IPRO 315
Design of a Large-Scale Bridge Structure

Project Plan

Advisor: Jeffrey Budiman

1.0. 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.

2.0. Background

A. The ASCE Steel Bridge Competition is co-sponsored by ASCE (American Society of Civil Engineers) and AISC (American Institute of Steel Construction). ASCE is an organization that is over 150 years old with a history in engineering and problem solving. The rules for the steel bridge competition are written by AISC and updated yearly.

B. The students are to design, fabricate and construct a scaled down steel bridge. The rules are based on real life build scenarios. Examples of said problems include: cost of the project, management, design, analysis, fabrication techniques, methods, and construction time, efficiency and safety.

C. Various technologies are used. SAP (Structural Analysis Program) is used to analyze the integrity and strength of the structure, AutoCAD is used to draw out the design, Strength of Materials is used in the choice of steel used, and fabrication using wood and metals is used in building templates and building the bridge. The use of tools is found throughout the entire project from fabrication to actual construction.

D. IIT has participated in this competition for many years. Our greatest success is the 2004 competition where the team went to nationals and placed in several events. The group last year was seriously hampered by bad fabrication and slow construction time.

E. Some scientific issues that can be investigated are different design methods and use of analysis to find the best overall design. Cultural problems arise in communication between the group members who come from different cultures. Ethical problems may arise in scoring of the competition.

F. All costs are absorbed by organization involved in solving the problem. There are no costs on society. Any costs arising to businesses are by their own choice through sponsorship.

G. The solution will be implemented by splitting off tasks into sub groups. There is a group for designing the bridge, another to fundraise for expenses, a group to help fabricate the bridge, the construction team for building the bridge at competition, a group to make posters and any presentation material, and any other tasks for individuals.

H. There is no research involved other than historical information that will be used from past years experiences.

I. Attached are the bridge layout rules set by AISC and the introduction and summary of the competition provided by AISC.

3.0. Methodology/Brainstorm/Work Breakdown Structure

To make the project more successful the team needs to first make sure the rules of the competition and specifications of design are understood. The team will then assign tasks to sub-teams to make everyone work more efficiently toward finalization of the project. A conceptual design will be produced by the design team using software such as AutoCAD and SAP2000. The design team will draw on past experiences and the knowledge of team members for the design, as well as the support of academic advisors. Concurrently, funding will be raised for materials and fabrication and a website will be

designed for the project by the other sub-teams. After selection of the design and a fabricator, the design process will begin. Wooden templates will be made to hold the steel sections in place for welding. Templates will also be made for connections and other parts of the bridge as needed. After fabrication, assembly of the bridge will be practiced and load testing will be done with the bridge. Final modifications of the bridge will be made as needed to facilitate assembly and satisfy loading requirements.

4.0. Expected Results

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.

5.0. Estimated Project Budget

Registration:		
School		$125
Individuals	$30/pp x 27pple =	$810
Hotel:		
	7 Rooms @ $80/night * 3 nights + tax is approx. =	$2,500
Travel:		
Gas Reimbursement for driving National pay =$.485/mi @ 240mi x 10 cars		$1,250
Fabrication:	Total Estimated:	$4,000
Welding		
Bolts		
Tools		
Wooden forms		
Hard Hats		
Presentation:	Total Estimated:	$50
Posters		
Printing		
Bridge Aesthetics:	Total Estimated:	$200
Paint		
Decals		
	Grand Total:	**$8,935**

