

## IPRO 339 PROJECT PLAN – SUMMER 2009

# Designing Affordable Housing out of Shipping Containers for Chicago

**IPRO Faculty Advisors**

Michael Glynn

Blake Davis

**IPRO Team Members**

Ahsan, M. Saad

Anderson, Aaron

Bais, Rajiv

Bhatti, Talha

Chan, Ronald

Davis, Blake

Dunn, Michael

Gibbons, Jennifer

Glynn, Michael

Gregory, Nicole

Jacobson, Joel

Kucher, Rostislav

LaBuda, Timothy

Lima, Nancy

Park, Ji Ae

Park, Lucas

Pederson, Erin

Pyciak, Mark

Rahman, Raihan

Ribot Garcia, Anna

Roseen, Michael

Silvestre, Ivan

Specht, Cassandra

## 1. TEAM INFORMATION

### A. Team member roster

1. Ahsan, M. Saad
  - [mahsan1@iit.edu](mailto:mahsan1@iit.edu)
  - [REDACTED]
  - STRENGTHS: Comfortable with writing and presentation activities.
  - NEW KNOWLEDGE/ SKILLS TO DEVELOP: Develop knowledge of structural engineering fundamentals.
  - EXPECTATIONS: To view the direct impact of our efforts on real world housing problems.
2. Anderson, Aaron
  - [aander2@iit.edu](mailto:aander2@iit.edu)
  - [REDACTED]
3. Bais, Rajiv
  - [rbais@iit.edu](mailto:rbais@iit.edu)
  - [REDACTED]
  - STRENGTHS: My strengths are having a good memory of events, researching, being approachable, and doing what I am told by a leader. I also am a student with a mechanical engineering minor.
4. Bhatti, Talha
  - [tbhatti@iit.edu](mailto:tbhatti@iit.edu)
5. Chan, Roland
  - [rchan1@iit.edu](mailto:rchan1@iit.edu)
6. Davis, Blake
  - [davisbl@iit.edu](mailto:davisbl@iit.edu)
  - [REDACTED]
7. Dunn, Michael
  - [mdunn1@iit.edu](mailto:mdunn1@iit.edu)
  - [REDACTED]
  - STRENGTHS: Computer and organizational skills
  - KNOWLEDGE/SKILLS TO DEVELOP: What goes into designing a building and making a proposal
  - EXPECTATIONS: To help advance a worthy cause that will support both the poor, and also the Chicago Olympic bid.
8. Gibbons, Jennifer
  - [jgibbon3@iit.edu](mailto:jgibbon3@iit.edu)
  - [REDACTED]
9. Glynn, Michael
  - [mglynn@iit.edu](mailto:mglynn@iit.edu)
  - [REDACTED]
10. Gregory, Nicole
  - [ngregory@iit.edu](mailto:ngregory@iit.edu)

## 11. Jacobson, Joel

- [jjacobs5@iit.edu](mailto:jjacobs5@iit.edu)
- STRENGTHS: Many years of construction experience (Union Laborer & Painter) Strong organization skills and reliable. Proficient at working with design software - i.e. Revit, Auto cad, Adobe
- NEW KNOWLEDGE/ SKILLS TO DEVELOP: How to work cohesively as a team, as well as the detailing of the project.
- EXPECTATIONS: I would like to see the project reach the point of being able to build a 1 to 1 scale model on campus.

## 12. Kucher, Rostislav

- [rkucher@iit.edu](mailto:rkucher@iit.edu)
- [REDACTED]

## 13. LaBuda, Timothy

- [tlabuda@iit.edu](mailto:tlabuda@iit.edu)
- [REDACTED]

## 14. Lima, Nancy

- [nlima@iit.edu](mailto:nlima@iit.edu)

## 15. Park Ji, Ae

- [jpark76@iit.edu](mailto:jpark76@iit.edu)
- [REDACTED]

## 16. Park, Lucas

- [lpark2@iit.edu](mailto:lpark2@iit.edu)
- [REDACTED]

## 17. Pedersen, Erin

- [pedeeri@iit.edu](mailto:pedeeri@iit.edu)
- [REDACTED]
- STRENGTHS: CAD MAX Sketch-Up Photoshop Illustrator Dream weaver MS Project/access/excel/word. Laser cutting model making digital cnc. I like working with my hands, and building things.
- NEW KNOWLEDGE/ SKILLS TO DEVELOP:
- EXPECTATIONS: To put together a cohesive well thought out plan for both the Olympic village and the perm housing; including detailed con docs renderings and physical models (site/full-scale)

## 18. Pyciak, Mark

- [mpyciak@iit.edu](mailto:mpyciak@iit.edu)
- [REDACTED]
- STRENGTHS: Detail oriented, well organized, and proficient in writing reports. Extensive knowledge in field of construction. Self employed as a slab and tile installer for several years.

