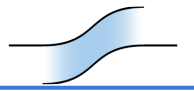




*team***EXPRESS**

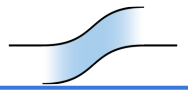
AEC PBL Global Teamwork 2015 - Stanford University

WATER IS A GLOBAL CHALLENGE



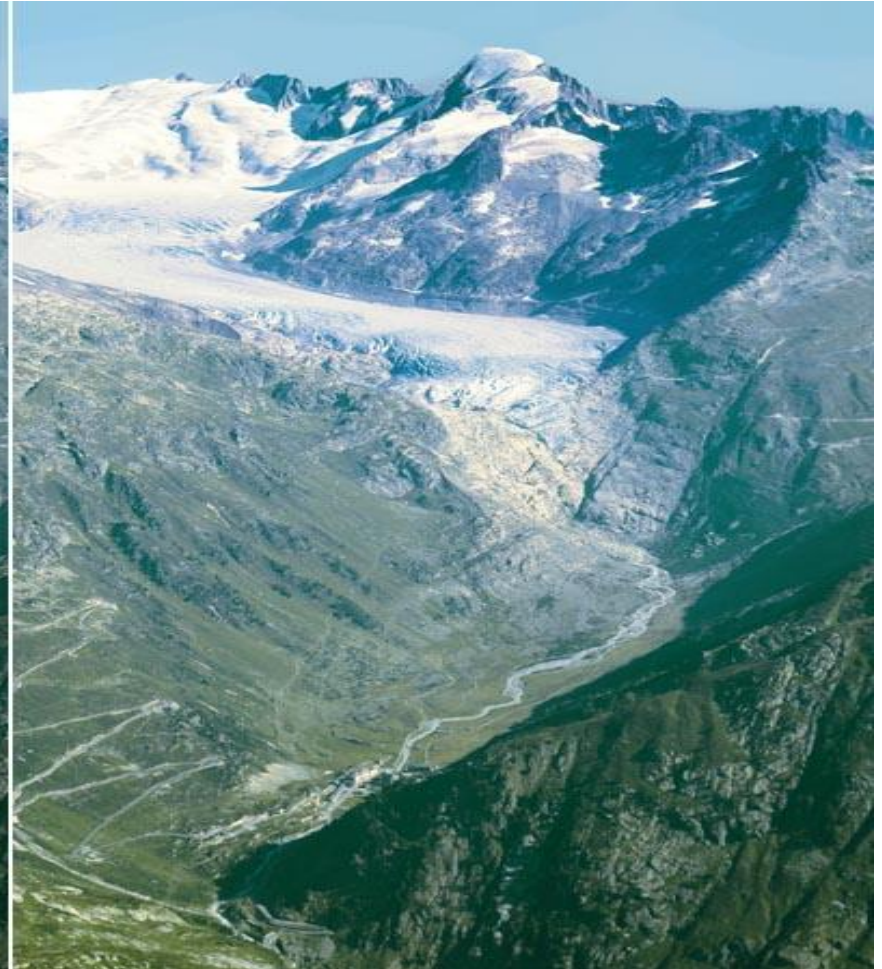
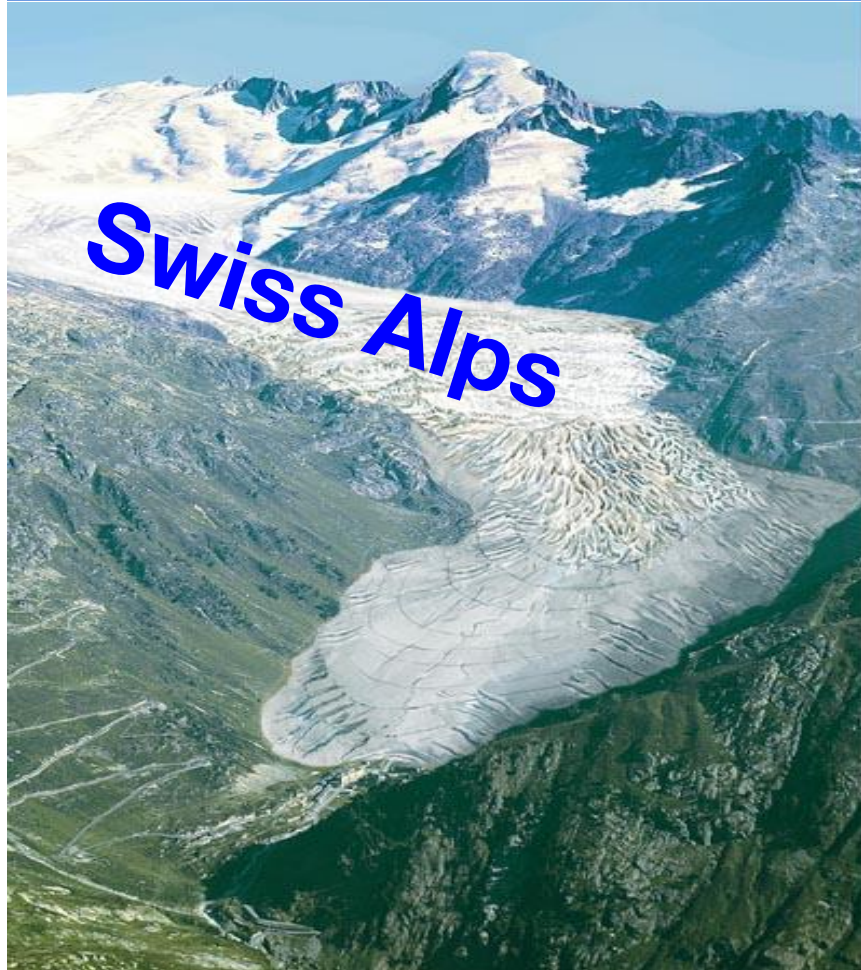
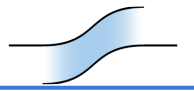
Folsom Lake California 2011

WATER IS A GLOBAL CHALLENGE

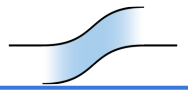


Folsom Lake California 2015

WATER IS A GLOBAL CHALLENGE



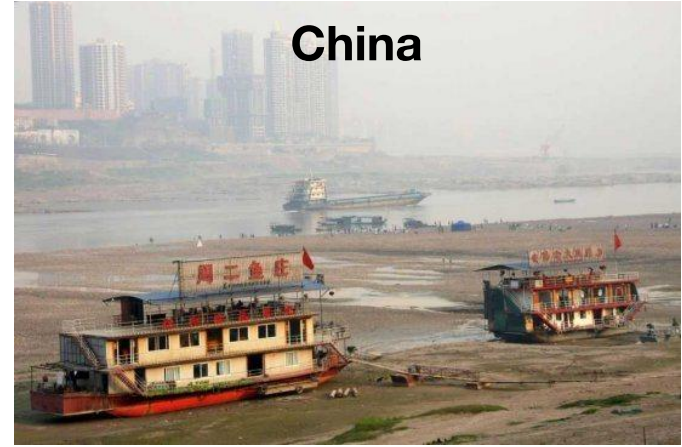
WATER IS A GLOBAL CHALLENGE



Slovenia



China

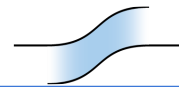


United Kingdom



Eritrea

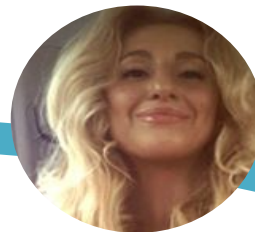




SE



CM



MEP



MEP



CM



SE

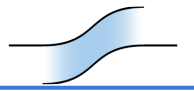


A



TEAM Express

***We Push The World Toward A
More Sustainable Future***

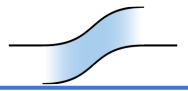


Inspired by Water ...



***Our building exists to Educate
the Community on Water***

WATER INNOVATION PREVIEW



**Design
Phase**

**Manufacturing
Phase**

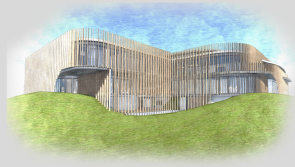
**Construction
Phase**

**Use
Phase**

**Education
Function**



Wave



*Geopolymer
Concrete*



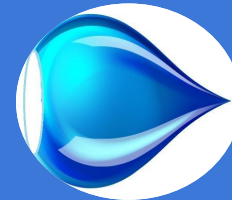
*Recycle
Material*



Fixtures

Water Drop

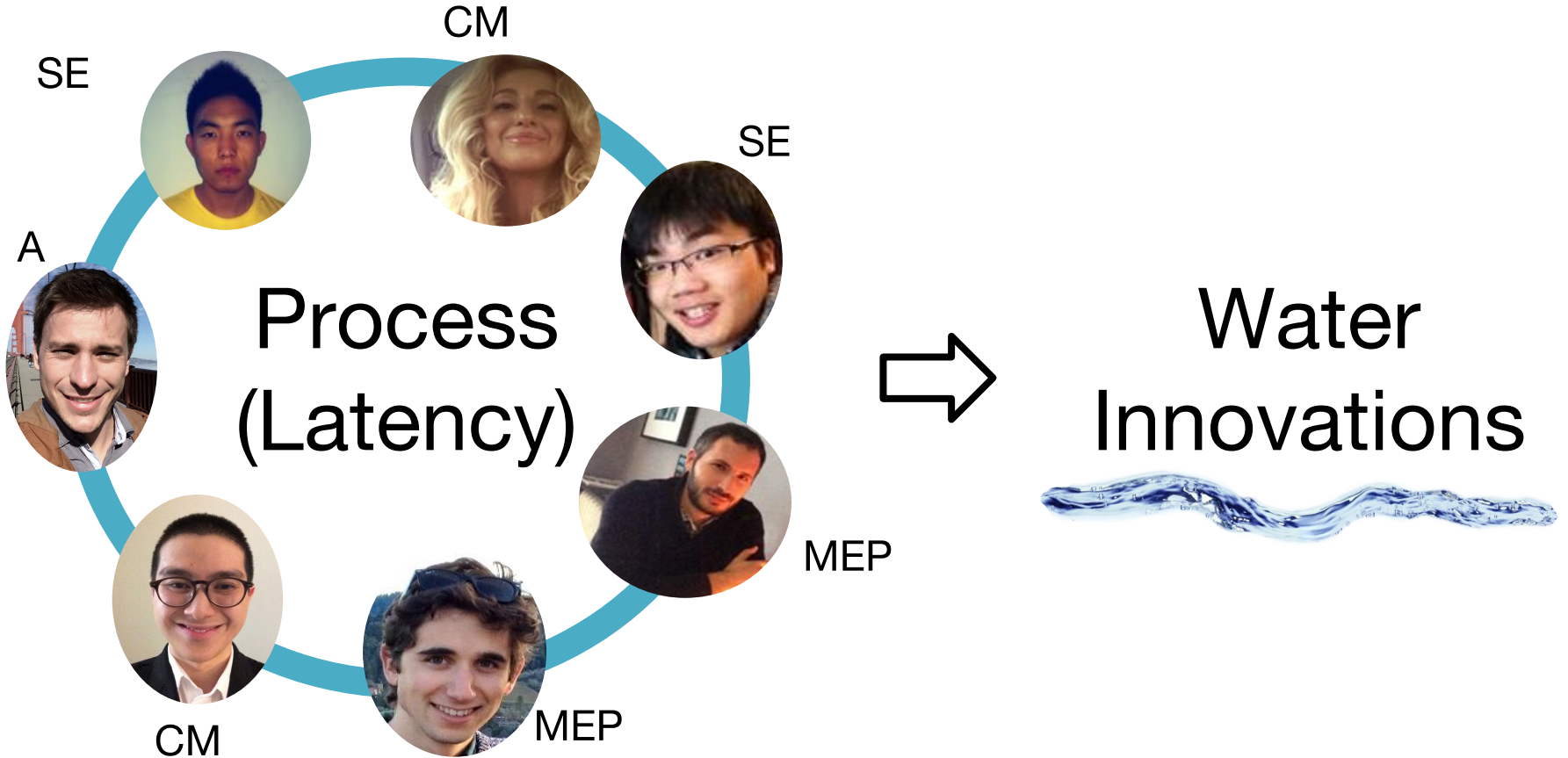
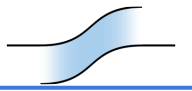
*Rainwater
Harvesting*



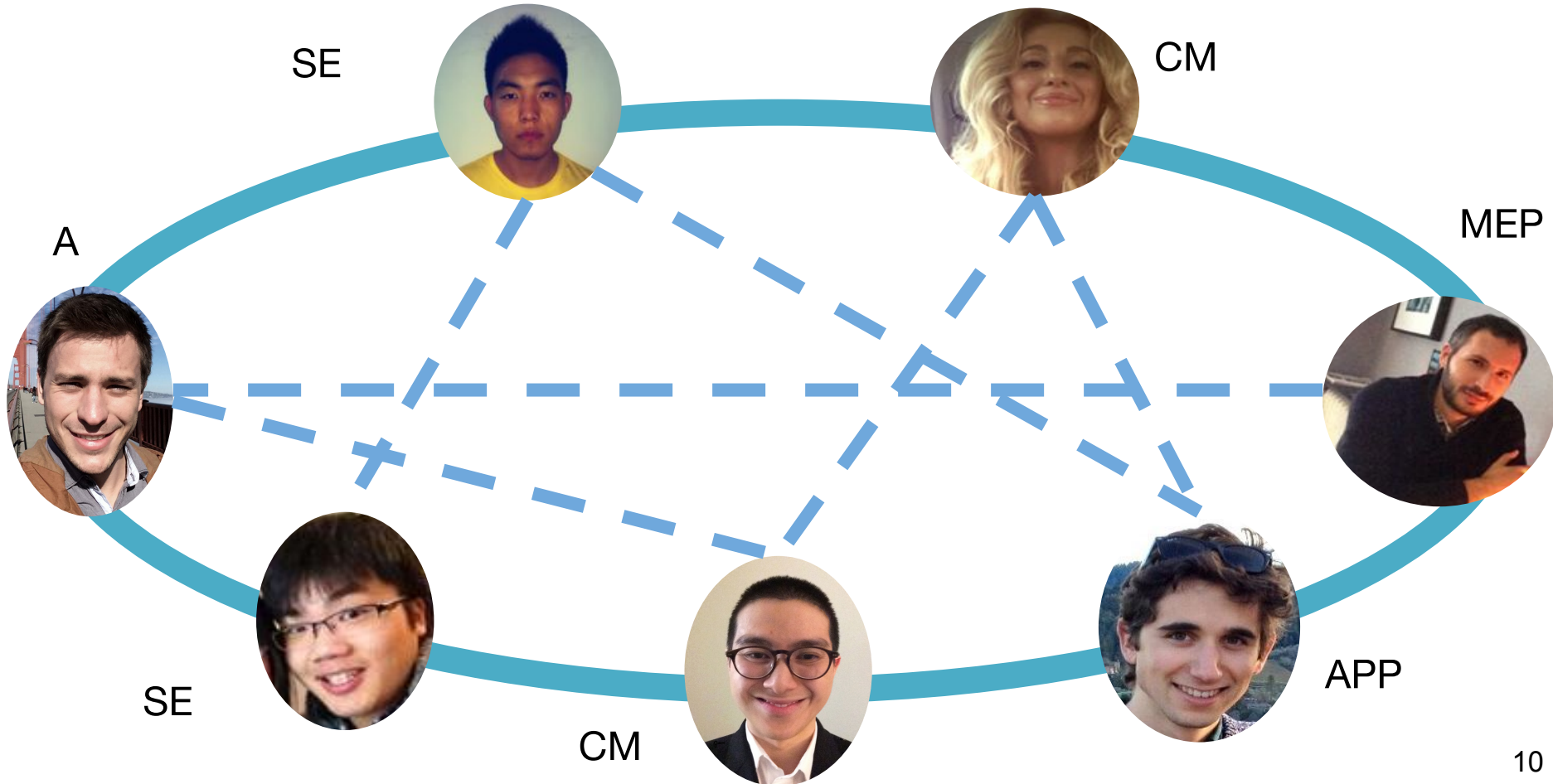
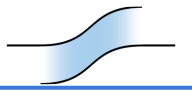
Waver App

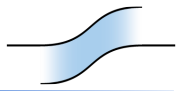


Water Efficiency ↑



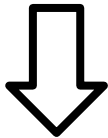
TEAM PROCESS





Good for:

- Collaboration
- Planning Workflow



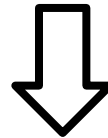
Used for:

- Weekly Meetings
- Owner Meetings
- Subgroup Meetings



Good for:

- Sharing Designs
- Co-editing Deliverables



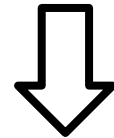
Used for:

- Mentor Meetings
- Subgroup Meetings



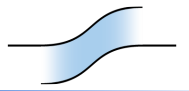
Good for:

- Planning Workflow



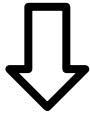
Used for:

- One-on-One Subgroup Meetings



Good for:

- Sharing Work
- Simultaneous Design



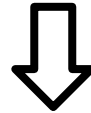
Used for:

- Revit
- Excel
- Navisworks



Good for:

- Storing files
- Saving Backups



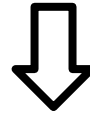
Used for:

- Storing completed presentations and documents



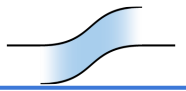
Good for:

- Co-editing presentations and documents



Used for:

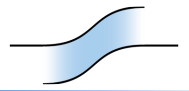
- Document and presentation creation



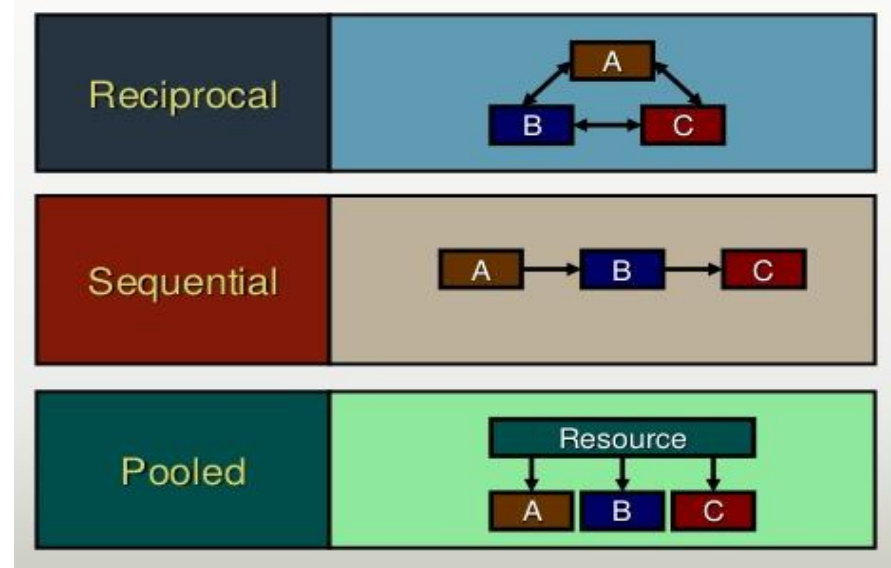
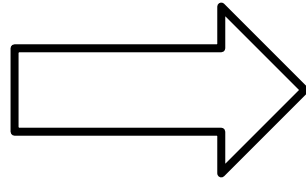
Flushing toilet with
less water than in a
BEER CAN

Smart systems
control the
water usage

<u>Han Chew</u>	flushing toilet with less water than in a beer can	100	United States
<u>Geffen Oren</u>	water catchment system that collects water on the roof, runs it down into a collection tank through a pipe. this pipe has a turbine in it that spins when water runs through it. the turbine is connected to a turbine that spins a generator and creates electricity	94	United States
<u>Stavros Moiragias</u>	smart systems control the water usage	85	Denmark
<u>Sio Chong Lo</u>	reclaimed water	79	United States
<u>Geffen Oren</u>	use excess water collected by the building to water the surround farm	79	United States
<u>Klara Alias</u>	over 70 % of our body is water ----> use that idea to take this into our building, over 70 % water should be reused	73	(please select a country)
<u>Han Chew</u>	rainwater catchment	72	United States
<u>Geffen Oren</u>	green roof/ green facade to mitigate run off	70	United States
<u>Geffen Oren</u>	placing the collection tank inside the building so that people see how much water is being caught	64	United States

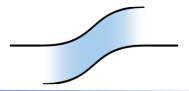


Agile Team Process



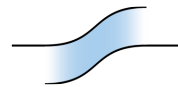
Subgroup Meetings
Set Deadlines

FINAL TASK MANAGEMENT



Overall Pull Plan

Weekly Pull Plan



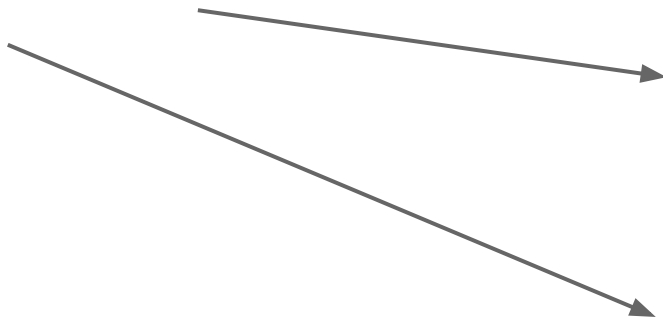
Latency:

Time Spent Waiting.....



Rework:

Time spent on something that can't advance the project



Delay:

Time spent waiting for something to be completed

Multitasking:

Time spent doing something else

BOOMERANG SURVEY



Value for Time Survey Reminder



Inbox x



Geffen Oren <goren@stanford.edu>

Apr 13 ☆



to Han, Klara, klara91, sio-chong, stavros, Robert, xi, me ▾

Please fill this out about today's meeting and last week's work:

https://docs.google.com/forms/d/14t5aAqk_wfUo4Py3ER5tk99vMrIfLXCqiaRYM1AHFM/viewform?usp=send_form

...



Geffen Oren <goren@stanford.edu>

Apr 20 ☆



to Han, Klara, klara91, sio-chong, stavros, Robert, xi, me ▾

...



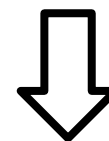
Geffen Oren <goren@stanford.edu>

Apr 27 (10 days ago) ☆

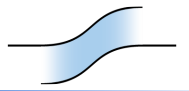


to Han, Klara, klara91, sio-chong, stavros, Robert, xi, me ▾

...



Collect
Data on
our KPIs



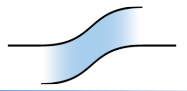
Rework: How many hours of rework did you encounter this week?

Delay:

-Did you have to wait this week for something to be delivered before you were able to move forward with your work?

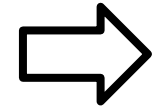
-If so, how much time?

Multitasking: Did you multitask during the meeting?



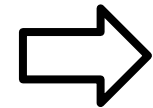
Strategies

- Communicating effectively
- Asking for help



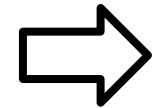
Reduce
Rework

- Communicating effectively
- Setting hard deadlines



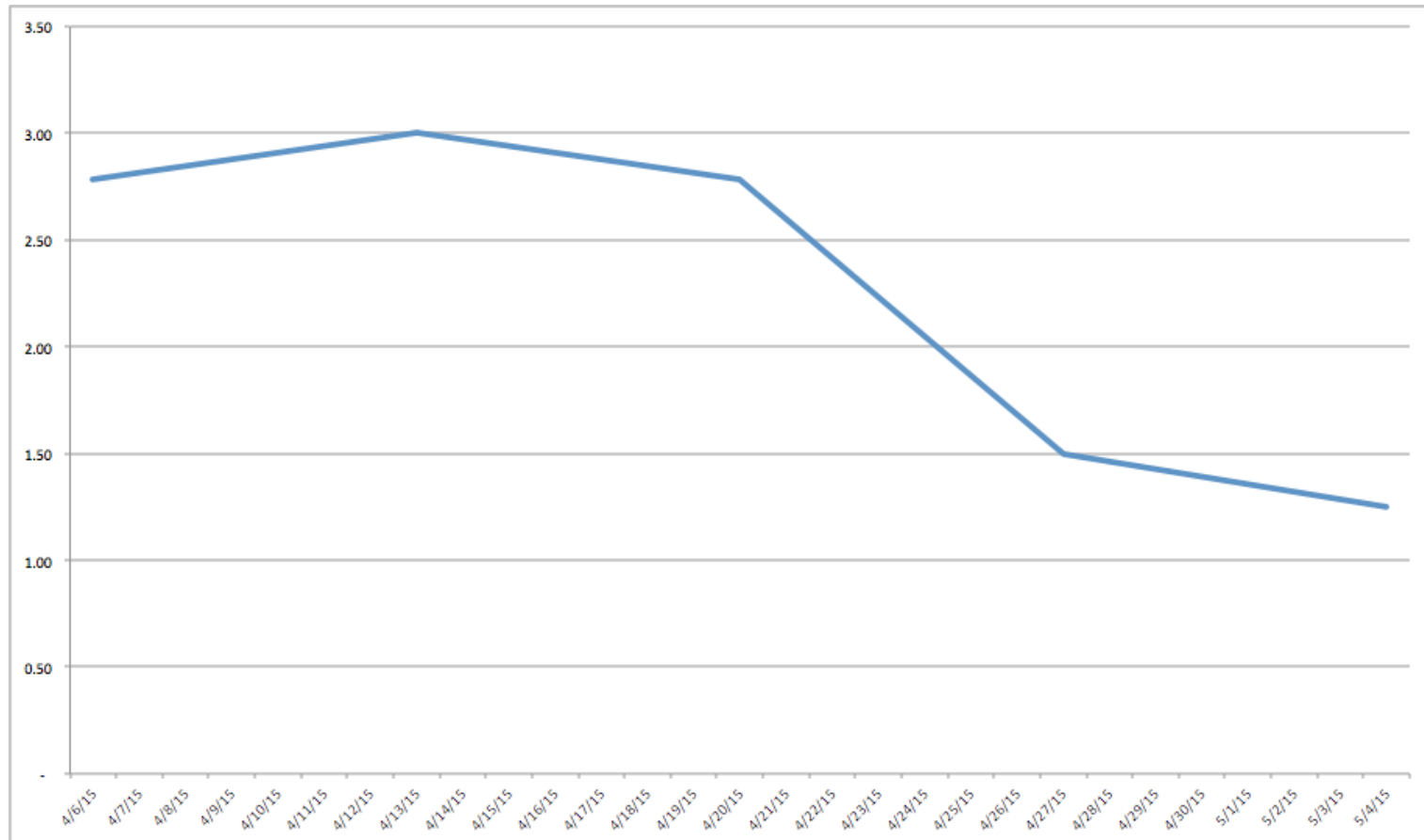
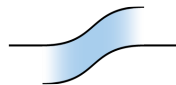
Minimize
Delay

- Call out people's names
- holding yourself accountable

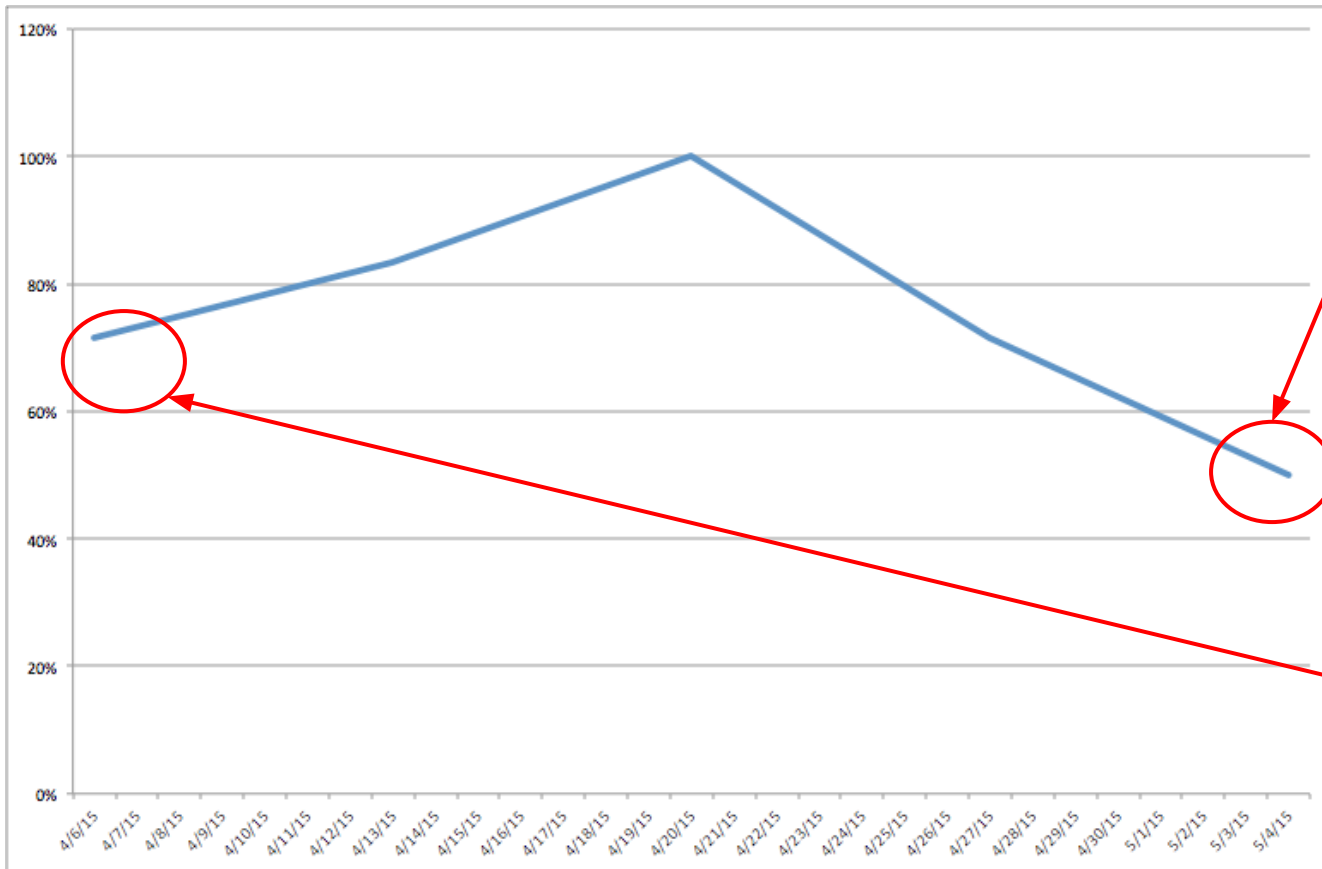
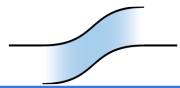


Discourage
Multitasking

REWORK



MULTITASKING



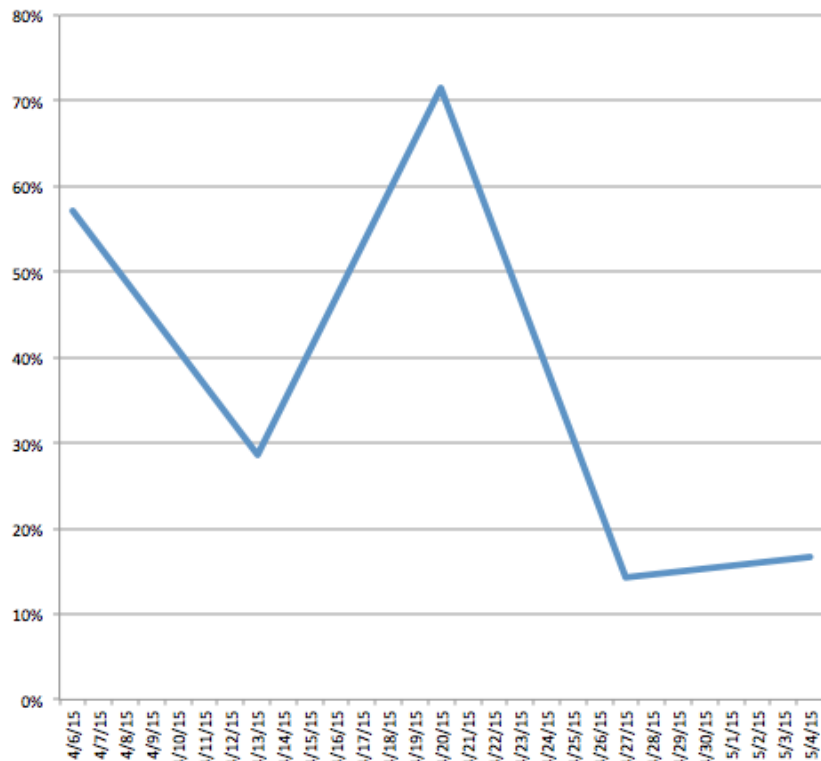
Co-location!!

Videos Turned On

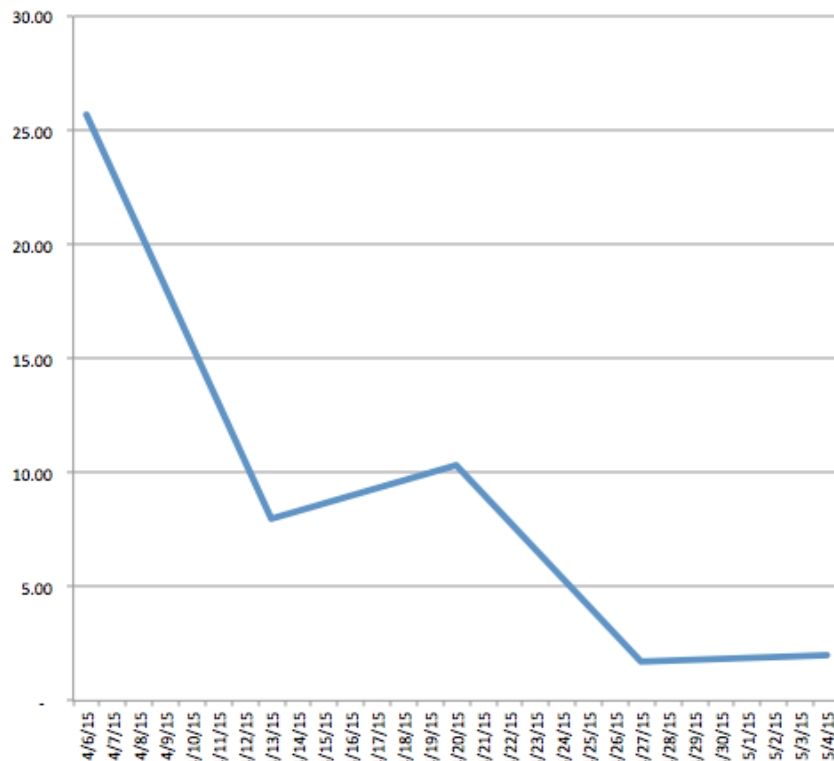


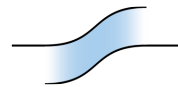


Percentage of People who Experienced Delay



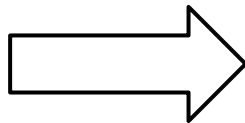
Length of Delay





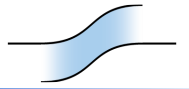
Latency:

- Rework**
- Multitasking**
- Delay**



**Value
for Time[®]**





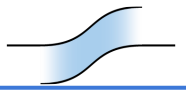
Feedback: Anything in particular you liked / disliked during the meeting?

Value per Activity:

-Which of the following activities were / were not valuable during the meeting?

(Brainstorming, Creating Deliverables, Updating, Resolving Coordination Issues, Developing Ideas, Planning Workflow, Special Activities)

Value: What percentage of the time during the meeting did you think was valuable?



Liked:

1. Short Updates from each discipline
2. BrainMerge
3. Set up Subgroup Meetings
4. Seeing People Over Video

Disliked:

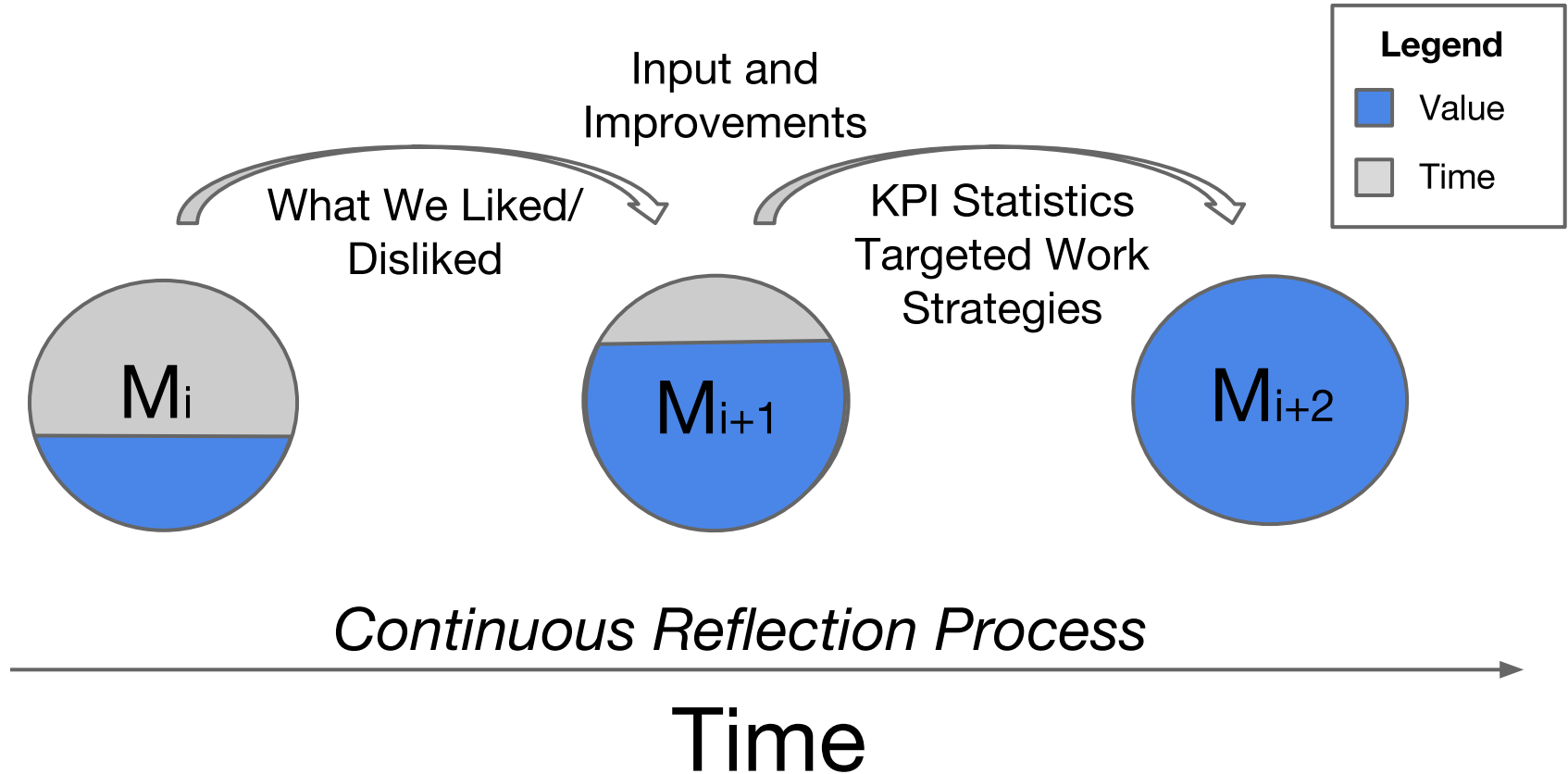
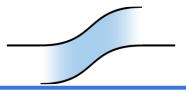
1. Planning Workflow

Feedback:

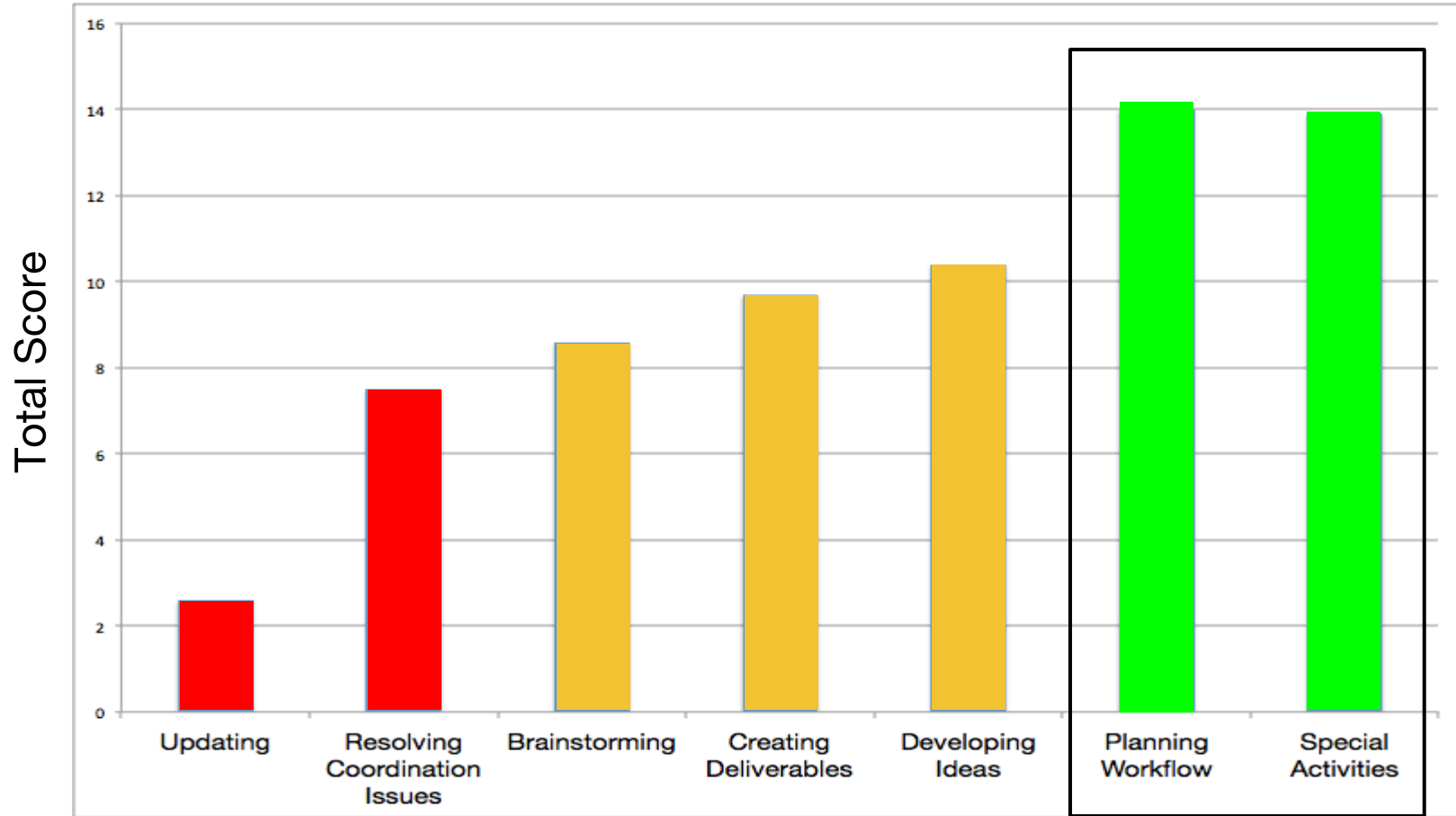
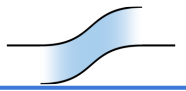
1. Say relevant things
2. Less comments and feedback time
3. Need to plan future work
4. Need to work on “process”

