

Good design
makes a difference™



Conceptual Energy Design Operations

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- College of Architecture, University of Nebraska-Lincoln

Conceptual Energy Design Operations

- Utilize energy modeling tools in practice
- Understand abilities and limitations
- Increase use, adoption and intelligence
- Formal design massing for virtual design

- *Putting metrics on building energy performance is a required step to make any progress on low-energy use and/or “green” buildings.*
 - Building Science Digest

Why do we do Energy Simulations?

- Measure building performance
- Examples
 - LEED ASHRAE 90.1 compliance
 - California Title 24
 - Building America Benchmark
 - HERS index and Energy Star
- 2008 Drury et. al, Studied 20 major programs
 - Ambiguous language and no commonality
 - Different resolutions
 - Recommend a suite of tools
 - Trust
- Energy Modeling is aimed at experts

Metrics for Measurement

- Energy Usage Intensity
 - 2030 challenge
 - EPA Energy Star
 - Commercial Building Energy Consumption Survey (CBECS)

Flaws

- Many any times, the model does not—or cannot--capture the complexities and realities of the actual building.
- Effect of the occupant of a building can be tremendous Building Science Digest 152 **Building Energy Performance Metrics** 2010-05 by
- Not everyone is an expert

Precedent

- Low-Energy Architecture

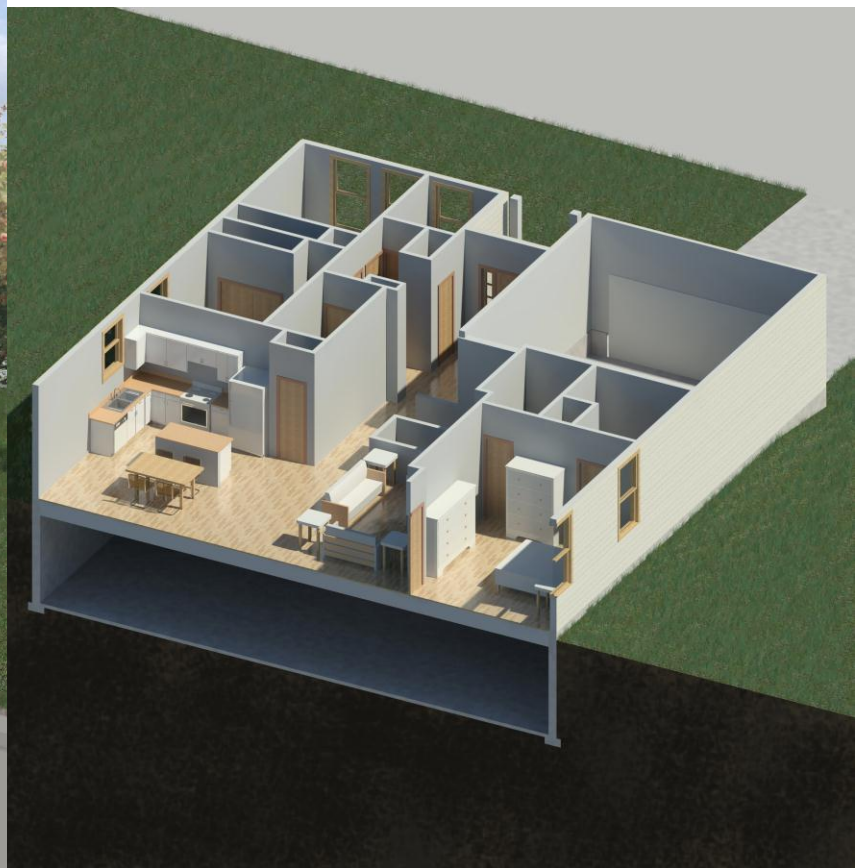






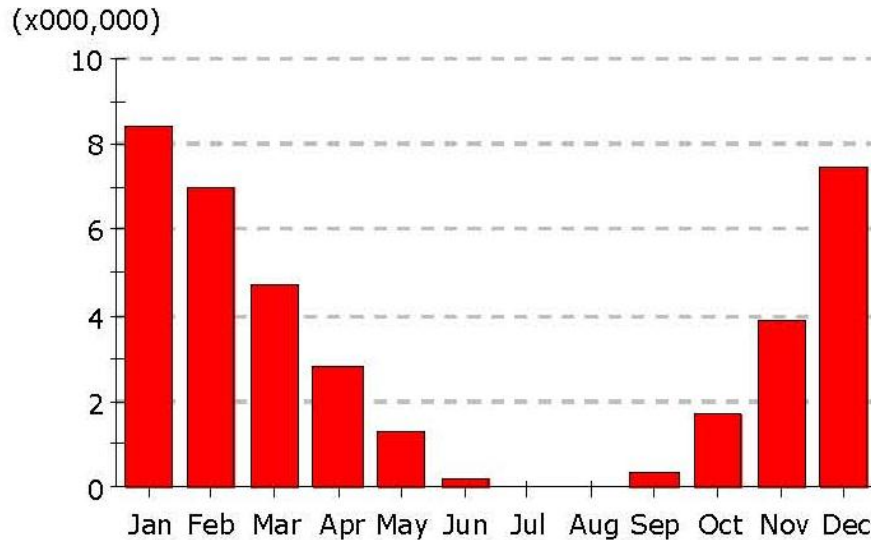
Validation

- Simulation Precedent

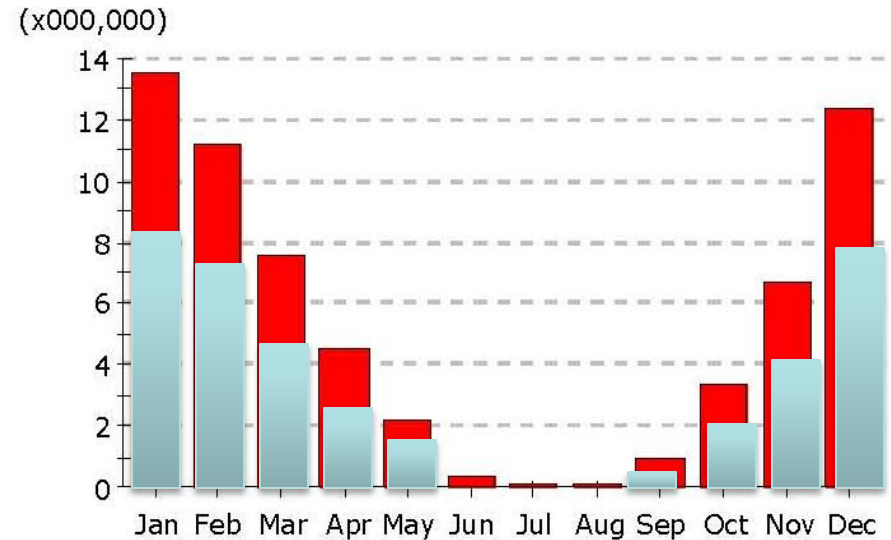


Gas Consumption (Btu)

Home - Albright

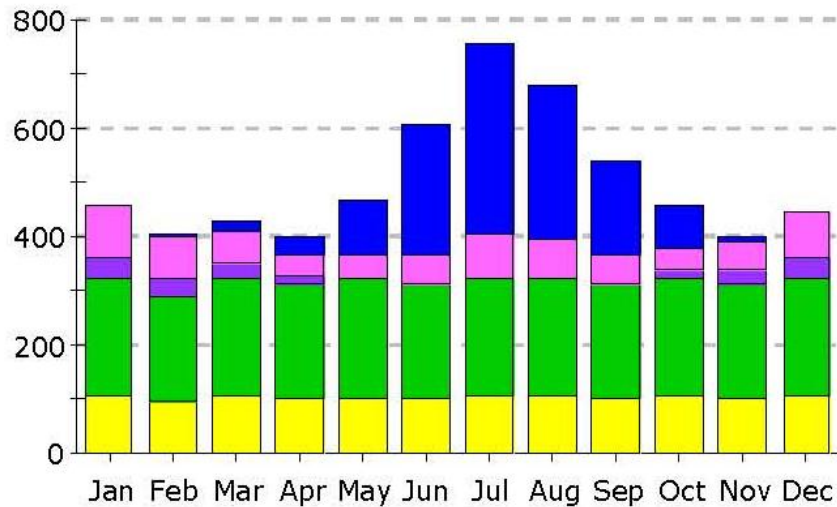


Building America Baseline

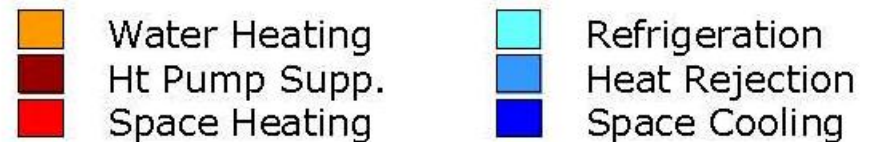
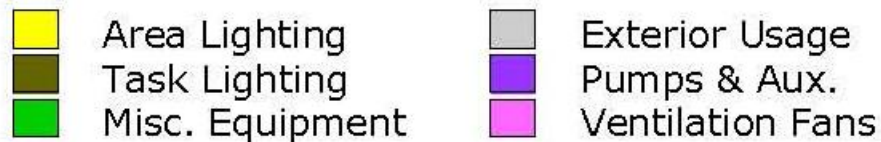
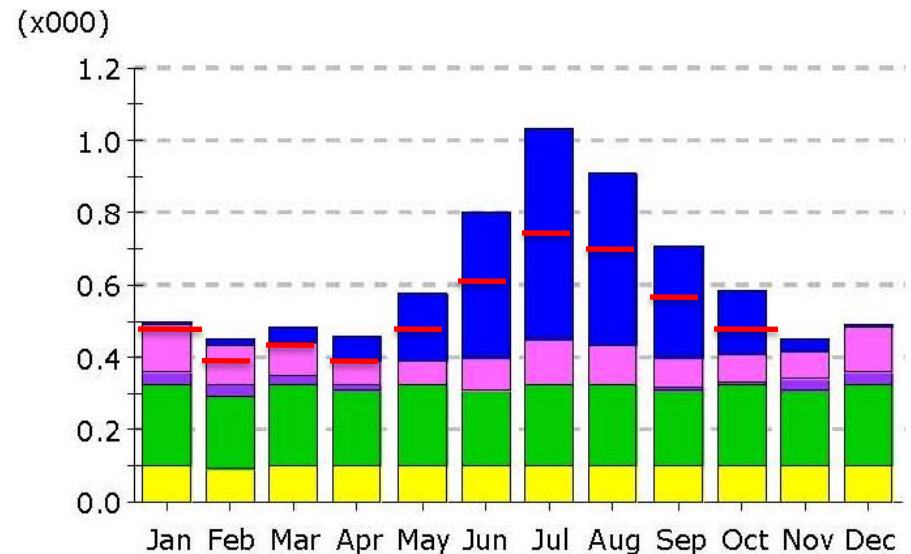


Electrical Consumption (kWh)

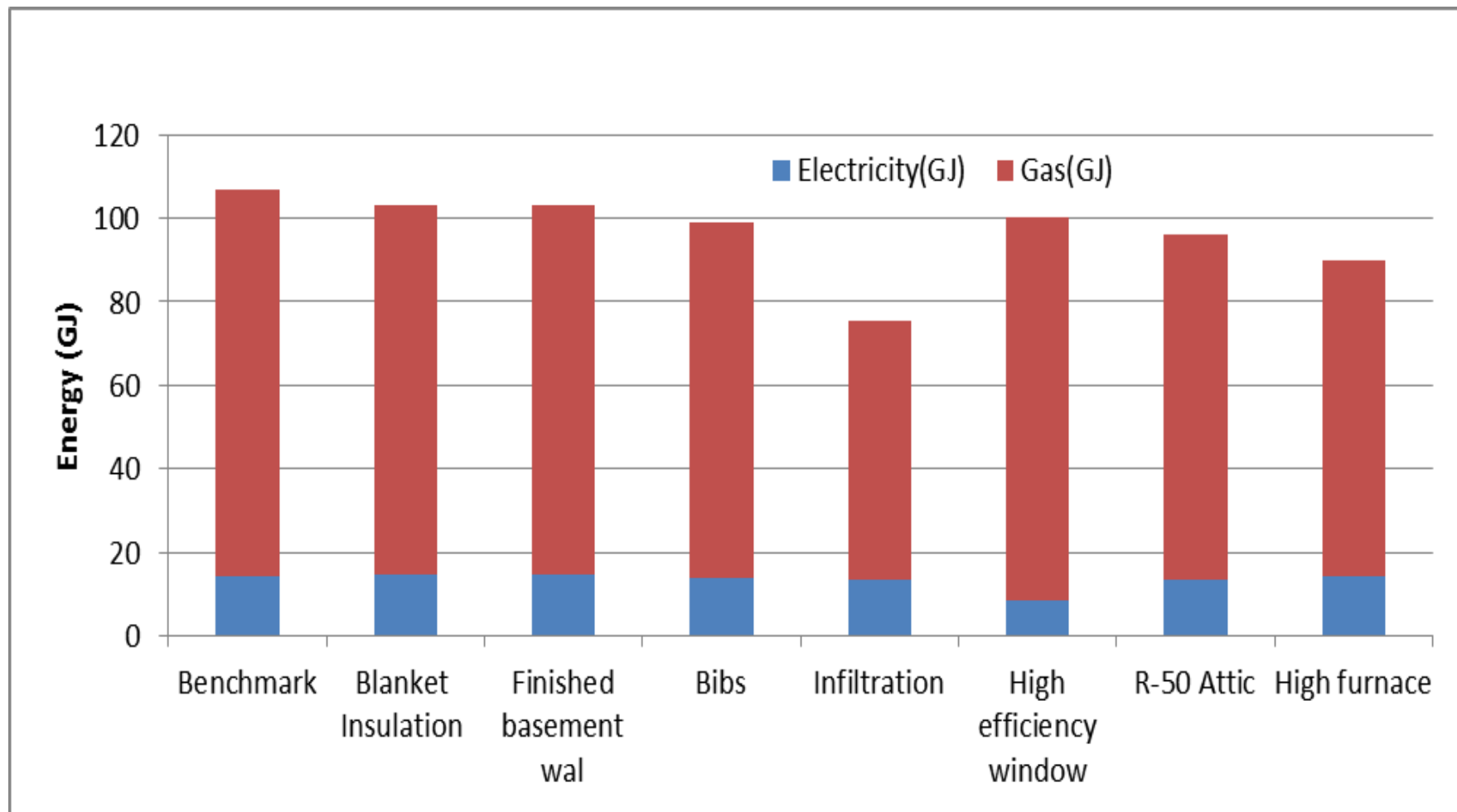
Home - Albright



Building America Baseline



Energy Consumption vs. Best Practice



⑤ Whole House Energy Monitoring & Control System

Using a real time monitoring system the ZNETH II home will obtain information on how much energy is being consumed and produced. Energy Star appliances, low-flow shower head, toilet and faucet conserve energy and water.

⑥ R-50 Attic

Loose fill insulation is blown into the attic at a uniform depth (approx. 17") to achieve an R-50 insulation factor.

⑦ Roof truss with energy heel

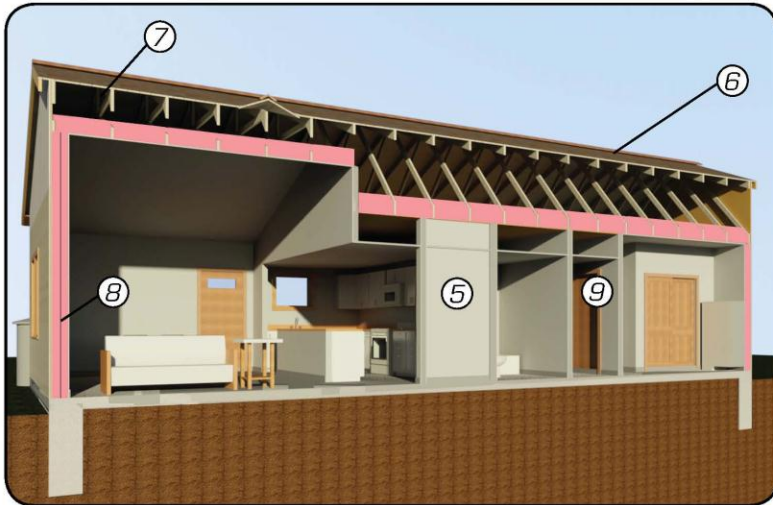
An energy heel lifts the roof to allow for additional insulation in the attic. Typical roof trusses narrow to 6" in thickness at the eave where the roof line meets the outer wall. As the roof gets narrower the effectiveness of the insulation is reduced due to less space. The advantage of including an Energy Heel in the roof trusses is it allows 14" of insulation versus the standard 6". This increases the R value of that area, and eliminates cold spots along the roof line.

⑧ Double 2x4 studwall

Double wall framing allows thermal isolation between inner and outer walls as well as eliminating the thermal bridging and air-barrier interruption of the floor deck. Using this technique along with insulation will achieve an R-30 value.

⑨ Geothermal Heatpump

Installed in the home is a 2 ton Geothermal heatpump, a two stage variable furnace blower combined with a hot water generator. A 5Kw backup heat and 6" fresh air intake. This system has an Energy Efficiency Rating of 26.



