

I PRO 339 FINAL REPORT

Designing Affordable Housing out of
Shipping Containers for Ciudad Juarez,
Mexico

I PRO Faculty Advisors

Michael Glynn

Blake Davis

Peter Beltemacchi

I PRO Team Members

Amy Bourquard

Carl Hart

Chandani Joshi

Joshua Lebak

Man Leung

Michael Lynn

Luke McGuire

Gustavo Mendoza

Brett Monroe

Patrick Park

Jacqueline Schaefer

Yihan Su

Jaquelin Tijerina

Maciej Tusz

Theresa Zappala

I PRO Sponsor

Mr. Brian McCarthy, President: Por Fin Nuestra Casa

0.1 Introduction

I PRO 339 is an investigation using shipping containers as an alternative affordable housing solution for under-paid and exploited working populations. Specifically, I PRO 339 focused on creating affordable home-ownership opportunities for the thousands of displaced workers from Mexico's rural regions who were forced to relocate to urban slums of Juarez – one of the fastest growing cities in Mexico due to globalization.

0.2 Background

The sponsor for I PRO 339 is Mr. Brian McCarthy, President of Por Fin Nuestra Casa (PFNC) Global Communities in Corrales, New Mexico. His company strives to create affordable housing for areas in the world where there is little to no adequate housing for the under-paid working population. One such area is in Juarez, Mexico where multinational companies run factories which manufacture and produce products strictly exported for non-Mexican markets. These factories, known as *maquiladoras*, employ thousands of laborers who typically leave their families and travel great distances in search of employment. Because the *maquiladoras* are located far from the workers' homes, employees must live near the *maquiladora* for which they work. Workers of *maquiladoras* struggle daily with wages of less than two dollars an hour and so are oftentimes forced to live in homes without electricity or plumbing. Despite these squalor living conditions, workers still strive for home ownership. In order to afford such a modest home on such meager wages, employees must co-own with several families for one home. Workers not wishing to co-own; therefore, have little choice but to create squatter settlements by constructing homes out of wooden palettes and boxes with a makeshift foundation or metal roof. The majority of these settlements do not have running water, sewage systems, or electricity for heating and air conditioning. Because the job turnover at the factories is sometimes over one-hundred percent a year, the communities are transient which attributes greatly to high crime and violence. By providing affordable homes which workers can actually afford, we hope that people will be able to stay longer and experience an entitlement to the land and community in which they live and work.

The slums of Juarez are not exactly ideal places to raise a family. For example, violence associated with gangs along with murders and rape of single women make the communities around the *maquiladoras* less than desirable to live in. Furthermore, there is little justice within the court system or with the police making the workers extremely marginalized from an otherwise healthy way of life. The majority of factory workers are single mothers with children, making these communities an extremely frightening place for them to live.

We will address issues associated with both creating affordable home-ownership opportunities and the social climate of these communities. The situation calls to mind previous attempts at public housing, which have often led to even greater social ills such as isolation from the rest of the community and dependency on the government for income.

Overall, there is not enough affordable housing for many areas of the world.

Our project aims to provide affordable homes for sale using reused shipping containers. Affordable housing should not cost more than thirty-percent of a household's gross income. Creating homes out of used shipping containers has been done many times before: Portakabin is one example where shipping containers have been successfully converted into youth centers, classrooms, office space, artists' studios, live / work spaces, nurseries and retail space. Habitech is another company which manufactures affordable housing technologies. Homes can be assembled in anywhere from one day or one week and cost about thirty to fifty percent less. Often these are more trendy projects; however, rather than basic housing like our project. We are therefore working on ways to make these containers still inviting and a place to call 'home'.

Through our investigation, the team made careful assessments about the way in which people live and what resources they would need. The investigation also revealed high violence and social problems within these communities and so our solutions attempted to address these issues, as well.

Our attempt was to create a base of information for the users of our container housing such as: social, economic, and physical needs to guide our designs. We looked at the climate and geography of the area and used this to influence the design of our HVAC and structural systems. We integrated spatial, cultural and physical investigations to create a suitable housing unit.

