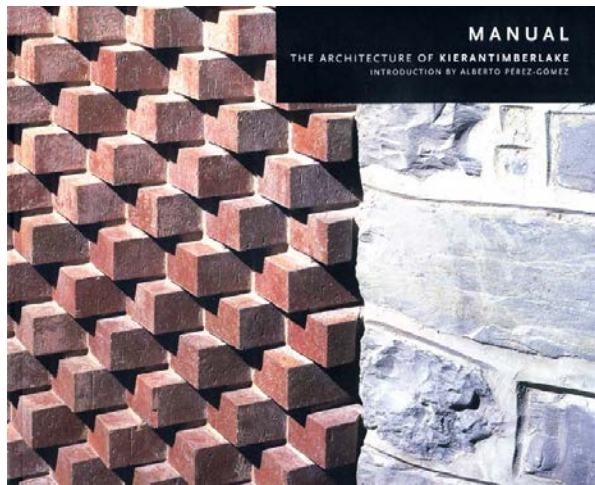


KIERAN TIMBER LAKE



WEST MIDDLE SCHOOL, THE SHIPLEY SCHOOL (1993)

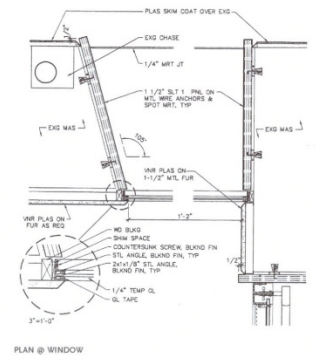
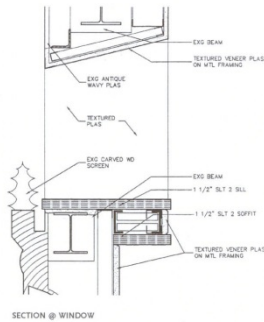
BEST 4 PLENARY | FORM VS. FUNCTION



FRAMING

Few can resist peering through a little hole to a world beyond. The asymmetrical angling of these windows is a quiet abstraction of medieval architecture, which further emphasizes the wall depth and draws the body into the role of voyeur. Most of these framing moments were found incident by incident. At the stair up to the dining hall balcony, we wanted to create a more generous pause by shoving the landing into an existing phone booth and storeroom. By removing the wooden panels, James Gamble Roger's elaborate woodcarvings become transparent and a more modern sense of public spatial depth is infused into formerly introverted rooms. At the bottom of the stair, a body size hole into the multi-purpose room extends the view through that space into the activity hall beyond, continuing the dialogue of circumstantial viewing.

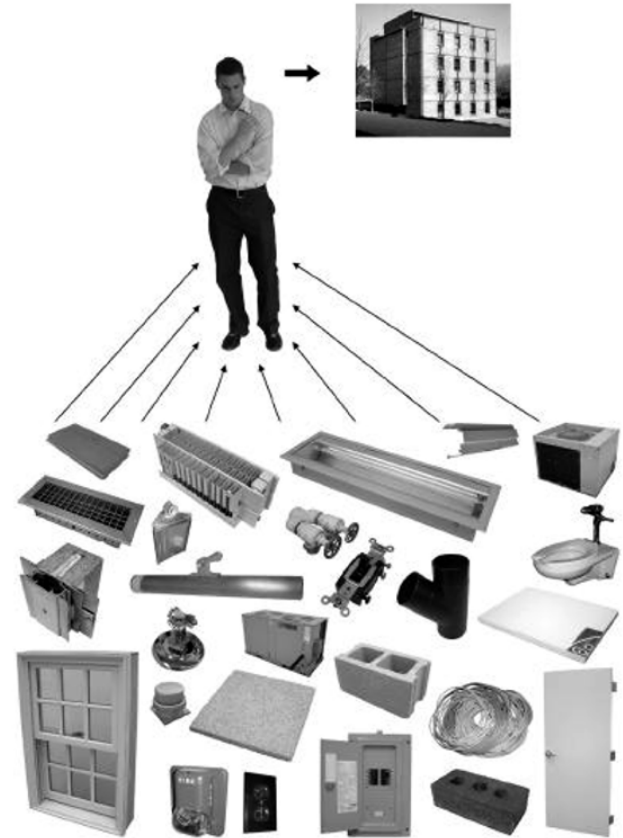
Berkeley 12 35 52 60 78 102 113 128 132



refabricating ARCHITECTURE

How Manufacturing Methodologies Are Poised to Transform Building Construction

Stephen Kieran James Timberlake



MASTER CONTROLLER

LOSING CONTROL *The last century witnessed an unprecedented development of new materials and improved environmental systems, as well as a new understanding of old topics, such as acoustics. This expansion of choices has added up to infinitely more complex and specialized buildings that require expertise in more subjects than one architect can master. The architect now coordinates the many diverse consultants who are able to master their own specialties.*



SMARTWRAP™(1999)

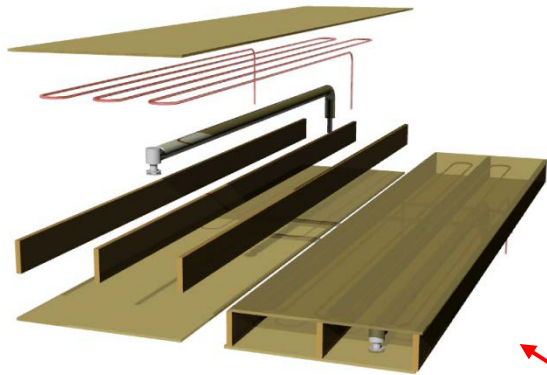
BEST 4 PLENARY | FORM VS. FUNCTION



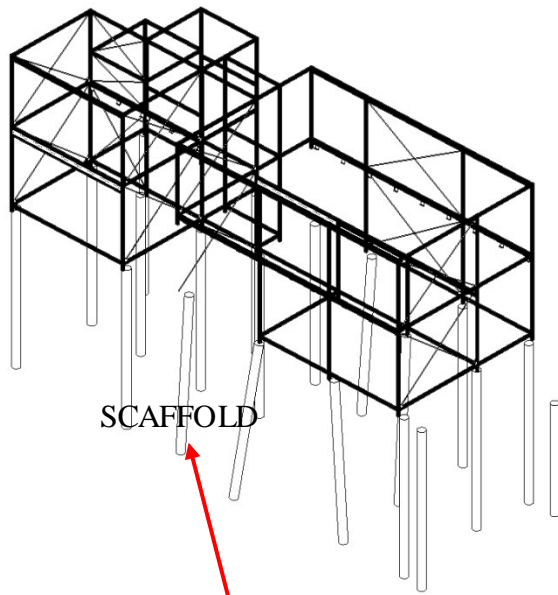
14 APRIL 2015 | © KIERANTIMBERLAKE



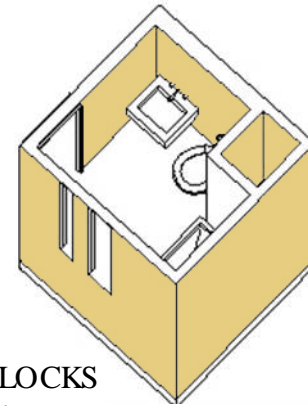
LOBLOLLY HOUSE (2006)
BEST 4 PLENARY | FORM VS. FUNCTION



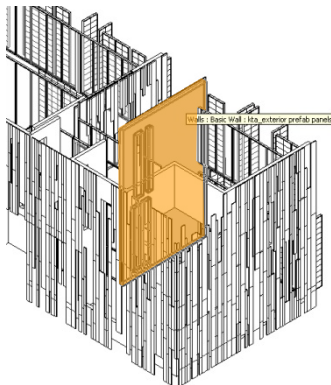
SMART CARTRIDGES



SCAFFOLD



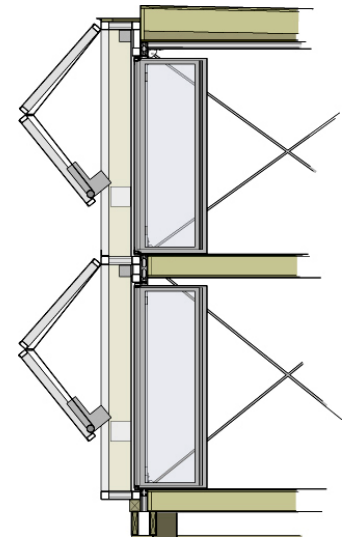
BLOCKS



DUMB CARTRIDGES



RATCHET

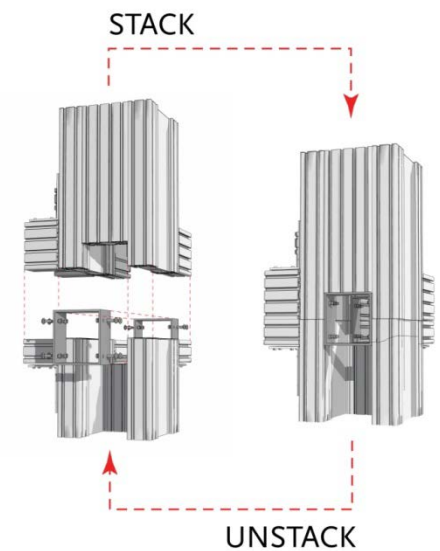
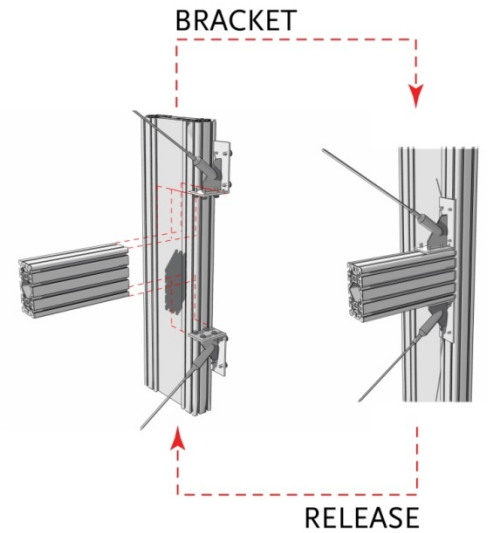
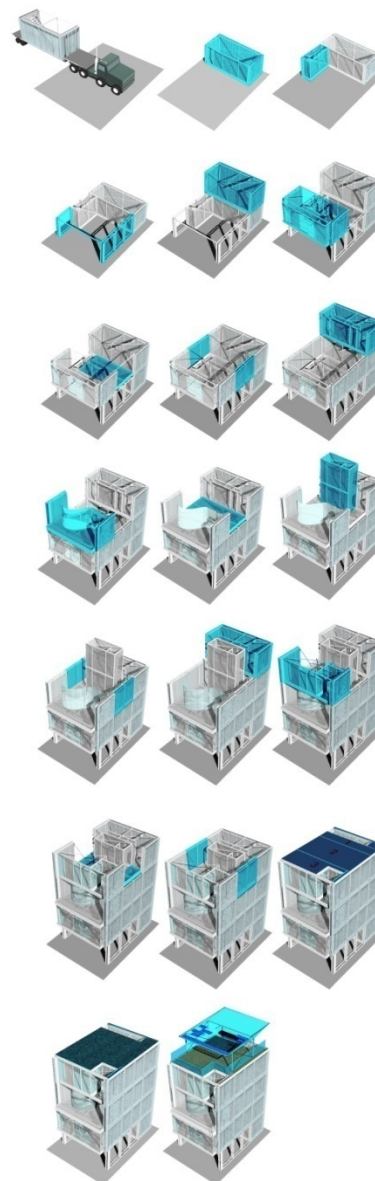


EQUIPMENT



CELLOPHANE HOUSE™(2008)

