

Urban Farming: End of Semester Review

EPICS  PURDUE

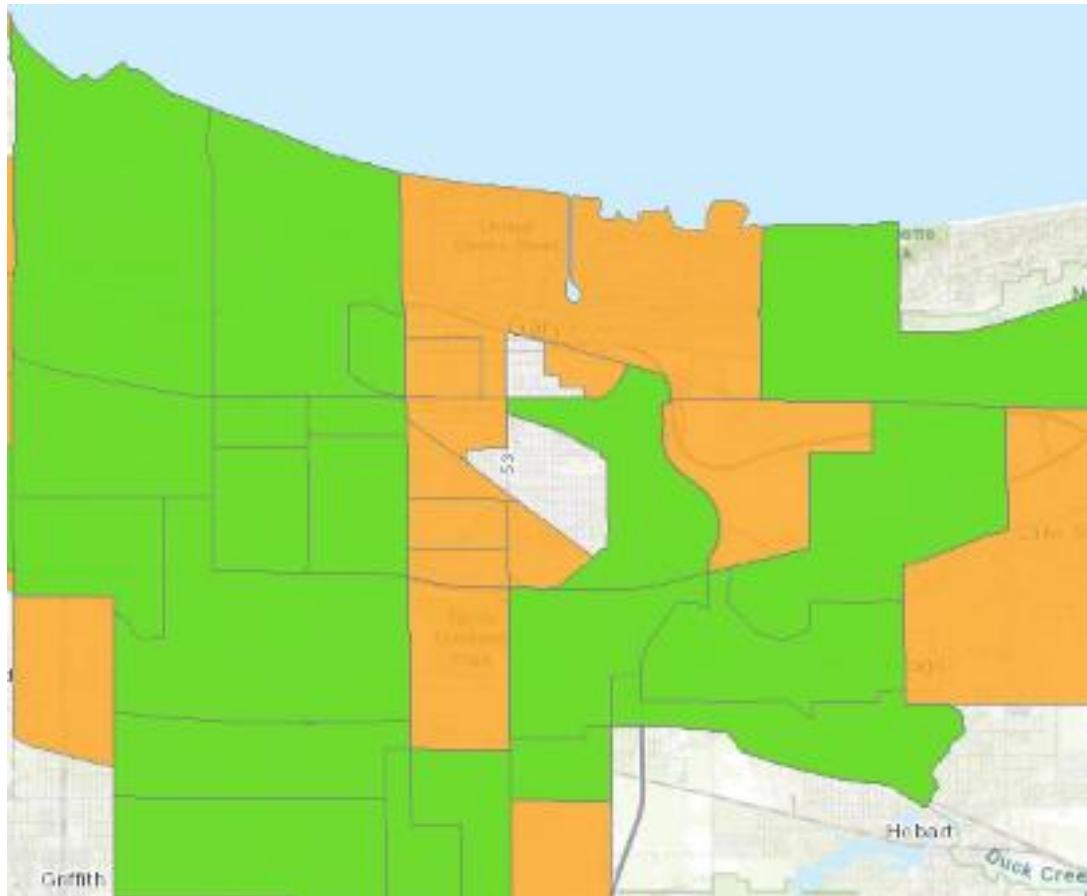
Agenda

- Introduction
- Team Garden
- Team Structure
- Questions and Comments

Framing the Issue - Food Desert

- Communities underserved by quality grocery stores
 - Distance to store over 1 miles in urban areas
 - Disproportionately in poor communities
 - 55% found in communities with median income less than \$25,000
- Limited Options on healthy food
 - High calorie, processed unhealthy food available
 - Creates poor diets and health effects

Framing the Issue - Food Desert



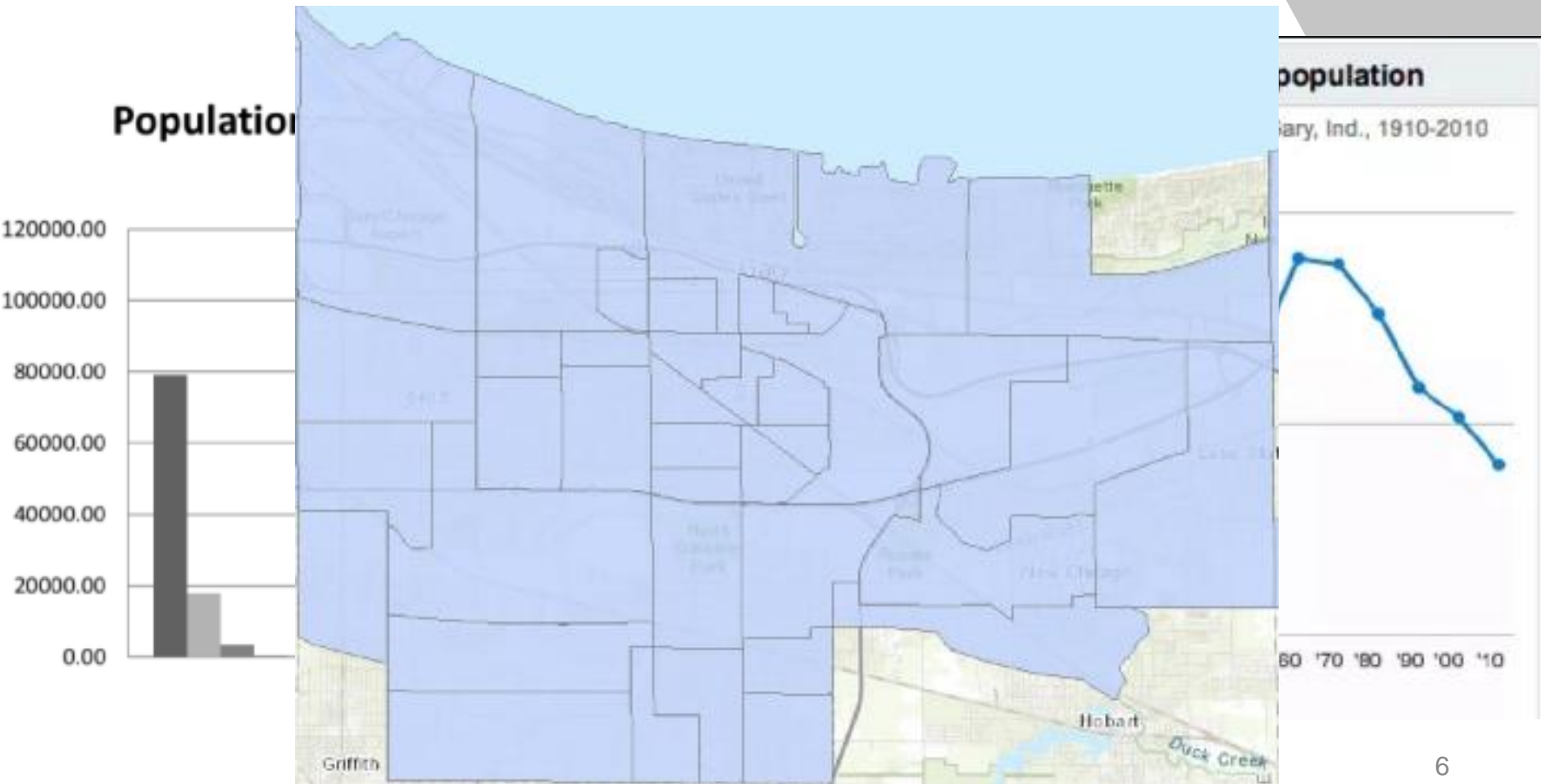
Orange = 10 miles for rural and
½ mile for urban
Green = 10 miles for rural and
1 mile for urban

