

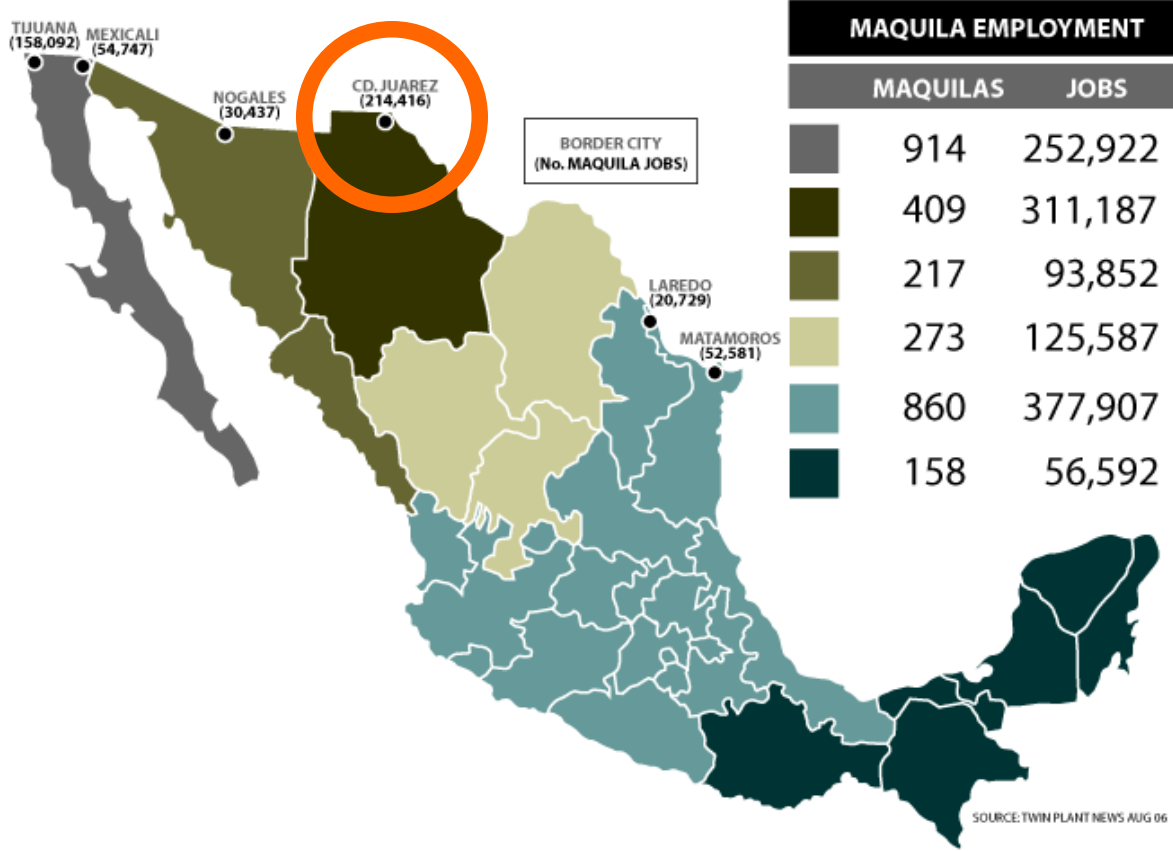
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designing affordable housing out of shipping containers for ciudad juarez, mexico

# maquiladoras + Ciudad Juarez

- over 3000 maquiladoras
- 40% in poverty
- \$1 to \$ 2.30 an hour
- lack of housing and facilities



# shipping containers

- 17 million empty containers worldwide
- 700,000 empty containers in the U.S.
- \$ 900 to ship back an empty container
- standard: 8'-0" x 8'-6" x 40'-0"



# goals + objectives

- improve the standard of living of *maquiladoras* workers in Ciudad Juárez by providing an affordable and desirable housing
- create a safe and pleasant community
- provide dignity and choice to residents of the community
- create a sense of pride and ownership for residents of the community
- provide comfortable living spaces that protect the inhabitants from the harsh environment