BEST 4 PLENARY | FORM VS. FUNCTION

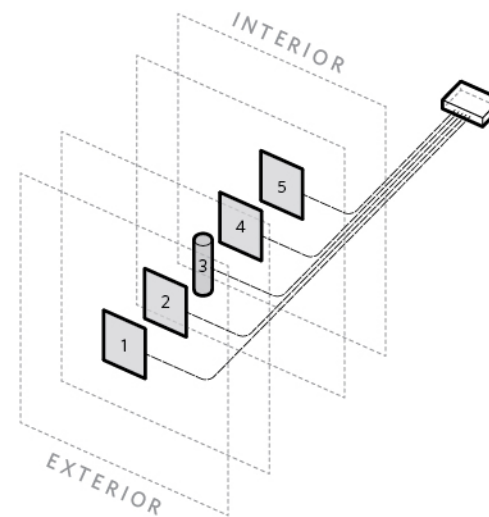
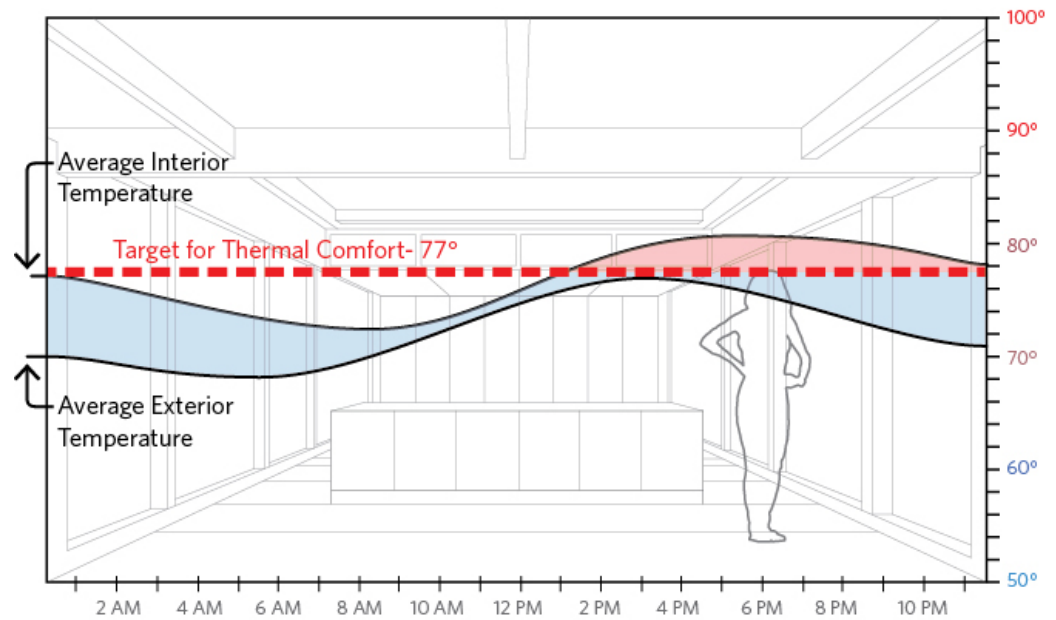




CELLOPHANE HOUSE™(2008)

BEST 4 PLENARY | FORM VS. FUNCTION


















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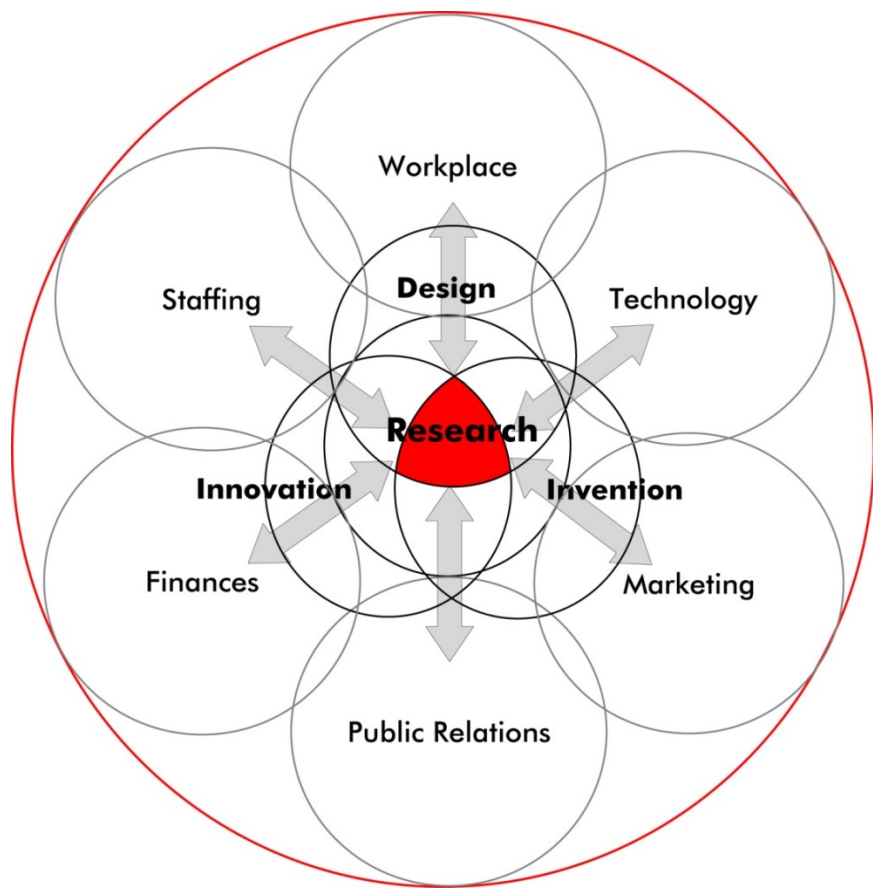
1. THERMOCOUPLE
Measures exterior surface temperatures, reflecting ambient temperatures and heat gain
2. THERMOCOUPLE
Measures rate of thermal transfer from interior to exterior
3. PENDANT SENSOR
Measures the temperature of the air within the cavity
4. THERMOCOUPLE
Monitors the degree to which the cavity space buffers the interior from exterior temperature
5. THERMOCOUPLE
Measures the thermal transfer from the cavity to interior surface

CELLOPHANE HOUSE™(2008)

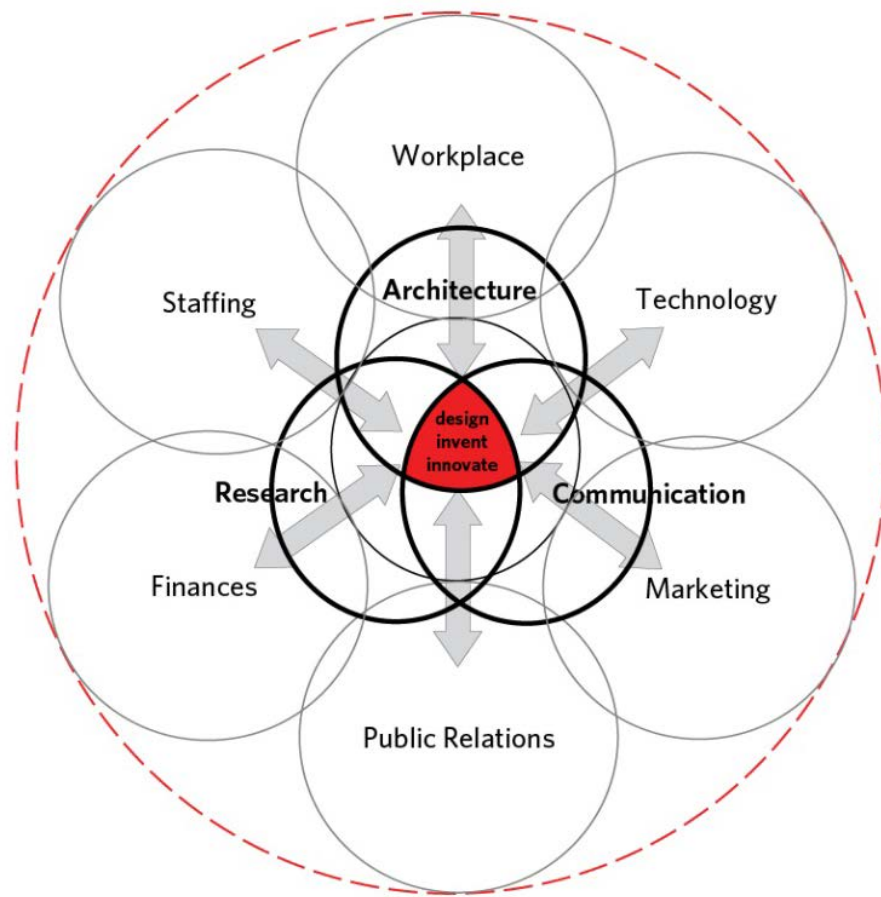
BEST 4 PLENARY | FORM VS. FUNCTION

COMPONENT	FRAME	SKIN	GLAZING	WALL PANELS	BATHROOM PODS	FLOORS	ROOF	STAIRS	FOUNDATION	
MATERIAL	 Bosch Aluminum Framing	 NextGen Smart Wrap™ (PET)	 Schüco Glass	 3-Form Varia (PETG)	 Fiberglass	 Aluminum Grate	 PVC Downspouts	 Acrylic	 Concrete	TOTALS 1,800 sf building 1,547,790 kWh 860 kWh/sf 98.95% 1,531,570 kWh 851 kWh/sf
	 Steel Connectors	 Aluminum Louvers	 Schüco Aluminum Frame			 3-Form Stage (PC)	 Steel Gutters		 Steel Rebar	
	 Steel Bolts						 Danpalon (PC)			
TOTAL EMBODIED ENERGY	955,631 kWh	22,224 kWh	71,423 kWh	22,577 kWh	71,448 kWh	146,008 kWh	8,214 kWh	235,001 kWh	15,264 kWh	TOTALS 1,800 sf building 1,547,790 kWh 860 kWh/sf 98.95% 1,531,570 kWh 851 kWh/sf
PERCENT RECOVERED	99.99%	100%	100%	100%	100%	100%	100%	100%	0%	
EMBODIED ENERGY RECOVERED	954,675 kWh	22,224 kWh	71,423 kWh	22,577 kWh	71,448 kWh	146,008 kWh	8,214 kWh	235,001 kWh	0 kWh	

MATERIAL					
	Bosch Aluminum Framing		NextGen Smart Wrap™ (PET)		Schüco Glass
	Steel Connectors		Aluminum Louvers		Schüco Aluminum Frame
	Steel Bolts				
TOTAL EMBODIED ENERGY	955,631 kWh	22,224 kWh	71,423 kWh	TOTALS 1,800 sf building 1,547,790 kWh 860 kWh/sf	
PERCENT RECOVERED	99.99%	100%	100%	98.95%	
EMBODIED ENERGY RECOVERED	954,675 kWh	22,224 kWh	71,423 kWh	1,531,570 kWh 851 kWh/sf	



2008



2013



About ▾

Support ▾

Download

News

KNOW YOUR IMPACT

Introducing Tally

The first LCA app that lets you calculate the environmental impacts of your building material selections directly in an Autodesk® Revit® model.

[Click to download a free trial](#)

WHOLE BUILDING LCA

Assess the embodied environmental impact of your entire building. Benchmark your impact throughout design.

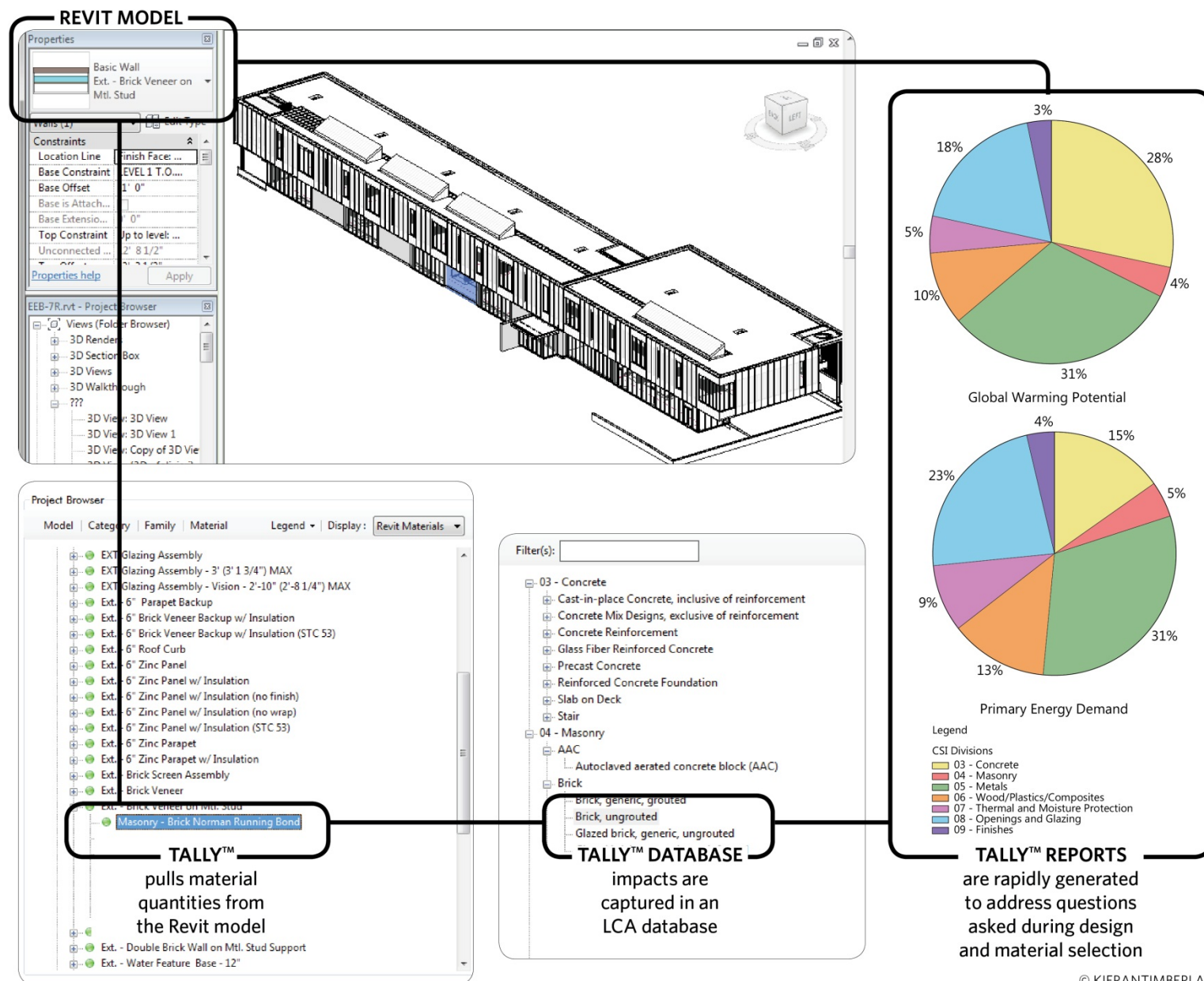
DESIGN OPTION COMPARISON

Compare two or more distinct sets of building components side by side.