ZNETH II

NEBRASKA RESEARCH INITIATIVE FUNDING

Interdisciplinary Building Science Research Partners:

- University of Nebraska-Lincoln College of Architecture
- Department of Chemistry at the University of Nebraska-Omaha
- University of Nebraska-Lincoln College of Architectural Engineering and Construction
- University of Nebraska Medical Center College of Public Health

The ZNETH II project is collaboration between the City of Omaha, Parks and Recreation and researchers at the University of Nebraska-Lincoln, Peter Kiewit Institute Technology Development Corp. Director of Parks, Recreation and Public Property, Melinda Pearson, said, "This caretaker residence is a great public partnership between the educational/research component at the University of Nebraska and the recreation/summer camp activities in the City of Omaha. The 1,000 square foot, two-bedroom, one-bath home will serve as a research test facility for the University and will provide a caretaker residence for year-round occupancy at Hummel Park." The project research goal is to provide the optimal energy efficiency at little to no additional construction cost.



ZNEETH II

zero net energy test house

OMAHA

① Ridge Vent

A ridge vent was installed to allow the attic proper ventilation. During the summer months outside air flows through the soffit vents and exits the ridge vent, which aids in keeping the temperature and moisture down in the attic.

⑤ Window Shutters

Operable window shutters provide security and shading.

② Absence of Roof Penetrations

Roof penetrations can be minimized by the use of ventless plumbing techniques, such as air admittance valves, side wall vents, and direct vented appliances. By removing all penetrations heat loss will be reduced and water leaks minimized.

⑥ Water Conservation

Water is captured and recycled on site through the use of rain barrels.

③ Hardiplank Siding

Hardiplank siding is a fiber-cement siding composed of cellulose fibers and cement-like material. This siding material is extremely durable, sustainable, and fire resistant. If installed and maintained properly Hardiplank siding can provide an airtight barrier which can last over fifty years.

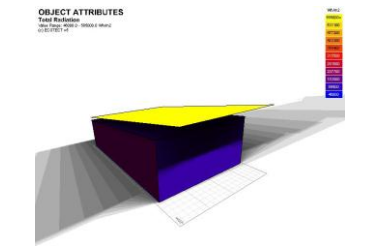
④ High Efficiency Doors and Windows

The use of air tight doors and windows allows for a HVAC system to operate at its highest efficiency. Windows are composed of double pane, argon filled, low-E coated glass. These windows have a U value of 0.16 and a SHGC of 0.57 which is optimized to the house orientation for maximum performance.



Design

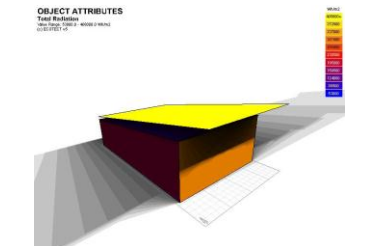
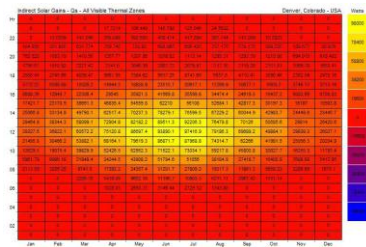
- Toolset of Ideas
- Bigger than added technology



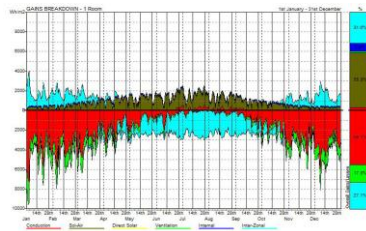
OBJECT ATTRIBUTES
 Test Results
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 10/1/2010 10:00:00 AM

May 1 - August 31

PARAMETERS
 AREA: 4800 SQ. FT.
 LOCATION: CPBS, OGALLALA, NE
 PROGRAM: CONFERENCE CENTER



October 1 - March 31

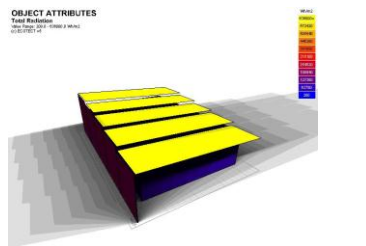


GAINS BREAKDOWN - 1 Room
 FROM: 1st January to 31st December

CATEGORY	LOSSES	GAINS
FABRIC	95.1%	3.1%
SOLAR	0.0%	99.9%
SOLAR	0.0%	0.0%
VENTILATION	15.8%	1.0%
INTERNAL	0.0%	8.4%
INTERZONAL	27.1%	31.6%

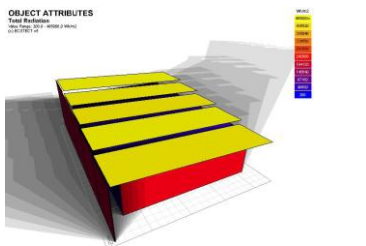
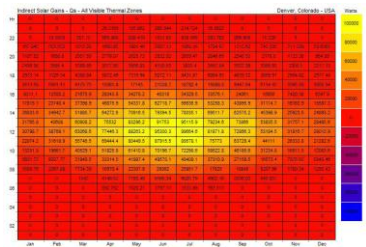
ANALYSIS AND CONCLUSIONS

The single double roof provides adequate shade to the core structure during the summer months and allows sufficient to warm the southern facade during the winter months. However, the roof of the core structure remains shaded during the winter months, failing to capitalize on an opportunity to increase the total solar gain of the structure during the region's cold winters. A more dynamic approach should be studied that is able to provide the core's roof and southern facade with shade in the summer and a significant amount of sun in the winter.

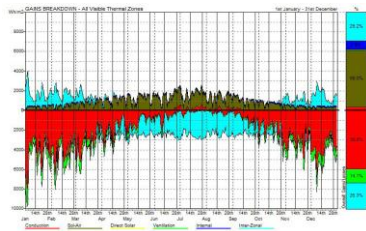


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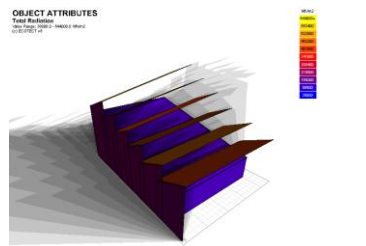


GAINS BREAKDOWN - All Visible Thermal Zones
 FROM: 1st January to 31st December

CATEGORY	LOSSES	GAINS
FABRIC	95.6%	3.4%
SOLAR	0.0%	99.0%
SOLAR	0.0%	0.0%
VENTILATION	14.1%	0.9%
INTERNAL	0.0%	8.6%
INTERZONAL	26.2%	29.2%

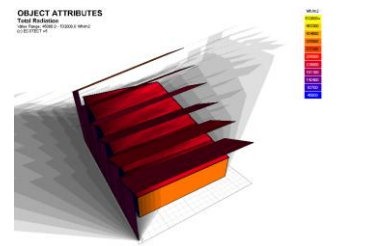
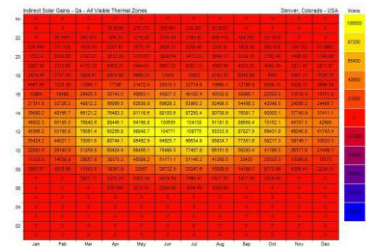
ANALYSIS AND CONCLUSIONS

The multiple panels of the double-roof / double-wall system provide adequate shading in the summer months and allow significant amounts of sunlight to strike the southern facade in the winter months. In addition, the gaps placed between each individual panel allow the low winter sun to penetrate to the interior of the shading device. This allows a greater amount of sunlight to strike the core's roof in the winter, but the increase is still only slight, and a more dramatic approach could produce a great deal of improvement.

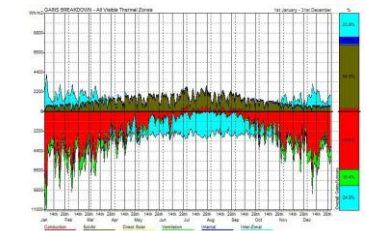


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October 1 - March 31

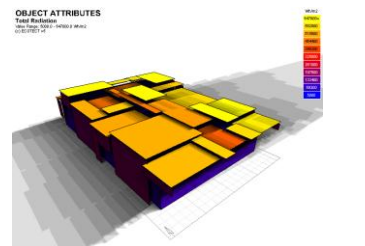


GAINS BREAKDOWN - All Visible Thermal Zones
 FROM: 1st January to 31st December

CATEGORY	LOSSES	GAINS
FABRIC	95.6%	3.2%
SOLAR	0.0%	99.0%
SOLAR	0.0%	0.0%
VENTILATION	15.4%	0.9%
INTERNAL	0.0%	7.5%
INTERZONAL	24.0%	23.9%

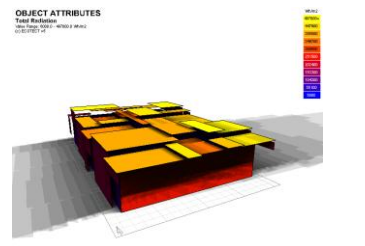
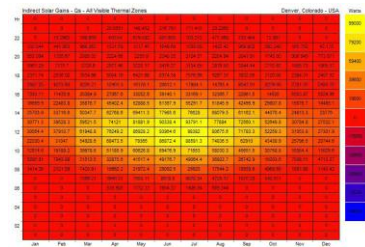
ANALYSIS AND CONCLUSIONS

The multiple panels of this design result in adequate shading during the summer months as well as adequate solar exposure during the winter months. The careful placement and angle of each panel allows the assembly to completely shade the roof and southern facade during summer while still allowing the low winter sunlight to reach the roof and southern face of the core during winter. In addition, the angle of the core's roof allows the winter sunlight to strike the roof more directly, resulting in a more efficient heat transfer process. The eastern facade remains unprotected and could be studied further.

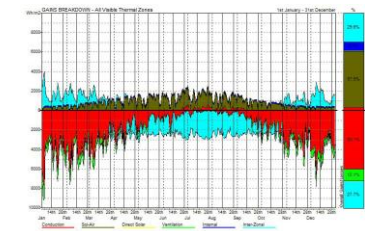


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October 1 - March 31



GAINS BREAKDOWN - All Visible Thermal Zones
 FROM: 1st January to 31st December

CATEGORY	LOSSES	GAINS
FABRIC	60.1%	3.4%
SOLAR	0.0%	97.2%
SOLAR	0.0%	0.0%
VENTILATION	12.1%	0.2%
INTERNAL	0.0%	8.7%
INTERZONAL	27.7%	28.6%

ANALYSIS AND CONCLUSIONS

The divided double-roof structure of this design provides adequate shade in the summer and allows significant amounts of sunlight to strike the southern facade in the winter, but, leaving the gaps between each double-roof panel, the roof of the core structure remains almost fully shaded during the winter months, making the design less dynamic and poorly suited for year-round operation. In addition, the orthogonal composition of the assembly results in high radiant gains. A more dynamic and fluid design could be explored to address this problem.

MAY 1 - AUGUST 31

Total Radiation

Value Range: 200.0 - 719000.0 Wh/m2

Wh/m2

719000+

647120

575240

503360

431480

359600

287720

215840

143960

72080

200

PANELS ABSORB SOME SOLAR RADIATION,
MAKING ROOF BELOW SLIGHTLY COOLER

1.

SOUTH FACADE IS COOL

Comparing

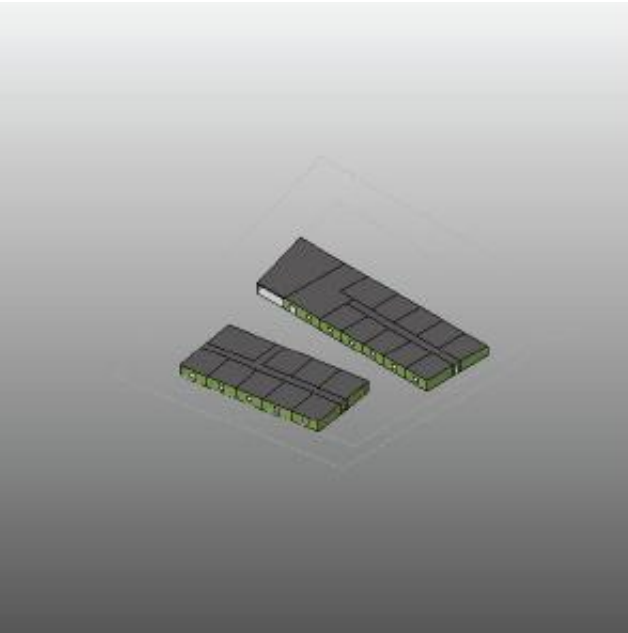
- Design Simulations

Energy Model Comparison

	Vasari	OpenStudioEnergyPlus
<i>Location</i>	Omaha, NE	Bellevue, NE
<i>Weather Station</i>	30149	Bellevue Offut. AFB 725540
<i>Building Type</i>	Multi-Family	Mid-Rise Apartment
<i>Exterior Wall</i>	Lightweight Construction - High Insulation	Gypsum Board, 154mm Insulation, Plywood, High Density Hardboard
<i>Interior Wall</i>	Lightweight Construction - No Insulation	Gypsum Board, Air Space, Gypsum Board
<i>Roof</i>	Typical Insulation - Cool Roof	Gypsum Board, 244mm Batt Insulation, Air Space, Sheathing, Building Paper, Asphalt Shingles
<i>Floor</i>	Lightweight Construction - No Insulation	Insulation, Lightweight Concrete, Carpet
<i>Glazing</i>	Double pane Clear - No Coating	2009 - LowEnergyCase_ExtWindow_ClimateZone3
<i>Building Operating Schedule</i>	24/7 Facility	Always On
<i>HVAC System</i>	Residential 14 SEER/8.3 HSPF Split Packaged Heat Pump	Autosized