Framing the Issue - Gary, Indiana

- Past
 - Formed by U.S Steel - 1906
 - A “model city”
 - 1960’s High point
 - population \approx 180,000



Framing the Issue - Gary, Indiana



Framing the Issue - Gary, Indiana

- Present
 - Population of 77,000
 - 81.5% of population is Black
 - 36% of population lives under the poverty line
 - \$28,895 median household income for Gary
 - \$43,995 median household income for Indiana

Project Partner - Peace Garden & Farms

- 4 workers
- 6.2 acres of land
- Grows food for 85 families



Stakeholders

- Marty Henderson
- Gary Youth
- Members of community
 - Healthier food provided
- Re-entry of justice served individuals
- Local grocery stores

Where EPICS Helps

- Our goal is to build a rooftop garden that is both beneficial and accessible to those who need it in the greater population of Gary.
- To do this, we have split into two teams:
 1. Garden: in charge of what goes in the garden.
 2. Structures: building the garden itself and making sure the building can support it.

Urban Farming Project

Fall 2018 End of Semester Design Review



Farm Design Team Members

Renae Kramer- Natural Resources and Environmental Science

Alyssa McNarney- First Year Engineering (Chemical Engineering)

Taylor Robbins- Anthropology

Mokammel Sanju- Environment and Ecological Engineering

Neil Sharma- First Year Engineering (Aerospace Engineering)

Bradley Turner- First Year Engineering (Chemical Engineering)

Troy Weber- First Year Engineering (Environmental and Ecological Engineering)

Hajera Zemy- Computer Science

Problem Statement

- Determining the best soil type and or organic soil mixture that is compatible with the weight requirements of the roof and also meets plant nutritional needs
- Determining crop types compatible for growing in rooftop conditions i.e different weather patterns and rainfall.

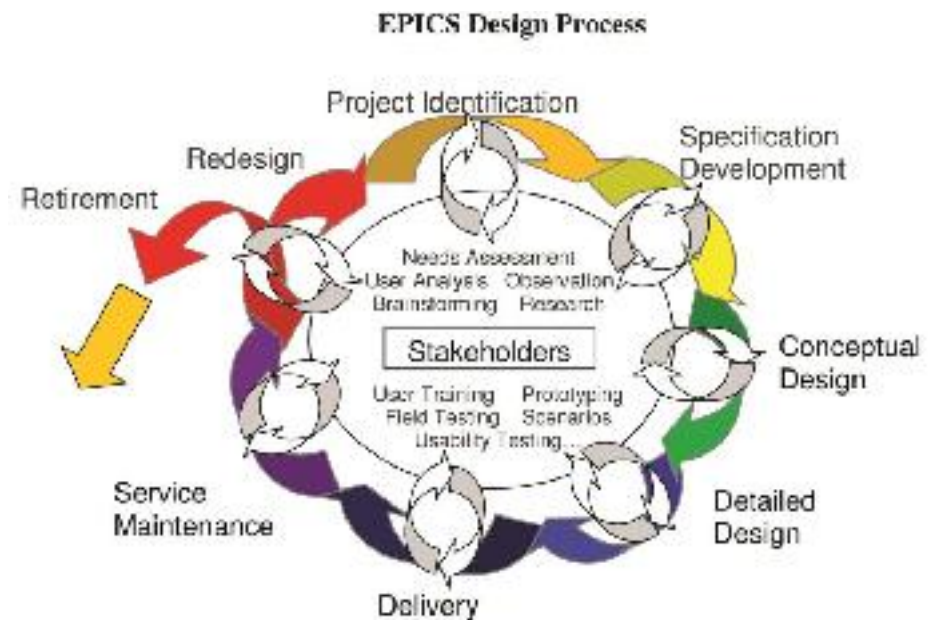
Site Visit

- Omni Ecosystems (Chicago, IL)
- Uncommon Grounds (Chicago, IL)