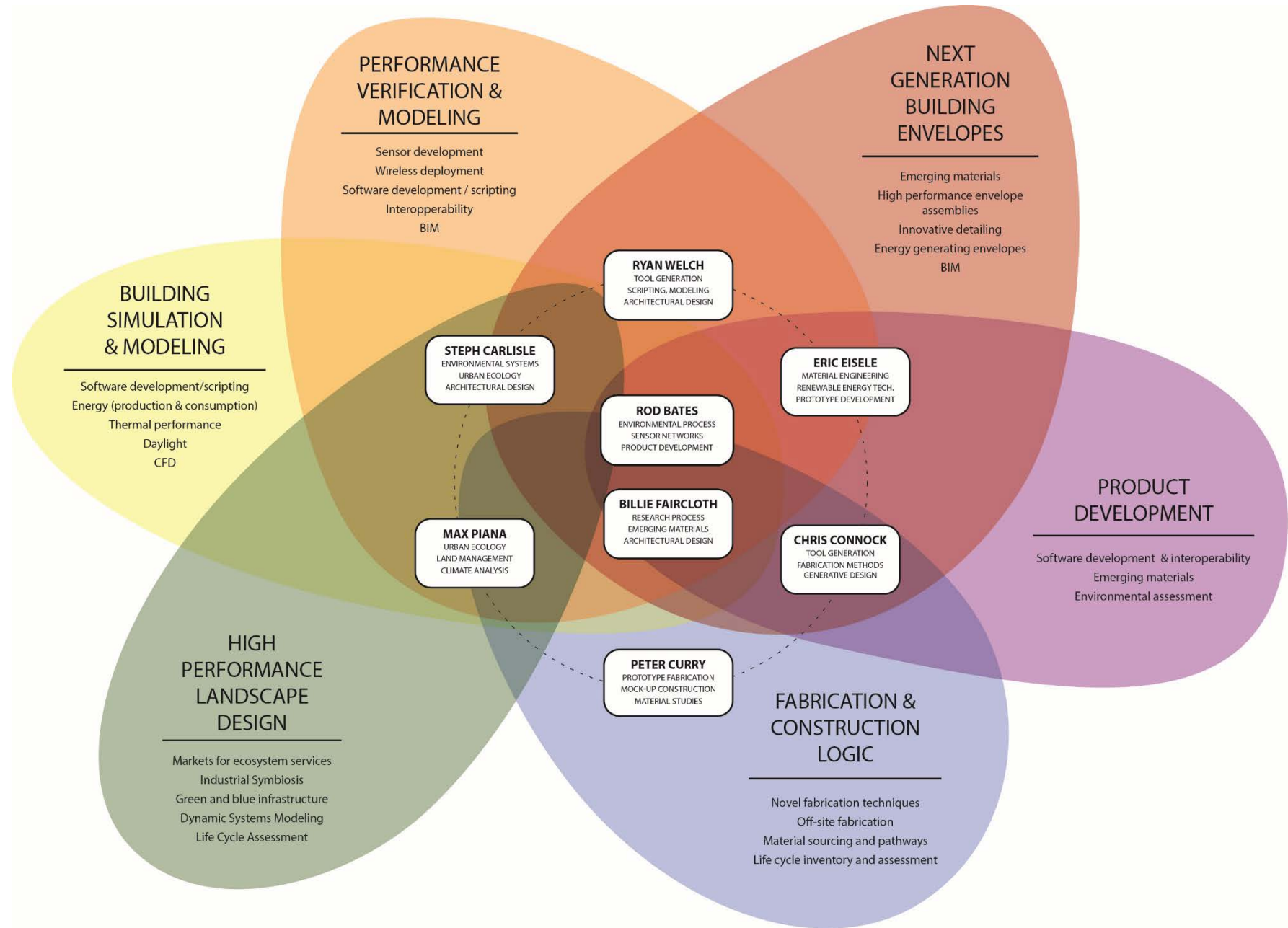
MATERIAL SELECTION

Compare LCA impacts and ingredients of materials and assemblies, including information from manufacturer EPDs.

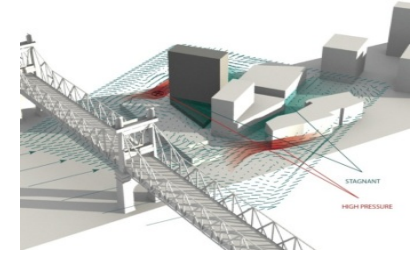
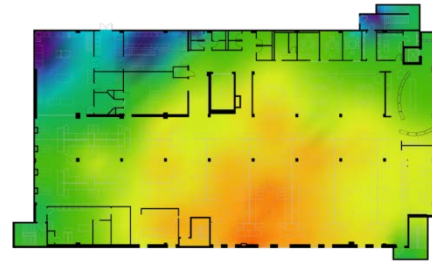
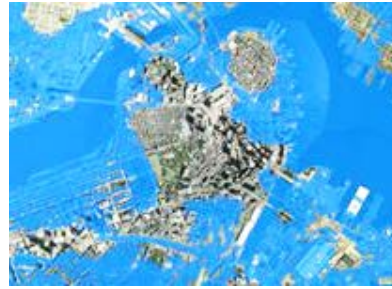
Tally™ pulls material quantities from the Revit model and creates an accurate bill of materials.



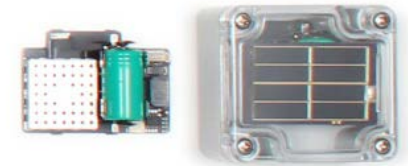
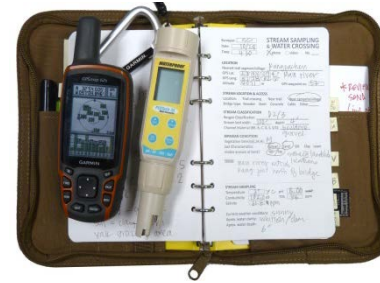
© KIERANTIMBERLAKE



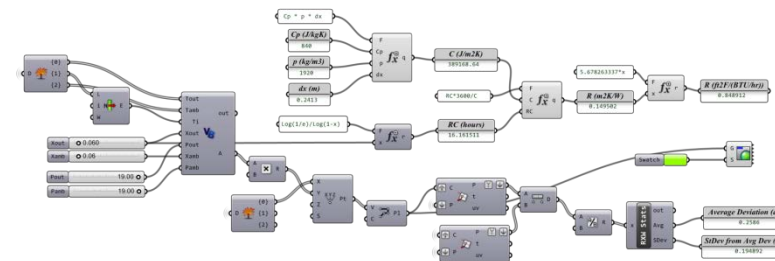
MODELING & SIMULATION



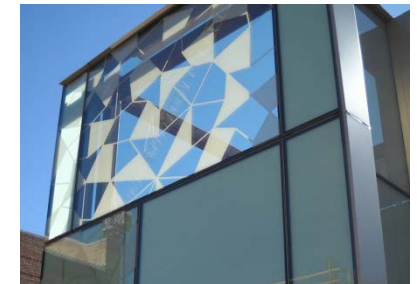
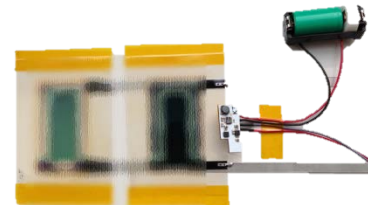
FIELD ASSESSMENT & DATA COLLECTION



TOOL DEVELOPMENT & DATA PROCESSING



PROTOTYPING & MATERIALS RESEARCH





RED REPORT

1. Client Goals
2. Program Analysis
 - Typologies
 - Building occupancy and use
 - Schedule
3. Site
 - Site & campus
 - Regional infrastructure
 - Facilities management
4. Climate
 - Regional climate
 - Micro climate
 - Thermal comfort
5. Landscape and Ecology
 - Geology
 - Stormwater and flooding
 - Vegetation and biodiversity
 - Ecosystem services
6. Local Resources
 - Energy
 - Atmosphere
 - Waste
 - Water
 - Building materials
7. Code/Regulations and Standards
 - Sustainability guidelines
 - Energy policy and incentives

KT	JH/EF		section needs updating
----	-------	--	------------------------------

06 PERFORMANCE & RESOURCES

Section Summary

Energy

KT/BH	RB	2	revision needed
KT	EF	2	ready for review
KT/BH	EF	2	ready for review
KT/BH	EF	2	ready for review
BH	MK	1	ready for review
BH	MK	1	ready for review
KT/BH	EF	3	ready for review

6.1 What is Brown's local source of energy (natural gas, coal, etc.)? What is the availability of power, gas, or thermal networks? What is the carbon factor of the grid?

6.2 What is the local utility provider for power and gas? How are the rates structured? Are there provisions for energy buyback?

6.3 How can sustainable systems or strategies be considered in relation to the other existing and planned buildings on the engineering campus? Are there any opportunities for shared energy infrastructure or load sharing with adjacent buildings/facilities?

6.4 What is the potential for on-site renewable energy generation (PV, wind, etc.)?

6.5 What is the anticipated baseline energy consumption for the building based on comparable buildings in this region?

6.6 Are there emerging technologies or systems relevant to managing the heavy energy use of laboratory buildings?

6.7 How might alternate energy reporting formats be applicable to the project?

Water

KT	JH	2	ready for review
----	----	---	---------------------

6.8 What is Brown's water source and treatment infrastructure? What are associated costs?

Atmosphere

KT	EF	3	ready for review
----	----	---	---------------------

6.90 What are the airborne pollutants present on site? Do any onsite pollutants preclude particular façade materials?

Waste

KT	MD/EK	2	started
KT	EF	1	ready for review

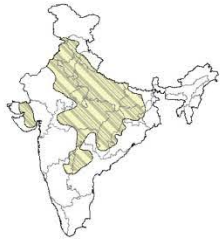
6.10 What is the solid waste management infrastructure on site?