Value
for Time[®]

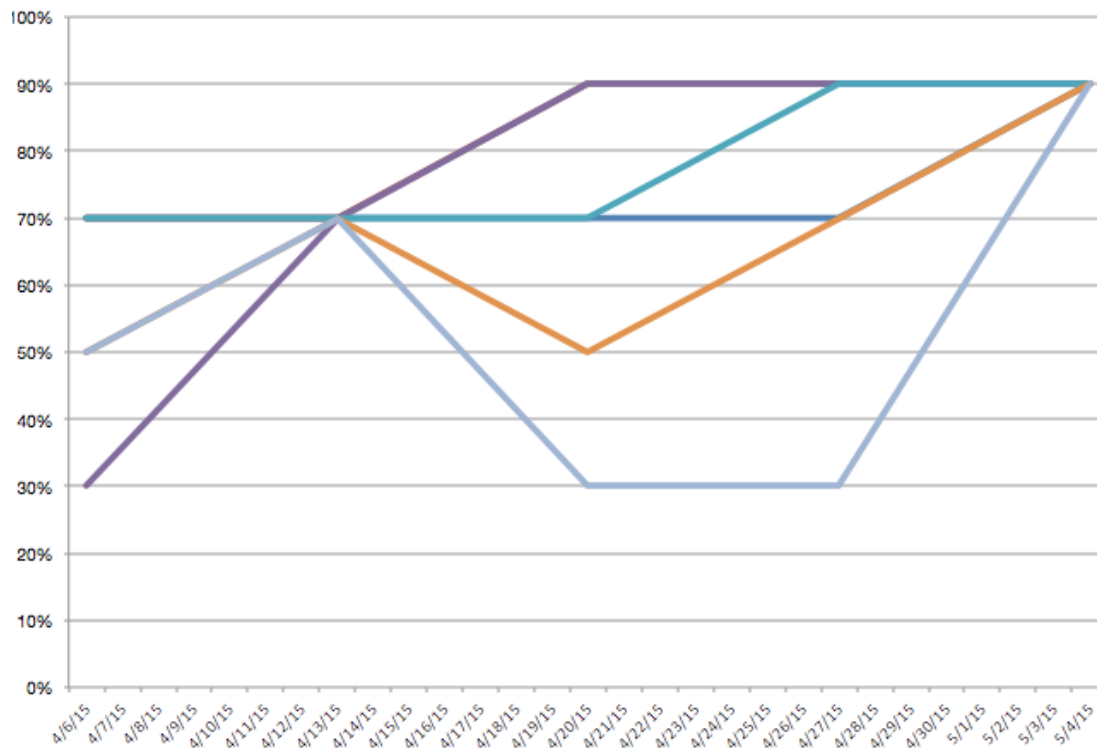
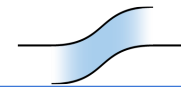
RESULT DRIVEN MEETINGS



VALUE FOR TIME PER ACTIVITY



VALUE FOR TIME PER MEMBER

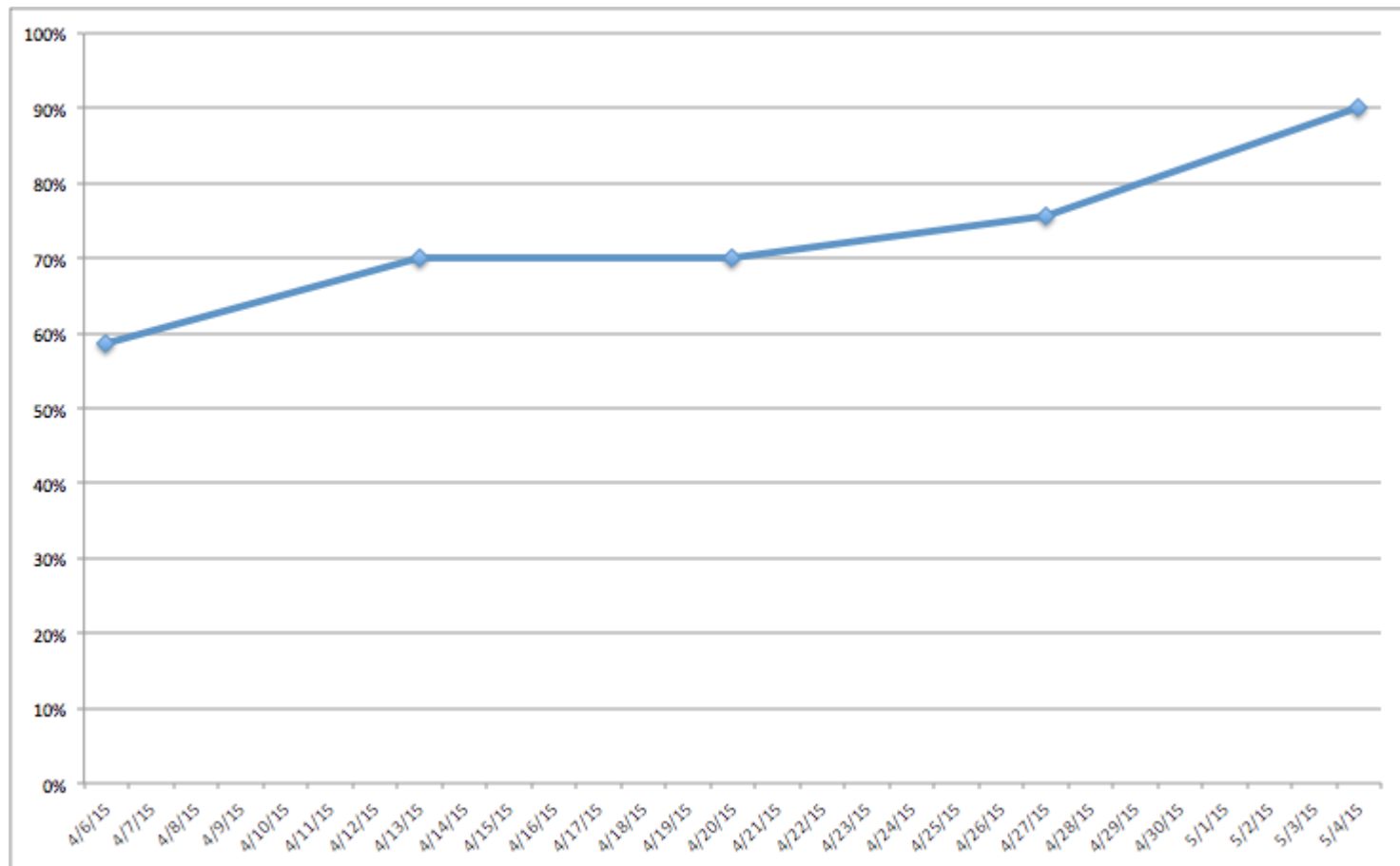
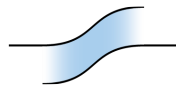


Team Members

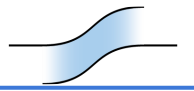
- Geffen
- Han Wei
- Klara
- Robert
- Sio Chong
- Stavros
- Xi Liu

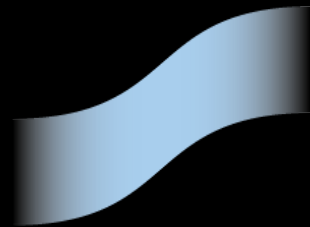


VALUE FOR TIME



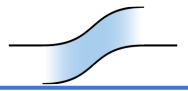
VALUE FOR TIME





waver

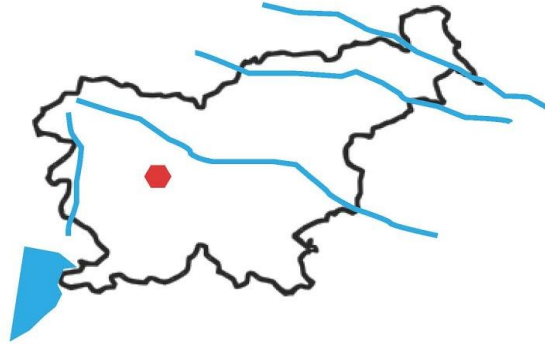
WATER NETWORK



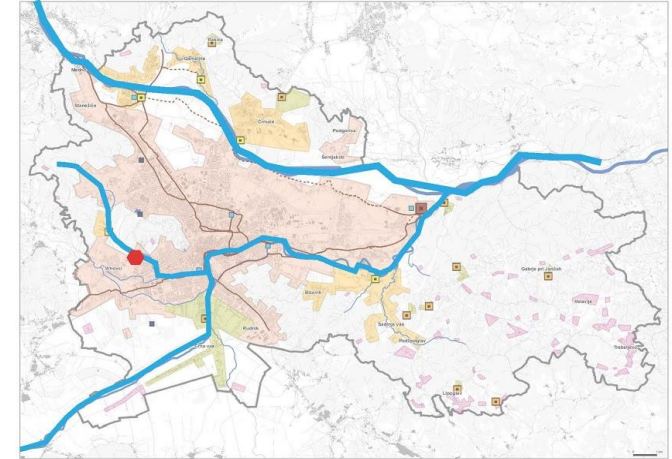
EUROPE



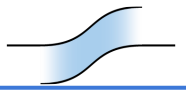
SLOVENIA



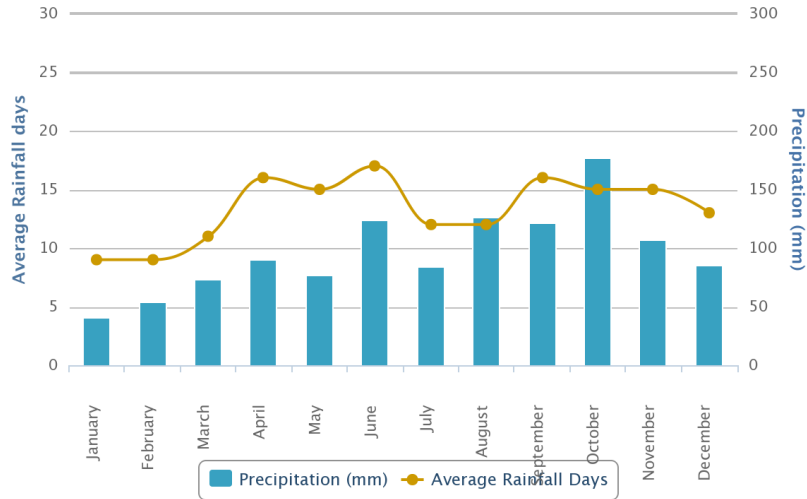
LJUBLJANA



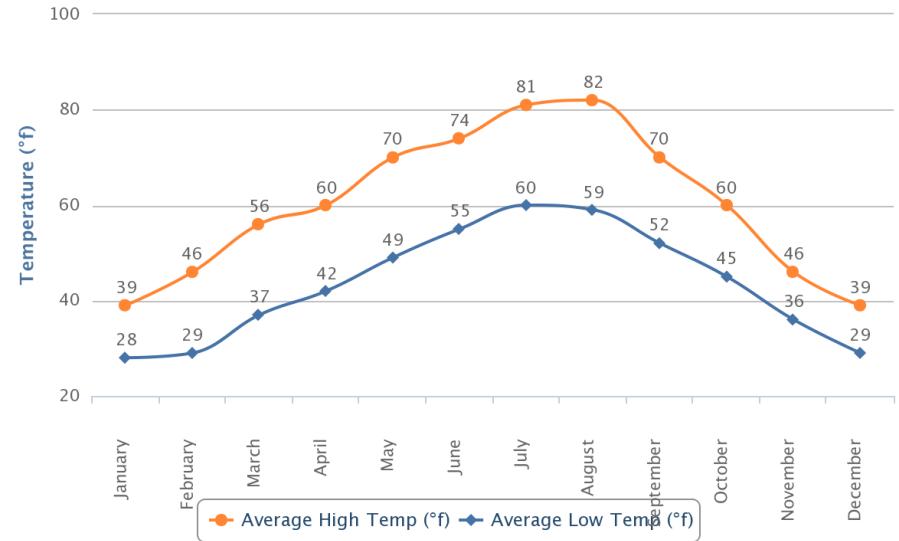
BASIN
OCEANIC CLIMATE
EARTHQUAKES
YEARLY FLOODINGG
FOG - 60 DAYS/YEAR



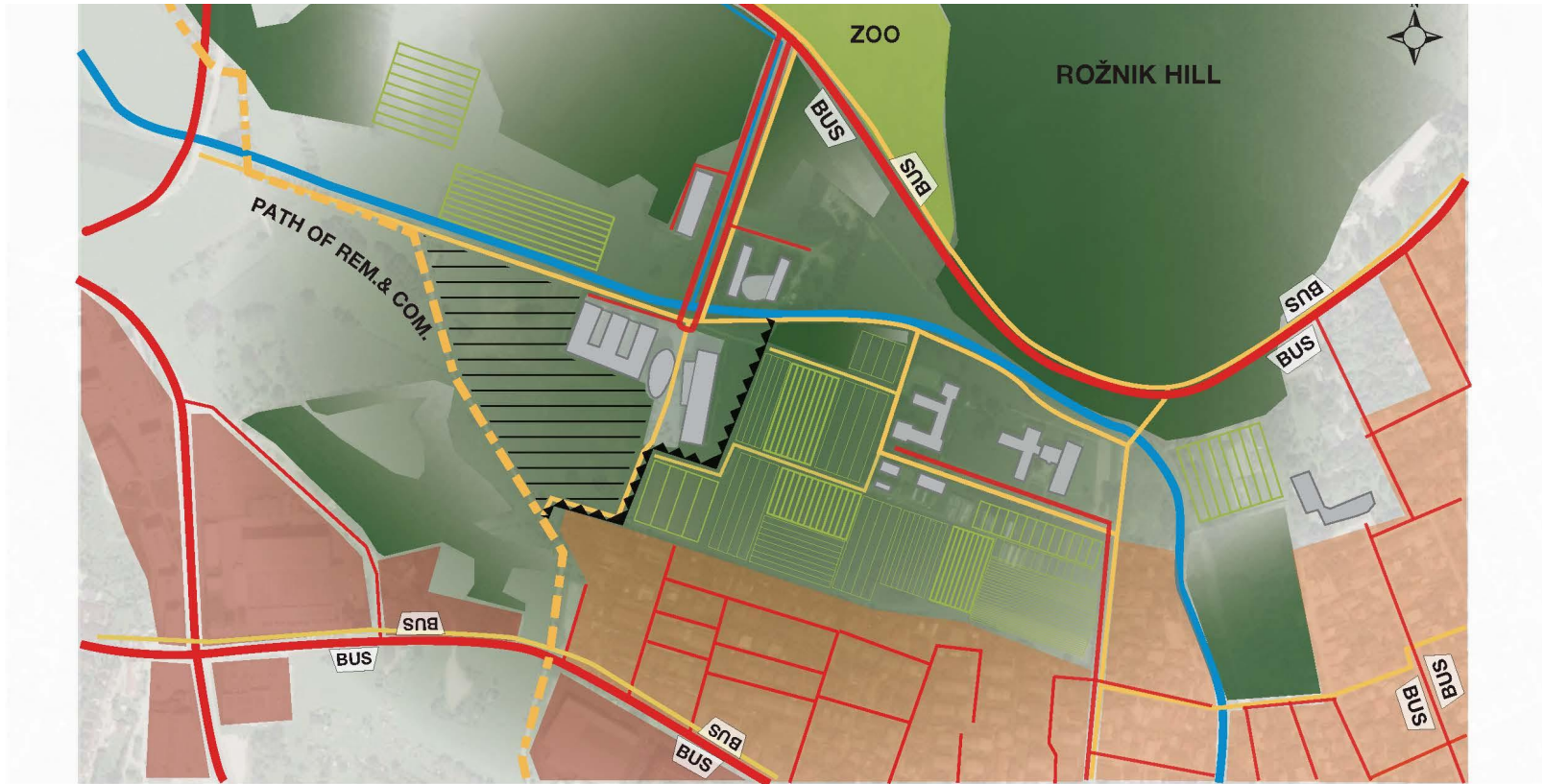
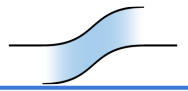
Average Rainfall (mm)



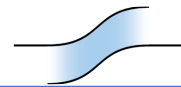
Average Temperature (°F)



SITE ANALYSIS



ORIENTATION



18_Mar_08:00am



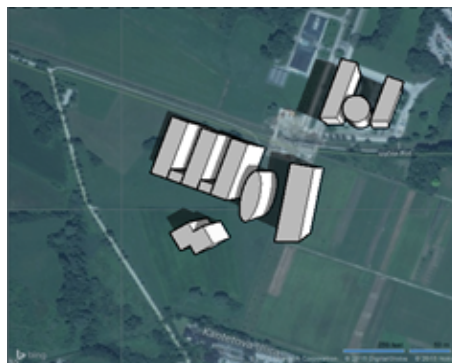
07_May_08:00am



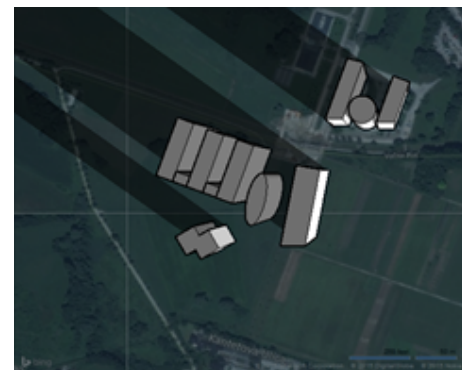
26_Jun_08:00am



15_Aug_08:00am

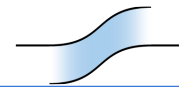


04_Oct_08:00am

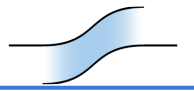


03_Dec_08:00am

SURROUNDING BUILDINGS



WHAT IS MISSING ?



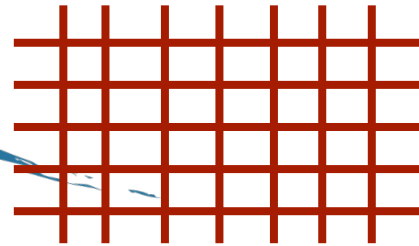
HILL ROZNIK
RELAX



FACULTY / STUDENTS



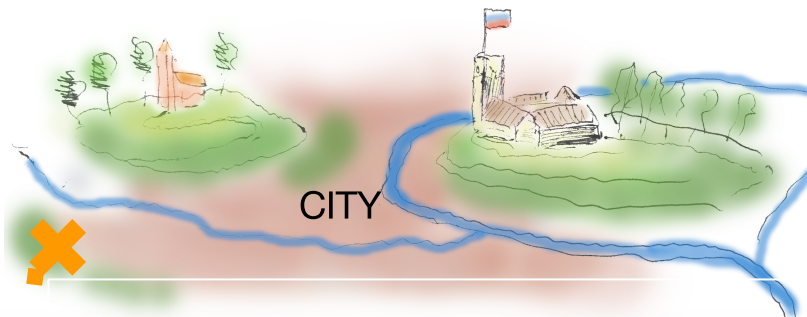
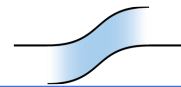
FACULTY / STUDENTS



CITY / LAY PUBLIC



GATES OF LJUBLJANA



PROJECT SITE

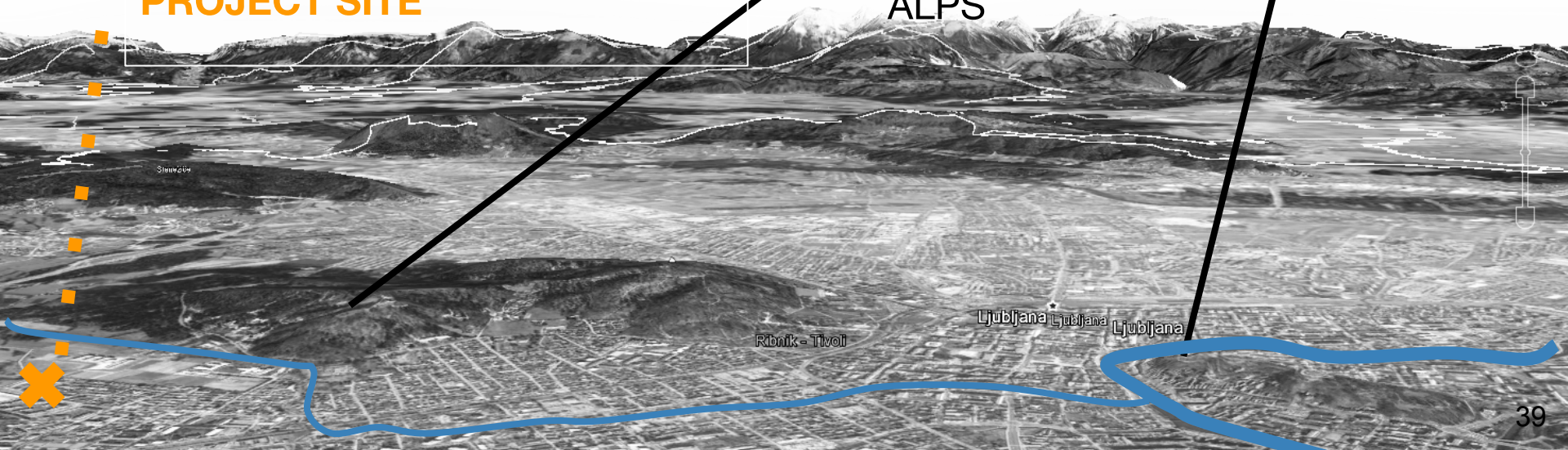
HILL ROZNIK

FLOW

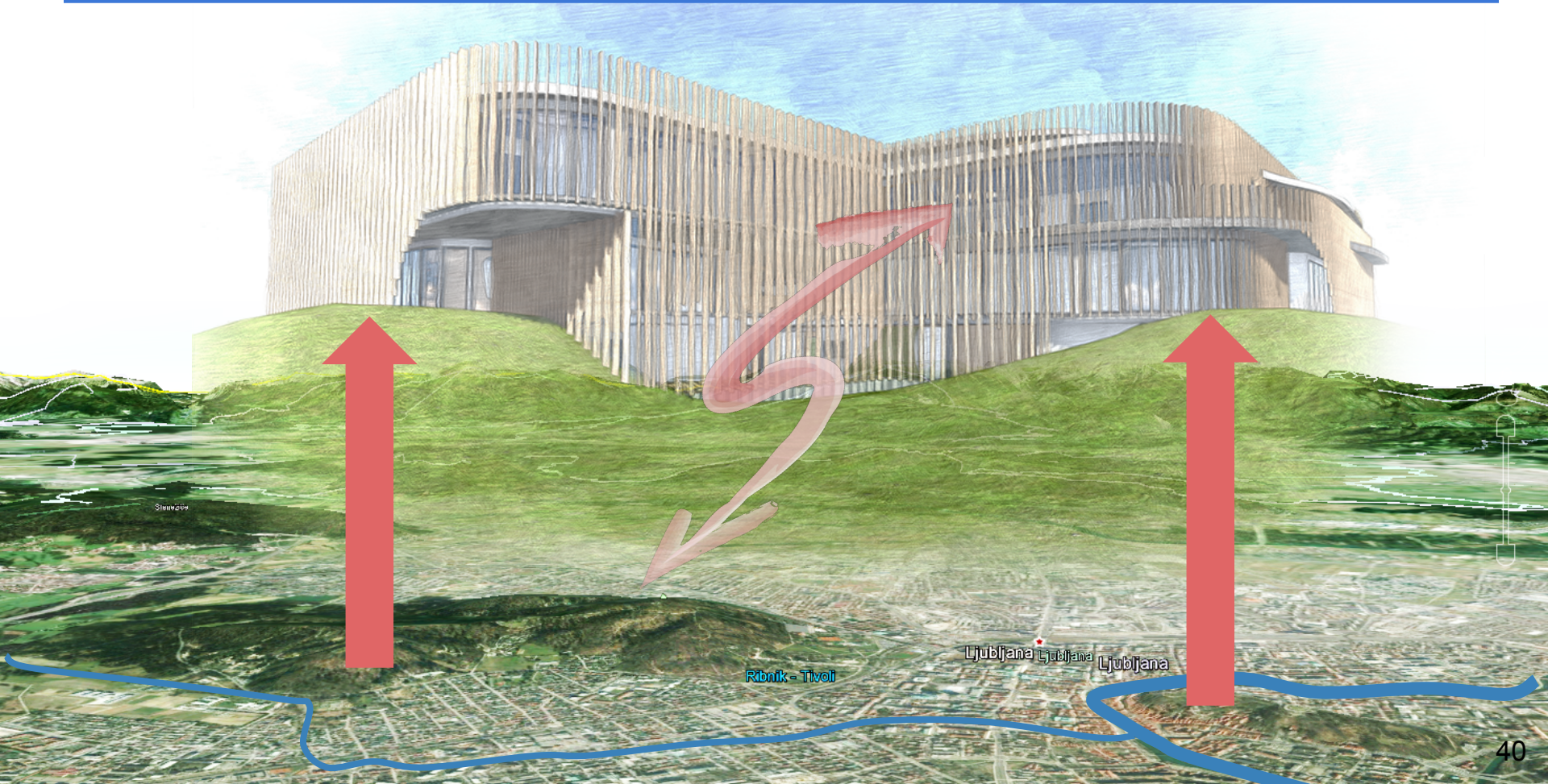
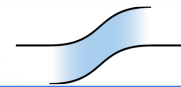
RIVER

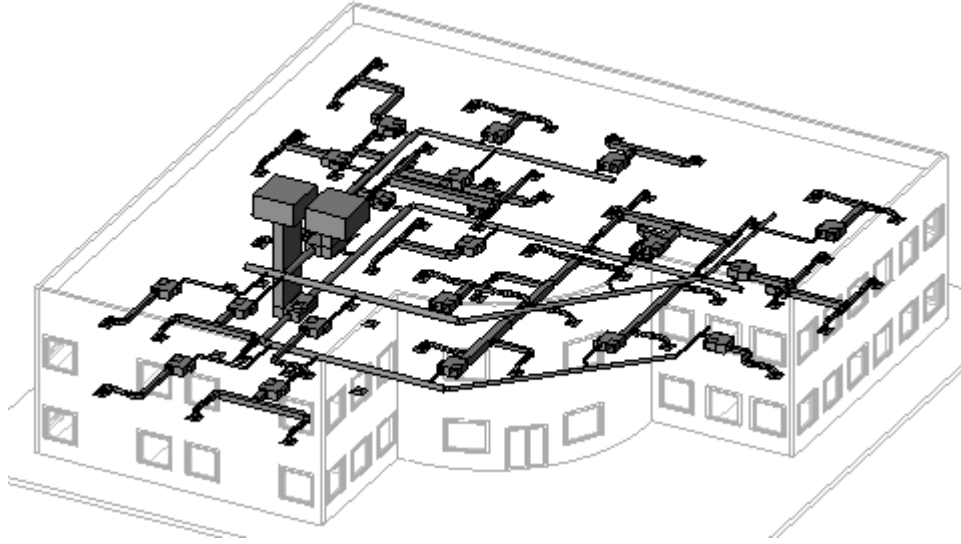
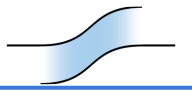
CASTLE HILL

ALPS

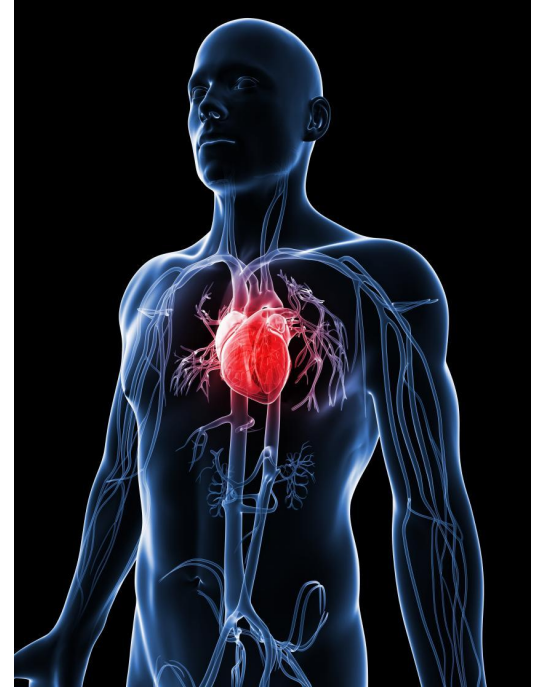


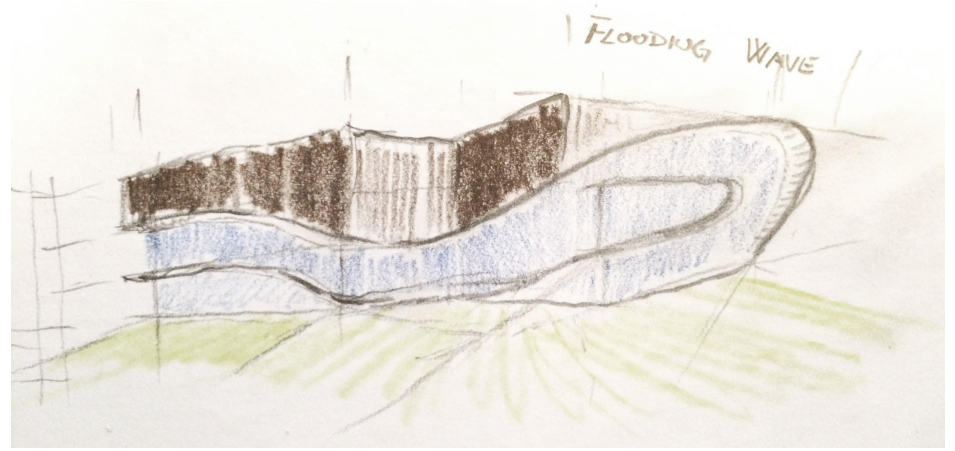
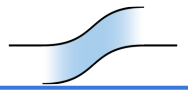
CONCEPT - SITE INTEGRATION



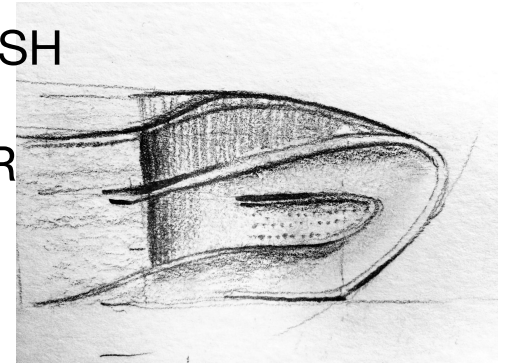


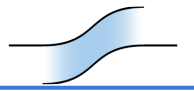
WATER = LIFE



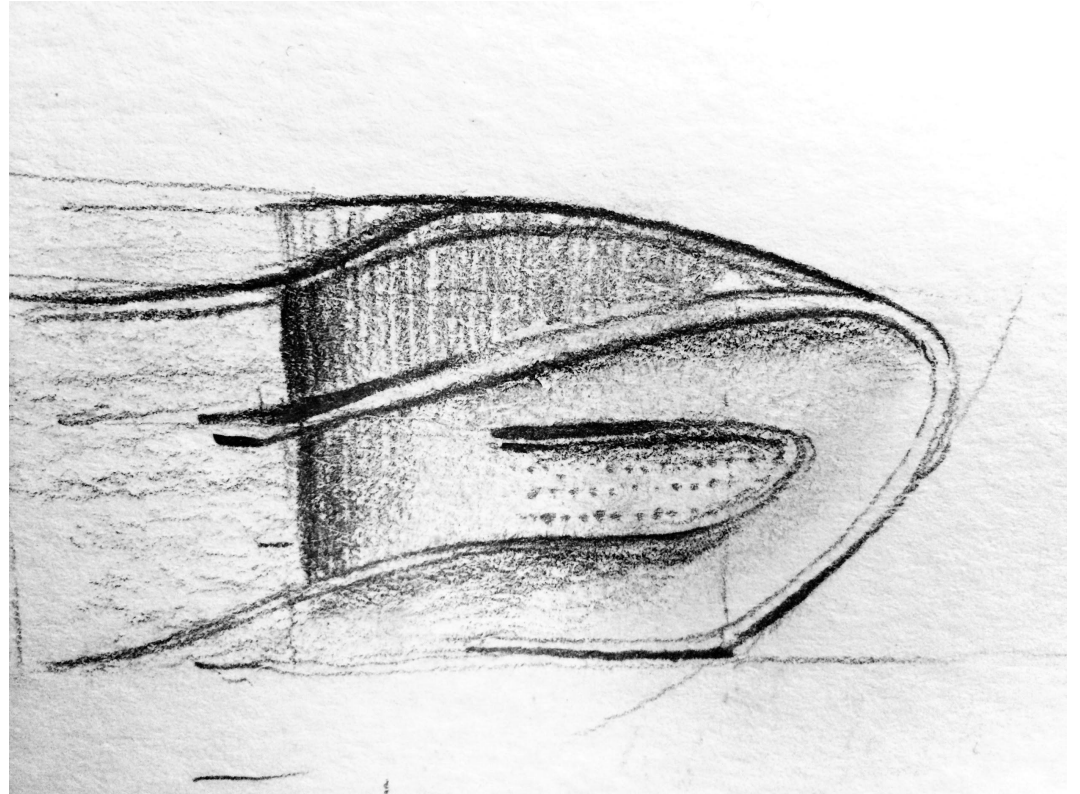


- PREHISTORIC PILE DWELLINGS - LJUBLJANA MARSH
- STRUCTURAL GRID SYSTEM
- VERTICAL WALL/SUNSHADE VS. HORIZONTAL/WATER
- GREEN ROOF- NATURAL INSULATION
- LOCAL MATERIALS
- FLOODS

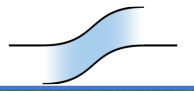


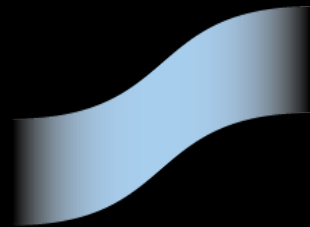


- DYNAMIC BUILDING
- SPACE ORGANISATION
- FLUIDITY / FLOW



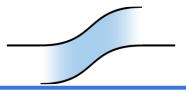
SITE PLACING



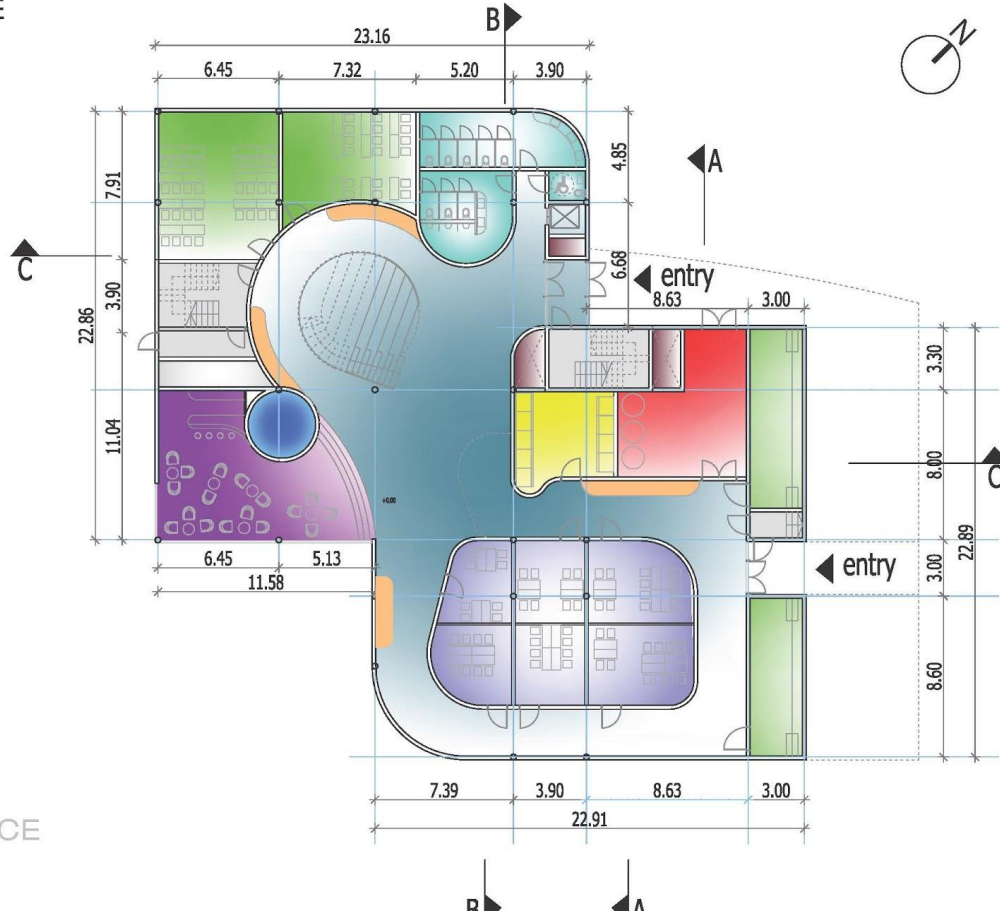


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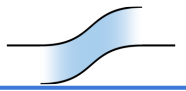
GROUND FLOOR



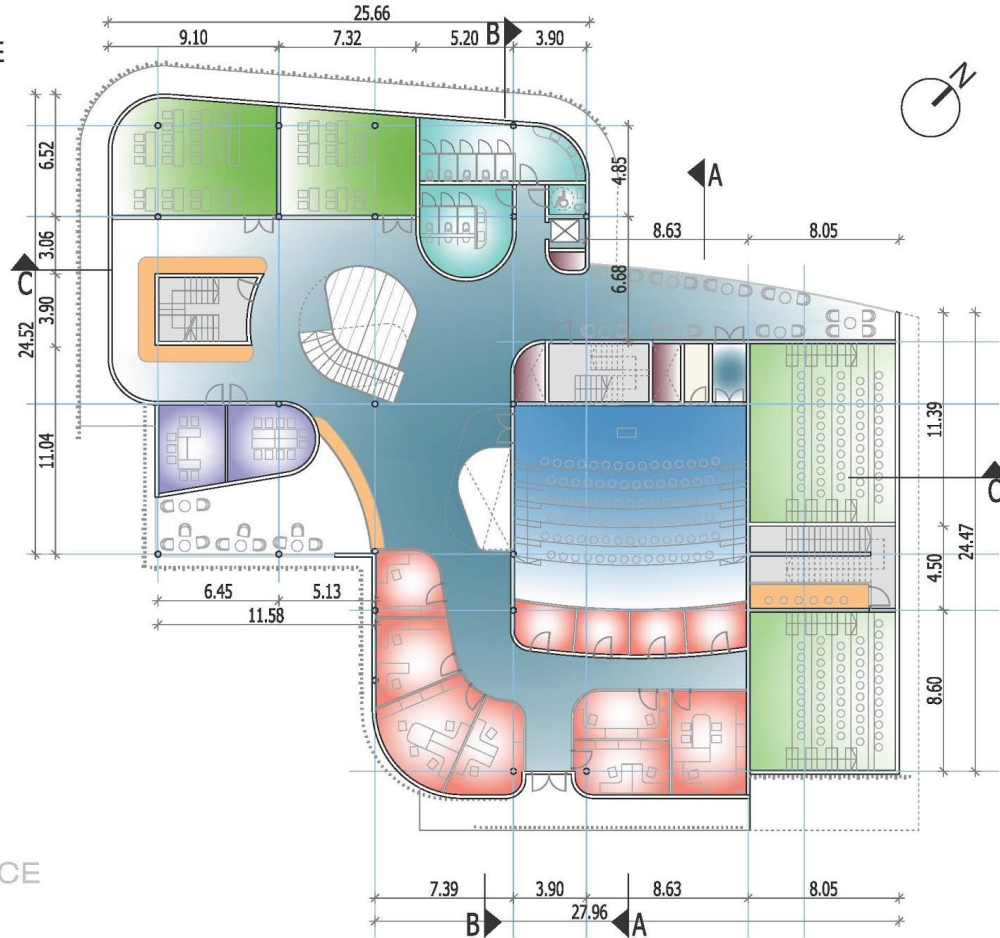
- CIRCULATION / LOUNGE
 - FIRE STAIRS / STORAGE
 - RESTROOMS
 - SERVER ROOM
 - MECHANICAL ROOM
 - WATER TANK
-
- AUDITORIUM
 - LARGE CLASSROOM
 - SMALL CLASSROOM
 - INSTRUCTIONAL LABS
 - SEMINAR ROOMS
 - STUDY'N'GO
-
- FACULTY OFFICES
 - CAFE LIBRARY
 - ROOF BAR WITH TERRACE