# methodology

research sub-groups

site planning  
space planning

structural  
civil  
mechanical/ electrical/ plumbing

sociology  
marketing  
cost analysis

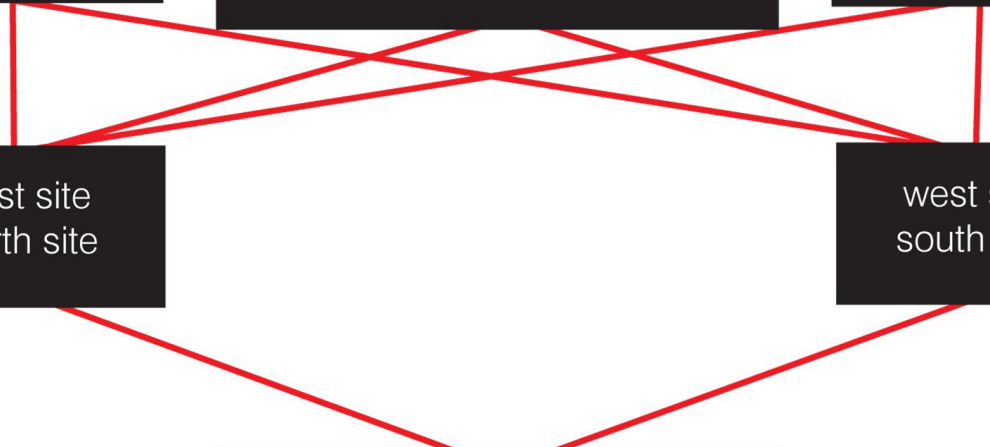
design sub-groups

east site  
north site

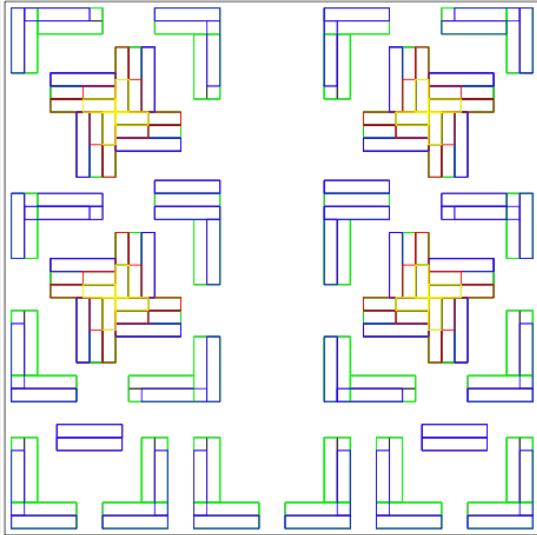
west site  
south site

final solution

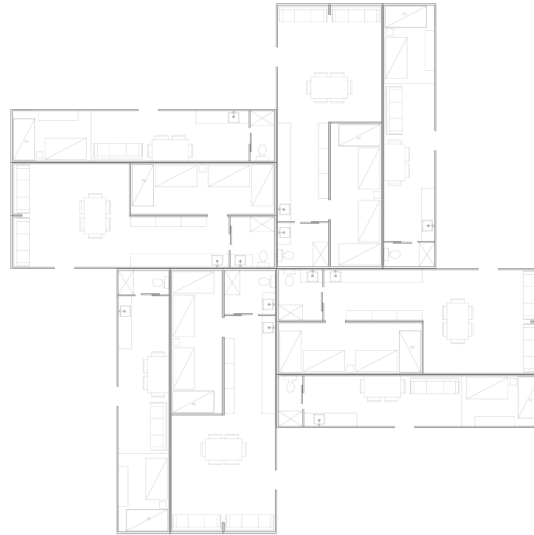
200 m x 300 m site study



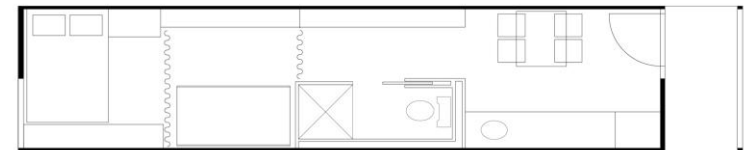
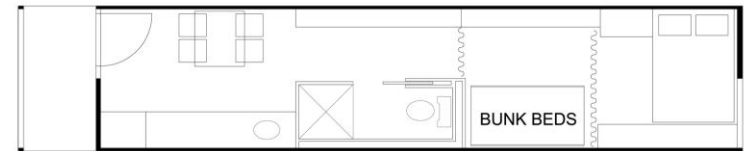
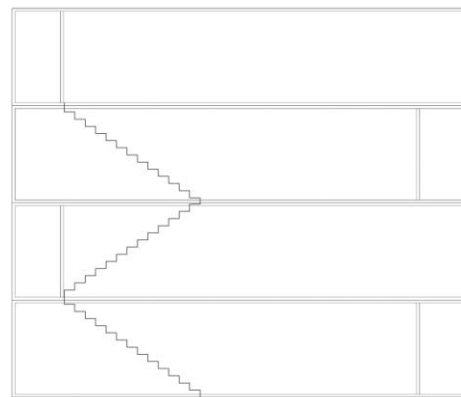
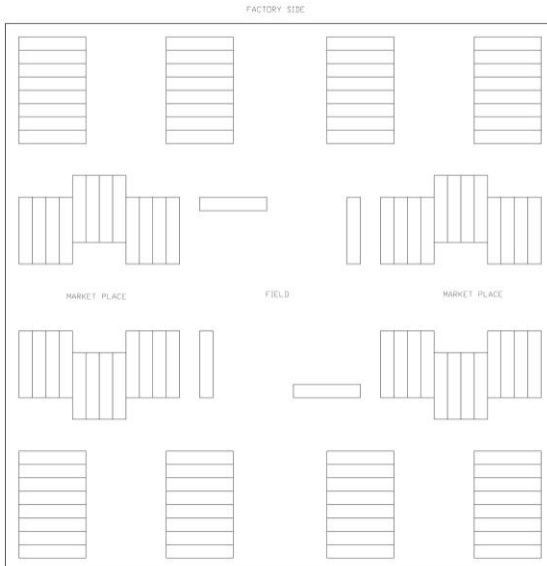
# west + south site studies



West site: 4 unit types, 130 Units. 530 people

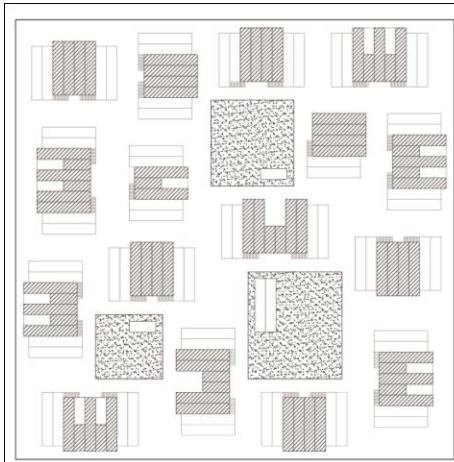


- to create courtyard spaces that would allow each unit to have access to more private outdoor space
- Provide a variety of different sized housing options
- Create an aesthetic that disguises the idea of 'shipping containers'