6.11 How do we dispose of hazardous laboratory waste?

CLIMATE

COMPOSITE ZONE

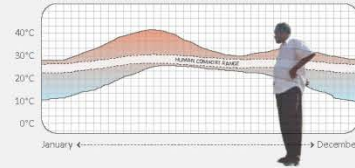
CURRENT CONDITIONS



SEASON	TEMP. (HIGH)	TEMP. (LOW)	RELATIVE HUMIDITY	AVG RAINFALL
Hot & Dry	43°C	28°C	20-25%	35mm
Hot & Humid	34°C	21°C	55-95%	900mm
Cool & Dry	25°C	5°C	20-25%	50mm

COMFORT

DRY BULB TEMPERATURE : COMPOSITE CLIMATE



GOAL

MAINTAIN A YEAR ROUND INTERIOR TEMPERATURE RANGE OF 21°C TO 29°C

RESOURCE CONSERVATION

WATER

CURRENT CONDITIONS

WATER ACCESS PER PERSON (%)

MUNICIPAL WATER AVAILABILITY (hours/day)

Amritsar

75.7%

11 hrs

Indore

77.3%

.75 hrs

Rajkot

91.5%

5 hrs

Nagpur

98.1%

.3 hrs

GOAL

COLLECT AND RECYCLE WATER, INCREASE WATER AVAILABILITY TO 24 HOURS

ENERGY

ENERGY DEMAND

CONSUMPTION (kwh/day)

Plug Loads:

6.6 kwh/day

Lighting Loads:

3.7 kwh/day

Mechanical Equipment:

16 kwh/day

Hot Water Heating:

9 kwh/day

BASELINE TOTAL:

35.3 kwh/day

17.3 kwh/day

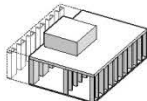
REDUCE HOUSE ENERGY CONSUMPTION BY 50%

COST

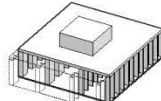
32m²



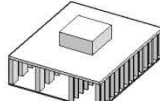
60m²



82m²



98m²



PROVIDE AFFORDABLE HOUSING EXPANSION AT 9,677 Rs/m² (\$20/ft²)

COST : 225,000 Rs.
(\$5,000)

COST : 450,000 Rs.
(\$10,000)

COST : 675,000 Rs.
(\$15,000)

COST : 900,000 Rs.
(\$20,000)

LOGISTICS

MATERIAL

AVG TIME FOR HOUSE COMPLETION

CURRENT CONDITIONS

BRICK CONSTRUCTION

2 YEARS



GOAL

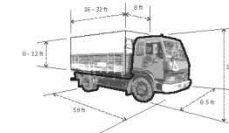
PRECAST COMPONENTS

2 MONTHS



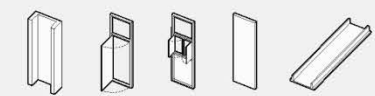
REDUCE ON-SITE CONSTRUCTION TIME BY 90%

MANUFACTURING



TRANSPORT TO SITE

MODULAR COMPONENTS



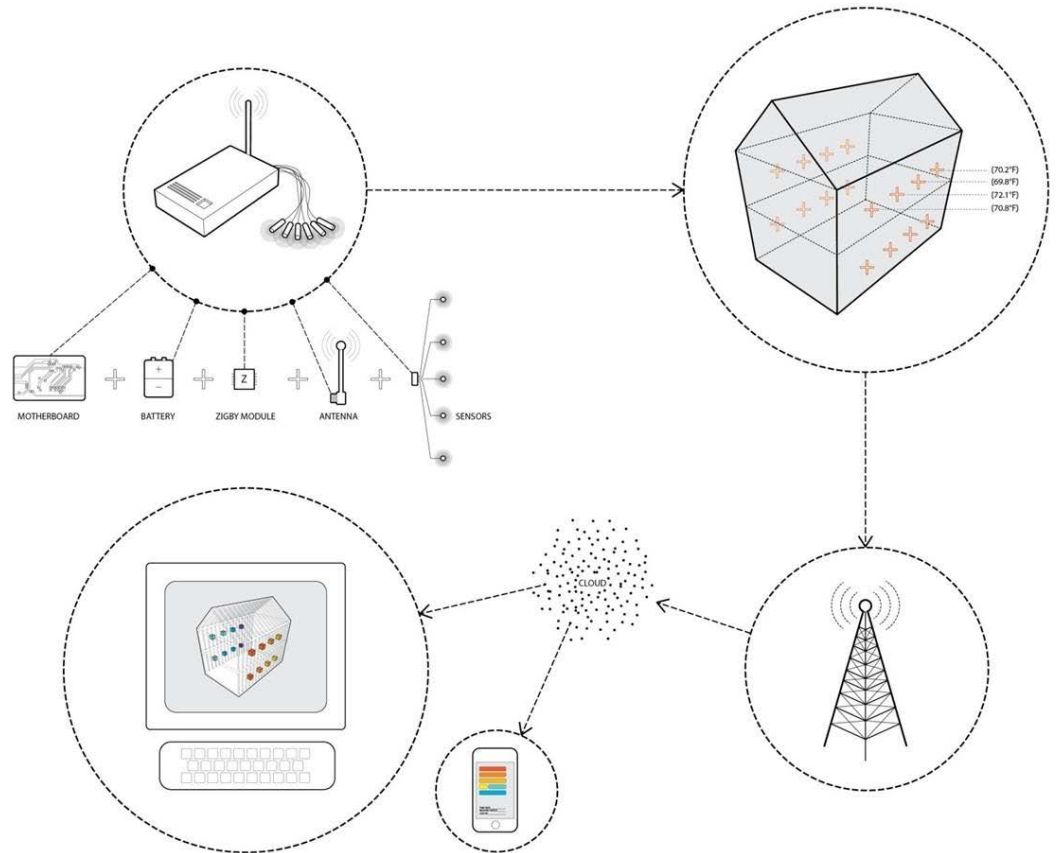
DIMENSIONED FOR TRANSPORT AND LIFTED BY HAND

*Sources: "2007 Benchmarking and Data Book of Water Utilities in India"
"2005 National Building Code - India"

AFFORDABLE, SOLID, QUICK-TO-BUILD, SUSTAINABLE HOUSING SOLUTION FOR INDIA'S COMPOSITE CLIMATE ZONE







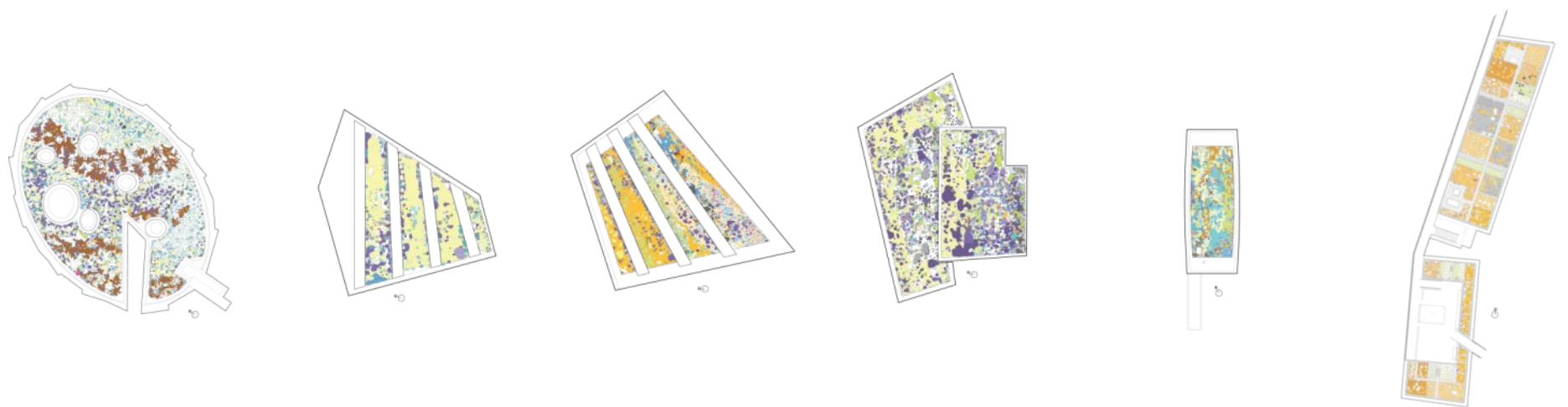
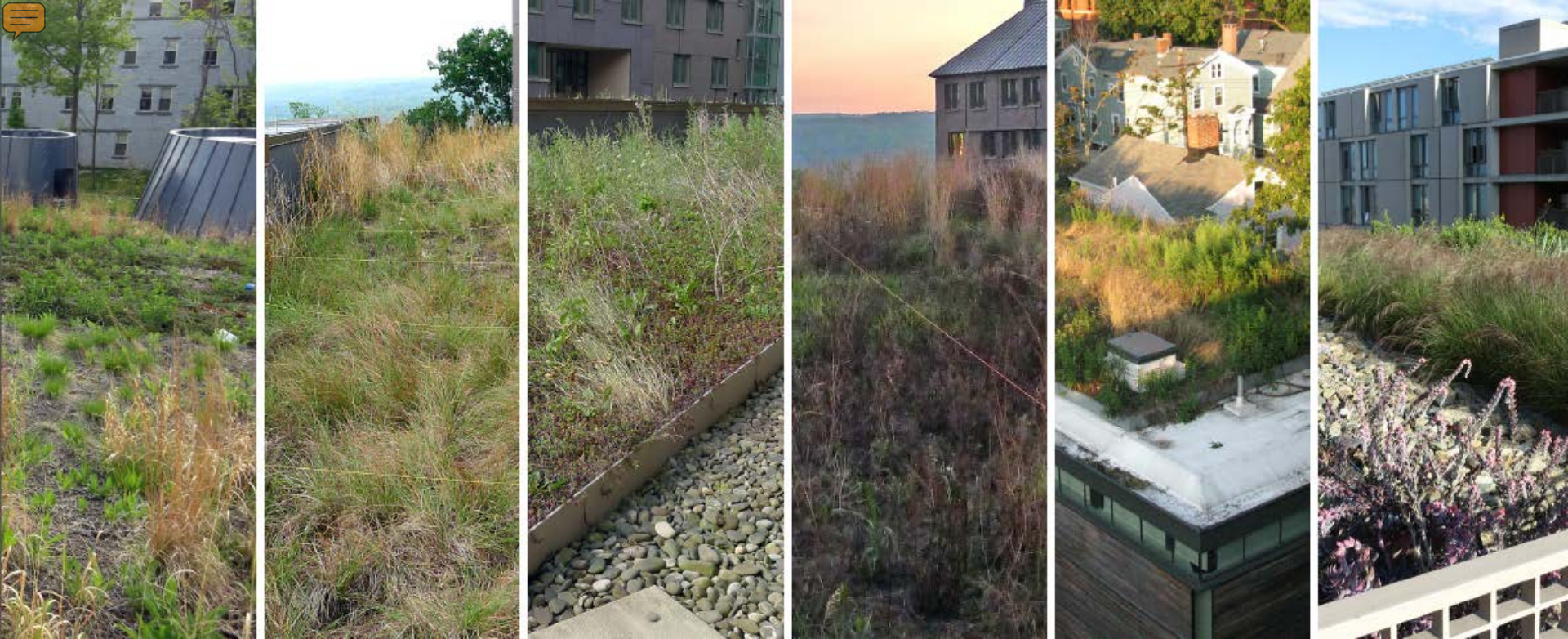




WIRELESS SENSOR NETWORKS

BEST 4 PLENARY | FORM VS. FUNCTION

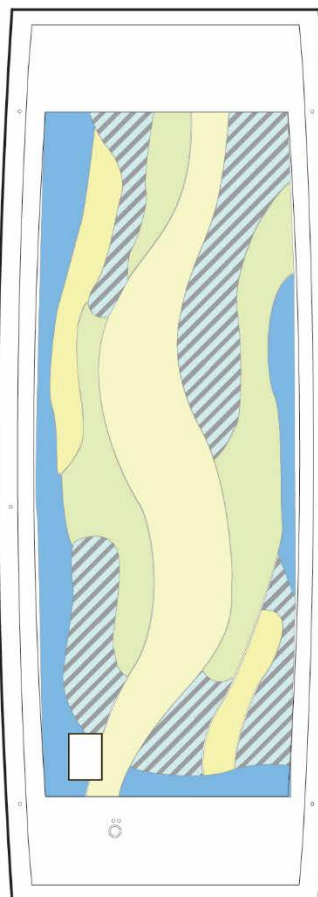
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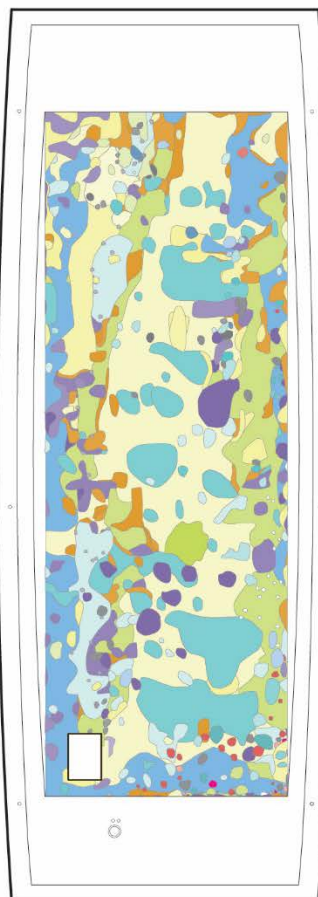
GREEN ROOF VEGETATION STUDY

BEST 4 PLENARY | FORM VS. FUNCTION

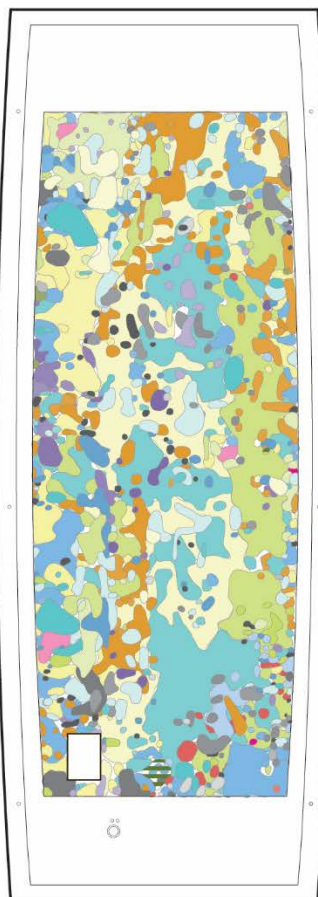
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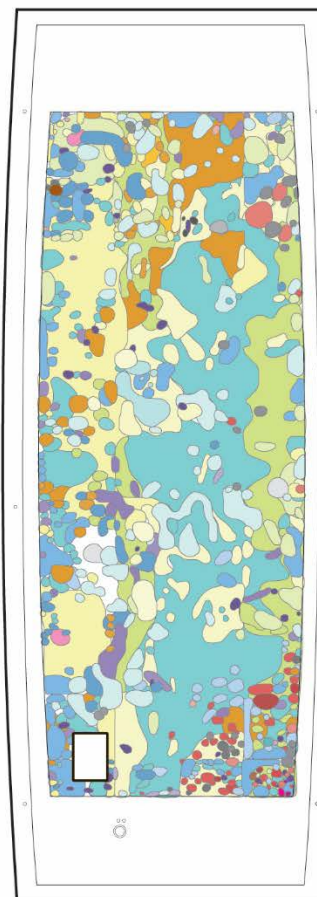
2006
11 SPECIES
100% PLANTED