- NEW KNOWLEDGE/SKILLS TO DEVELOP: Understand how architectural applications are applied in real world applications.
- EXPECTATIONS: To showcase sustainability at the 2016 olympics.

19. Rahman, Raihan

- [mrahma3@iit.edu](mailto:mrahma3@iit.edu)



20. Ribot Garcia, Anna

- [aribot@iit.edu](mailto:aribot@iit.edu)



- STRENGTHS: team-worker, good in graphical representation, construction detailing and presentations.
- NEW KNOWLEDGE/ SKILLS TO DEVELOP: modular construction detailing and cost estimation. Increase the structural engineer's influence into design.
- EXPECTATIONS: achieve realistic results after design process.

21. Roseen, Michael

- [mroseen@iit.edu](mailto:mroseen@iit.edu)



22. Silvestre, Ivan

- [isilvest@iit.edu](mailto:isilvest@iit.edu)

23. Specht, Cassandra

- [cspecht@iit.edu](mailto:cspecht@iit.edu)



**B. Team Identity**

1. Name: "Housing in a Tin" IPRO 339
2. Logo:



3. Motto: "Do not go where the path may lead, go instead where there is no path and leave a trail".

**2. TEAM PURPOSE AND OBJECTIVES****A. Team Purpose**

The City of Chicago has been nominated as the U.S. Bid City for 2016 Olympic Games and currently remains a strong contender for this title. If Chicago is selected as the Host City it will face the enormous task of providing temporary housing for all Olympiad participants including athletes, coaches, organizers, and media reporters. Continuing in the vein of last semester's IPRO, our IPRO is proposing an economical and environmentally friendly solution to this challenge. We propose to utilize thousands of old shipping containers that are cluttering up shipping yards in the Chicago area and to convert them into low-cost housing units. With proper foresight, this challenge can become an opportunity for the

City to demonstrate an attitude of sustainability that can serve as a model for other cities around the world to follow suit. The intense media attention directed towards the Olympic Games could be channeled to showcase our commitment to environmentally and socially responsible actions.

The shipping containers will be modified and equipped with all amenities including electrical, plumbing and HVAC installations. The interior and exterior of each unit will be finished using the most sustainable, economical, and energy efficient products available on the market. The goal is to make each unit both aesthetically and functionally comparable to conventional housing. Following the completion of the Olympic Games, these housing containers could be easily disassembled and relocated providing affordable permanent housing for low income residents. This will allow local residents from depressed neighborhoods to benefit from higher quality affordable housing without being forced to relocate. Considering that housing accommodations in Chicago during Olympics will be highly priced most of the construction costs can be covered in this manner.

Our IPRO hopes to design and facilitate the implementation of esthetically appealing and practical permanent housing out of materials that will be recycled twice: first from the shipping containers and second from the Olympic Housing. We also plan to accommodate the particular needs of temporary residents during Olympics and later permanent residents as well as to explore the most effective transformation methods from one purpose to the other. These housing units must appeal to many individuals from different cultural backgrounds, and provide them with good living conditions for a short period of time.

We are also proposing to find a market to raise money for the Olympic Unit as well as the concept of the Shipping Container Home. Once funding is raised and materials are purchased, we plan to build a life size mock-up of each of the apartment styles, and to demonstrate the ability to promote fast, affordable and effective low income housing options. Our goal is to properly design the Olympic and permanent housing so that necessary systems are incorporated, structural integrity is maintained in accordance with the rules and regulations established by the City of Chicago Department of Buildings, and affordability is always met with a strong focus on sustainability.