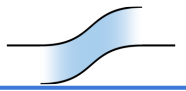
FIRST FLOOR



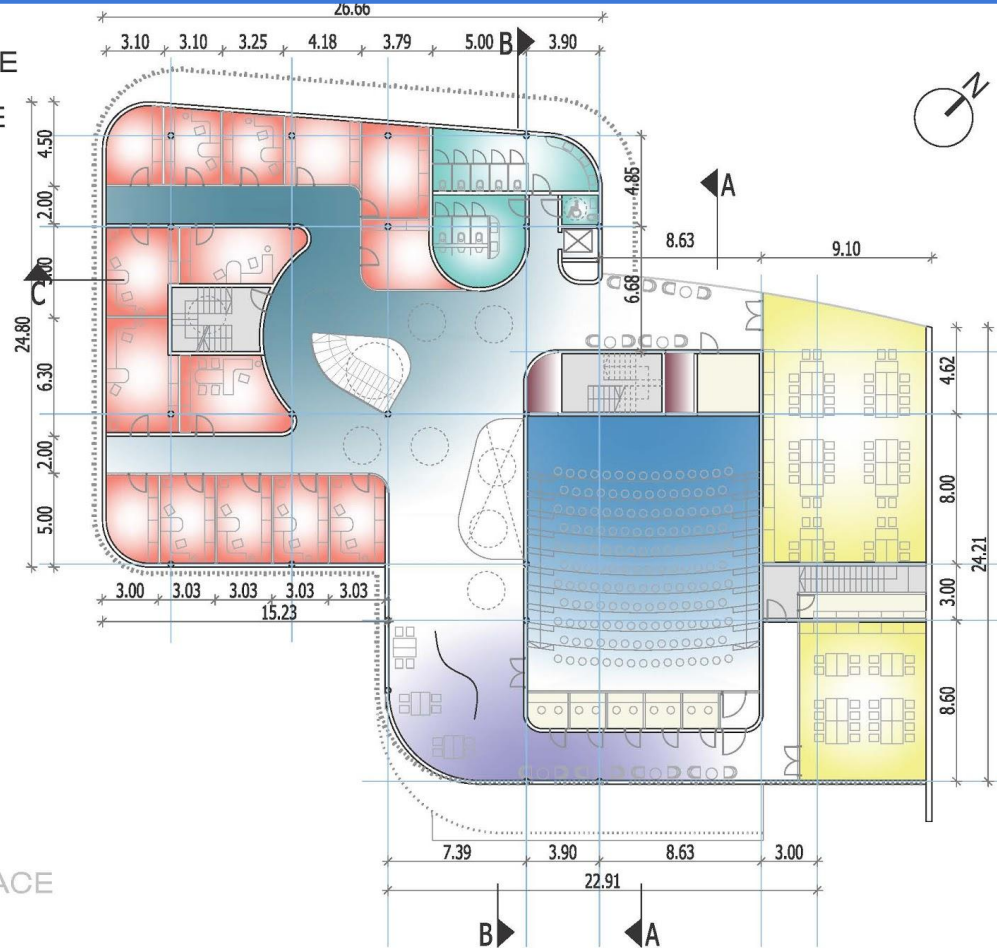
- CIRCULATION / LOUNGE
- FIRE STAIRS / STORAGE
- RESTROOMS
- SERVER ROOM
- MECHANICAL ROOM
- WATER TANK
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- SEMINAR ROOMS
- STUDY'N'GO
- FACULTY OFFICES
- CAFE LIBRARY
- ROOF BAR WITH TERRACE



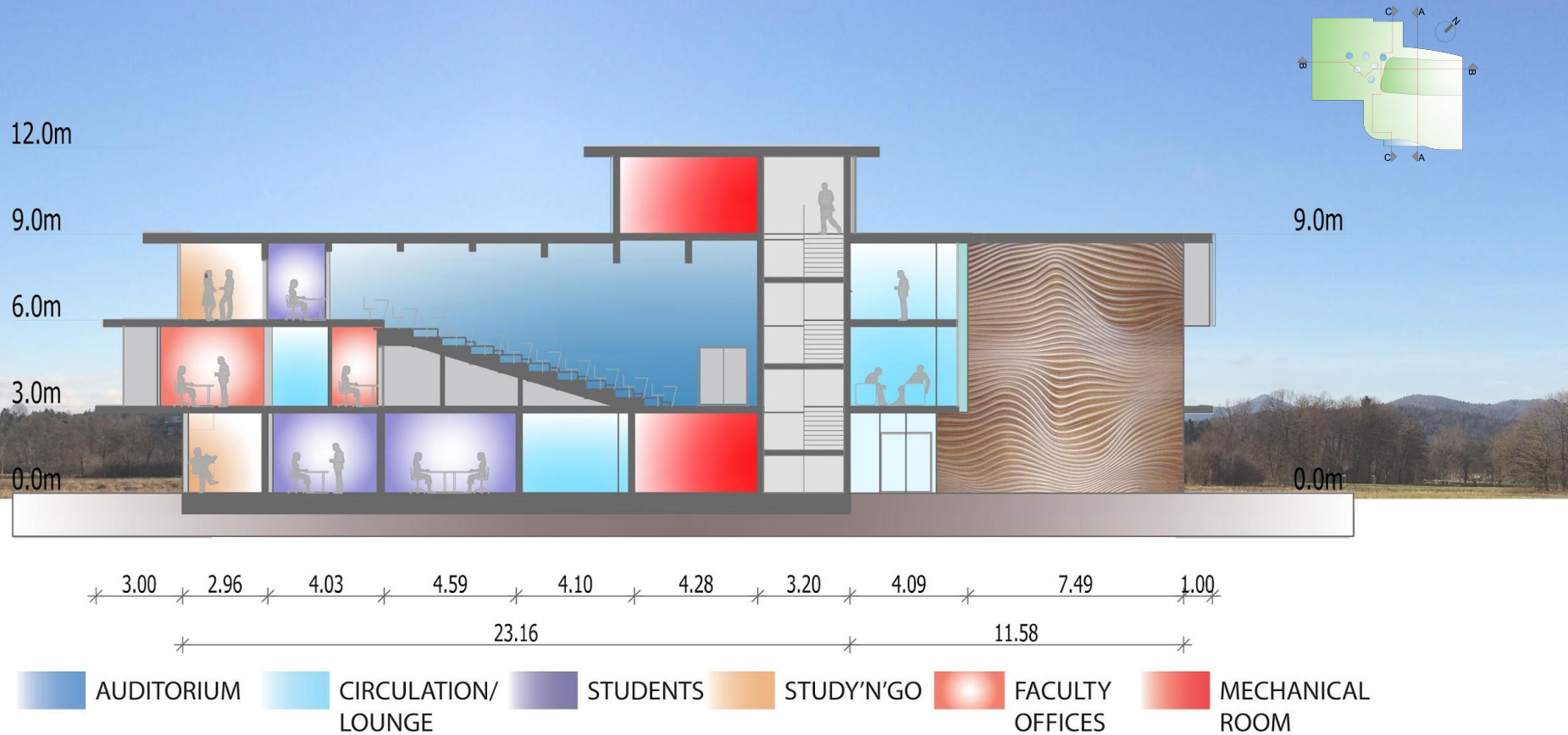
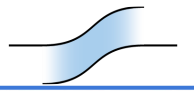
SECOND FLOOR



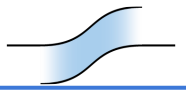
- CIRCULATION / LOUNGE
- FIRE STAIRS / STORAGE
- RESTROOMS
- SERVER ROOM
- MECHANICAL ROOM
- WATER TANK
- AUDITORIUM
- LARGE CLASSROOM
- SMALL CLASSROOM
- INSTRUCTIONAL LABS
- SEMINAR ROOMS
- STUDY'N'GO
- FACULTY OFFICES
- CAFE LIBRARY
- ROOF BAR WITH TERRACE



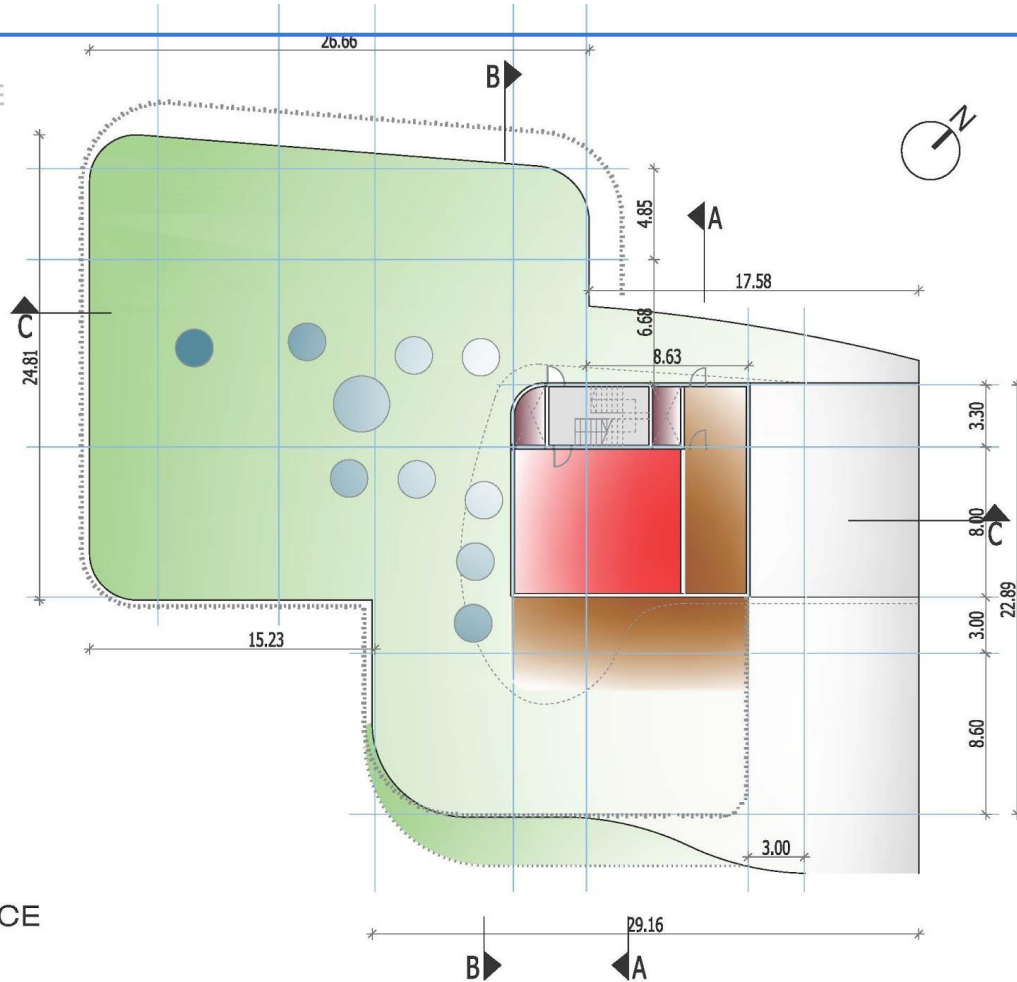
SECTION A-A



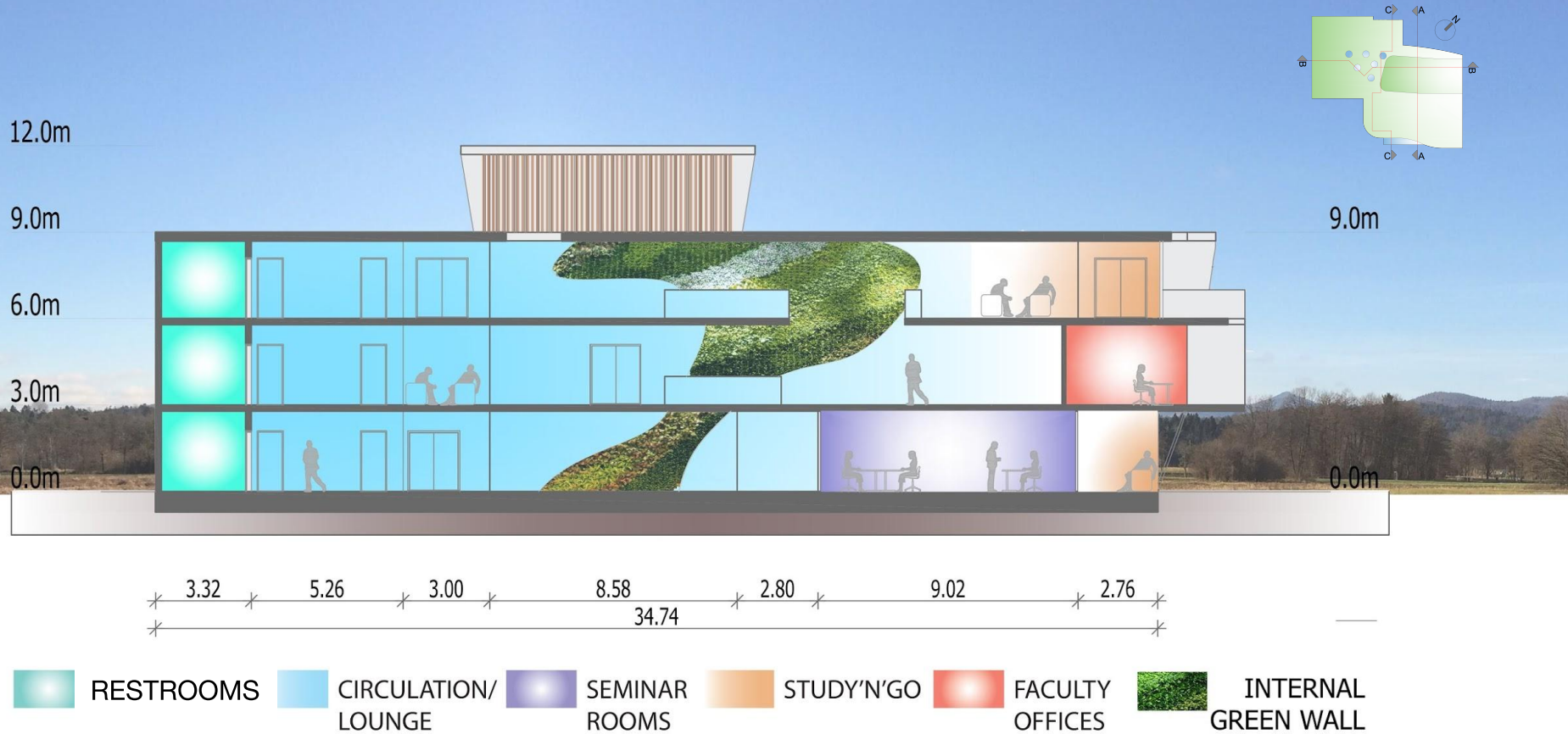
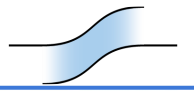
THE ROOF



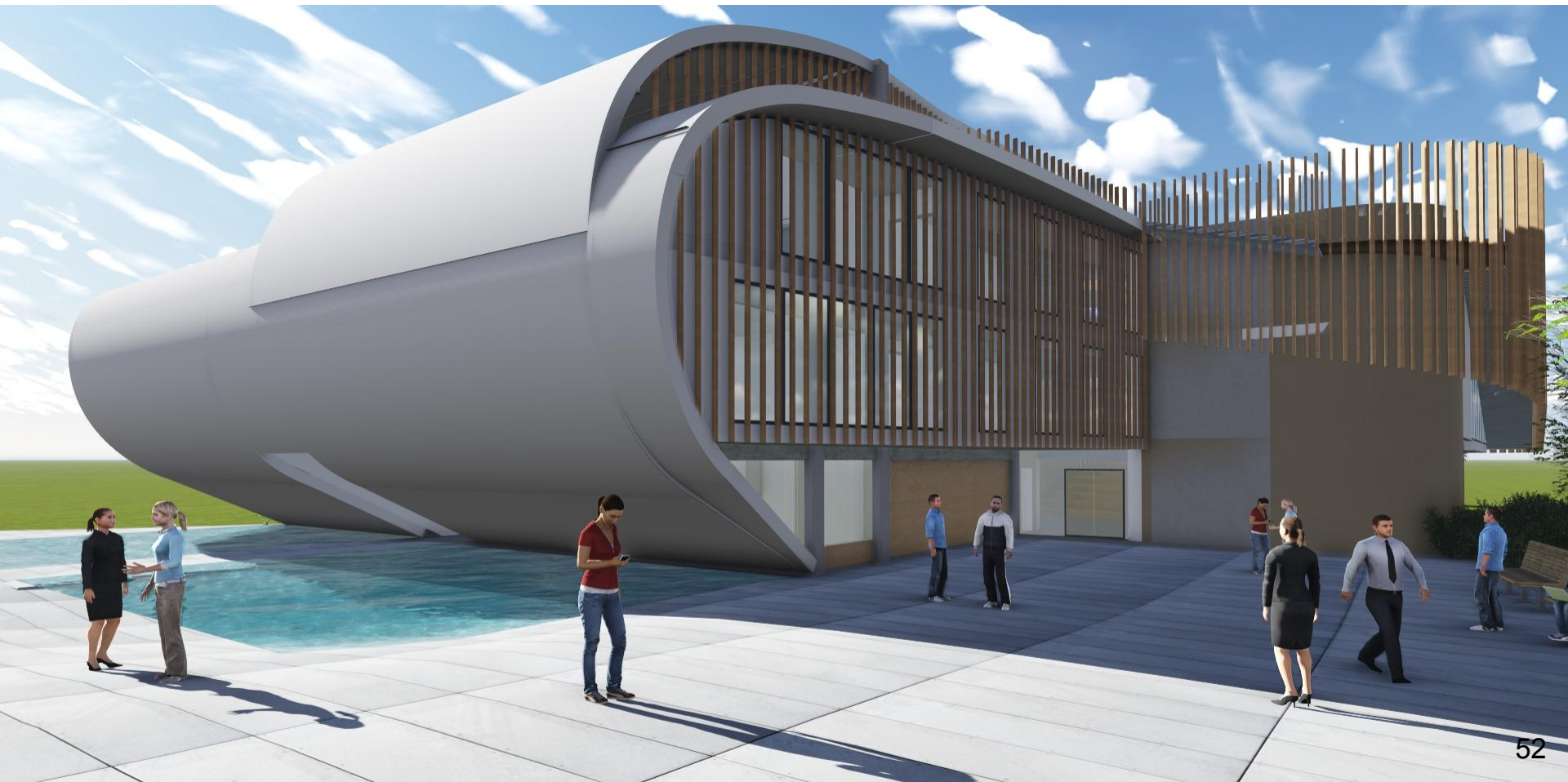
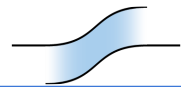
- CIRCULATION / LOUNGE
 - FIRE STAIRS / STORAGE
 - RESTROOMS
 - SERVER ROOM
 - MECHANICAL ROOM
 - WATER TANK
-
- AUDITORIUM
 - LARGE CLASSROOM
 - SMALL CLASSROOM
 - INSTRUCTIONAL LABS
 - SEMINAR ROOMS
 - STUDY'N'GO
-
- FACULTY OFFICES
 - CAFE LIBRARY
 - ROOF BAR WITH TERRACE

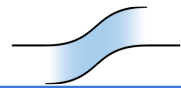


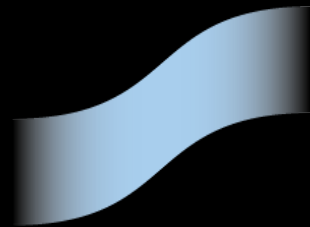
SECTION B-B



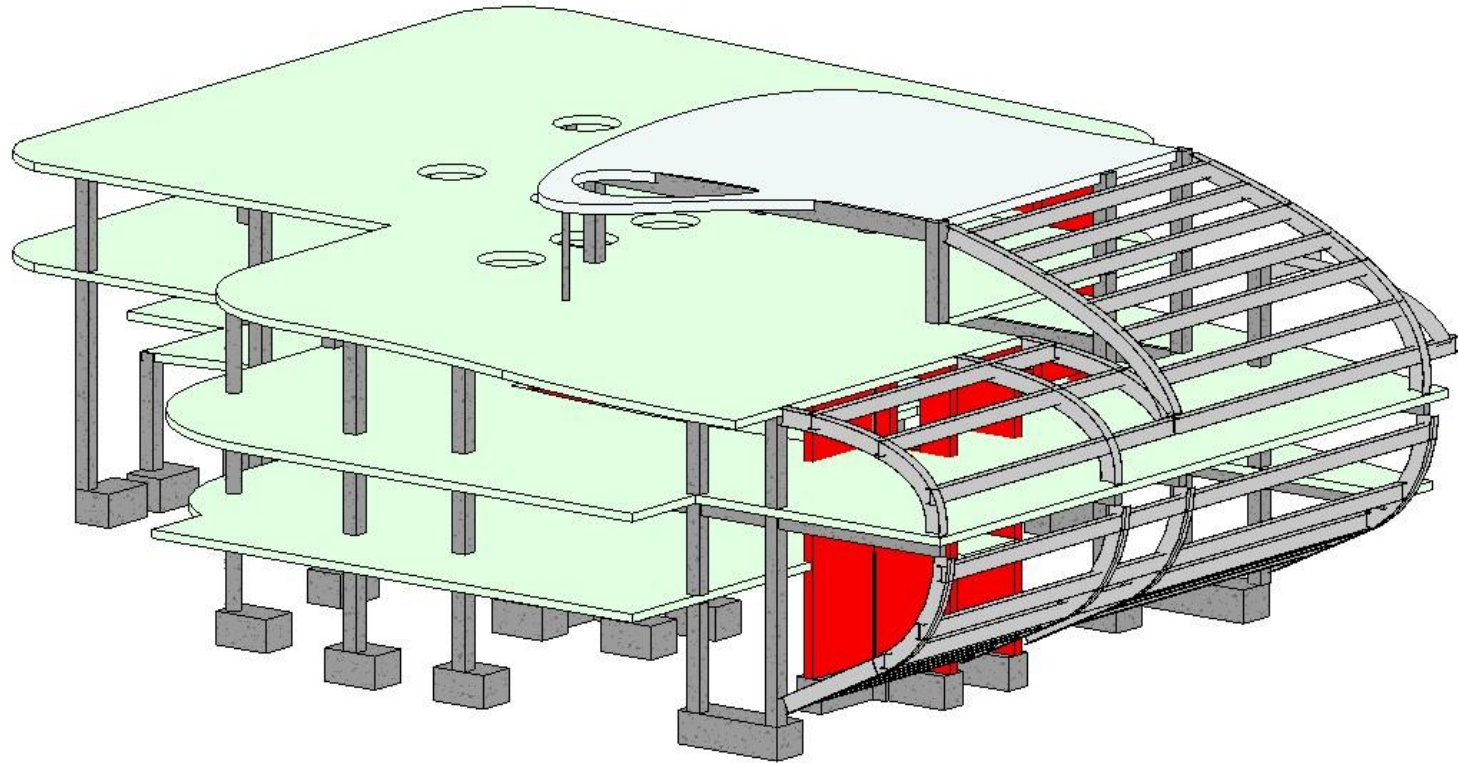
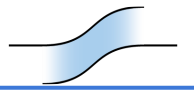
ENTRANCE PLAZA

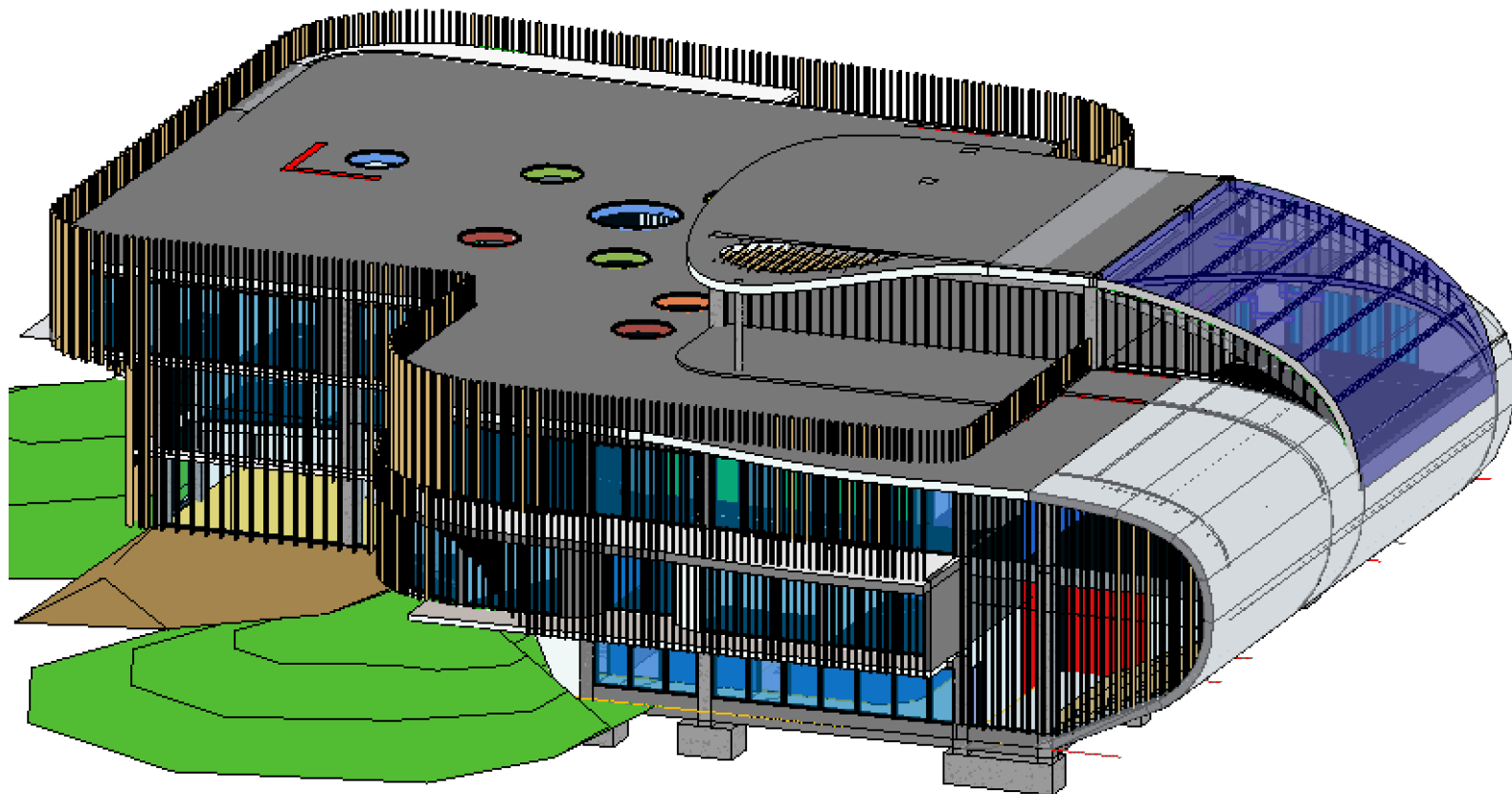
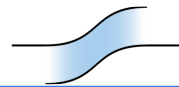


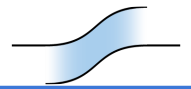




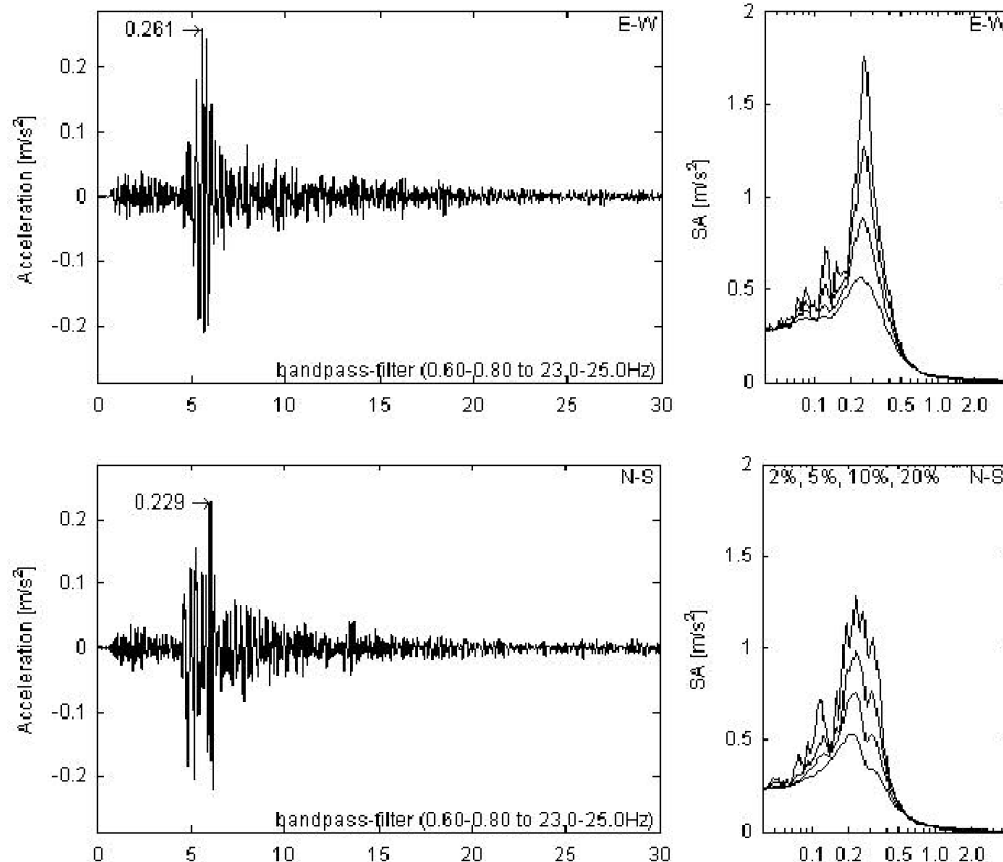
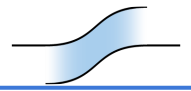
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	Occupancy or Use	Uniform Load
Uniform Live Load	Classroom	40 psf
	Office	50 psf
	Computer Lab	100 psf
	Auditorium	150 psf
	Corridor	80 psf
	Green Roof	60 psf
Concentrated Live Load	Mechanical Room Grating (on area of 4 in ²)	300 lb
Uniform Dead Load	Concrete Self Weight	150 pcf
	MEP System Allowance	10 psf
Wind Load	All Level	8.6 psf
Earthquake Load	All Level	Time History



Earthquake Time History Data at Trebnje, Slovenia

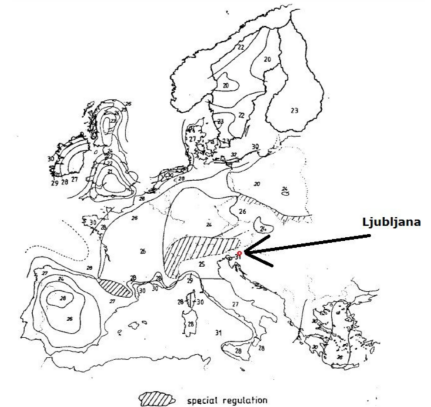
- ❖ Max Ground Acceleration at EW = 0.261 m/s²
- ❖ Max Ground Acceleration at NS = 0.229 m/s²

Ref: Ambraseys N., P Simt, R. Sigbjomsson, P. Suhadolc, B. Margis (2001)

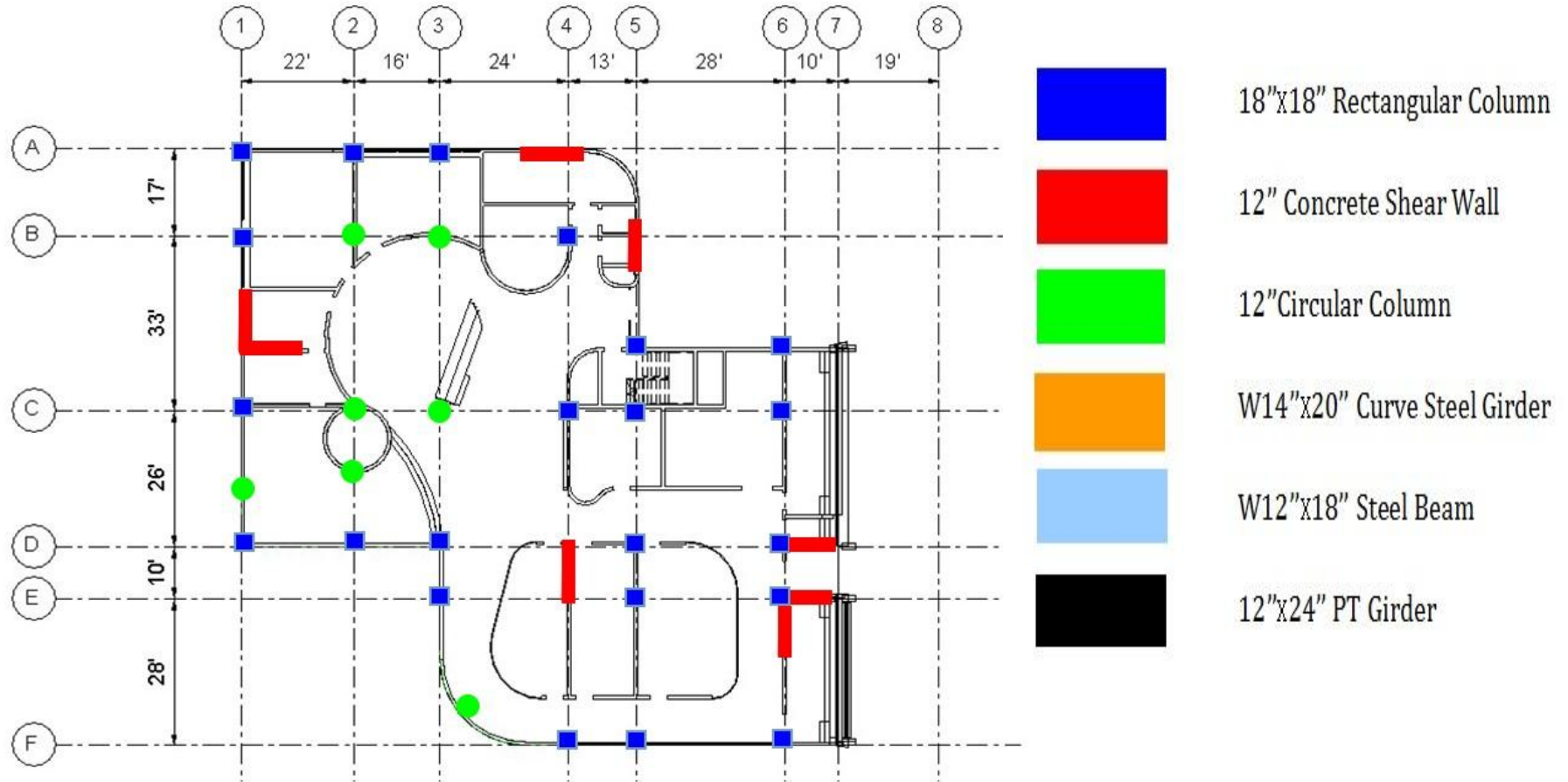
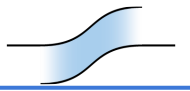
Use a simplified format based on the provisions of the ASCE Standard

$$\text{Wind Pressure } P = 0.00256V^2IK_zK_{zt}K_dGC_p = 8.6\text{psf}$$

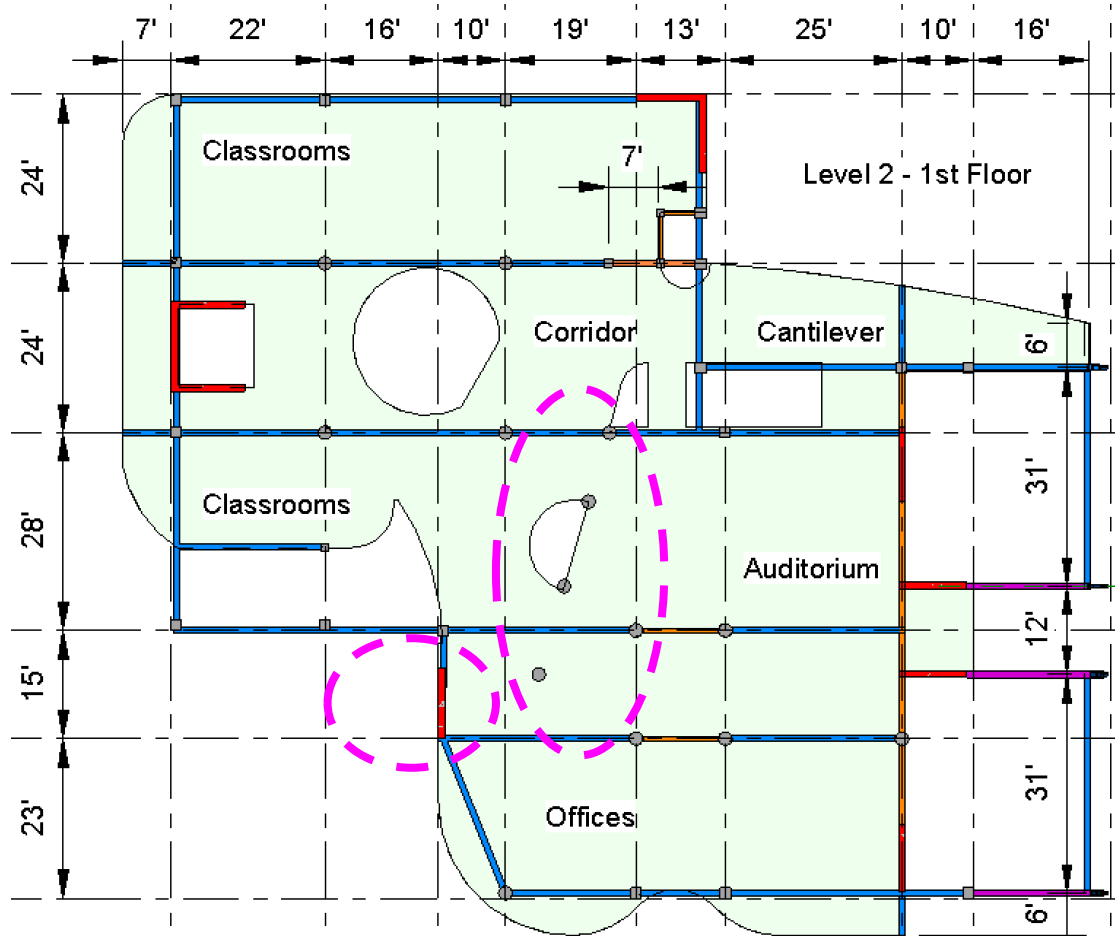
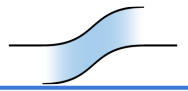
- Assume basic wind speed $V = 85$ mph (same with CA).
- School -> Occupancy Level 3 -> $I = 1.15$;
- Exposure Category B & Low-rise Building -> $K_z = 0.7$ for all levels;
- Building on ground level -> $K_{zt} = 1.0$;
- Main Lateral-Resisting System -> $K_d = 0.85$;
- Rigid Structure -> $G = 0.85$;
- Windward Wall -> $C_p = 0.8$.



