

## THE PROBLEM

There are over 3000 Maquiladoras in Mexico, employing thousands of employees each. These workers earn on average \$1.00- \$2.15 an hour, which makes it difficult for them to afford suitable housing. As a result, the majority of these workers live in make-shift shelters without electricity or running water. The communities that these shacks form also experience a very high rate of crime.

The problem the Maquiladoras face is that there is a very high turn over rate in the factories. Because the wages are so low, a worker will move to work at another factory offering a \$.01/hour higher wage. The hope is that by providing the workers with permanent housing, they will be less likely to leave their factory in search of a slightly higher wage.

## GOALS AND OBJECTIVES

- \* To provide a safe and healthy community for the workers in Ciudad Juarez, Mexico
- \* Provide a variety of unit types to meet the varying needs of the workers in Juarez
- \* To encourage and promote a sense of community, so that the sense of community currently in place is enhanced
- \* To provide a housing solution that is affordable for the workers, while still greatly increasing their standard of living
- \* To create prototypes that could be applied to other third world sites

## METHODOLOGY

Members of IPRO 339 were first divided into research sub-groups: energy, exterior envelope, design, and infrastructure. These groups were responsible for researching and recommending solutions for the design of the buildings. Another division in the IPRO was into two teams: a Chicago team and a Juarez Team.

In addition to these research groups, the Juarez team was divided into two sub groups each responsible for designing individual units, and later larger multi-unit structures. These sub-groups made recommendations about the systems necessary to the project, including exterior cladding, electrical and HVAC systems, and plumbing systems.

These two sub-groups later combined to develop a final site plan that included both building layouts designed by the sub-groups.

## OUR SOLUTION

Shipping containers were proposed as a solution to the affordable housing need because they are structurally very strong; they are also readily available and a less expensive source of steel. Using the standard container size of 40ft x 8ft x 8.5ft (height) as our basic unit size, we developed 5 unit layouts, including two single units (using a single container), a single unit with a shared kitchen (using two containers), and two double units (each using two containers).

By providing a variety of unit types and layouts, we hoped to meet the needs of a variety of users. The individual units were combined to form two different building types: the u-plan and the cross plan. Both building plans feature more private courtyards and attempt to maintain a relationship to the ground by not building more than three stories tall.

The overall site plan features wide walkways and strips of greenspace between the units. A large green space was also included in the site planning to provide the occupants with a space for outdoor sports and recreation, and market activities. Space was designated for multi-purpose buildings also built using shipping containers.

In order to reduce the heat gain on the buildings, a green roof was incorporated into the two buildings. The green roof would not only serve as insulation, but also provide space for gardens where tenants can grow their produce. Heat gain in the units was also reduced by using a straw bale insulation on the exterior walls. A grey water collection systems was implemented to reduce the fresh water demand of the complex.

The other heating and cooling needs will be met by individual HVAC systems in each living unit.

## CONCLUSION

The climate in Ciudad Juarez, Mexico presented a difficult problem because of the extreme heat gain, the limited rainfall, and sparse wind flow. The green roof and straw bale insulation will help to greatly reduce the heat gain; the straw bale insulation will be a relatively inexpensive insulation solution because it is possible to find near the site.

The structural strength of the shipping container allowed us to greatly reduce the building cost and provides us with an opportunity to prefabricate many of the features in the unit, making the installation and construction process very short.

## IPRO 339-B

# CREATING AFFORDABLE HOUSING USING SHIPPING CONTAINERS

IN CIUDAD JUAREZ, MEXICO

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