0.3 Purpose.

IPRO 339 was focused on providing an affordable housing option for the working poor in Juarez, Mexico. This semester we researched the technologies involved in reusing shipping containers for this housing. We designed three prototype housing units which were related to other units in an overall community, with services such as commerce, open spaces for activity, and community centers to support them. We wished to design a housing community that embodies the ideals of humanity, affordability, functionality, opportunity, sustainability, durability, safety, culture, and neighborhood. In order to do this, our team for the Spring Semester set forth the following objectives:

- Research and understand the users of our product by looking at the social, economic, and physical factors in Juarez, Mexico and in the *maquiladoras* where they work.
- Research the most cost efficient and sustainable ways of incorporating plumbing, HVAC, and electricity into the homes.
- Research the structural aspects of building in this community.
- Develop a potential site plan, floor plans and sections for the housing units.
- Using our research and designs, develop a proposal for our sponsor, considering the client at hand.

0.3 Research Methodology

1. We had three initial subgroups which consisted of a Sociology/Marketing Team, Design Team, and an Engineering Team. When we divided into these subgroups, we completed initial research to get a better understanding of what would be

- required when converting shipping containers into livable spaces. These subgroups yielded initial design ideas that we were able to use in our first design: Development Study One. Development Study One had the constraints of using a 100 meter by 100 meter site on either side of a theoretical factory. These two studies produced respective densities of 130 dwelling units and 111 dwelling units.
2. After we completed Development Study One, we met with our sponsor Mr. Brian McCarthy, the president of Por Fin Nuestra Casa. We presented both of our solutions and discussed other possible ideas to make each development solution better. After we presented our initial ideas, he presented PFNC's business plan and explained his efforts in developing housing from recycled shipping containers.
 3. We then split into two development study groups each consisting of half the total project team. Each team completed a separate high density study on a theoretical 100 meter by 100 meter site adjacent to a *maquiladora*. These subgroups were named "North Subgroup" and "South Subgroup". The results of the North Subgroup yielded 512 dwelling units and the South Subgroup yielded 352 dwelling units on each 100 meter by 100 meter site.
 4. The investigation has yielded the possibility of applying our solution not only to our site in Juarez, Mexico but sites around the world which have a need for employee, volunteer, or relief housing solutions. Research and refinement of our working models are resulting in low-cost, attractive housing solutions for poor or displaced people in need of quality housing.
 5. We have produced two sets of working drawings that include site plans, floor plans, and model configurations, as well as a physical model of each subgroup development solution. In each of our solutions we also have preliminary cost analysis studies with cost projections for single units as well as the entire development. Both hard and soft costs for our site in Juarez, Mexico are part of each analysis.
 6. We continue to have communications with our valued sponsor, Mr. Brian McCarthy, PFNC President. His visit to IIT to review our Development Study One report was useful to our team in outlining guidelines and constraints for our most recent Development Study Two. An in depth cost analysis became a key component of the overall development process. He then asked us to examine in depth the cost per unit for our development and to use his constraint of eight thousand dollars per unit to drive our solution.
 7. Our final development was to combine the most effective results from both study groups into a cohesive plan.

0.5 Assignments

A. Individual Members and Responsibilities.

1. Name: Amy Bourquard
Year: 4th year
Major: Materials Science and Engineering
Experience, Skills, Strengths:
Roles: Code of Ethics, preliminary research, participated in the Ethics workshop, worked in initial cost analysis, MEP, and Structural engineering subgroups, worked on Design study – East and North, and is a member of the development engineering sub-group.
2. Name: Carl Hart
Year: 3rd year
Major: Architectural Engineering
Experience, Skills, Strengths: Architectural Intern, AutoCAD, HVAC Analysis/Design Software, Highly Analytical and Detailed
Roles: iGroups manager, preliminary research, worked in initial MEP, Space planning, and sociology/marketing subgroups, worked on Design study – East and North, an is a member of the development engineering sub-group.
3. Name: Chandani Joshi
Year: 3rd year
Major: Molecular Biochemistry and Biophysics/ Pre-medicine
Experience, Skills, Strengths: Organization, Management, Research
Roles: Project management plan, minute taker, preliminary research on Juarez, worked in initial cost analysis, space planning, and sociology/ marketing subgroups, worked on Design study – East and North, and is a member of the development sociology sub-group.
4. Name: Joshua Lebak
Year: 4th year
Major: Architecture
Experience, Skills, Strengths: Urban planning, design, space planning, AutoCAD, 3d Studio Max, Adobe Creative Suite, Model Making, has worked for Lake Forest's planning office.
Roles: preliminary research, worked in initial civil engineering, space planning, and site planning sub-groups, worked on Design study – West and South, and is a member of the development Design sub-group, Midterm Report.