6.0. Schedule of Tasks and Milestone Events

1-20-07	IPRO Olympics
1-30-07	Conceptual Design
2-3/4-07	Project Management Workshop, 10-2pm SH 237
2-06-07	Preliminary to final Design
2-13-07	Detailed design and Drawing, Selection of size and shape of bridge members. Order the steel materials.
2-16-07	Project Plan due to the IPRO office
2-20-07	AutoCAD Drawings for fabricators, Construct template
2-27-07	Work with Fabricator
3-06-07	T-shirts Design and order, Develop Website
3-20-07	Working with Fabricator
3-23-07	Midterm Report due to the IPRO office
2-27-07	Receive bridge from fabricator.
	Bridge refinement and adjustments.
4-3/16-07	Bridge Assembling Practice, Load testing. Develop posters
4-06-07	Team Minutes due to the IPRO office
4-14-07	Bridge painting
4-16-07	IPRO Hints and Tricks meeting
4-20-07	IPRO website link, poster and abstract are due to IPRO office
4-25-07	IPRO presentation due to IPRO office
4-26-07	Team leaders Register at Purdue University
4-27-07	IPRO Presentation. Leave for Purdue University
4-28-07	Bridge Competition

7.0. Individual Team Member Assignments

Gbadebo Atewologun

Major:	Civil Engineering
Skills:	SAP, MathCAD, and proficient with hand and mechanized tools.
Strengths:	Problem-solving ability and aptitude with structural analysis and design. Meticulous and organized work ethic.
Experiences:	Steel analysis and design courses. Has been apart of a design sub-team in an internship, the project was a success and was presented to the project sponsors.
Sub-Teams:	Design

Christina Barrett

Major:	Computer Science
Skills:	Microsoft Office and anything Adobe
Strengths:	Working with computers and following rules.
Experience:	Has created an IPRO website during Fall 06 semester. Helped build a trebuchet, two catapults, and a loft.
Sub-Teams:	Leader of Website Representative to the IPRO office Bridge Construction

John Brilla

Major:	Architecture
Skills:	AutoCAD, CAModeling/Manufacturing, Photoshop/Illustrator, Web Design, some coding, and public speaking
Experiences:	Presentations, Construction Documents, Model Building, and Personal Websites.
Sub-Teams:	Website Presentation Posters/CAD Template Fabrication

David Fahs

Major:	Civil Engineering
Sub-Teams:	Design

Patrick Fong

Major:	Architecture
Skills:	AutoCAD, Adobe Photoshop, and Adobe Illustrator
Strengths:	How to get drawings to print for AutoCAD, Adobe Photoshop, and Adobe Illustrator.
Sub-Teams:	Template Fabrication Posters/CAD

Bernard Froehlich

Major:	Civil Engineering
Skills:	Has worked in construction.
Strengths:	Tall
Experiences:	AFROTC
Sub-Teams:	Design
	Bridge Fabrication
	Bridge Construction

Emiliano Giana

Major:	Civil Engineering
Skills:	Has worked in construction.
Strengths:	Tall
Experiences:	AFROTC
Sub-Teams:	Design
	Bridge Fabrication
	Bridge Construction

Naomi Heler

Major:	Civil Engineering
Skills:	Design and Analysis, Management
Strengths:	Organized, Technical
Experiences:	Has done this IPRO before and was the project leader then.
	Has been to the conference before and is fairly knowledgeable in what is expected and of problems that may arise.
Sub-Teams:	Leader of Fundraising
	Design
	ASCE competition Representative

Daniel Hernandez

Major:	Civil Engineering
Skills:	Design
Strengths:	Structural engineering
Sub-Teams:	Design
	Bridge Fabrication
	Bridge Construction

Ei Hong

Major:	Civil Engineering
Skills:	Design, AutoCAD, and SAP2000
Strengths:	Structural analysis
Sub-Teams:	Design
	Template Fabrication
	Bridge Fabrication

Thomas Huang

Major:	Architecture
Skills:	AutoCAD, 3D modeling, and model making
Sub-Teams:	Posters/CAD
	Template Fabrication

Mohamad Khudeira

Major:	Civil Engineering
Skills:	Planning, construction, and management
Strengths:	Team-work and communication
Experiences:	Is working in an office doing drawing, and has worked in the field as an inspector of the jobsite.
Sub-Teams:	Fundraising
	Design

