

Innovating Affordable Shipping Container Housing in Mexico

Solutions to the Problem

**Students: Shreyas Dole, Ruth Droescher, Harry Michael, Brett Monroe, Sumayya Nikhat,
Maribel Valdez, Aubrey Vander Heydem, Jacqueline Villa, Allisyn Williams**

Faculty Advisors: Blake Davis and Michael Glynn

Problem

Juarez, Mexico

- Over 3000 *maquiladoras*
A factory that imports materials and equipment on a **duty-free** and **tariff-free** basis for assembly or manufacturing and then re-exports the assembled product, usually back to the originating country.
- 40% in poverty
- \$1 to \$ 2.30 an hour
- Growing abundance of empty shipping containers stored in United States due to trade imbalance
- **Lack of affordable housing**



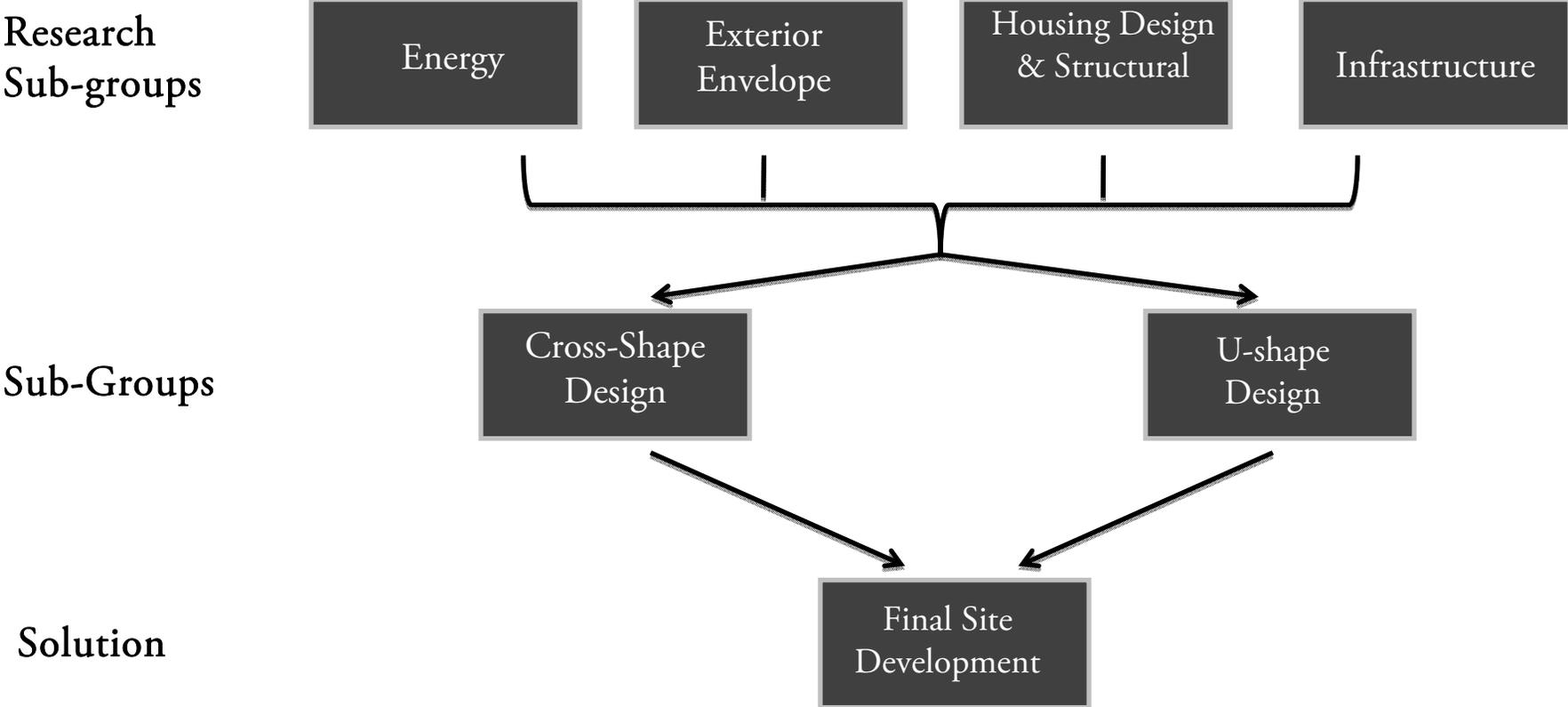
Goals and Objectives

- Create a safe and pleasant community.
- Improve the standard of living of *maquiladoras* workers in Ciudad Juárez by providing an affordable and desirable housing.
- Provide dignity and choice to residents of the community.
- 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 semester.
- Provide comfortable living spaces that protect the inhabitants from the harsh environment.