2011
44 SPECIES
52% PLANTED
48% RUDERAL



2012
54 SPECIES
56% PLANTED
44% RUDERAL



2013
48 SPECIES
60% PLANTED
40% RUDERAL

FORBS (ASTERACEAE)

Ageratina altissima	Snakeroot
Ambrosia artemisiifolia	Ragweed
Arctium minus	Burdock
Artemisia vulgaris	Mugwort
Aster cordifolius	Blue Wood Aster
Aster novae-angliae	New England Aster
Aster pilosus	Skinny Aster
Corylus canadensis	Horseweed
Erigeron annuus	Daisy Fleabane
Lactuca serriola	Prickly Lettuce
Leontodon autumnalis	Fall Dandelion
Liatris aspera	Rough Blazing Star
Liatris squarrosa	Scaly Blazing Star
Solidago canadensis	Flat Leaf Goldenrod
Solidago sempervirens	Seaside Goldenrod
Taraxacum	Dandelion

FORBS (FABACEAE)

Medicago officinalis	Sweet clover
Trifolium spp.	Pea (trifol)
Trifolium arvense	Rabbit's foot
Trifolium pratense	Red Clover
Vicia cracca	Bird vetch

FORBS (ASSORTED)

Acalypha rhomboidea	Rhombic Copperleaf
Asclepias syriaca	Common Milkweed
Asclepias tuberosa	Butterfly Milkweed
Chamaecyparis maculata	Spotted Sandmat
Chenopodium album	Lambquarters
Euphorbia	Euphorbia (Spurge)
Lipidium	Lipidium
Lyrthrum salicaria	Purple Loosestrife
Oenothera biennis	Primrose
Oxalis stricta	Woodsorrel
Plantago major	Plantain
Rumex obtusifolius	Broadleaf Dock
Silene latifolia	White Camellion
Thlaspi arvense	Field Penny Cress
Verbascum thapsus	Common Mullein

GRASSES

Andropogon gerardii	Big Bluestem
Bouteloua curtipendula	Sideoats Grama
Cyperus esculentus	Nutbidge
Digitaria	Craggrass
Festuca spp.	Festuca
Panicum Virgatum	Switchgrass, Panic Grass
Phleum pratense	Timothy
Schizachyrium scoparium	Little Bluestem
Setaria faberii	Foxtail Grass
Sporobolus heterolepis	Prairie Dropseed

TREES

Acer saccharum	Sugar Maple
Amelanchier spp.	Service Berry
Juniperus virginiana	Eastern Red Cedar
Pinus strobus	White Pine
Quercus alba	White Oak
Rhus typhina	Staghorn Sumac
Ulmus americana	American Elm

SUCCULENTS

Phemeranthus calycinu	Flowering Portulaca
Sedum hispanicum	Blue Carpet Sedum

VINES

Celastrus orbiculatus	Oriental Bittersweet
Rosa multiflora	Multiflora Rose
Hedera spp.	Hedera

MOSS

Bryophytes	Mosses, Liverworts
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Values

INFLUENCE the industry to design, implement, and operate integrated energy-efficient renovations.

REPEATABLE DEMONSTRATION incorporating replicable energy-efficient technology, processes, and procedures that are affordable, workable and efficient.

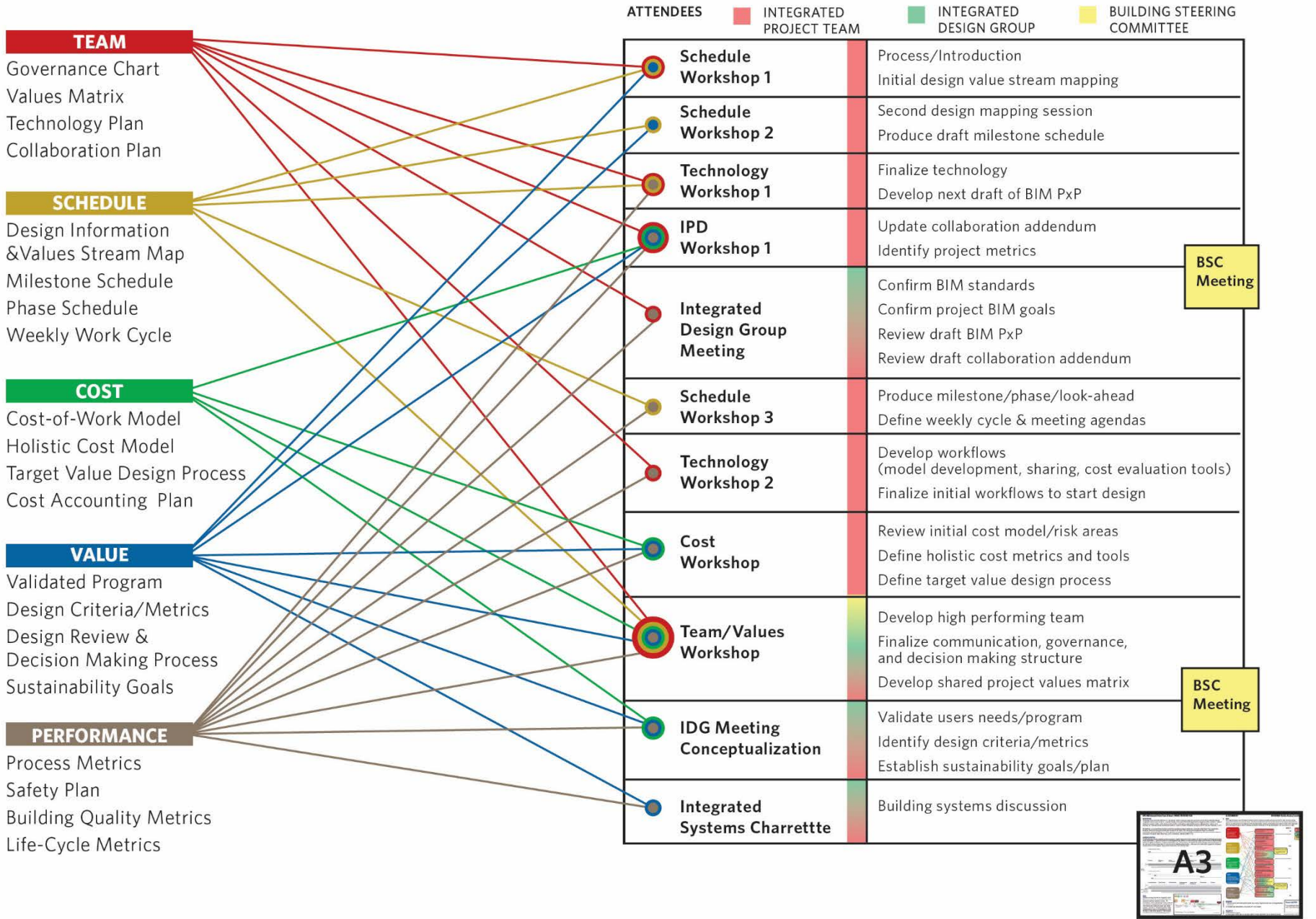
LEARNING about the efficacy, affordability, repeatability and constructability of efficient and effective energy retrofits.

COLLABORATIVE ENVIRONMENTS to provide a nexus for regional demonstration, learning, and influence.

SYSTEMS INTEGRATION for efficient and effective energy retrofits through synergistic integration of dependable components and subsystems.

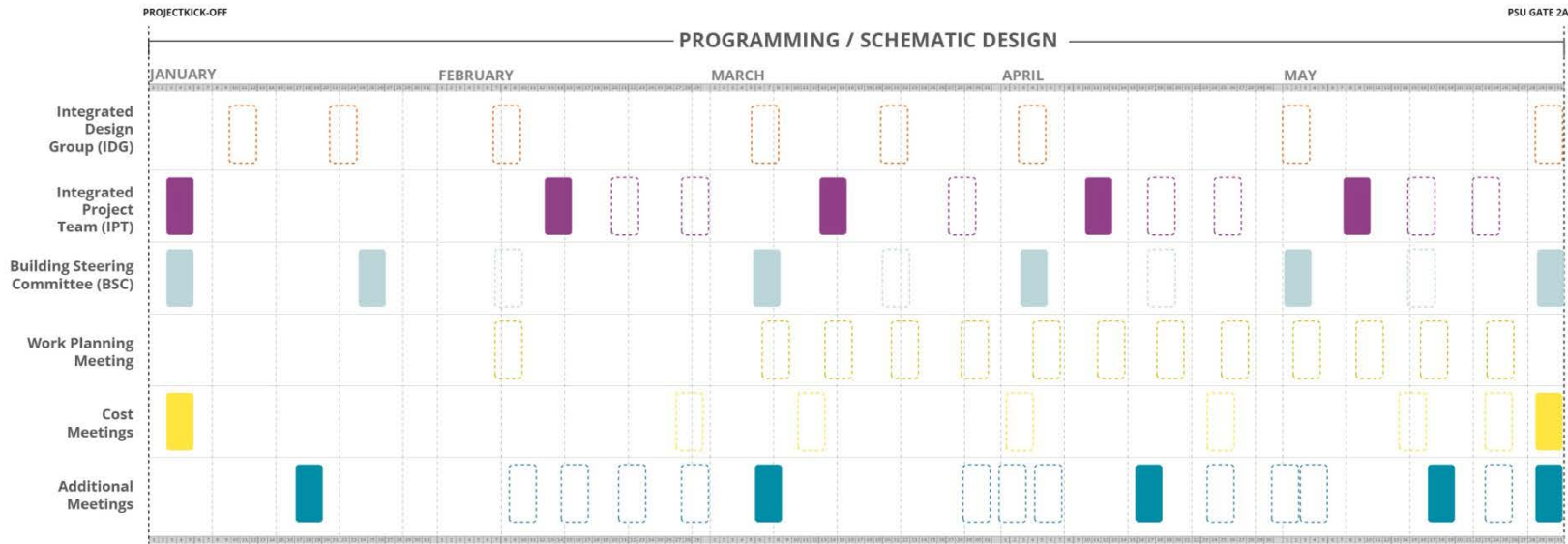
COST CERTAINTY to use available funds to maximize scope and minimize long-term facility costs with constant consideration of premium and affordability.

TIME RELIABILITY make decisions at the most responsible moment and create a safe and quality work environment.