Yong-Wan Kim

Major:	Civil Engineering
Skills:	AutoCAD, MathCAD, MS Word, MS Excel, SAP2000
Strengths:	Fast, diligent, and team-work
Experiences:	Learned bridge designing from CAE 408 and structural analysis.
Sub-Teams:	Design
	Posters/CAD
	Bridge Construction
	Bridge Fabrication

Linda Lee

Major:	Architecture
Skills:	AutoCAD
Strengths:	Teamwork
Experiences:	Has learned about steel structures and has studied steel buildings
Sub-Teams:	Posters/CAD

Man Leung

Major:	Civil engineering
Strength:	theoretical, frame, and structure analysis
Experience:	Official and unofficial participation in both regional and international high school bridge building competitions at IIT from 1999- current. Student bridge judge in both regional and International competitions in 2003
Sub-Teams:	Design
	Bridge Construction

Heather Mahoney

Major:	Civil engineering
Skills:	Construction experience
Sub-Teams:	Fundraising
	Leader of Bridge Fabrication

Jinit Patel

Major:	Civil Engineering
Skills:	cutting steal
Experiences:	Working with cars and metal cutting.
Sub-Teams:	T-Shirts
	Design
	Bridge Fabrication
	Bridge Construction

Robert Pershey

Major:	Political Science
Skills:	Construction experience and editing
Strengths:	Negotiation/compromise
Experiences:	NROTC and helped build a trebuchet, a catapult, and a loft.
Sub-Teams:	Fundraising
	Bridge Construction

Sotiel Polena

Major:	Civil Engineering and Construction Management
Skills:	Project Management and Structural Design
Experiences:	Has been in construction related work for five years and is currently working in construction management.
Sub-Teams:	Design
	Presentation

Fuzel Shethwala

Major:	Architecture
Skills:	AutoCAD, 3D Max, Model Making, and working with related tools.
Sub-Teams:	Posters/CAD

Lucas Shorette

Major:	Civil Engineering
Experiences:	Has done this IPRO before.
Sub-Teams:	T-Shirts
	Presentation
	Minute Taker of Design

Milena Stopic

Major:	Architecture
Skills:	Spatial and Urban Planning, Material Modelling, 3D Modelling, Animation, Presentations, and Visualizations
Sub-Teams:	Leader of Posters/CAD

Melissa Swinderski

Major:	Civil Engineering
Skills:	AutoCAD
Experiences:	Has done this IPRO before.
Sub-Teams:	Fundraising
	Template Fabrication
	Bridge Fabrication

Chintan Thakkar

Major:	Mechanical Engineering
Skills:	Design and management
Strengths:	Team-work
Sub-Teams:	Design

Lee Welsh

Major:	Civil Engineering
Skills:	Design and construction management
Experiences:	Seven years in US Army and an internship with F. H. Paschen.
Sub-Teams:	Leader of Design
	Template Fabrication
	Bridge Fabrication
	Presentation

Sub-Teams

Design
This sub-team is responsible for completing the bridge design that will be built, as well as running virtual structural tests.

Fundraising
This sub-team will create a list of possible sponsors and send personalized donation requests to each.

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.

Presentation
This sub-team will be in charge of the IPRO Day presentation.

T-Shirts
This sub-team will design and get competition t-shirts made.

Website
This sub-team will create and maintain the IPRO 315's website.

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.

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.

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.

8.0. Designation of Roles

Sub-Team Leaders:

Leader of Design	Lee Welsh
Leader of Fundraising	Naomi Heler
Leader of Posters/CAD	Milena Stopic
Leader of Presentation	unassigned
Leader of T-Shirts	Lucas Shorette
Leader of Website	Christina Barrett
Leader of Template Fabrication	unassigned
Leader of Bridge Fabrication	Heather Mahoney
Leader of Bridge Construction	unassigned

Other Roles:

ASCE competition Representative	Naomi Heler
Representative to the IPRO office	Christina Barrett
Minute Taker of Design Sub-Team	Lucas Shorette