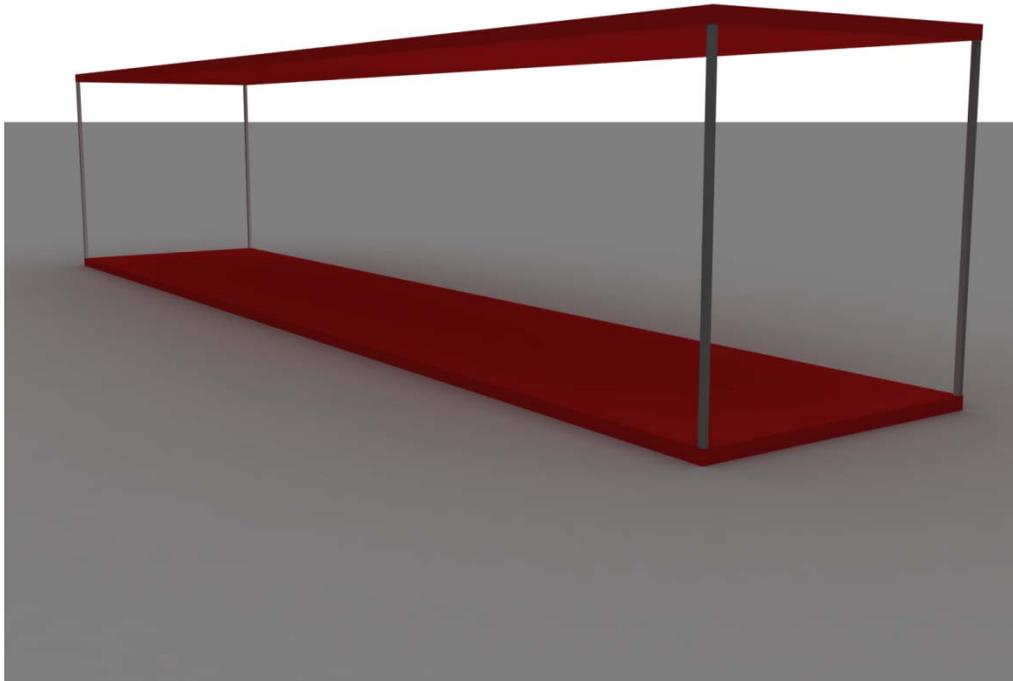
Methodology

Juarez, Mexico



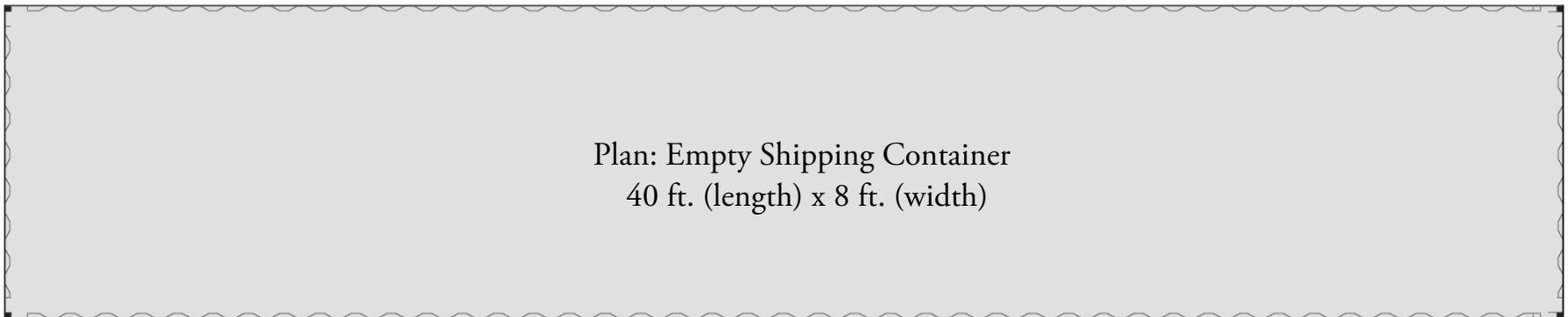
Single Unit Floor Plan

Juarez, Mexico



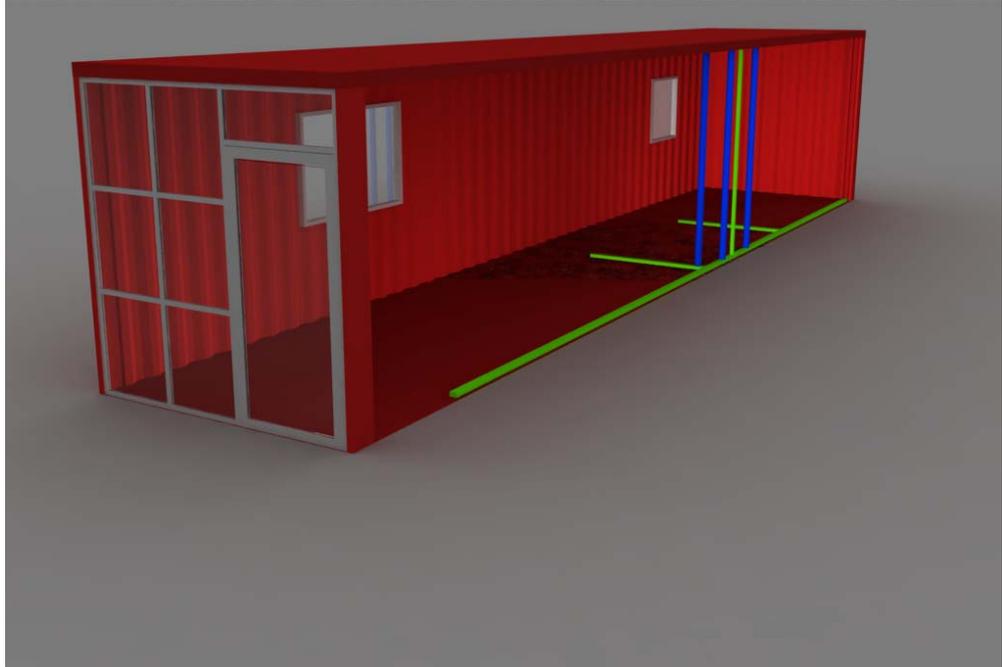
COST

Empty Container	\$1,500.00
Shipping	500.00



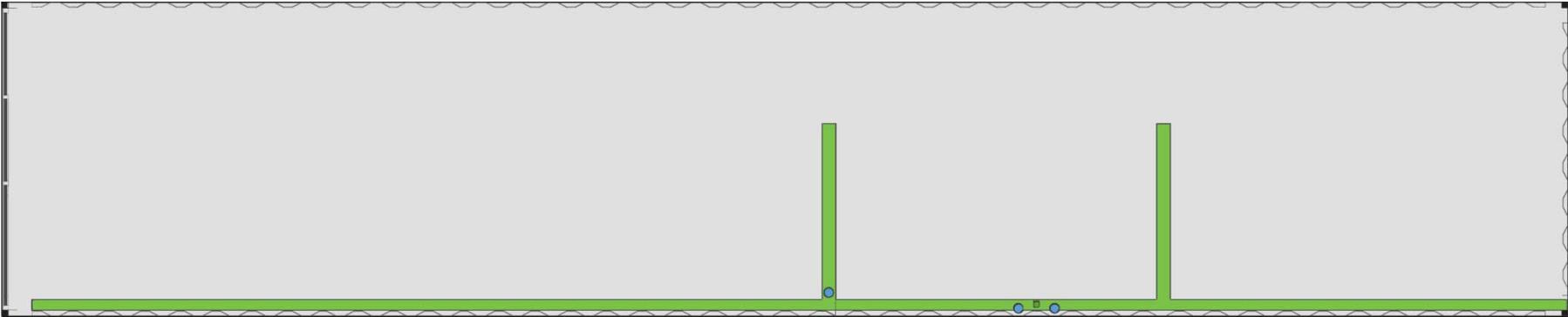
Single Unit Floor Plan

Juarez, Mexico



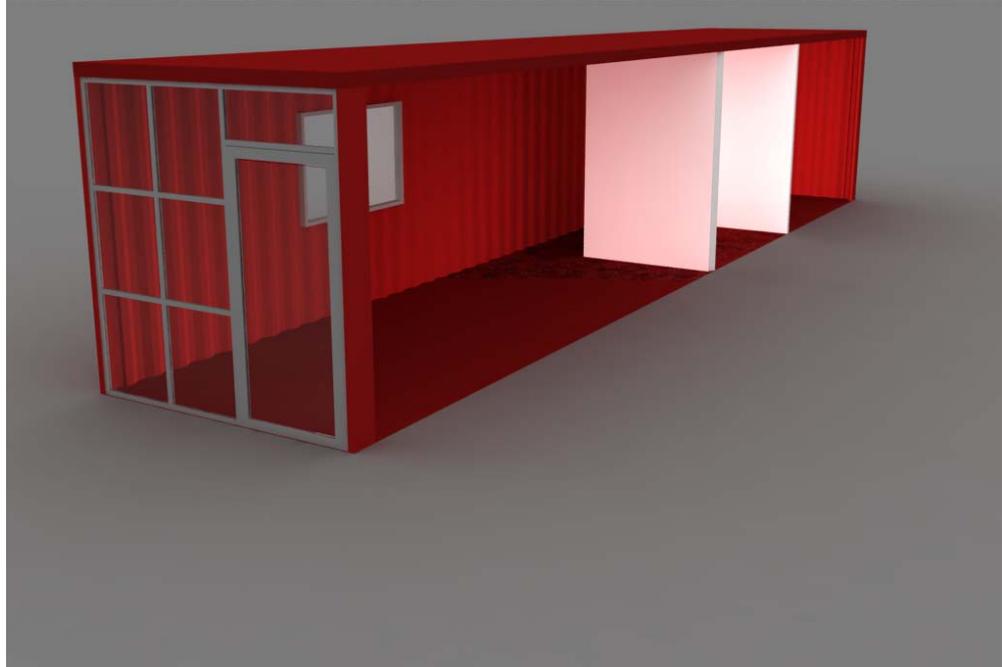
COST	
General Plumbing	\$432.23
General Electrical	620.07