GROUND FLOOR FLOORPLAN



WINTER GROUND FLOOR FLOORPLAN



Floor Plan (Winter Presentation)

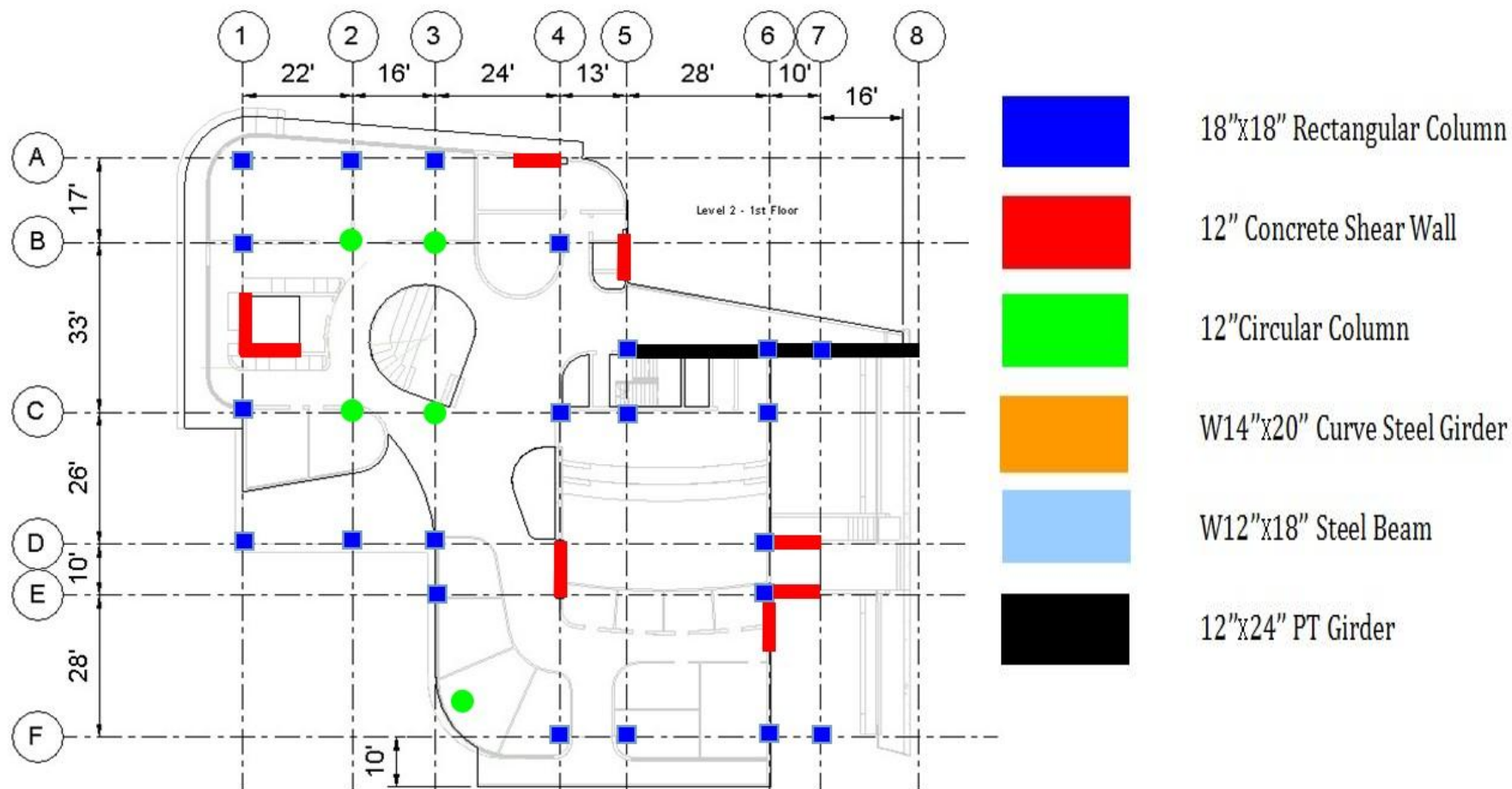
Problems:

1. Off-grid Columns
2. Shear Wall on Curtain Wall

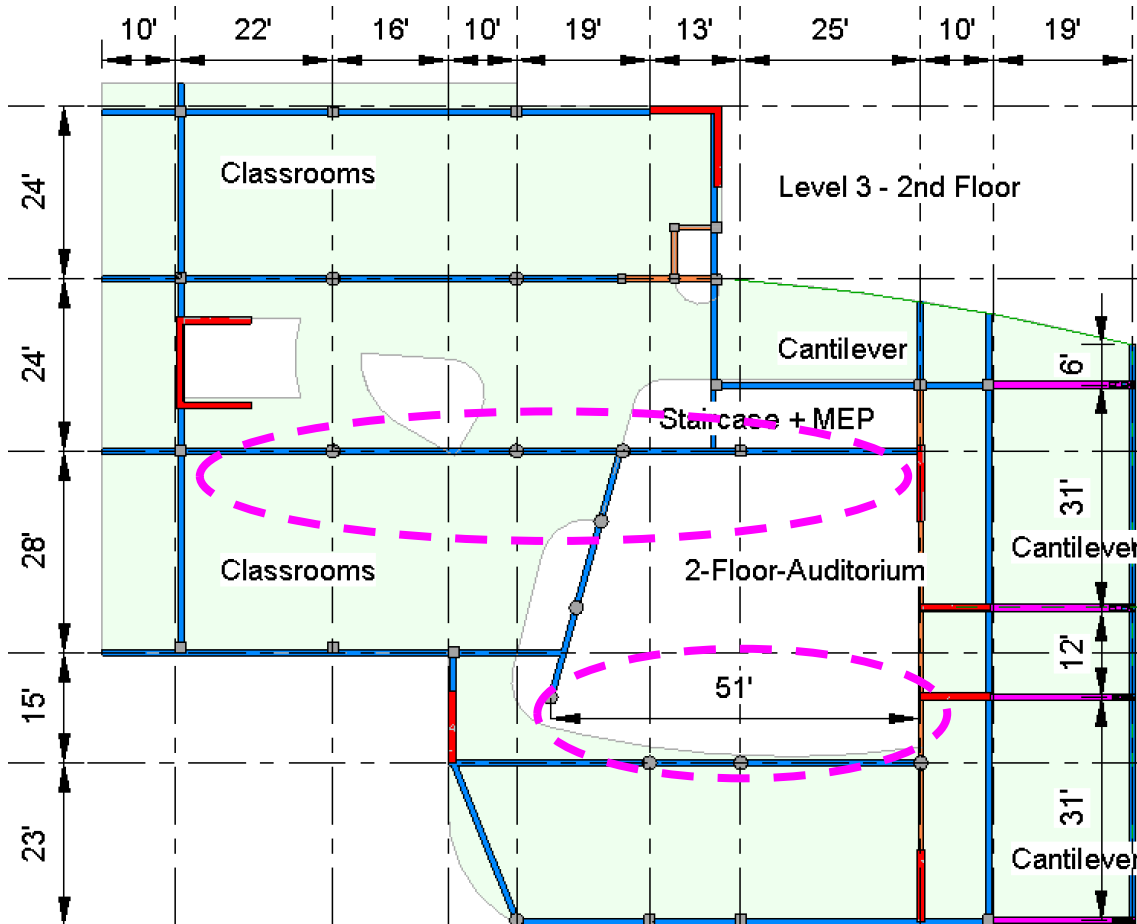
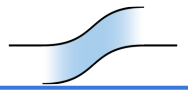
Solutions:

1. Relocate the columns
2. Move the shear wall

1ST FLOORPLAN



WINTER 1ST FLOORPLAN



Floor Plan (Winter Presentation)

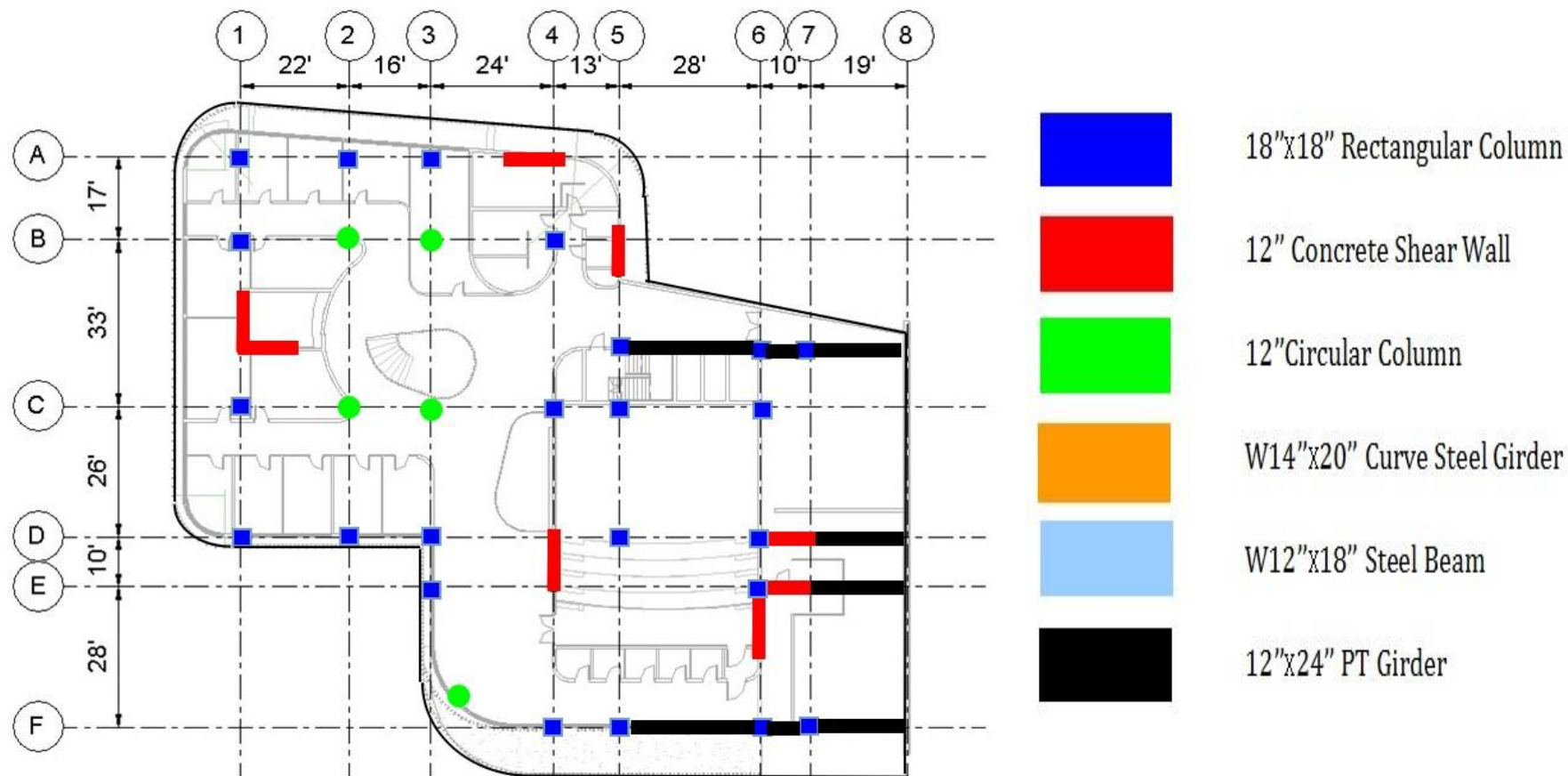
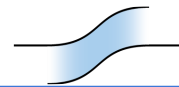
Problem:

1. MEP Ducts cannot penetrate beams
2. Too Large a span

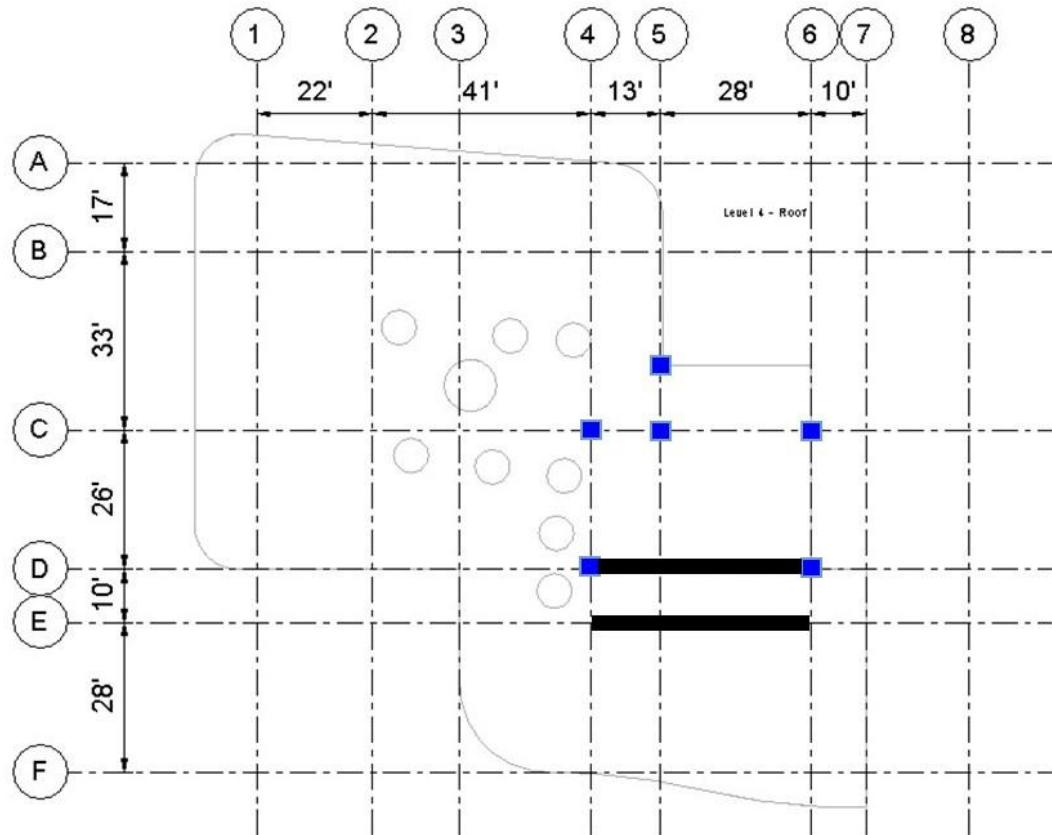
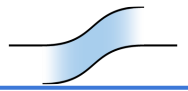
Solution:

1. Flat Floor without beams.
2. Change the grid.

2ND FLOORPLAN



ROOF FLOORPLAN



18"x18" Rectangular Column



12" Concrete Shear Wall



12" Circular Column



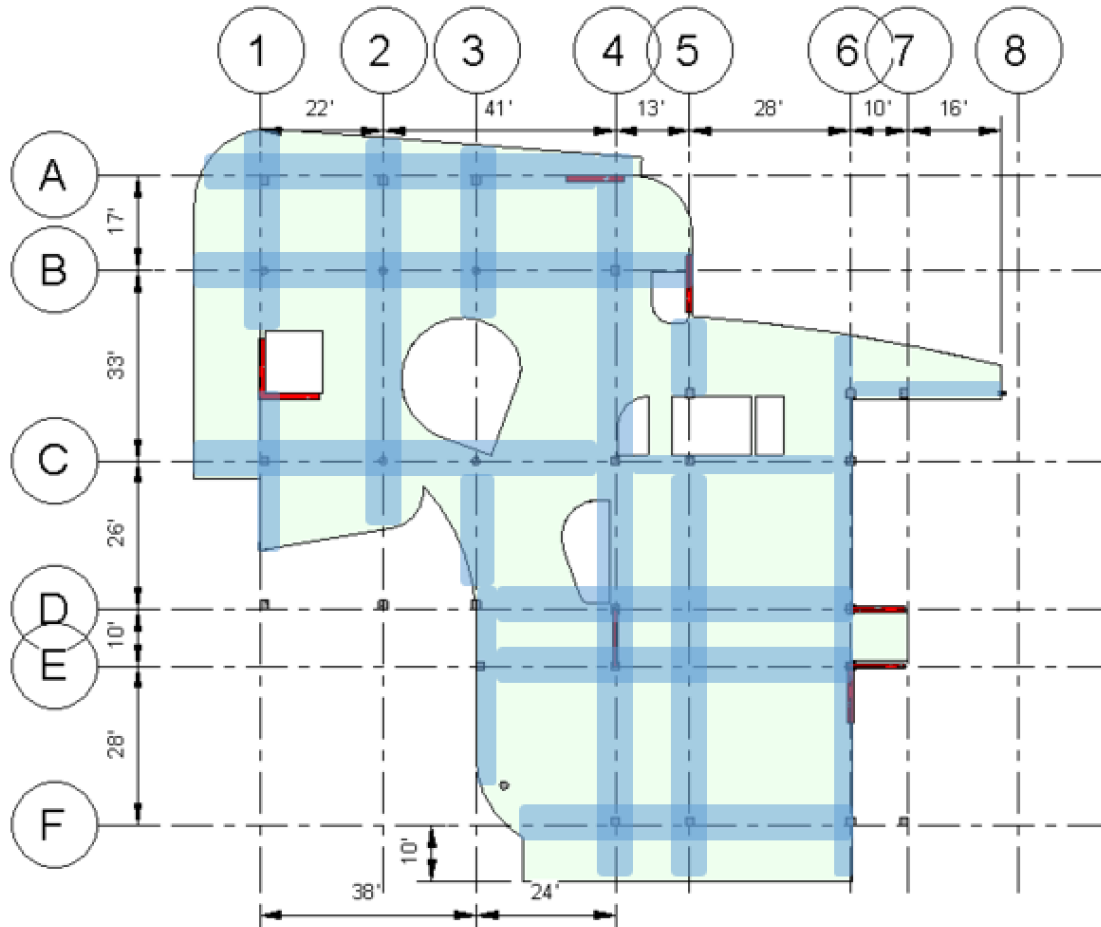
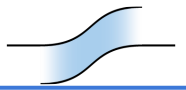
W14"x20" Curve Steel Girder



W12"x18" Steel Beam

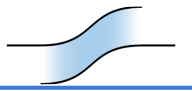


12"x24" PT Girder



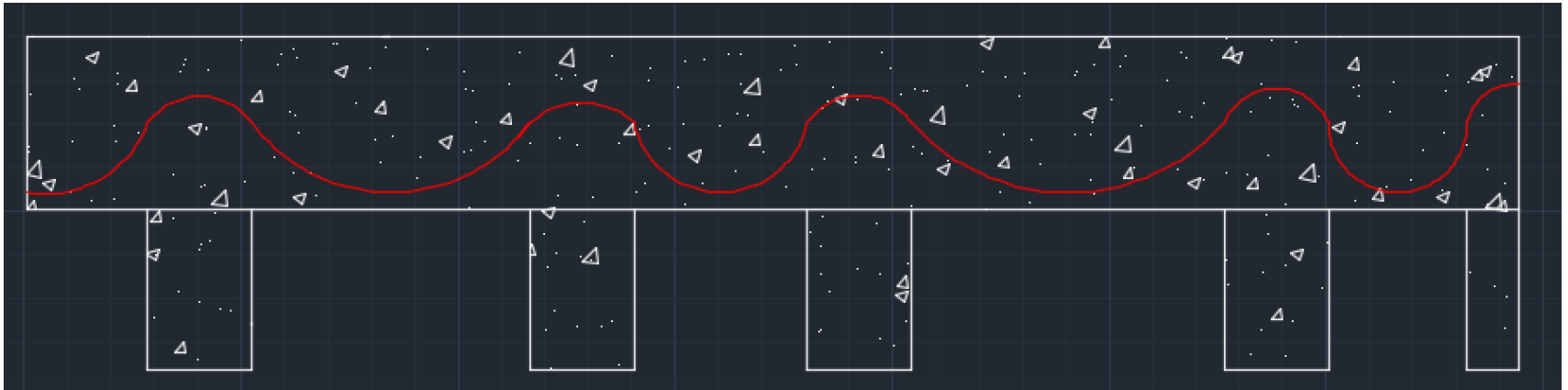
- Tendon @ 1 ft
- Tendon @ 2.5 ft

PT Slab Property	
Tendon Diameter	0.6 inch
Initial Prestress	162 ksi
Concrete Strength	5000 psi
Slab Thickness	10 inch
Clear Cover	0.75 inch

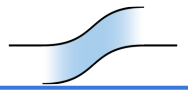


Values for Users:

1. Flat floor
2. Long spans and less columns
3. More open spaces

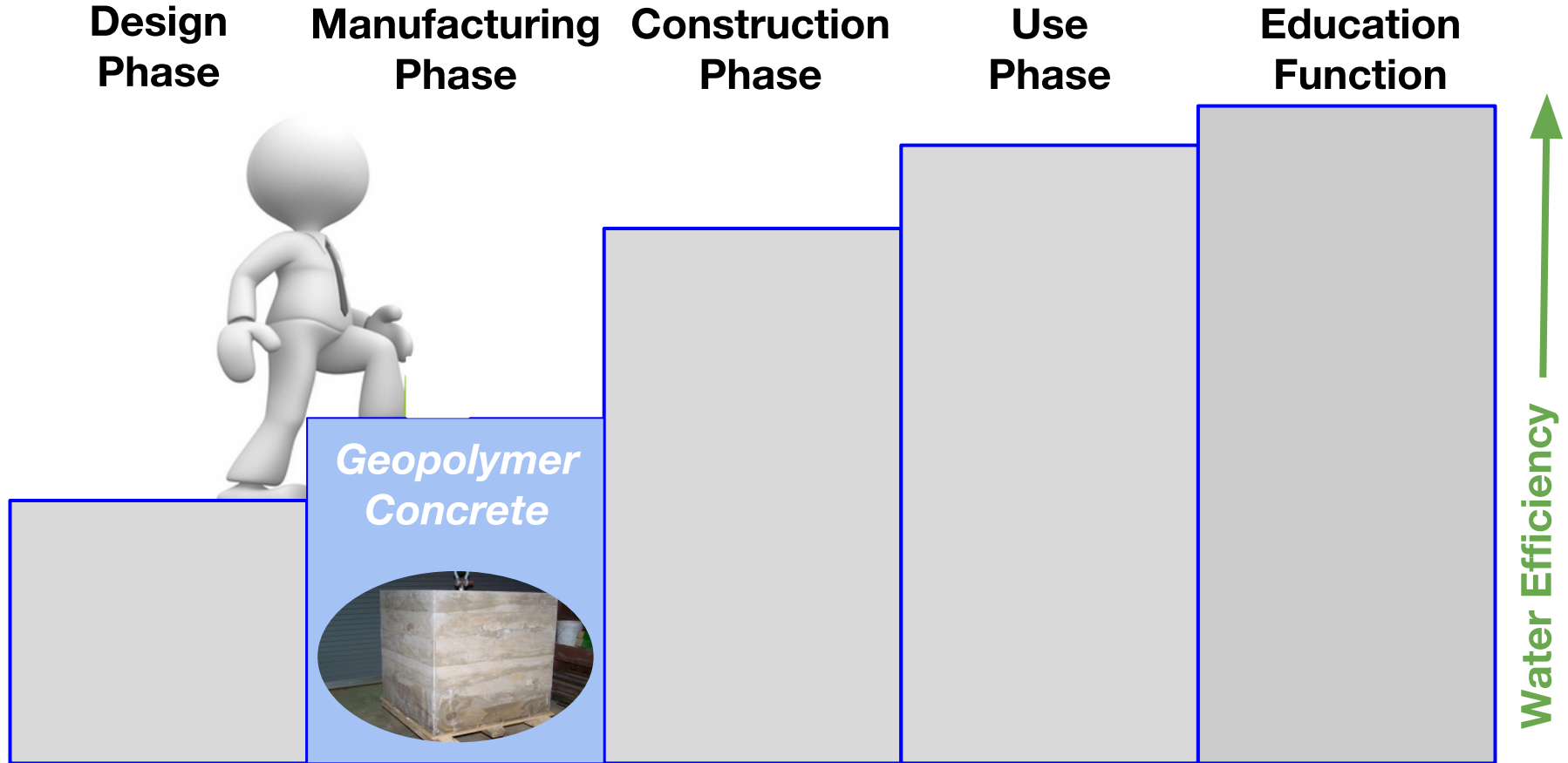
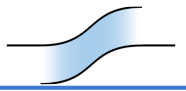


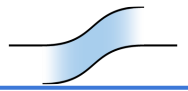
Tendon Profit



**Typical PT Slab to
Column Connection**

GEOPOLYMER CONCRETE



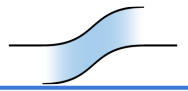


Cubic Yard of Concrete	Geopolymer Concrete	Portland Cement Concrete
Portland Cement (lbs)	0	560
Fly Ash (lbs)	667	0
Coarse Aggregates (lbs)	1,863	1,760
Fine Aggregates (lbs)	1,193	1,100
Admixtures (lbs)	0	1.4
Water (lbs)	0	290
8 mol. NaOH solution (lbs)	300	-



Values of Geopolymer Concrete

Consumes **47%** less Water during the material manufacturing phase than portland cement concrete.



Other Facts about Geopolymer Concrete



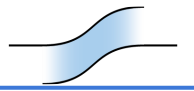
1. **68%** less Greenhouse Gas Emissions than Portland Cement Concrete.
2. Geopolymer Concrete develops strength through Geopolymerization of fly ash, which is a by-product of coal combustion in power plants.
3. A university building in Australia made with Geopolymer Concrete



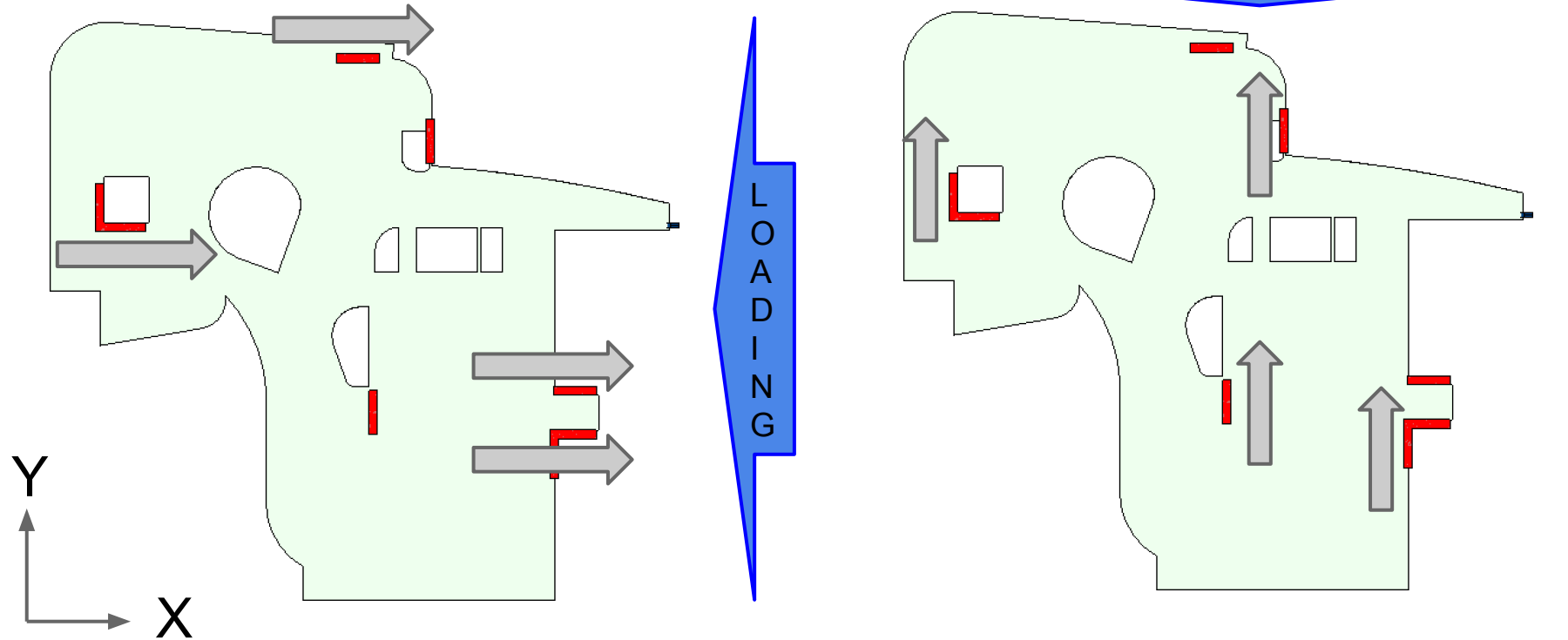
Queensland's University GCI building with 3 suspended floors made from structural geopolymer concrete. Credit: Hassel Architect

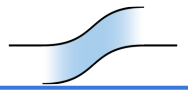


LATERAL LOADING

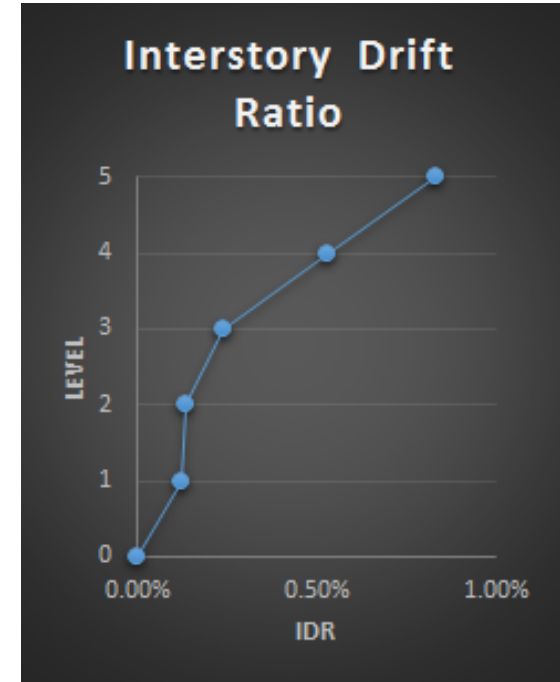
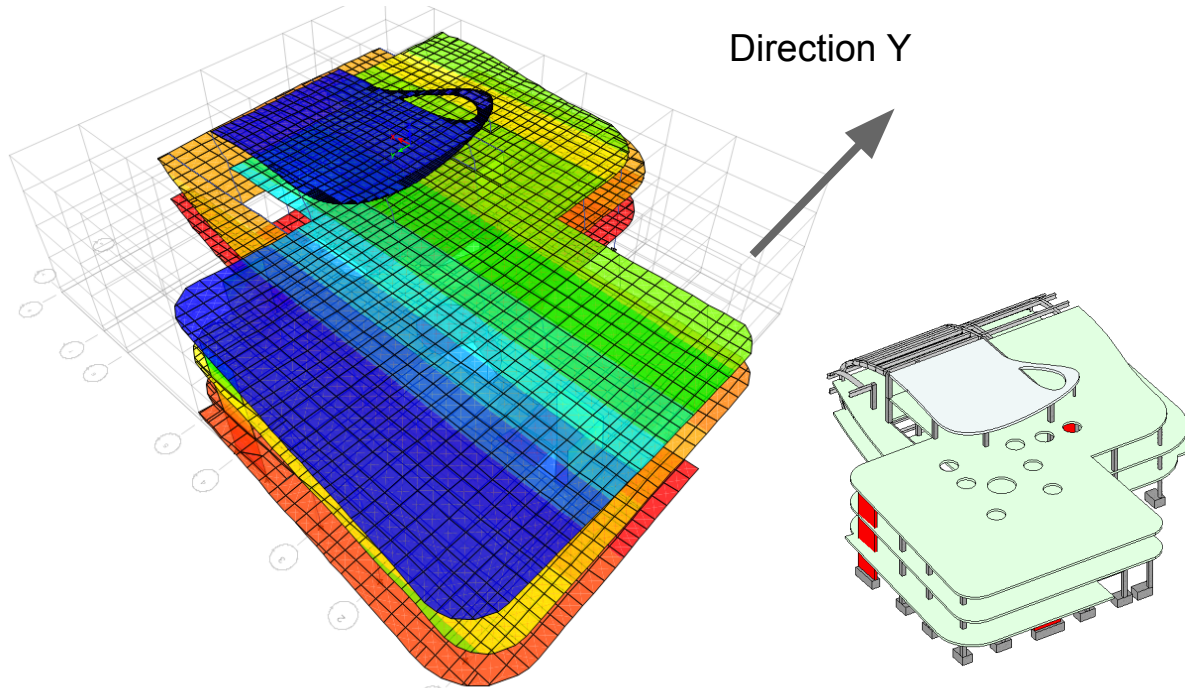


Four 12" Shear Walls + Rigid Diaphragm in Each Direction



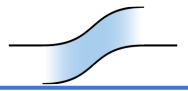


Max IDR at Y direction = 0.8% < 2%
Max Displacement at Y direction = 1.0 inch

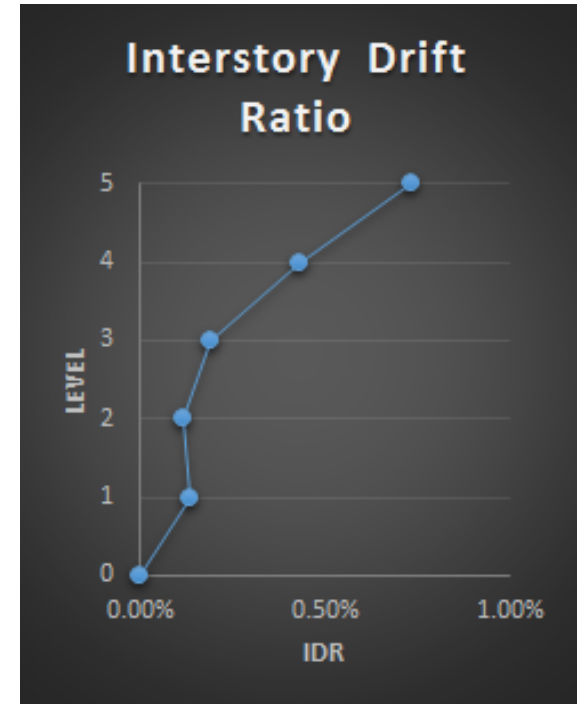
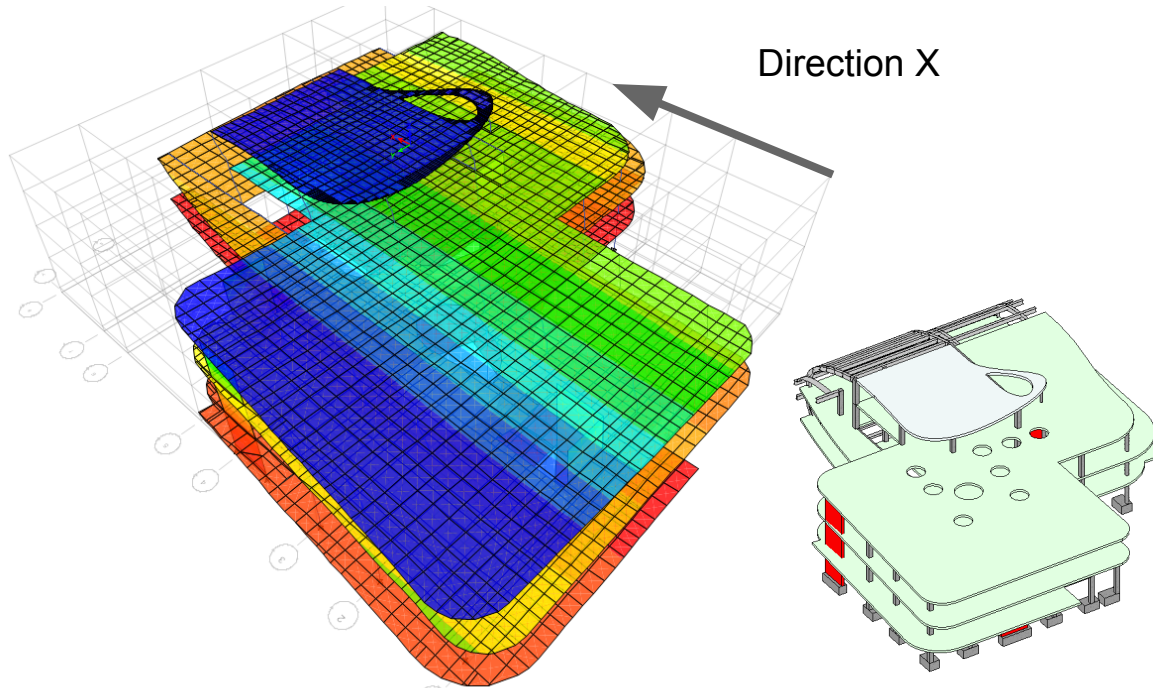


ETABS

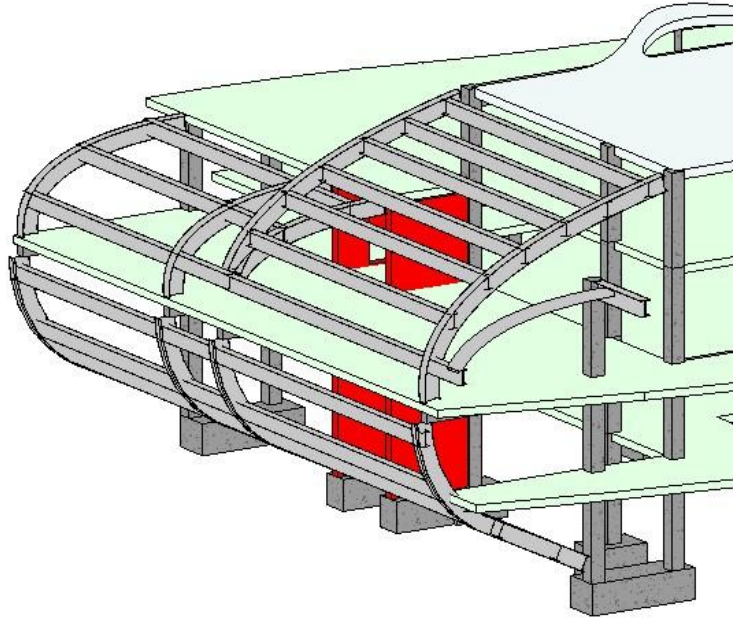
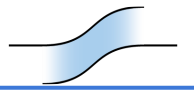




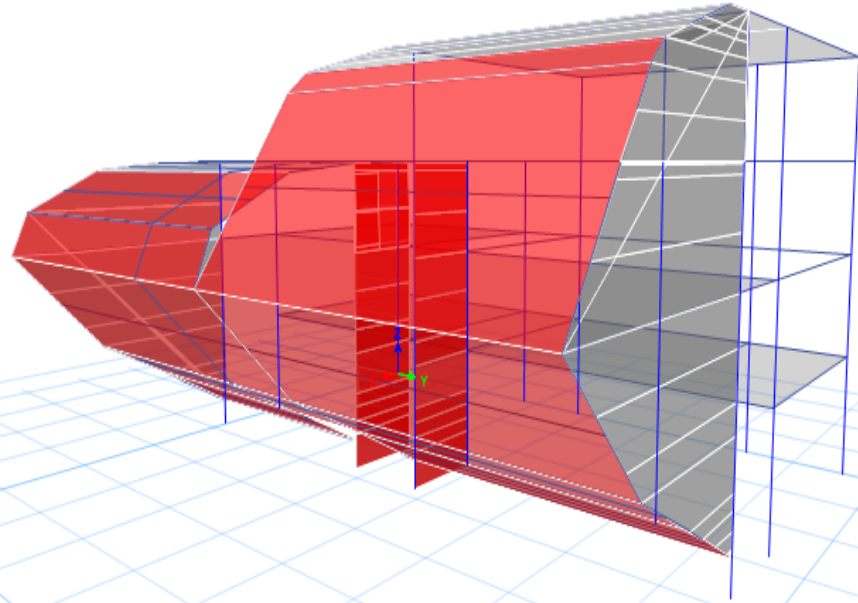
Max IDR at X direction = 0.7% < 2%
Max Displacement at Y direction = 0.9 inch



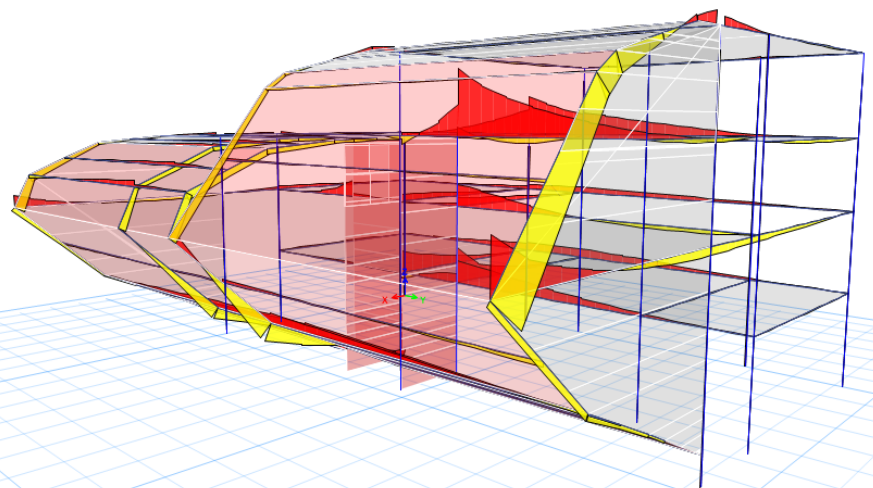
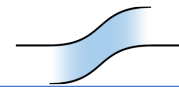
ETABS



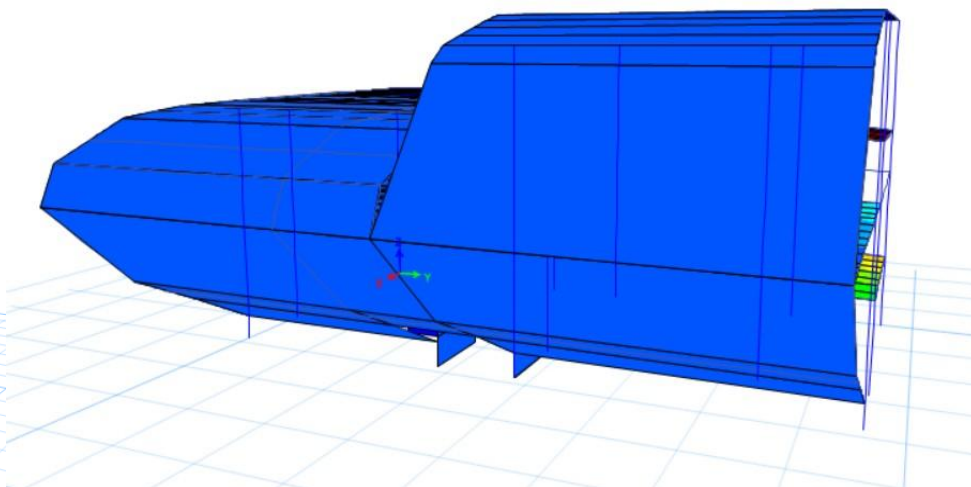
Revit Model



ETABS Model

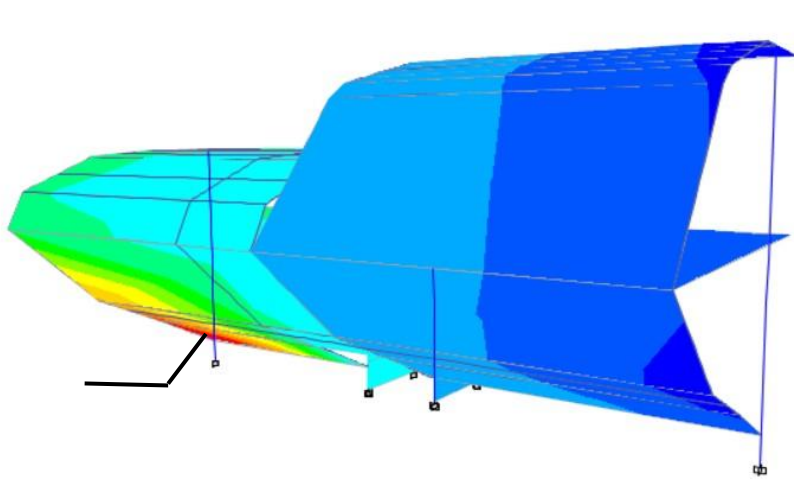
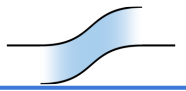


