

Project Plan

IPRO 338:

Project Management Strategies and Technology Efficiency for Electrical
Contractors' Construction Projects

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Team Information

Team Member Roster

- Bum Kyung Cho, Mechanical Engineering fourth year
 - Strengths: Willingness to participate in any tasks necessary; good Excel skills; commitment to teamwork
 - Expectations: To experience and solve real world problems; to enhance teamwork skills; to learn about BIM and the electrical design process; to get a good grade
- Sarah Crites, Electrical Engineering third year
 - Strengths: Ability to incorporate well into a team; willingness to take on whatever jobs need to be done; hard-working and persistent
 - Expectations: To achieve the expectations of the IPRO sponsor; to perform well as a team and get a grade that reflects our work; to develop experience with a real-world project; to learn about electrical contracting
- Sarah Czapla, Electrical and Computer Engineering third year
 - Strengths: Extremely organized; knowledge of many computer programs; good teamwork skills; willingness to take on a leadership role
 - Expectations: To satisfy the needs of the IPRO sponsor; to have the team communicate and work well as a group; to develop research skills; to gain experience working with real-world problems; to get a good grade!
- Jose Guerrero, Aerospace and Mechanical Engineering fourth year
 - Strengths: Good presentation skills; a wide range of leadership experience; IPRO experience; good computer skills; good teamwork skills
 - Expectations: To develop time management skills by balancing this IPRO and other leadership positions; to go above the expectations of the sponsor and deliver a project that reflects the team's efforts; to have the team run smoothly; to win IPRO day; to get an A!
- Yoosuk Kim, Electrical Engineering fourth year
 - Strengths: Leadership experience; willingness to either lead or follow as the situation demands
 - Expectations: To learn about practical issues in the Electrical Engineering field; to perform well as a team; to get a good grade
- Frank Malawski, Architecture fifth year
 - Strengths: Familiar with CAD software as well as BIM; has contacts in the industry; ability to contribute to the design aspect of the IPRO

- Expectations: To come out of this IPRO knowing the effects BIM can have on the ECA and other contractors; to keep clear goals in mind and focus on what is achievable for the semester
- Michael Maloney, Industrial Technology and Management 3rd year
 - Strengths: Ability to research a problem and find a realistic solution; ability to put together and present a high-quality presentation
 - Expectations: To become more of an out-of-the-box thinker by developing the ability to work well with people from different backgrounds
- Kaleo Pedrina, Electrical Engineering third year
 - Strengths: Good teamwork skills; ability to incorporate every member of the team into the project; good leadership skills
 - Expectations: To learn to work well with a team of strangers rather than a familiar group; to gain experience from the IPRO that can be applied to future projects
- Li Qiu, Electrical Engineering third year
 - Strengths: No hesitation in exploring an unknown area
 - Expectations: To learn how to implement the team's decisions efficiently; to achieve the IPRO's overall goal
- Jennifer Yi, Business third year
 - Strengths: Ability to contribute to the team's understanding of the business aspect of the IPRO; creativity; open-mindedness
 - Expectations: To develop research and interviewing skills; to learn about the field of electrical contracting; to get real-world experience out of the IPRO

Team Identity

Team Name: BIM iiT

Team Motto: BIM iiT!

Team Logo:



Team Purpose and Objectives

Team Purpose:

To identify ways to improve the efficiency of electrical contracting projects through new software and technology, communications, and project management techniques, especially through Building Information Modeling (BIM) utilization.

Objectives:

Team objectives:

- To avoid procrastination
- To be responsive and accountable
- To have everyone in the IPRO contribute to the project
- To have good interactions with and to satisfy our sponsor

Project objectives:

- To summarize the main sources of inefficiency in the electrical contracting field
- To assess possible solutions to inefficiencies, especially Building Information Modeling (BIM)
- To gain an understanding of technologies such as BIM, with the goal of teaching them to electrical contractors
- To devise and implement a plan for distributing the team's recommendations for improving efficiency to electrical contractors

Background

The sponsor for this IPRO is the Electrical Contractors' Association of Chicago (ECA). ECA helps developers find the right contractor for their needs, provides information for members about training opportunities, Labor Relations services, and information on Codes and Standards. Its members work in a wide variety of contracting fields, from industrial plants, hospitals, and schools to apartment buildings, condominiums, and single-family homes.