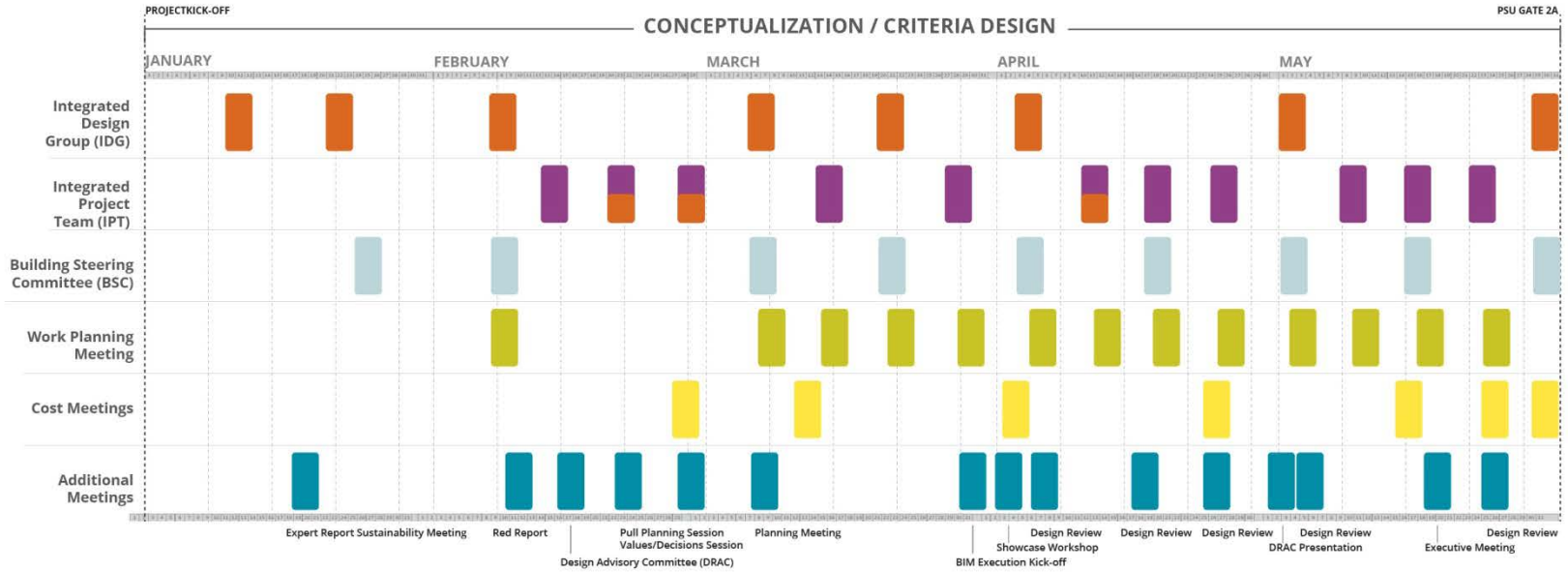




TRADITIONAL PROCESS



INTEGRATED PROCESS

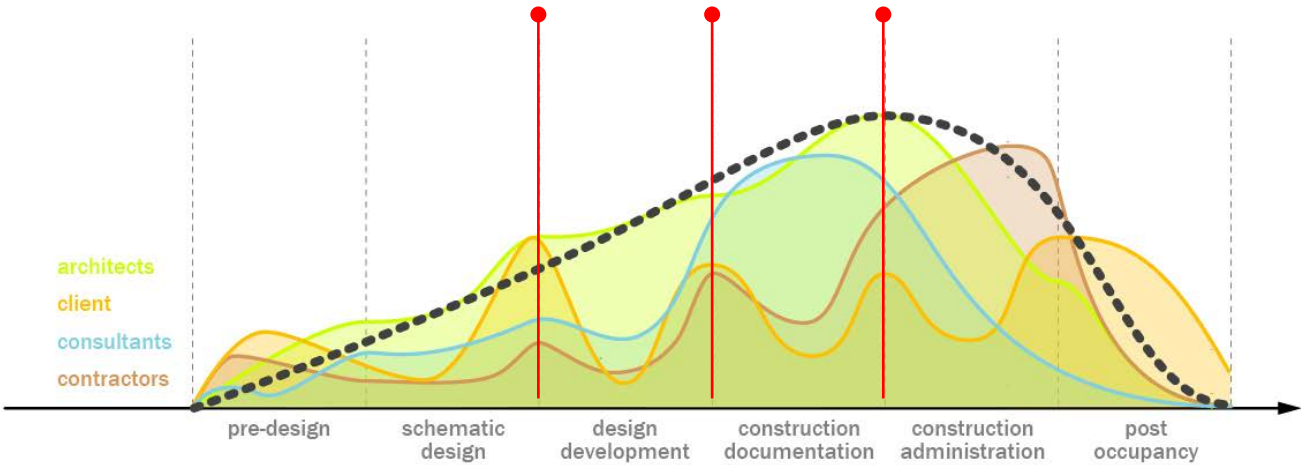


INTEGRATED PROJECT SCHEDULE



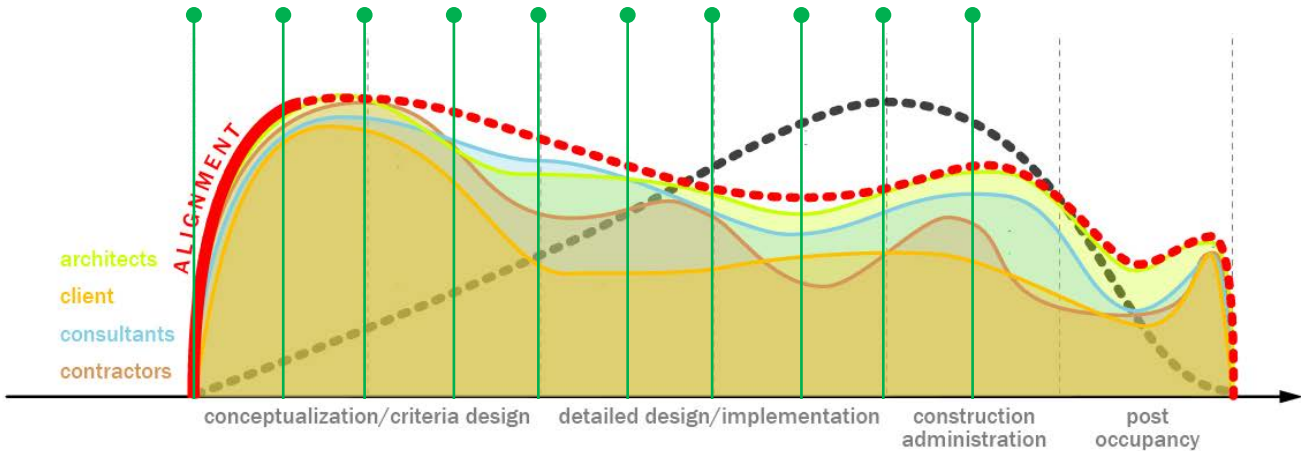
TRADITIONAL WORK PLAN

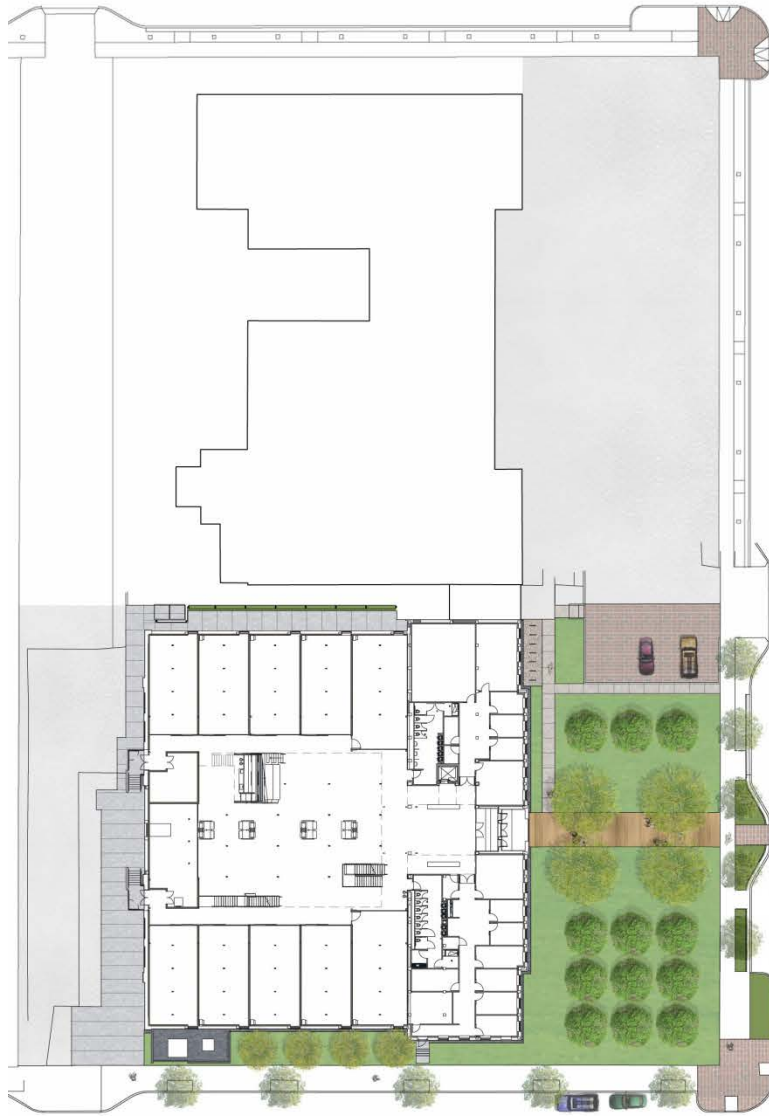
Cost estimating at end of phase results in value engineering and redesign effort



INTEGRATED WORK PLAN

Cost modeling to inform design results in target value design

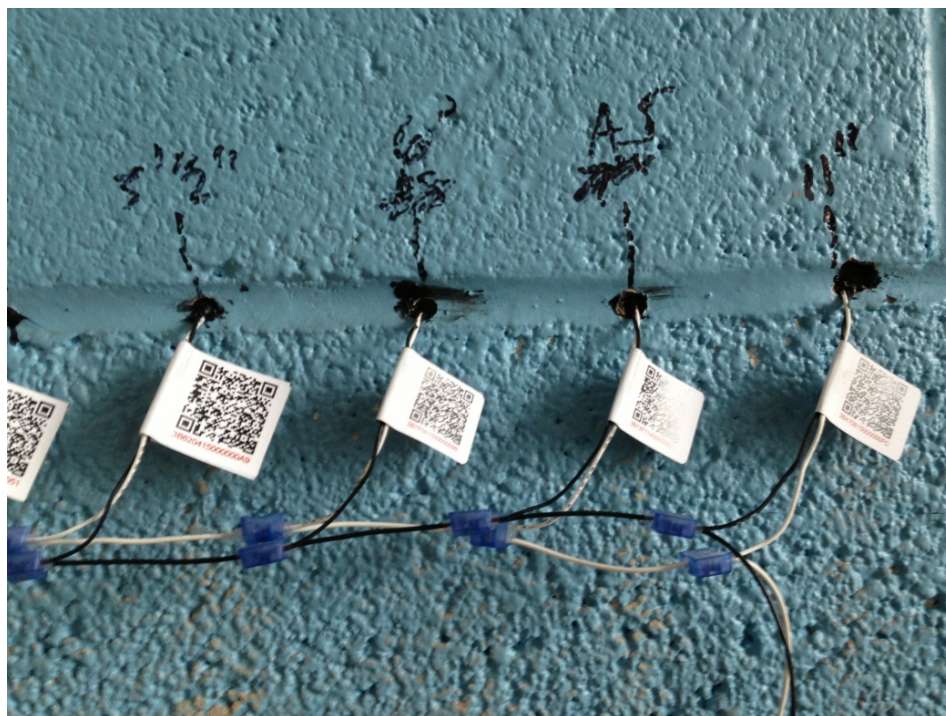
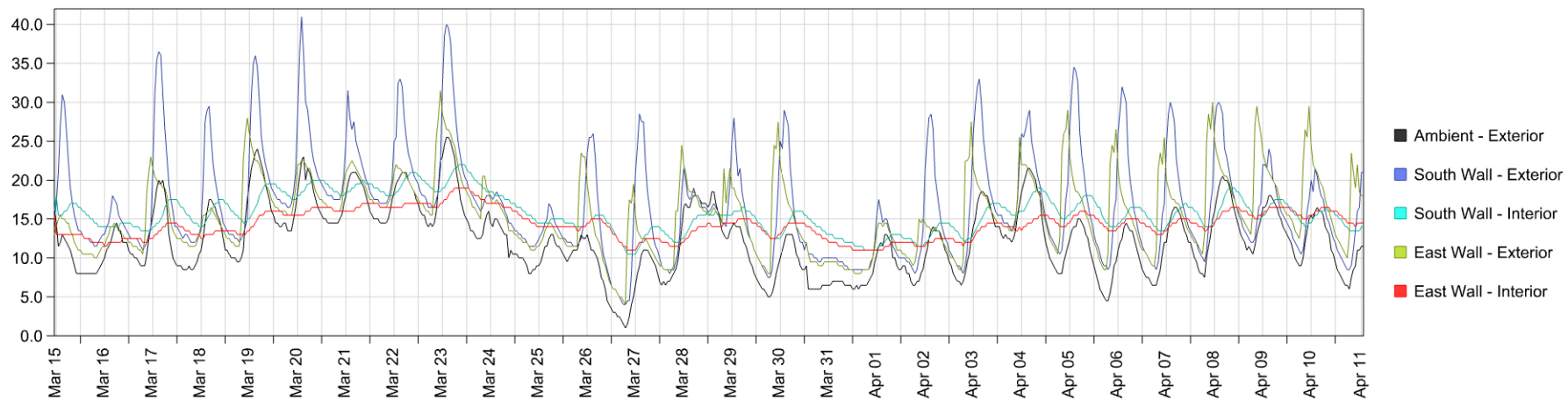