Moment Diagram



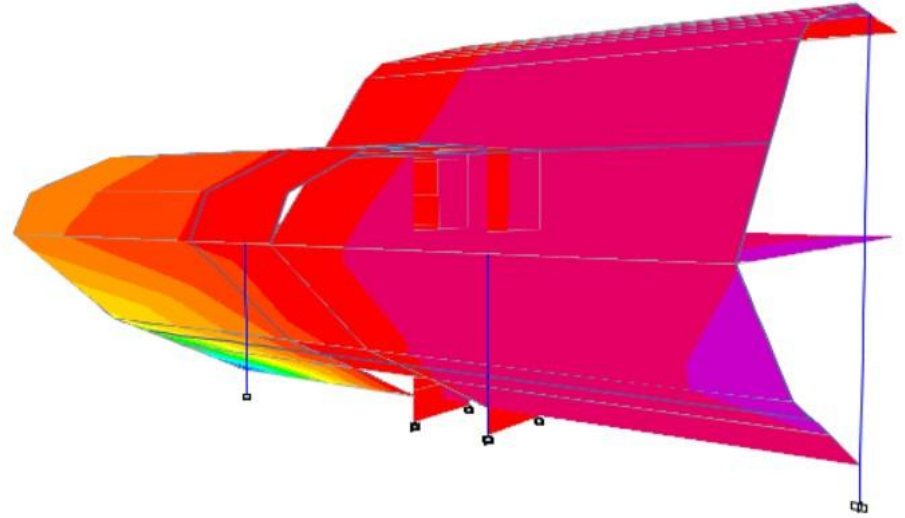
Deflection **Z**

[Inch]



[inch]

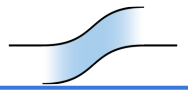
Deformation **X**



[inch]

Deformation **Z**

FLOODING



Flood Direction



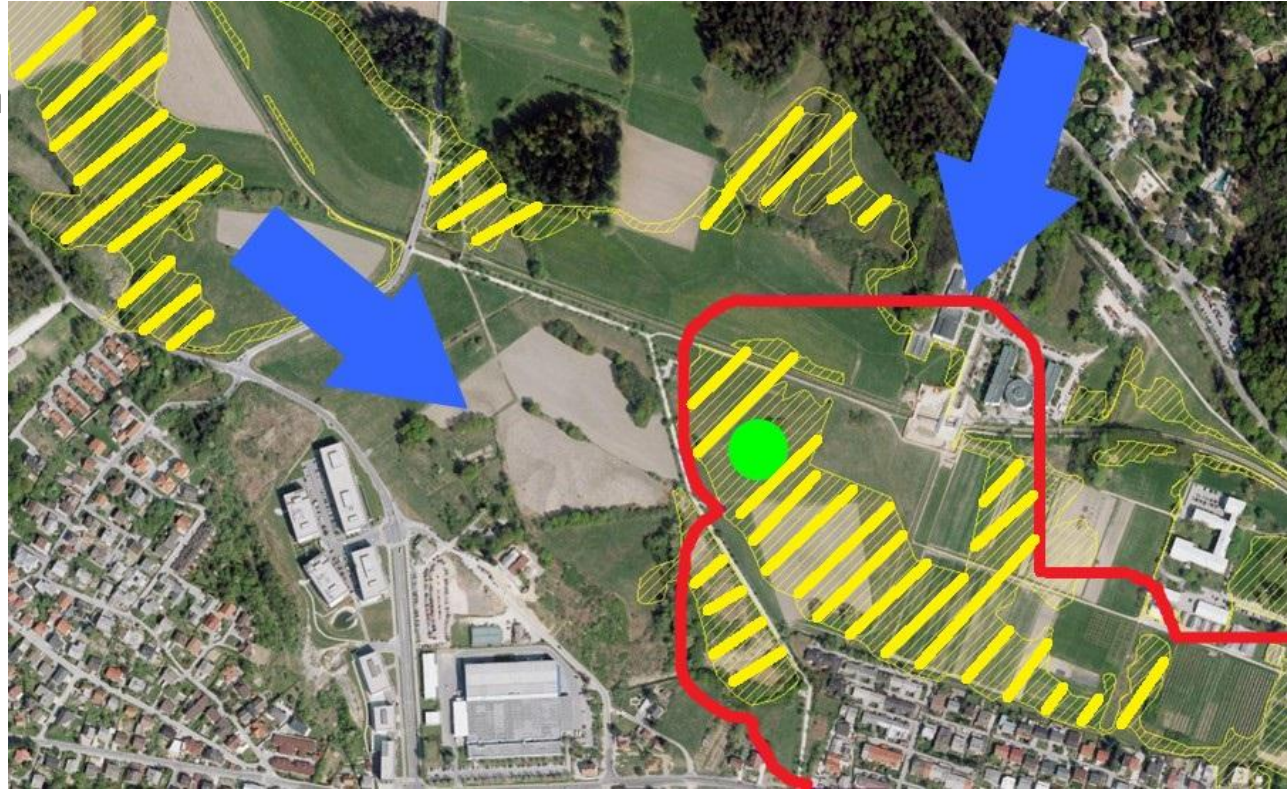
Important Area



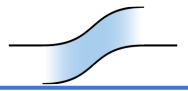
Small Flood
Hazard



Site Location



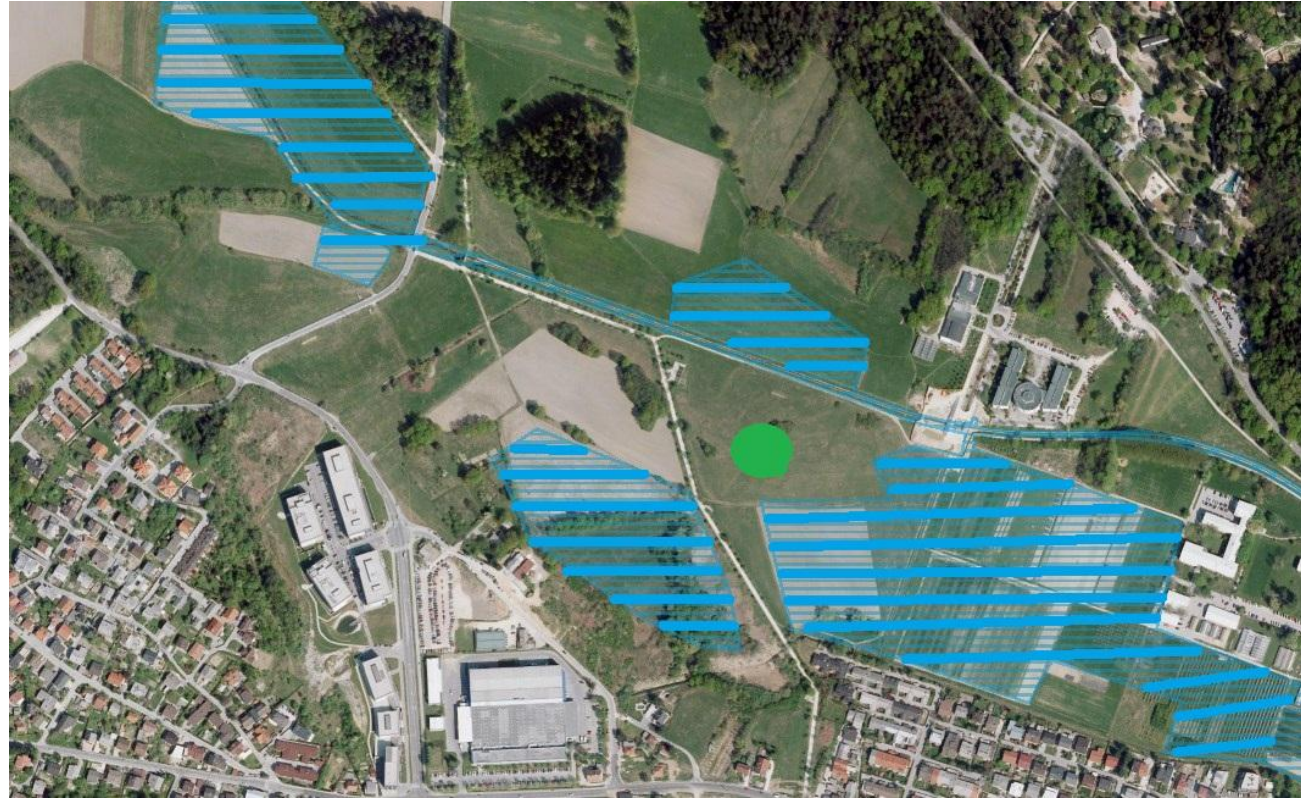
FLOODING

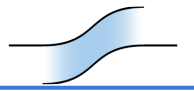


Flood Event
2010.09.18-20



Site Location



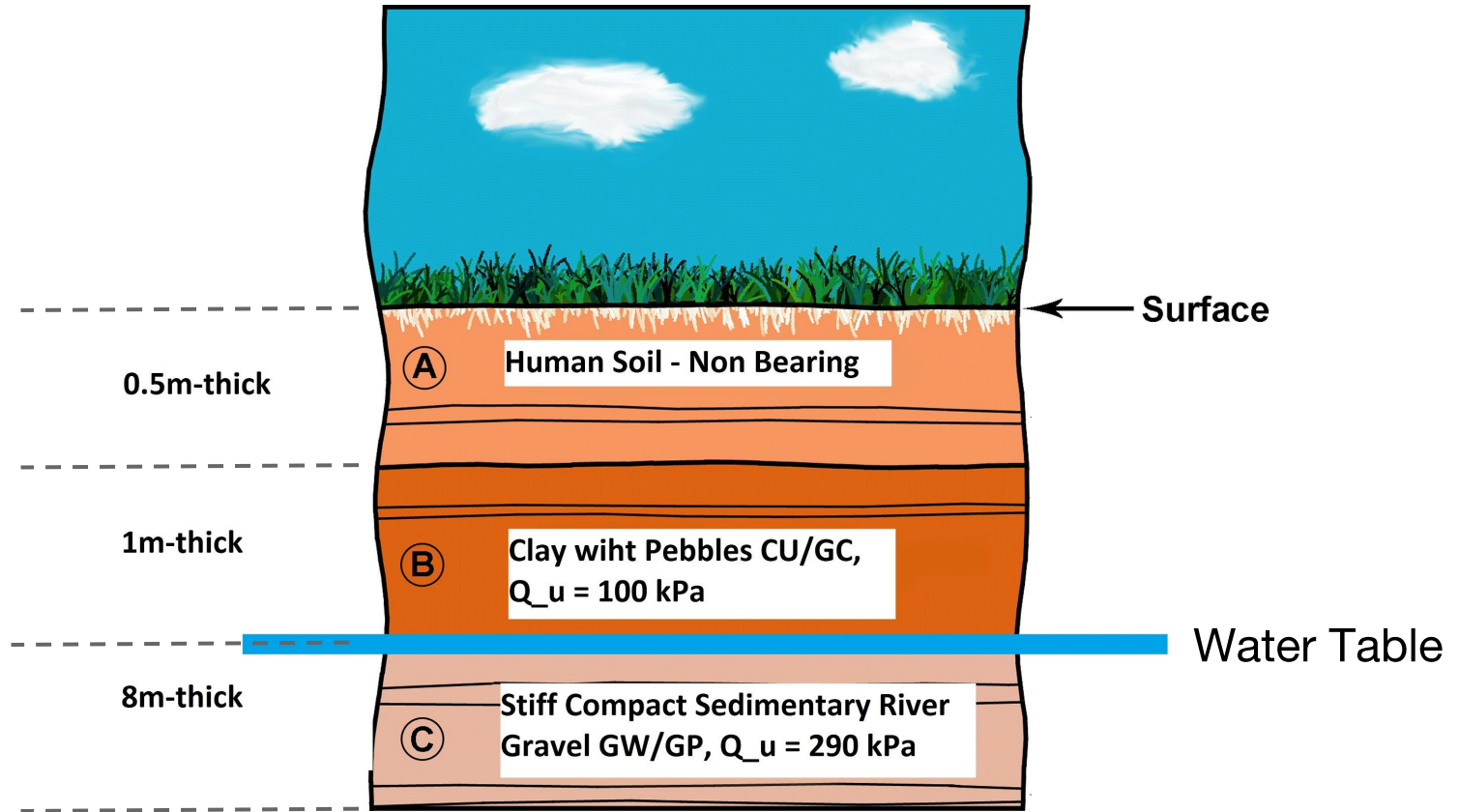
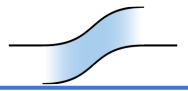


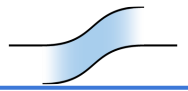
FloodStop



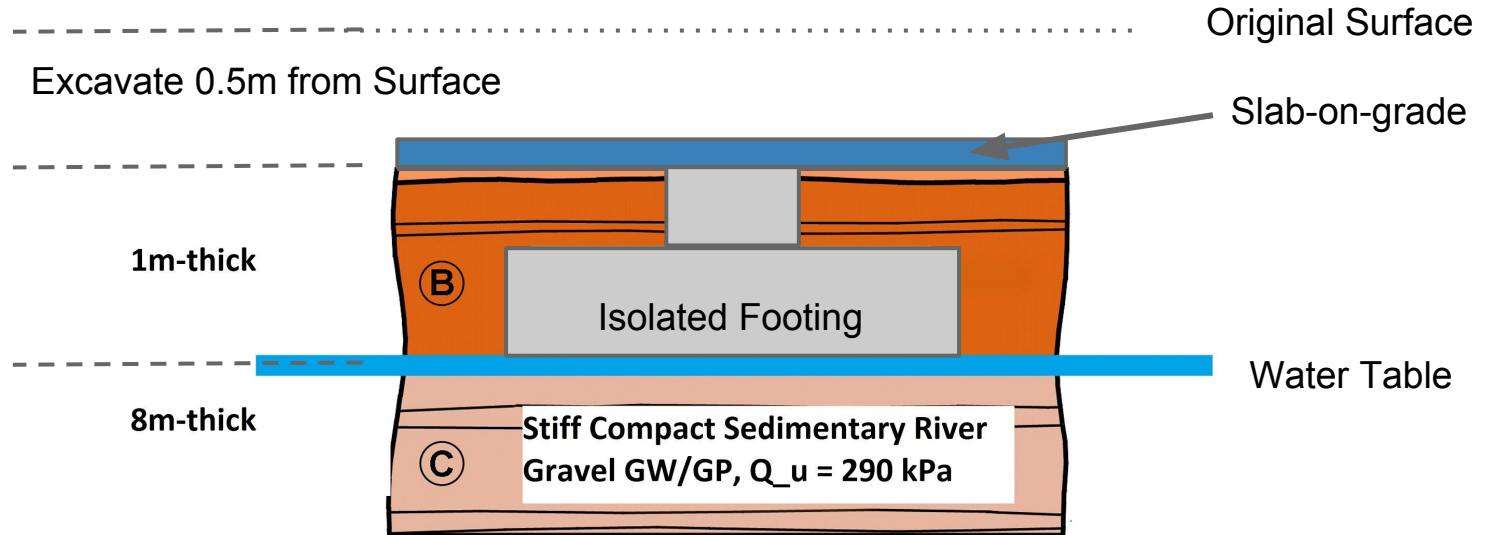
Performance

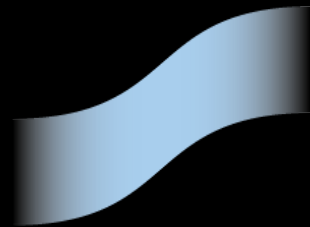
SOIL PROFILE



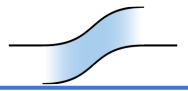


- Excavate for 0.5m to remove the non-bearing human soil.
- 4" slightly R.C. Slab-on-grade at 0.5m below ground level.
- Isolated Footing at 1.5m below ground level.





waver



Primary Systems

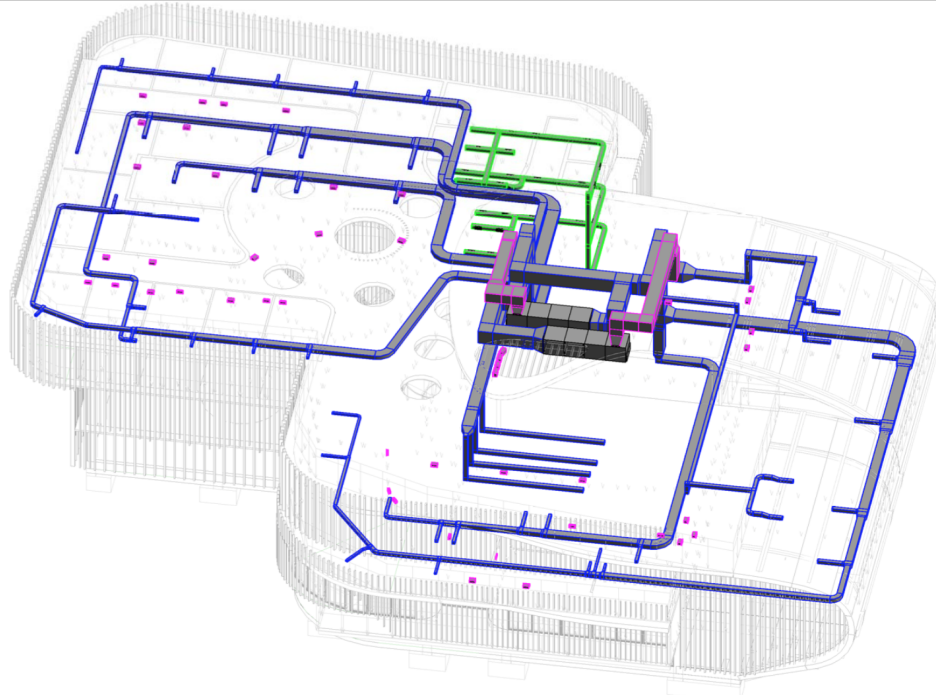
Central Plant
Hot water
Chilled water

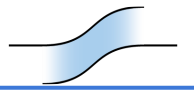
Secondary Systems

Supply Ducts
Radiant Heating

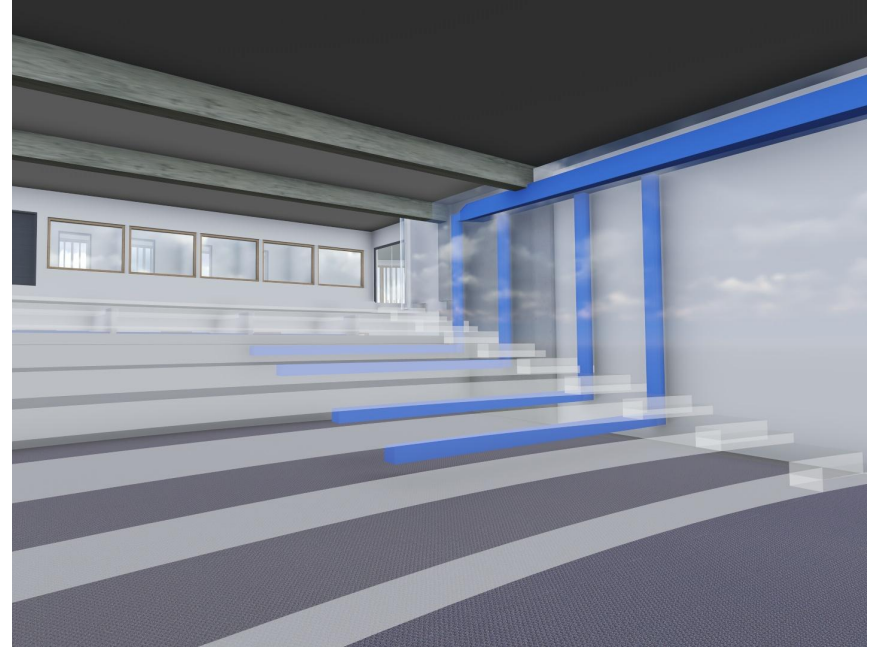
Terminal Systems

Return Grilles
Controls
VAV boxes

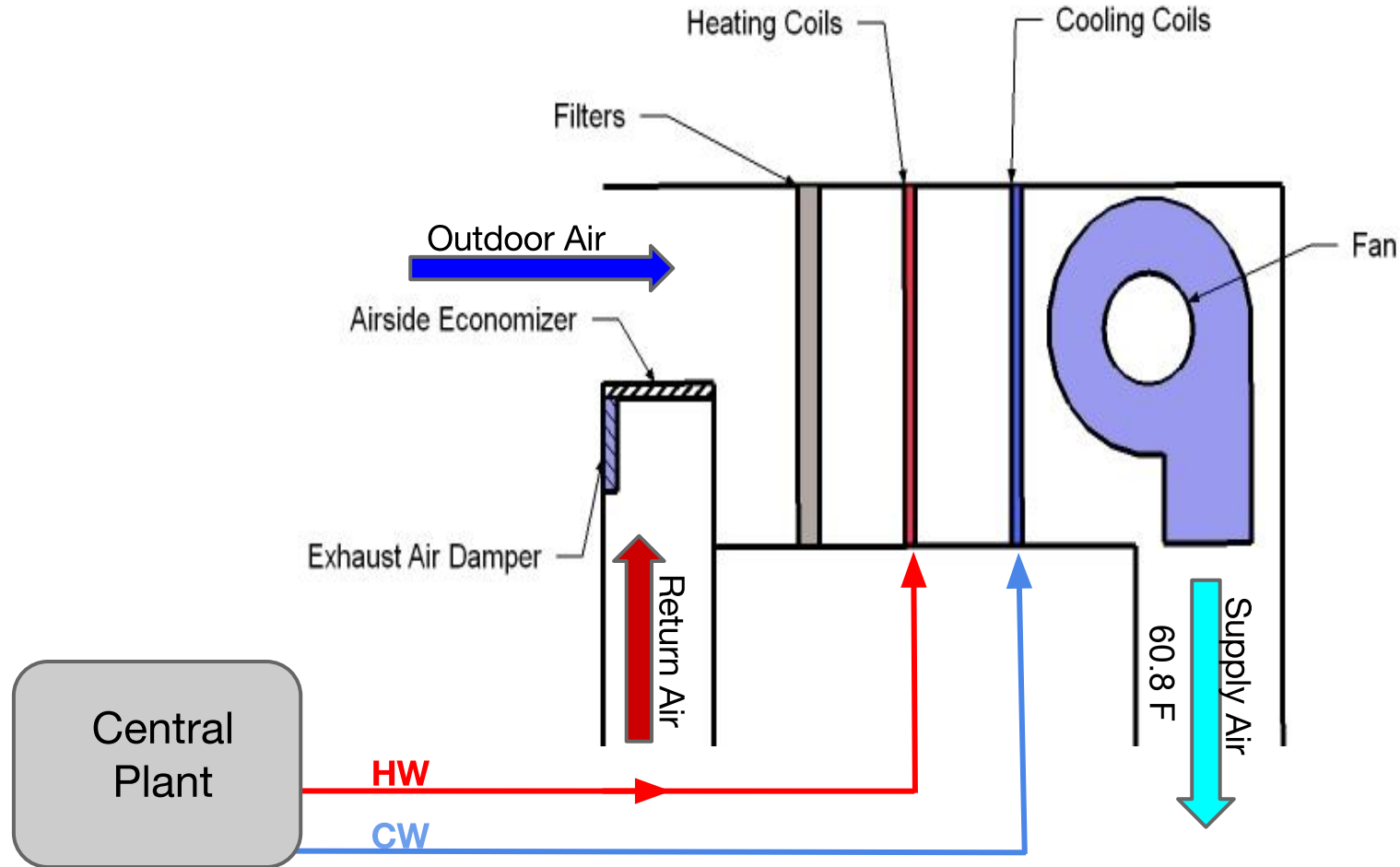
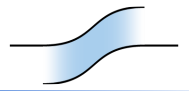




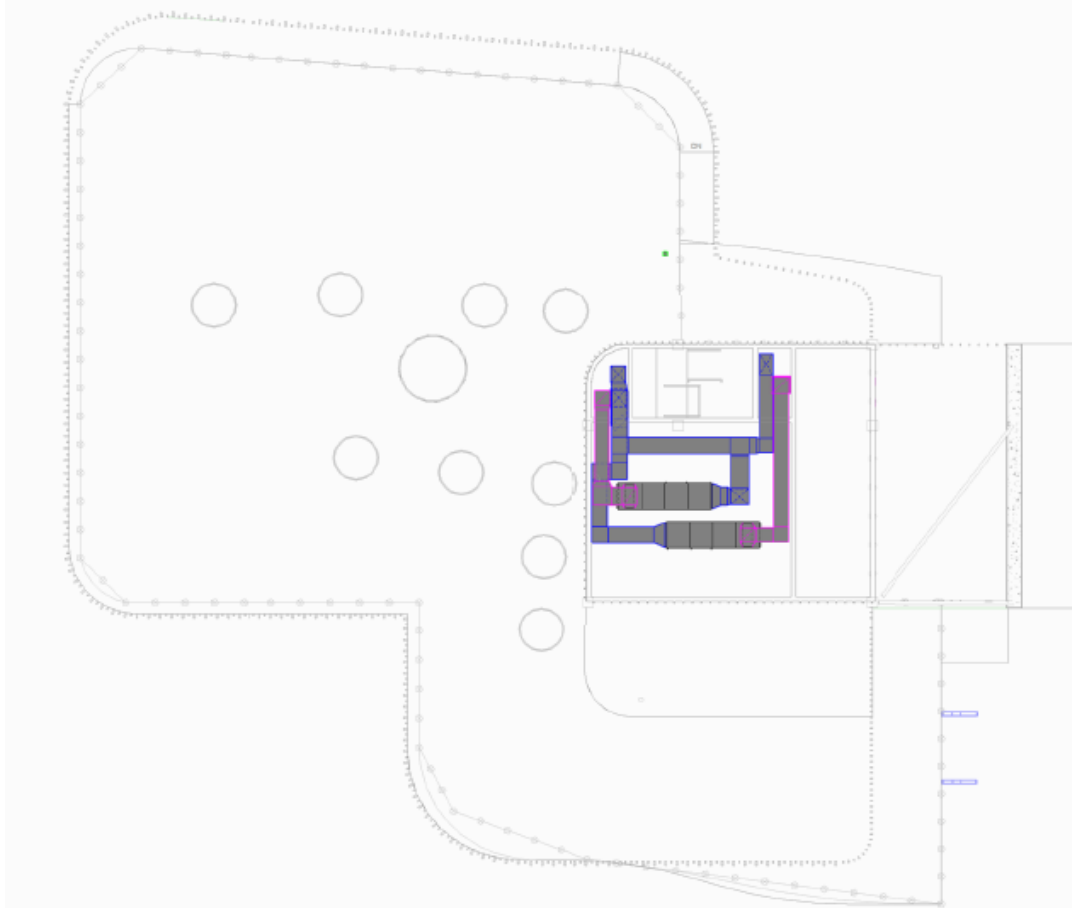
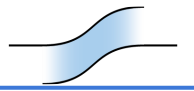
Auditorium Underfloor Air Distribution



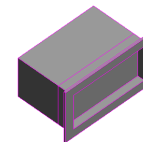
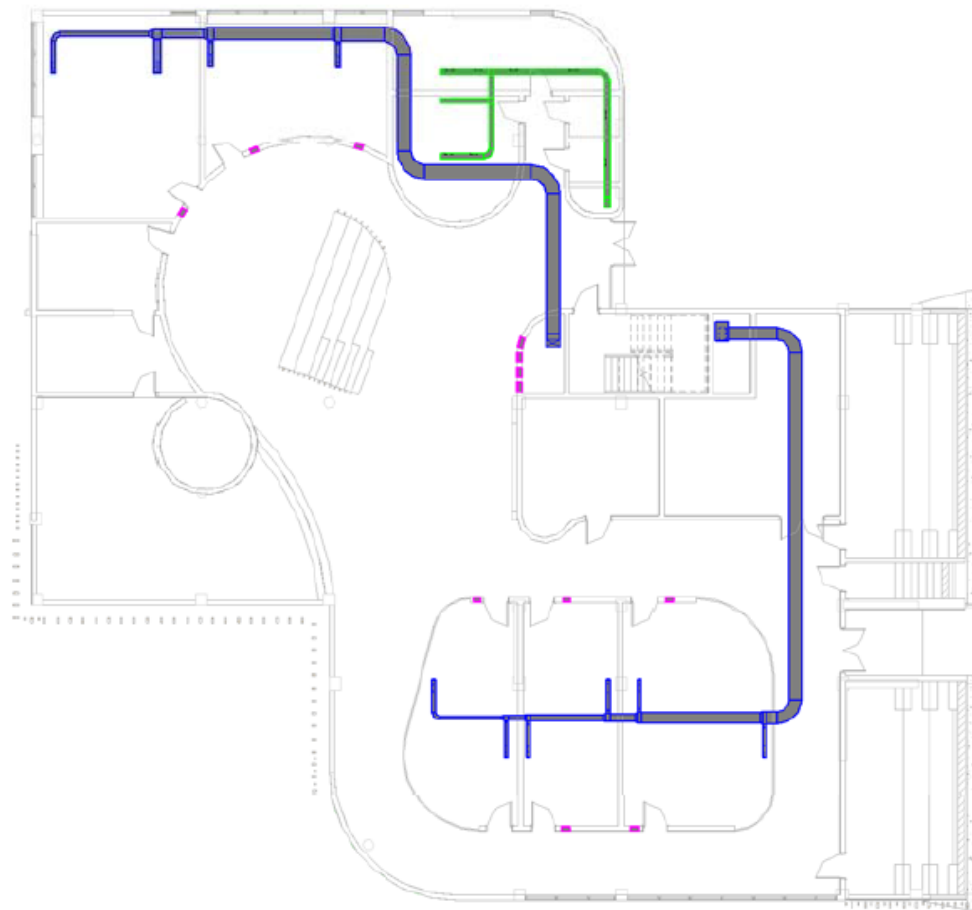
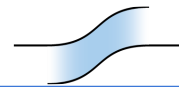
AIR HANDLING UNIT



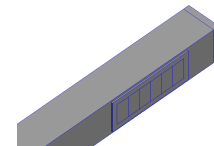
ROOF



GROUND FLOOR

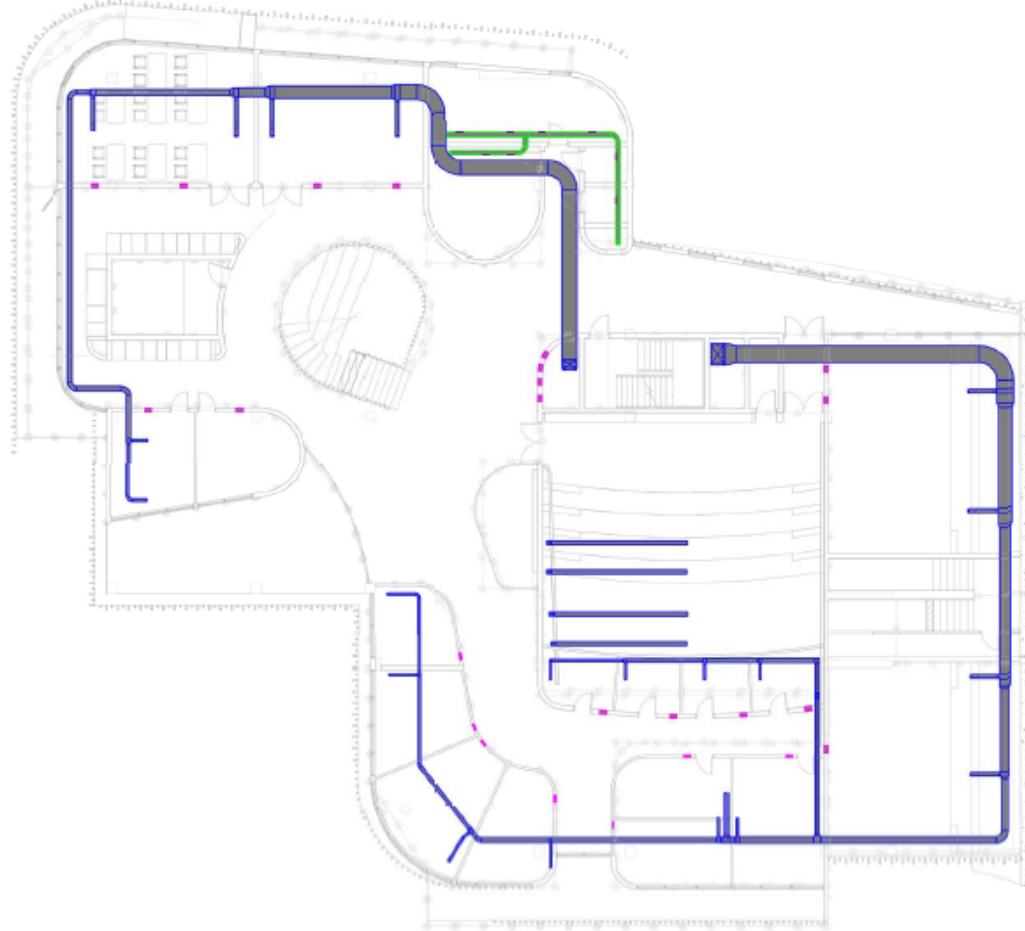
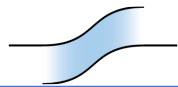


Return
Grilles

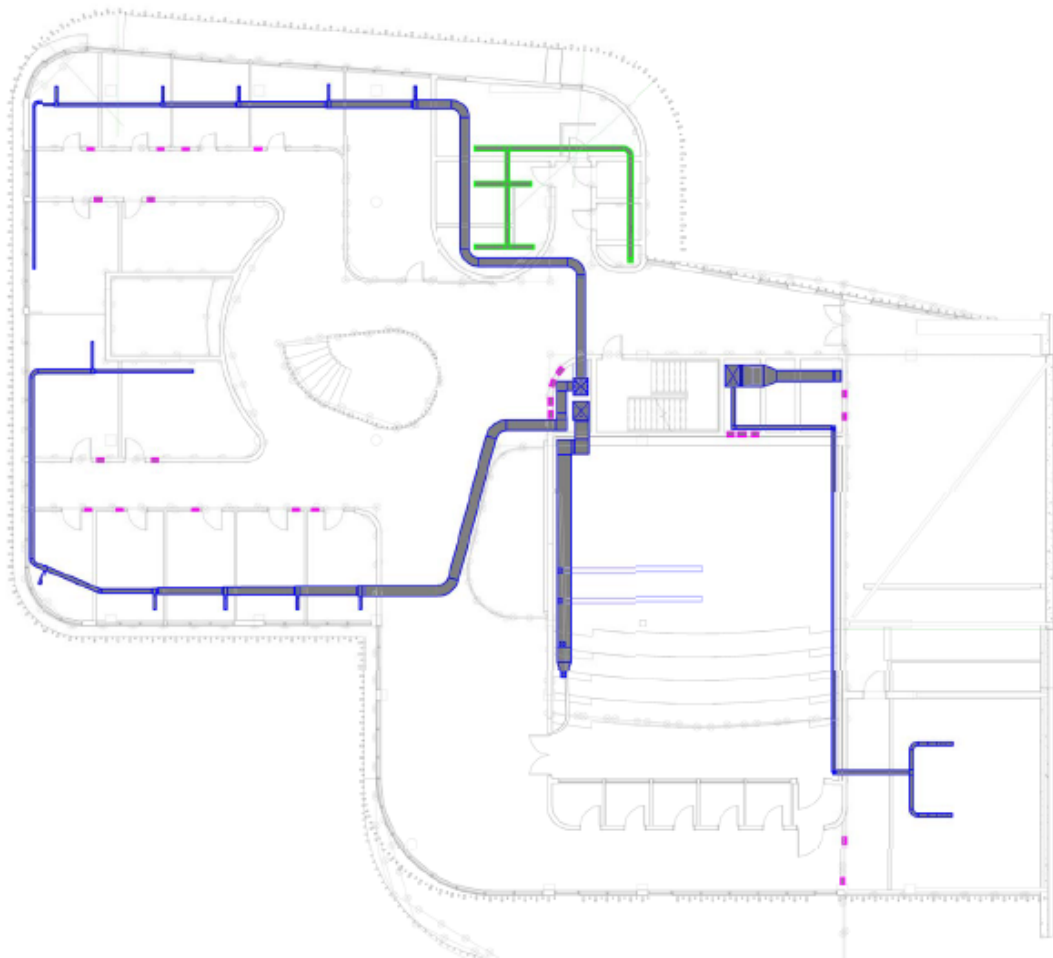
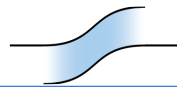


Supply
Ducts

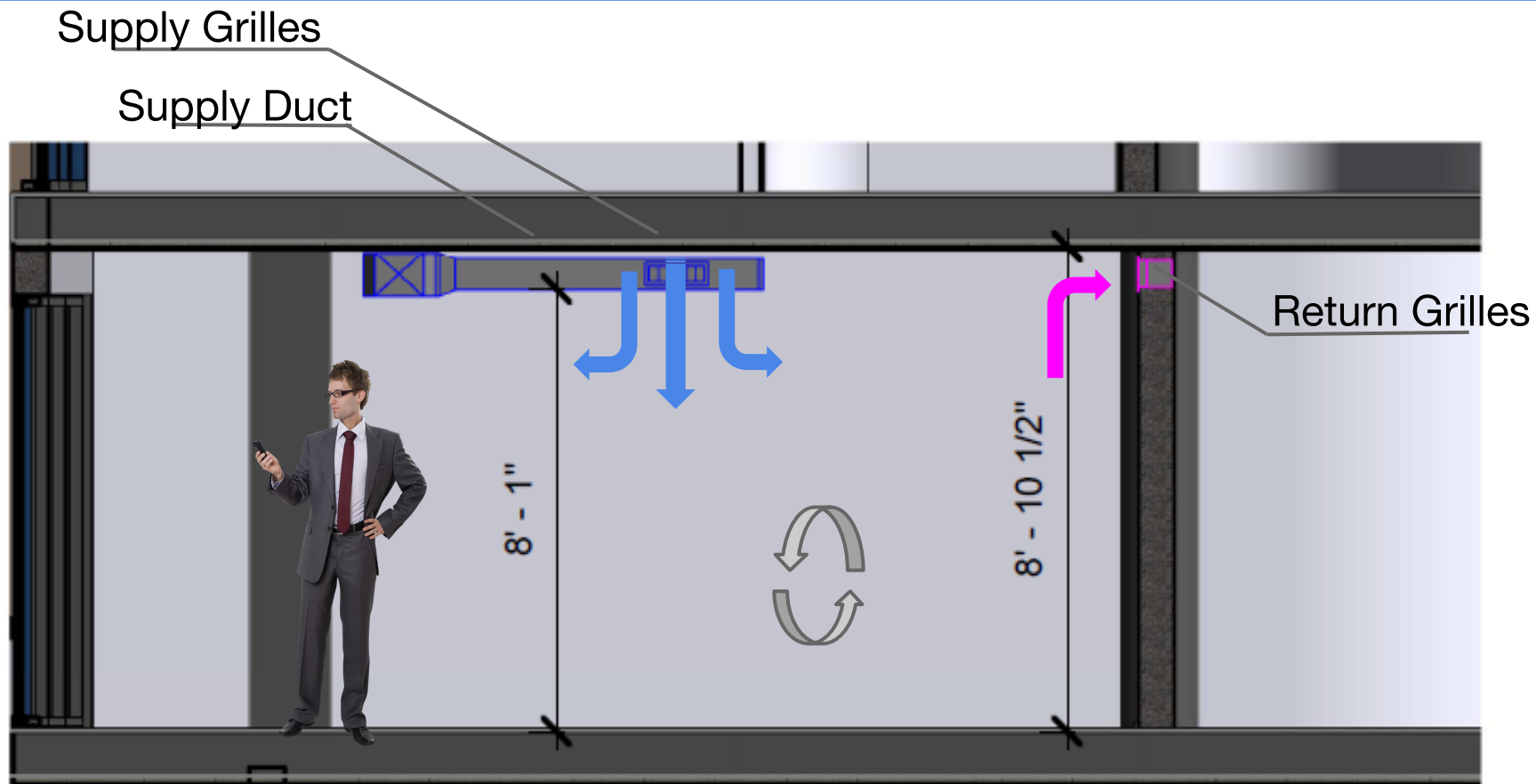
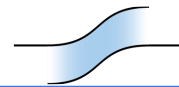
1ST FLOOR



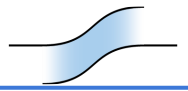
2ND FLOOR



FLOOR SANDWICH



BUILDING ENVELOPE OVERVIEW



External blinds control the Daylight



Direct/Indirect, energy efficient luminaires



Low-e triple glazing



Low U-value insulation



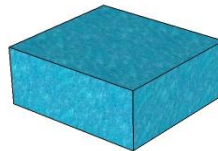
Reuse of greywater



Water efficient plumbing fixtures



Rainwater Harvesting



Water Tank Collector



Acoustic Ceiling Panels

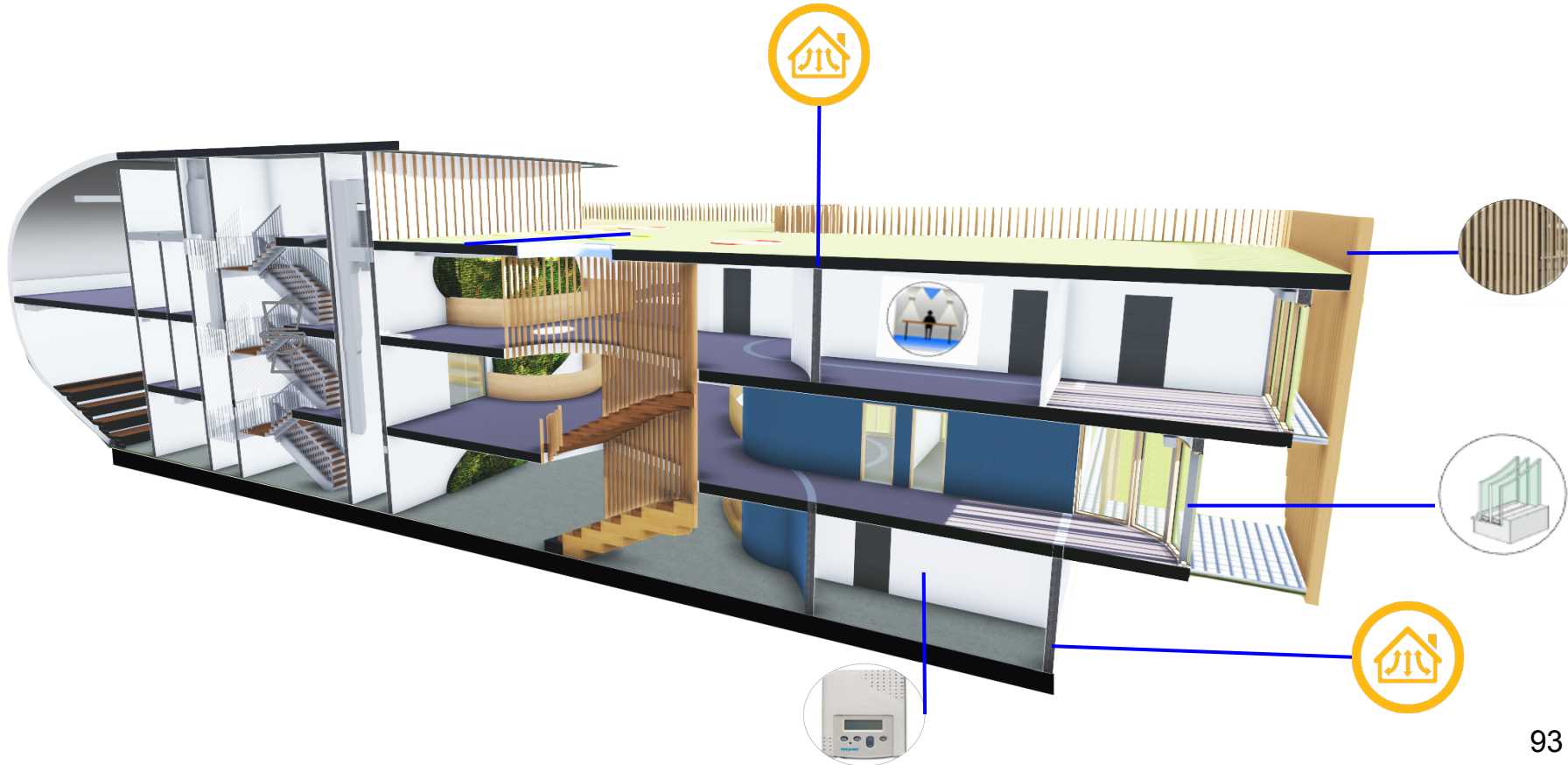
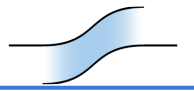