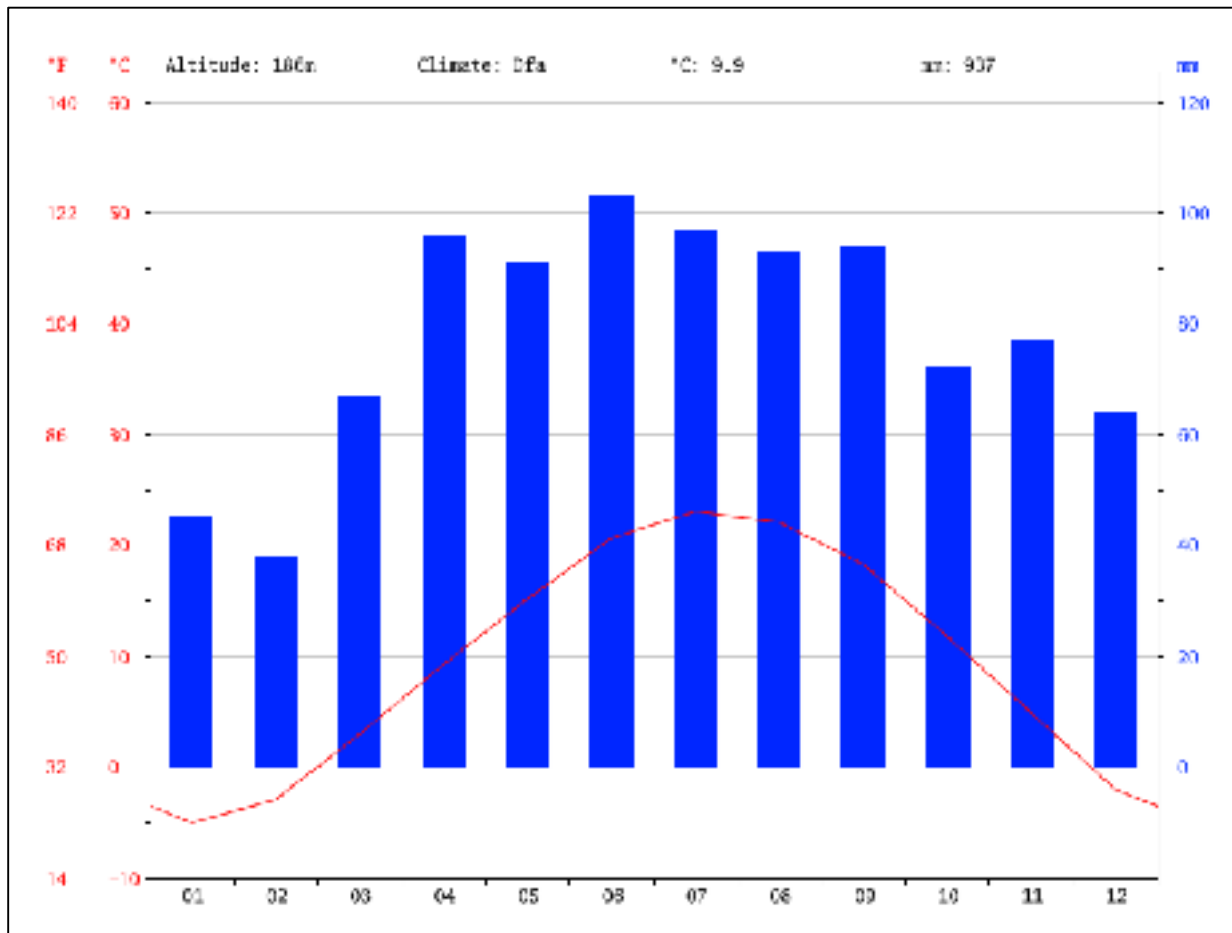


Specification Development Phase

- Context
 - Rooftop Garden in Gary, IN
- Stakeholder Profiles
 - Marty Henderson
 - Citizens of Gary, IN
- Prototype
 - Rooftop Garden in Purdue
 - Task analysis
 - Partner approval
- Comparing to other products
 - Omni Ecosystems-soil