5. Name: Man Leung
Year: 5th year
Major: Civil Engineering
Experience, Skills, Strengths: Structural design/analysis to AISC/ASCE Steel Bridge Building Competition 2007, 2008; Non-linearized structural analysis using SAP2000
Roles: preliminary research on pre-existing conditions in Juarez, worked in initial civil engineering, structural engineering, and cost analysis sub-groups, worked on Design study – West and South, and is a member of the development engineering sub-group.

6. Name: Michael Lynn
Year: 5th year
Major: Architecture
Experience, Skills, Strengths: AutoCAD, adobe illustrator/Photoshop, 3d modeling, model making. Experience in construction and working at architectural firms. I have also worked at CNU, Congress for New Urbanism, doing site planning related research.
Roles: preliminary research on Juarez, worked in initial site planning, sociology, and structural engineering sub-groups, worked on Design study – East and North, and is a member of the development Design sub-group.

7. Name: Luke McGuire
Year: 3rd year
Major: Architectural Engineering
Experience, Skills, Strengths: IT manager for group of 7 medical clinics (Minnesota Oncology), Software developer for Parametric Technology Corporation, General manager campus radio station, Peer Leadership program developer and facilitator, AutoCAD, MathCAD, Pro/Engineer
Roles: Code of Ethics, preliminary research, worked in initial Site planning, Space planning, and structural engineering subgroups, worked on Design study – West and South, and is a member of the development engineering sub-group.

8. Name: Gustavo Mendoza
Year: 5th year
Major: Architecture
Experience, Skills, Strengths: AutoCAD, Adobe suite
Roles: preliminary research, worked in initial structural engineering, site planning, and sociology sub-groups, worked on Design study – East and North, and is a member of the development Design sub-group.

9. Name: Brett Monroe
Year: 4th year
Major: Architecture
Experience, Skills, Strengths: Problem solving, design, planning, Auto CAD, Adobe Photoshop and Illustrator, 3d Studio Max, Model Making, has worked in several architectural firms in the city of Chicago.
Roles: preliminary research, worked in initial site planning, space planning, and MEP sub-groups, worked on Design study – West and South, and is a member of the development Design sub-group, Midterm Report.

10. Name: Patrick Park
Year: 4th year
Major: Electrical Engineer
Experience, Skills, Strengths: AutoCAD, Adobe suite
Roles: preliminary research, worked in initial sociology, MEP, and cost analysis sub-groups, worked on Design study – West, and is a member of the development Design sub-group.

11. Name: Jacqueline Schaefer
Year: 3rd year
Major: Architecture
Experience, Skills, Strengths: have worked in 2 architecture offices, cad and some 3dmax skills
Roles: project management plan, code of ethics, preliminary research, worked in initial site planning, space planning, and MEP sub-groups, worked on Design study – West, and is a member of the development Design sub-group.

12. Name: Yihan Su
Year: 3rd year
Major: Applied Mathematics, physics minor
Experience, Skills, Strengths: Matlab, a little C++ computer language, 2 languages (Chinese and English), has worked as an accountant in a shipping company.
Roles: preliminary research, worked in initial Civil engineering, cost analysis, and structural engineering sub-groups, worked on Design study – West, and is a member of the sociology/marketing sub-group.

13. Name: Jaquelin Tijerina
Year: 5th year
Major: Architecture, specialization in landscape architecture
Experience, Skills, Strengths: AutoCAD, adobe illustrator/Photoshop, 3d modeling, model making, graphic design, bilingual in Spanish/ English, visited Mexico, and have worked as an architectural intern, where I have handled projects and dealt with consultants.
Roles: preliminary research on Juarez, worked in initial space planning, site planning, and sociology/marketing sub-groups, worked on Design study – East, and is a member of the development Design sub-group.
14. Name: Maciej Tusz
Year: 5th year
Major: Aerospace Engineering and Materials Science, Math minor
Experience, Skills, Strengths: Worked at NASA for the summer, studied abroad, speak 3 languages, traveled to some poor neighborhoods in my life. Lived in communist Poland so understand the mentality of some of these projects, open mind
Roles: time sheet collector/ summarizer, preliminary research on materials, worked in initial MEP, Structural, and cost analysis sub-groups, worked on Design study – East, and is a member of the development engineering sub-group.
15. Name: Theresa Zappala
Year: 3rd
Major: Architecture
Experience, Skills, Strengths: Project leader, group leader, computer skills (Adobe suite, Microsoft Office suite, CAD, VIZ), on time, dedicated, able to see the whole picture and focus on many different parts of a project at once, worked as an intern for two different firms
Roles: project management plan, preliminary research, worked in initial site planning, space planning, and sociology sub-groups, worked on Design study – West and South, and is a member of the development sociology / marketing sub-group.