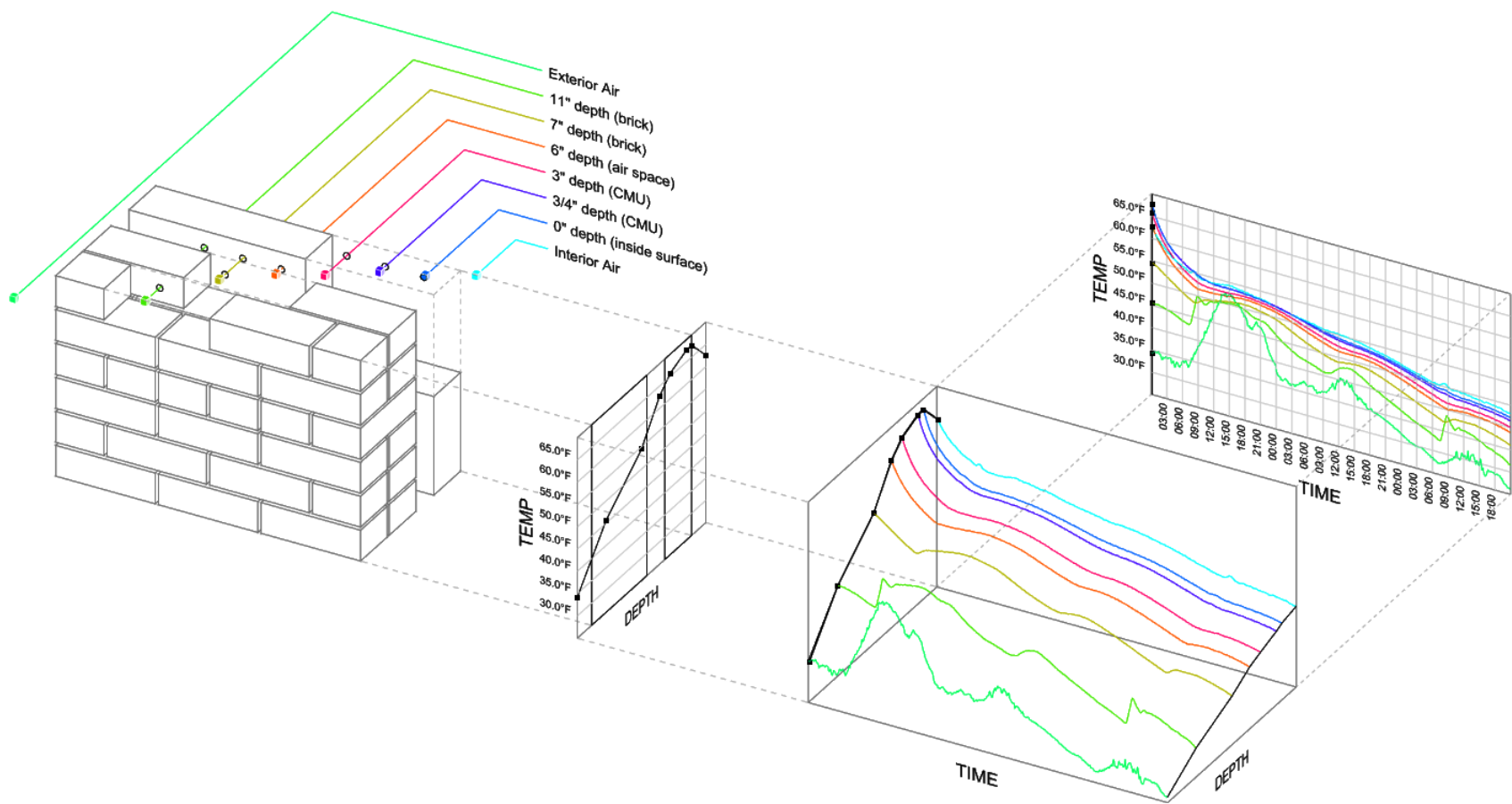
BUILDING 661

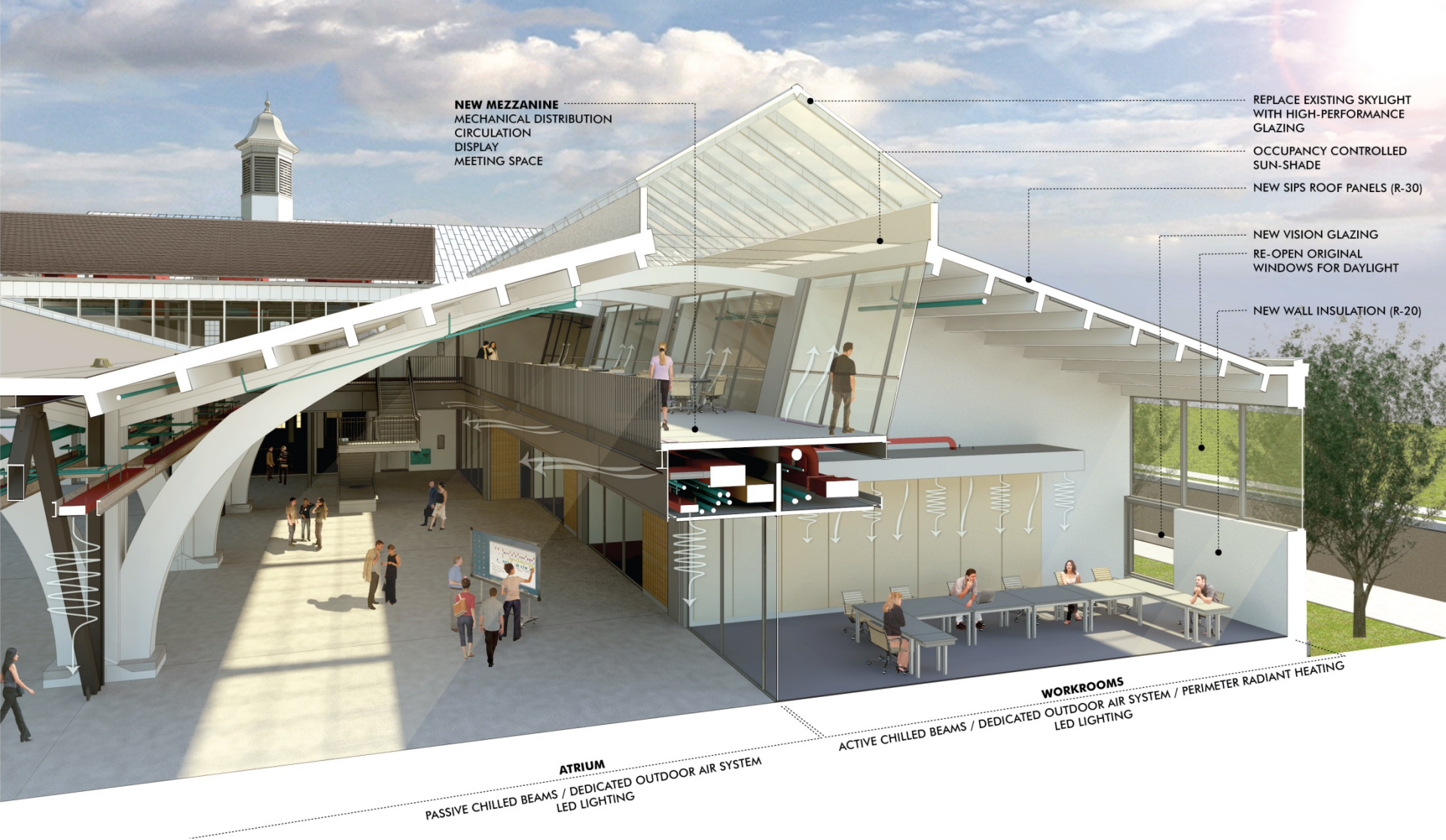


BUILDING 7R



DATA COLLECTION





NEW MEZZANINE
MECHANICAL DISTRIBUTION
CIRCULATION
DISPLAY
MEETING SPACE

REPLACE EXISTING SKYLIGHT
WITH HIGH-PERFORMANCE
GLAZING

OCCUPANCY CONTROLLED
SUN-SHADE

NEW SIPS ROOF PANELS (R-30)

NEW VISION GLAZING

RE-OPEN ORIGINAL
WINDOWS FOR DAYLIGHT

NEW WALL INSULATION (R-20)

ATRIUM

PASSIVE CHILLED BEAMS / DEDICATED OUTDOOR AIR SYSTEM
LED LIGHTING

WORKROOMS

ACTIVE CHILLED BEAMS / DEDICATED OUTDOOR AIR SYSTEM / PERIMETER RADIANT HEATING
LED LIGHTING



Baseline	71 kBtu/sf-yr
Energy Reduction	52.5% (+75% than target)
EUI	34 kBtu/sf-yr
E Cost Reduction	37.5% (+25% than target)
LEED EAc1	15 out of 19 points
Energy Star Rating	94-97



BUILDING 661 INTERIOR

BEST 4 PLENARY | FORM VS. FUNCTION

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BUILDING 661 INTERIOR

BEST 4 PLENARY | FORM VS. FUNCTION

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BUILDING 661 INTERIOR

BEST 4 PLENARY | FORM VS. FUNCTION

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BUILDING 7R NEW CLASSROOM BUILDING

BEST 4 PLENARY | FORM VS. FUNCTION

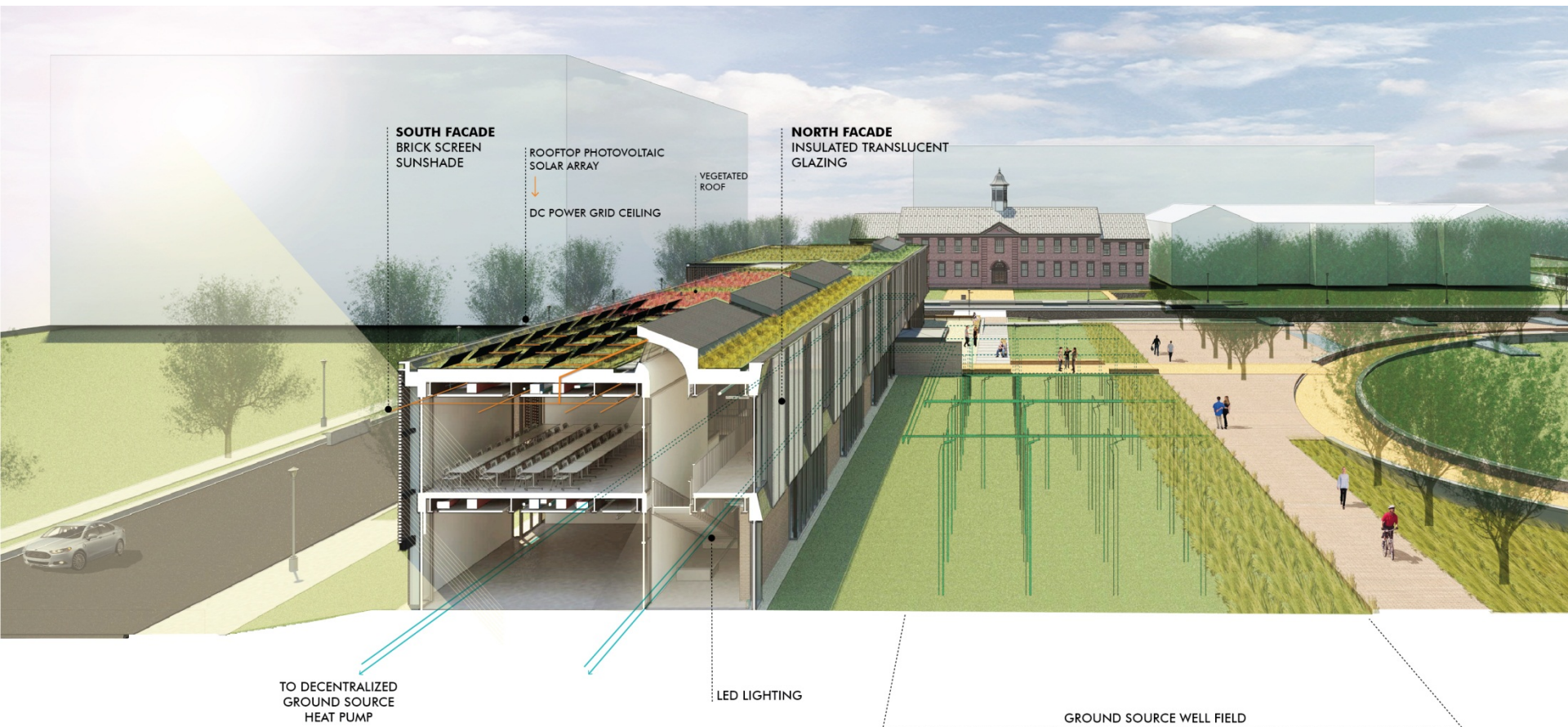
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BUILDING 7R SOUTH FACADE

BEST 4 PLENARY | FORM VS. FUNCTION

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Baseline	53 kBtu/sf-yr
Energy Reduction	36.2% (+20% than target)
EUI	34 kBtu/sf-yr
E Cost Reduction	39.3% (+31% than target)
LEED EAc1	14 out of 19 points