Weather Research

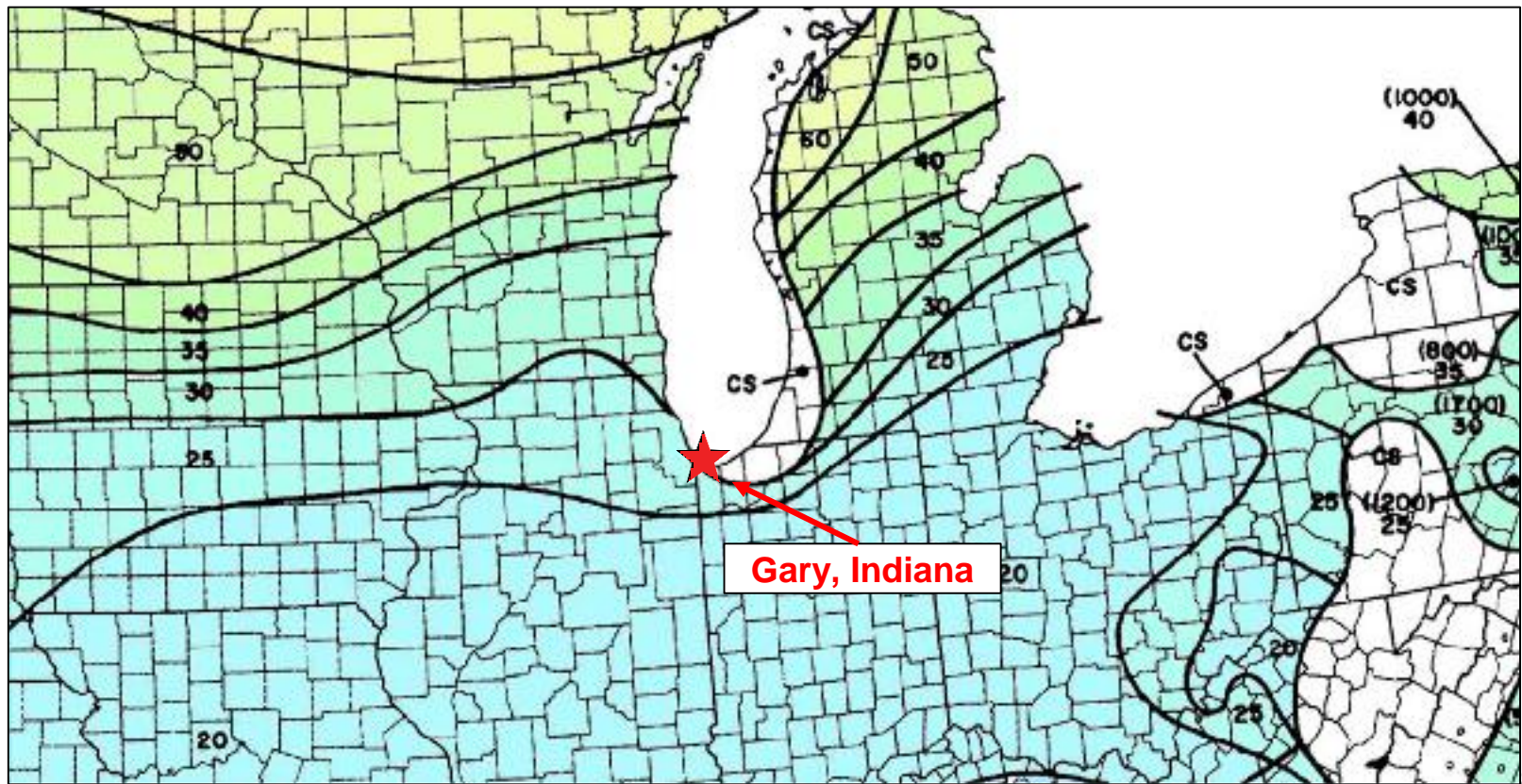


- Average Summer Temp
 - 25°C
- Average Winter Temp
 - -3°C
- Average Rainfall
 - 96cm

ROOF SURFACE	DEGREES FAHRENHEIT ON A SUNNY, 90-DEGREE DAY
Black roof	140-190
Aluminum reflective coated	Up to 68 degrees cooler than black roofs
Gravel	125-140
Unpainted metal	138-145, but feels hotter to the touch than a black roof
Painted Metal (ex: BASF Cool Paint)	105-115 or up to 42% cooler than unpainted metal
White	102-120
Vegetative	90

Weather Research cont.

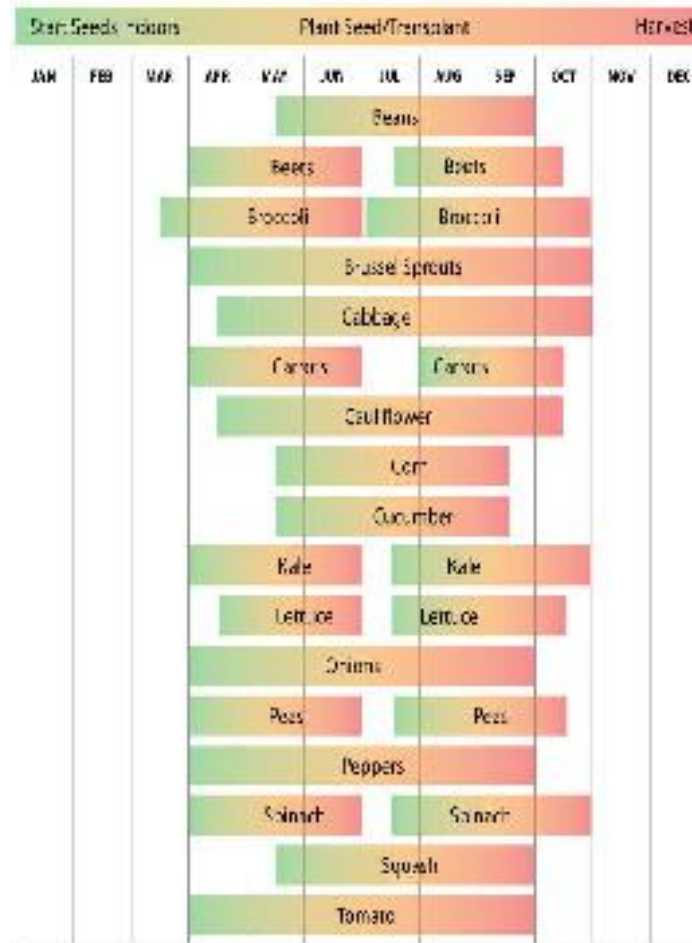
Snow Chart (lbs/ft²)



Plant Data



Plant Data



Plant Data cont.