B. Sub-groups.

1. **Sociology/Marketing:** Defining the economic scope of our project and our clients (both the corporation buying the project and the families buying the units). Defining the cultural needs of the clients, in order to work their habits into the design. Researching social patterns that affect design. Researching the best way to present the idea to a client. Preparation of building/construction cost analysis.
Sub-group leader: Chandani Joshi
2. **Design Team:** Using the sponsor's initial requirements as a starting point, preparing individual unit floor plans and a site arrangement conducive to fostering a community atmosphere without drastically changing the cultural needs of the client.
Sub-group leader: Jacquelin Tijerina
3. **Engineering Team:** Preparing an analysis of the best and most cost effective passive heating and cooling systems, any supplementary mechanical systems, plumbing systems, and any auxiliary structural systems needed to support the Design Team's plans.
Sub-group leader: Luke McGuire
4. **Developmental Study Group One, East:** Preparing developmental studies which analyze a typical 100 meter by 100 meter site. Analyzing conditions and constraints that effect design decisions. Research topics which address design intents within the scope of the project. There are no designated sub-group leaders for the individual developmental studies.
5. **Developmental Study Group One, West:** Preparing developmental studies which analyze a typical 100 meter by 100 meter site. Analyzing conditions and constraints that effect design decisions. Research topics which address design intents within the scope of the project. There are no designated sub-group leaders for the individual developmental studies.
6. **Developmental Study Group Two, North:** Preparing developmental studies which analyze a typical 100 meter by 100 meter site with a high density solution (higher than development study one) which has a typical building height of four stories. Analyzing conditions and constraints that effect design decisions. Research topics which address design intents within the scope of the project. There are no designated sub-group leaders for the individual developmental studies.
7. **Developmental Study Group Two, South:** : Preparing developmental studies which analyze a typical 100 meter by 100 meter site with a high density solution (higher than development study one) which has a typical building height of three stories. Analyzing conditions and constraints that effect design decisions. Research topics which address design intents within the scope of the project. There are no designated sub-group leaders for the individual developmental studies.

Sub-group Name	Sociology/Marketing	Design Team	Engineering Team
Sub-group Leader	Chandani Joshi	Jacquelin Tijerina	Luke McGuire
Group Members	Theresa Zappala	Jacqueline Schaefer	Carl Hart
	Yihan Su	Michael Lynn	Man Leung
	Patrick Park	Joshua Lebak	Maciej Tusz
	Michael Glynn (Prof)	Gustavo Mendoza	Amy Bourquard
	Blake Davis (Prof)	Brett Monroe	Michael Glynn (Prof)
		Michael Glynn (Prof)	Blake Davis (Prof)
		Blake Davis (Prof)	
Sub-group Name	Development Study Group One East & Group Two North	Development Study Group One West & Group Two South	
	Amy Bourquard	Joshua Lebak	
	Carl Hart	Man Leung	
	Chandani Joshi	Luke McGuire	
	Michael Lynn	Brett Monroe	
	Gustavo Mendoza	Patrick Park	
	Jaquelin Tijerina	Jaquelin Schaefer	
	Maciej Tusz	Yihan Su	
		Theresa Zappala	