Controlled Ventilation

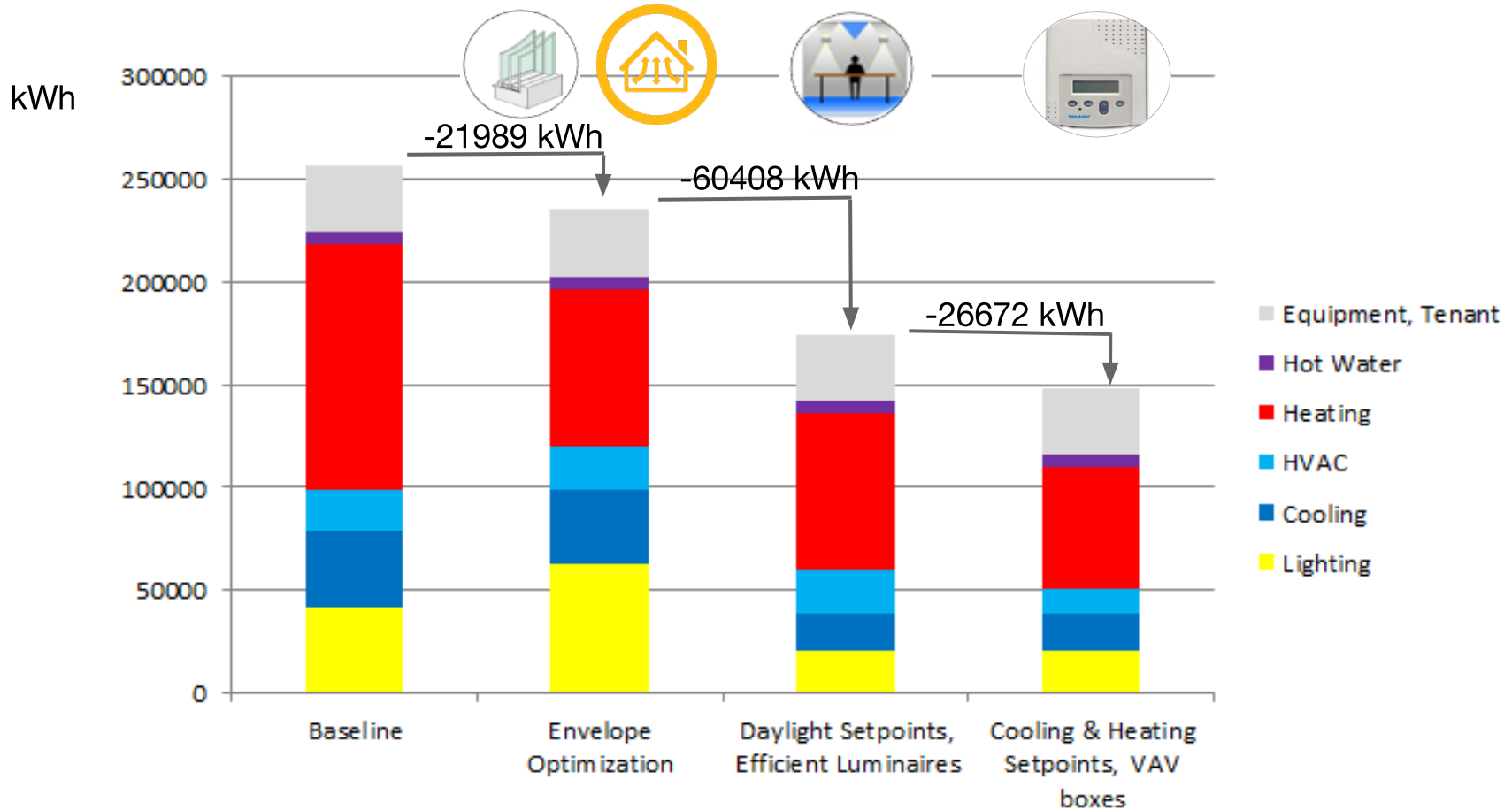
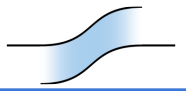


Green Roof filters the rainwater and reduce roof temperature

BUILDING ENVELOPE OVERVIEW



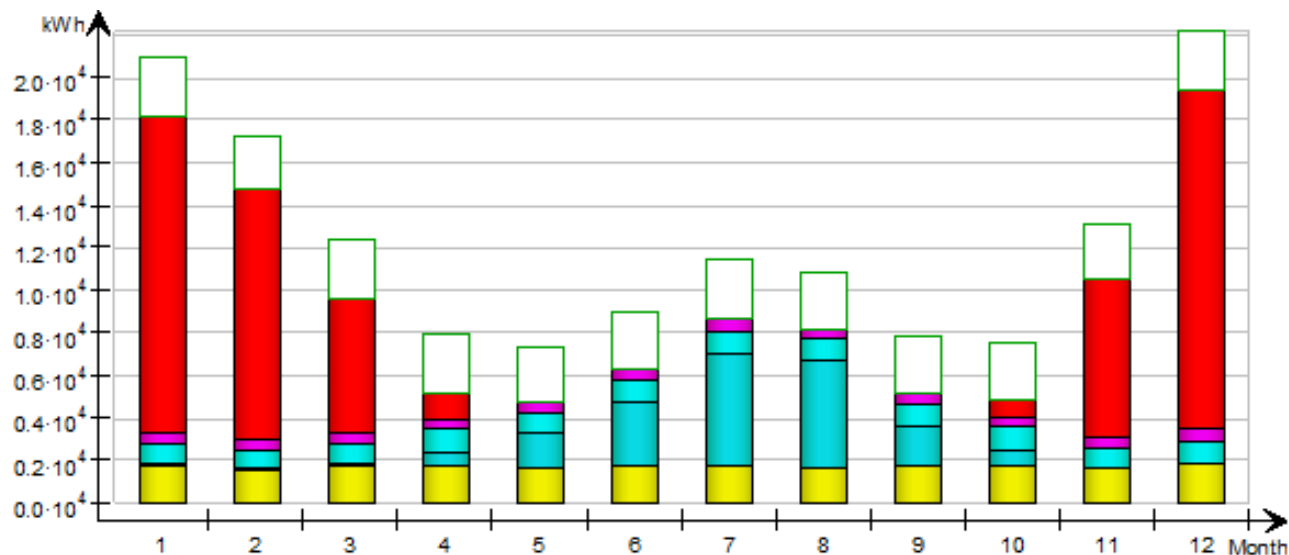
REDUCING THE ENERGY CONSUMPTION



ENERGY ANALYSIS



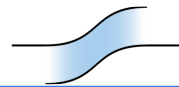
		Delivered energy	
		kWh	kWh/m ²
	Lighting, facility	20306	7.0
	Electric cooling	18543	6.4
	HVAC aux	12085	4.1
	Domestic hot water	6231	2.1
	District heating	58403	20.0
	Equipment, tenant	32248	11.1
Grand total		147816	50.7



Heating Setpoints : 69.8° F

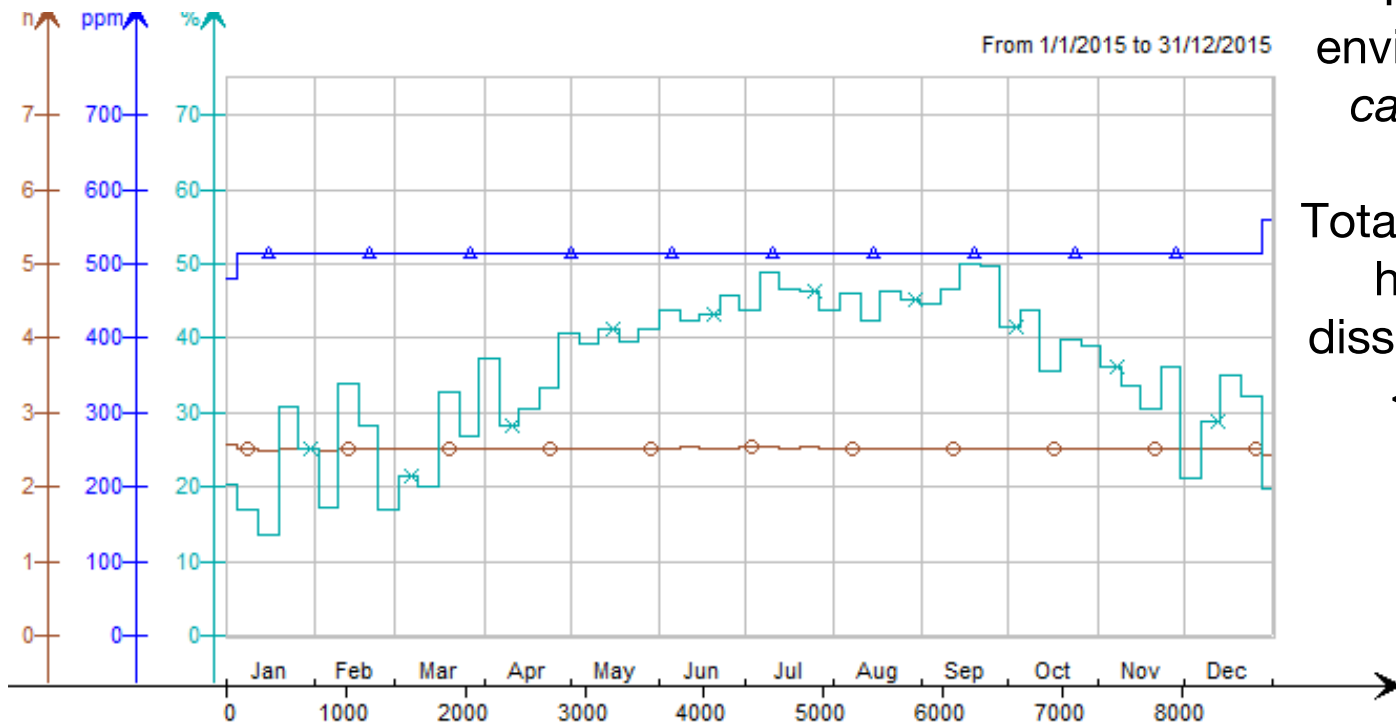
Cooling Setpoints : 77° F

INDOOR AIR QUALITY



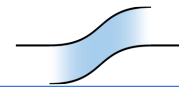
Room: Large Classroom
Monthly Average

- Air age, h
- △ CO2, ppm (vol)
- × Relative humidity, %

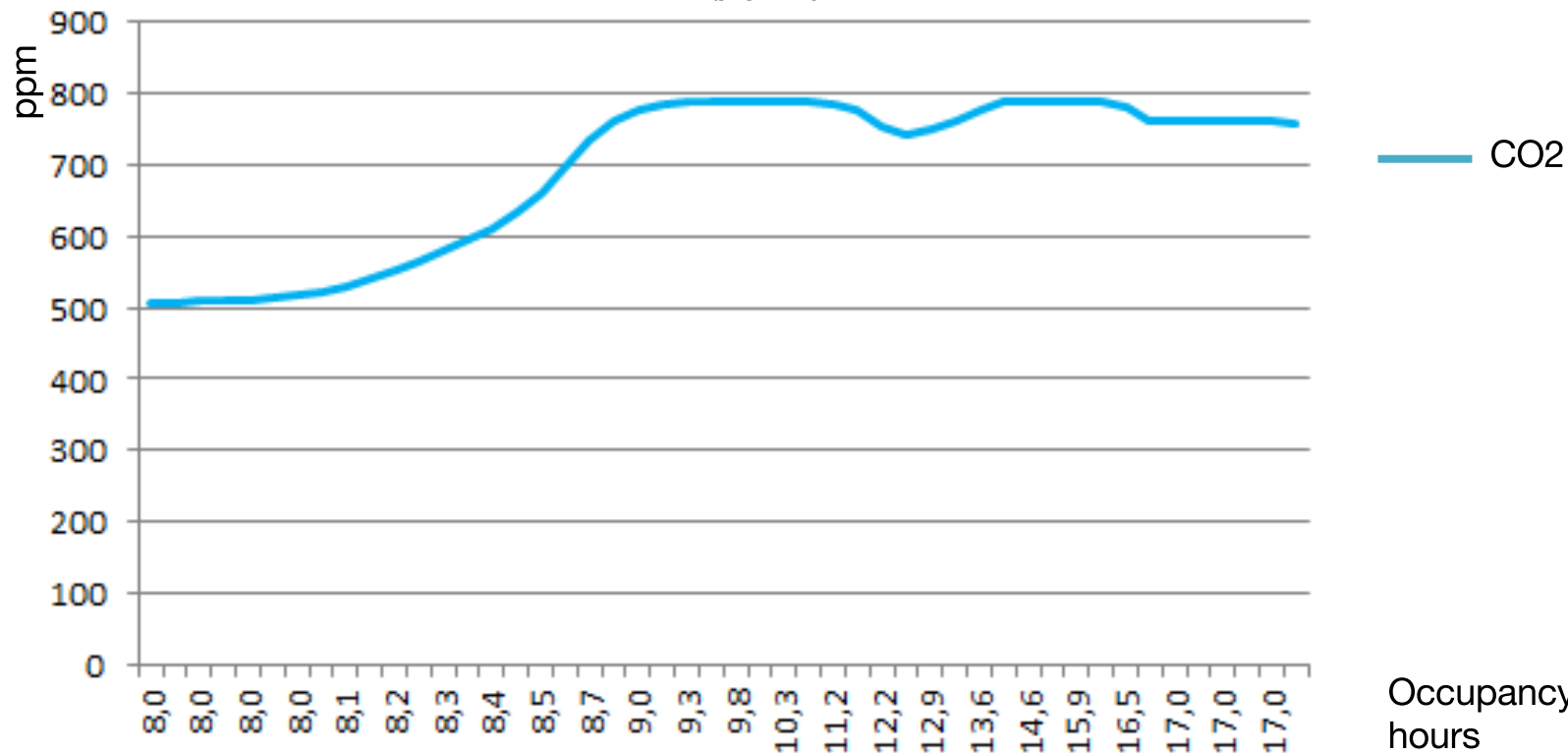


Thermal environment :
category II

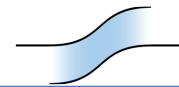
Total occupant
hours of
dissatisfaction
< 10%



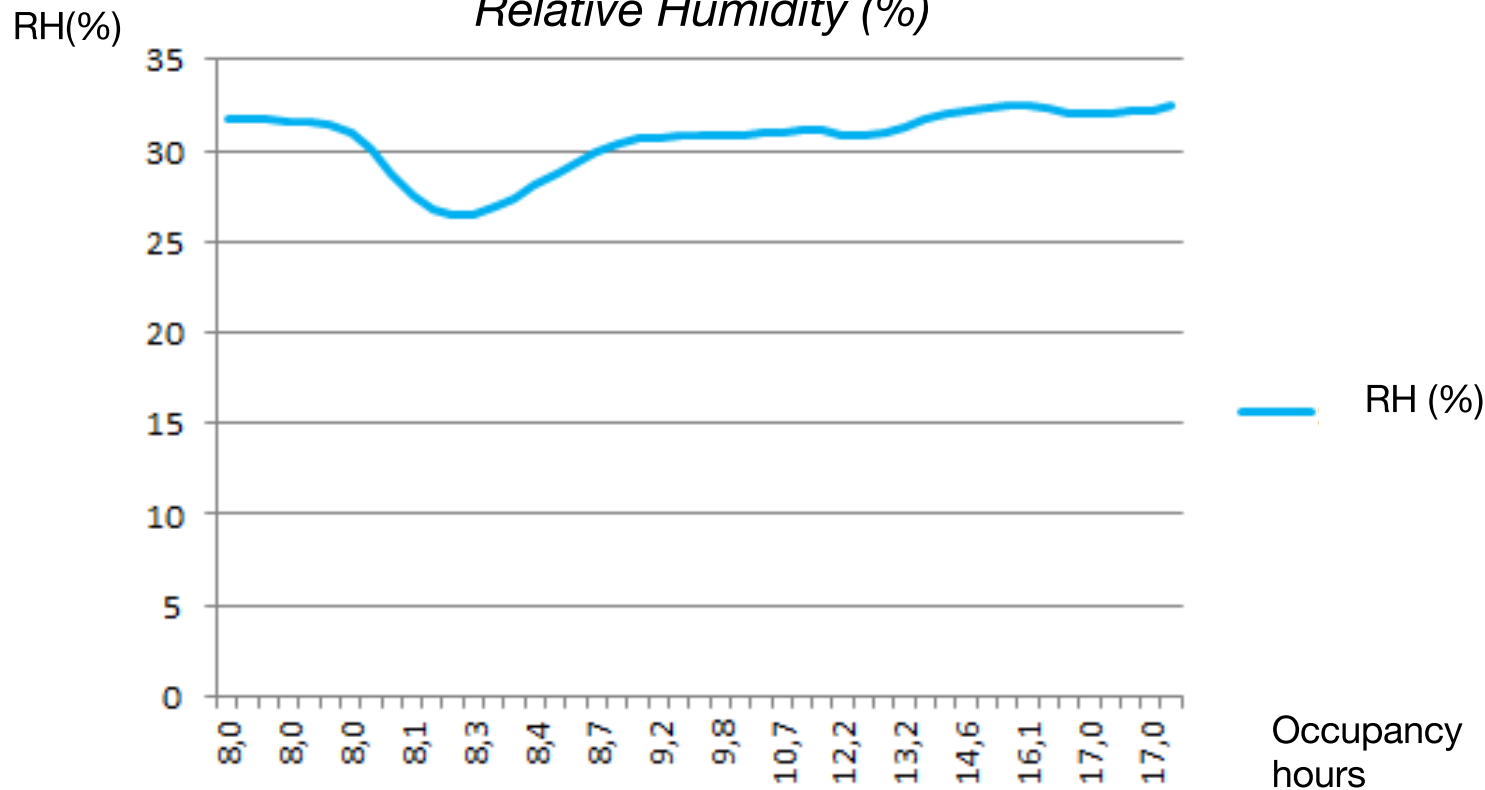
Room: Large Classroom
Daily Occupancy Hours (08:00 -17:00)
CO₂ (ppm)

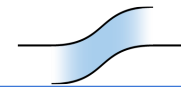


Occupancy
hours

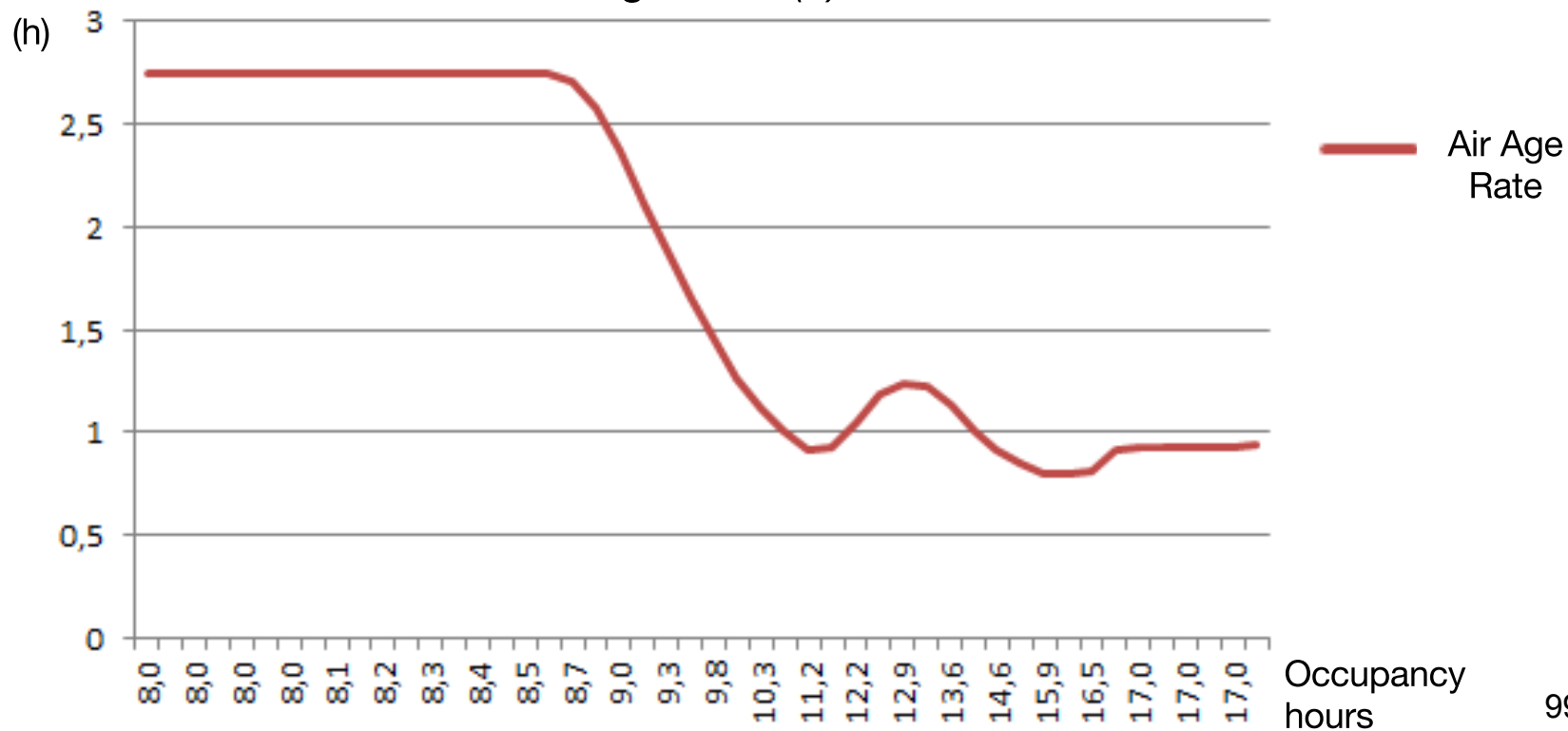


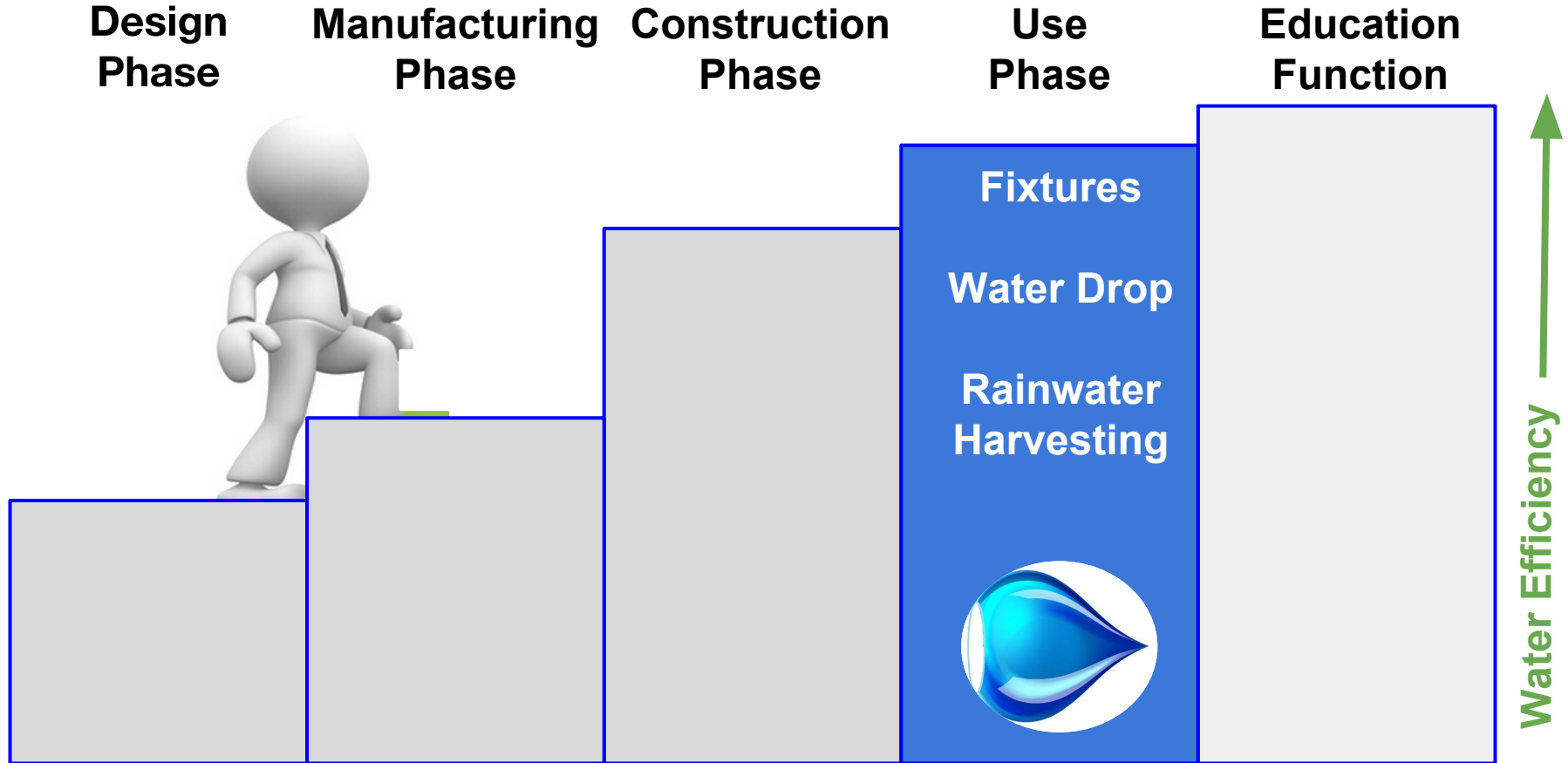
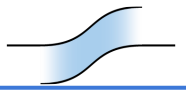
Room: Large Classroom
Daily Occupancy Hours (08:00 -17:00)
Relative Humidity (%)



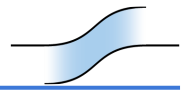


Room: Large Classroom
Daily Occupancy Hours (08:00 -17:00)
Air Age Rate (h)





BUILDING ENVELOPE OVERVIEW



External blinds control the Daylight



Direct/Indirect, energy efficient luminaires



Low-e triple glazing



Low U-value insulation



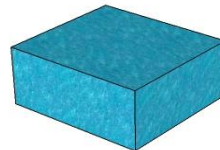
Reuse of greywater



Water efficient plumbing fixtures



Rainwater Harvesting



Water Tank Collector



Acoustic Ceiling Panels

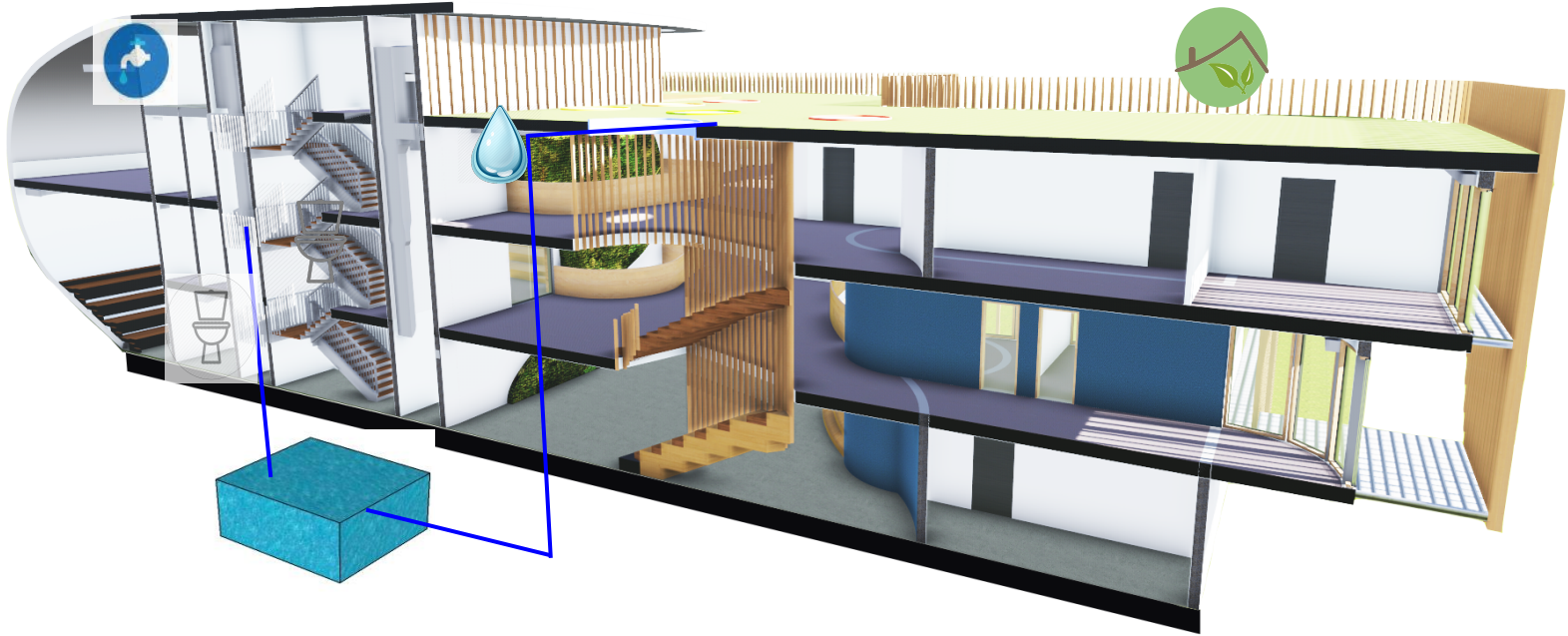
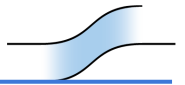


Controlled Ventilation

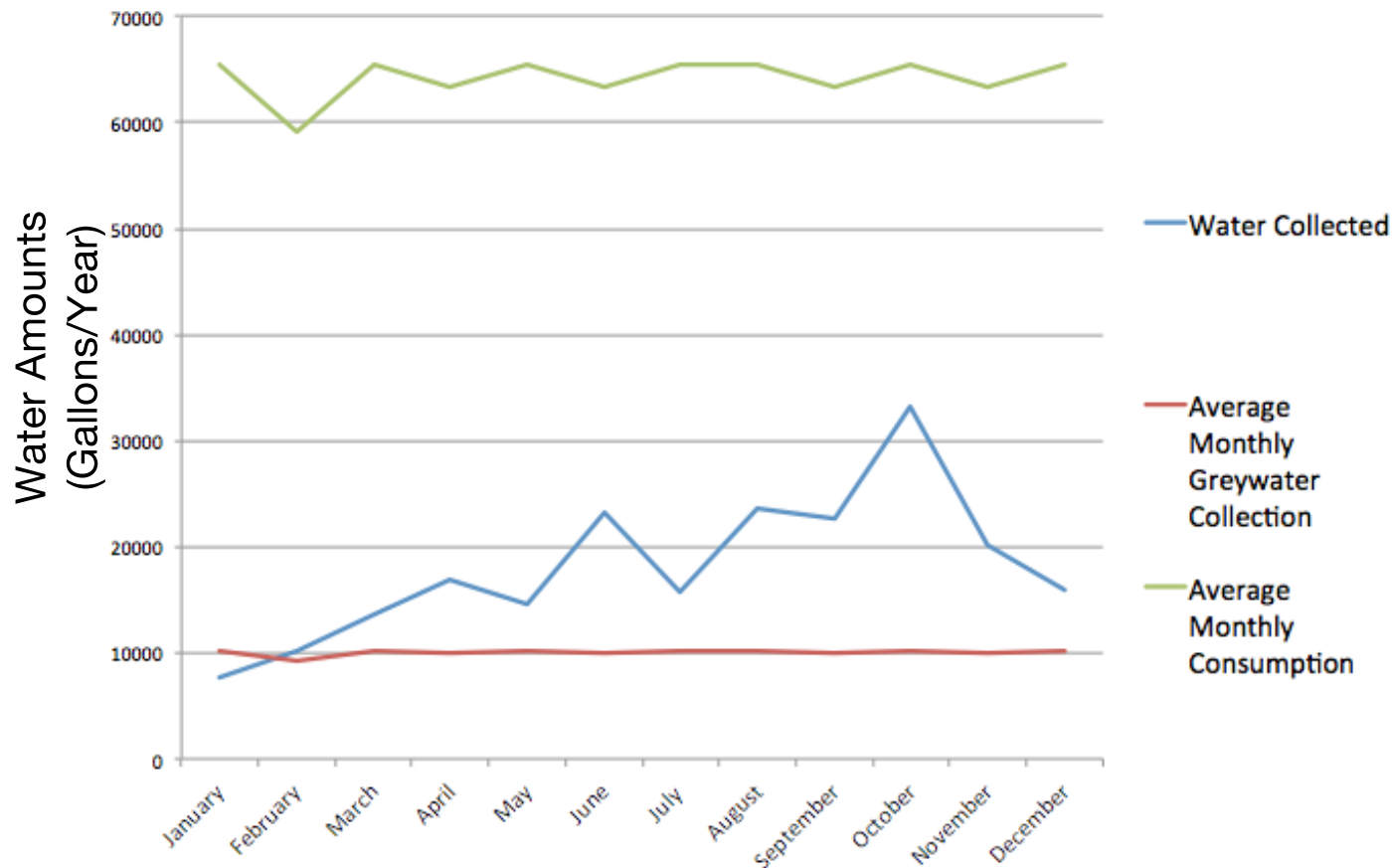
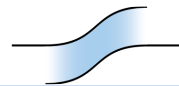


Green Roof filters the rainwater and reduce roof temperature

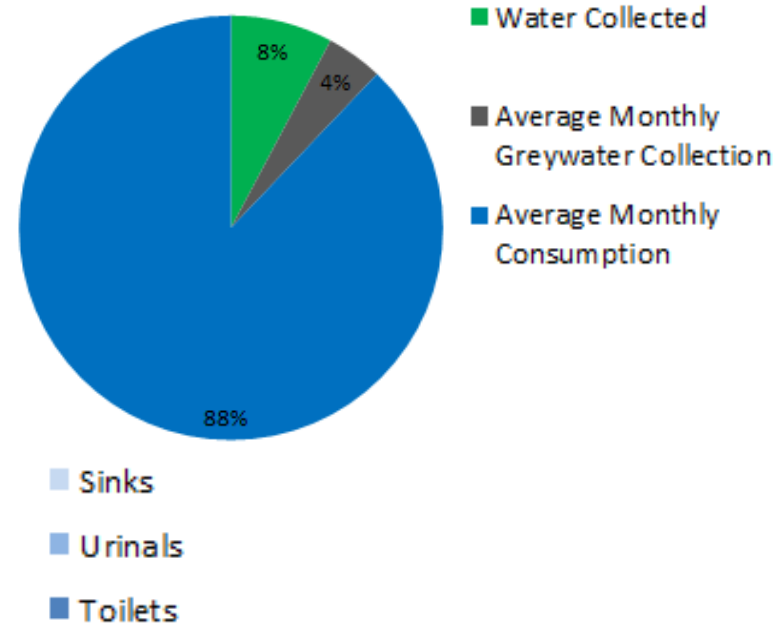
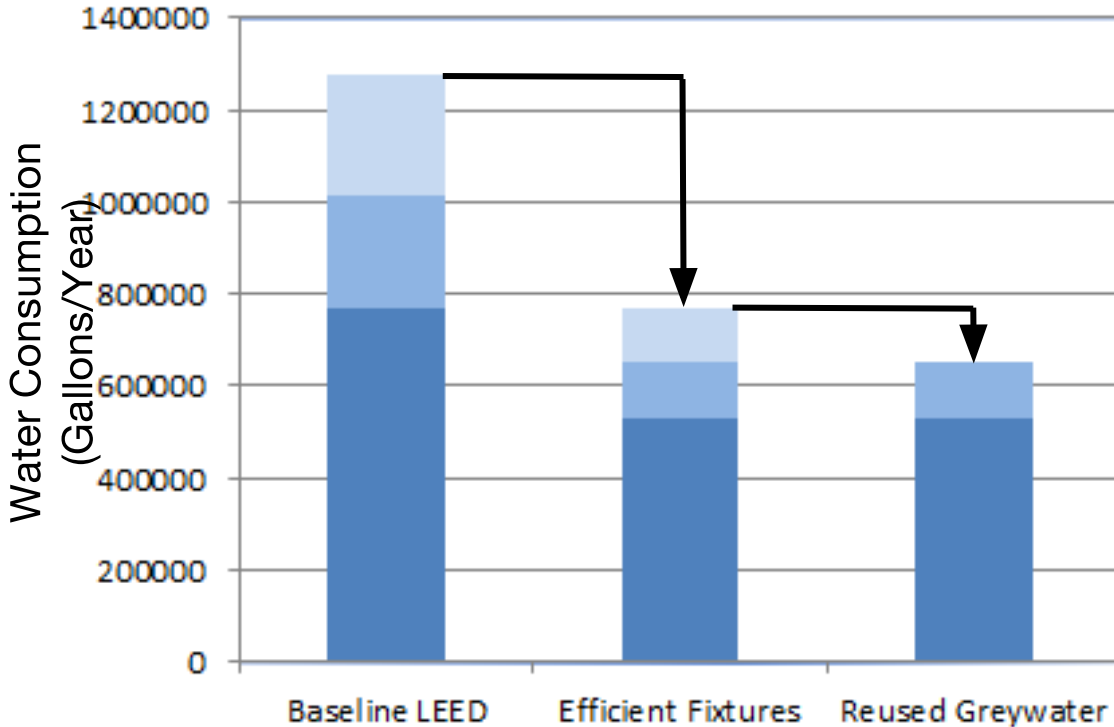
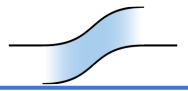
BUILDING ENVELOPE OVERVIEW