The user problem being faced in this IPRO is the problem of inefficiency in the electrical contracting field. Inefficiency is clearly an important issue facing the field: in a 2005 survey by Electrical Construction & Maintenance magazine, developers and property owners stated that their biggest cost concern was general inefficiencies in the construction process rather than materials and labor, and between 40% and 50% of construction projects run behind schedule. Preliminary research points to poor communication, paperwork error, delay in decision making, and the standard design-build-bid method as key concerns for contractors in getting jobs done quickly and profitably. The IPRO team will study these issues as well as new ones brought up in research and interviews, and attempt to pinpoint possible solutions for the most pressing problems.

The key technology this IPRO will study as a possible aid to increasing efficiency in electrical contracting is Building Information Modeling, or BIM. BIM is a building modeling program that incorporates all aspects of the building design, from the architectural frame to the systems and equipment in the building. It can be used to simulate the building's actual performance, and allows designers to pinpoint clashes between systems before construction begins. It also incorporates the dimension of time into the program, allowing scheduling information to be added to the design. Cost and price considerations can be added as well as a fifth dimension of modeling. In addition, energy modeling, acoustic and thermal data, sustainability information, and Green building considerations can be added to the program. The model can also be updated as construction progresses, recording changes to design and schedule, so that all members of the construction/design process are able to see in near-real time the progress of all aspects of the building. BIM has the potential to vastly improve communication between the different areas of a construction project, prevent during-construction conflicts, and improve prediction of systems operations prior to completing the building.

Other technologies that may be investigated include the more traditional AutoCAD Electrical software and EPLAN software. These are commonly used CAD programs for electrical applications that may be easier to use than BIM, but that lack the multi-dimensional, multi-disciplinary aspects that make BIM unique. The team will also consider technologies such as Radio Frequency Identification and Laser Scanners as efficient ways to gather data from construction sites to be incorporated into an up-to-date building model of the site.

This is the first IPRO with the objective of improving efficiency in the electrical contracting industry, so the team has no previous experience of successes and failures to build on. However, there are considerations about past innovations in the electrical industry to be considered. When computer-aided design software first came onto the market in the late 1980s there were high expectations that it would revolutionize the

industry. While CAD softwares did have significant effects on many areas of construction and design, they served to primarily convert what once were paper designs to electronic form without changing the nature of design and management of the project. The team should consider the history and success of other CAD programs when assessing BIM's likelihood to be incorporated by contractors into their everyday operations.

There are several ethical issues that the IPRO team may have to consider as this IPRO progresses. Some are general and team-related: team members must take it upon themselves to all pull their own weight for the team, and must be careful not to make assumptions about the IPRO solution that may make work easier but that aren't supported by research. Other issues are those related to the project itself. One possibility the team may face is that BIM, the program expected to be most helpful in increasing efficiency, may not be the best solution for contractors. The team must be sure not to push BIM if another solution is better, or if it does not fulfill expectations. Another issue is directly related to increasing efficiency for electrical contractors: some jobs could be lost if the IPRO team emphasizes technological solutions for inefficiencies. This is an issue the team will have to spend a good deal of time considering if it arises.

The business-related costs of the current inefficiency in the industry are obvious: loss of time means loss of money, delays in the overall construction project, and dissatisfaction from the developer. However, it must be considered that though in the long run implementing a solution like BIM might increase profitability, in the short term it would require a number of expenditures including the purchase of the program and training of operators for the program. The problem has a clear economic cost, but the solution will also carry a cost.

The most effective way of communicating the team's results to a large number of electrical contractors is one of the topics to be studied during the IPRO. However, a tentative plan for sharing the team's recommendations includes: an easily navigated website explaining the IPRO's purpose, research, results, and a comprehensive tutorial on any technologies selected as solutions; a presentation of the team's results to the Electrical Contractor's Association of Chicago (ECA), the IPRO sponsor; and easily readable pamphlets to be given to ECA for distribution among their members.

This IPRO is facing a new challenge as there has not been a concerted effort to improve efficiency in electrical contracting in the past. The advent of computer design programs such as AutoCAD can be seen as a similar situation to the more recent development of BIM software; however, since this IPRO's goal is not only to find a solution to inefficiencies in electrical contracting, but also to share the team's proposed solution with electrical contractors, the team will face the challenge of finding a way to motivate contractors to try to learn and incorporate new technology into their everyday work. The team's solution will also not be based entirely on the implementation of BIM in electrical contracting; failures in communication, inefficient use of time and resources on the job, and paperwork errors are all areas that will be addressed. This approach of considering all aspects of electrical contracting is a novel challenge for the IPRO team.