-  Electrical Runs
-  Plumbing Runs



Single Unit Floor Plan

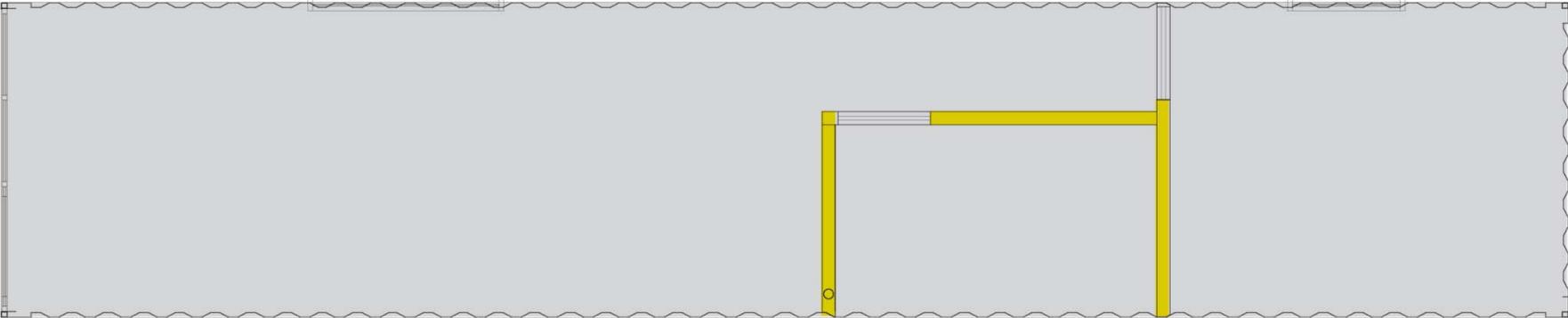
Juarez, Mexico



COST

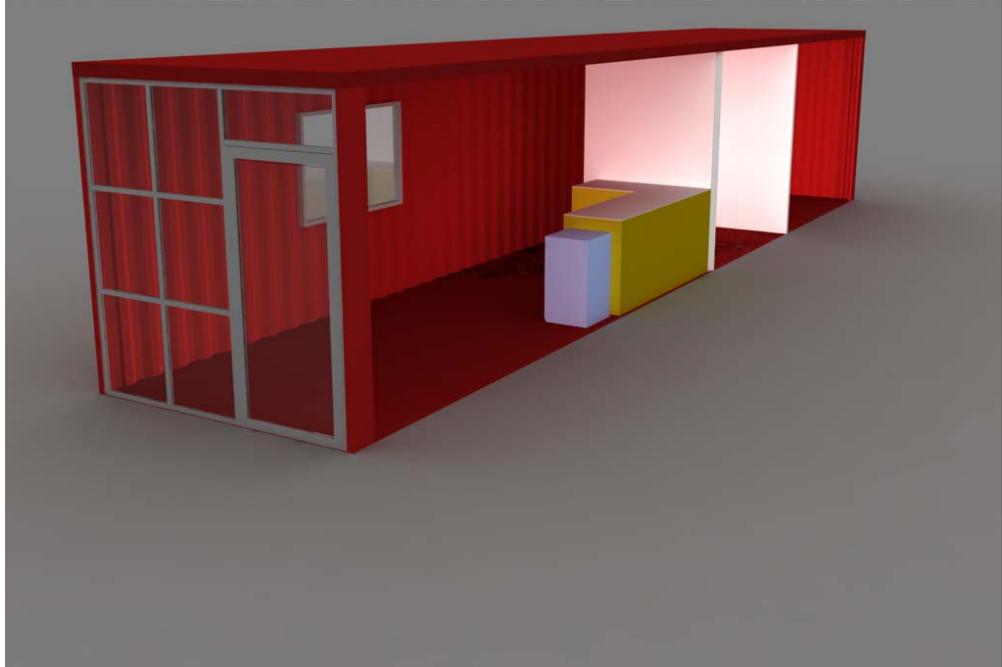
Interior Walls	\$165.00
Insulation/Sound Proofing	594.00
Exterior Cladding	918.00

 Interior Walls

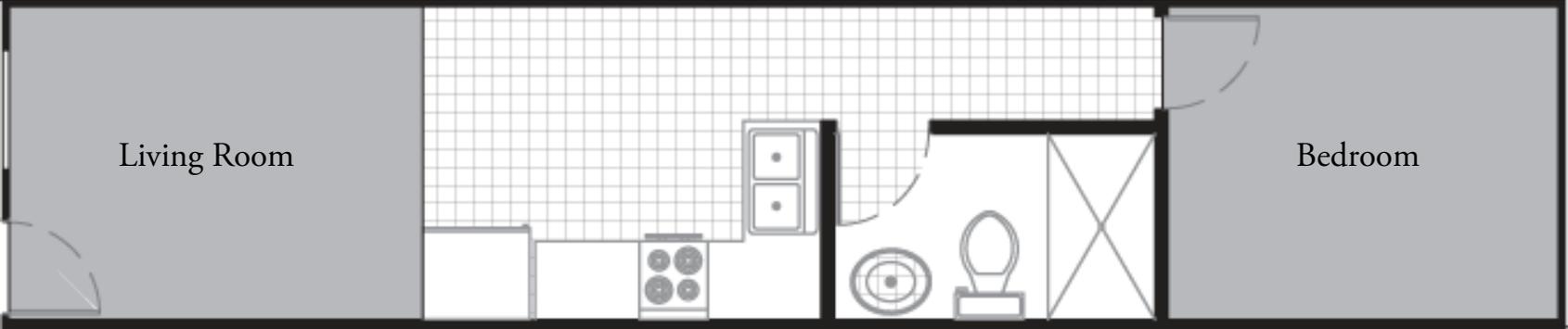


Single Unit Floor Plan

Juarez, Mexico

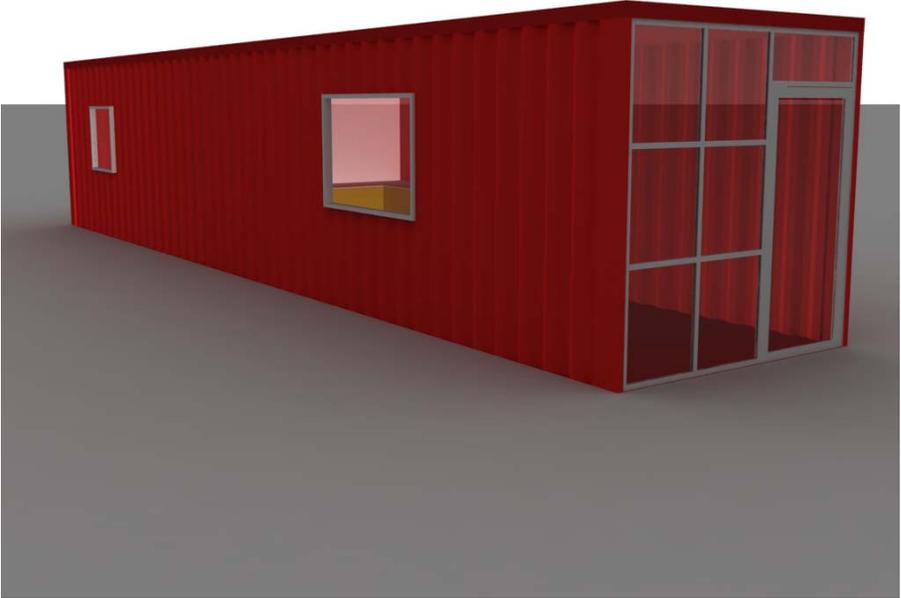
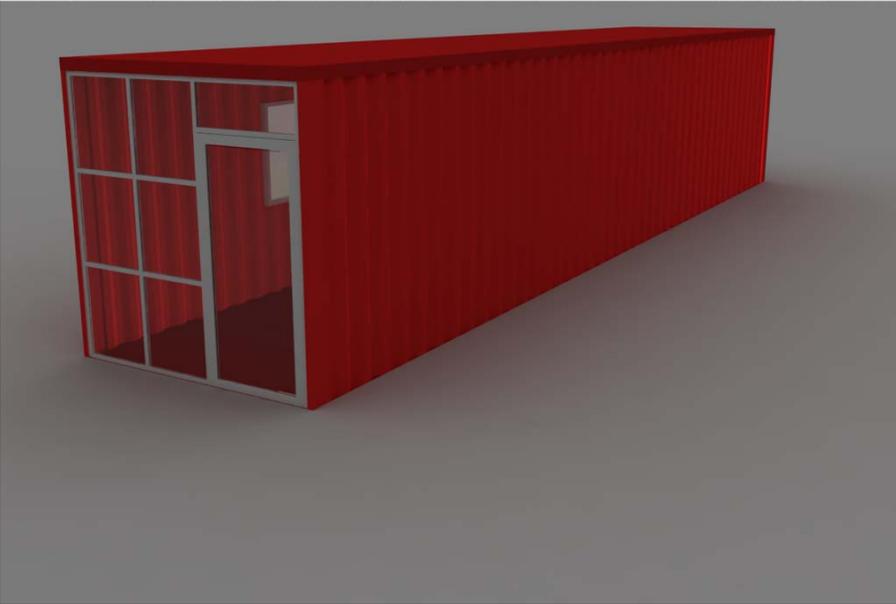


