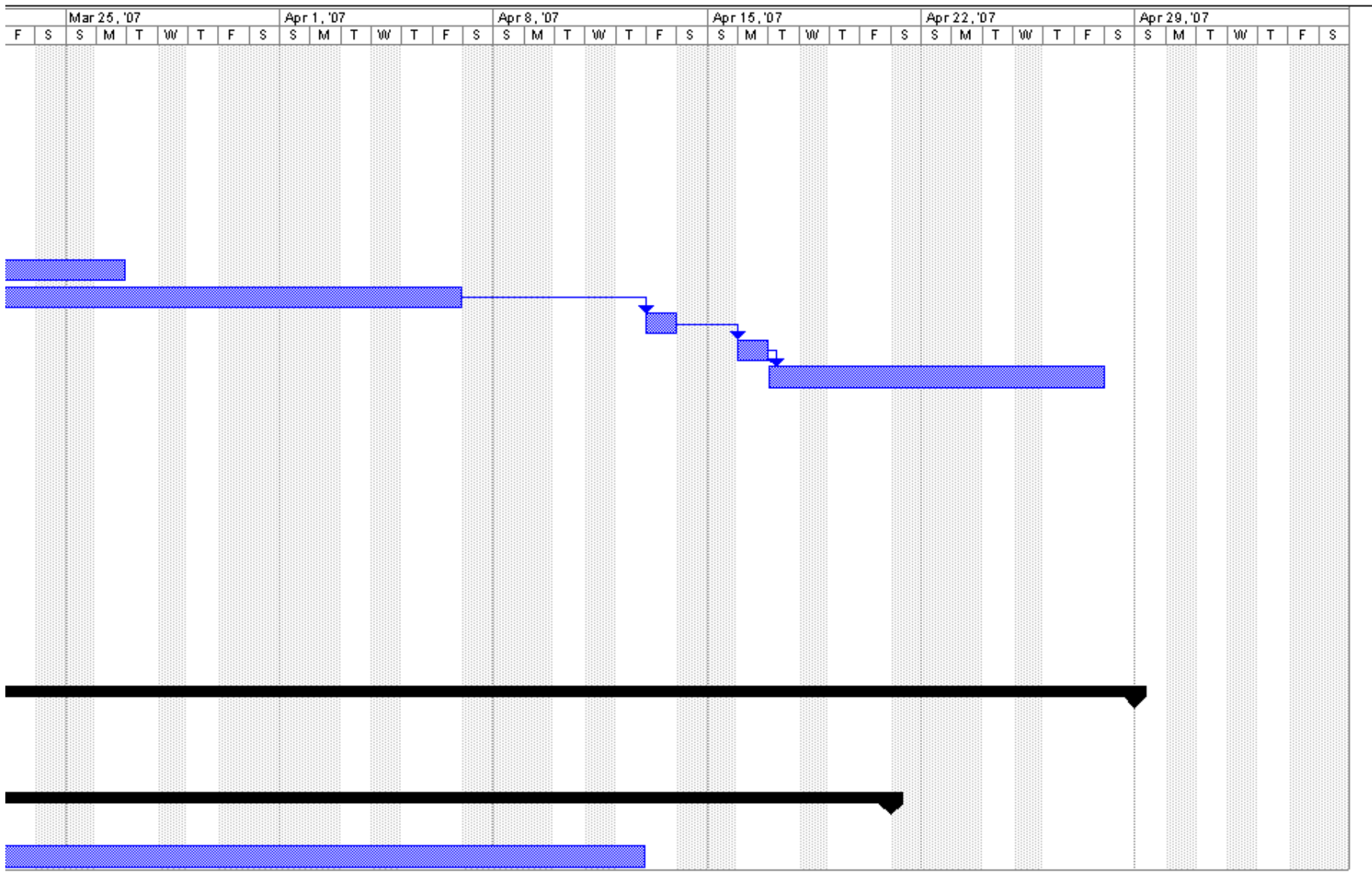
- Helped with fundraising by calling companies to find out the appropriate person to contact regarding donations.