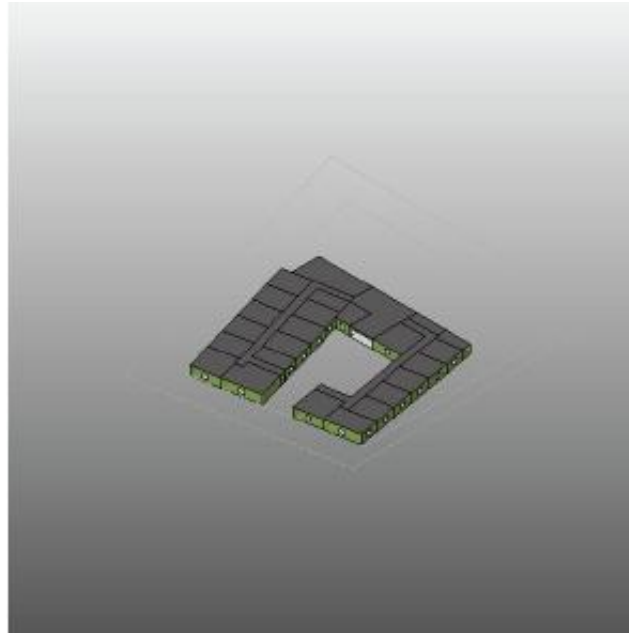
Energy Model Comparison

Opt 1



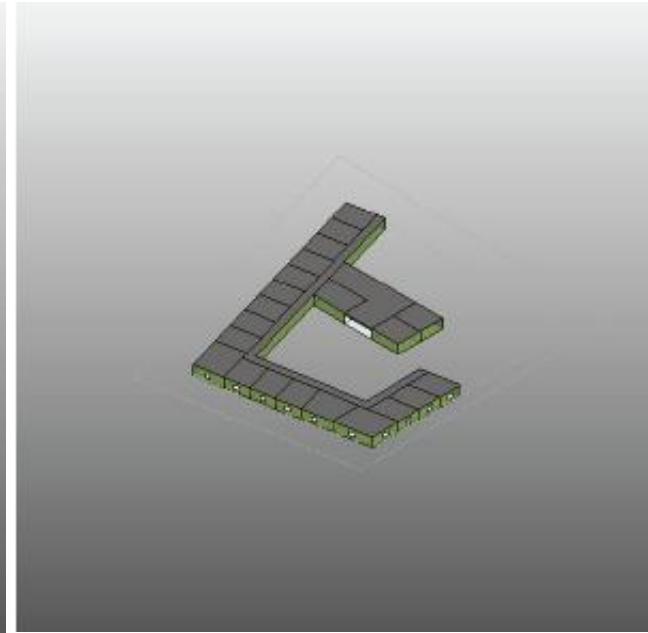
- ☺ Performance
- ☺ Cost
- ☹ Function

Opt 2



- ☹ Performance
- ☹ Cost
- ☺ Function

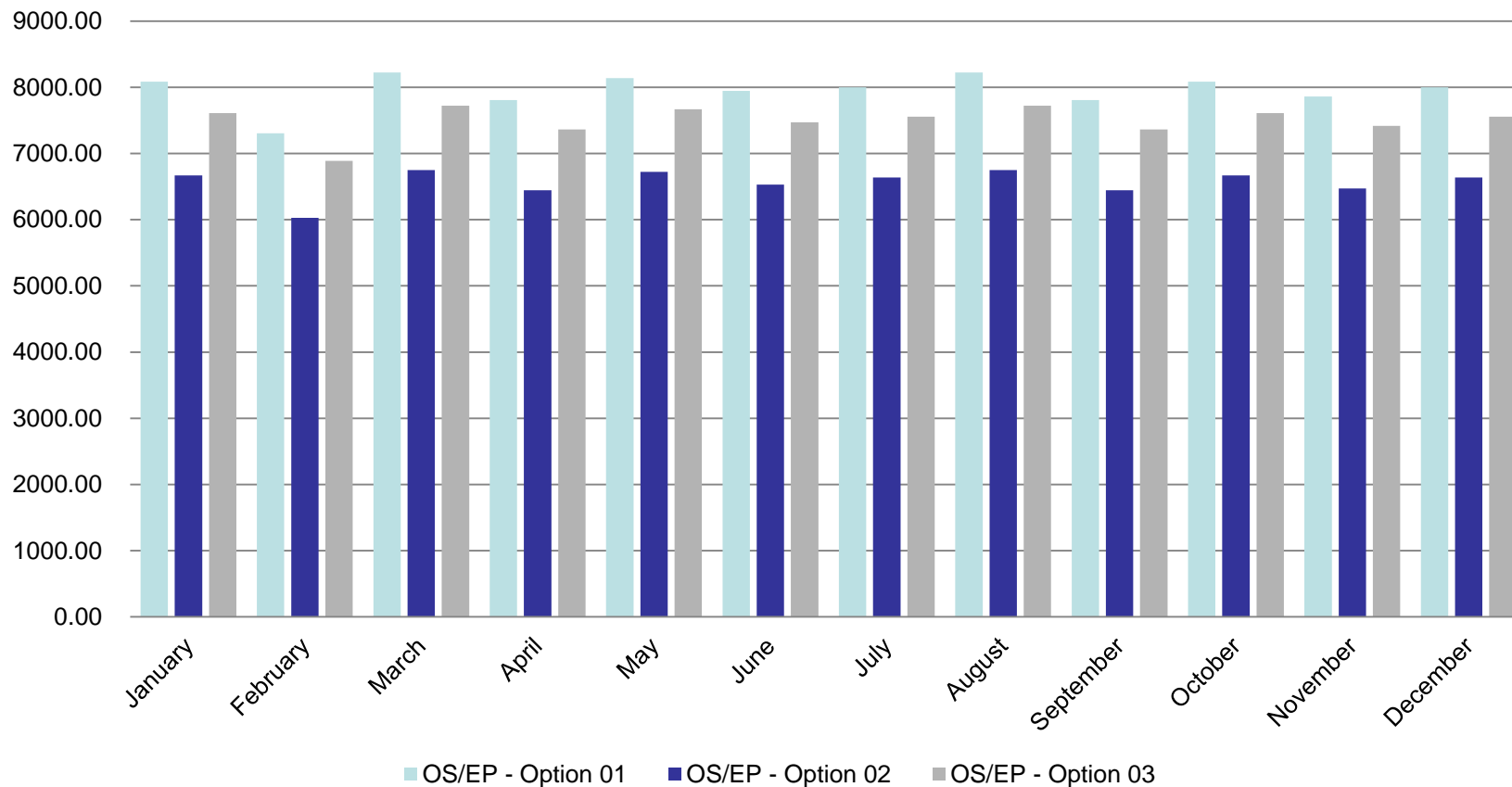
Opt 3



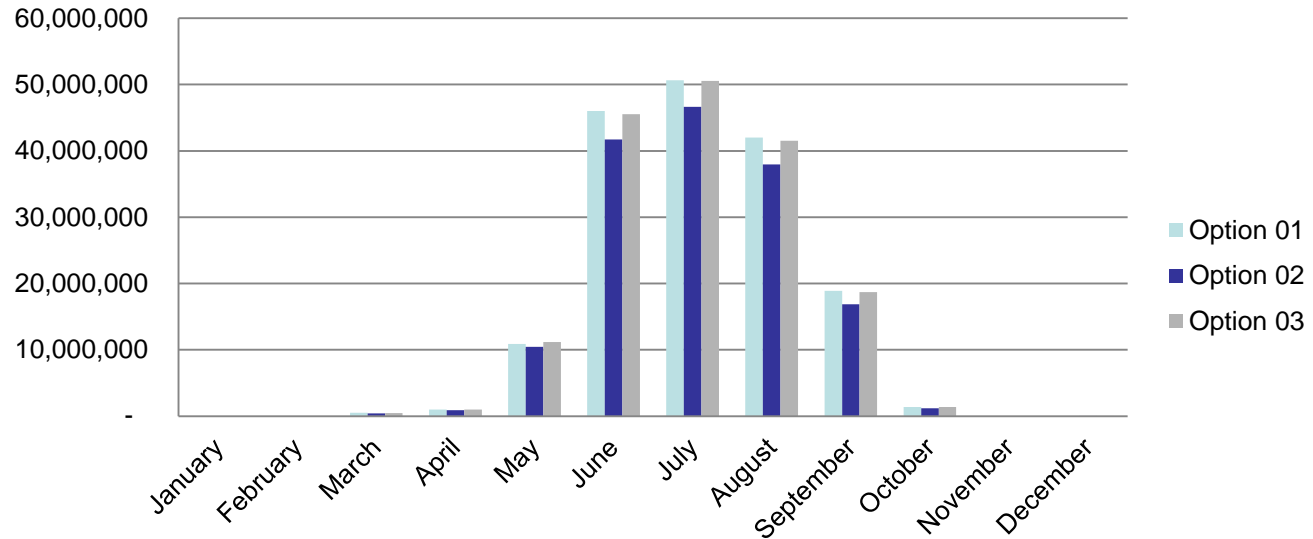
- ☹ Performance
- ☹ Cost
- ☹ Function

Results

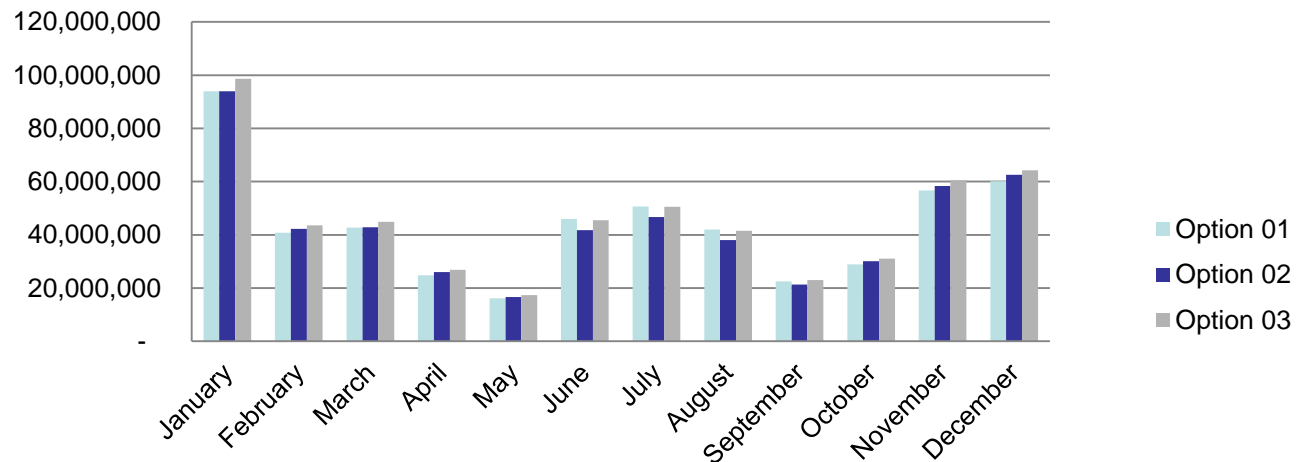
OpenStudio / EnergyPlusMonthly Electrical Consumption (kWh)



Cooling (Btu)



Heating and Cooling (Btu)



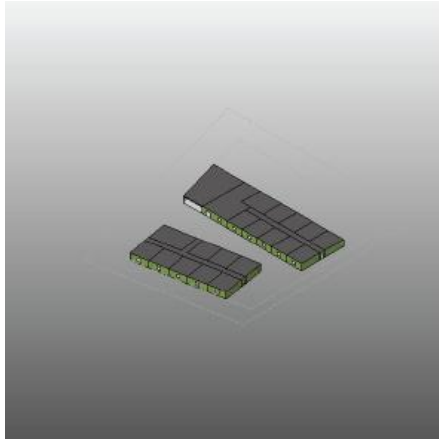
EUI comparison

Energy Use Intensity

	Vasari Option 1		Vasari Option 2		Vasari Option 3	
Electricity EUI	14 kWh/sf/yr		14 kWh/sf/yr		14 kWh/sf/yr	
Fuel EUI	30 kBtu/sf/yr		30 kBtu/sf/yr		30 kBtu/sf/yr	
Total EUI	78 kBtu/sf/yr		79 kBtu/sf/yr		79 kBtu/sf/yr	
	OSEP Option 1	EUI **	OSEP Option 2	EUI **	OSEP Option 3	EUI **
District Heating [kBtu]	353,867.52	15	364,160.82	16	376,937.39	17
District Cooling [kBtu]	171,251.60	7	155,972.79	7	170,256.39	8
Interior Lighting [kWh]	40,691.67	2	35,327.78	2	40,527.78	2
Interior Equipment [kWh]	54,772.22	2	43,386.11	2	49,380.56	2
Total End Uses Electricity [kWh]	95,463.89	4	78,713.89	3	89,908.33	4
Total End Uses District Cooling [kBtu]	171,251.60	7	155,972.79	7	170,256.39	8
Total End Uses District Heating [kBtu]	353,867.52	15	364,160.82	16	376,880.52	17
		27		26		28

Energy Model Comparison

Opt 1

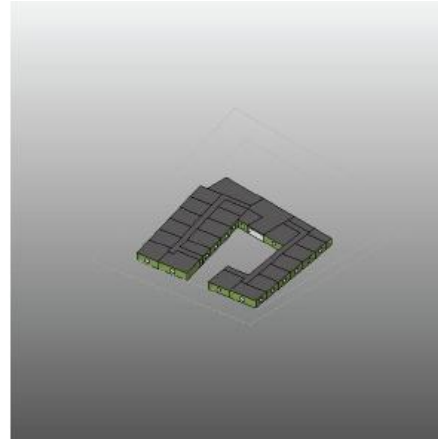


- ☺ Performance
- ☺ Cost
- ☹ Function

OSEP Option 1 EUI **

Total Electricity [kWh]	95,463.89	4
Total Cooling [kBtu]	171,251.60	7
Total Heating [kBtu]	353,867.52	15
		26

Opt 2

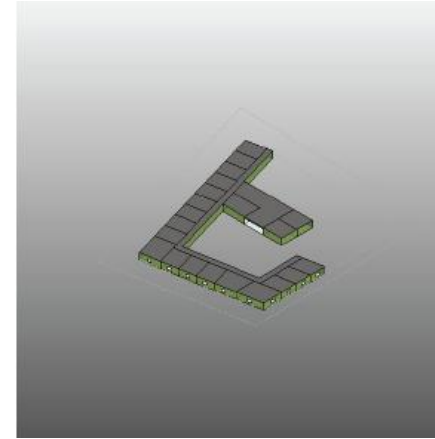


- ☹ Performance
- ☹ Cost
- ☺ Function

OSEP Option 2 EUI **

78,713.89	3
155,972.79	7
364,160.82	16
	26

Opt 3



- ☹ Performance
- ☹ Cost
- ☹ Function

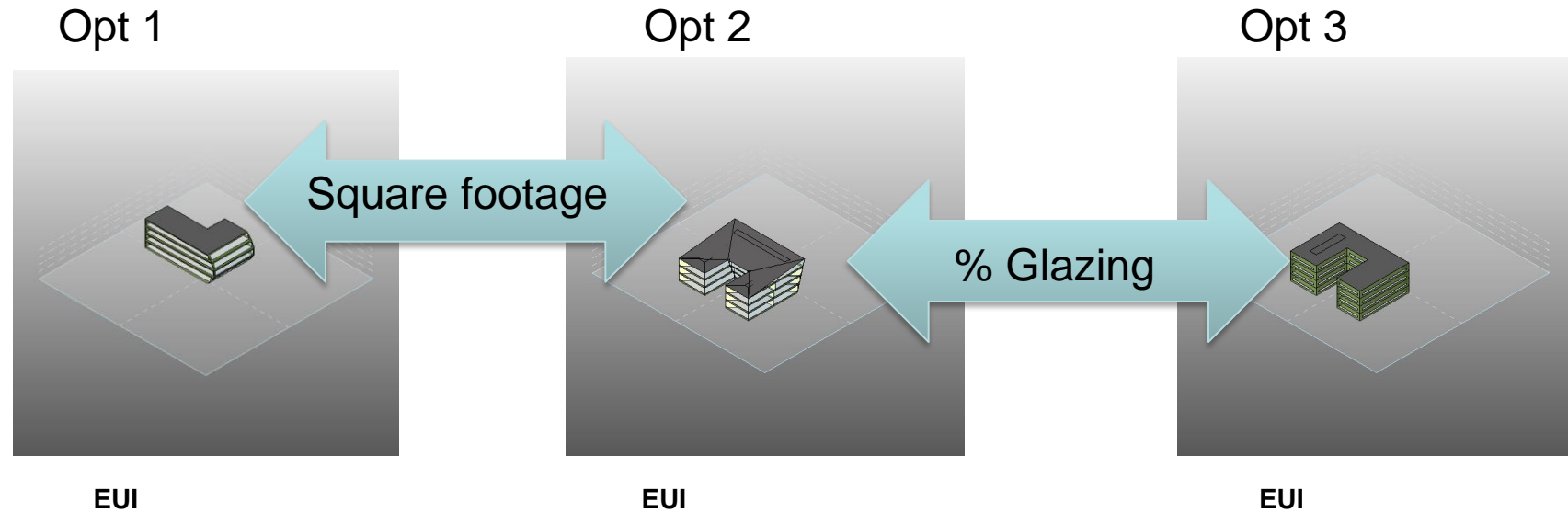
OSEP Option 3 EUI **

89,908.33	4
170,256.39	8
376,880.52	17
	28

Student Experiments

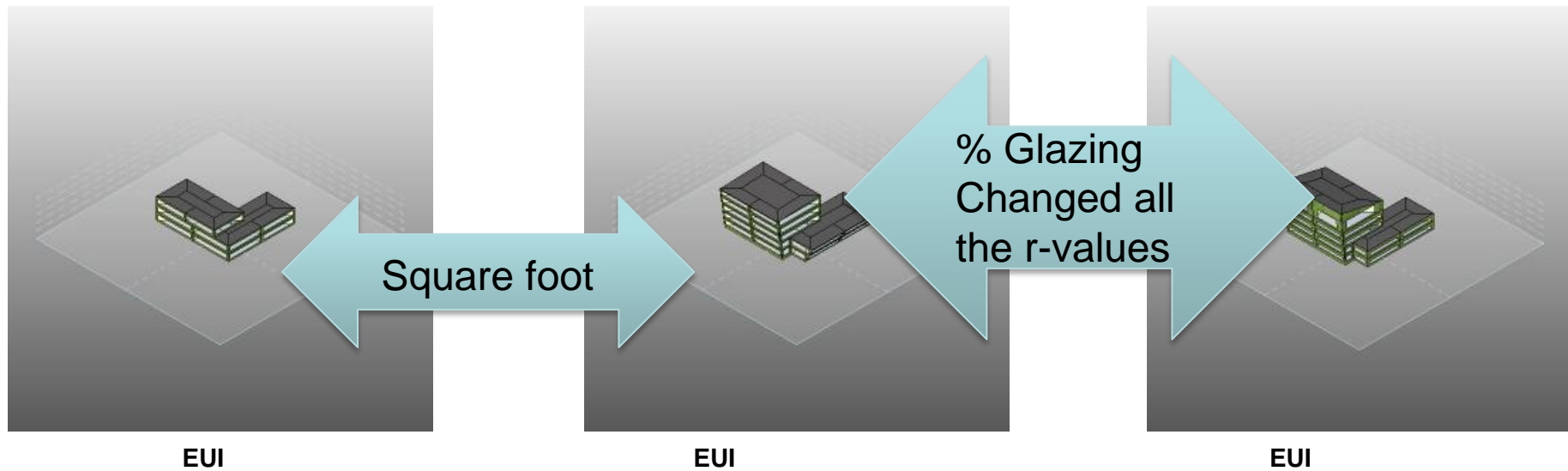
- *Maintain assumptions with incremental changes to only one item*

Energy Model Failures



Total Electricity [kWh]	17	21	15
Total Fuel [kBtu]	35	44	17
Total EUI [kBtu]	94	114	67

Energy Model Failures



Total Electricity [kWh]	17	17	16
Total Fuel [kBtu]	13	11	51
Total EUI [kBtu]	72	69	104

What did we learn?

Vasari

The interface is the same as Revit

- Knowledge of Revit makes Vasari easy to use

Vasari's energy analysis capabilities are limited

- This is advantageous for schematic design

Materials and assemblies are predefined and the selection is limited

- This is limiting if the design differs from the available choices

Vasari doesn't have error checking capabilities

- A user doesn't know if the model and analysis is correct

Energy results are graphed

- This provides a visual that is easily legible

- The graphs are not editable which is limiting

Energy results include cost information

What did we learn?

OpenStudio / EnergyPlus

Time consuming to learn even with prior knowledge of SketchUp

Many ways to customize and edit energy models

- More steps increase the chance for errors

- Leaving information out limits the outputs

Materials and assemblies (constructions) can be customized

- There are unlimited possibilities for how assemblies can be designed

Detailed error checking

- Allows the user to pinpoint specific problems with the energy model

Energy results are extensive and customizable

CONCLUSION

Conclusion

Vasari is best for early schematic design or massing models that do not require precise results.