	COST
Windows/Doors	\$315.00
Kitchen	580.00
Bathroom	390.00
HVAC	300.00
Flooring	137.20



Single Unit Floor Plan

Juarez, Mexico



10% Contingency, Labor, Infrastructure, and Land Cost

\$2,397.65

Cost Analysis

Juarez, Mexico

IPRO 339B - Cost Analysis - Single Width Unit Type

26-Jul-08

Container Size: 40 ft. x 8 ft. x 8.5 ft. (height)

	Qty. / Unit	Material Cost	Unit Cost
<u>Hard Cost</u>			
Container	1	\$1,400.00	\$1,400.00
Window Unit Type A	1	\$48.00	\$48.00
Window Unit Type B	1	\$52.00	\$52.00
Entry Door & Window	1	\$125.00	\$125.00
Interior Door	2	\$45.00	\$90.00
Prefabricated Shower Unit	1	\$200.00	\$200.00
Shower Valve	1	\$75.00	\$75.00
Water Closet	1	\$80.00	\$80.00
Bath Sink & Faucet	1	\$75.00	\$75.00
Kitchen Sink	1	\$25.00	\$25.00
Kitchen Sink Faucet	1	\$25.00	\$25.00
Laminated Countertop - Bath (by linear foot)	3	\$15.00	\$45.00
Laminated Countertop - Kitchen (by linear foot)	10	\$15.00	\$150.00
Wire Shelving - Bedroom (by linear foot)	8	\$1.20	\$9.60
Wire Shelving - Storage (by linear foot)	22	\$1.20	\$26.40
Light Fixtures (per unit cost)	3	\$32.00	\$96.00
Refrigerator (Half Size)	1	\$100.00	\$100.00
Electric Cooktop & Range	1	\$250.00	\$250.00
Kitchen / Bath Exhaust Fans	2	\$30.00	\$60.00
HVAC Unit	1	\$300.00	\$300.00
Electrical Outlets / Switches (per unit cost)	10	\$30.00	\$300.00
Electrical Conduit (by linear foot)	70	\$1.90	\$133.00
Interior Walls (by linear foot)	30	\$5.50	\$165.00
Bathroom Subfloor	1	\$65.00	\$65.00
Plumbing - Rough In	1	\$100.00	\$100.00
Vinyl Flooring - Bathroom	1	\$80.00	\$80.00
Refinish Wood Flooring (by square foot)	280	\$0.50	\$140.00
Furniture	1	\$250.00	\$250.00
Insulation / Soundproofing	1	\$594.00	\$594.00
Strawbale / Stucco Exterior Wall Finish	1	\$918.00	\$918.00
<u>Logistics and Labor</u>			
Container - Shipping Cost	1	\$250.00	\$250.00
Crane Operation - Container Installation	1	\$35.00	\$35.00
Factory Labor	1	\$450.00	\$450.00
Onsite Labor	1	\$210.00	\$210.00
<u>Shared Infrastructure & Land Costs</u>			
Concrete Footings / Foundations	0.0417	\$1,750.00	\$72.98
Domestic Water Heating Plant	0.0417	\$4,250.00	\$177.23
Electrical Distribution System	0.0417	\$2,100.00	\$87.57
Land Cost (\$16,000 / acre)(60 d.u./ acre)	0.017	\$16,000.00	\$272.00
Stairs, Landings & Railings	0.0417	\$9,500.00	\$396.15
Green Roofing / Single Ply Roofing	0.0417	\$2,800.00	\$116.76