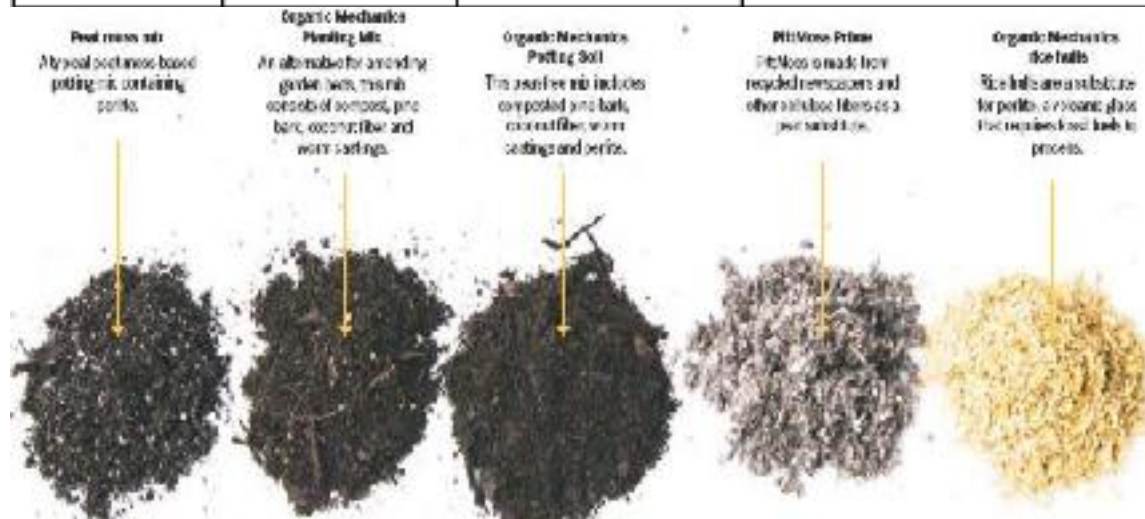
Criteria	Criteria Weight	Cabbage	Lettuce	Tomatoes	Sweet Potatoes	Green Beans	Collard Greens	Swiss Chard
Ability to grow with other plant	x1	2	5	2	1	2	4	4
Maintenance	x2	4	4	1	3	1	3	3
Amount of water	x3	4	4	4	2	2	4	4
Nutrition (based on calories)	x4	2	1	5	5	5	4	4
Amount per sq ft	x5	5	4	2	2	3	4	4
Total Points		55	49	46	43	45	58	58

Picture of building



Soil research

General Soil Types	Density (lbs/ft ³)	Weight of Soil 12'x12'x8' (lbs)	Total Weight With Water and Plant Weight
Clay Pebbles	21	14	32
Peat Moss	72	48	66
Loam	60	53.4	71.4
Silt	81	54	72



Midwest trading horticultural soil information

Product code	Description	Weight (lbs/ft ³ saturated)	Cost per cubic ft	Water retention (%)	Water Permeability (mm/min)
APPS	A blend of pine bark, peat moss and coir, also comes with a controlled release fertilizer	62.8	4.50	75	17.6
CM63	Grower mix with pine, has bark and compost I and sand	70.5	3.80	67	11.9
CM66	Grower mix with perlite. Lots of peat, perlite sand and compost	63.8	4.44	62	12.8
PM35	Planter soil mix with pine, soil sand and compost	88	3.00	56	15
MW intensive	Green roof medial with lightweight aggregate and compost	76.7	Unknown	52	19.6

Laws and Regulations for Producing and Selling

- A **scheduled process** must be followed strictly throughout the growing and harvest phase, with an accurate record
- Acidified (Pickled) Foods (regulation 1 CFR 114 and 21 CFR 108.25 for FDA regulated products)
- Certain food products and crops will need to be heat treated after harvest
 - Packaged/Canned food

Survey

- Giving the community a voice
- Participants will be families that Marty Henderson works with through Peace Garden and Farms
- Survey format will be dependent on optimizing quality and quantity of information
- Uncertainties about Institutional Review Board (IRB)

Next steps:

- Test the soil
- Plan growing seasons
- Plan crop rotations
- Create guide for maintenance of garden

Infrastructures



Infrastructure Team Members

Alex Pusateri - Civil Engineering (Design Lead)

Tasha Geisler- Civil Engineering

Jake Rokop - Electrical Engineering

Anjas Kapur - Electrical Engineering

Jonathan Moore - Computer Science

Harley Clark - Biomedical Engineering

Claire Bhamani - Biomedical Engineering

Alex Roberts - Environmental and Ecological Engineering

Overall Team Goal

- **To determine if the building is capable of holding a rooftop garden.**

Structure Goals

- Determine capacity and maximum safe load

$$\textit{Capacity} > \textit{Demand}$$

- Capacity must be greater than demand by a certain amount to be considered safe.

Team Trip



- Army Reserve Building
 - Took measurements
 - Looked at building type and roof reinforcement inside the building