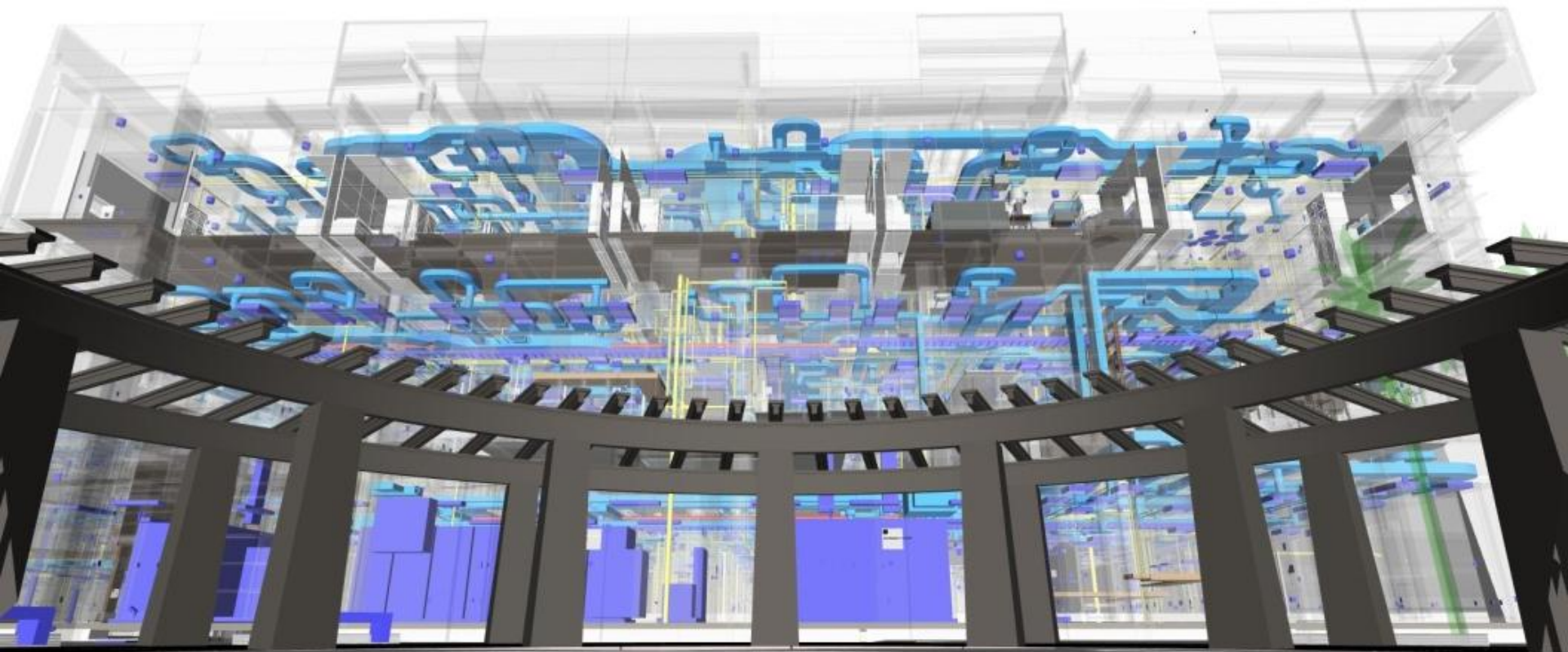
OpenStudio and EnergyPlus are best for designs that are further along in the design process and are looking for accurate results. More accurate model, however more knowledge is required.

References

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<http://etd.gatech.edu/theses/available/etd-04012008-100330/>
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- Kohta Ueno, Building Energy Performance Metrics, Building Science Digest 152, 2010-05, www.buidingscience.com

Conceptual Energy Design Operations

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A BIM Journey: Destination Carbon Neutral

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Good design
makes a difference™





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LEARNING OBJECTIVES



- ☐ Better understand the process of incorporating sustainable and energy analysis tools within your project.
- ☐ Set up models that respond to the collaboration needs of Architects, Engineers, Designers and other players in the design team.
- ☐ Produce and coordinate deliverables across multiple disciplines, multiple models and multiple interfacing software.
- ☐ Define strategies for BIM collaboration: model linking and data exchange.

RLF BIM PROCESS

www.rlfae.com

A Reflection of Office Characteristics and Deliverable Requirements



Founded in 1935

Based in Winter Park, Florida

Services include Master Planning, Architecture,
Engineering and Interior Design

130+ Professionals

Type of Projects

Healthcare / Education / Cultural / Religious

Scope of Work

Design Build / Design Bid Build / Joint-
Ventures / Prime / Consultant

Clients

US Department of Defense

Veterans Administration

Private Sector

Our Values

Design Excellence

Strong Management

Technology Driven

Design with Integrity

Model with Integrity

Positive **BIM** influences:

Standards Development / Resources

NIBS

buildingSMART Alliance



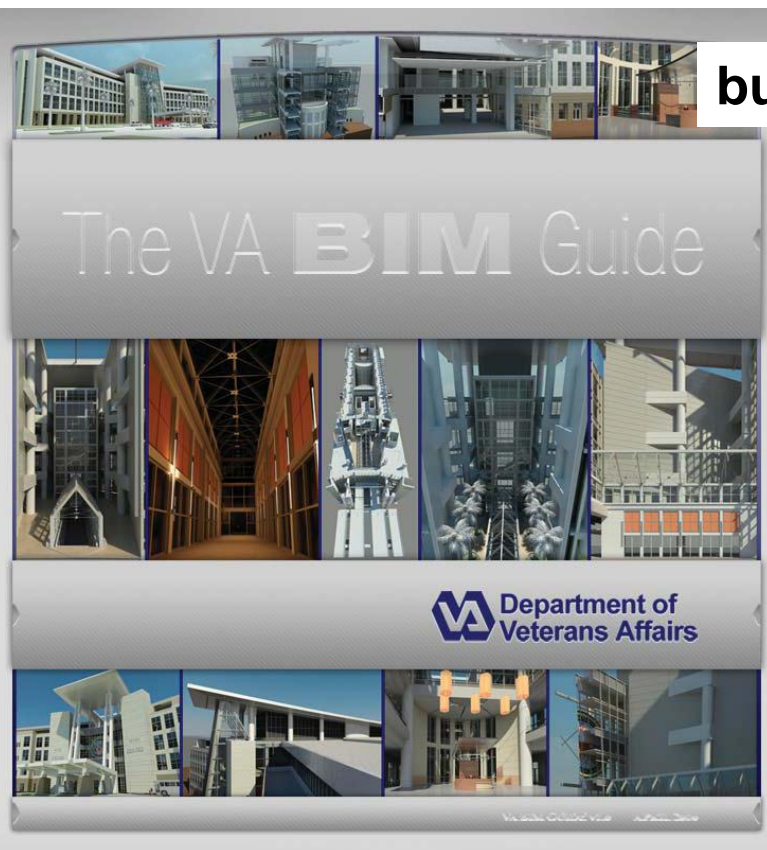
Penn State



GSA



Modeling Data Influences



VA

USACE BIM Guidelines- Attachment F

AIA NTAP

New Technologies, Alliances, Practices



From RAW information to STREAMING DATA

Autodesk Revit Architecture 2011 - Schedule: Room Schedule (Via Orlando Nursing Home)

Building Level	Line Number	Plan Room Num	Plan Room Name	Room Schedule (Via Orlando Nursing Home)	Plan Room Size	SEPS	Department	Perimeter
LEVEL_N1	1795	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1796	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1797	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1798	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1799	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1800	ELEC	100	100				40'-0"
LEVEL_N1	1801	EQUIP	100	100	-3.4%			11'-1.00'
LEVEL_N1	1802	EQUIP	100	100	-1.0%			11'-6.50'
LEVEL_N1	1803	LAUNDRY	100	100	0.1%			40'-0.50'
LEVEL_N1	1804	EXAM	140	101	0.2%			10'-3.00'
LEVEL_N1	1805	NOISINESS	50	50	70.5%	SUPPORTED BY 40 SF FROM 1804		37'-0"
LEVEL_N1	1806	MECH	5	468	-3.7%			57'-2.10'
LEVEL_N1	1807	MECH	100	100	-3.7%			50'-4.50'
LEVEL_N1	1808	COMN	100	100				40'-0"
LEVEL_N1	1809	BATHROOM	100	100	-3.7%			40'-0.50'
LEVEL_N1	1810	DINING	100	100	-3.7%			40'-0"
LEVEL_N1	1811	BATHROOM	100	100	-3.7%			40'-0.50'
LEVEL_N1	1812	CARE STATION	100	100	0.1%			40'-0.10'
LEVEL_N1	1813	KITCHEN	100	100	30.0%	SUPPORTED BY 30 SF FROM 1804		40'-0"
LEVEL_N1	1814	STORAGE	10	10	-2.2%			17'-1.00'
LEVEL_N1	1815	EQUIP ALCOVE	40	30	-3.1%			27'-4.50'
LEVEL_N1	1816	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1817	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1818	BATHROOM	55	57	3.3%			37'-0"
LEVEL_N1	1819	BATHROOM	55	57	3.3%			37'-0"
LEVEL_N1	1820	BATHROOM	55	57	3.3%			37'-0"
LEVEL_N1	1821	BATHROOM	55	57	3.3%			37'-0"
LEVEL_N1	1822	BATHROOM	55	57	3.3%			37'-0"
LEVEL_N1	1823	BATHROOM	55	57	3.3%			37'-0"
LEVEL_N1	1824	BATHROOM	55	57	3.3%			37'-0"
LEVEL_N1	1825	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1826	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1827	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1828	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1829	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1830	BEDROOM	200	217	8.4%			72'-2.50'
LEVEL_N1	1831	CARE STATION	100	100	13.1%			40'-0"
LEVEL_N1	1832	KITCHEN	100	100	20.0%	SUPPORTED BY 30 SF FROM 1804		17'-1.10'
LEVEL_N1	1833	STORAGE	10	10	-2.2%			17'-1.10'
LEVEL_N1	1834	EQUIP ALCOVE	40	30	-4.0%			27'-3.10'
LEVEL_N1	1835	OFFICE	100	100	10.0%			40'-0"
LEVEL_N1	1836	OFFICE	100	115	10.0%			40'-0"
LEVEL_N1	1837	CLEAN	100	100	10.0%			40'-0.50'
LEVEL_N1	1838	SOLEID	100	80	-11.7%			37'-0"
LEVEL_N1	1839	PANTRY	70	80	-11.7%			28'-1.10'
LEVEL_N1	1840	PANTRY	70	80	-11.7%			28'-1.10'

Planning Program For Design
HOSPITAL & CLINICS-OUTPATIENT

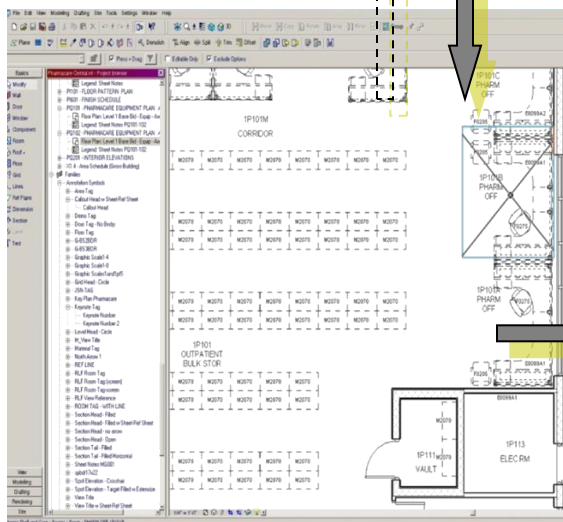
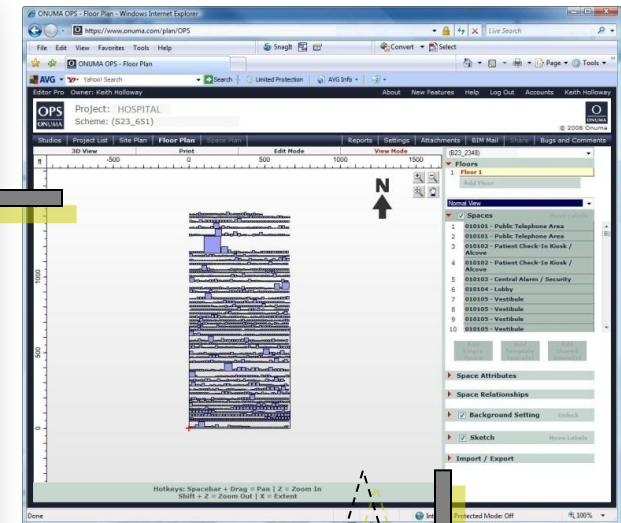
(262) AMBULATORY CARE - SPECU
EXAMINATION / TREATMENT MODULE 2

LINE #	ROOM NAME
262A15	Multipurpose Examination Room
262A16	Special Purpose Examination Room
262A17	Waiting Area
262A18	Public Toilet, Male
262A19	Public Toilet, Female
262A20	Multipurpose Conference/Conference
262A21	Storage (Clean Level, Storage, Med. E)
262A22	Clean Utility Room
262A23	Social Utility Room
262A24	Multipurpose Procedure Room

TOTALS FOR EXAMINATION / TREATMENT MO

262A25 EXAMINATION / TREATMENT MO |

262A26 Multipurpose Examination Room || 262A27 | Special Purpose Examination Room |
262A28	Waiting Area
262A29	Public Toilet, Male
262A30	Public Toilet, Female
262A31	Multipurpose Conference/Conference
262A32	Storage (Clean Level, Storage, Med. E)
262A33	Clean Utility Room
262A34	Social Utility Room
262A35	Multipurpose Procedure Room



Net Area Tabulations

Line #	Room Name
1 - UNIFIED COMMON AREAS	
1 - LOBBY	
010101	EX001 Courtyard Telephone Area
010102	GLSC1 Information Kiosk
010103	COMK3 Corridor
010104	LCB01 Lobby
010105	LCB02 Vestibule
Totals for Functional Area Number 01	
2 - RETAIL AREAS	
010201	BF001 ATM Alcove
010202	EX000 Exchange Retail Store (Gift Shop)
010203	EX001 Vending Machine Area
010204	FGC01 Vending Seating Area
Totals for Functional Area Number 02	
3 - SLEEP ROOMS	
010301	DUTY1 On-Call Room
010302	DUTY1 On-Call Room, Hospitalist

“Program for Design Spreadsheet Data Reuse...”

TAP Faster Forward 2011



Early Site Impressions



3D View

Objects

- ☒ Site
- ☒ Floor Slabs
- ☒ Building Volume
- ☒ Site Components
- ☒ Parcels
- ☒ Sketches
- ☐ Google 3D Buildings

Color Coding

Building:



For more information, review the user manual for Google Earth:

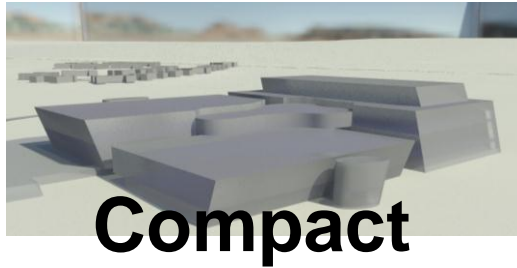
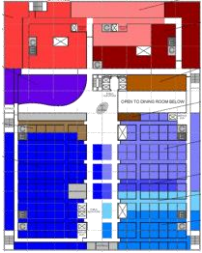
- [3D Viewer Navigation](#)
- [Navigating in Google Earth](#)

Image USDA Farm Service Agency
Image © 2011 DigitalGlobe
Image © 2011 GeoEye

Google
Terms of Use



Charrette Design Options



Compact



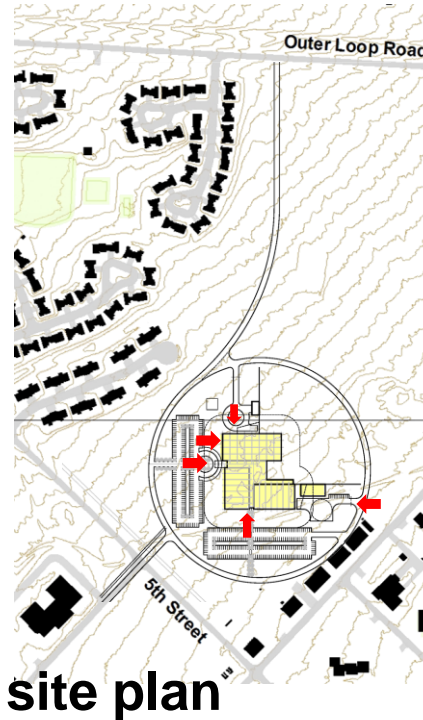
Magnet



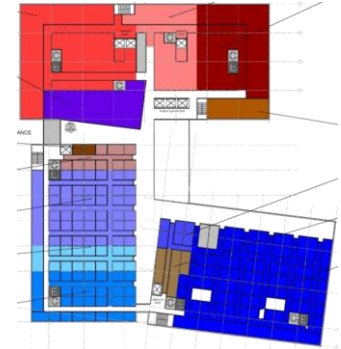
Pinwheel



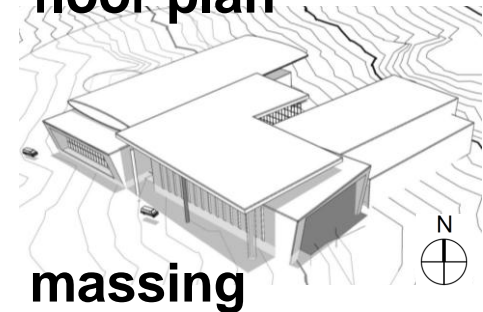
L- Shape



site plan



floor plan



massing

Selected Option

Energy Modeling Methodology: AECOM

INPUTS

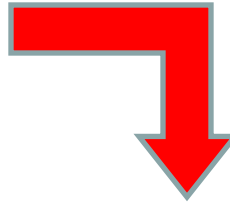
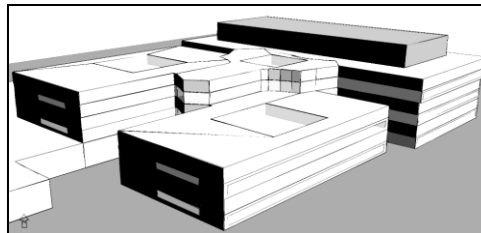
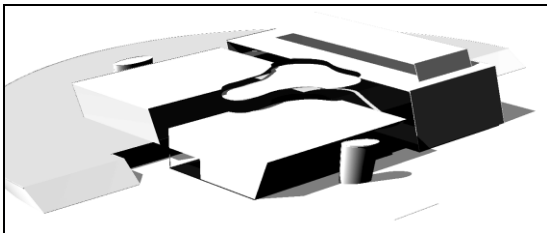


Inputs from Revit

- Building geometry
- Building orientation

Energy Modeling Inputs

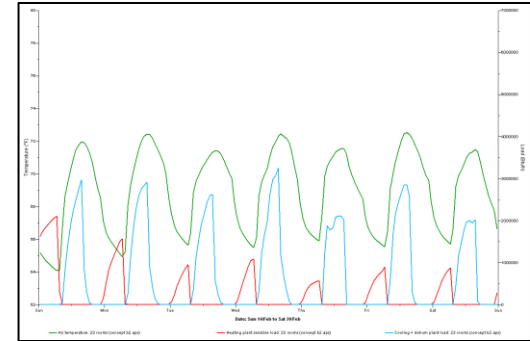
- Site location
- Building construction assemblies
 - ✓ Architect input
 - ✓ ASHRAE 90.1-2007
- Internal gains and schedules
 - ✓ ASHRAE Fundamentals



Simulation
Software



RESULTS



Heating Loads/Cooling Loads

Advantages

- Compact design reduces wall area.
- High window to wall area ratio provides access to views.
- Building entrance is located within wind shadow from dominant NE wind.