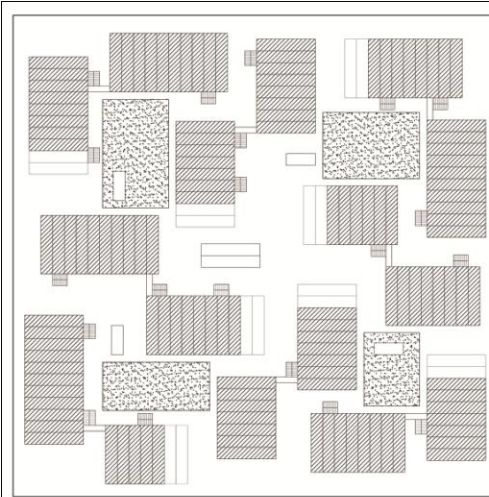


South site: 2 unit types, 352 units, 1408 people

# north + east site studies

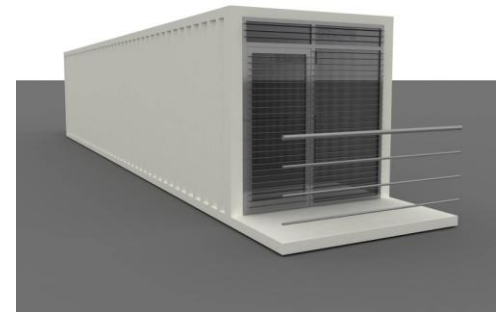


East site: 100m x 100m, 3 unit types,  
111 Units, 555 people, 555 people/ hectare



North site: 100m x 100m, 2 unit types,  
512 units, 2,560 people, 2,560 people / hectare

- Vehicular corridors restrained to site's perimeter
- Security gained by visibility
- Maximum of four containers tall
- Incorporation of potential commercial activity within site
- Adaptability to similar situations around the world
- Accommodation of culture in the physical environment



# final site



Final site: 200m x 300m, 3 unit types,  
1,773 units, 8,865 people, 1,478 people / hectare