Critical Documents

Akinci, Burcu, Esin Ergen, Itir Z. Karaesmen, Fuat Keceli, and Semiha Kiziltas.

"Modeling and Analyzing the Impact of Technology on Data Capture and Transfer Processes at Construction Sites: A Case Study." Journal of Construction Engineering and Management Nov. 2008: 1148-1157.

"BIM: A New Dimension For Buildings." Electrical Design Library May 2008. National Electrical Contractors Association. 8 Sept. 2009 <<http://www.necanet.org/edl/index.cfm?fa=viewPastIssues&startrow=7&currPage=2&docType=13>>.

Bremer, Darlene. "The Perfect Pair." Electrical Contractor Jun. 2009: 128-130.

Team Values Statement

Desired Team Behavior:

- Be on time
- Fulfill responsibilities assigned by the team
- Communicate clearly with other team members
- Respond promptly to phone and email communications from the team
- Address conflicts between members immediately
- All team members are responsible for helping the leader when necessary

Conflict Management:

- Team members who have personal conflicts should go to Dr. Tomal, who will mediate a face-to-face discussion between them.
- Team members who have IPRO-related problems should go to their subteam leader, who will take the problem to the rest of the team if it cannot be solved within the subteam.

Work Breakdown Structure

Methodology

The team will begin by gaining an understanding of the electrical contracting business. Research is obviously key here, and presentations by the team sponsor and a team member with experience in the industry are already planned. One of the first active steps beyond research will be interviewing selected electrical contractors to gain their perspectives on the inefficiencies in the field.

After gaining an overall understanding, the team will conduct an in-depth study on project management processes and technology and assess their efficiency, pinpointing the trouble areas.

Once the areas of the worst inefficiency have been identified the team will study the possible solutions, such as Building Information Modeling and other new technology and improved communication and management techniques. The best overall solution, combining any or all of the possible solutions, will be chosen as the team's recommendation.

The final step in the IPRO is to package the team's findings in a way that will allow electrical contractors to easily access and understand the information. Possibilities (website, presentations, pamphlets) for passing this information on to contractors in the most straightforward and efficient manner will be studied and selected.

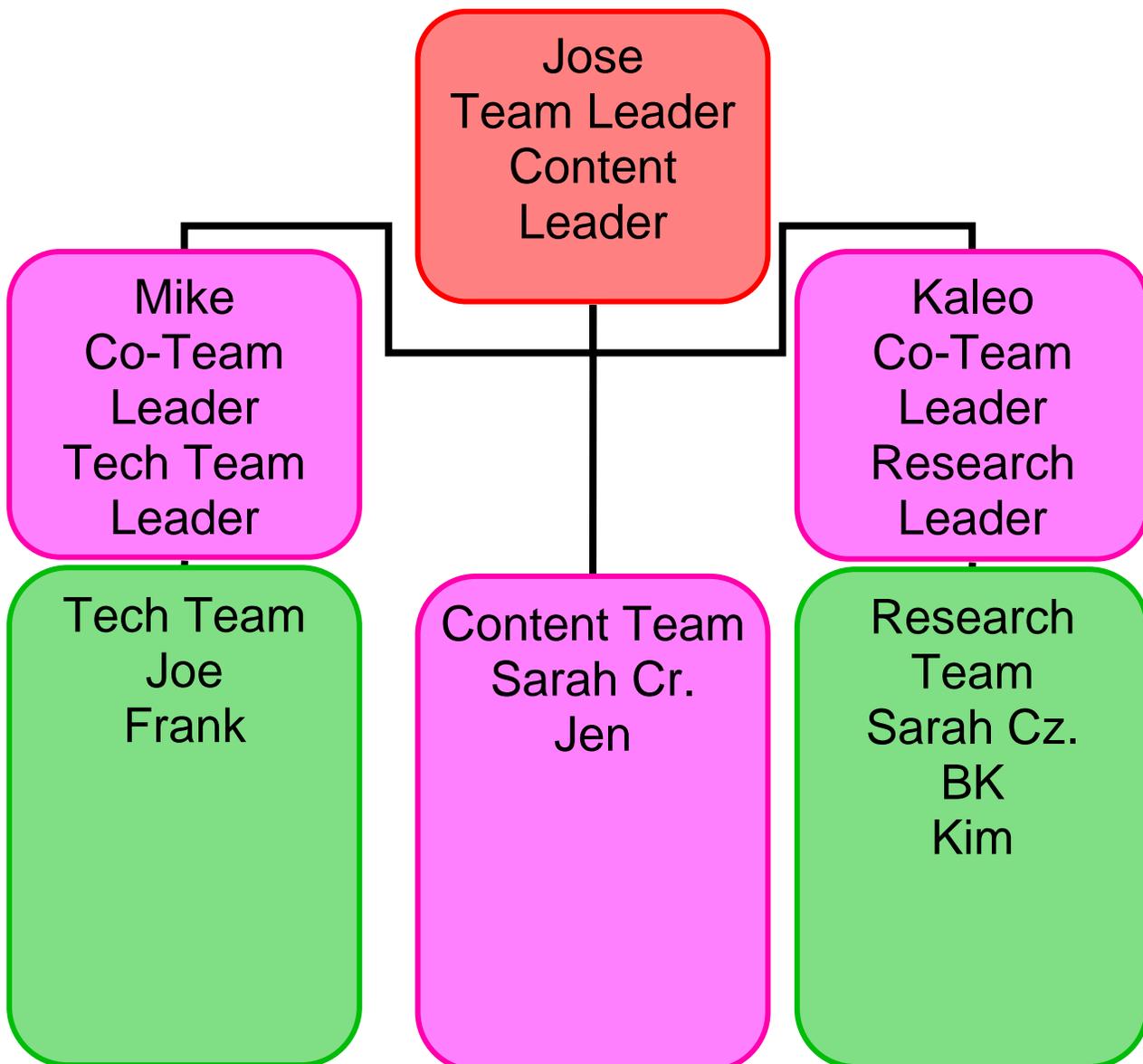
The main tasks in this IPRO will be: interviewing contractors; researching the usage of BIM and other technology; gaining an understanding of BIM and similar technologies; maintaining communication with the sponsor; assessing the costs (both monetary and ethical) of implementing a solution like BIM; and creating a final document detailing a plan for decreasing inefficiencies in the field.