- Was involved in sending fundraising letters out and making follow-up phone calls.
- Helped in the assembly of one of the templates and the tweaking of another.
- Helped grind and finish the cut steel pieces.
- Helped to slot some of the sections for the plates.
- Helped to fit the pieces into the templates and label them so they could be sent to the fabricator.
- Before the end of the semester
 - Plans to help sand finish the sections once they come back from the fabricator.
 - Will help with the testing of the bridge prior to the competition.

Lee Welsh

- For the design team, he worked on the load analysis and design of member sizes.
- Started the project working on the design.
- Is the primary contact with the MMAE department who were machining parts for the bridge.
- Created plans and initiated work on the templates.
- Supervised and took part in the cutting and fabrication.
- Is one of the two primary contacts with the welders.
- Organizes meetings and work times and tracks the work progress.
- Before the end of the semester
 - By Monday, March 26, the goal is to have all pieces cut, drilled and fitted to templates, and to have the pieces sent to the welders.
 - The pieces are tentatively scheduled to return on Friday April 6.
 - The following week he plans on overseeing the testing and creating a checklist of changes or repairs that need to be made.
 - Plans on attending the competition, but probably will not be on the construction team.





				Feb 11, '07				Feb 18, '07				Feb 25, '07				Mar 4, '07				Mar 11, '07				Mar 18, '07																			
W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T							



4.0. Updated Task Assignments and Designation of Roles

- A. There is an overall team leader for IPRO 315, Lee Welsh, who makes regular progress reports to the team weekly. Each of the sub-teams has a team leader in charge of ensuring the completion of the sub-team's goals. No new sub-teams have been created since the start the Project Plan. When new tasks arise someone is put in charge of it, the tasks haven't required a new sub-team yet.
- B. Sub-Teams
 - a. Design:
This sub-team is responsible for completing the bridge design that will be built, as well as running virtual structural tests.
 - b. Fundraising:
This sub-team will create a list of possible sponsors and send personalized donation requests to each.
 - c. Posters/CAD:
This sub-team will create and print the IPRO Day and ASCE Competition posters. This team will also help make the AutoCAD drawings.
 - d. Presentation:
This sub-team will be in charge of the IPRO Day presentation.
 - e. T-Shirts:
This sub-team will design and get competition t-shirts made.
 - f. Website
This sub-team will create and maintain the IPRO 315's website.
 - g. Template Fabrication
This sub-team will be building the templates for us to use for cutting the sections as well as the templates to send to the fabricators to weld the pieces. Passing the safety test at Crown Hall is a requirement.
 - h. Bridge Fabrication
This sub-team will be used to track and manage the fabrication of the bridge. It will include visits to the fabricator as well as any design changes.
 - i. Bridge Construction
This sub-team will be the competition team. Being a member of ASCE is a requirement as well as the trip to Purdue for the assembly at the regional competition.
- C. Current team member roles within the team and sub-teams
 - a. Design
 - i. Sub-team leader: Lee Welsh
 - ii. Members: Gbadebo Atewologun
David Fahs
Bernard Froehlich
Emiliano Giana
Naomi Heler
Daniel Hernandez
Ei Hong
Mohamad Khudeira
Yong-Wan Kim