Total Cost Estimate \$8,044.68

Sales Price (Includes Total Cost + 10% Contingency) **\$8,849.15**

IPRO 339 B

July 26, 2008

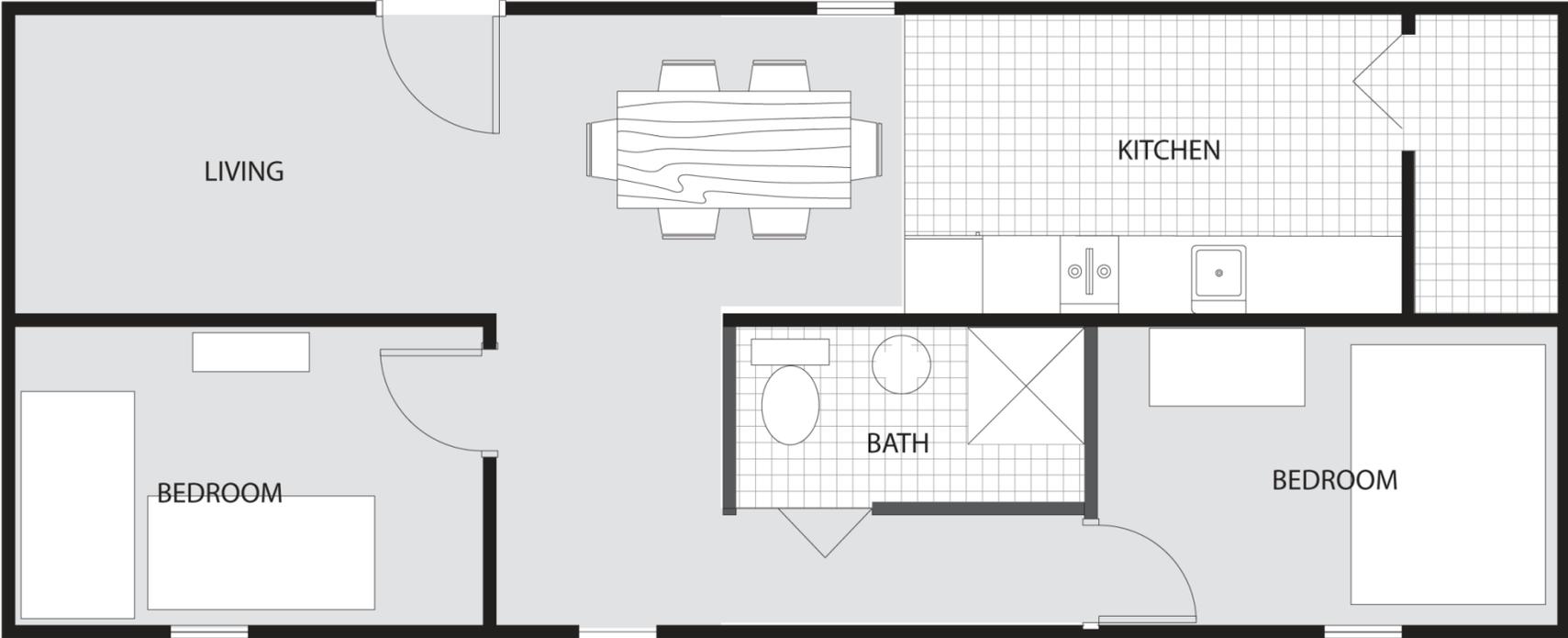
Double Unit Floor Plan

Juarez, Mexico



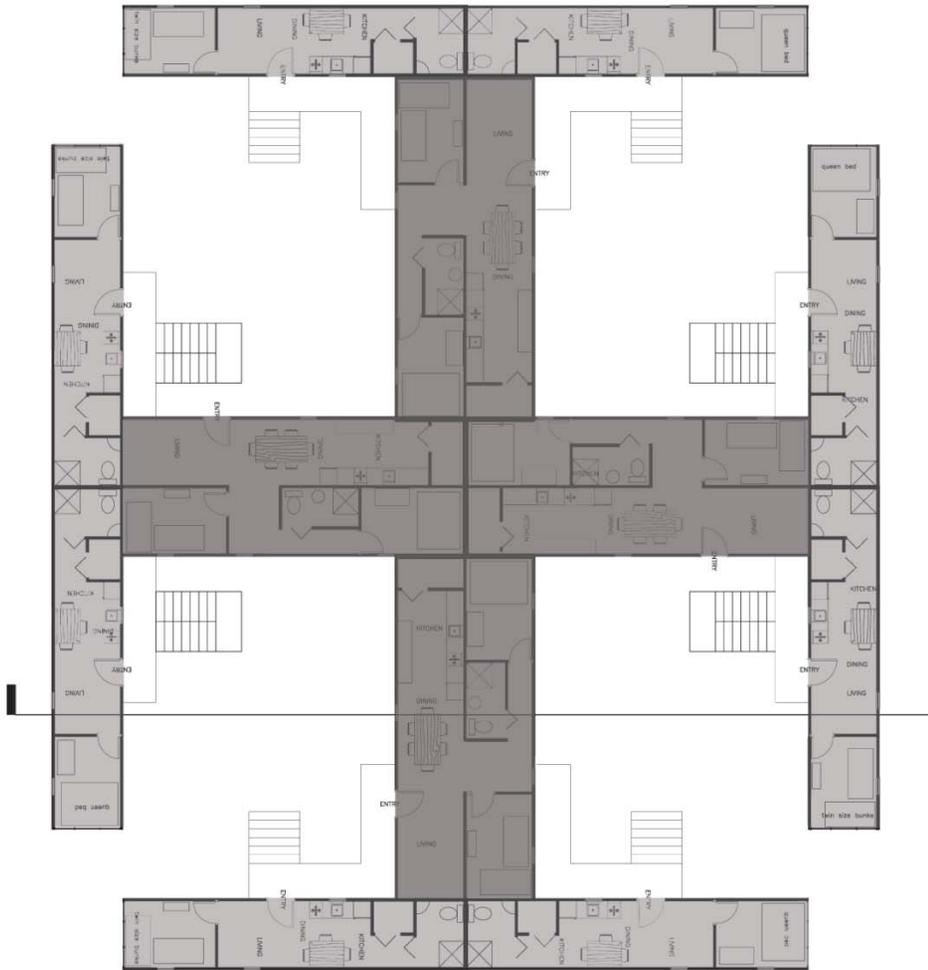
Double Unit Floor Plan

Juarez, Mexico

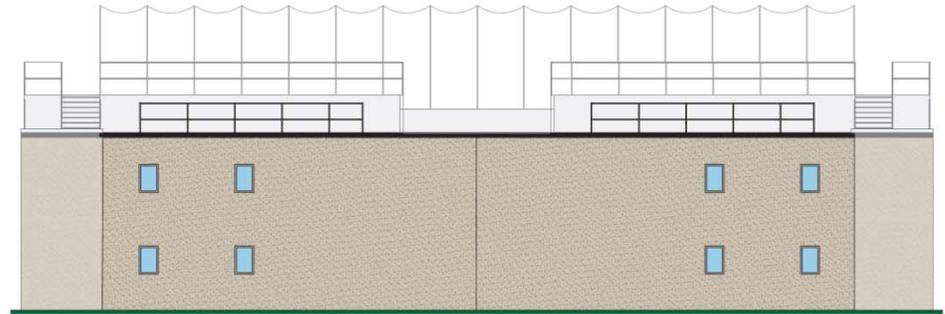


Cross Plans

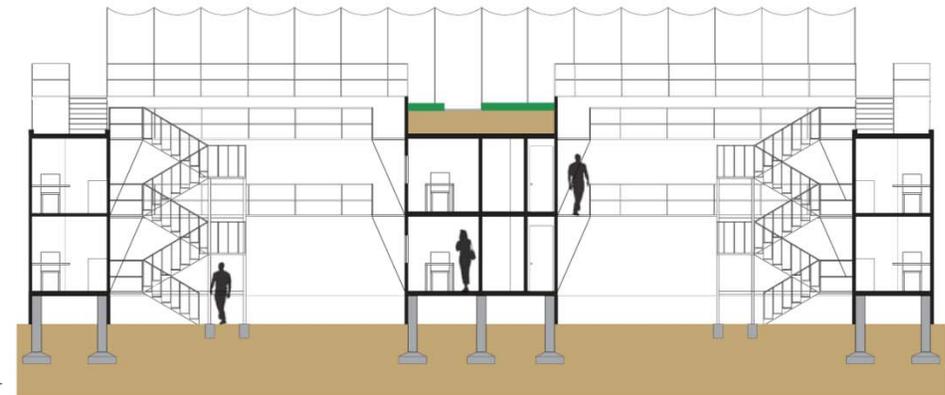
Juarez, Mexico



PLAN



ELEVATION



SECTION

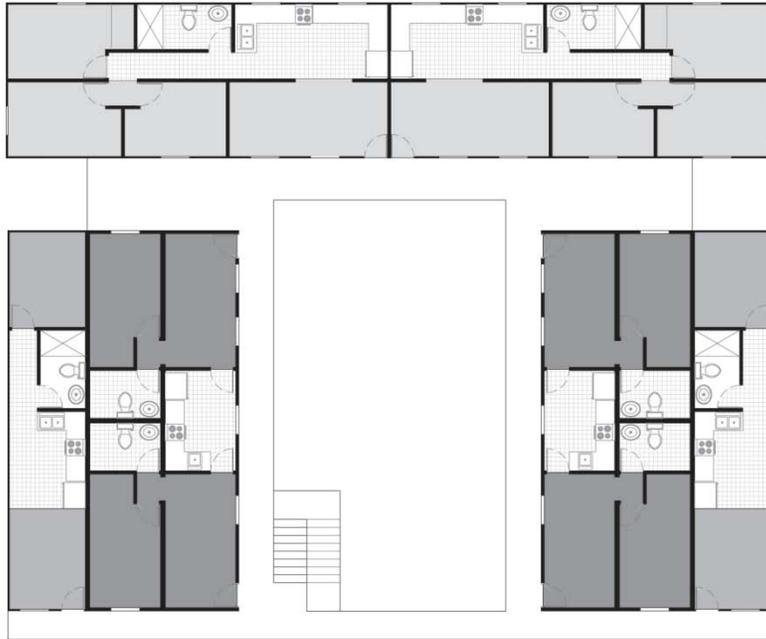


Features

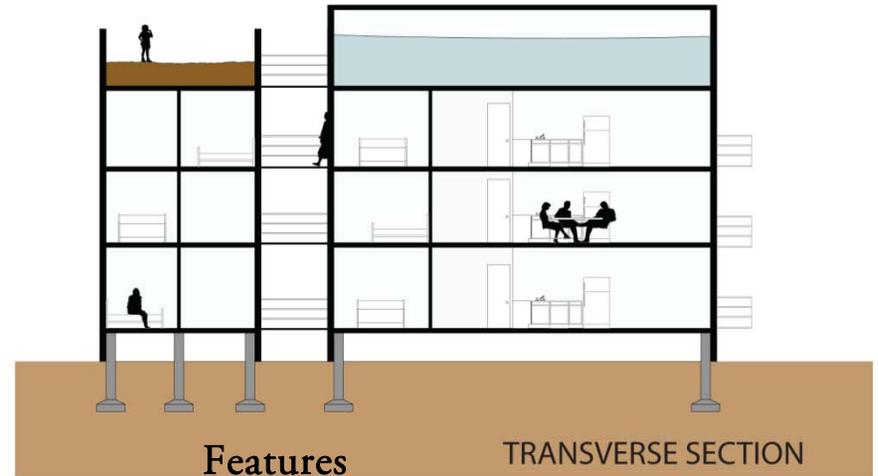
- Four Gardens
- Roof Gardens
- Private Space/Natural Ventilation