Disadvantages

- Deep floorplates limit depth of daylighting.
- Significant SE glazing could result in early morning solar control issues.

Potential Mitigation Strategies

- Solar Shading
- Daylighting strategies



Site Opportunities: Wind Energy : Solar Energy

Site Opportunities: Solar

High average solar radiation levels provides opportunities for:

- Solar PV power generation
- Solar thermal water heating

Site Challenges: Solar

- Impact of dust on modules.

Site Opportunities: Passive Design

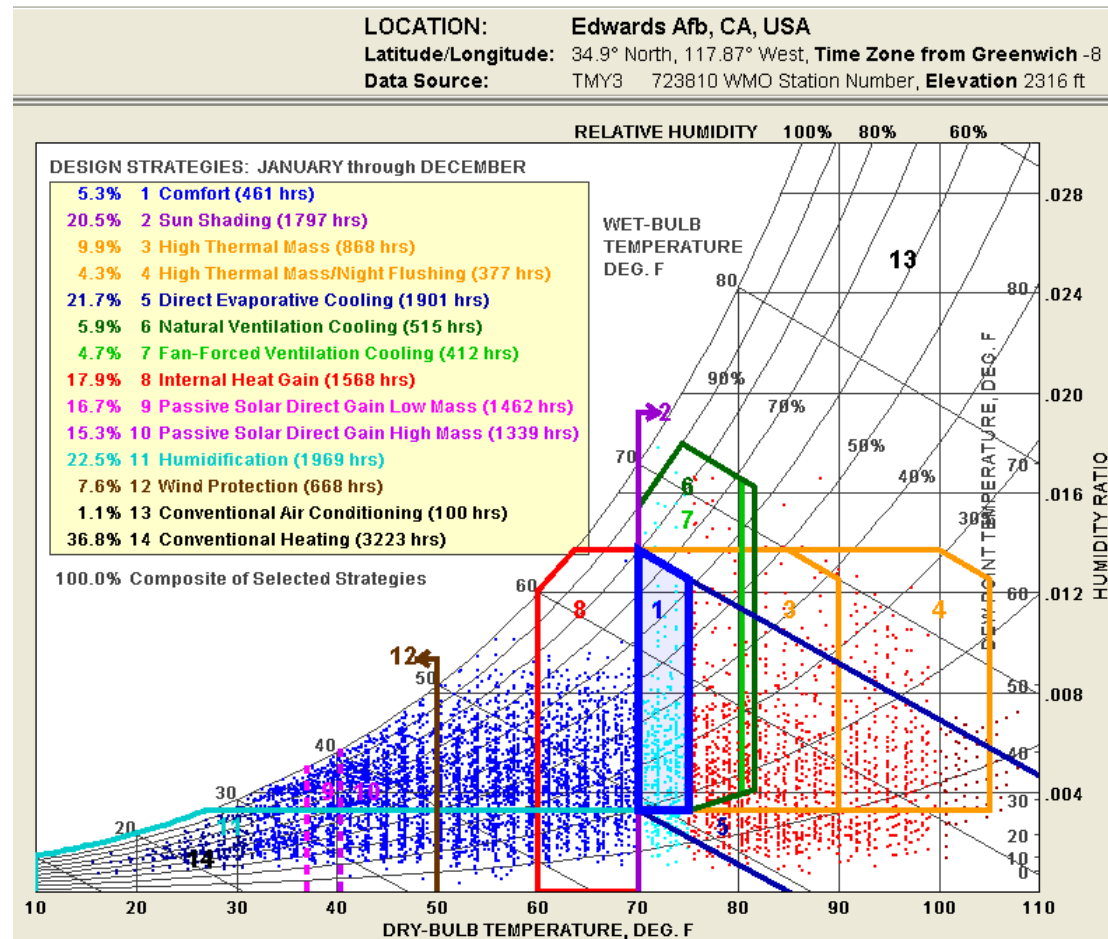
- Evaporative cooling
- Solar shading
- Natural ventilation
- Use of thermal mass storage

Site Challenges : Passive Design

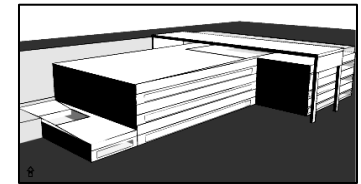
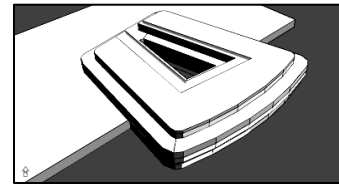
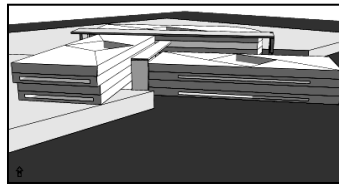
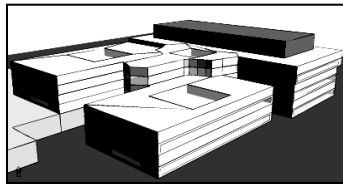
- Water limitations
- Dust / Sand

: Diurnal Temperature Range

: Passive Design Strategies



Energy Modeling Results – Summary



	“Compact”	“Pinwheel”	“Magnet”	“L-shaped”
Conditioned Floor Area [ft ²]	186,715	215,787	278,229	196,868
Window-to-Wall Ratio	0.36	0.25	0.34	0.29

- Ranking by combined annual heating / cooling energy demand

	Combined Peak [BTU/h-ft ²]	Ranking
“Compact”	66.7	3
“Pinwheel”	67.3	4
“Magnet”	64.5	2
“L-shaped”	64.1	1

- Ranking by combined peak heating and cooling

	Combined Peak [BTU/h-ft ²]	Ranking
“Compact”	42.9	4
“Pinwheel”	43.9	3
“Magnet”	38.9	1
“L-shaped”	39.1	2

A detailed floor plan of the World Trade Center site, color-coded by zone. The plan includes several labeled areas:

- RED ZONE:** Located at the top left and top right of the main building complex.
- PURPLE ZONE:** A central area within the red zone.
- CYAN ZONE:** A large rectangular area in the center, containing a smaller pink square.
- ORANGE ZONE:** A small area adjacent to the cyan zone.
- BROWN ZONE:** A long, narrow strip along the bottom edge.
- BLUE ZONE:** A large area at the bottom right, separated from the others by a diagonal boundary.

Key features and labels include:

- ENTRANCES:** "AMERISOURCE ENTRANCE" and "WALK-IN ENTRANCE" are labeled at the top; "MAIN ENTRANCE" is indicated on the left side.
- STAIRS AND ESCALATORS:** Labeled as "STAIRS TO MEZZ" and "STAIRS TO MEZZA".
- Other Labels:** "MEZZA" and "MEZZA" are also present near the stairwells.
- Structural Elements:** The plan shows numerous rooms, corridors, and structural columns throughout all zones.

The floor plan shows a central blue-shaded area labeled 'AE5122' with dimensions '10'-8 1/2"' and '12'-6 3/4"'. Surrounding this area are various rooms and corridors, including rooms labeled E128, E127, E154, E156, E155, E169, E167, E168, E172, and E173. Dimensions for different sections are provided, such as '6'-7"', '3'-7 1/2"', '14'-9 1/2"', '12'-5"', '7'-7 1/4"', and '11'-5"'. The plan also includes labels for 'OS3L' and 'OS3D' along the walls and corridors.

Instance Properties

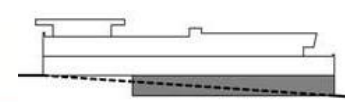
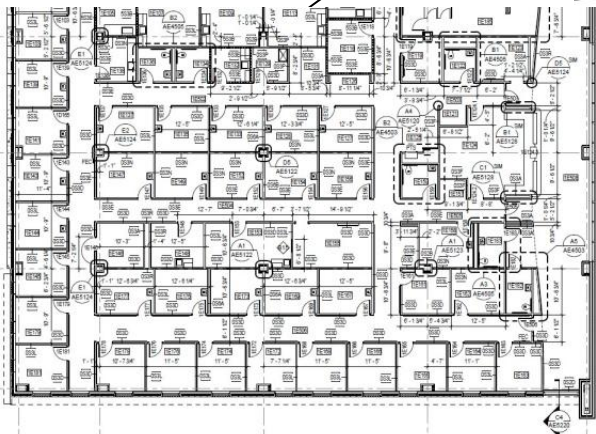
Family: System Family: Room Load...

Type: Room Edit Type...

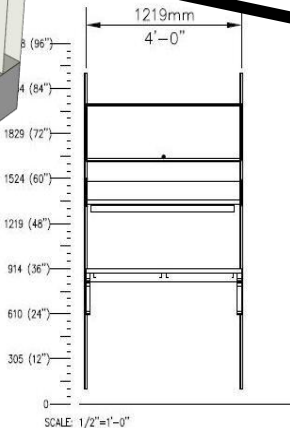
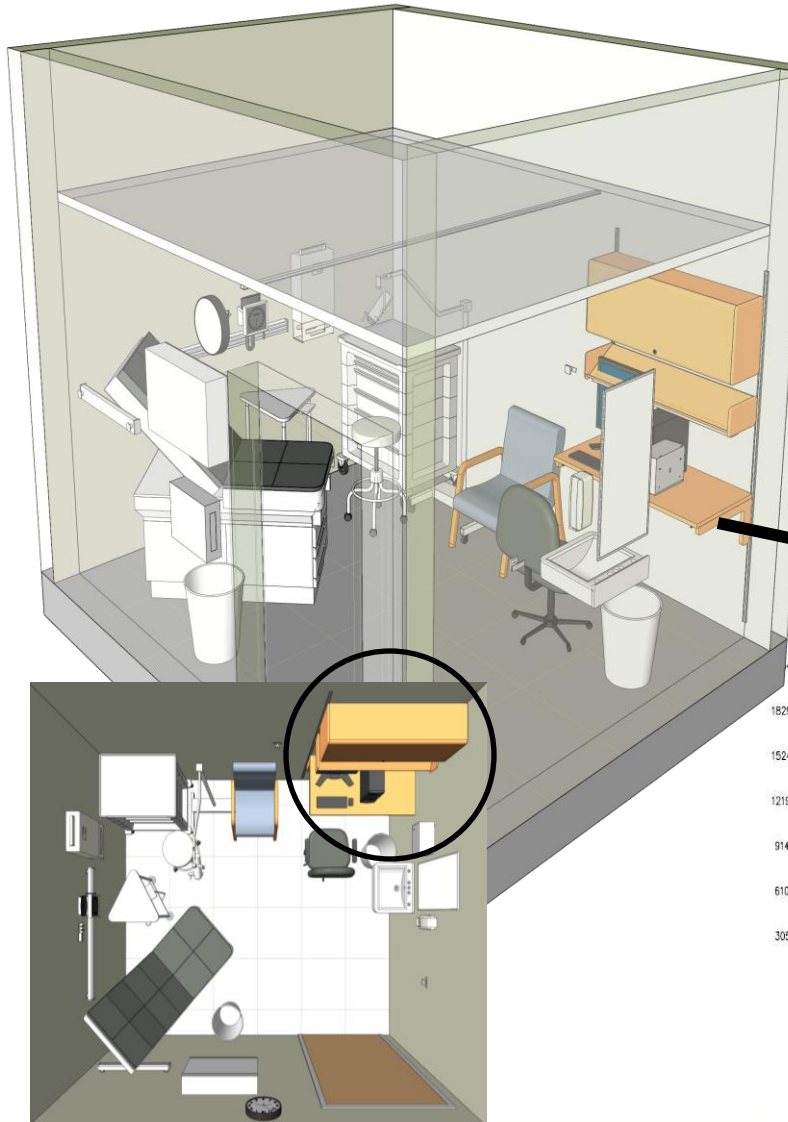
Instance Parameters - Control selected or to-be-created instance

Parameter	Value
Dimensions	
Identity Data	
Workset	Workset1
Number	1E155
Name	WAIT / OBSERVE
Comments	
Occupancy	
Department	PRIMARY CARE - WELL BABY, EFMP & IM
Base Finish	V-1
Ceiling Finish	ACT-1
Wall Finish	PT-1
Floor Finish	CPT / VCT
Occupant	
Department Number	21
Edited by	
Phasing	
IFC Parameters	
IfcGUID	eGW125BMjQqfta9ldEtwrh
ANSI/BOMA Space Categ	
NSA STAR Space Categor	00

OK Cancel



BIM CONTENT DEVELOPMENT

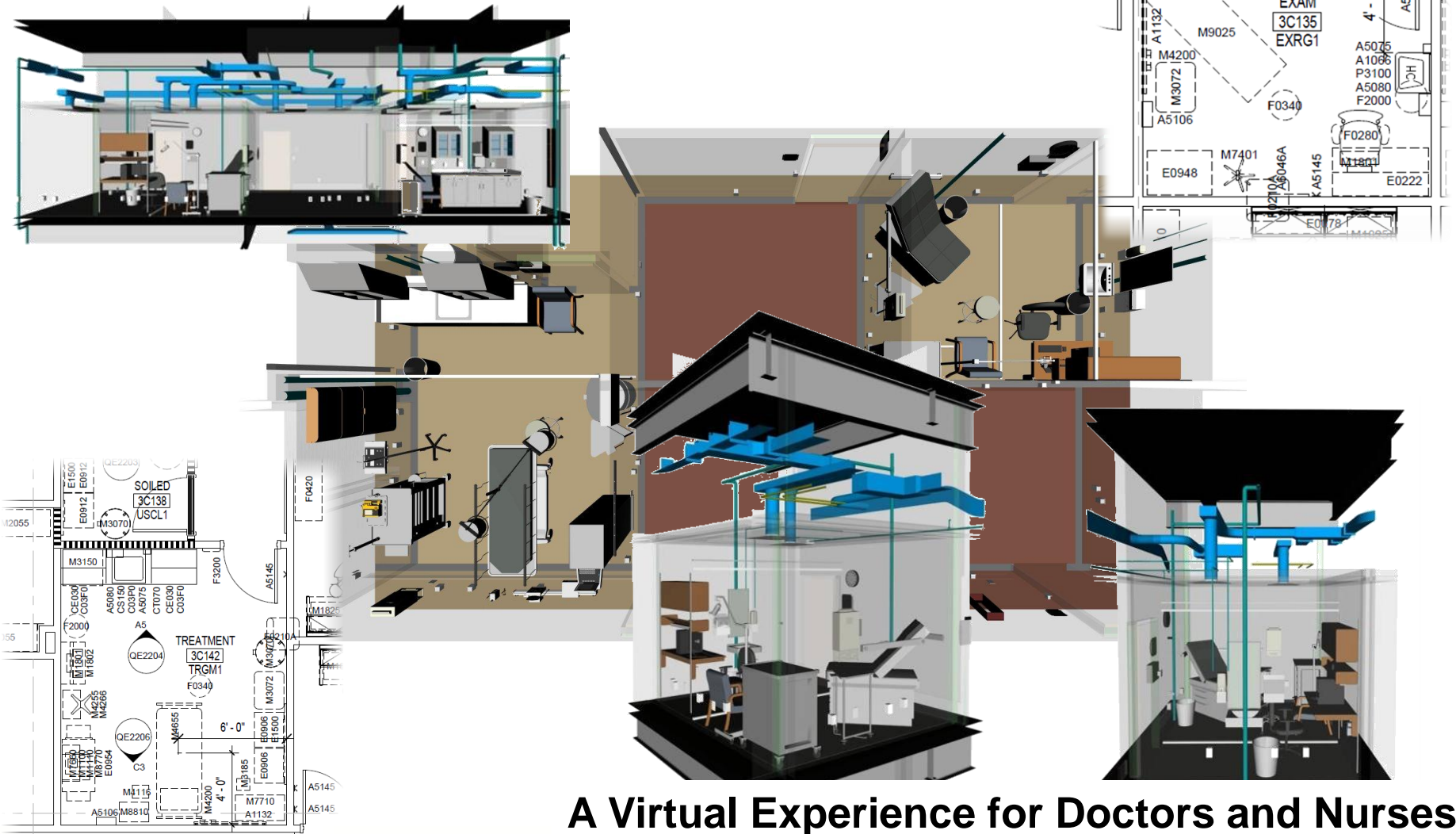


QTY	DESCRIPTION
2	Vertical Hanging Strips
1	Lockable Flipper Unit
1	Shelf, Storage/Display
1	Light
1	Canilevered Work Surface