Infrastructure Semester Breakdown

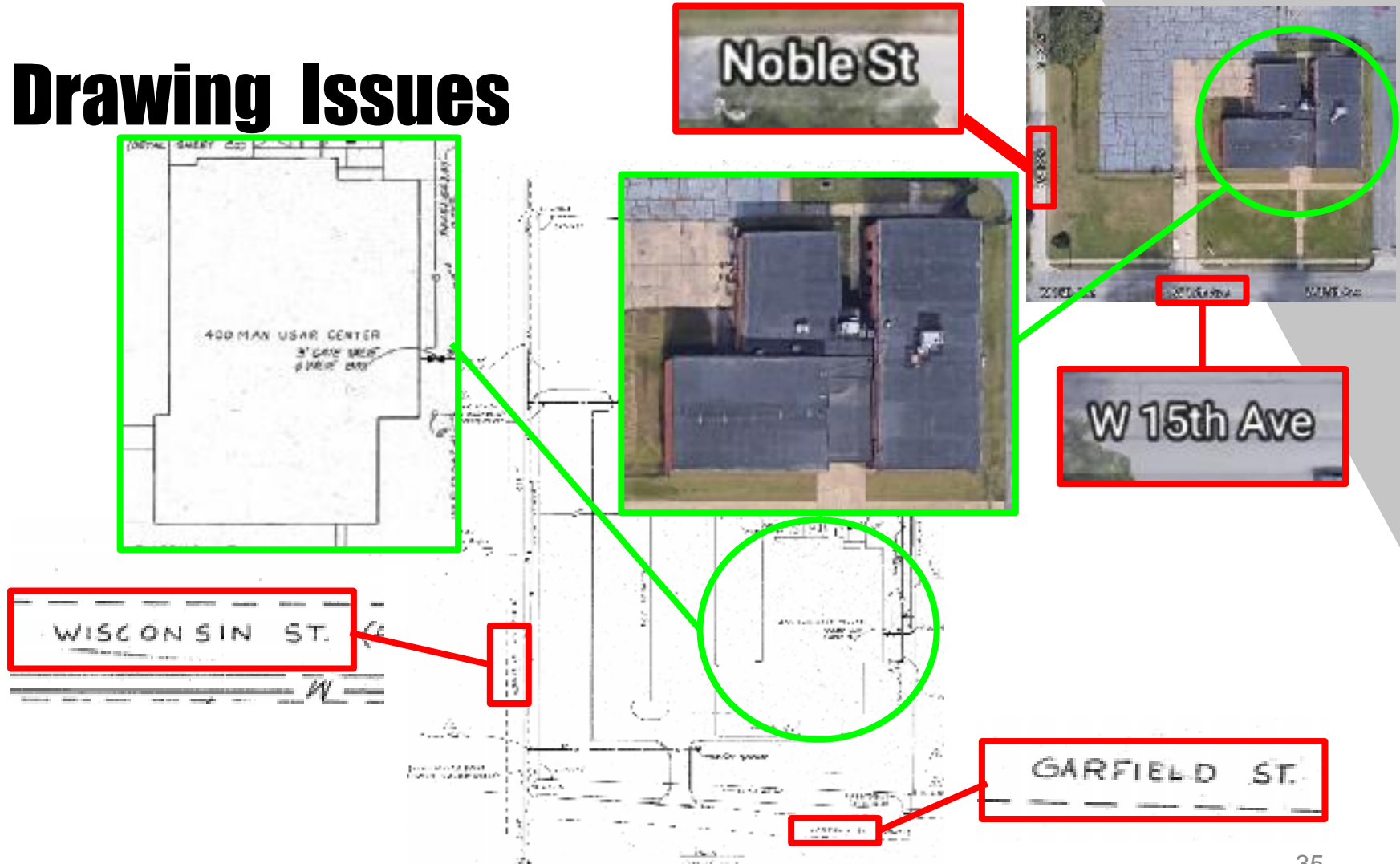
Structures:	<ul style="list-style-type: none"> • Went through and reviewed building drawings • Weight loads Estimating • Contacted structural Engineers
Rest of Semester	1. Irrigation/Drainage Research
	2. Roof Access Research
	3. Roof Safety Research

Organizing Drawings

- Categorical System:
 - red- important for structures
 - blue- important for irrigation
 - yellow- not important at this time
 - orange- important for both teams

13	HVAC Schedule
14	HVAC Sections
15	Electric Layout
16	Plumbing Floorplan
17	Roof Framing Plan
18	Wall Details

Drawing Issues



Finding the Drawings

- US Army Corps of Engineers
 - headquarters archive
- “Blueprints for a Civilian Soldier: A Nationwide Historic Context Study of US Army Reserve Centers”
 - Four drawings given
 - printed
- FOIA
 - at least a year to process