## **B. Objectives**

- Research previous use of shipping containers for purpose of building housing units
- Continue with previous semester's IPRO proposal to develop the dual-purpose housing concept of providing temporary and subsequent permanent housing.
- Determine the most efficient way to convert these units from temporary housing used for Olympic Games to permanent affordable housing for local residents
- Explore possible technical solutions for structure of façade and ensure successful implementation into Chicago's urban environment
- Research the most cost efficient and sustainable ways of incorporating plumbing, HVAC, and electricity into these units
- Explore possibilities aimed to increase energy efficiency of the housing in cost efficient ways
- Compile a list of required materials and components
- Compile an estimated amount of labor hours that will be required by out of house sources (such as union workers)
- Create a budget
- Develop a marketing plan
- Create a presentation to present to city officials including a 3-D rendered model which will be integrated into our marketing plan
- Create a list of potential target audiences and attempt to raise enough funding to build two mock apartments
- Build both mock apartments
- Use our prototypes to promote the implementation our solution on a global scale
- Ensure civic and handicap accessibility

### **3. BACKGROUND**

- A. This project does not have a sponsor per se, but our customer is ultimately the City of Chicago and the Chicago 2016 Olympic Committee for whom housing will be developed initially, as well as a non-profit housing organization for whom the housing will be adapted for permanent use.
- B. We plan to use shipping containers to create housing for two different types of residents (temporary and permanent) and therefore we may be faced with issues arising from different needs and expectations of two socio-economic groups. The visitors that will occupy these housing units during the Olympic Games must be satisfied with proximity of the housing to the Olympic events, accessibility to

- public transportation and overall comfort. On the other hand, the permanent residents that will occupy these units following the completion of Olympic Games must find them affordable, functional and aesthetically appealing. Therefore, the housing must be designed to meet the needs of all. The City of Chicago and its officials have failed to develop the permanent housing objects for people in need time and time again, resulting in many that are left homeless. The paucity of affordable housing solutions available for the residents of the City of Chicago has forced numerous people to either relocate or to move to the streets. In order to ensure that our attempt to develop affordable social housing doesn't face the same fate as numerous others projects have in the past, we must take extra care in making sure that our housing objects fit into the typical Chicago lot and that they resemble the architecture and character of neighboring homes.
- C. Previous attempts to design public housing had limited success and it resulted in various social problems that led to increase in crime incidences, segregation from the rest of the community and dependency of many on the government for income. Robert Taylor Homes (demolition finished 2007) and Cabrini-Green (demolition nearly complete) are the most notorious examples of failed housing projects that we can find in the City of Chicago. Many problems are the prodigy of socio-economic isolation that residents of the housing projects face. To avoid previous mistakes in the future, we must integrate these individuals into communities that are already well functional and provide the new residents with housing solutions of wide range of affordability. The city of Chicago offers good environment for our project because of its close proximity of advance communities and socially and economically isolated neighborhoods that are in need of better quality housing. We also face numerous other challenges that we need to circumvent in order for this project to be success. We need to develop the means to (i) easily and affordably transform the temporary Olympic housing into permanent housing structures, (ii) maintain the minimum of 7'6" clearance when container inside dimensions are only 7'10", and (iii) to make the project appealing to the groups that it targets.
- D. Even today, many of the shipping containers housing projects are made of single or only few units. Also there are numerous examples of utility or special purpose objects. Affordable housing is in high demand all over the world but examples of large scale shipping container structures are fairly rare. One exception is Keetwonen, the student housing project in Amsterdam, Netherlands, which is made of 1000 units and is a great example of large scale project. It was initially meant to last only 5 years before being relocated, but it is expected that repositioning will be postponed until 2016. Regardless of initial skepticism, the quality of the project is outstanding and offers a list of amenities that often fail in other student dormitories. Temporary Housing, the company behind this project, is also working on 4 star hotel in Nigeria (still under construction) and similar

student housing projects in Diemen, Netherlands (still under construction) which is composed of 250 containers. We are also familiar with the U.S. Army's use of shipping containers to quickly construct barracks and other buildings in military complexes in Afghanistan. However, the Army's units are constructed no more than three stories high, whereas our units must be eight stories high to meet Olympic Committee specifications.