BUILDING 7R INTEGRATED SYSTEMS

BEST 4 PLENARY | FORM VS. FUNCTION

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RAINSCREEN DESIGN (REDUCED R-VALUE)

R- Value		North (Level 1)	North (Level 2)	West (Level 1)	West (Level 2)	South	East	Building Total	Systems
Total Façade		3,550	5,550	850	850	9,100	1,700	21,600	
Opaque Wall	20	1,825 51%	1,790 32%	510 60%	275 32%	6,605 73%	1,085 64%	12,090 56%	12,090 Solid wall
Clear Glazing	4	1,725 49%	1,035 19%	340 40%	160 19%	2,495 27%	615 36%	6,370 29%	9,510 Curtainwall / Storefront
Translucent Insulated Glazing	8.5		2,725 49%		415 49%			3,140 15%	
Average R-Value		12.2	11.4	13.6	11.4	15.6	14.2	13.6	

BUILDING 7R FACADE STUDIES

BEST 4 PLENARY | FORM VS. FUNCTION

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TWIN WALL ACRYLIC PANEL



INSULATED TRANSLUCENT PANEL





BUILDING 7R NORTH FACADE

BEST 4 PLENARY | FORM VS. FUNCTION

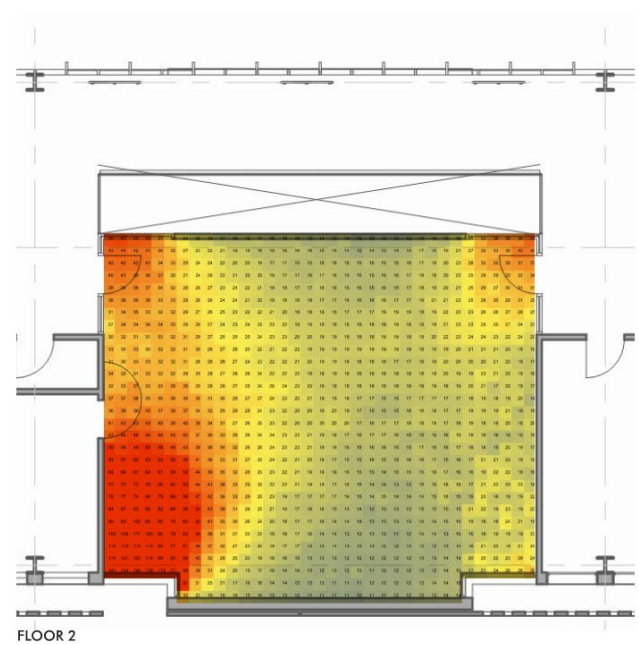
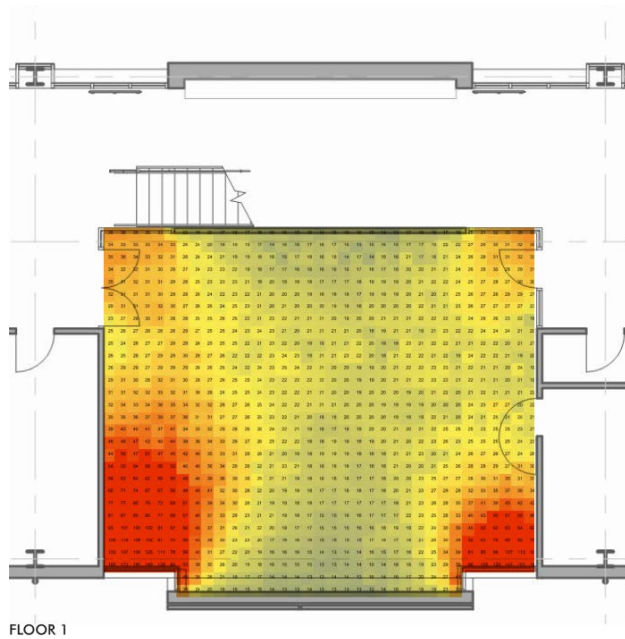
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BUILDING 7R SOUTH FACADE

BEST 4 PLENARY | FORM VS. FUNCTION

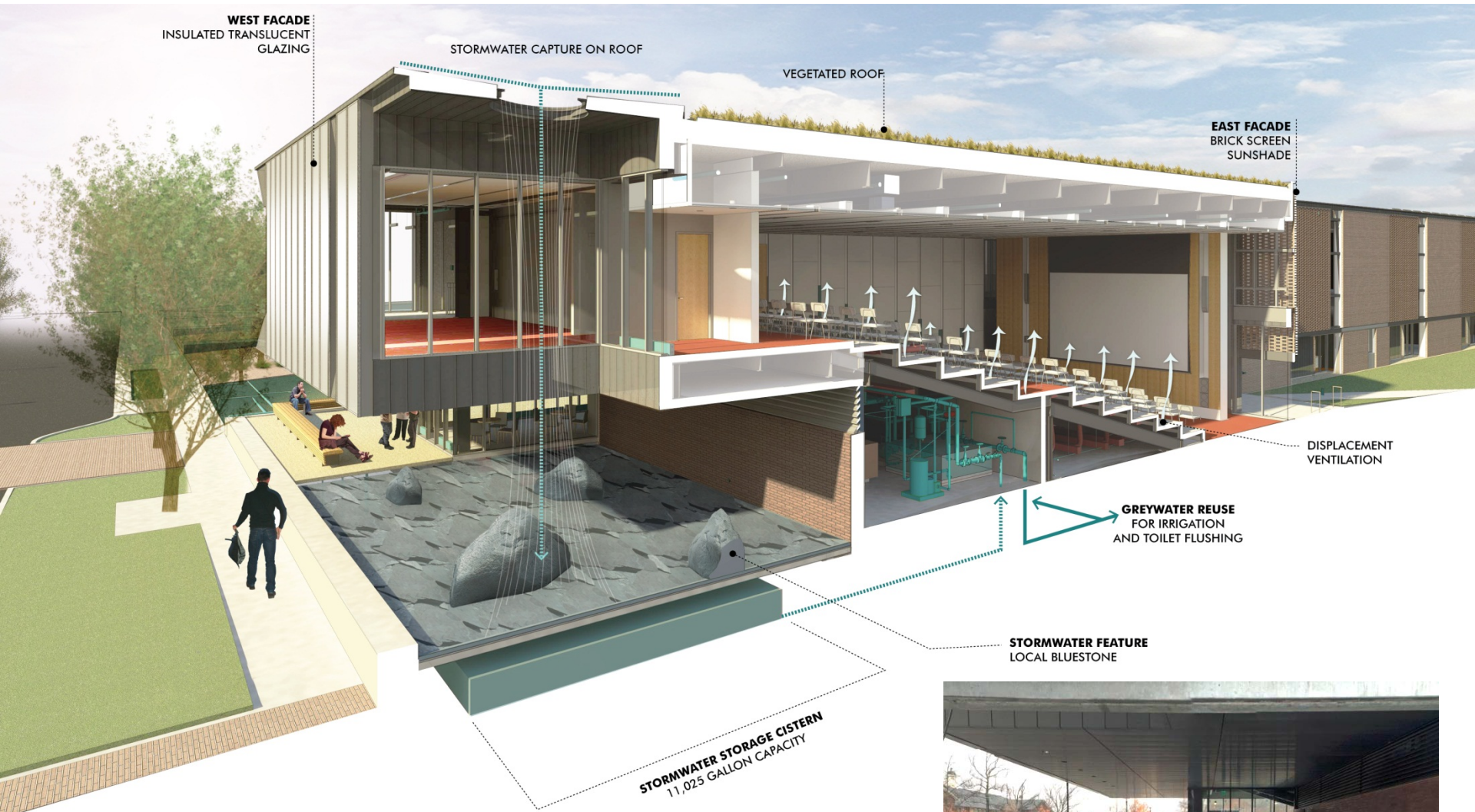
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BUILDING 7R CLASSROOM DAY LIGHTING ANALYSIS

BEST 4 PLENARY | FORM VS. FUNCTION

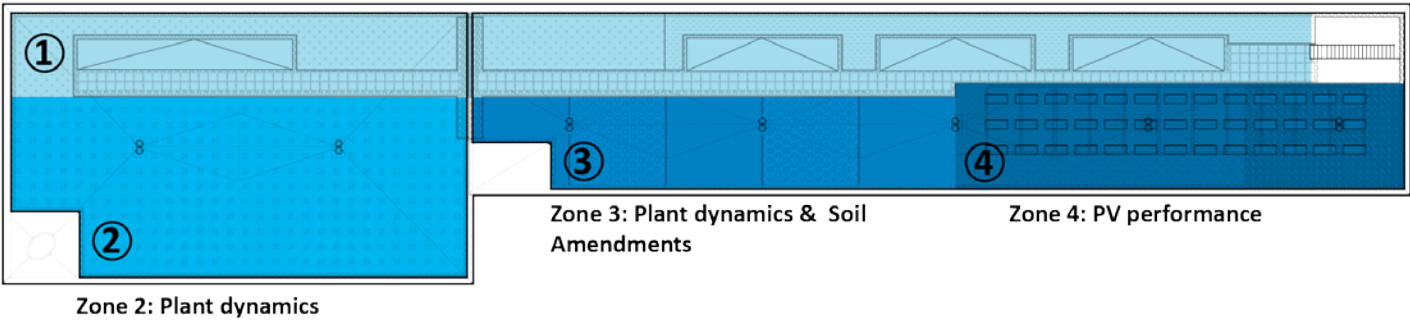
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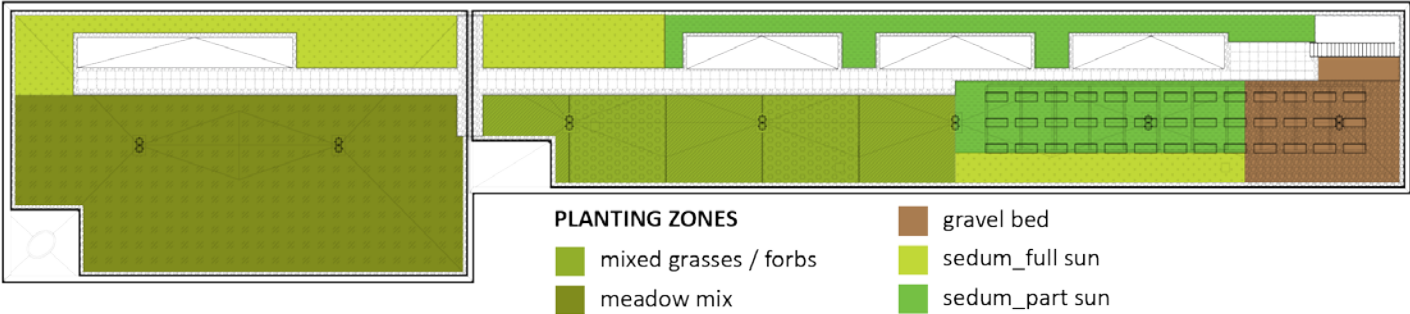
BUILDING 7R MECHANICAL SYSTEMS DETAIL



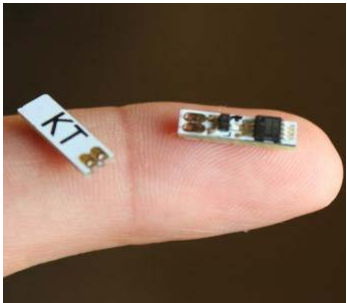
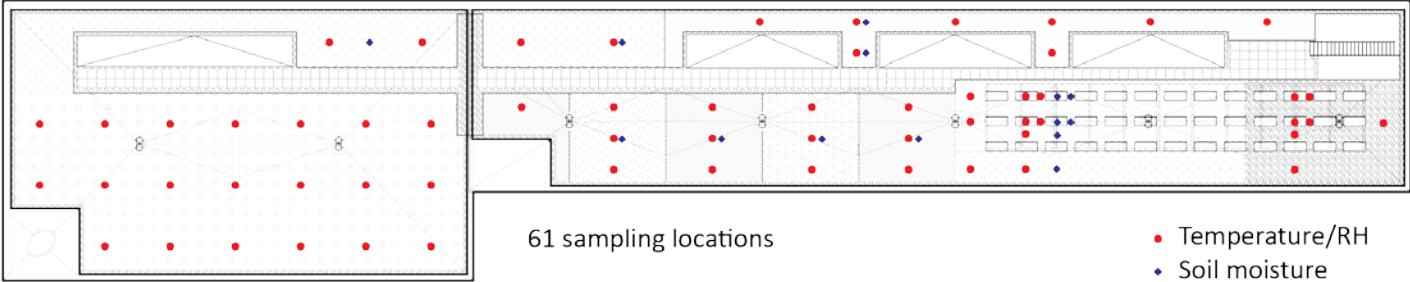
EXPERIMENTAL ZONES



PLANTING PLAN



SENSOR DEPLOYMENT PLAN





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