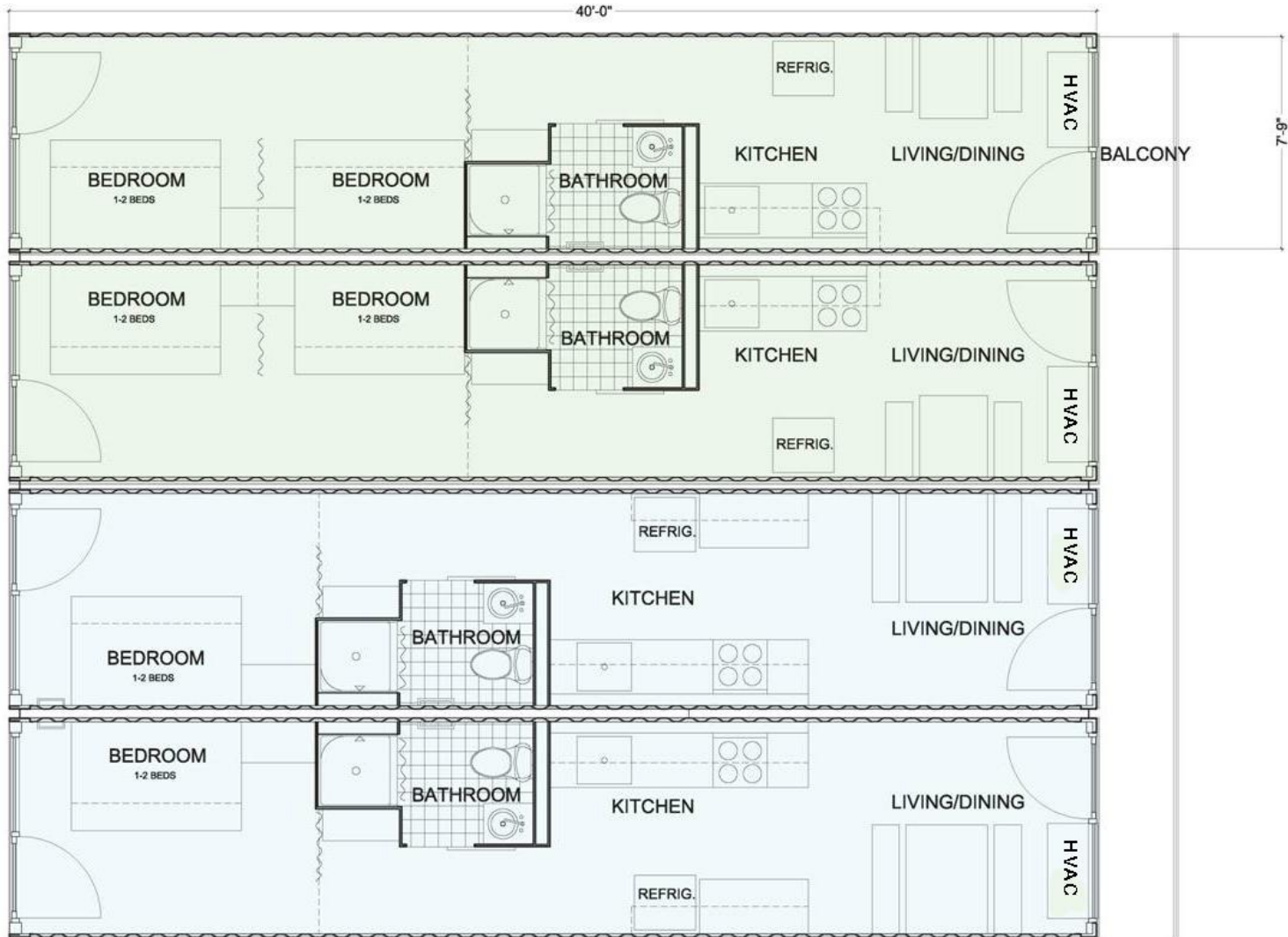




# unit types

## Proposed Unit Plan A

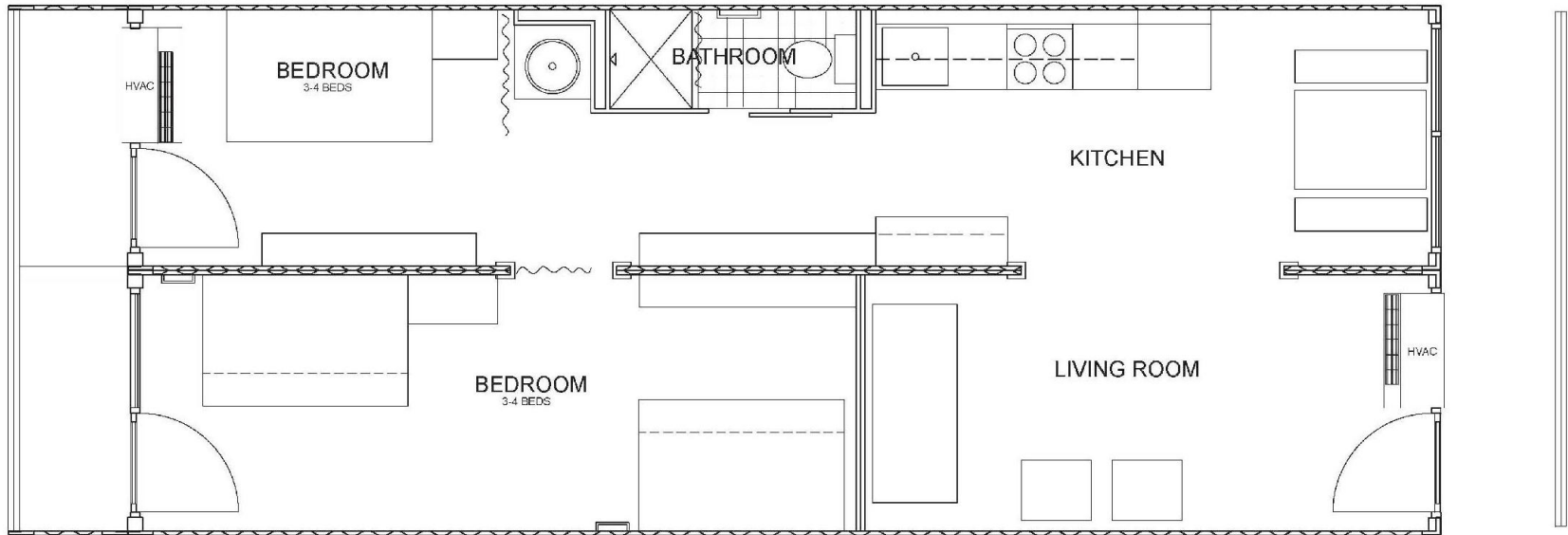
shell: 8 ft. x 40 ft.  
modified shipping  
container