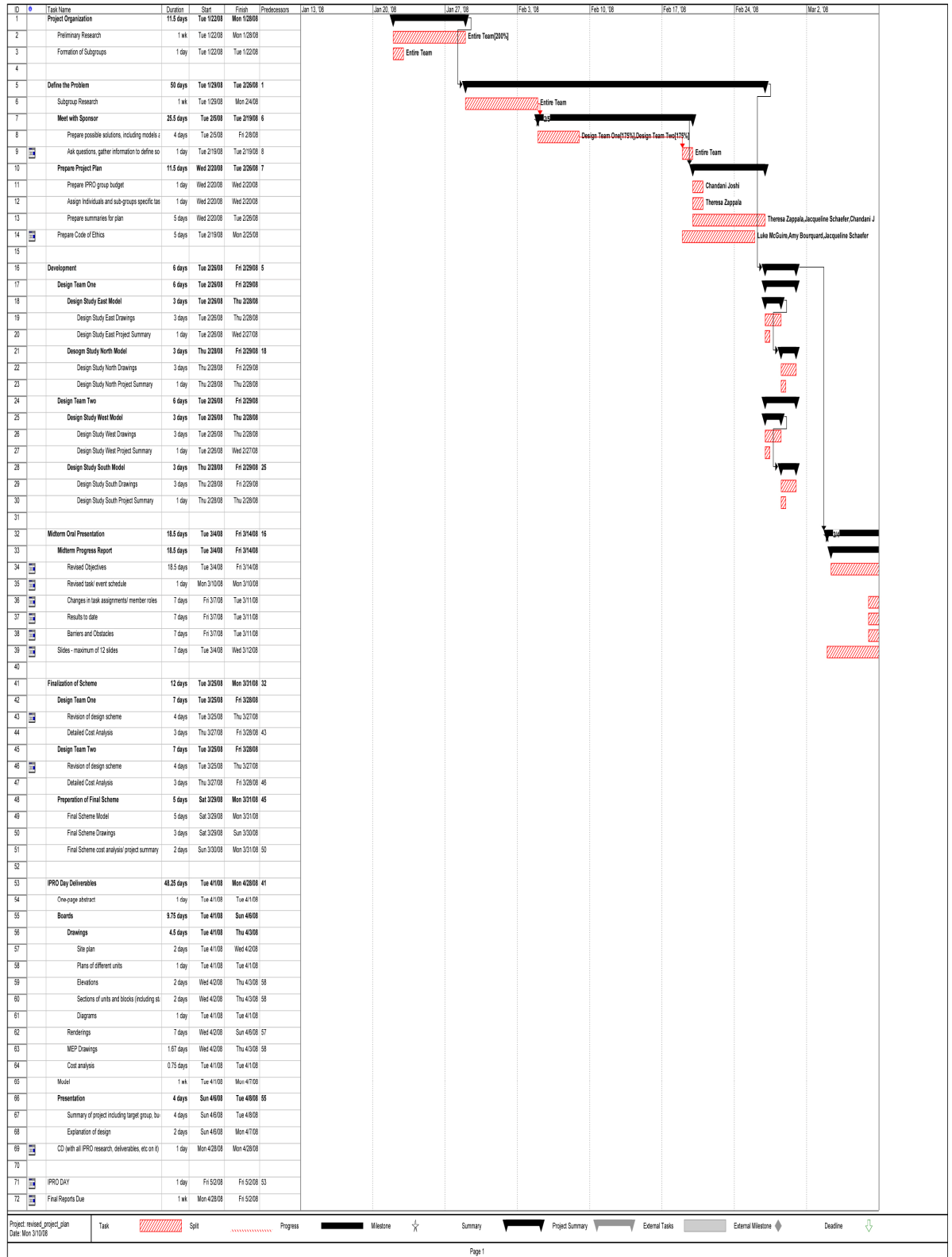
C. Roles.