The team should be able to accomplish the necessary tasks in time available. Physical resources required for this IPRO are few, freeing the team from potential issues involving costs and resource shortages. Instead, the team will focus on research, which will be directed by the research subteam but will include all members of the team. There are many books, electronic resources, and human resources available to the team, and the subteams will be able to split the work well between them. However, since this is the first semester this IPRO has been done, it is not reasonable to expect a perfect solution to this problem on the first attempt.

Team Structure

- Team leader: Jose Guerrero
 - Responsibilities: lead meetings; set priorities for team overall; lead Content subteam; coordinate subteam activities with co-leaders to maximize efficiency in the team
- Co-leaders: Kaleo Pedrina and Michael Maloney
 - Responsibilities: assist the leader at meetings; lead subteams; coordinate activities of subteams with each other for smooth running
- Secretary: Sarah Czapla

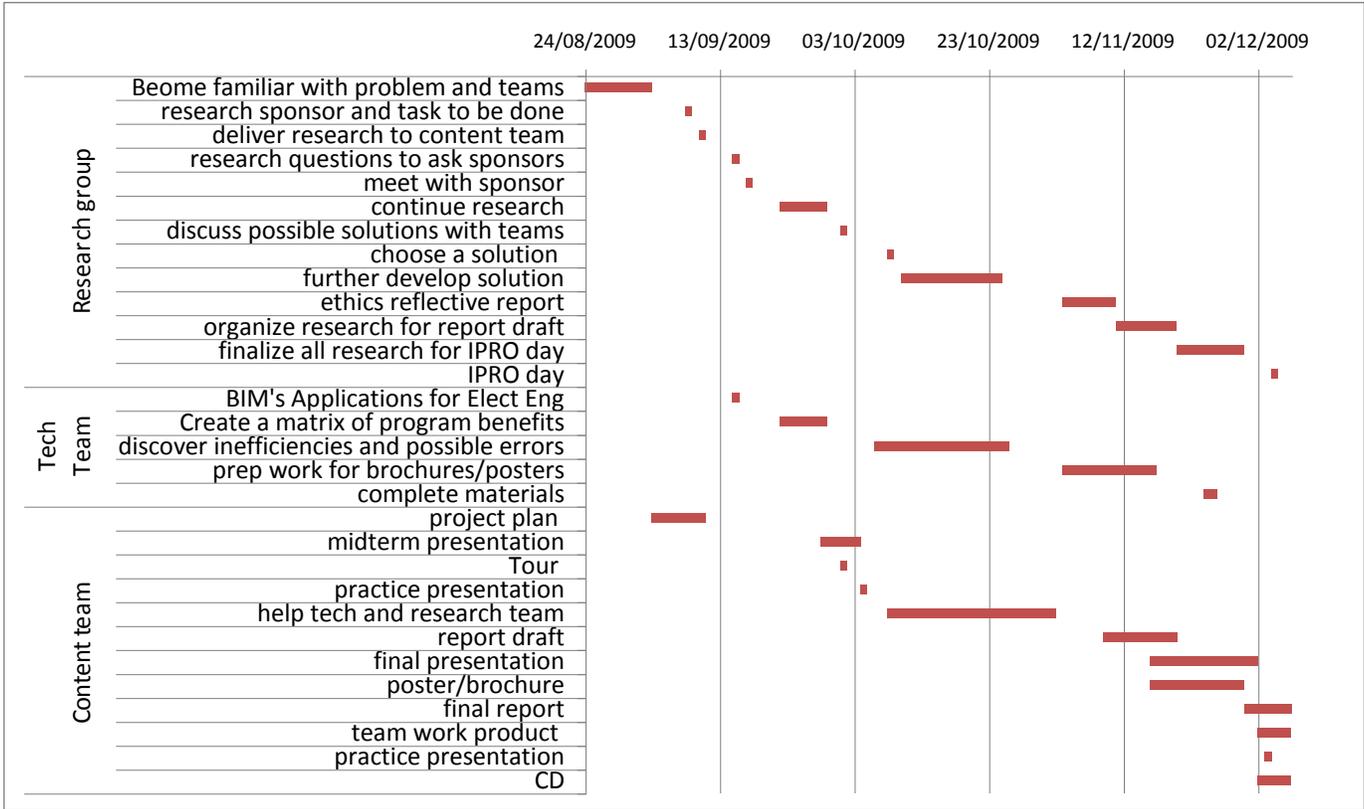
- Responsibilities: take minutes at meetings and post them on iGroups; post agendas on iGroups; make sure agendas are kept to during meetings
- Content Team: Sarah Crites, Jose Guerrero (leader), Jennifer Yi
 - Responsibilities: make sure all deliverables are done on time; submit deliverables through Nuggets; send email reminders about responsibilities discussed in meetings; moderate iGroups
- Research Team: Bum Kyung Cho, Sarah Czapl, Yoosuk Kim, Kaleo Pedrina (leader)
 - Responsibilities: research the process of electrical contracting; perform interviews with contractors; research the usage of BIM and other technologies in contracting
- Tech Team: Frank Malawski, Michael Maloney (leader), Li Qiu
 - Responsibilities: build website; learn how to use BIM and other programs used by electrical contractors; prepare a way to simplify teaching BIM to electrical contractors



Schedule