- E. A new dimension to the problem being addressed this term is the lack of funding and support from the community. Local aldermen are concerned about the appearance of shipping container housing in their neighborhoods, and we have yet to pitch the idea formally to the Chicago 2016 Olympic Committee. To facilitate the proposal process, we would like to build a full-scale mock-up of a single unit, using real shipping containers. The problem we are facing in achieving this goal is that the current level of funds is insufficient and inhibits operations. Once we conduct fundraising, hopefully we will be able to obtain enough materials to complete our mock-up.

#### **4. TEAM VALUES STATEMENT**

##### **A. Desired behaviors**

- Give 100% effort
- Work as a team to achieve shared goals
- Be on time to all the meetings
- Communicate clearly and effectively
- Respect all team members and their ideas
- Resolve issues in an effective manner
- Perform assigned tasks
- Ask for help if needed
- Meet deadlines
- Use resources wisely

##### **B. How to address problems**

- The following steps will be taken when issues arise:
  1. Attempt to resolve the problem within the subgroup
  2. When necessary ask other IPRO group members for advice
  3. As a last resort, contact IPRO instructors
- No-shows/ incomplete tasks need to be recorded and addressed personally. If not resolved, then issue will be reported to the instructor in order to avoid any delays in the project

- Resolve problems with time conflicts within individual subgroups on personal basis
- Promptly report time conflicts with weekly meeting to the instructor

## 5. METHODOLOGY/BRAINSTORM/WORK BREAKDOWN STRUCTURE

- A. Design, create, and market affordable and sustainable housing for the city of Chicago by employing recycled shipping containers, while resembling Chicago's local styles and tastes.
- B.
  - Research the most cost efficient and sustainable ways of incorporating plumbing, HVAC, and electricity into the homes.
  - Develop additional site plans, floor plans, and sections as different solutions and options to the previous semesters work by developing design solutions to the problems of solar gain minimization, water collection, optimizing site orientation, and enhancing thermal zones.
  - Using our research and previous designs to continue to develop multiple solutions to satisfy the needs of the potential client.
  - Using our prototypes to implement and focus our solution for both Olympic housing and the transition to an affordable Chicago multi-unit structure.
  - Research a viable and cost effective energy solution
  - Make the housing compliant with Chicago fire code guidelines and investigate the ethical responsibilities of further Fire Protection.
  - Ensure civic and handicap accessibility for the housing.
  - Incorporate the climatic needs of the Chicago region into the site design.
  - Ensure both housing projects are going to be structurally sound. Ensure the MEP and HVAC systems are going to be able to be implemented without issue.
  - Calculations will be made to test the structural integrity of the Olympic housing against wind loads as well as force-modeling to get an accurate picture of what will be happening, and the necessary limitations will be given to the architecture subgroup.
  - Foundation calculations will be made and will be correlated with the soil information to see if the soil can handle the dead load.
  - Design of the structures will be checked against any necessary implementation of MEP and HVAC systems to prevent conflicts during construction.
  - Wind load testing will be done with force-modeling.

- Results of testing and calculations will all be documented with the calculations and a small conclusion.
- Analysis of the test results is simply seeing what type of connections will be required inside the building and how much of the outside walls will have to be contiguous, untouched wall.

To go about solving the above subtasks of the overall problem, our team will be divided into groups to work on individual tasks. The individual tasks will be categorized, and one category given to each subgroup. All design goals should be completed within the given timeframe, but the ultimate construction of the housing unit will require additional time and resources.

- C. Potential solutions will be tested using computer-aided design software, and mathematical computation, to be performed by the appropriate subgroup.
- D. All findings will be transparently posted using the IGroups system, to be reviewed by other members of the subgroup, as well as the overall design team.
- E. Results will be subjected to professional review by outside sources, such as licensed professionals and government officials. These third-party individuals will be contacted by members of the subgroups before the finalization of the design to ensure all project requirements have been met.
- F. One or more representatives of each subgroup will meet with the lead instructors to complete each deliverable in the required timeframe. They will meet outside the regular class period, and will be responsible with the task of organizing pertinent information and structuring the deliverable file per its requirements. One or more representatives of each subgroup will meet with the lead instructors to complete each deliverable in the required timeframe. They will meet outside the regular class period, and will be responsible with the task of organizing pertinent information and structuring the deliverable file per its requirements.