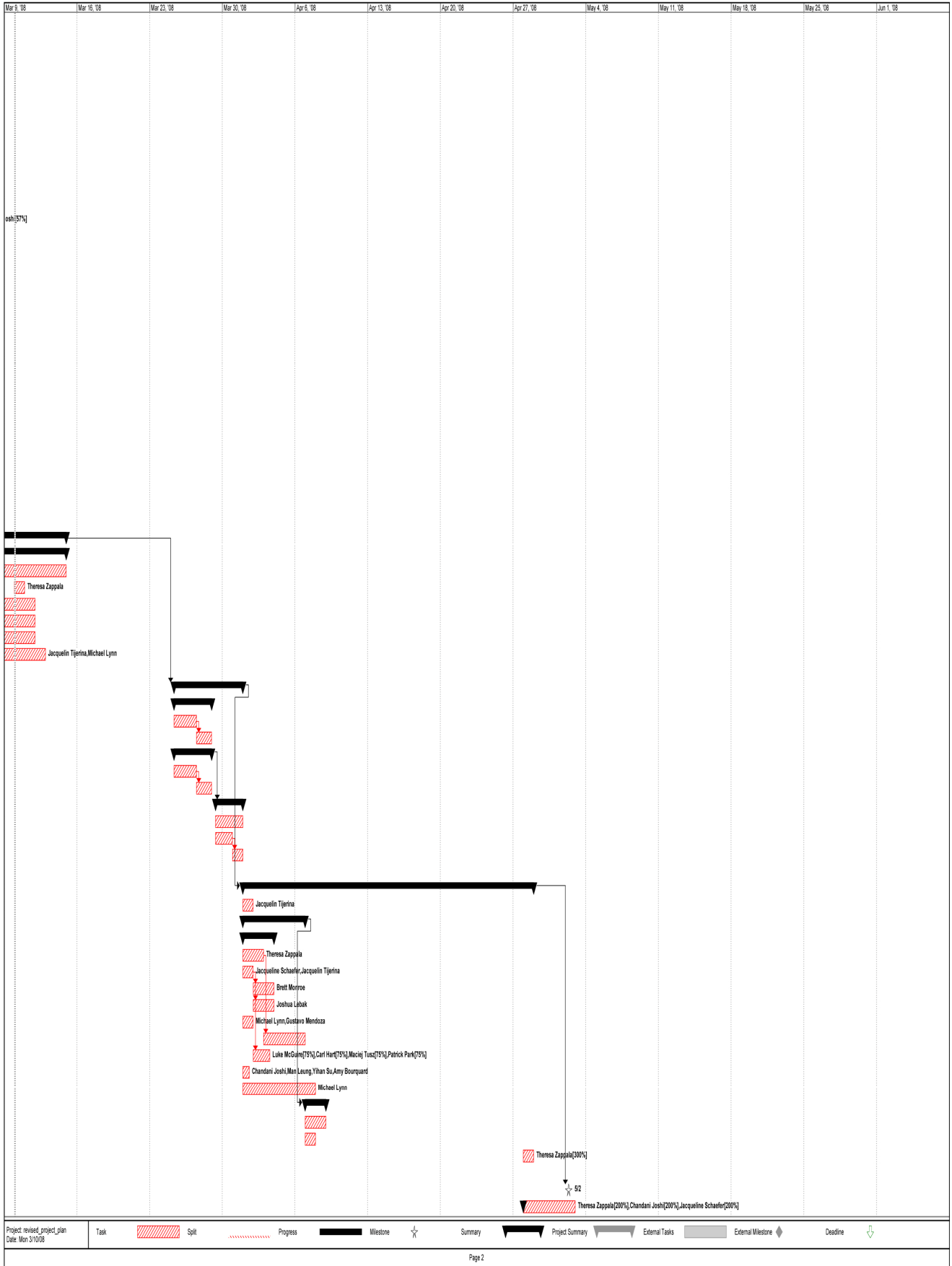
1. Meeting Roles
 - i. Minute Taker: Chandani Joshi
 - ii. Agenda Maker: The professor is the agenda maker for this IPRO.
 - iii. Time Keeper: The professor is time keeper for this IPRO.
2. Status Roles
 - i. Weekly Timesheet Collector/ Summarizer: Maciej Tusz
 - ii. Master Schedule Maker: Chandani Joshi
 - iii. iGROUPS: Carl Hart

D. Changes From Project Plan.

The major change from the Project Plan was the addition of two more sub-groups to develop higher density solutions simultaneously. These two sub-groups consisted of various members from each established sub-group. The purpose of both developmental studies was to take a 100 meter by 100 meter site and come up with two solutions within the same constraints i.e. site configuration, floor plans, density, and amenities. Each group consists of members from each previous sub-groups so all disciplines are present to develop two complete ideas

from varying backgrounds. Then we took the strongest solutions and developed a 200 by 300 meter final site to increase density.