**Magic content: visual
graphics, database,
relationship validation**

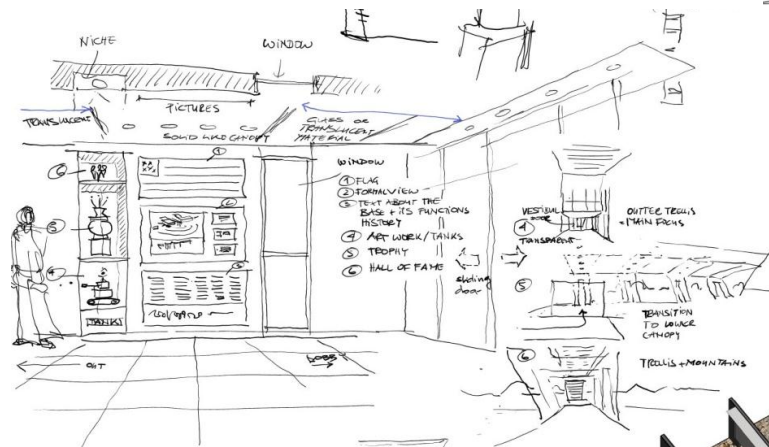
CONTRACT DOCUMENT DEVELOPMENT

2D / 3D Mockup/ Full 3D Levels of Communication

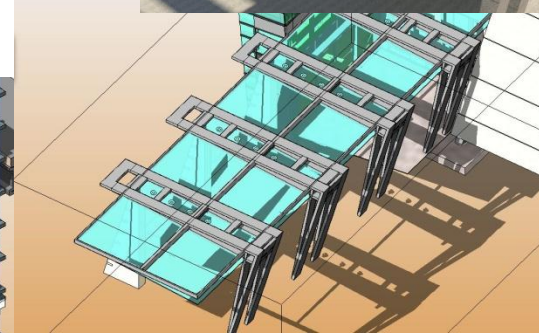
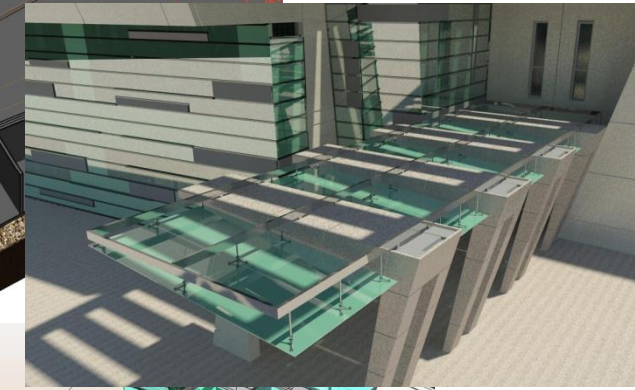
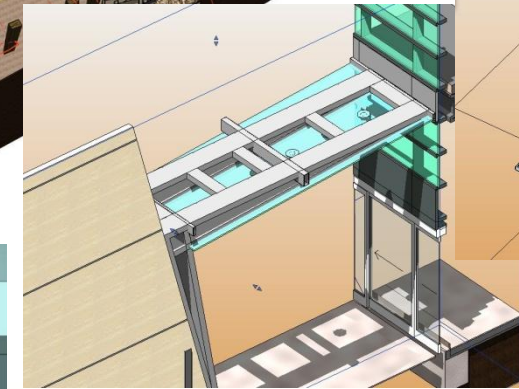
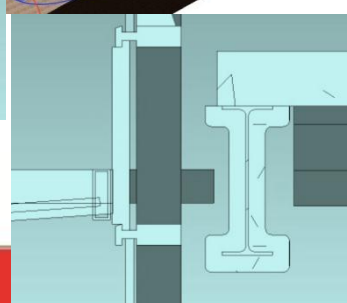
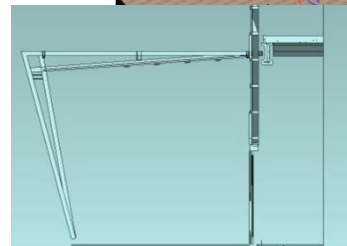


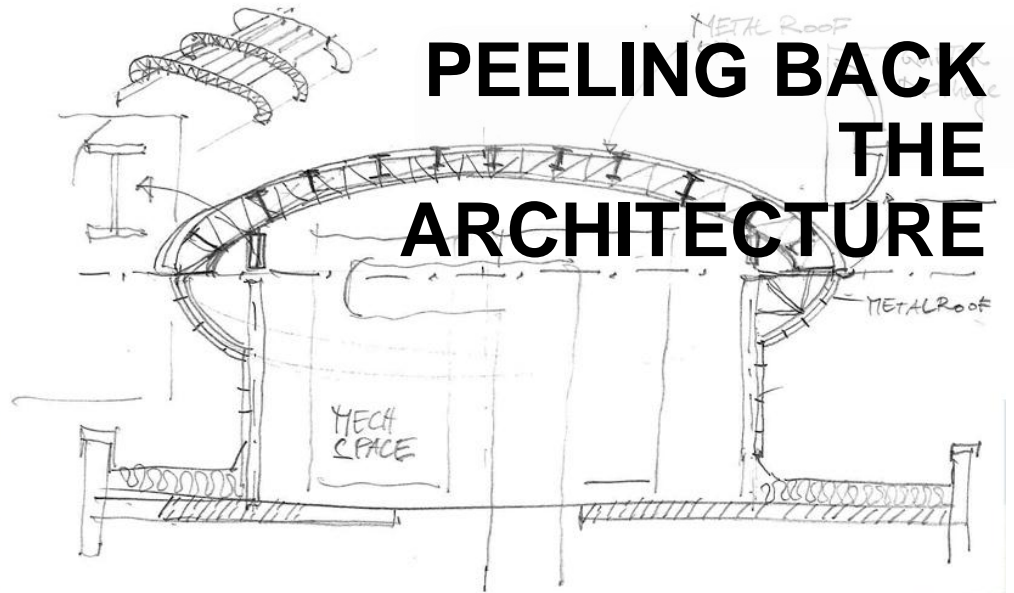
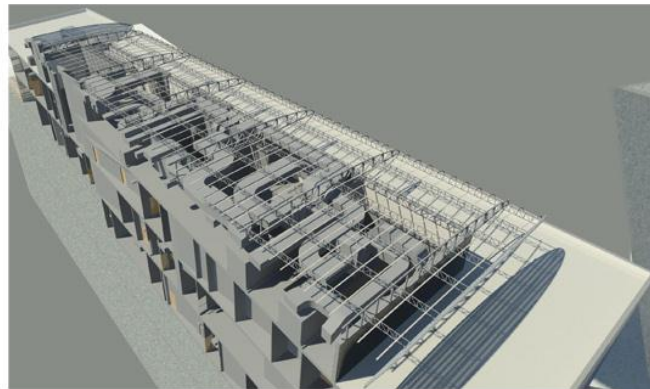
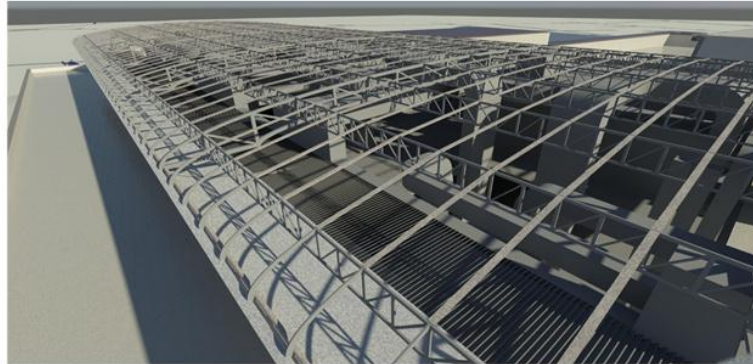
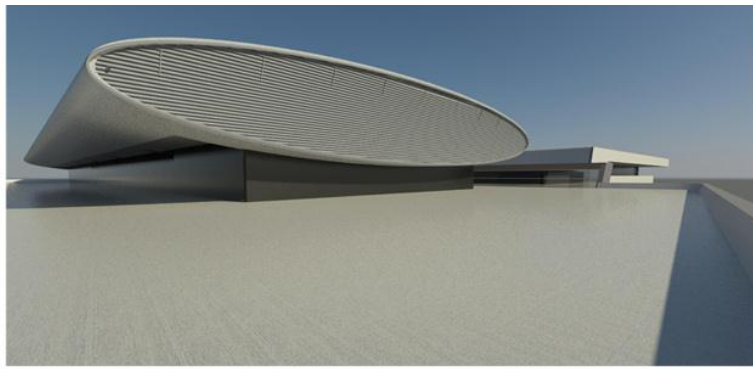
A Virtual Experience for Doctors and Nurses

Mind Set Transitions with Tool sets

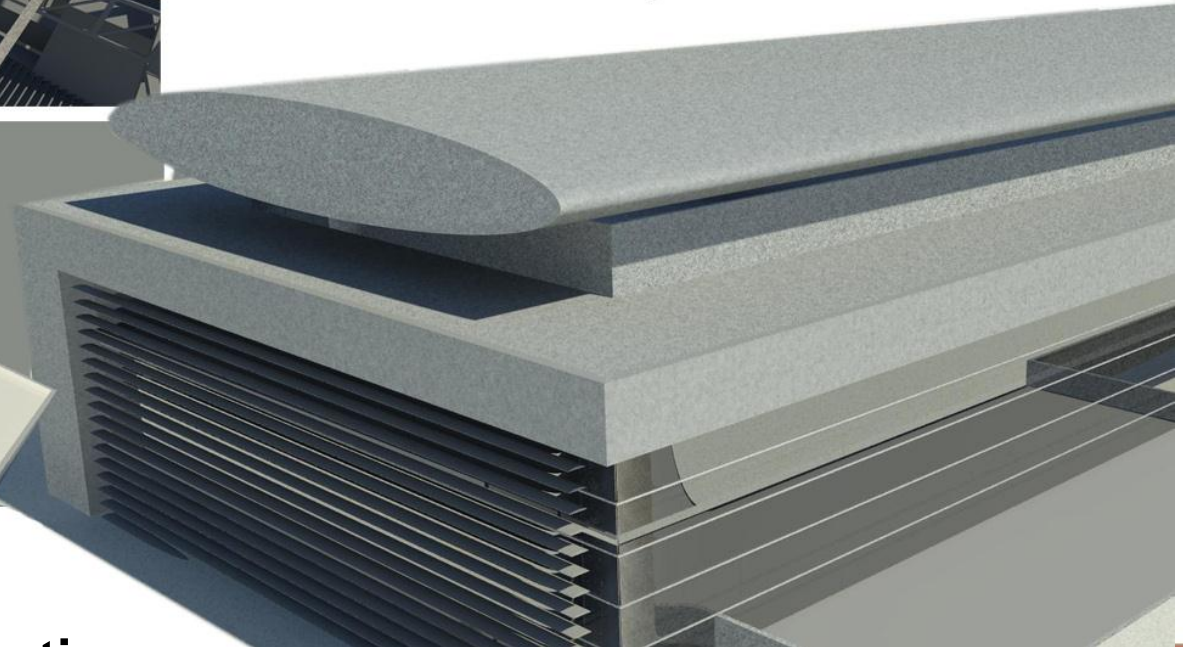


- 1 MAIN FOCUS ENTERING THE BUILDING
 - 2 EYECATCH (SHORT FOCUS)
 - 3 MT THICK LOBBY
- could be LED SIGN OR BONE SCULPTURE OR SIMILAR
- GLASS BOX WITH SHED CONTENT
- MT THICK LOBBY