## **6. EXPECTED RESULTS**

Level 1: Affordable Shipping Container Housing

Level 2:

- 1.1-1. Construction Costs / Project Financing
- 1.1-2. Container Fabrication / Construction
- 1.1-3. Land Acquisition / Zoning / Permits
- 1.1-4. Marketing / Aesthetics
- 1.1-5. Olympic Model

## 1.1-6. Testing

### Level 3:

#### 1.1- Construction Costs / Project Financing

- 1.10- Itemize material costs
- 1.11- Estimate construction labor costs
- 1.12- Estimate permitting costs
- 1.13- Estimate rezoning and land acquisition costs
- 1.14- Anticipate other related expenses
- 1.15- Develop a project financing plan
- 1.16- Research sources of financing, both private and corporate
- 1.17- Secure financing

#### 1.2- Container Fabrication / Construction

- 1.20- Finalize energy model
- 1.21- Research and finalize HVAC system
- 1.22- Modular equipment and visit RV installation plant
- 1.23- Finalize unit floor plan and site layout
- 1.24- Research radiant flooring system
- 1.25- Further investigate passive systems
  
- 1.26- Finalize solar orientation on site
- 1.27- Develop and finalize construction documents
- 1.28- fully design the structural aspect of the Olympic housing
- 1.29- fully design the structural aspect of the permanent housing

#### 1.3- Land Acquisition / Zoning / Permits

- 1.30- Determine necessary type of lot zoning
- 1.31- Investigate rezoning process, if necessary
- 1.32- Ensure design complies with zoning ordinances
- 1.33- Research City of Chicago fast track green permitting
- 1.34- Acquire appropriate building permit for construction
- 1.35- Ensure availability of proposed housing location and secure site for construction
- 1.36- Make appropriate design considerations to obtain LEED gold certification
- 1.37- Contact Alderman for assistance with permitting and land acquisition

#### 1.4- Marketing / Aesthetics

- 1.40- Create a course of action to promote the project to the community, government officials, and financial institutions

- 1.41- Define a positive, identifiable image for the project
- 1.42- Devise incentives in terms of salability
- 1.43- Devise incentives in terms of sustainability
- 1.44- Research methods of incorporating the vernacular
- 1.45- Research and finalize a building façade
- 1.46- We will be coordinating business meetings with Chicago based companies.
- 1.47- Gathering materials and fund raising in order to accomplish our goals.

#### 1.5- Olympic Model

- 1.51- Once we complete construction, we will have a life size model that we can walk the Olympic Officials through.
- 1.52- The goal of these tasks is raise funding and completion of life size mock up.
- 1.53- If the project is successful and we raise that expected amount of funding, we will have a simulated mock-up that will be shown to clientele.
- 1.54- The challenges we face are related to fundraising. People and corporations do not want to part with money.
- 1.55- We need to obtain proper supervision during construction so that no injuries occur.
- 1.56- If results are successful, then we will use the building models to sell the idea to the Olympic Committee as well as the Chicago district Aldermen.

#### 1.6- Testing

- 1.61- Calculations will be made to test the structural integrity of the Olympic housing against wind loads as well as force-modeling to get an accurate picture of what will be happening, and the necessary limitations will be given to the architecture subgroup.
- 1.62- Foundation calculations will be made and will be correlated with the soil information to see if the soil can handle the dead load.
- 1.63- Design of the structures will be checked against any necessary implementation of MEP and HVAC systems to prevent conflicts during construction.
- 1.64- Wind load testing will be done with force-modeling.
- 1.65- Results of testing and calculations will all be documented with the calculations and a small conclusion.

1.66- Analysis of the test results is simply seeing what type of connections will be required inside the building and how much of the outside walls will have to be contiguous, untouched wall.

**7. PROJECT BUDGET**

Item	Price	QTY	Price	Purpose
Models	\$25.00	2	\$50.00	Developing prototypes of our designs for review and further study.
Printing	\$5.00	10	\$50.00	Printing of renderings, floor plans, site plans for in class presentations
Travel Expenses	\$250.00	1	\$250.00	Travel for teams of 3
Labor Supervision and Construction	\$3000-5000	1	\$3000-5000	Necessary for building life size model
<b>Total:</b>			<b>\$5350.00</b>	