0.6 Barriers and Obstacles.

A. **Obstacles Encountered.**

Obstacle One: The initial brainstorming of the project, which included site layout and plan design, was one of the biggest obstacles to resolve. A group member may have wanted their idea to ultimately be used over another member's idea because they may have thought it was the best plan for the application. There were many great ideas between group members, but unfortunately, not everything could be implemented.

Obstacle Two: The outcome and the overall reaction to the finished product. We asked ourselves a few questions: How the residents in Ciudad Juarez would react to the shipping container as an environment for living and how the space would actually be inhabited.

B. **Obstacle Resolution.**

Obstacle One: In order to advance on final decisions, the group had to make a number of compromises. It was especially hard when one does not offer full support in someone else's idea. To aid in the process, we took in account input on the disliked and liked ideas. If their idea wasn't chosen, it wasn't completely disregarded or looked over. Their idea was either built upon or modified certain ways to create the best solution for the application.

Obstacle Two: To overcome this obstacle, we did some research of the current conditions in Ciudad Juarez that the workers are living in. They are living in some sort of shanty town by the factory. Their current living conditions don't have any permanent structure, only implemented scraps that could be considered garbage to us. We thought if any new type of innovative and affordable housing was introduced to the area, it would undoubtedly be an improvement over anything they have encountered.

C. **Remaining Barriers / Obstacles.**

Barrier One: A big barrier that we are facing is the ability to create an innovative, sustainable design to meet our client's budget per container. Some ideas wanted to stray away from a simple stacking, causing us to have to add more supports around the container. Along with abnormal layout, minimizing stairs in the overall site was a concern, in forms of accessibility and egress.

Obstacle One: Clashing of majors in the IPRO. Certain people may think they are in the IPRO to fulfill their one specialty duty. This greatly limits how the problem could be solved by having only one person working on separate problems.

D. **Team Plans Regarding Barriers / Obstacles.**

Proposed Plan-Barrier One: When thinking of the final design, we want to minimize the amount of additions, unnecessary components, and

fabrication to the project in order to help keep costs down. Also, we can consider buying certain appliances or materials in bulk to help save costs and to keep under budget. We can research suppliers and compare prices on their products.

Proposed Plan-Obstacle One: Someone of a different specialization has a different outlook on the same problem. They can aid in the final decision by putting the problem in a different perspective. It makes problem solving easier to tackle it from multiple angles from multiple people than have one person have the same perception.

0.7 Results

Our solution is a prototypical 200 meter by 300 meter site. In addition to almost 2,000 units on the site, we also incorporated a regulation-size soccer field, a large space for a park and market place, and room for a church. These elements are arranged on the site in such a way that they break up the housing units into separate ‘neighborhoods’ to create smaller communities within the larger whole. The arrangement of the public amenities is spread throughout the site to promote usage of the site by everyone, so as not to alienate any one area from another. Roads wide enough for emergency vehicles run through the site in the N-S and E-W direction.

The individual units are constructed out of 40’ shipping containers. Each unit has a small kitchen area and a small bathroom with a toilet and shower. The units also can sleep four to five people comfortably. Both ends of the unit are glass to allow light in. None of the buildings are more than four units tall, to minimize the number of stairs to one’s apartment. The railings of the walkways provide shading for the units, while the exterior of the buildings will have a cob exterior, a cost effective and attractive way of insulating our buildings.

IPRO 339 produced schematic drawings for our site plan and units, including plans, section, and elevations. We also have done materials and structural research for the project, and a cost analysis including soft and hard costs. See Appendix A: Cost Analysis Breakout for Single and Double Units.

0.8 Recommendations

IPRO 339 attempted to address most issues to develop a sustainable container community. Our findings primarily addressed site development, container densities, and unit layouts. Further development of our recommended findings will be necessary to optimize the potential of a container development. Recommendations to explore should consist of, but not be limited to; further exploration of passive heating and cooling options, true modularity of internal components to be pre-fabricated such as, bathrooms units, kitchen components, furniture and an in depth examination of the social issues facing the community. Also, we recommend further exploration of efficient methods to increase densities and connect all MEP components. We also recommend developing a marketing plan focused on the companies in Juarez, who will then be able to sell the units to their workers at prices they can afford.