PEELING BACK THE ARCHITECTURE

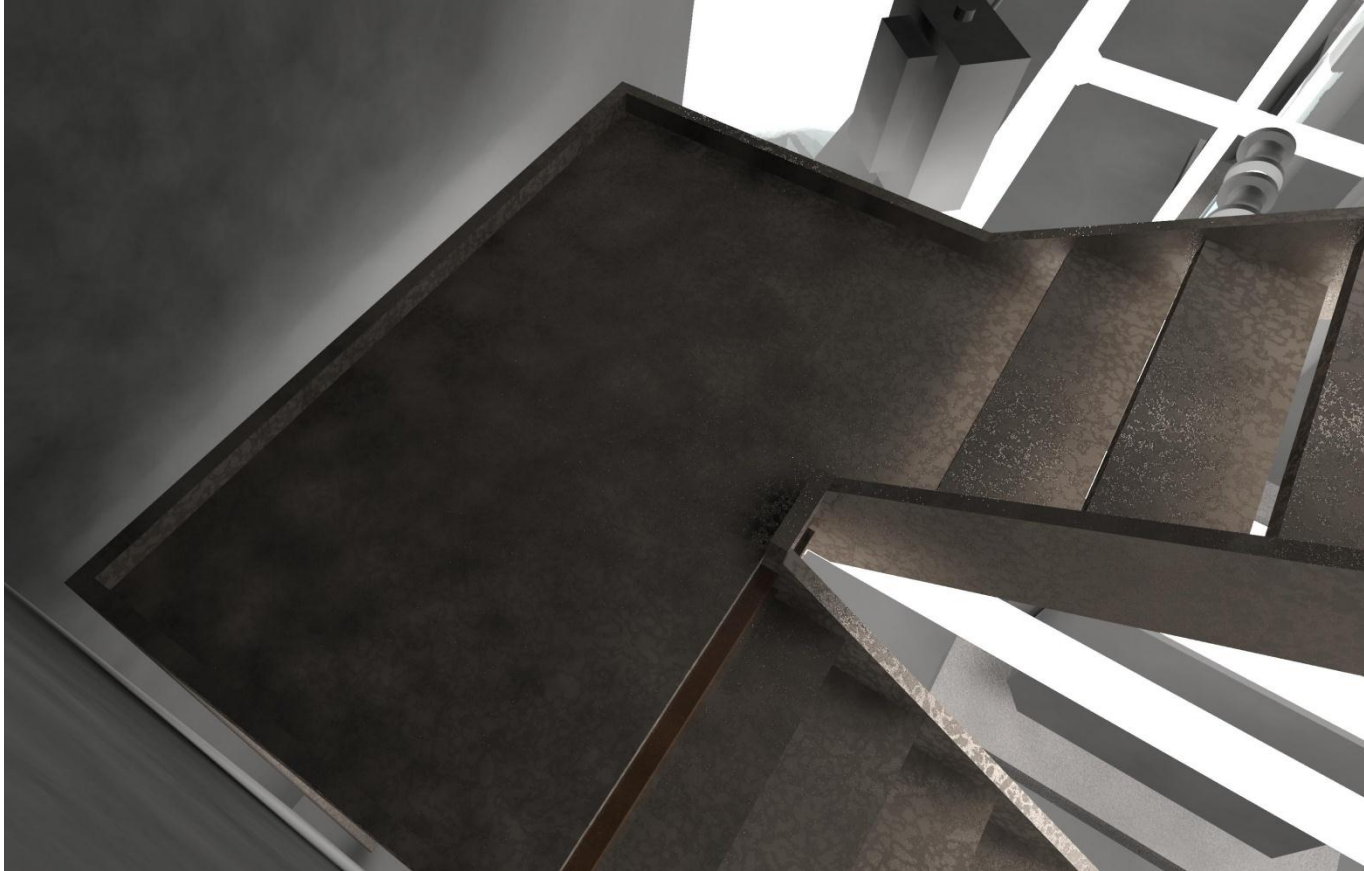


New Avenues of Integration

TAP Faster Forward 2011



Coordination Walk through the Building

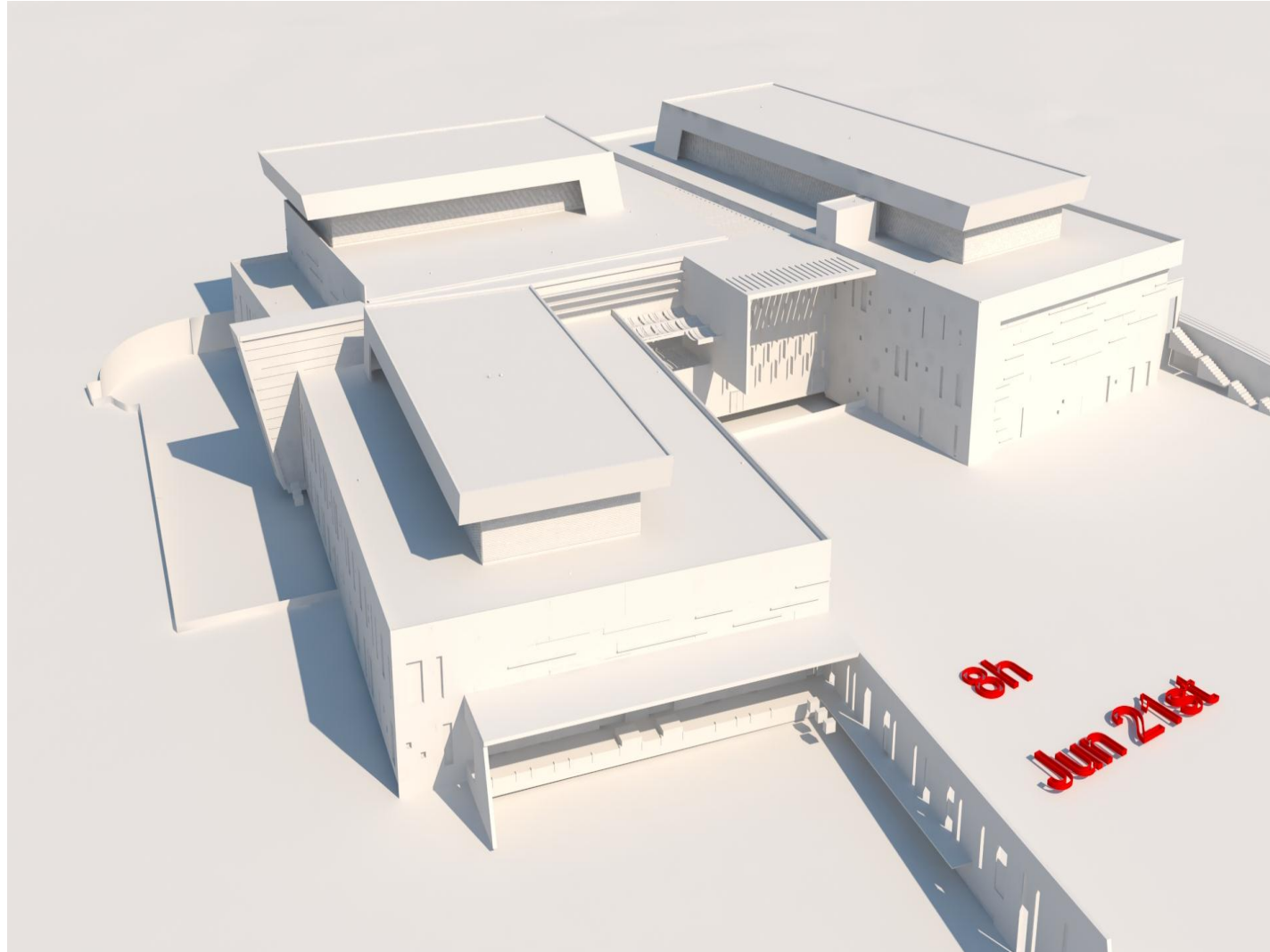


Technology Based Design Studies

TAP Faster Forward 2011



SUN STUDIES

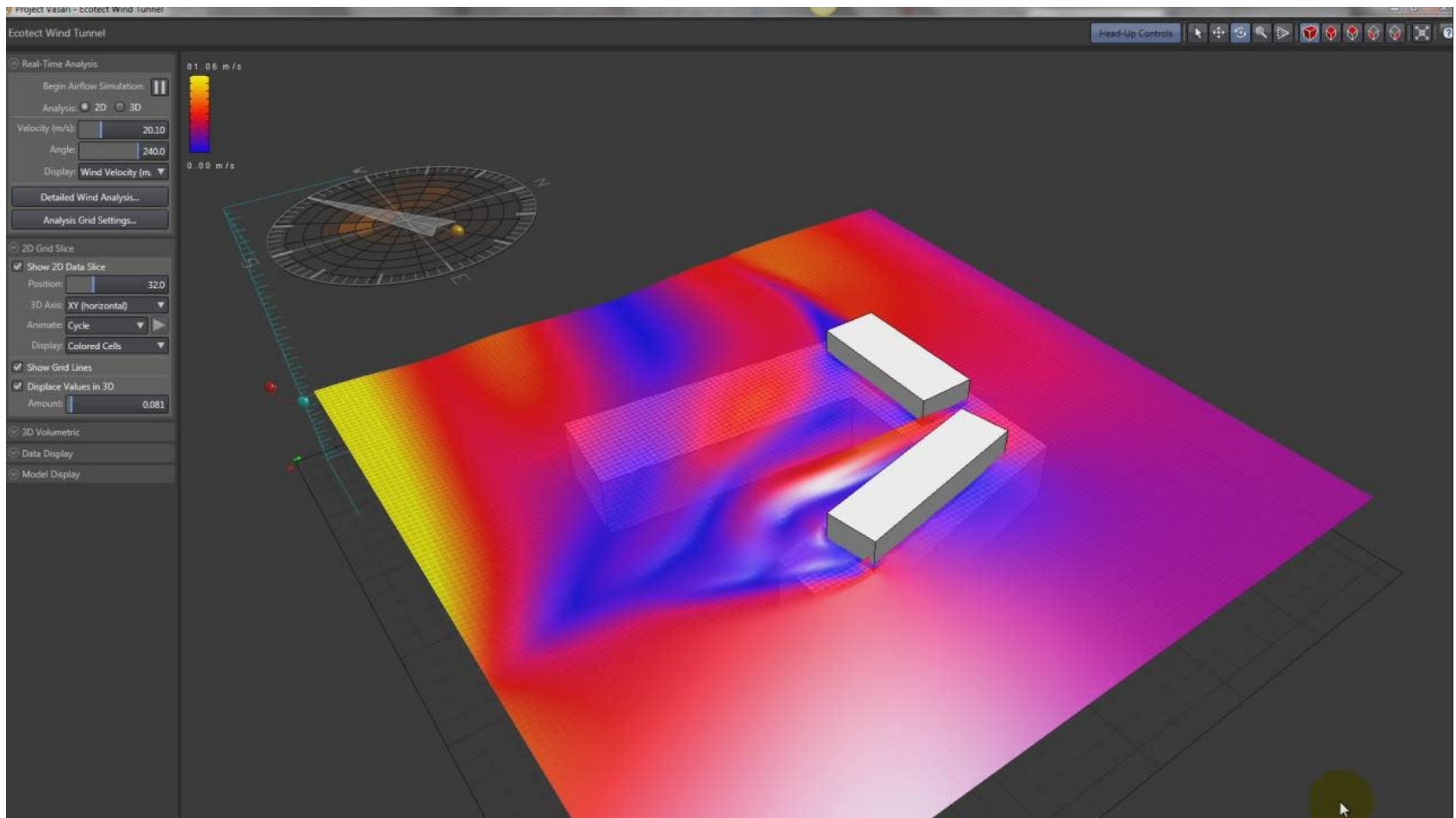


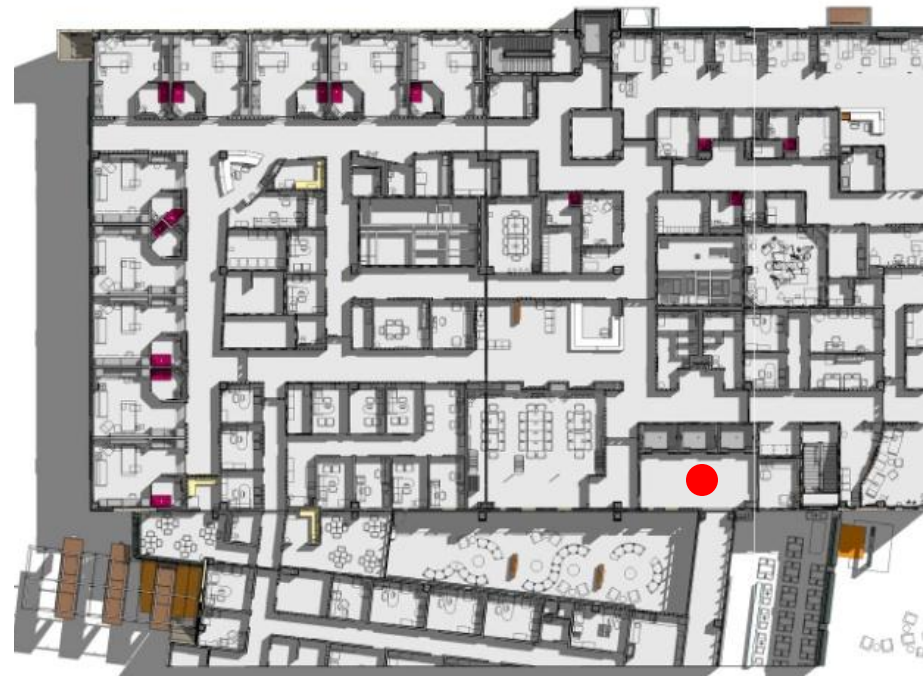
Technology Based Design Studies

TAP Faster Forward 2011



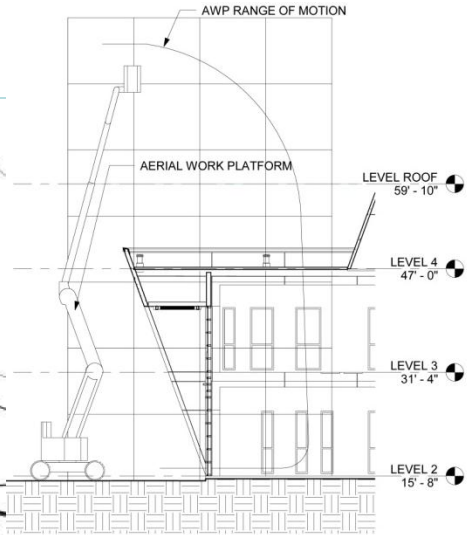
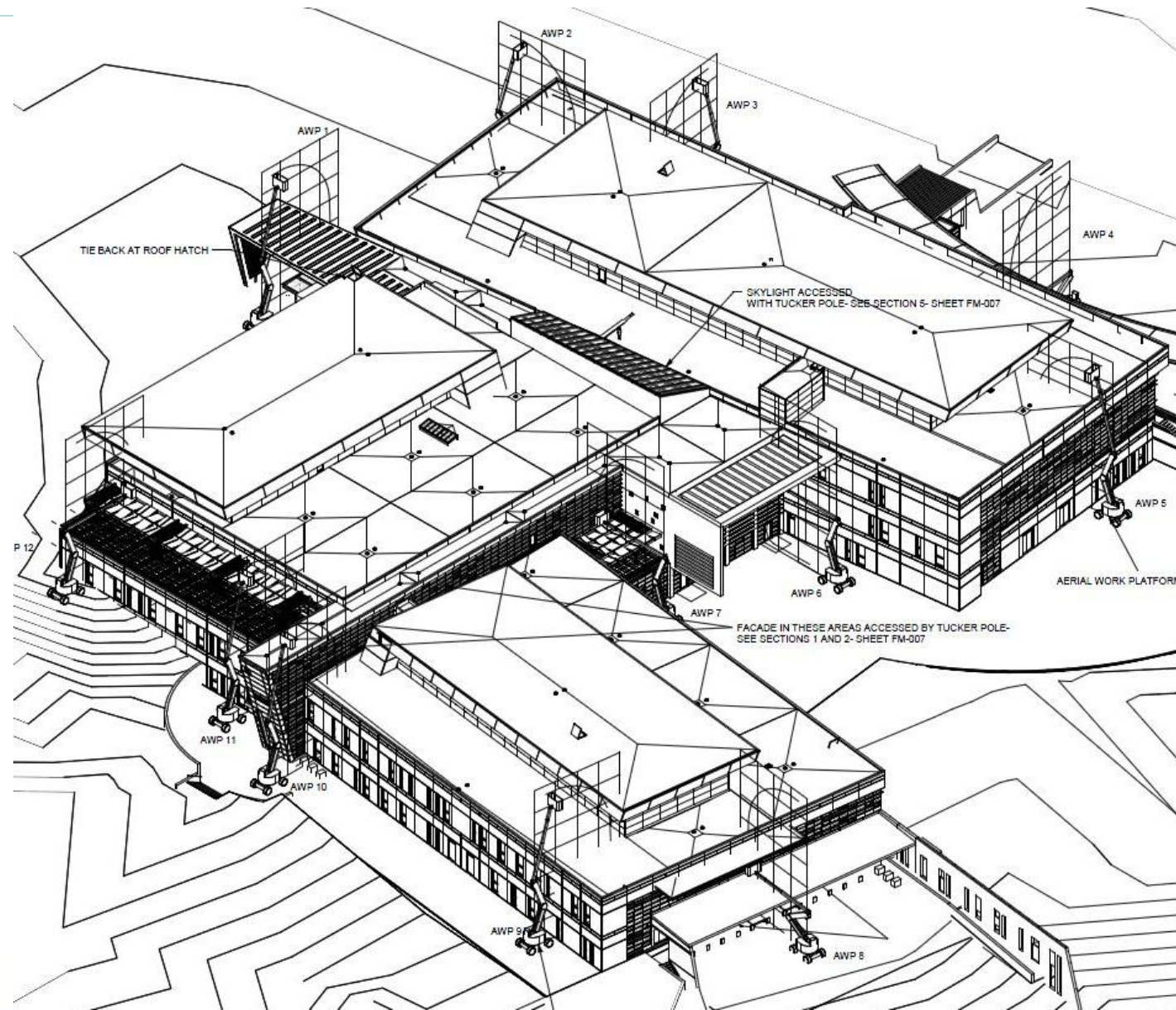
WIND SIMULATION



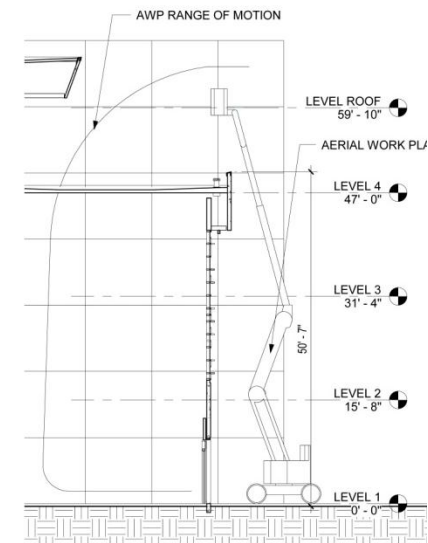


Visualization / Simulation

FACILITY MAINTANANCE STUDIES



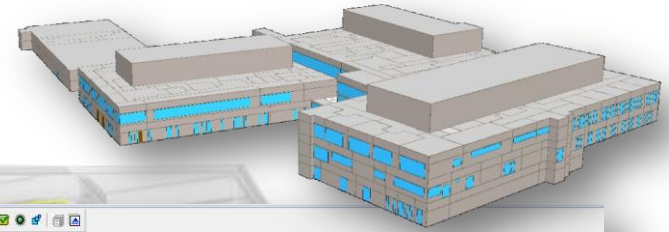
SECTION AT HOSPITAL WEST FACADE
3/32" = 1'-0"



5 SECTION AT EAST FACADE-
3/32" = 1'-0"

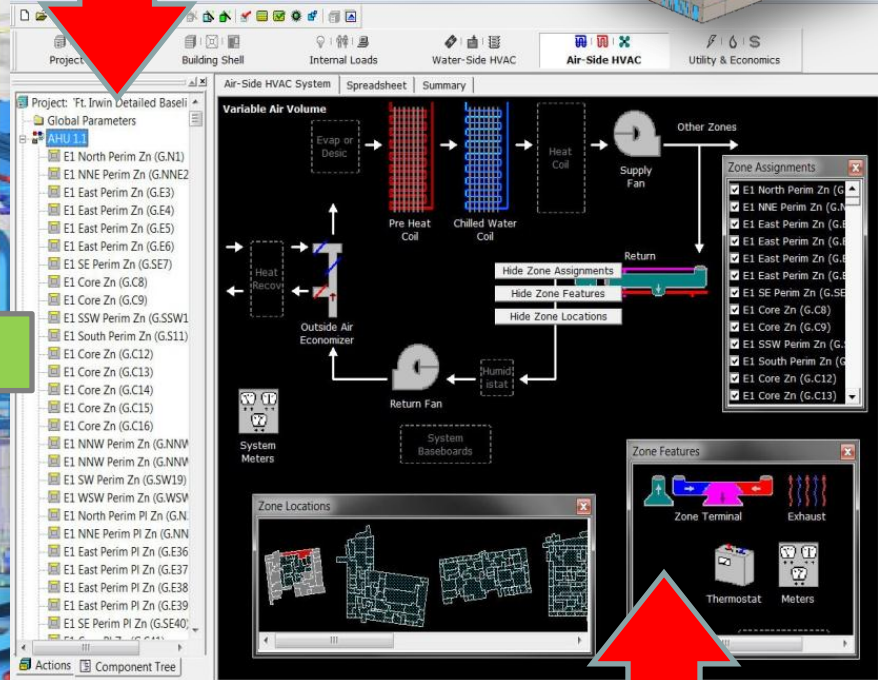
Comprehensive Energy Model

Inputs from Architecture



- Building Envelope
- Mechanical Systems
- Electrical Systems
- Controls

Optimize Design



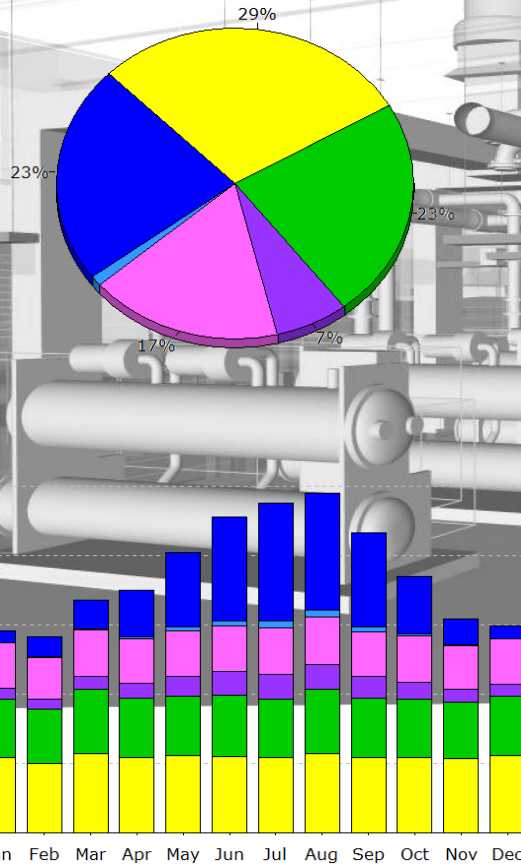
Inputs from Program (site, engineering, schedules, codes, ...)

