

IPRO 315: DESIGN OF A LARGE-SCALE BRIDGE STRUCTURE

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PURPOSE AND OBJECTIVE: IT IS THE OBJECTIVE OF THIS IPRO, WHILE FOSTERING TEAMWORK AND EXPOSURE TO REAL WORLD DESIGN, CONSTRUCTION AND MARKETING TASKS, TO PURSUE THE DESIGN AND EVENTUAL CONSTRUCTION OF A STEEL BRIDGE FOR THE PURPOSE OF AND UNDER THE SPECIFICATIONS OF THE AISC/ASCE AND ITS ANNUAL STUDENT STEEL BRIDGE COMPETITION (SSBC).

GOALS: THE GOALS OF THIS IPRO, IN AN ATTEMPT TO ACHIEVE TEAMWORK AND OUR OVERALL OBJECTIVES, HAVE BEEN BROKEN INTO MANAGEABLE TASKS UNDER THE DIRECTION OF SPECIFIC SUB-TEAMS. THE DIVISION OF THESE GOALS CAN BE SEEN ON THE REVERSE SIDE OF THIS DOCUMENT.

RESULTS & CONCLUSIONS: THE ACTUAL COMPETITION WILL BE HELD AFTER IPRO DAY, BUT THUS FAR THE GENERAL APPROACH TO THIS PROJECT HAS ALLOWED FOR THE SUCCESSFUL COMPLETION OF THE PROJECT TO DATE, WITH LITTLE TO NO VARIATION FROM THE PROJECTED INITIAL SCHEDULE.

OBSTACLES: THE PROJECT HAS REMAINED GENERALLY ON SCHEDULE, WITH LITTLE VARIANCE, DUE TO THE INITIAL REVIEW OF OBSTACLES IN PREVIOUS PROJECTS OF A SIMILAR NATURE. THERE HAVE ONLY BEEN A FEW OBSTACLES INCLUDING THE FABRICATION TIME PAIRED WITH A LACK OF SKILLED HANDS, THE QUALITY OF FABRICATION TOOLS, FABRICATION ERRORS INCLUDING THE SIZE OF WELDS, RULE VIOLATIONS OR INCORRECT INTERPRETATIONS, AND THE GENERAL ABILITIES OF EACH PROFESSION WITHIN THE PROJECT. MOST IMPORTANTLY, INITIAL TESTING OF THE BRIDGE FAILED, REVEALING A NEED FOR LATERAL BRACING.

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1. **ANALYSIS OF PREVIOUS WORK ON THE SUBJECT:** IT WAS IMPORTANT THAT, AS AN IPRO TEAM, WE REVISIT THE SUCCESSES AND FAILURES ON SIMILAR VENTURES IN THE PAST. AS THIS IPRO OPPORTUNITY REPEATS ANNUALLY, THIS ALLOWED THE GROUP THE ABILITY TO SET TIMETABLES AND DESIGN GOALS.
2. **DIVISION OF TASKS BASED ON INITIAL TIMETABLE:** THIS DIVISION HAS ALLOWED THE TEAM AS A WHOLE TO RECOGNIZE THE RESPONSIBLE PARTIES FOR EACH TASK, ENSURING THAT EACH TASK WILL STAY GENERALLY ON SCHEDULE.
3. **DESIGN:** THE DESIGN OF THE BRIDGE, INCLUDING LESSONS LEARNED FROM PREVIOUS ATTEMPTS, INCLUDED A NUMBER OF PHASES RANGING FROM THE INITIAL DESIGN CONCEPTIONS THROUGH LOAD TESTING AND CONSTRUCTION METHODS.