## Proposed Unit Plan B

shell: 8 ft. x 40 ft.  
modified shipping  
container

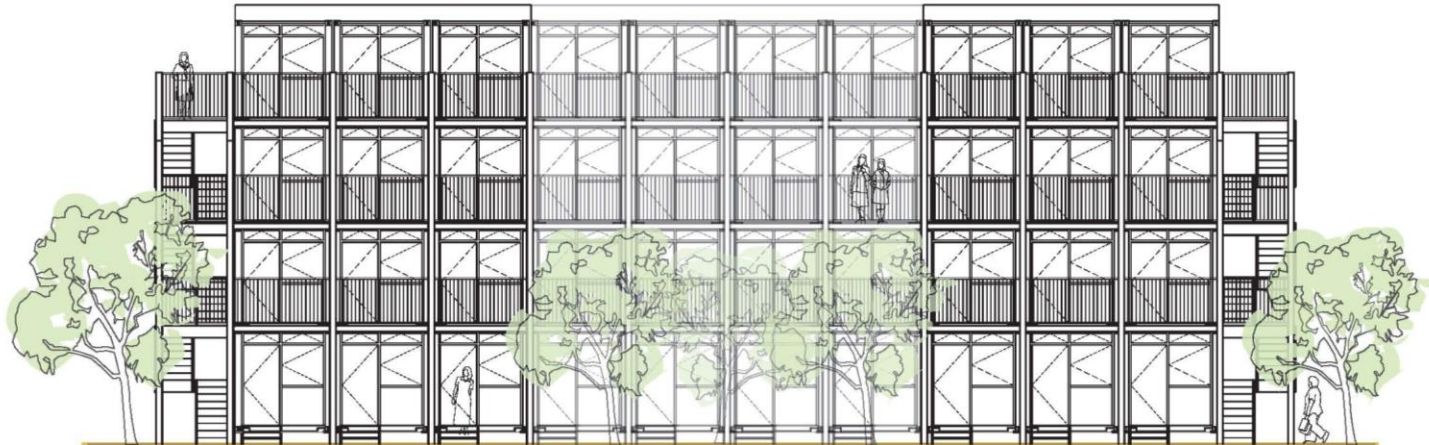
# unit types



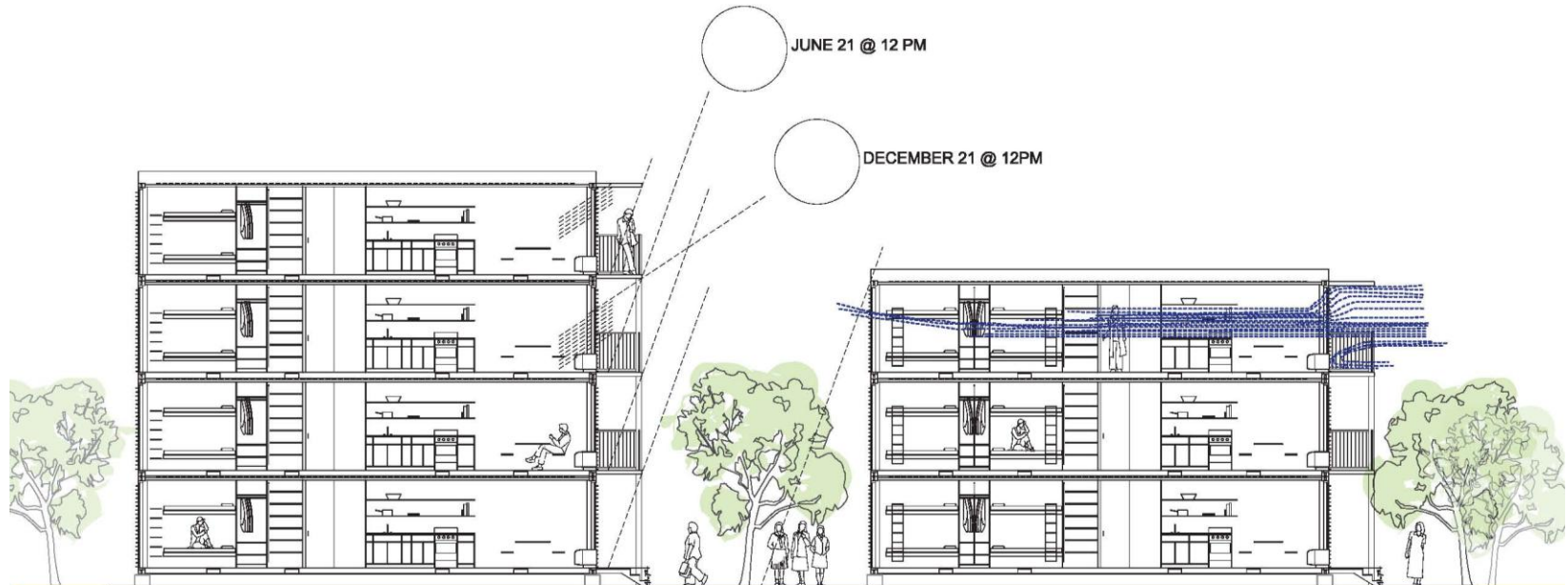
Proposed double-unit plan

shell: 2 - 8 ft. x 40 ft. modified shipping containers

# sections + elevations



Typical Elevation



Typical Section