- Man Leung
 - Jinit Patel
 - Sotiel Polena
 - Lucas Shorette
 - Chintan Thakkar
- b. Fundraising
 - i. Sub-team leader: Naomi Heler
 - ii. Members: Mohamad Khudeira
Heather Mahoney
Robert Pershey
Melissa Swinderski
- c. Posters/CAD
 - i. Sub-team leader: Milena Stopic
 - ii. Members: John Brilla
Patrick Fong
Thomas Huang
Linda Lee
Sotiel Polena
Fuzel Shethwala
- d. Presentation
 - i. Sub-team leader: unassigned
 - ii. Members: John Brilla
Sotiel Polena
Fuzel Shethwala
- e. T-Shirts
 - i. Sub-team leader: Lucas Shorette
 - ii. Members: Jinit Patel
- f. Website
 - i. Sub-team leader: Christina Barrett
 - ii. Members: John Brilla
- g. Template Fabrication
 - i. Sub-team leader: Thomas Huang
 - ii. Members: Patrick Fong
Ei Hong
Linda Lee
Fuzel Shethwala
Milena Stopic
Melissa Swinderski
Lee Welsh
- h. Bridge Fabrication
 - i. Sub-team leader: Heather Mahoney
 - ii. Members: Gbadebo Atewologun
David Fahs
Bernard Froehlich
Emiliano Giana

Daniel Hernandez
Ei Hong
Yong-Wan Kim
Jinit Patel
Sotiel Polena
Lucas Shorette
Melissa Swinderski
Lee Welsh

i. Bridge Construction

- i. Sub-team leader: unassigned
- ii. Members:
Christina Barrett
Bernard Froehlich
Emiliano Giana
Daniel Hernandez
Mohamad Khudeira
Man Leung
Jinit Patel
Robert Pershey
Lucas Shorette
Yong-Wan Kim

j. Other Roles

- i. ASCE competition Representative: Naomi Heler
- ii. Representative to the IPRO office: Christina Barrett
- iii. Minute Taker of Design Sub-Team: Lucas Shorette
- iv. Catalogs the steel pieces: John Brilla
- v. Creator of the bridge animation: John Brilla

5.0. Barriers and Obstacles

A. Problem 1: The coordination between majors has been challenging at times due to the technical aspects of the project, since some did not feel comfortable taking an idea and running with it by themselves. During the initial design stage of the project, which lasted a couple weeks, most of the work was for Civil Engineering students. During this time many other students lost interest because they did not have the technical skills required to make informed contributions to the project.

Problem 2: Very few of the students have experience working with tools and metal parts. Compounding this problem is the fact that we have limited tools for fabrication. Without outside help our design would be hard, if not nearly impossible, to accomplish.

Problem 3: The fabricator that we contracted to do our welding is doing it as a donation because during the winter they have a slow season. However, as the weather has warmed up, they have become busier and will have a harder time completing the bridge to our schedule.

- B. Problem 1: We simply worked through the tasks by being patient with each other and helping out with explanations whenever needed. Also, after the design was complete, an effort was made to assemble sub-teams according to team members' strengths and interests. These sub-teams would work together in an effort to finish the bridge construction as early as possible.

Problem 2: IPRO 315 sought out expertise from many different places. From IIT, the MMAE Department machined parts, the Architecture Department helped with wood templates, and Stan Johnson from the CAE Department has been offering time and help with templates, materials, and fabrication. In addition, Angus Construction has donated their time and materials for the welding that the fabrication of the bridge requires. Their help, training, and tools have made the fabrication process significantly easier and has allowed us to keep on schedule.

Problem 3: To work with the fabricator with the welding of the bridge, we have sent the bridge out as sections are completed, rather than all at once, so that they could start welding early. Also, we have extended the welding completion milestone on our schedule so that they will have sufficient time to finish all of the parts without rushing.

- C. Problem 1: In spite of computer simulations, the final bridge may need adjustments before it meets our expected specifications. After we get the bridge back from the fabricator, it will not be possible to take it back to make changes.

Problem 2: Another barrier is getting everyone to contribute to this final push for bridge fabrication. It needs to be done within a week, and it is a man-hour intensive process.

- D. Problem 1: We have ordered extra material and we will soon get the supplies for our welder so that we can make any modifications, improvements, or repairs that we see fit. Also, Stan Johnson from the CAE department will be our expert when we need to know how to do the welding ourselves.

Problem 2: Many people are coming in extra to put forth the extra hours needed to get the steel bridge pieces cut and to the fabricator on time.