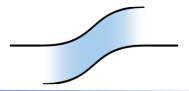
WATER CONSUMPTION



WATER REDUCTION



STV - PROGRESS



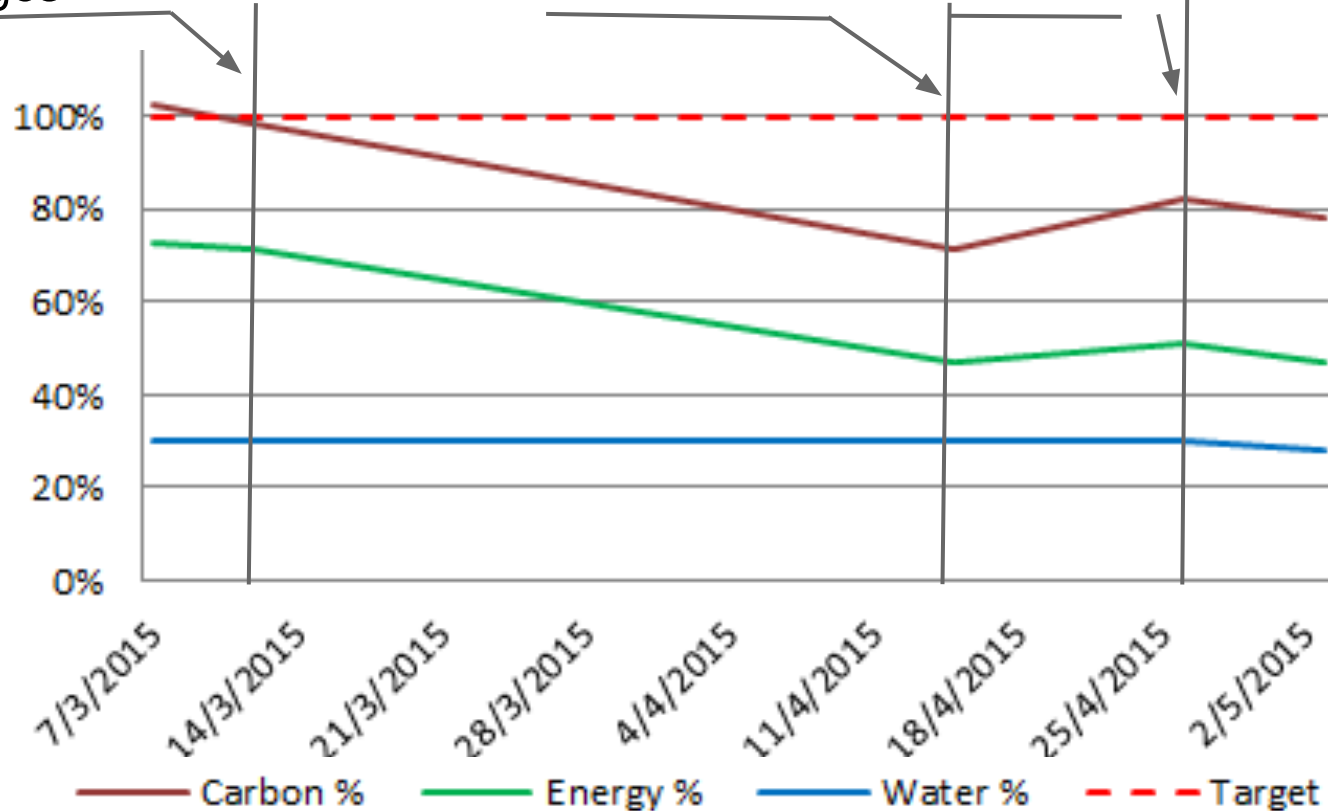
Structural Model
Changes

Energy Analysis

Construction
Materials Increase

Duct
Quantity
Reduction

Efficient
Fixtures

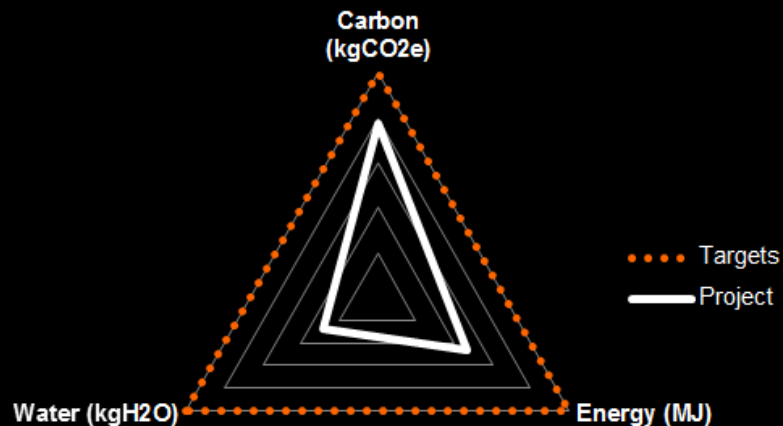


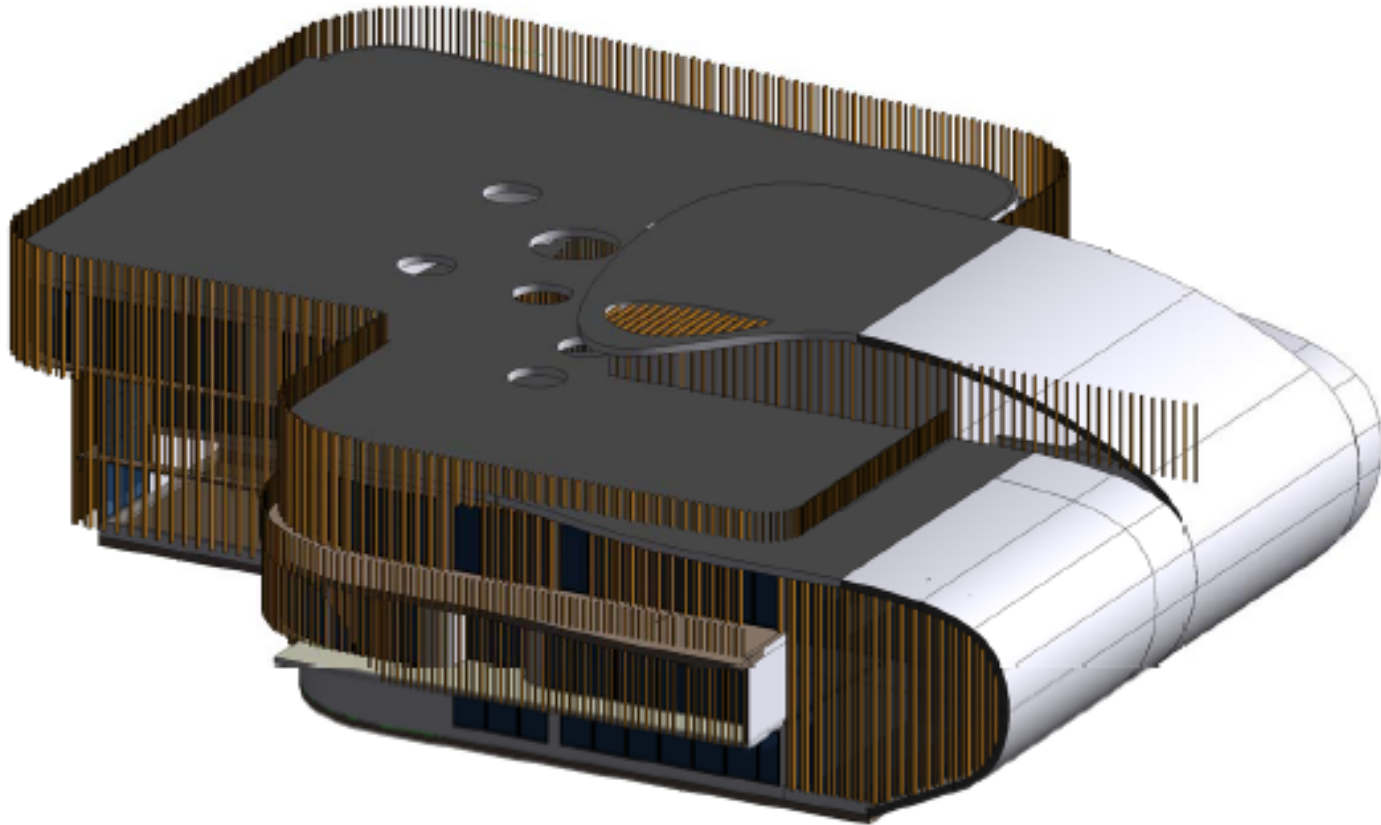
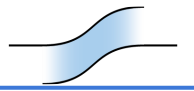
Life Cycle Assessment Results Overview

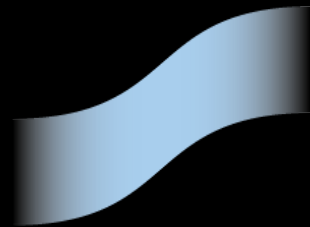
Total Life Cycle Impacts

Performance Relative to Life Cycle Impact Targets

Impact	Target	Project	%
Carbon (kgCO ₂ e)	4.664.724	3.627.006	78%
Energy (MJ)	163.196.824	76.757.323	47%
Water (kgH ₂ O)	1.466.958.904	414.276.105	28%
Ozone (kgCFC11)	-	1,51E-01	-

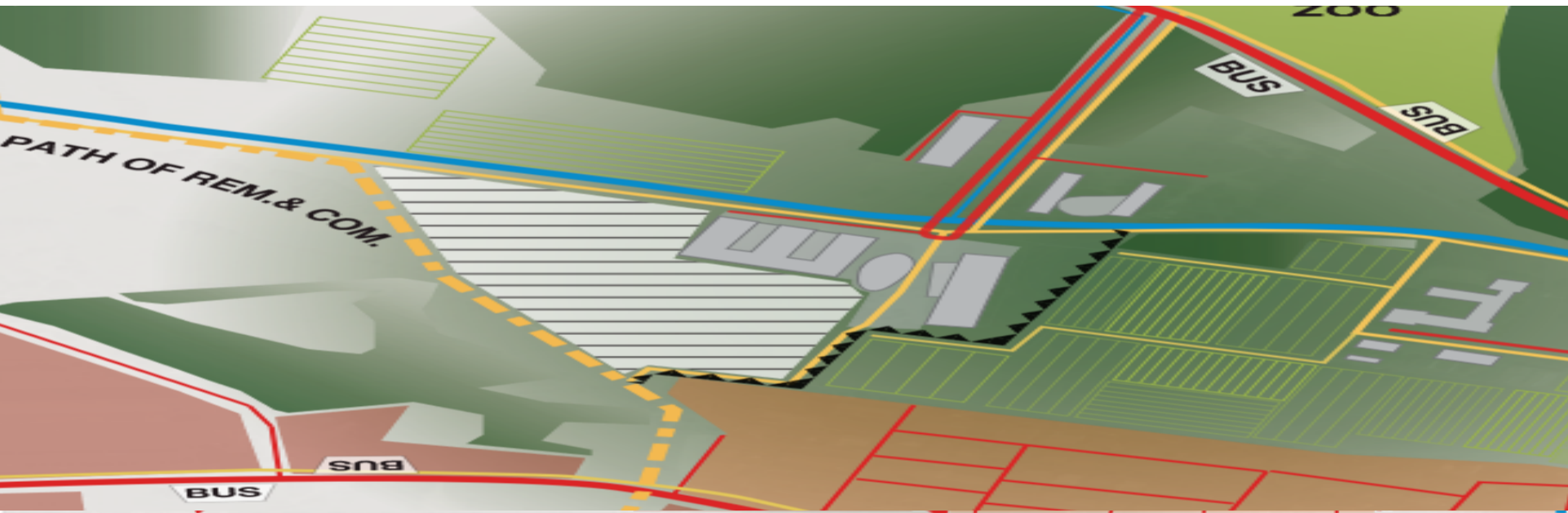




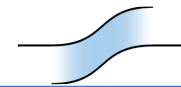


waver

SITE PLAN



- | | | | |
|---------------------|-----------------------|-------------------------|---------------|
| residential | educational buildings | roads | path of R & M |
| industry & business | ZOO | pedestrians, cyclists | |
| forest | | water | |
| agricultural fields | project area | physical barrier, fence | BUS stop |



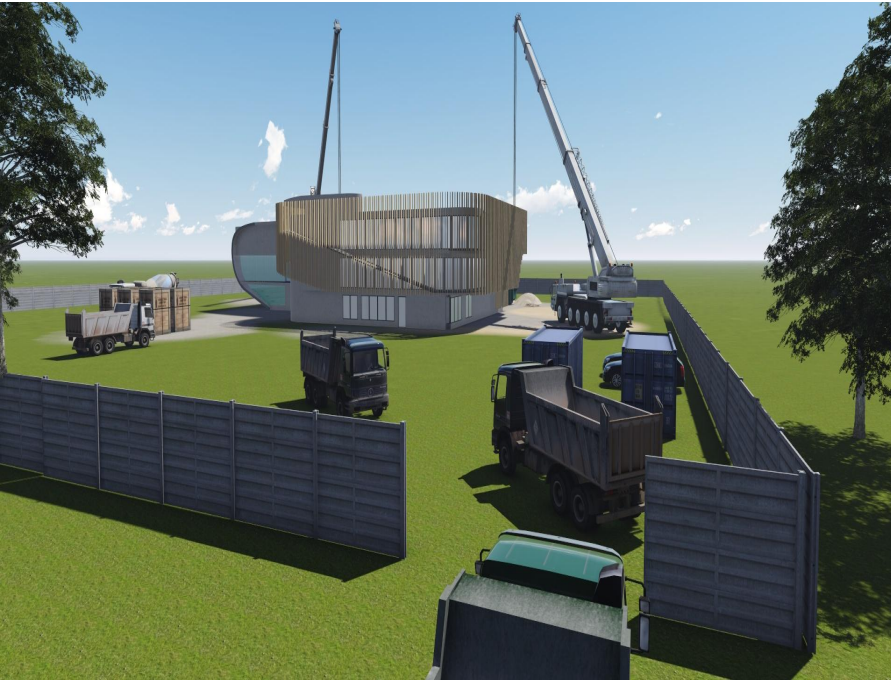
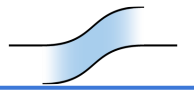
For windows
M-Sora

For green roofs and green wall:
HUMKO

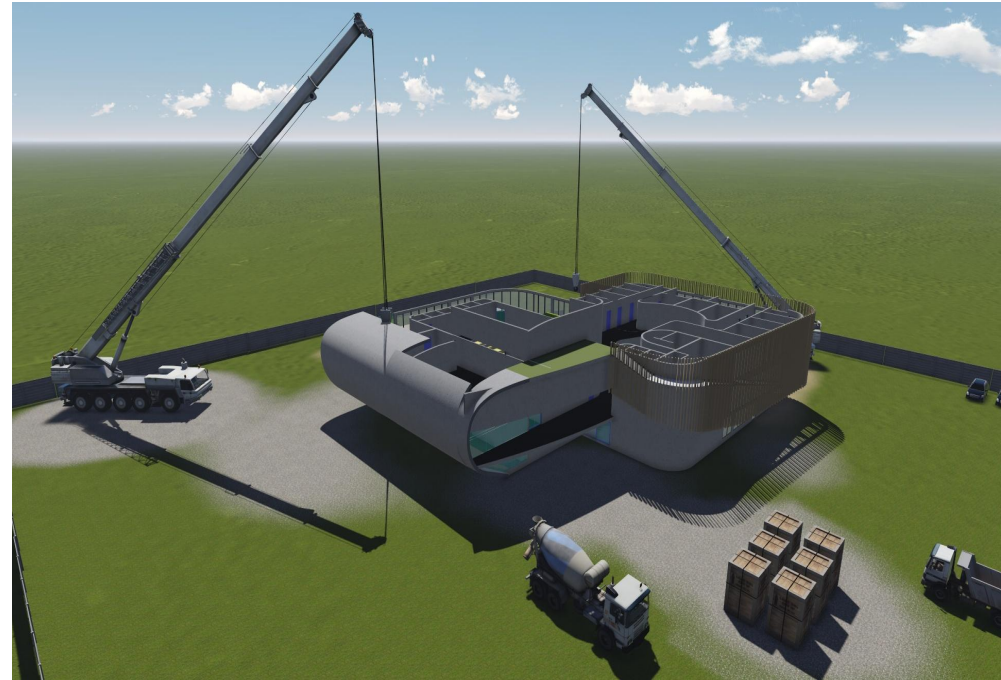


For facade
RIKO-HISE





Vehicle access
Parking area



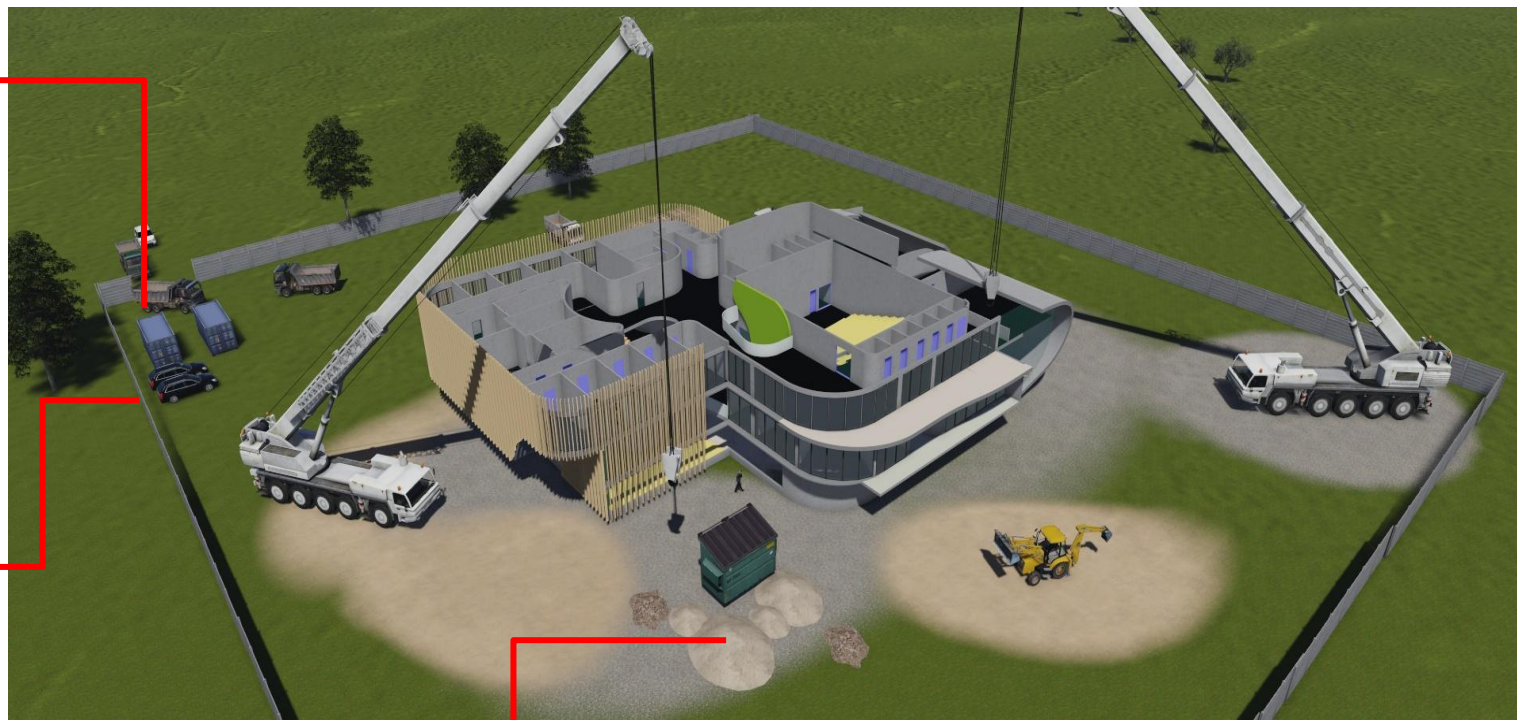
Drop off area
Concrete mixer



Trailers

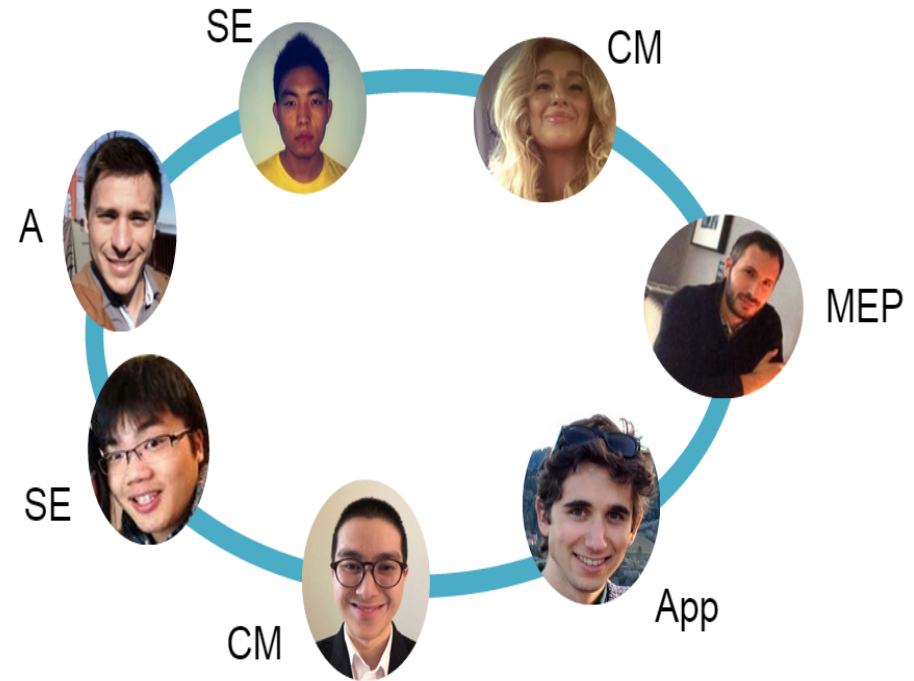
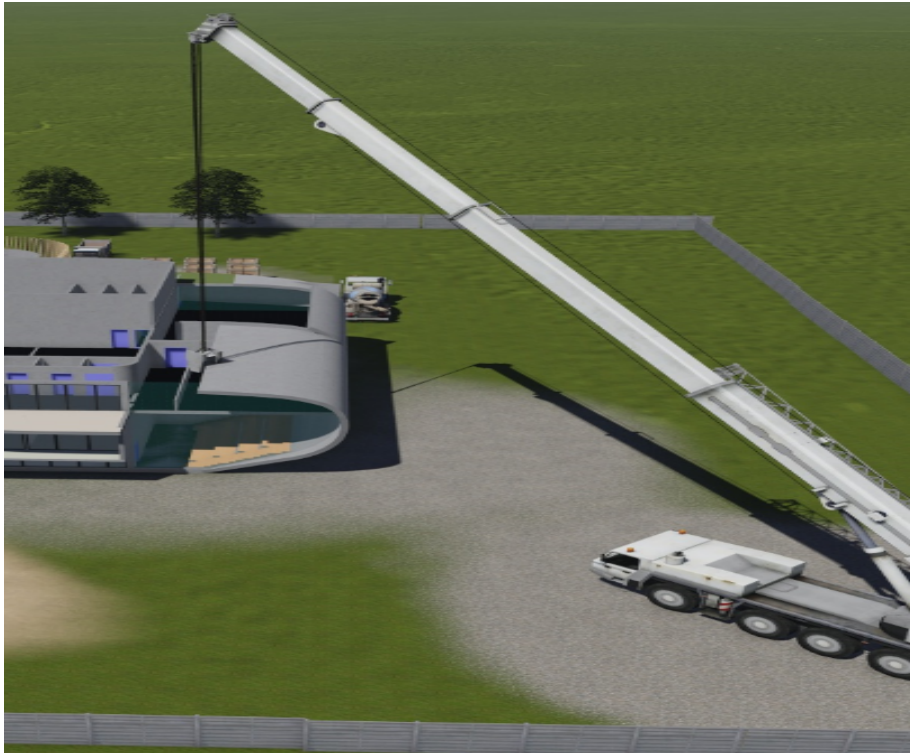
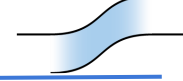


**Parking
area**

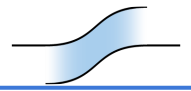


Recycling area



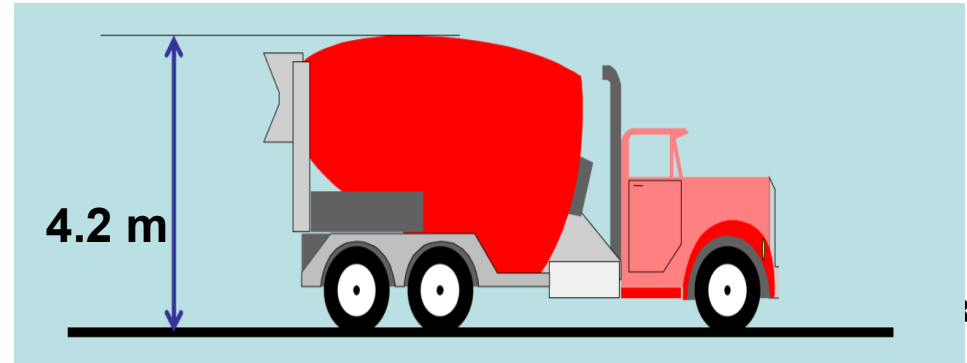


MAXIMUM LEGAL DIMENSIONS



PERMISSIBLE MAXIMUM DIMENSIONS OF TRUCKS IN EUROPE

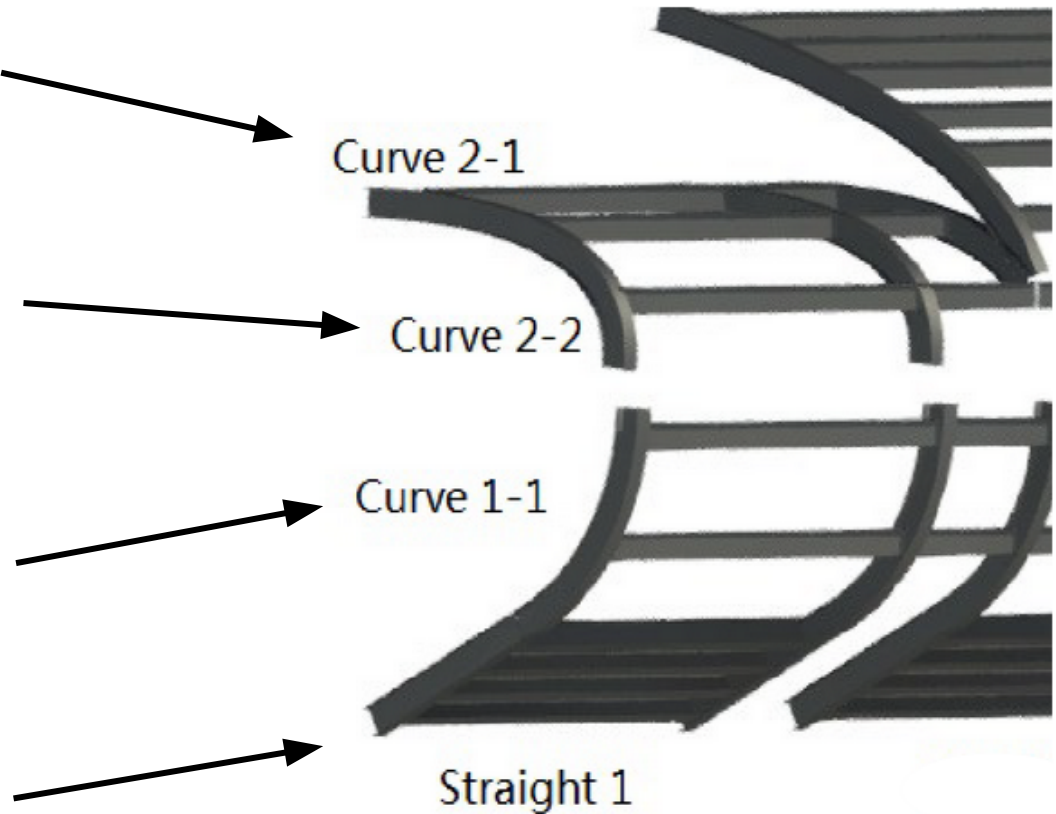
COUNTRY	HEIGHT	WIDTH	LENGTH		
			Lorry or Trailer	Road Train	Articulated Vehicle
SLOVENIA	4.2	2.55m	12m	18.75m	16.50m



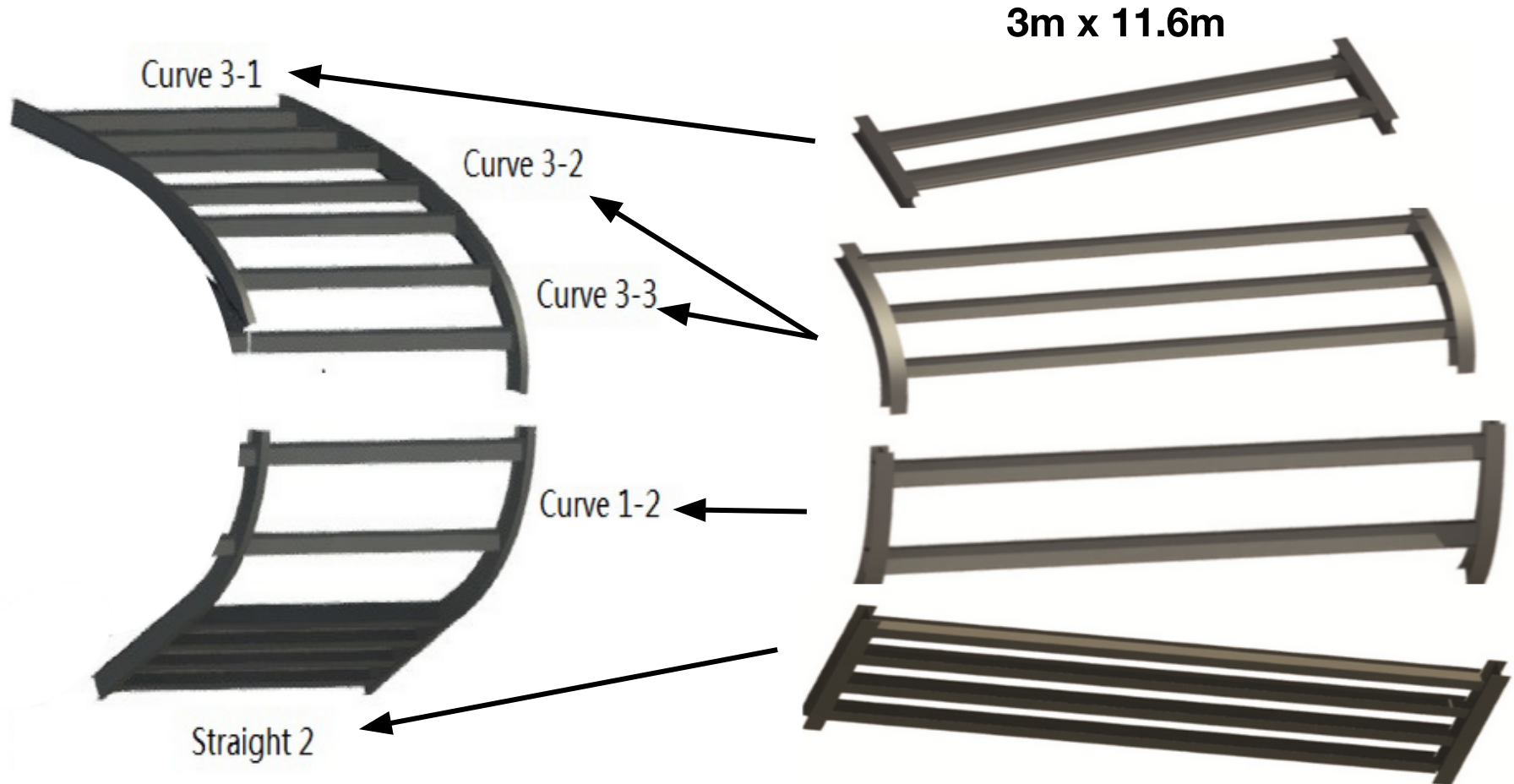
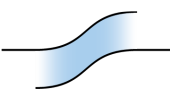


CURVED ELEMENTS

3m x 11.3m



CURVED ELEMENTS



EQUIPMENT SELECTION



**2 mobile
cranes
Furthest (1800 kg) 36m**



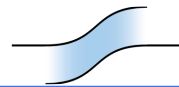
**Flatdeck/extendable
semi-trailers**



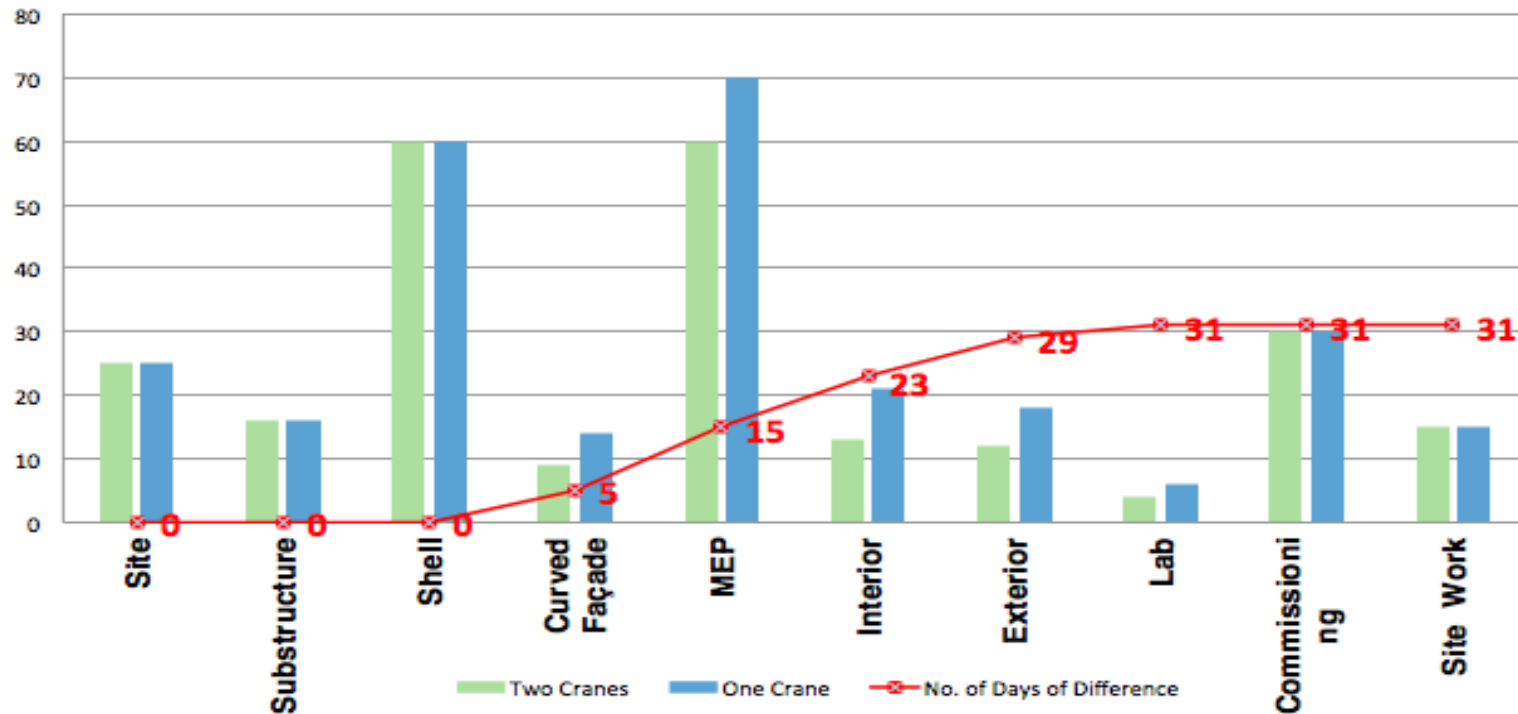
**Transporting long materials, steel
and concrete**

Excavator

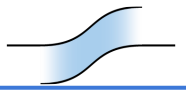


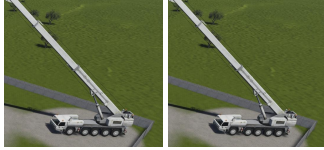


One Crane Vs. Two Crane Comparison

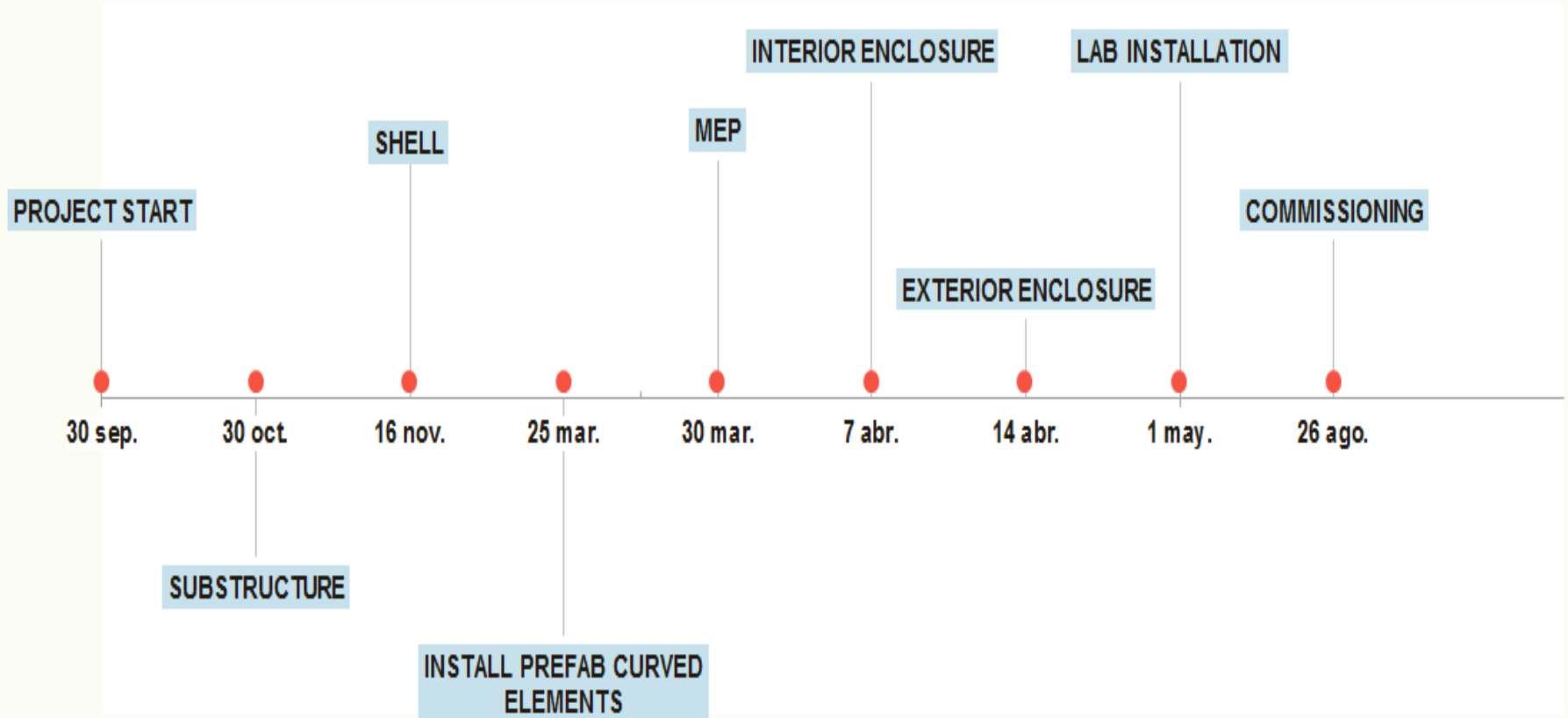
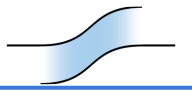


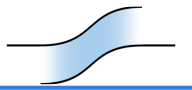
OUTCOMES: 2 VS 1 CRANE



	Two 	One 
Commissioning	Completed 8/26/2020	Completed 9/30/2020
Lab Installation	Done in time	Delays
Time	Time = \$	Limitations: movement of crane, mobilizing takes more time

CONSTRUCTION TIMELINE

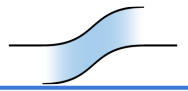




What do we really know about water usage on construction sites?



Which are the processes that takes a lot of water?