THE DESIGN OF THE BRIDGE MUST ADHERE TO THE FOLLOWING, AS DERIVED FROM TEAM DESIRES AS WELL AS AISC SPECIFICATIONS.
 - THE DESIGN MUST BE AS LIGHT-WEIGHT AS POSSIBLE, IN AN ATTEMPT TO NOT ONLY WIN THIS SECTION OF THE COMPETITION, BUT ALSO TO HELP COUNTERACT ANY WEIGHT PENALTIES DURING THE COMPETITION.
 - THE JOINERY MUST BE FABRICATED IN SUCH A WAY, OR THE CONSTRUCTION PROCESS MUST BE STRUCTURED SUCH THAT THE TIME OF CONSTRUCTION IS MINIMIZED BY THE REDUCTION IN FASTENING TIME. THE MORE EASILY THE BOLT IS FASTENED BETWEEN TWO ASSEMBLIES, THE FASTER THE CONSTRUCTION, THE CLOSER THE TEAM IS TO WINNING THIS SECTION OF THE COMPETITION.
4. **FUNDRAISING:** THE MATERIALS FOR THE FABRICATION OF THE BRIDGE, AND THE COMPETITION, EACH COST MONEY. ALSO, THE FABRICATION OF THE BRIDGE ITSELF IS A VERY TIME-CONSUMING PROCESS. THUS, IT HAS BEEN OF UTMOST IMPORTANCE THAT THE PROPER DONATIONS OF BOTH TIME AND MONEY ARE MADE.
5. **FABRICATION:** THE FABRICATION OF THE BRIDGE ELEMENTS, AS IT IS A TIME-CONSUMING PROCESS AND AS THE MACHINING EQUIPMENT ON HAND HAS NOT BEEN GUARANTEED TO BE ACCURATE, HAS BEEN BROKEN INTO THREE SECTIONS INCLUDING THE INITIAL OF TEMPLATES, FABRICATION OF THE ELEMENTS AND THE WELDING OF THE ASSEMBLIES. THE FIRST TWO HAVE BEEN LEFT TO THE IPRO TEAM, WHEREAS THE THIRD HAS BEEN MOSTLY OUTSOURCED ON DONATION.
6. **RULES:** THROUGHOUT THE PROCESS, IT IS NECESSARY THAT THE RULES HAVE BEEN CONTINUOUSLY CHECKED AND COMPARED WITH THE PROGRESS OF THE PROJECT. THIS HAS DEMANDED CHANGES WITHIN ELEMENTS OF THE DESIGN AND CONSTRUCTION PROCESS.
7. **CONSTRUCTION:** ONE OF THE MOST CRITICAL ELEMENTS OF THE PROJECT IS THE ACTUAL SELECTION AND TRAINING OF THE CONSTRUCTION TEAM, AND THE DESIGN OF SPECIAL TOOLS FOR CONSTRUCTION. THE TEAM MUST BE FAMILIAR WITH THE COMPETITION SETUP AND WITH THE CONSTRUCTION PROCESS OF THE BRIDGE, INCLUDING RULES ABOUT CONSTRUCTION.

ALSO, THE TEAM MUST BE EITHER ABLE TO CREATE OR SUPPLIED WITH INNOVATIVE TOOLS THAT ALLOW FOR EASE OF CONSTRUCTION. THESE TOOLS INCLUDE RETRACTABLE LEASHES FOR WRENCHES AND OTHER TOOLS, SO THAT THE TOOL CAN NEVER FALL TO THE GROUND OR CAUSE A PENALTY TO BE CHARGED. THIS INCLUDES SPECIALLY DESIGNED JOINTS, THESE BEING DESIGNED TO HOLD THE FASTENERS IN PLACE SO THAT A HUMAN CAN NEVER DROP THEM OR CAUSE A PENALTY TO BE CHARGED.
8. **MARKETING & PRESENTATION:** MARKETING AND PRESENTATION BECOMES ONE OF THE MOST IMPORTANT GOALS IN A PROJECT, AS IT RELATES TO THE STAKEHOLDERS (THE ILLINOIS INSTITUTE OF TECHNOLOGY, AISC, AND ALL DONORS). IT IS IMPORTANT THAT THIS TEAM NOT ONLY REPRESENT THE BRIDGE WITHOUT ACTUALLY PRESENTING THE PHYSICAL OBJECT, BUT ALSO TO EXPLAIN THE PROCESS BEHIND THE PROJECT, LEAVING THE STAKEHOLDERS WITH REFERENCE TO THE USEFULNESS OF THE PROJECT.