Project Management - Gantt Chart

Tasks	Start Date	Duration (days)	End Date
Become familiar with problem and teams	24/08/2009	10	03/09/2009
research sponsor and task to be done	08/09/2009	1	09/09/2009
deliver research to content team	10/09/2009	1	11/09/2009
research questions to ask sponsors	15/09/2009	1	16/09/2009
meet with sponsor	17/09/2009	1	18/09/2009
continue research	22/09/2009	7	29/09/2009
discuss possible solutions with teams	01/10/2009	1	02/10/2009
choose a solution	08/10/2009	1	09/10/2009
further develop solution	10/10/2009	15	25/10/2009
ethics reflective report	03/11/2009	8	11/11/2009
organize research for report draft	11/11/2009	9	20/11/2009
finalize all research for IPRO day	20/11/2009	10	30/11/2009
IPRO day	04/12/2009	1	05/12/2009
BIM's Applications for Elect Eng	15/09/2009	1	16/09/2009
Create a matrix of program benefits	22/09/2009	7	29/09/2009
discover inefficiencies and possible errors	06/10/2009	20	26/10/2009
prep work for brochures/posters	03/11/2009	14	17/11/2009
complete materials	24/11/2009	2	26/11/2009
project plan	03/09/2009	8	11/09/2009
midterm presentation	28/09/2009	6	04/10/2009
Tour	01/10/2009	1	02/10/2009
practice presentation	04/10/2009	1	05/10/2009
help tech and research team	08/10/2009	25	02/11/2009
report draft	09/11/2009	11	20/11/2009
final presentation	16/11/2009	16	02/12/2009
poster/brochure	16/11/2009	14	30/11/2009
final report	30/11/2009	7	07/12/2009
team work product	02/12/2009	5	07/12/2009
practice presentation	03/12/2009	1	04/12/2009
CD	02/12/2009	5	07/12/2009



Expected Results

Expected activities involved in the project will include interviews with electrical contractors, research on the electrical contracting industry and BIM, BIM software practice and exploration, visits to construction sites to view management techniques firsthand, assessment of inefficiencies, and the development of a plan to improve efficiency in electrical contracting. The team will also develop a way to communicate the results of the IPRO to the electrical contracting industry.