# initial cost summary

## CATEGORY

## COST

LAND \$2,384,000.00

### HARD COST CONSTRUCTION

Single width units Qty: 1,689 \$13,108,560.00

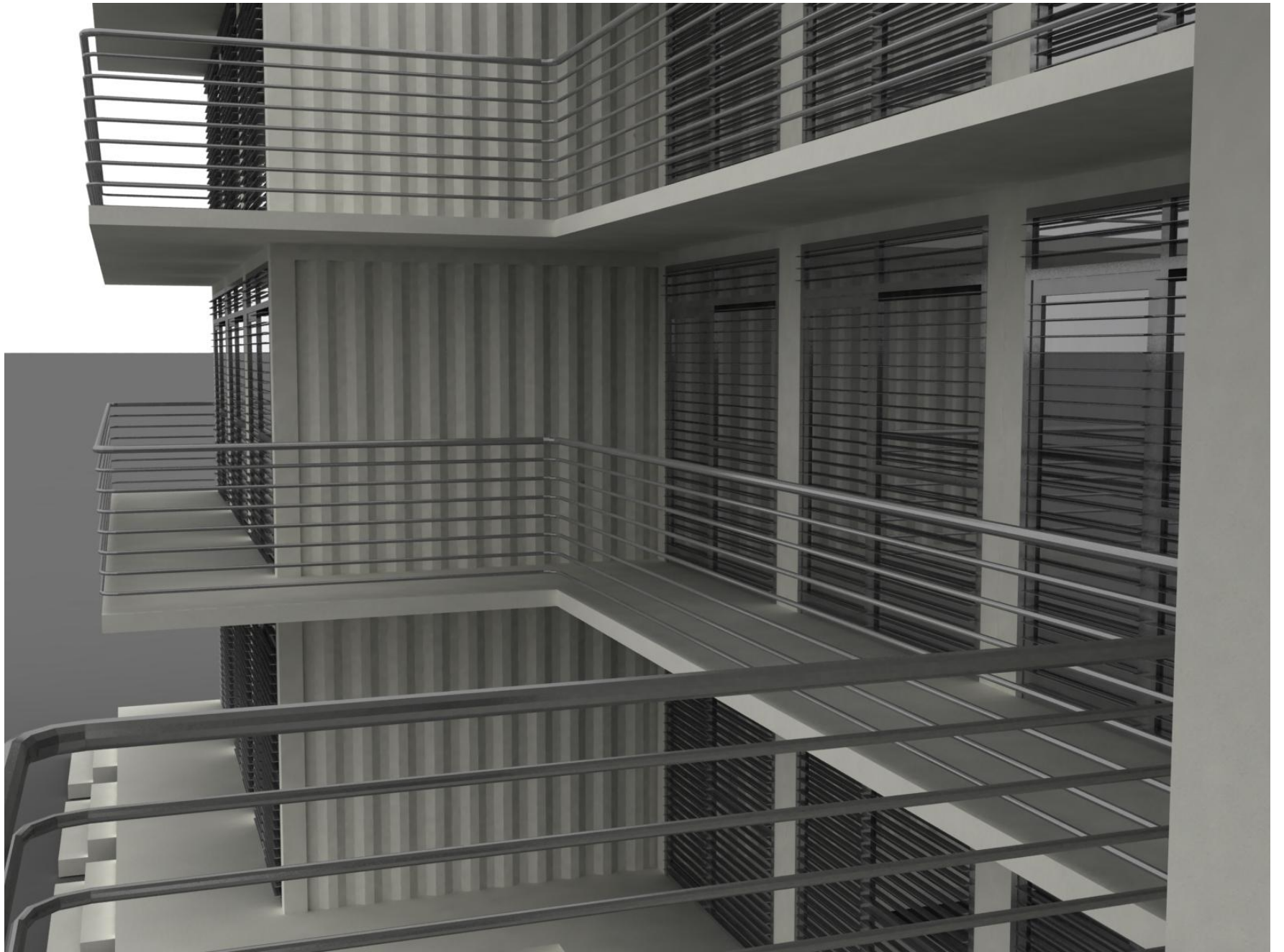
Double width units Qty: 75 \$791,625.00

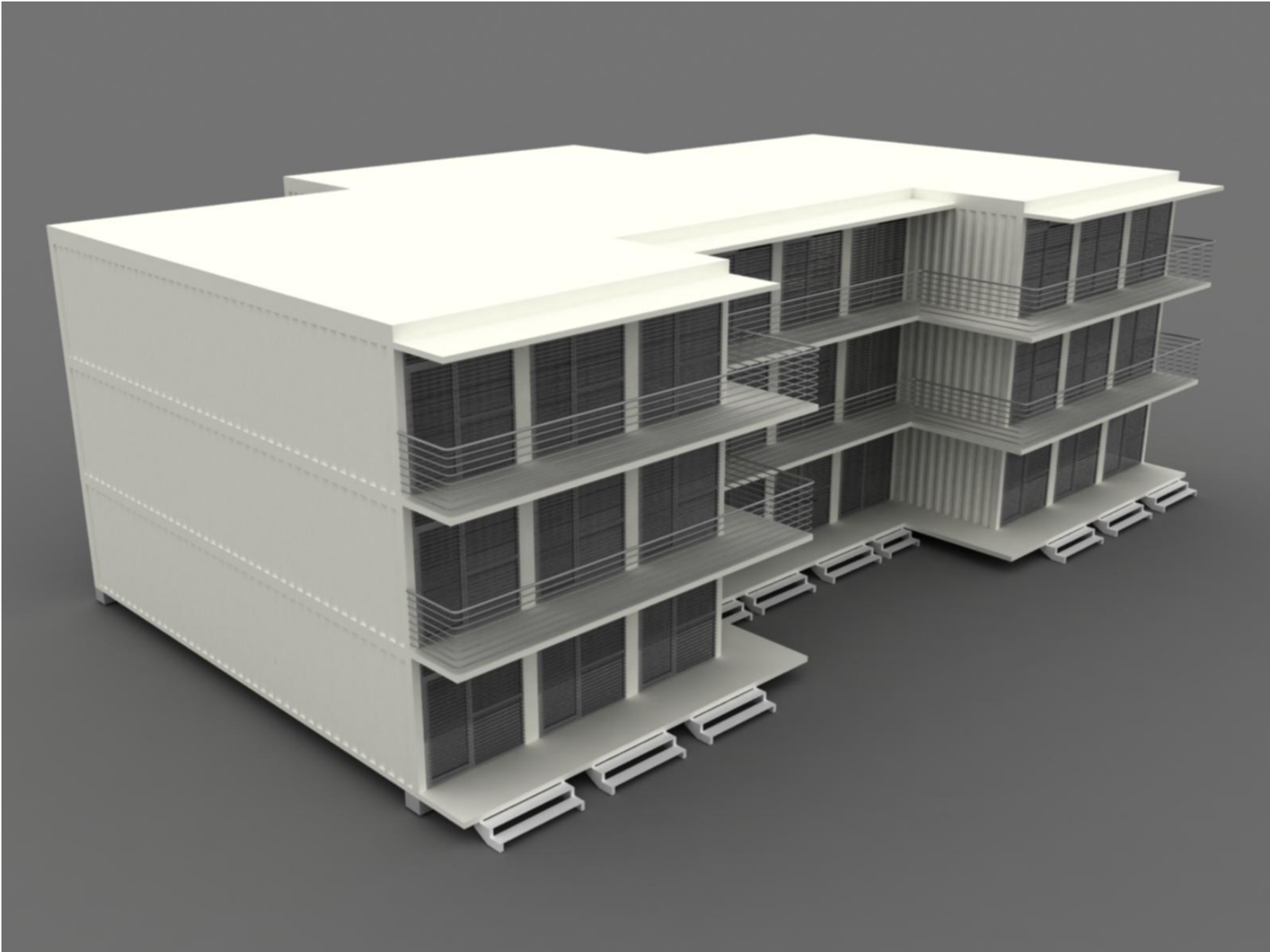
SOFT COSTS \$1,505,390.00

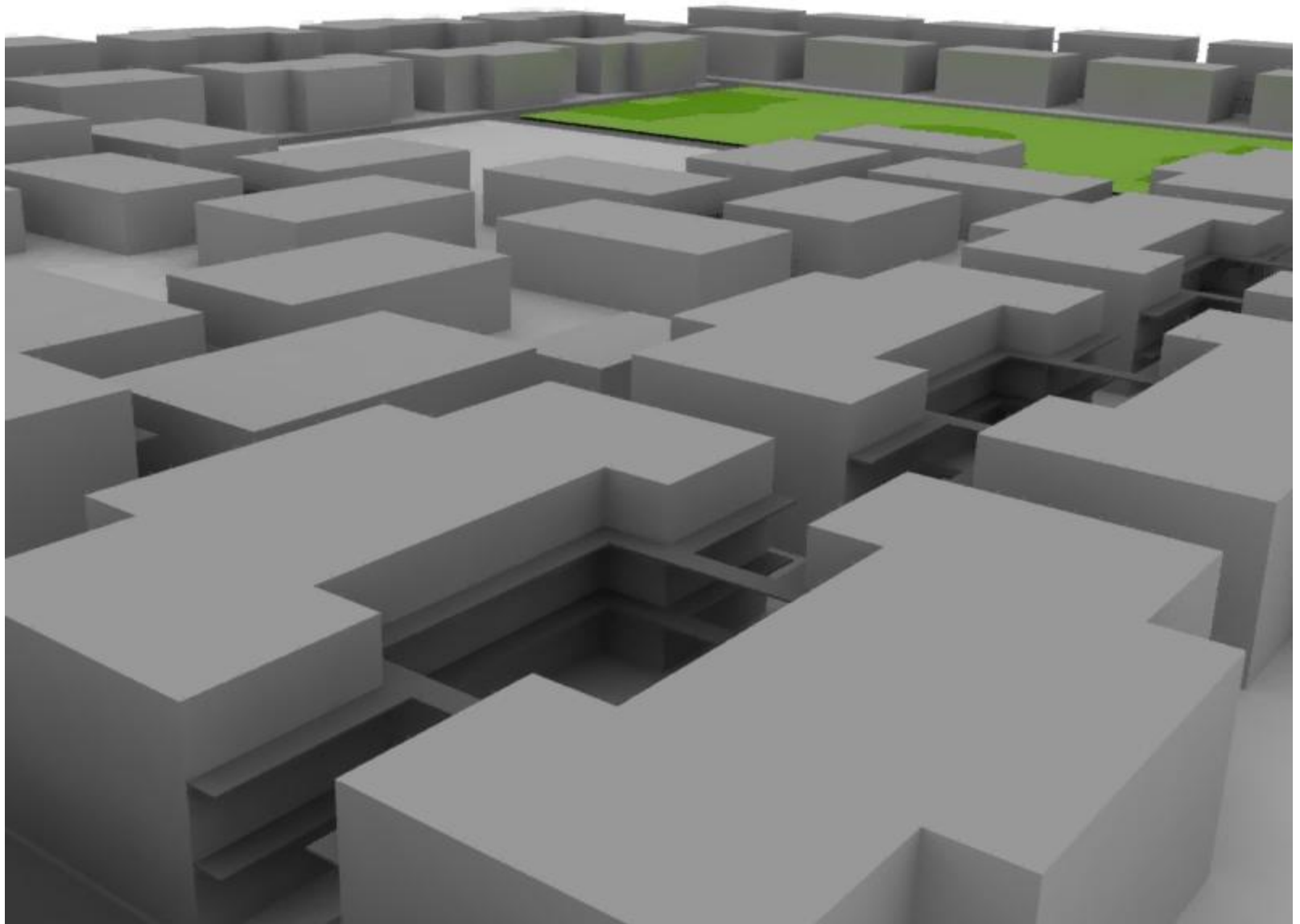
TOTAL = LAND + HARD COST + SOFT COST **\$17,789,575.00**