0.9 References

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Appendix A: Cost Analysis Breakout for Single and Double Units

I P R O 339 - COST ANALYSIS

Final Development Study

Project Description

Site:	200 meters x 300 meters. Six (6) hectares. 14.826 acres.
Dwelling Units:	1,698 single width units (40 ft x 8 ft.) 75 double width units (40 ft x 16ft.) <hr/>
	1,773 Total Dwelling Units.
Density:	(Assume five (5) occupants / dwelling unit) 8,865 Total Occupants 598 Dwelling Units / Acre.

I. PROPOSED OWNERS STATEMENT

Final Development Study

<u>ITEM</u>	<u>COST:</u>
LAND	\$2,384,000.00
CONSTRUCTION - Hard Cost	\$13,900,185.00
PERMITS	\$34,750.46
ARCHITECTURE / ENGINEERING	\$556,007.40
LEGAL / ACCOUNTING	\$69,500.93
INSURANCE	\$69,500.93
SURVEYS / TESTING	\$34,750.46
SOFT COST CONTINGENCY	\$7,645.10
DEVELOPERS FEES	<u>\$733,234.76</u>
TOTALS	\$17,789,575.04

I PRO 339 - COST ANALYSIS

Final Development Study

II. PROPOSED HARD COST STATEMENT

For Single Width Dwelling Units:

1,698 single width units (40 feet x 8 feet.)

<u>ITEM</u>	<u>COST:</u>
General Conditions	\$250.00
Sitework / Excavation	\$200.00
Underground Utilities	\$100.00
Landscaping	\$150.00
Roads / Driveways / Walkways	\$300.00
Poured in Place Concrete	\$400.00
Container Unit Cost	\$1,100.00
Container Installation	\$50.00
Steel Stairways / Steel Misc.	\$400.00
Carpentry Materials	\$250.00
Carpentry Labor	\$250.00
Cabinets / Built Ins	\$350.00
Counter Tops / Vanity Tops	\$100.00
Interior Furninshings	\$150.00
Thermal Insulation	\$75.00
Sound Attenuation	\$450.00
Roofing	\$75.00
Hardware	\$25.00
Doors	\$80.00
Windows	\$450.00
Interior Partitions	\$50.00
Interior Paining	\$50.00
Exterior Painting	\$50.00
Flooring / Wood & Tile (Sanding and Finish)	\$180.00
Bath Accessories	\$10.00
Storage Accessories	\$25.00
Appliances	\$600.00
Plumbing Labor	\$600.00
Plumbing Fixtures	\$200.00
HVAC	\$250.00
Electrical Labor	\$400.00
<u>Electrical Fixtures</u>	<u>\$100.00</u>
TOTAL Cost for Individual Single Width Unit.	\$7,720.00

Total Hard Cost for all Single Units. (1,698 x \$7,720)

\$13,108,560.00

I PRO 339 - COST ANALYSIS

Final Development Study

III. PROPOSED HARD COST STATEMENT

For Double Width Dwelling Units:

75 single width units (40 feet x 16 feet)

<u>ITEM</u>	<u>COST:</u>
General Conditions	\$500.00
Sitework / Excavation	\$400.00
Underground Utilities	\$200.00
Landscaping	\$300.00
Roads / Driveways / Walkways	\$300.00
Poured in Place Concrete	\$400.00
Container Unit Cost	\$2,200.00
Container Installation	\$100.00
Steel Stairways / Steel Misc.	\$400.00
Carpentry Materials	\$250.00
Carpentry Labor	\$250.00
Cabinets / Built Ins	\$500.00
Counter Tops / Vanity Tops	\$200.00
Interior Furnishings	\$300.00
Thermal Insulation	\$150.00
Sound Attenuation	\$450.00
Roofing	\$150.00
Hardware	\$25.00
Doors	\$160.00
Windows	\$450.00
Interior Partitions	\$100.00
Interior Paining	\$50.00
Exterior Painting	\$100.00
Flooring / Wood & Tile (Sanding and Finish)	\$360.00
Bath Accessories	\$10.00
Storage Accessories	\$50.00
Appliances	\$600.00
Plumbing Labor	\$600.00
Plumbing Fixtures	\$200.00
HVAC	\$250.00
Electrical Labor	\$400.00
<u>Electrical Fixtures</u>	<u>\$150.00</u>

TOTAL Cost for Individual Double Width Unit. \$10,555.00

Total Hard Cost for all Double Units. (75 x \$10,555) **\$791,625.00**