U-Shaped Plans

Juarez, Mexico



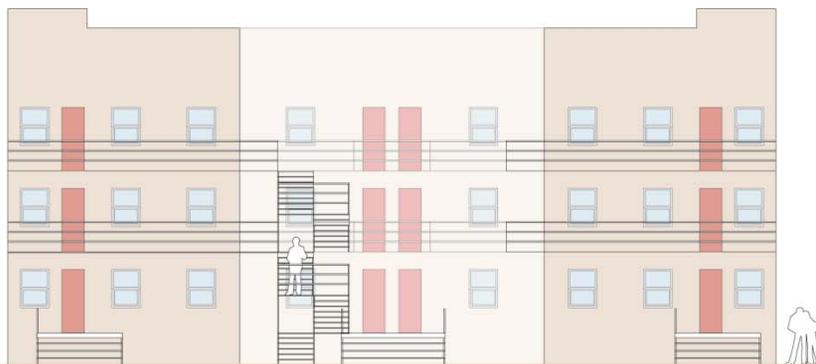
TYPICAL FLOOR PLAN



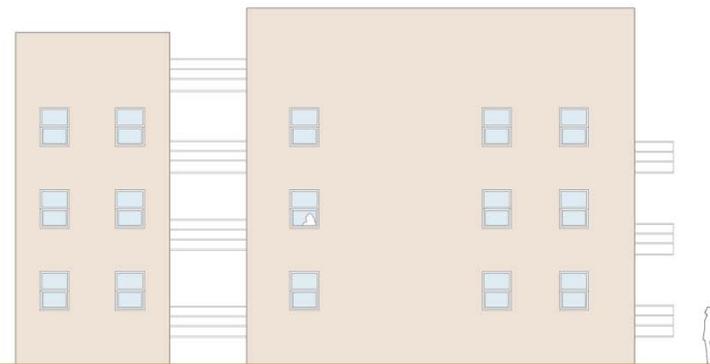
Features

TRANSVERSE SECTION

- Common Entrance
- Shared Courtyard
- Roof Garden and Grey Water Storage



SOUTH ELEVATION



WEST ELEVATION

Site Plan

Juarez, Mexico

PROPOSED SITE (occupancy statistics):

Lot size :	150m x 150m	= 5.6 acres
SINGLE UNITS :	148	= 222 occupants
DOUBLE UNITS :	104	= 520 occupants
SINGLE UNITS :	84	= 126 occupants
W/ SHARED KITCHEN		
Total Units	336	= 868 occupants