General site activities including tool washing



Site trailers



**Wheel washing,
high pressure
cleaning**

Commissioning and testing of building plants and service





Value for money

Unlikely that the introduction of expensive processes on temporary construction sites will be preferred by companies when procuring

The work environment

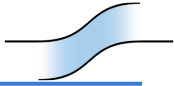
Technology is robust to stand up to the demands of construction sites

Habits

Behaviour change is not a process that will happen overnight



	Processes using water	Procedures	Behaviour	Technologies
Trailers 	Toilets, washing	Monitor with meter reading. Rainwater collection and use	Site inspections for leaks, increase awareness	ECO trailers Water meter
General site activities, cleaning 	Tool washing	Site inspections, checking leaks	Use toolbox talks, make people understand. Use buckets to wash	Auto shut- off Trigger hoses to switch off Closed- loop systems water recycling
Plants,commissioning and test 	Building plants/services	Capture and reuse commissioning water	Site inspection to ensure water is off when not needed	Recirculation systems, closed loop systems



Recycled Content Products

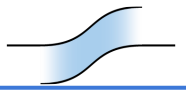
Composting Toilet

Reused Building Materials



	Green trailer	Typical trailer	Annual benefits
WATER	0 gallons	1600 gallons	1600 gallons or \$1020 annually

COST ESTIMATE - TVD



Winter Estimate:

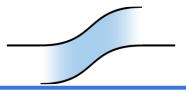
Large Delta
Between
Targets and
Estimate

ESTIMATE AND TARGET VALUE - SUMMARY			
	ESTIMATED VALUE	TARGET VALUE	VALUE DELTA
TOTAL	\$ 8,850,000	\$ 9,000,000	\$ 150,000
A Substructure	\$ 140,000	\$ 930,000	\$ 790,000
B Shell	\$ 1,860,000	\$ 1,800,000	\$ (60,000)
C Interiors	\$ 1,100,000	\$ 1,370,000	\$ 270,000
D Services	\$ 3,700,000	\$ 2,200,000	\$ (1,500,000)
E Equipment and Furnishing	\$ 50,000	\$ 700,000	\$ 650,000
F Specialty Construction	\$ 350,000	\$ 580,000	\$ 230,000
G Building Sitework	\$ 350,000	\$ 700,000	\$ 350,000
H General Conditions	\$ 1,300,000	\$ 700,000	\$ (600,000)

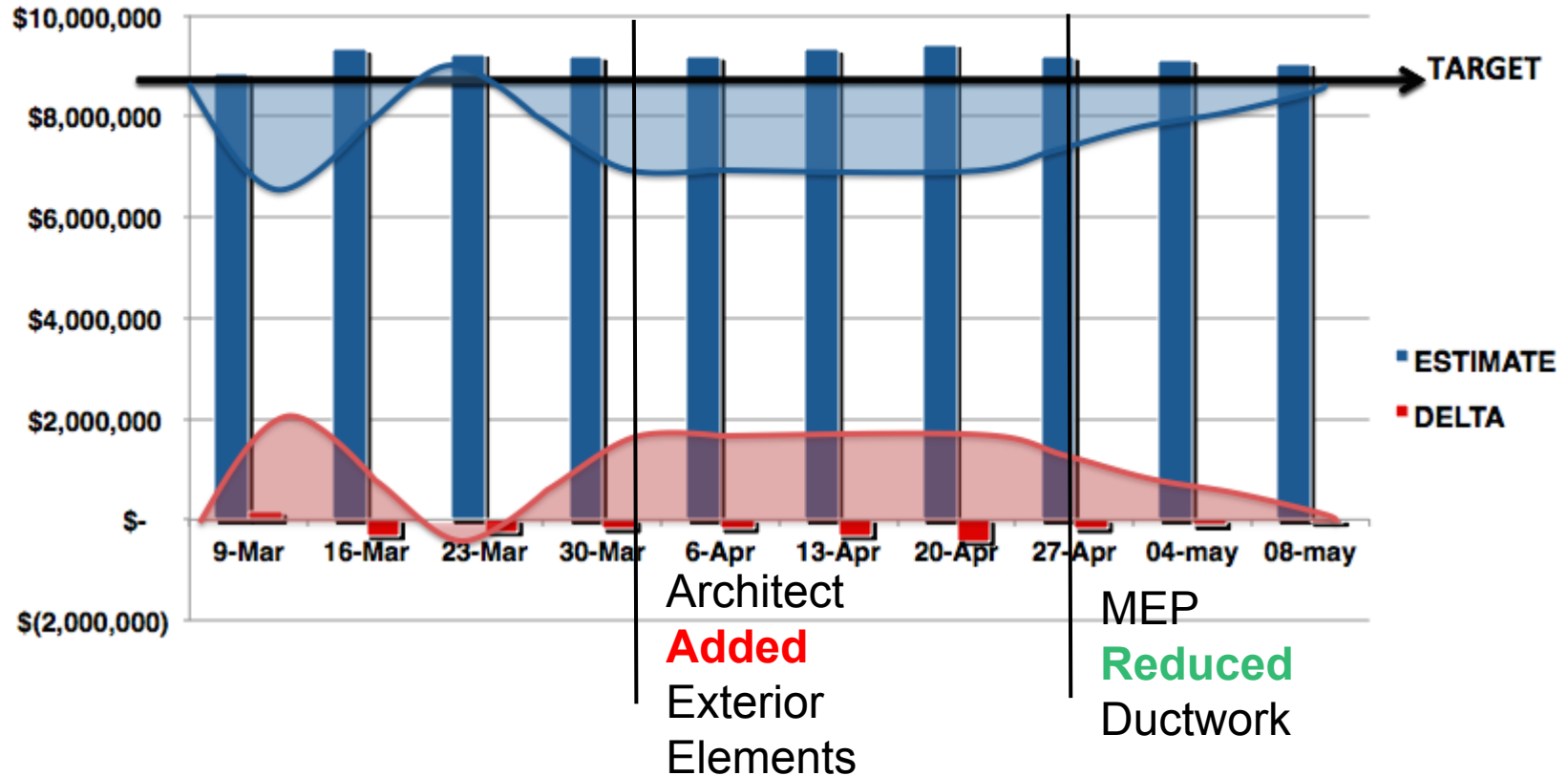
Spring Estimate:

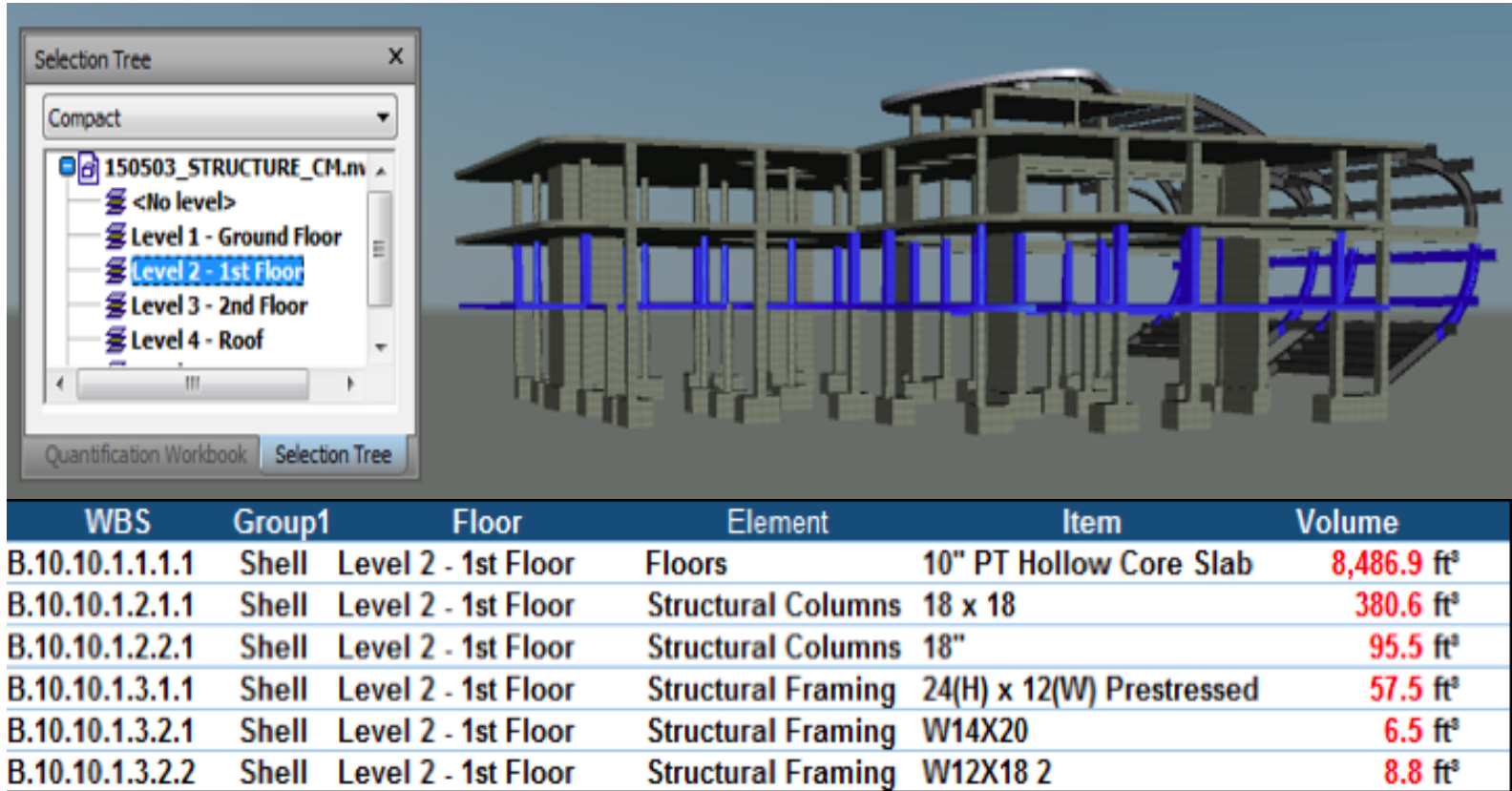
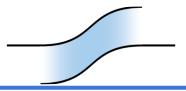
Smaller Delta
Between
Targets and
Estimate

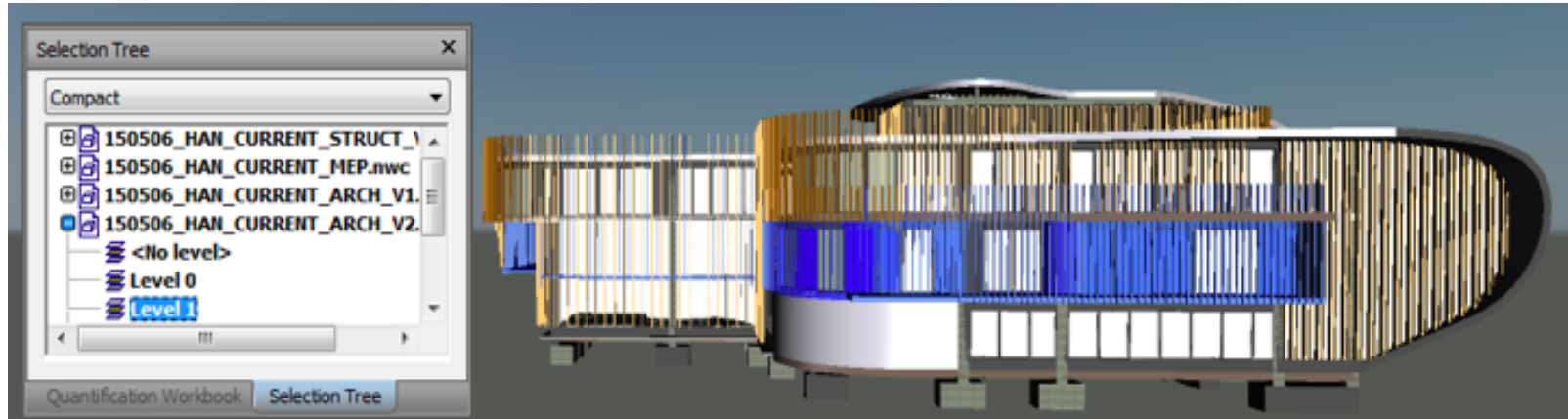
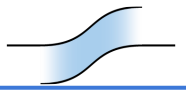
ESTIMATE AND TARGET VALUE - SUMMARY			
	ESTIMATED VALUE	TARGET VALUE	VALUE DELTA
TOTAL	\$ 9,050,000	\$ 9,000,000	\$ (50,000)
A Substructure	\$ 130,000	\$ 250,000	\$ 120,000
B Shell	\$ 2,790,000	\$ 2,500,000	\$ (290,000)
C Interiors	\$ 1,350,000	\$ 1,400,000	\$ 50,000
D Services	\$ 3,350,000	\$ 3,400,000	\$ 50,000
E Equipment and Furnishing	\$ 30,000	\$ 100,000	\$ 70,000
F Specialty Construction	\$ 300,000	\$ 350,000	\$ 50,000
G Building Sitework	\$ 350,000	\$ 300,000	\$ (50,000)
H General Conditions	\$ 750,000	\$ 700,000	\$ (50,000)



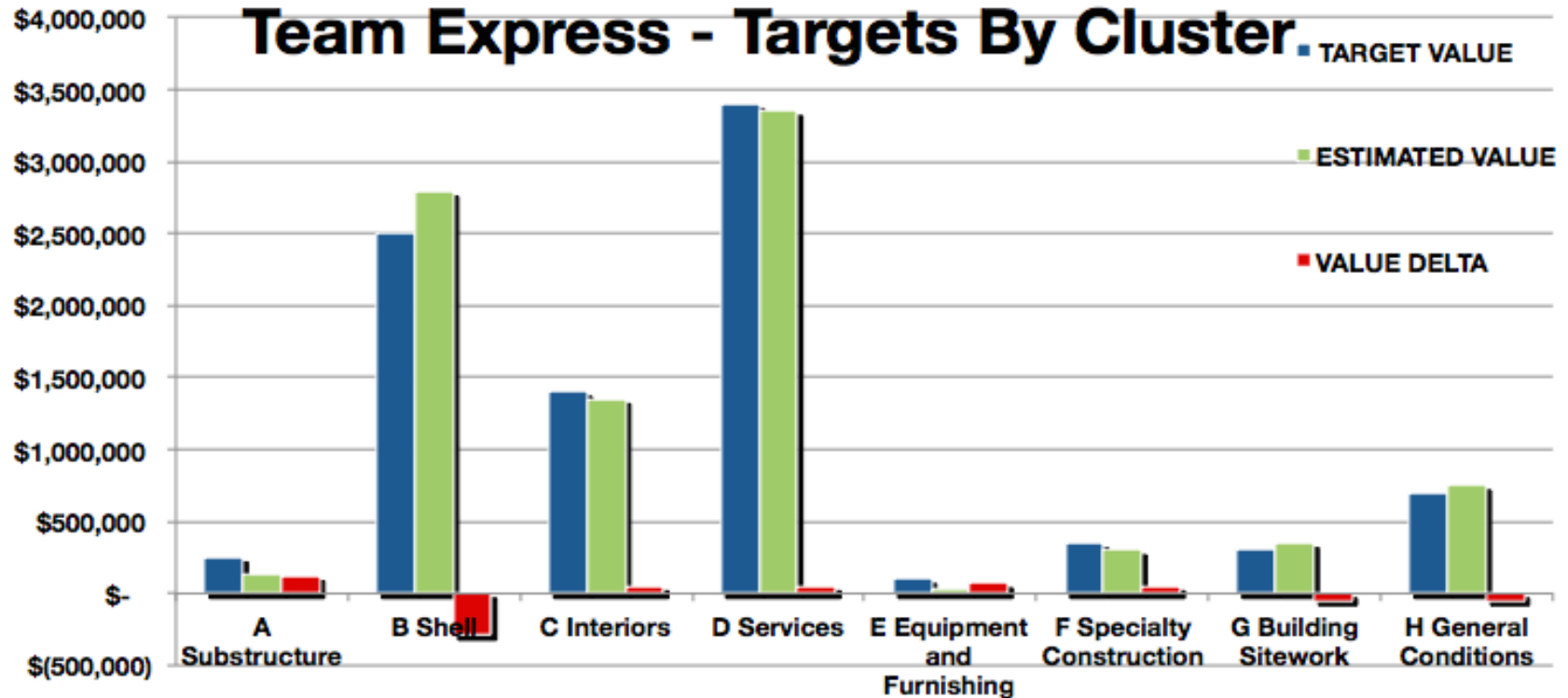
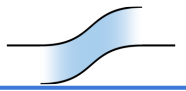
Target Value Design - Tracking Over Time

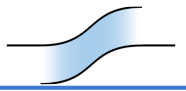




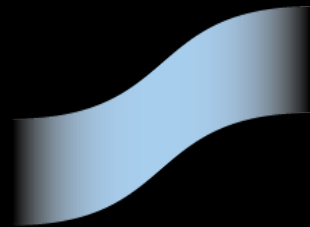


WBS	Group1	Element ID	Element	Item	Volume	
C.1.2.3.1.6	Interiors	Floors	Floor	floor slab auditorium 30	1,099.9	ft ³
C.1.2.3.1.7	Interiors	Floors	Floor	floor slab auditorium 15	44.5	ft ³
C.1.2.4.1.1	Interiors	Walls	Basic Wall	Wall_200	4,695.6	ft ³
C.1.2.4.1.2	Interiors	Walls	Basic Wall	Wall_200	33.8	ft ³
C.1.2.4.1.3	Interiors	Walls	Basic Wall	Wall_100	755.2	ft ³
C.1.2.4.1.4	Interiors	Walls	Basic Wall	STUDYANDGO	911.9	ft ³

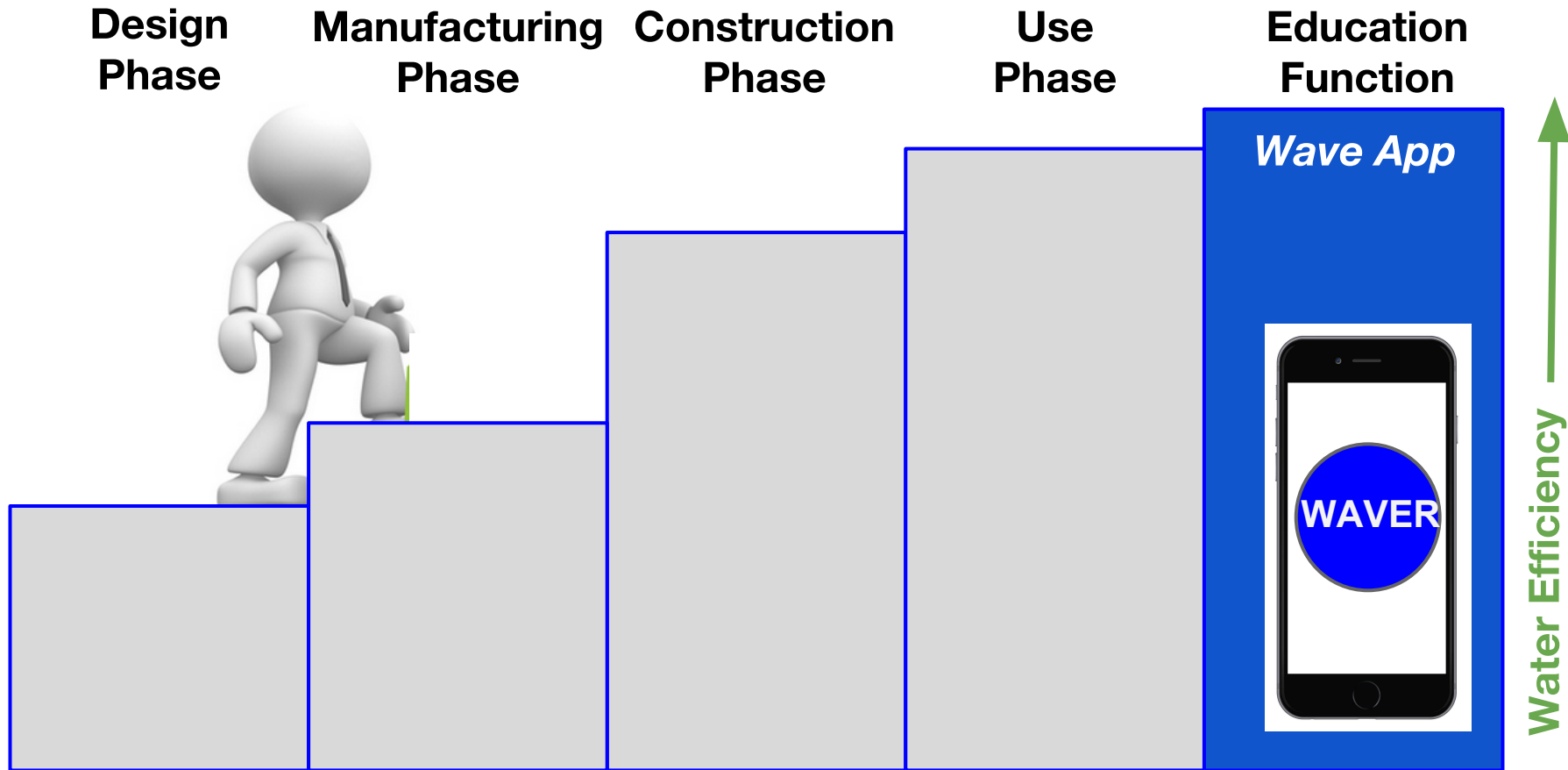
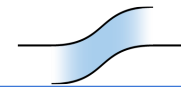


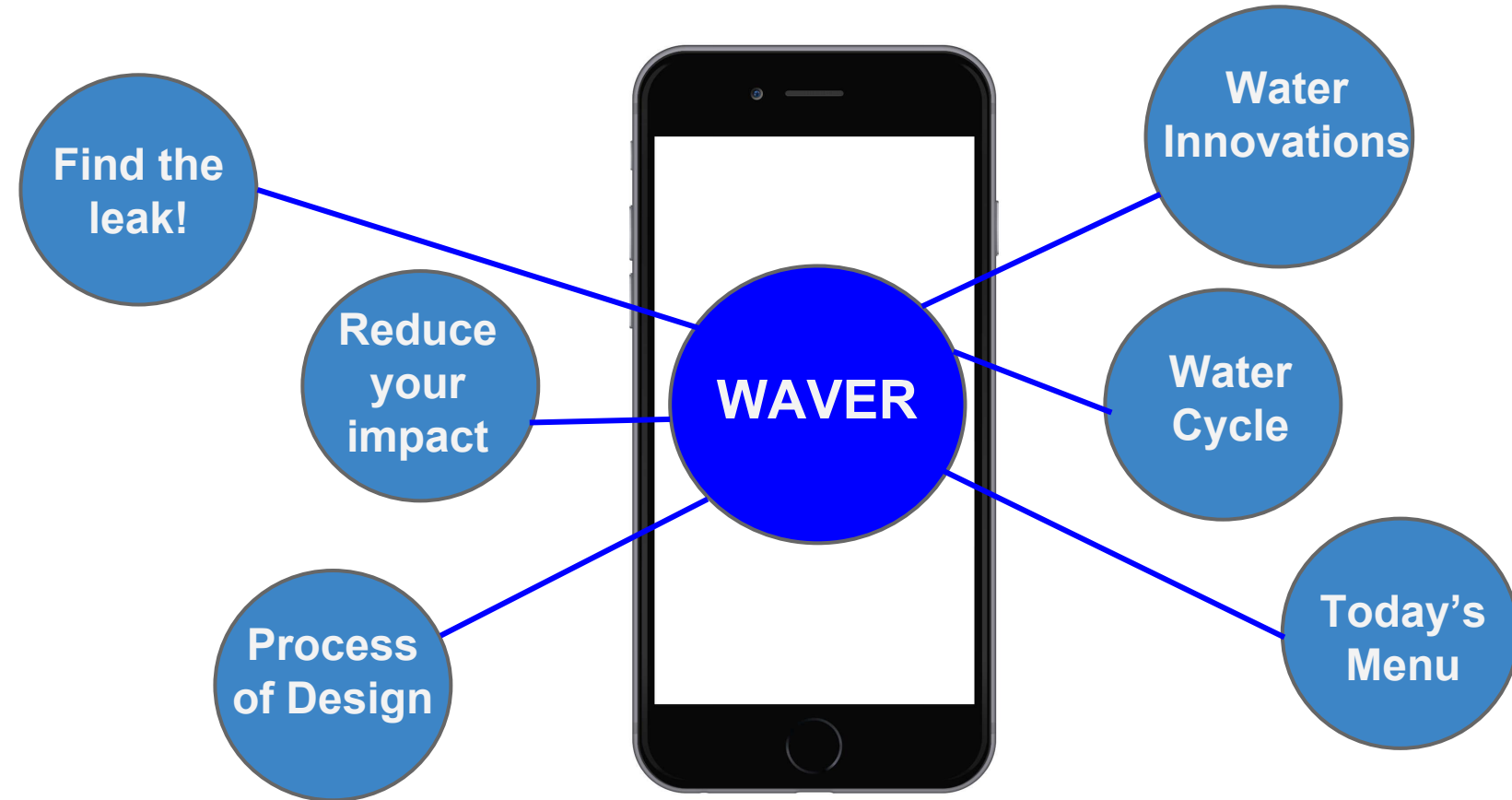
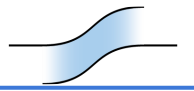


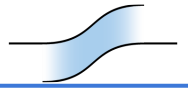
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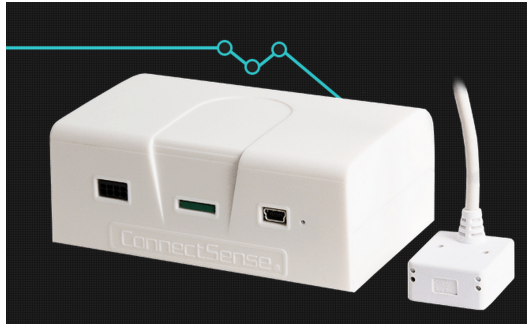
waver







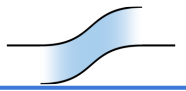
Cloud Based Leak Detection



Provides real-time data about water flow in the building

Reports the leaks in the water fixtures immediately

Helps occupants identify the leaks and fix them as soon as possible



Explore these foods see how much water you can save by altering your diet.

BEEF



106 gal/oz

LAMB



85 gal/oz

LENTILS



71 gal/oz

MANGOS



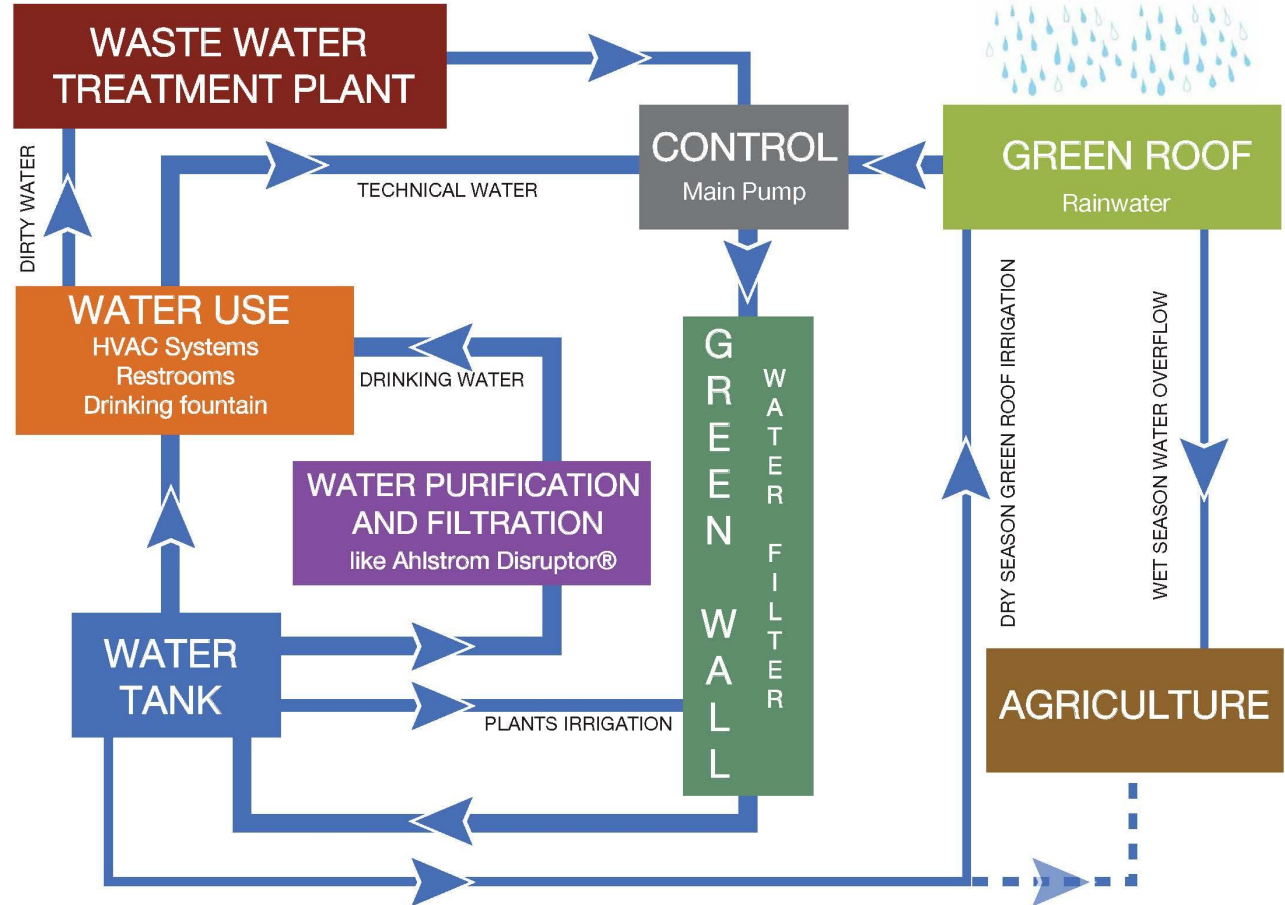
28 gal/oz

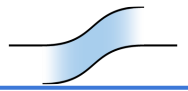


Vegetarian Cafe



You actually **save more water** by altering your diet than by taking shorter showers.





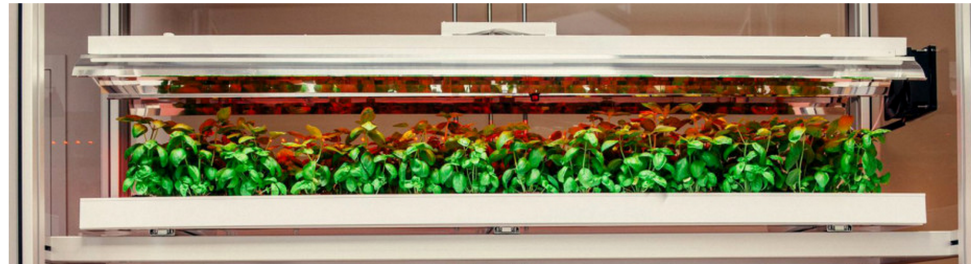
DROUGHT

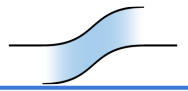
TECH HELPS STRAWBERRY FARMERS CONSERVE
DURING DROUGHT



WATER
DROP

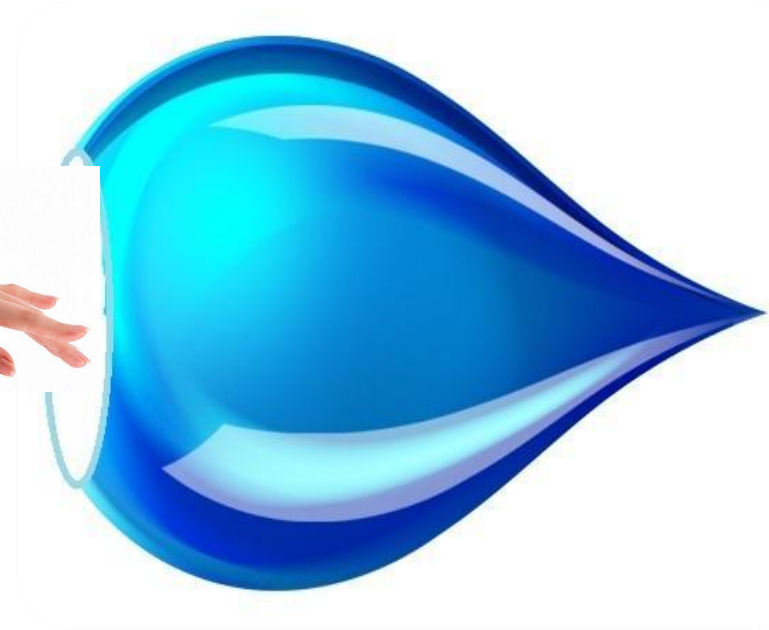
**THIS INDOOR FARM CAN BRING FRESH
PRODUCE TO FOOD DESERTS**





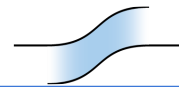
Make every **drop** count

Smart **Water** Saving Machine



Originally invented by Express Team

WASH STEP



1. Hand



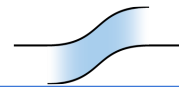
2. Foam Soap



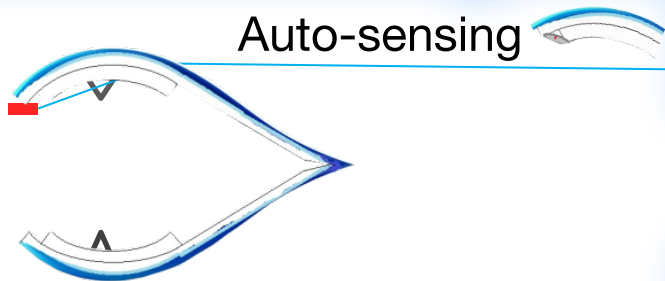
4. Dryer



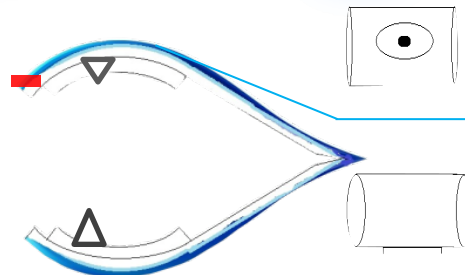
3. Water Clean



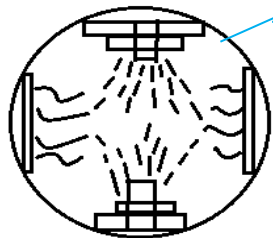
Auto-sensing



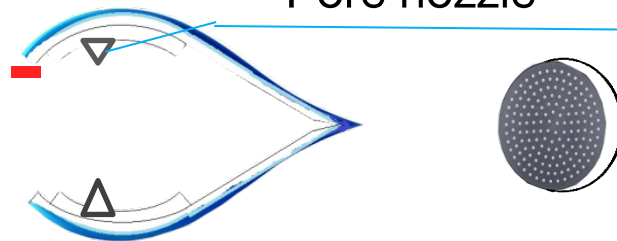
Foam

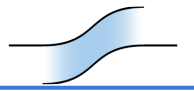


High-speed dryers

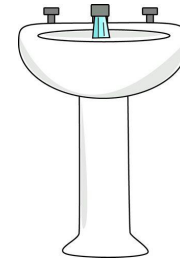


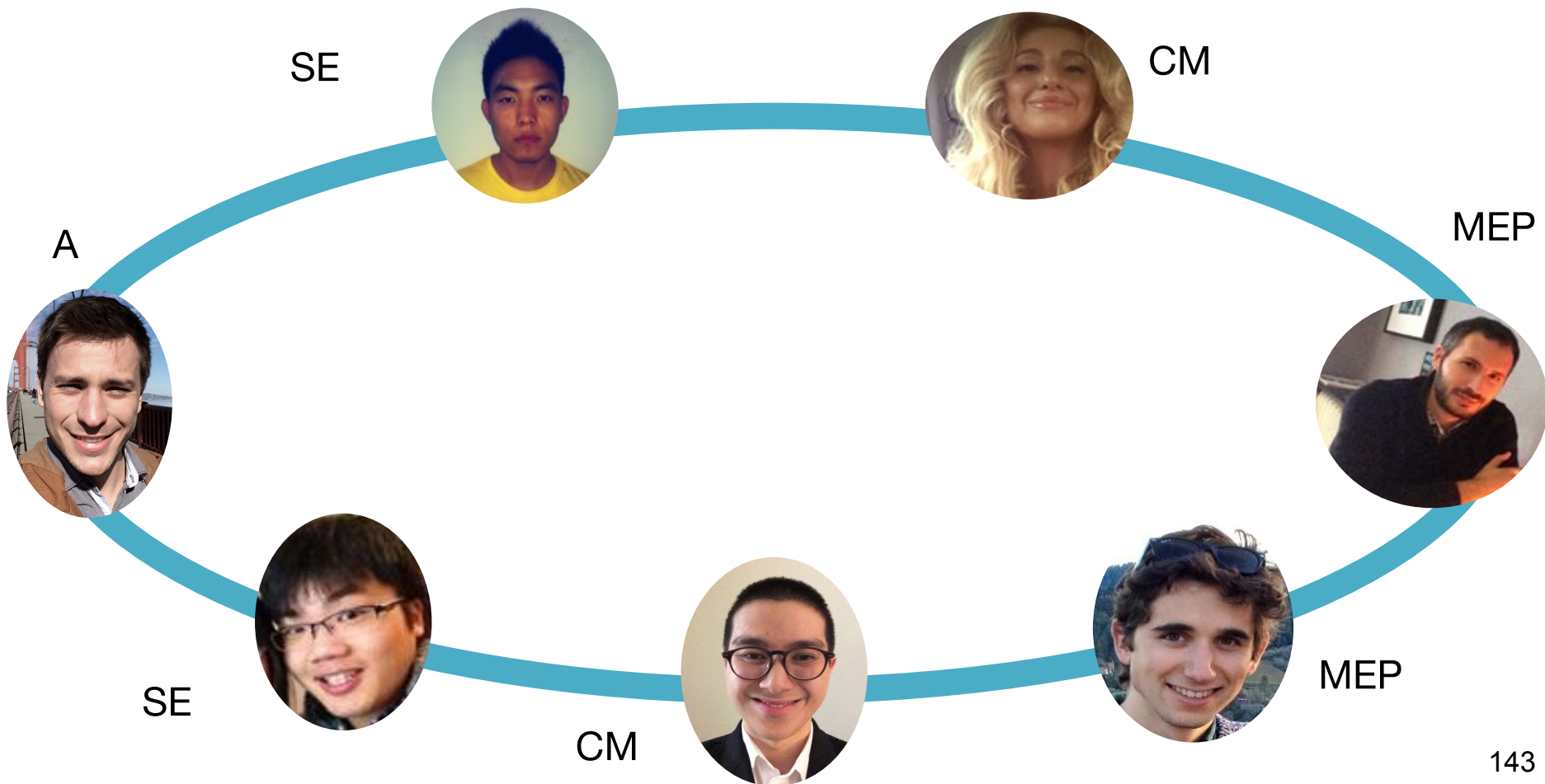
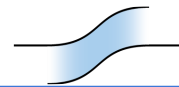
Pore nozzle



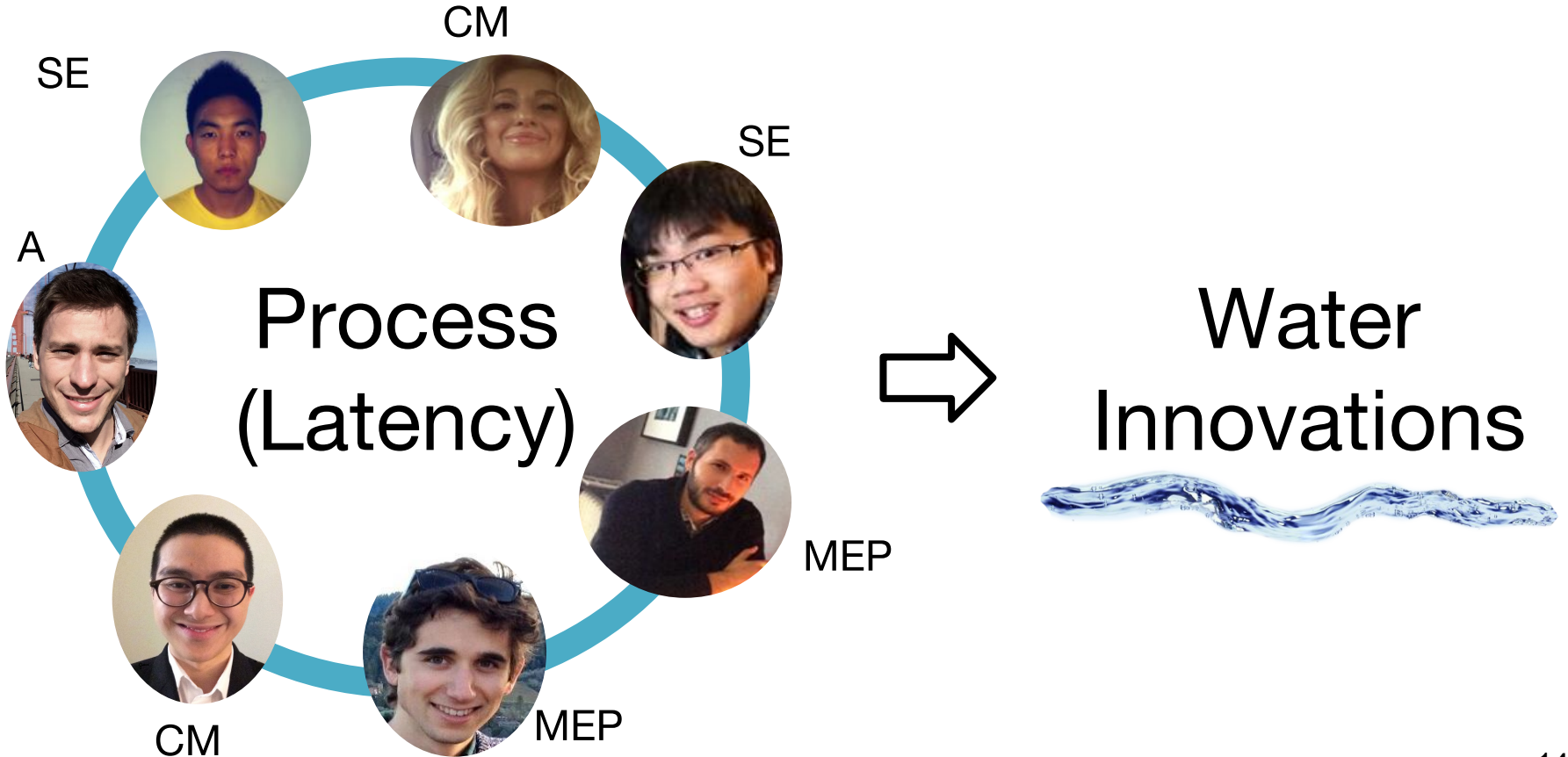
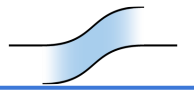


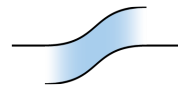
**Water
Safe**





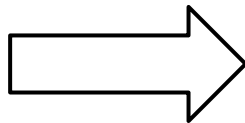






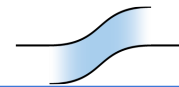
Latency:

- Rework**
- Multitasking**
- Delay**



**Value
for Time[®]**





**Design
Phase**

**Manufacturing
Phase**

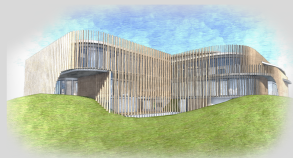
**Construction
Phase**

**Use
Phase**

**Education
Function**



Wave



*Geopolymer
Concrete*



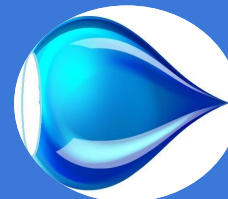
*Recycle
Material*



Fixtures

Water Drop

*Rainwater
Harvesting*



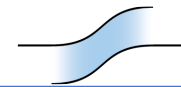
Waver App

*Green Wall
Green Roof*

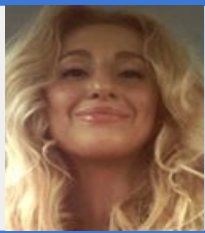


Water Efficiency



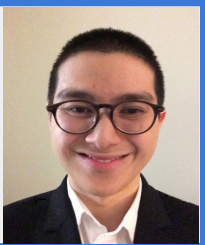


**Klara
(CM)
Iraq**



“Best team ever”

**Han
(CM)
Singapore**

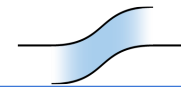


“Long distance relationship”

**Geffen
(App)
USA**



“Get to know your team well”



**Robert
(A)
Slovenia**



“Compassion”

**Sio
Chong
(SE)
China**



“Work out the team process, then work out the project”

**Xi Liu
(SE)
China**



“Creative idea generation”

**Stavro
s
(MEP)
Greece**

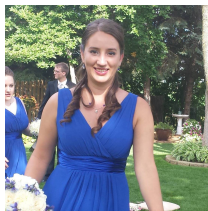
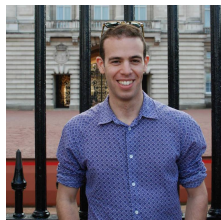


“Integrated design process”



TEACHING TEAM:

Renate Fruchter
Flavia Grey
Maria Frank
Tongda Zhang



OWNERS:

Maria Selk
Ethan Landy
Anja Jutraz
Anirudh Rao

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David Bendet
Hollmen Saija
Justin Schwaiger
Greg Luth
Eduardo Miranda
Glenn Katz
Luis Rivera
Kyle Adams
John Nelson
Fernando Castillo
Cohen
Ken Rock
Fredrik Wincent