AFFORDABILITY (BASED ON HARD COST ONLY) **\$7,761.00** Per unit

Single width units Qty: 1,689  $\$13,108,560 / 1689 =$   
Double width units: Qty: 75  $\$791,625 / 75 =$   
**\$10,555.00** Per unit

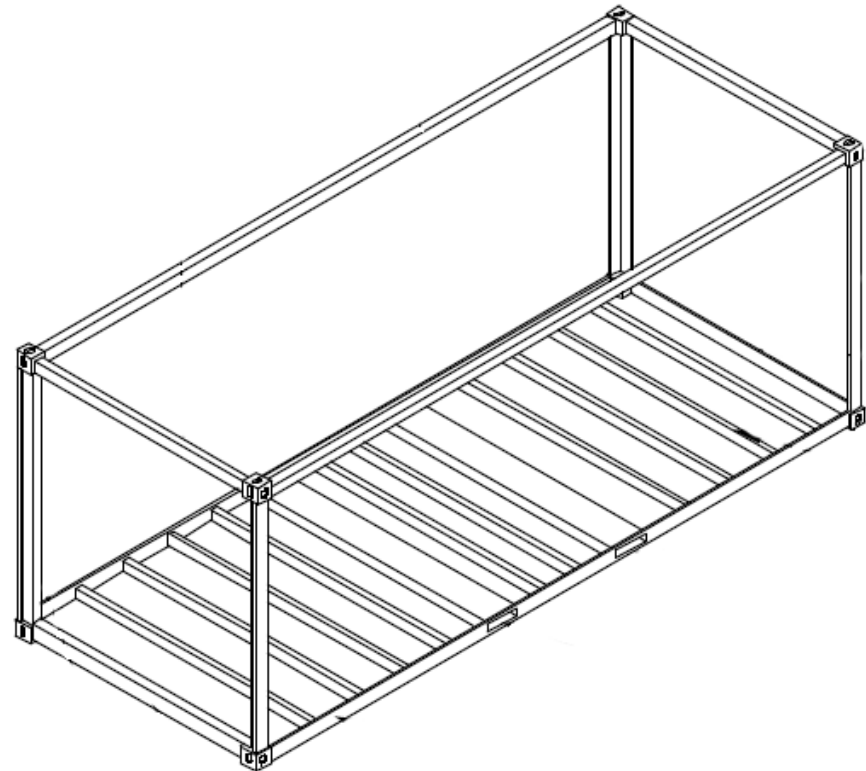
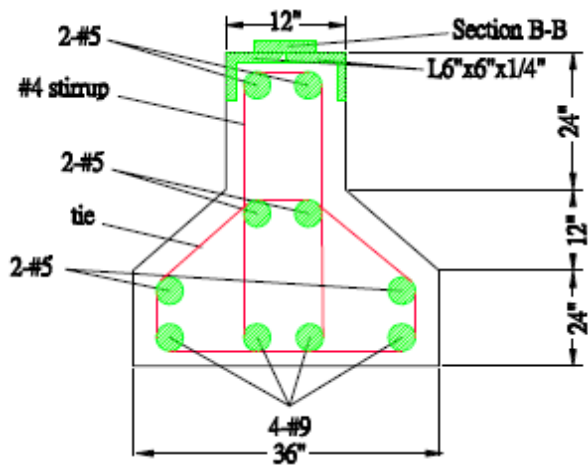






# shipping container as structure

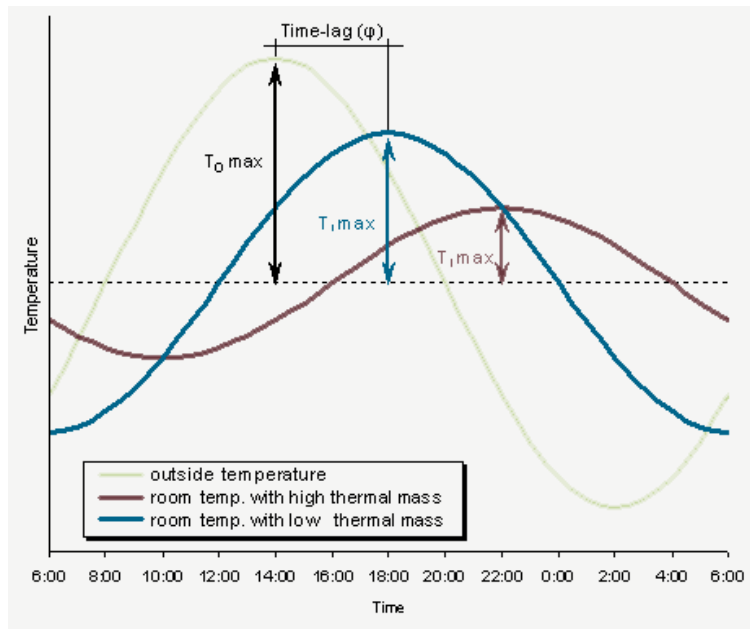
- Rigid steel frame, primary load bearing component
- Concrete foundations required