Data the team expects to gather include subjective data from interviews, information on the division of time spent on each aspect of a contracting project from paperwork to materials handling and physical labor, economical data about the cost of time wasted in each area of the project and the money that could be saved by increasing efficiency, and information on the amount of time each solution the team proposes will save a contractor.

The IPRO team does not plan to create a marketable product by the end of the IPRO. The end result of the semester will be a proposal for electrical contractors detailing the team's research and suggestions on how to improve efficiency on the job.

The outputs from the project tasks are fairly straightforward: interviews will result in transcripts and recommendations from experts in the electrical contracting field; the tech team's study of BIM and other software and technology will result in a definition of the pros and cons of each technology and a report on how to use the technologies; other research will result in reports, and collections of statistics and other data collected by previous researchers; economic studies of the situation will result in a report on the economical aspect of the project; and all of these will combine to allow the team to make a recommendation on the best way to improve efficiency in electrical contracting.

The main deliverable from this IPRO will be the team's description of how they propose to best improve efficiency in electrical contracting. The information gathered and proposed solutions will be presented to electrical contractors in a way that allows the contractors to implement the suggestions directly in their everyday work.

Some challenges the IPRO team will face include the vast amount of research that must be done to construct a well-rounded view of all aspects of the electrical contracting process and the fact that the path to increasing efficiency will probably include many aspects of the job rather than just one technological aspect. The team will need to avoid focusing all effort on the most clearly obvious solution, BIM, and develop a solution that addresses all aspects of inefficiency. There are also challenges related to the implementation of BIM as a solution to inefficiencies. One is that since BIM is a dynamic model, able to be modified by all parties, it will be important to ensure that all parties involved in the project are working from the most recently updated version of the model, rather than older versions missing recent modifications by other parties. Also, in order for BIM to be used to its full capacity, the model will have to be continuously updated as construction proceeds, which will demand that everyone working on the project be responsible to make additions and update as they make modifications on-site.

All research, both quantitative (economic models, statistics) and qualitative (interviews and contractor opinions), will be taken into consideration by the team in selecting the areas of the greatest inefficiency and selecting the optimal set of solutions for the final recommendation.

Project Budget

The team will take several trips to construction sites to observe, and individual team members may need to travel to perform interviews with contractors. The only cost that needs to be budgeted for is the cost of travel at the standard reimbursement rate per mile, not exceeding \$100.

Designation of Roles

Bum Kyung Cho (Research Team member)

- Responsibilities: Perform whatever research is necessary; help assess inefficiencies based on research of electrical contracting

Sarah Crites (Content Team member)

- Responsibilities: Submit deliverables to iGroups; send out reminder emails to the team; moderate and organize iGroups

Sarah Czaplá (Secretary, Research Team member)

- Responsibilities: Take minutes at meetings; upload minutes to iGroups; prepare agendas in iGroups based on minutes; keep meetings on track according to agenda

Jose Guerrero (Team Leader, Content Team leader)

- Responsibilities: Lead meetings of full team; coordinate activities of Content Team with the other two subteams; moderate team discussions

Yoosuk Kim (Research Team member)

- Responsibilities: Perform necessary research; help assess possible solutions for correcting inefficiencies in electrical contracting

Frank Malawski (Tech Team member)

- Responsibilities: Become team's BIM expert; prepare a plan to make BIM and other technologies accessible and understandable to contractors

Michael Maloney (Co-leader, Tech Team leader)

- Responsibilities: Assist leader in running meetings; coordinate activities of Tech Team with other subteams; interview contacts in electrical contracting; help perform efficiency assessment of technologies used in contracting

Kaleo Pedrina (Co-leader, Research Team leader)

- Responsibilities: Assist leader in running meetings; coordinate activities of Research Team with other subteams

Li Qiu (Tech Team member)

- Responsibilities: Study alternative technologies to BIM; build website for group

Jennifer Yi (Content Team member)

- Responsibilities: Assist in performing interviews of contractors; assess the economics of implementing potential solutions; moderate Google Doc sharing of deliverables so all members can edit