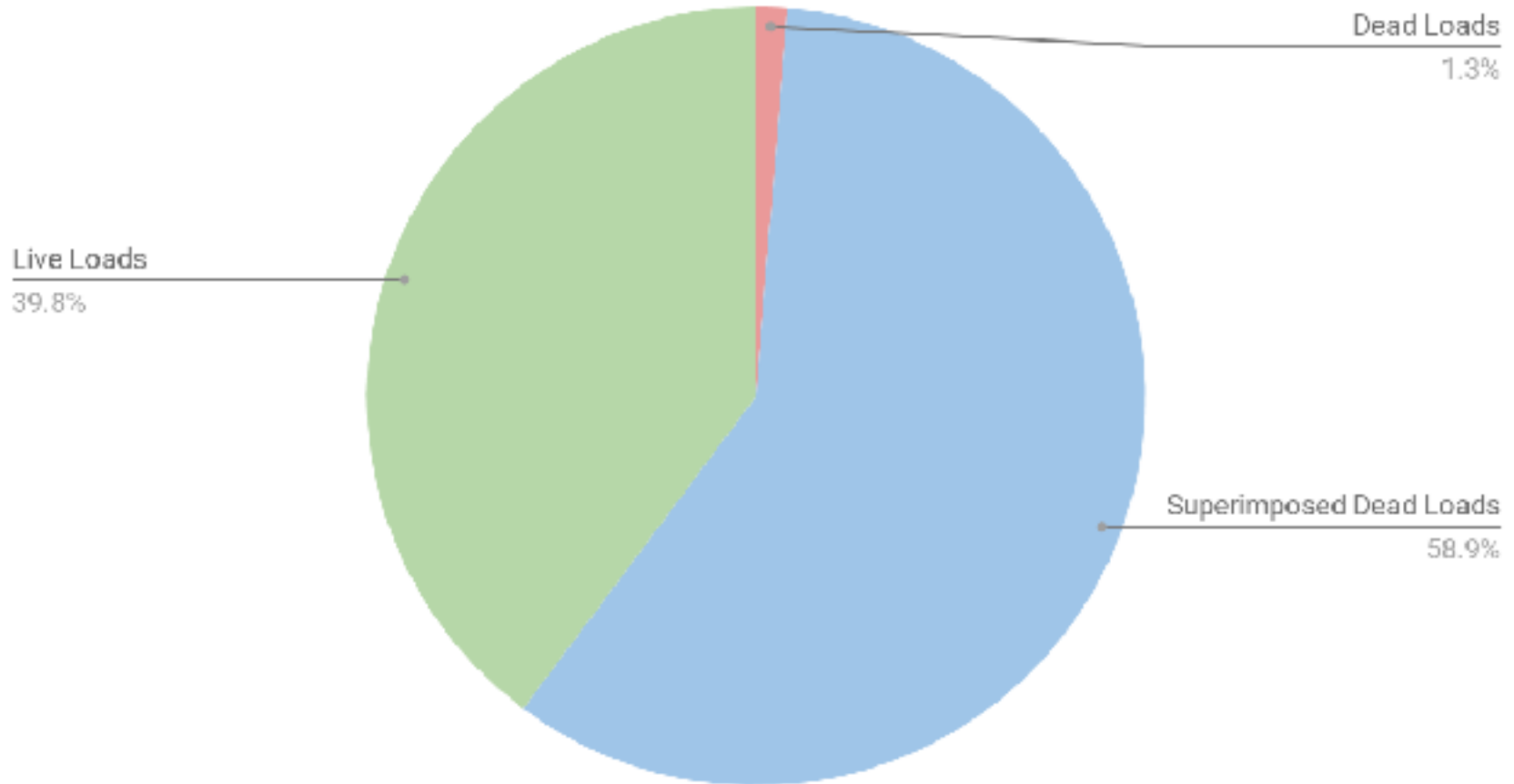
Structural Engineers Contacted

Thomas Engineers	SilverCreek
<u>Enspect</u> Engineering Consultants	Building Department of Gary
Superior Engineering	MECA Engineering
DLZ Engineering	RJ <u>Mycka</u> Inc

Potential Loads

- Determining potential demand on the building
 - Dead Loads
 - Weight of the roof material
 - Superimposed Dead Loads
 - Weight of saturated soil on the roof
 - Live Loads
 - Snow loads, People loads

Potential Loads



New Direction

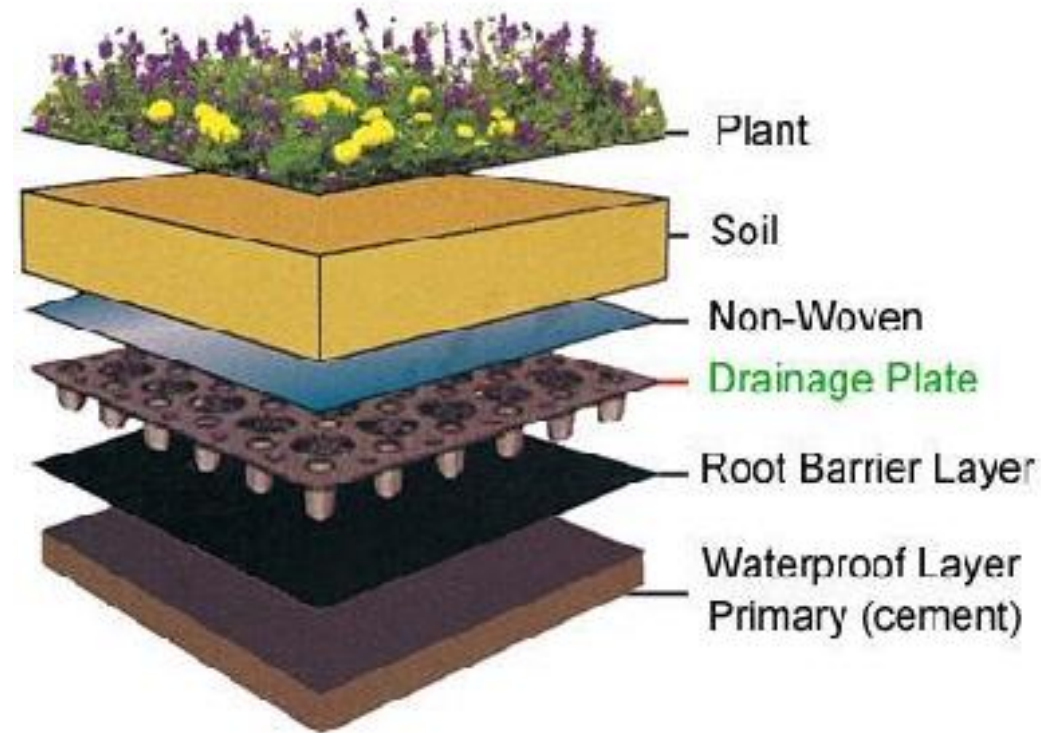
- Documentation Focus
- Mid-Semester Review Suggestions
 - Safety and Movement of Materials
- Added Loads
- Get Expert Advice
 - Sue Khalifah

Irrigation and Drainage Progress

- Conducted research into different irrigation methods
- Determined cost, efficiency, and weight
- Figure out if the existing drainage system fits into our irrigation system.
- Drawings highlighting drainage system were unclear.

Irrigation Decision Matrix

Criteria	Weight	Drip Irrigation	Sprinklers	Micro-spray	Subsurface
Garden Health	3	4	1	2	5
Cost	4	4	1	5	3
Efficiency	5	1	1	2	5
Ease of Maintenance	2	5	4	4	2
Ease of Installation	1	5	2	4	3
	Total.	63	22	48	55



Roof Access

3 main options that we are considering to get materials onto the roof:

1. Winch/pulley system
2. Material lift/moving platform
3. Conveyor belt system

<https://www.aecinfo.com/cranky-portable-winch-system-125126/news.html>



← Winch

Material Lift →



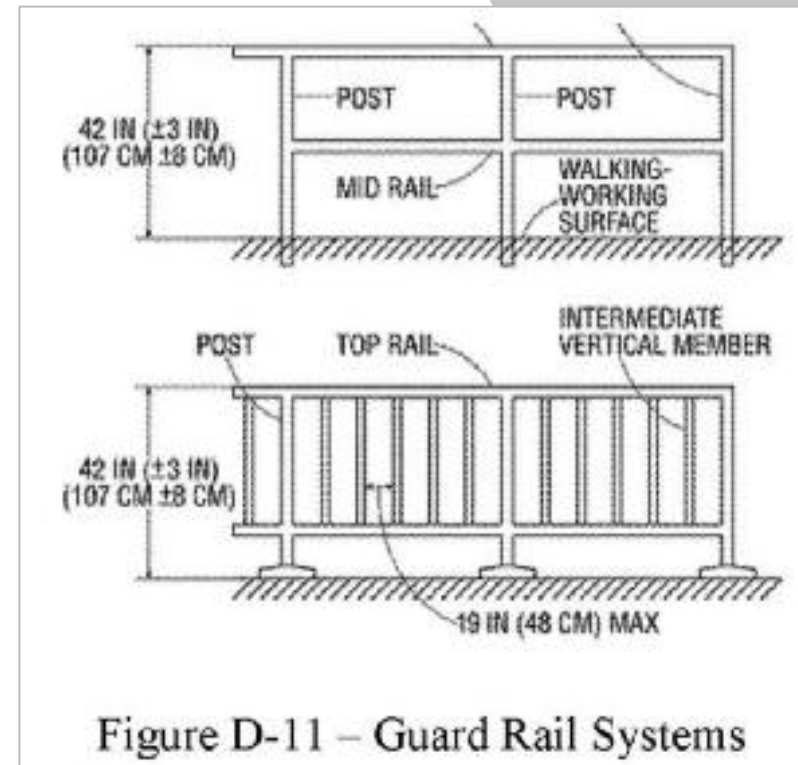
<https://www.genielift.com/en/material-handling-products/material-lifts>
Model GH-5.6

Material Moving Decision Matrices

Criteria	Hand-carry	Winch/Pulley	Conveyor Purchase	Conveyor Rent	Moving Platform purchase	Moving Platform Rent
Up-front costs	36	48	41	51	48	50
Long-term investment	29	55	46	47	51	44
Installation Time	38	51	42	56	47	54
Total	103	154	129	154	146	148

Roof Safety

- OSHA- Railing Systems
 - Fe26 Iron Railing
 - Aluminum Made. Fortress™ Durable.



(<https://www.fallprotect.com/techtalk/osha-requirements-for-guardrail-and-safety-railing-compliance/>)

Importance in Documentation

Important Semester Document

Thursday, October 25, 2018 11:36 AM

End of Semester Gantt Chart



UF Gantt
Chart End of

Amin's Book



2005-
04RoofTopGar

Roof Loads Doc



Roof Weight
Excel Doc

US Army Reserve Center
Building Information



Epics Urban
Farms Team



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Irrigation Recommendation Report



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Irrigation Research

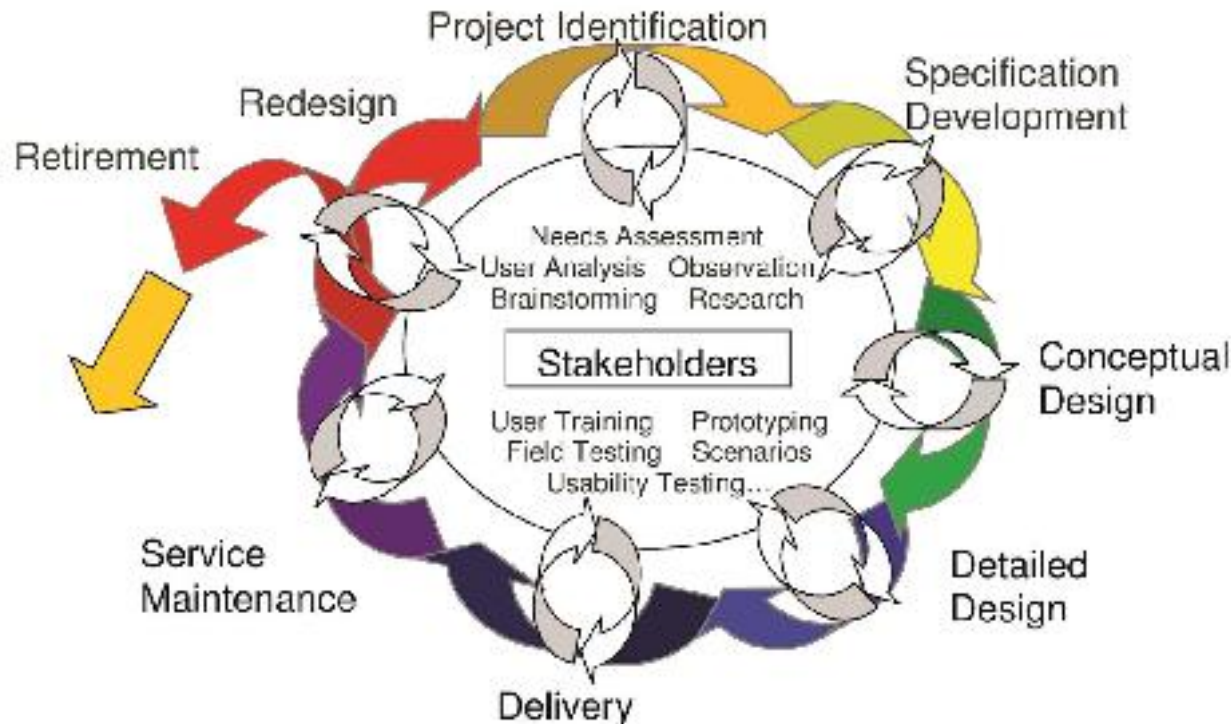
Roof Safety Research Report



Rooftop
Safety Report

EPICS Design Phase

EPICS Design Process



Project Identification:

- Background Knowledge
- Created Semester plan

Specification Development

- Researching Structural capacity/demand
- Irrigation/Drainage Research

Next Semester Recommendation

- Potentially high cost for this project
- Consider creating a design for 1 roof
- Keep design general so it can be modified



Image acquired from amazon.com

Questions, Comments, and Concerns