# cob as thermal insulation

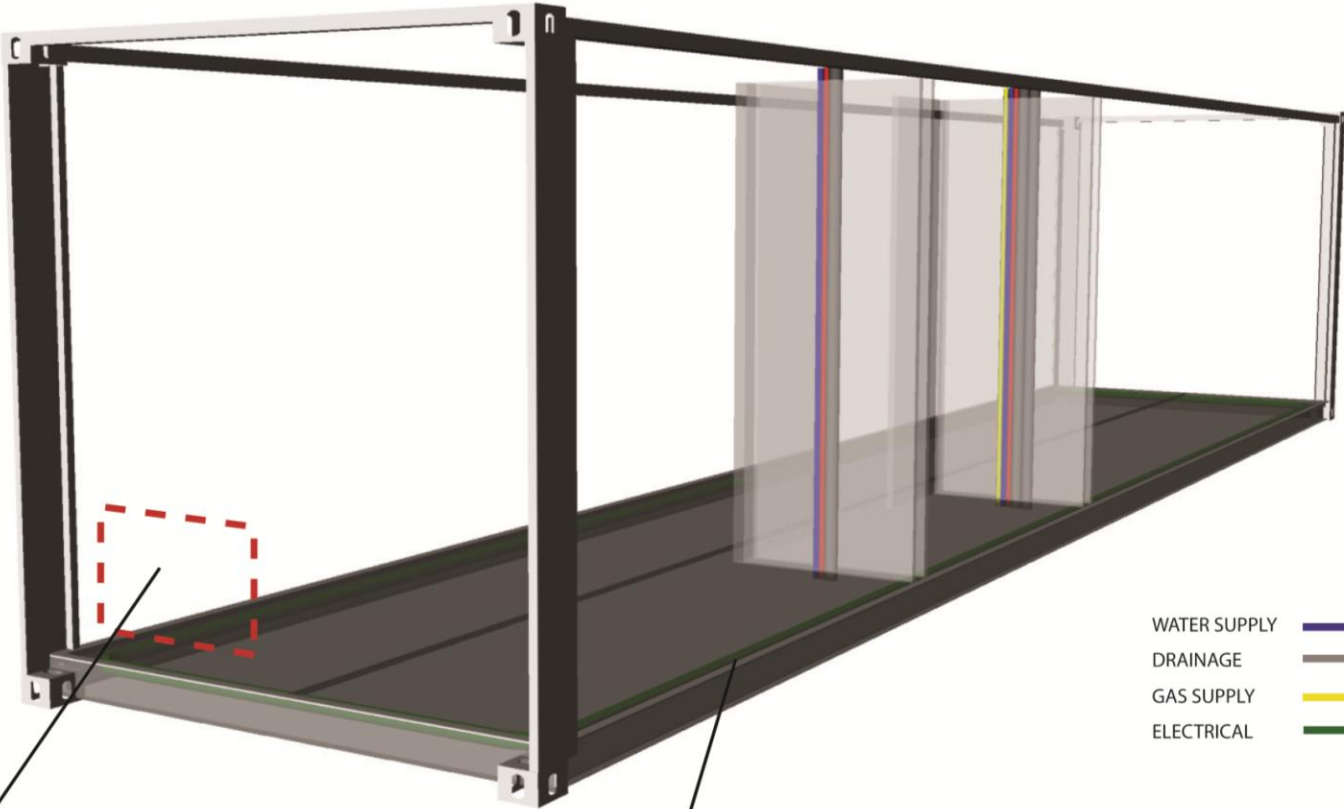
- Low thermal conductivity ( $0.6 \text{ W/m}\cdot\text{K}$ ) compared to steel ( $50 \text{ W/m}\cdot\text{K}$ )
- High thermal mass



- A natural resource



# proposed MEP distribution



- WATER SUPPLY 
- DRAINAGE 
- GAS SUPPLY 
- ELECTRICAL 

## MECHANICAL

INDIVIDUALLY CONTROLLED HEAT & A. C.

## ELECTRICAL

COMMON RISER SYSTEM  
WITH BRANCH CIRCUIT SYSTEM

## PLUMBING

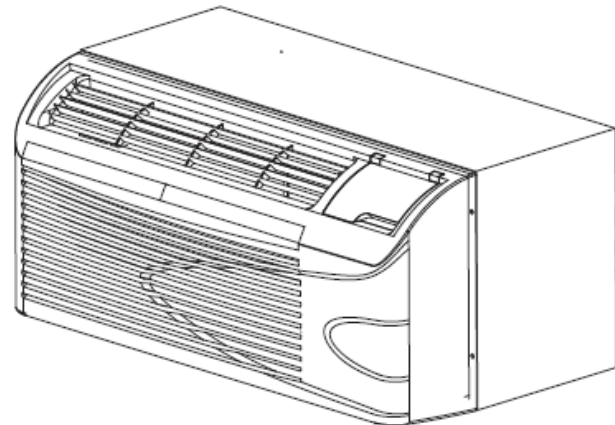
COMMON SHARED RISER SYSTEM  
FOR WATER, WASTE AND VENTS

# mechanical system

- Heating and Cooling loads:

<b>Building Orientation</b>	<b>Cooling Load (Btu/hr)</b>	<b>Heating Load (Btu/hr)</b>
North-South	10,000	15,000
East-West	15,000	15,000

- PTAC, heats and cools



# addressing the cultural needs



- Provide recreational, spiritual and practical areas
- Tailor cost to the average income
- Keep safety and security in mind



questions?