DENSITY = $\frac{336 \text{ Dwelling Units}}{5.6 \text{ acres}}$
 = 60 d.u./acre

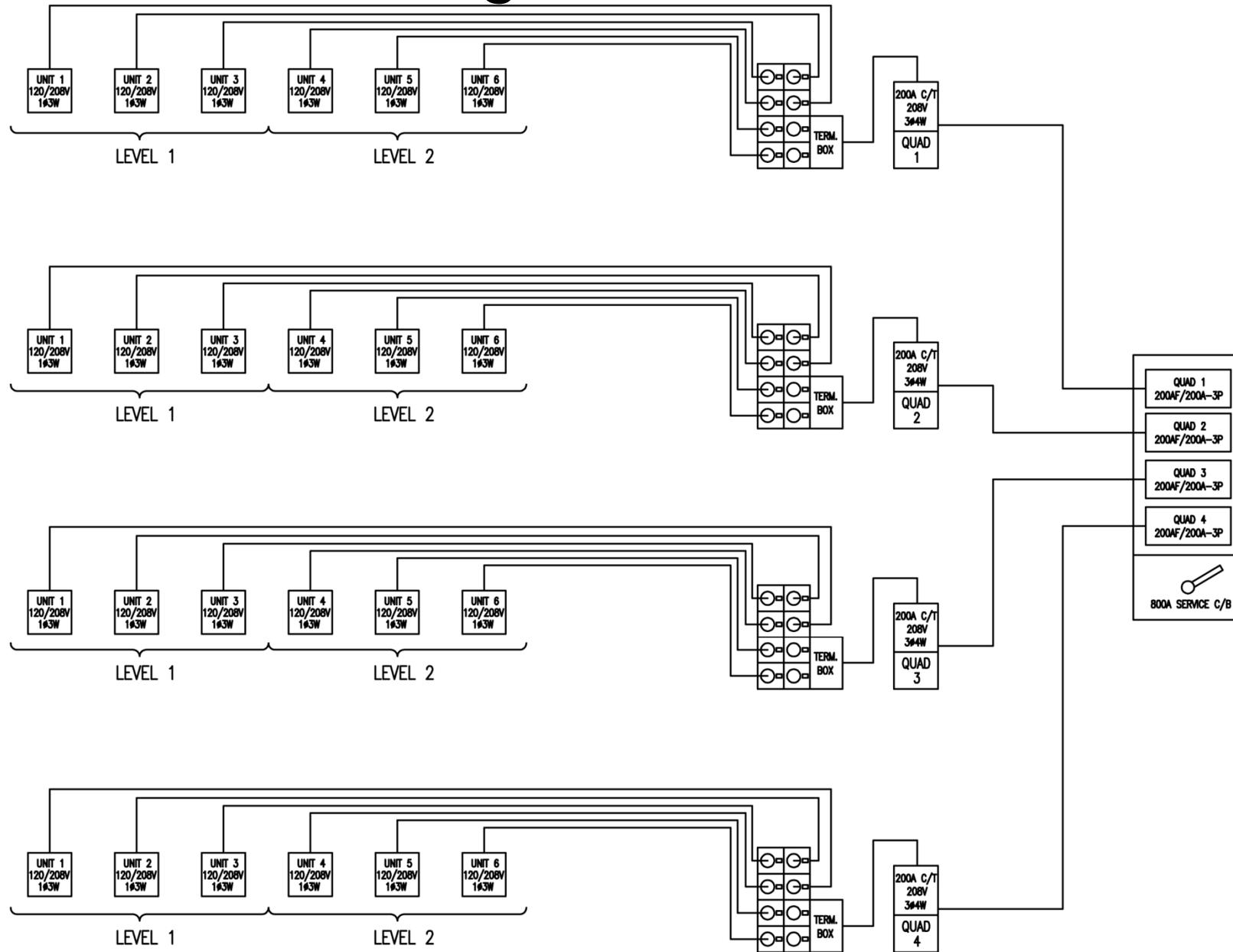


- SINGLE UNIT
- SINGLE W/ SHARED KITCH
- DOUBLE UNIT
- MULTIPURPOSE SPACE



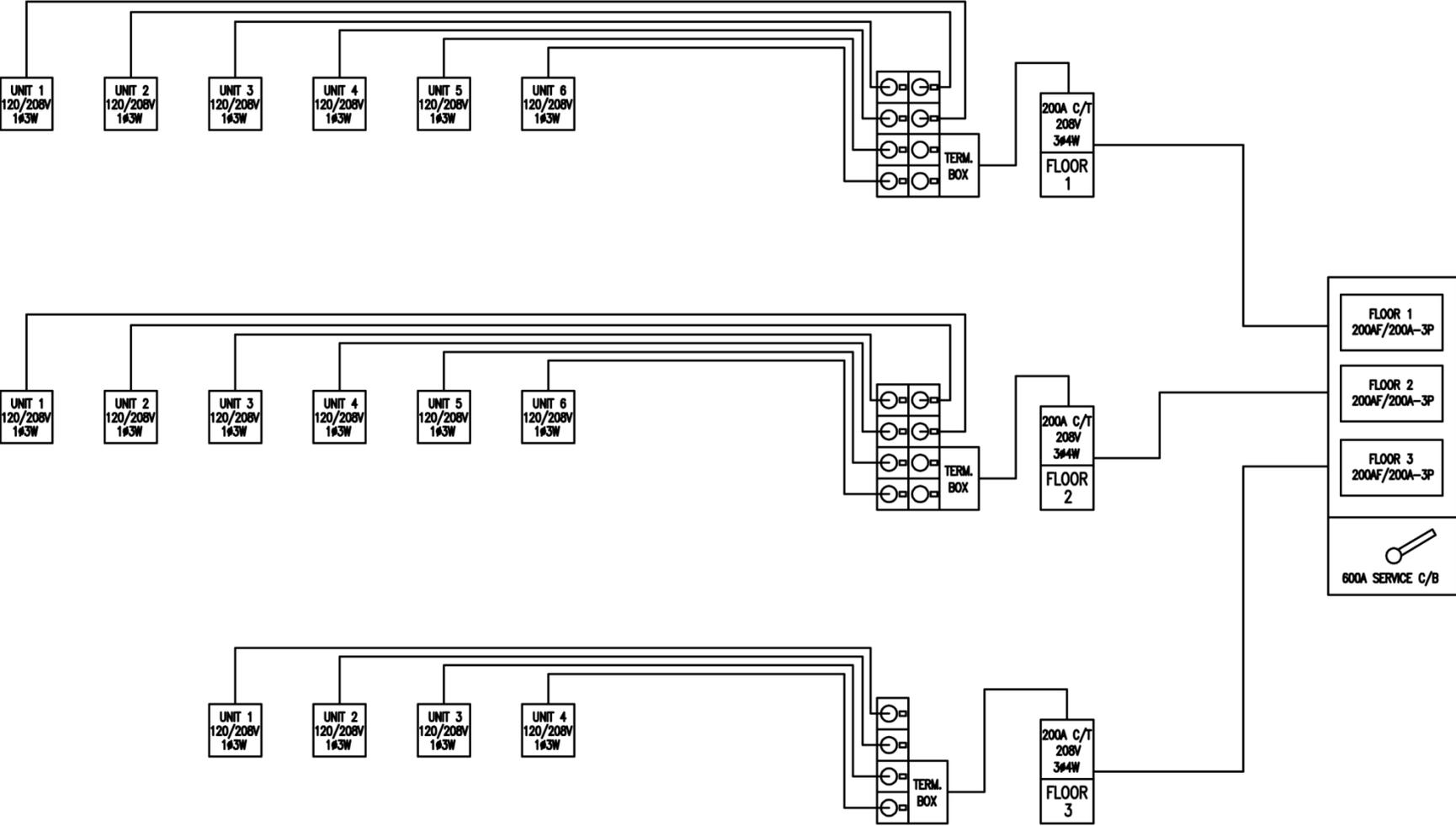
Electrical Riser Diagram

Juarez, Mexico

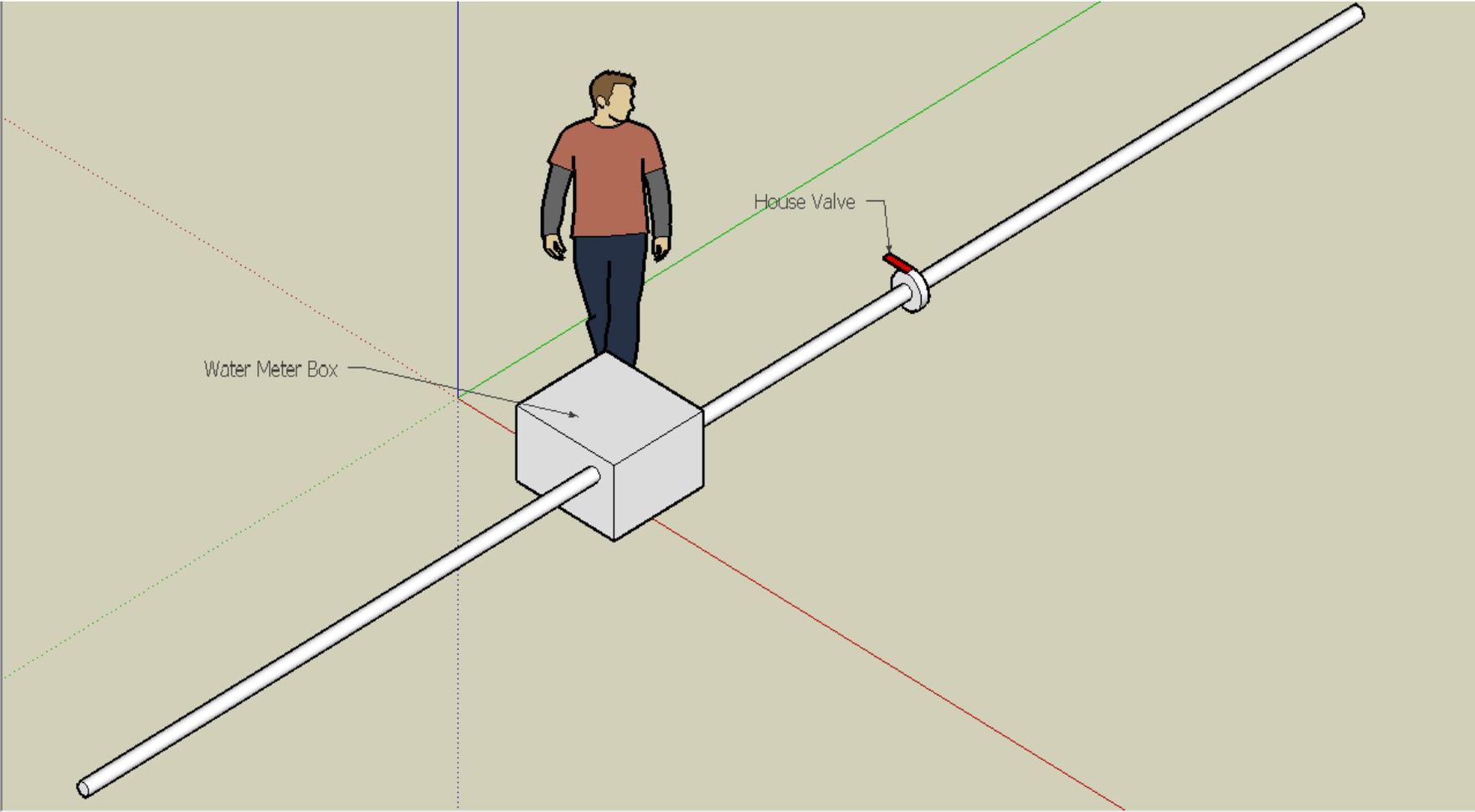


Electrical Riser Diagram

Juarez, Mexico



Plumbing - Water Distribution

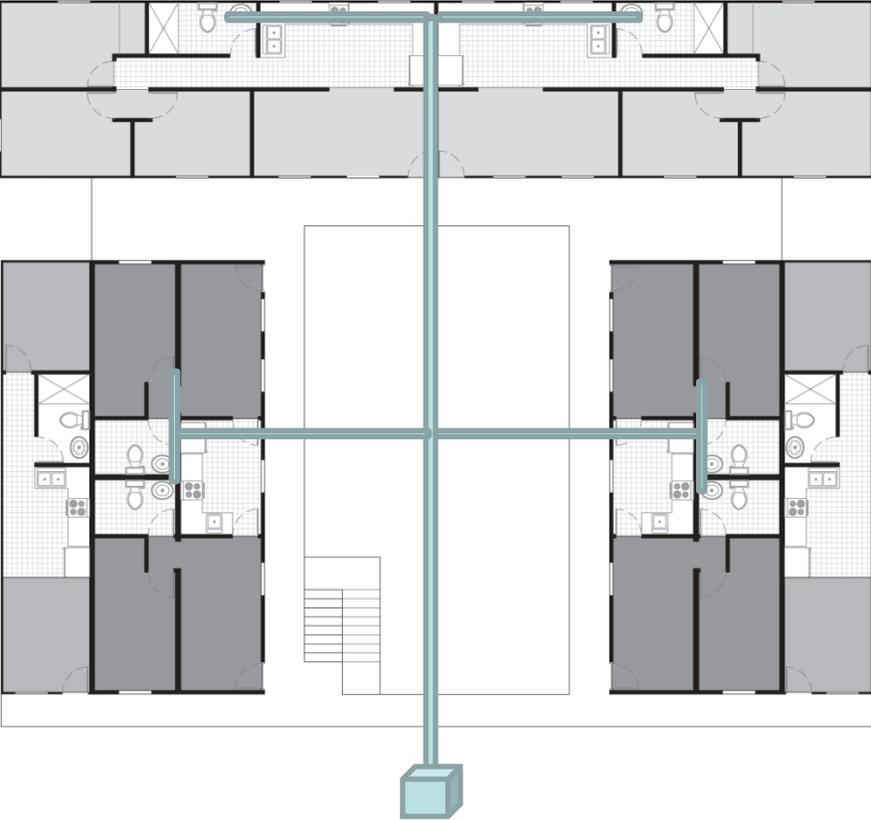


Connection to
Municipal Water Supply

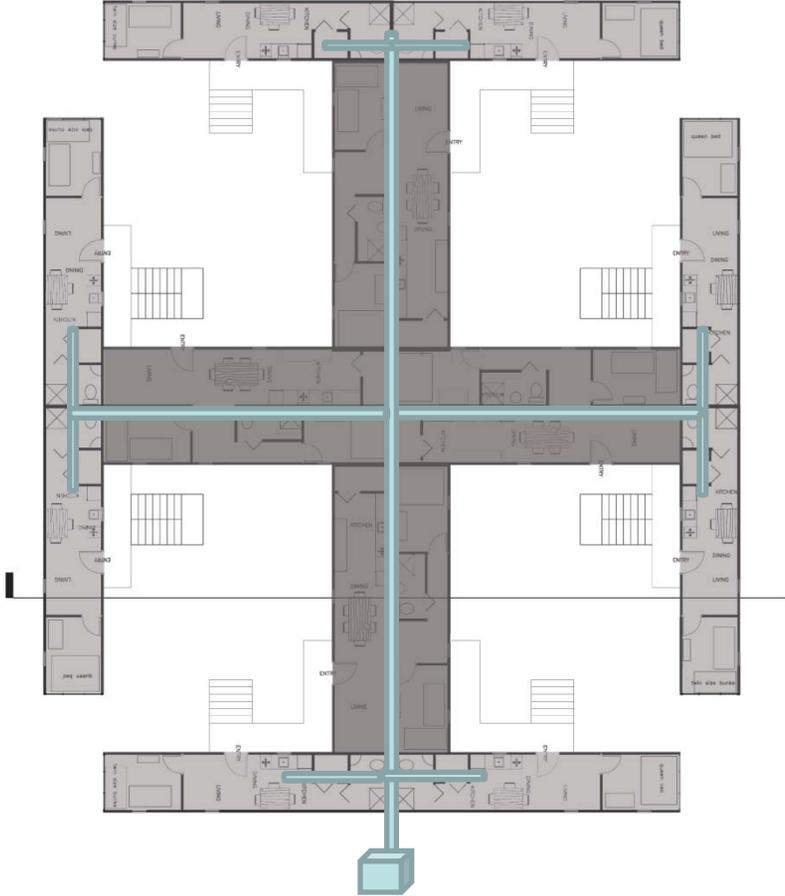
Plumbing - Water Distribution

Juarez, Mexico

U-Shape Plan



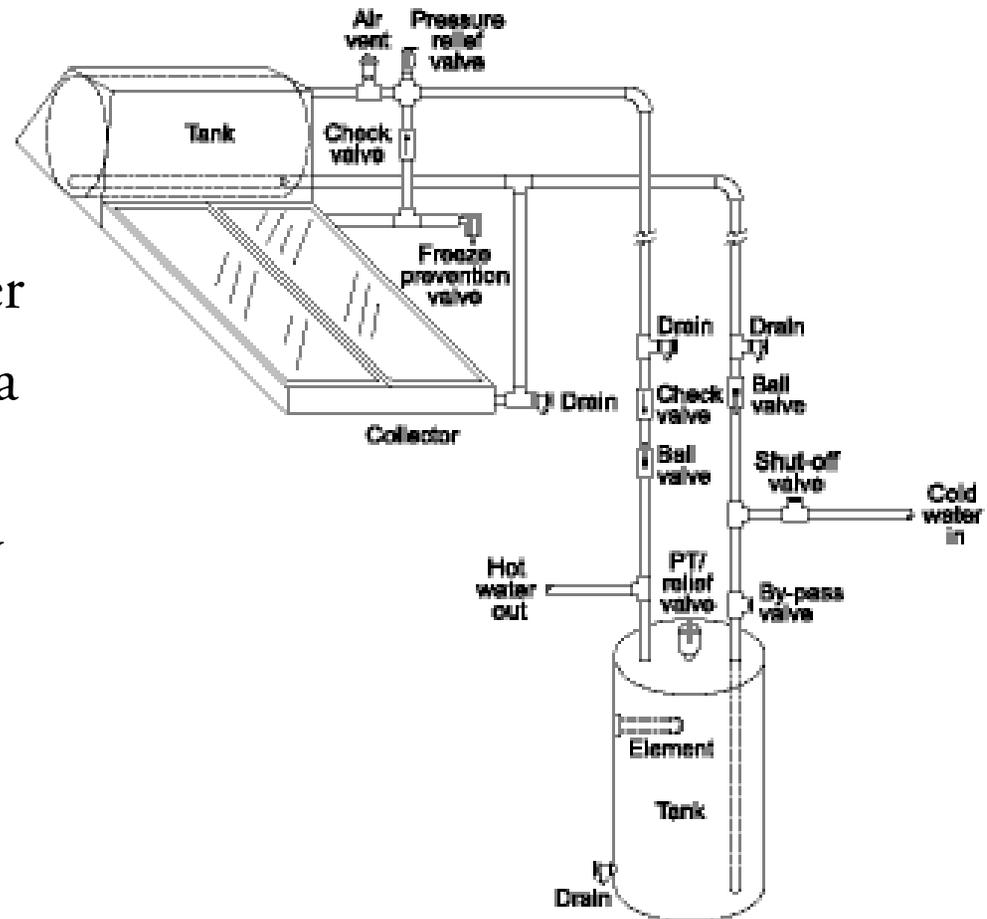
Cross Plan



Plumbing - Water Heating

Juarez, Mexico

- Tank uses solar heated water
- Electric heating element as a back-up system
- 80 gallon water tank supply per 3 units.



Problems Faced

Juarez, Mexico

Problems Solutions

- | | |
|--|--|
| I. Meeting between sub-groups to cross-exchange research. | i. Prepared weekly presentations to facilitate exchange of information. |
| II. Adapting new research ideas to specific apartment complex designs. | ii. Continuously updated presentations to facilitate exchange of new information. |
| III. Communicating highly technical concepts amongst peers of varying disciplines. | iii. Formed into sub-groups that were homogenous mixtures of architects, engineers, etc. |

Social Impact

- Addressing basic housing needs without sacrificing Mexican culture.
- Developing sustainable and affordable housing without debasing future inhabitants.
- Promoting ideal of improved living while disassociating from political implications of *maquiladoras* in Mexican border towns.



Conclusion

- Area of the Housing site:
253,872 ft² (5.8 Acres)
- Total Number of Housing Units:
336 Units
- Total Number of People the Site could house:
868 People
- Density:
294 ft² / Person
- Density / Acre:
60 Units / Acre
- Cost of the completed site:
\$2,973,364.00

(Based on single width unit type)



Questions?

Juarez, Mexico