**8. SCHEDULE OF TASKS AND MILESTONE EVENTS**

	<b>Start</b>	<b>end</b>
1) IPRO Deliverables	6/6/09	7/24/09
2) Project Plan	6/6/09	6/16/09
3) Midterm Presentation Preparation	6/6/09	6/30/09
4) IPRO Day Preparation	6/6/09	7/22/09
5) Exhibit/Poster	6/6/09	7/21/09
6) Abstract/Brochure	6/6/09	7/21/09
7) Final Report	6/6/09	7/24/09
8) Teamwork Product	6/6/09	7/24/09
9) IKnow Updates	6/6/09	7/24/09
10) IPRO Day	7/18/09	7/23/09
11) Project Plan Due Date	6/6/09	6/16/09
12) Midterm Presentations	6/21/09	6/30/09

	<b>Start</b>	<b>End</b>
<b>1)Construction Costs/Project Financing</b>	<b>6/6/09</b>	<b>7/18/09</b>
1.1) Research Phase	6/6/09	7/18/09
1.2) Prototype-Cost estimate	6/6/09	7/18/09

1.3) Search for funding	6/6/09	7/18/09
1.4) Finalize costs and financing	6/6/09	7/18/09
<b>2) Container Fabrication/Construction</b>	<b>6/6/09</b>	<b>7/18/09</b>
2.1) Research Phase	6/6/09	7/18/09
2.2) Develop Prototype	6/6/09	7/18/09
2.3) Construction sections-model	6/6/09	7/18/09
2.4) Finalize construction method	6/6/09	7/18/09
<b>3) Land Acquisition/Zoning/Permits</b>	<b>6/6/09</b>	<b>7/18/09</b>
3.1) Research Phase	6/6/09	7/18/09
3.2) Organize appropriate paperwork	6/6/09	7/18/09
3.3) Finalize details	6/6/09	7/18/09
<b>4) Marketing/Aesthetics</b>	<b>6/6/09</b>	<b>7/18/09</b>
4.1) Research Phase	6/6/09	7/18/09
4.2) Develop marketing schemes	6/6/09	7/18/09
4.3) Finalize marketable product	6/6/09	7/18/09

## 9. INDIVIDUAL TEAM MEMBER ASSIGNMENTS

### A. Group Leaders / Veterans

It is the responsibility of the group leaders to steer the subgroups toward the given ipro objectives and to assure that said goals will be accomplished within the semester timeline. Team members in this group have demonstrated strong communication skills as well as leadership fundamentals.

### B. Presentation

This team will spend time determining the target market of the container project and studying various ways to market the idea to investors as well as the potential end user. Group members have strong marketing skills and possess a valuable set of design skills.

In order to build a building, one must first obtain financing and therefore have knowledge of the project costs. This team will aim to price the project as accurately as possible as well as search for the alternative means of financing. This team consists of members strong in math and financing with knowledge of alternative funding possibilities.

### C. Engineering

Building with containers is a relatively new endeavor and therefore requires a significant amount of research into the details and construction methods necessary to construct such a project. Team members have a strong set of design tools and are capable of creatively solving problems of structure and construction.

**D. Design Architecture**

The members of this team will be responsible for all things related to the design aspects of the project and its associated responsibilities. This includes, but is not limited to, working with officials to speed zoning changes, acquire land, and obtain needed permits for the progress of this project. Team member have great organization skills and ability to read architectural drawings and maps.

**E. Quality Control**

This team will serve to produce, edit, and publish the necessary documentation and reports associated with the IPRO. Operational objectives include ensuring high standards of professionalism and maintaining the team on track to meet various deliverable deadlines.

**10. DESIGNATION OF ROLES**

**Minute Taker:** records decisions made during meetings, including task assignments or changes under consideration.

- Raj Bais

• **Agenda Maker:** creates an agenda for each team meeting, which provides structure to the meetings and offers a productive environment.

- Lucas Park

• **Time Keeper:** is responsible for making sure meetings go according to the agenda.

- Raihan Rahman

• **Weekly timesheet collector/summarizer:** responsible for collecting weekly timesheets from each member of the team and updating everyone with a summary report.

- Nancy Lima

• **Master schedule maker:** responsible for collecting schedules from all the team members and developing a master schedule, this tells the team when members are available and how to contact them.

-Mark Pyciak

• **iGroups:** responsible for organizing the team's iGroups account and ensuring that it is used properly.

- Ivan Silvestre

• **General Secretary:** responsible for facilitating engineering endeavors.

-Jennifer Gibbons