Conservation Measures

Life Cycle Cost Analysis to justify choices

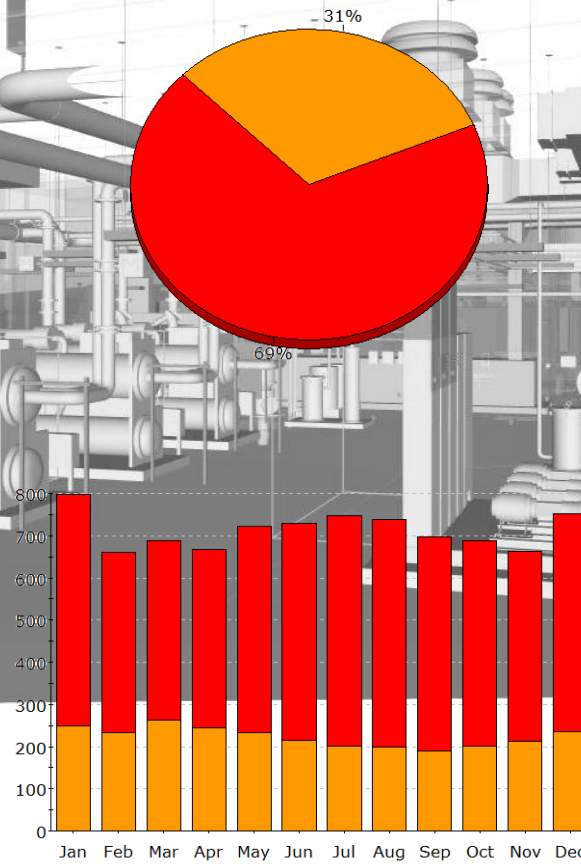
Electric Consumption

(KWh x 1,000)



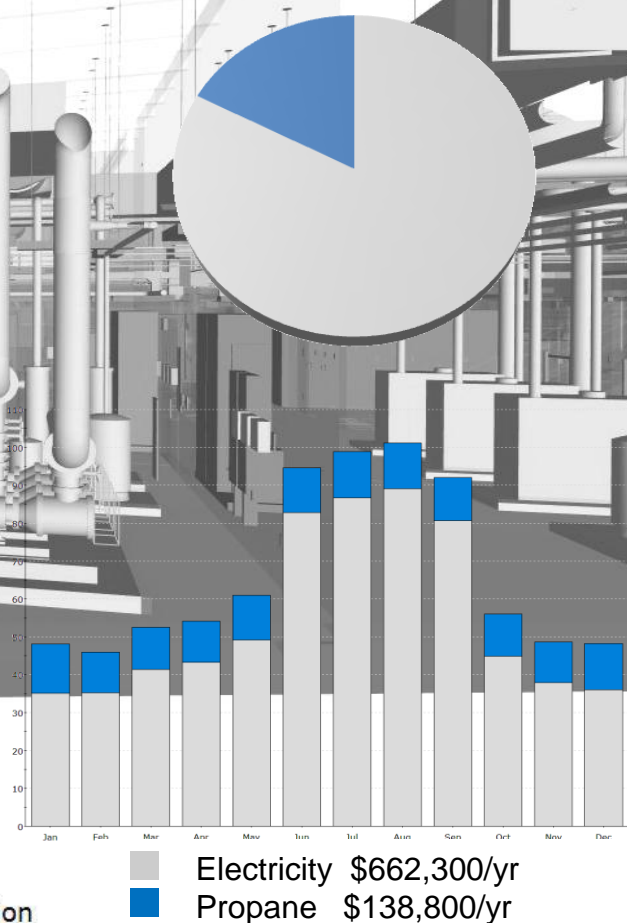
Gas Consumption

(Btu x 1,000,000)



Monthly Utility Bills

(\$)



Electricity \$662,300/yr
Propane \$138,800/yr

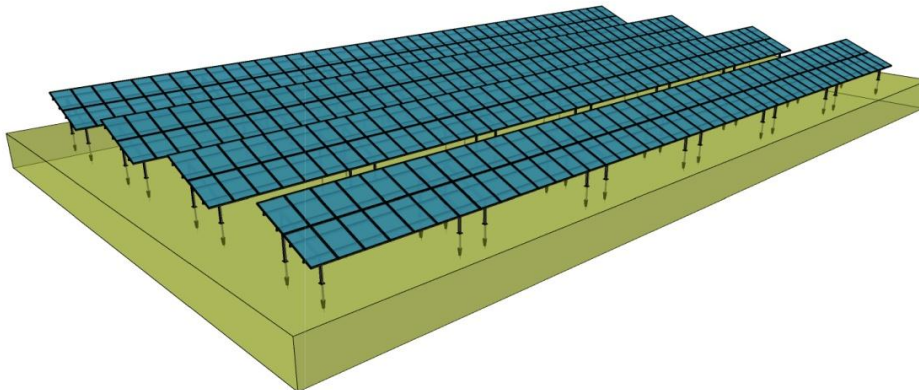
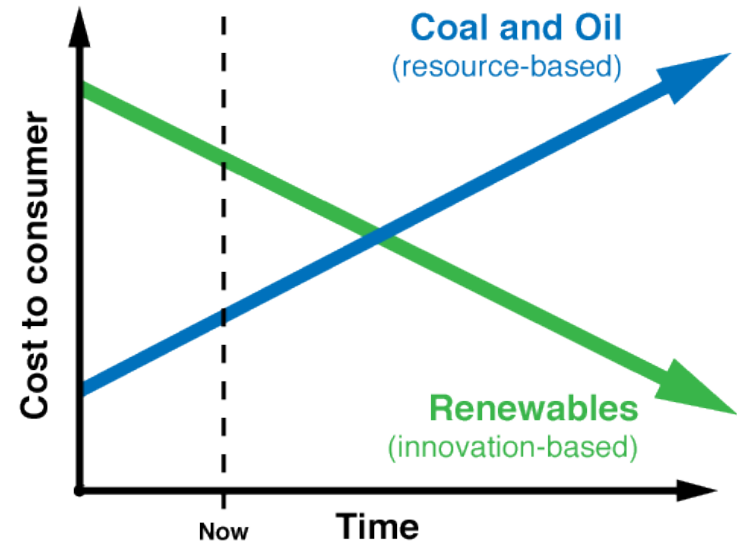
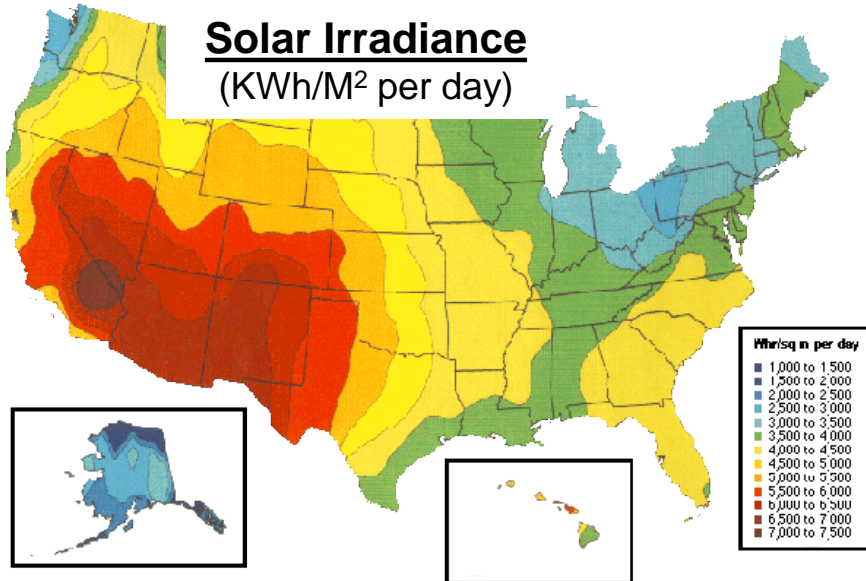
Area Lighting
Task Lighting
Misc. Equipment
Exterior Usage
Pumps & Aux.
Ventilation Fans

Water Heating
Ht Pump Supp.
Space Heating
Refrigeration
Heat Rejection
Space Cooling

Generation Measures (2nd effort)

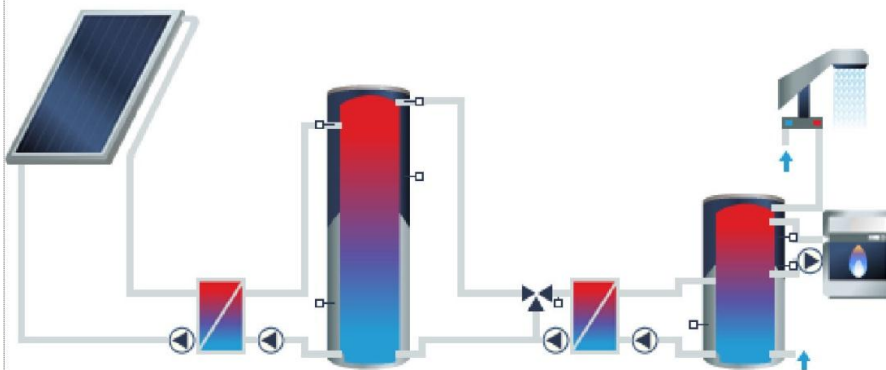
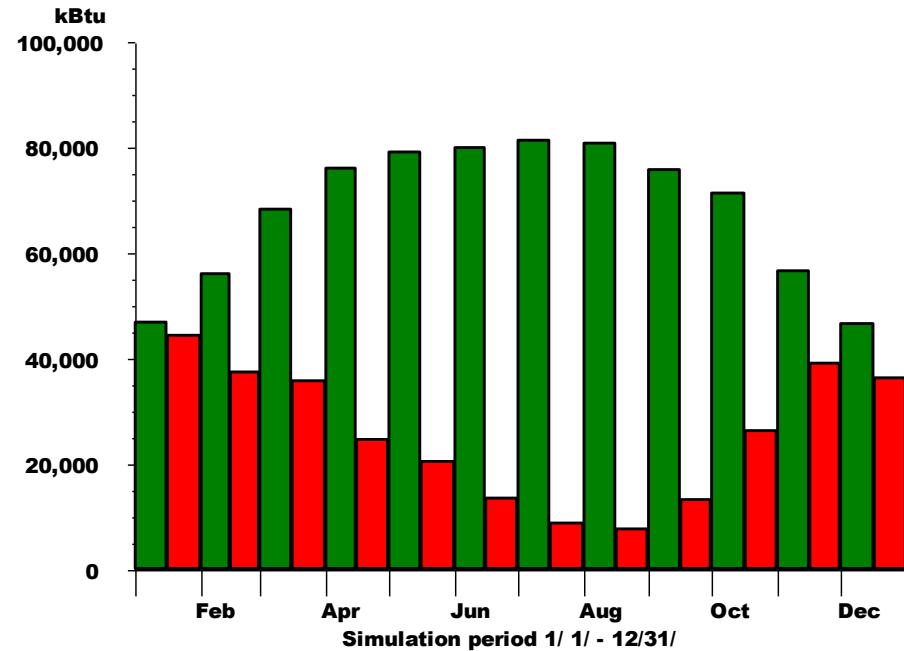
- 2 MW Solar Array
- (15 year simple payback)

Solar Irradiance
(KWh/M² per day)



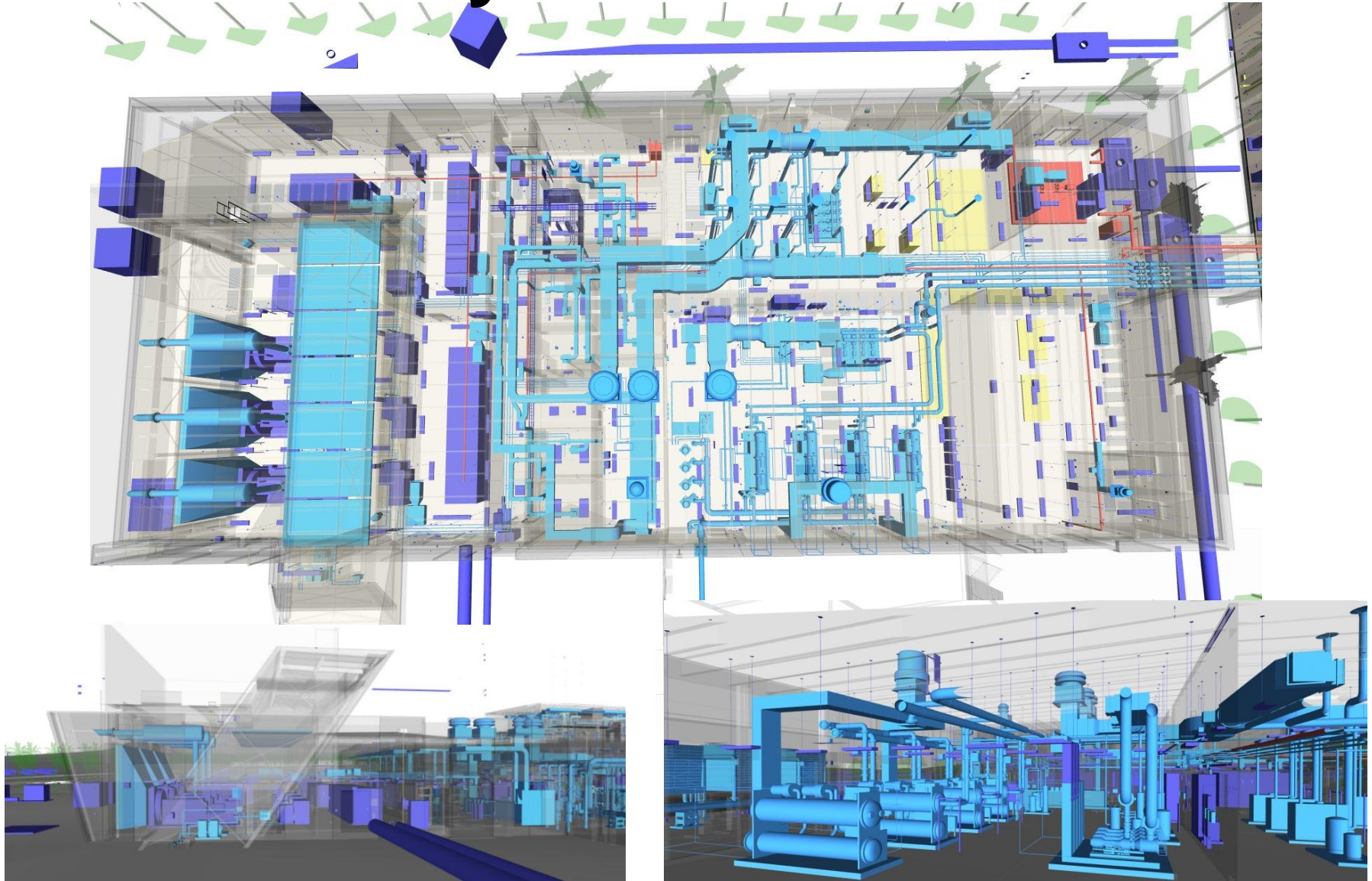
Generation Measures (2nd effort)

- 475,000 Btu/hr Solar Thermal Array
- Energy Model used to optimize components
- (12 year simple payback)

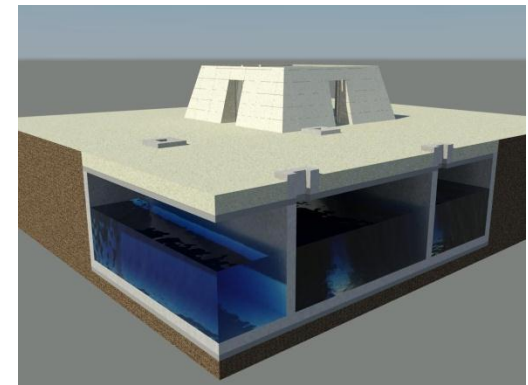


■ Solar Contribution
■ Auxiliary Heating

Central Utility Plant



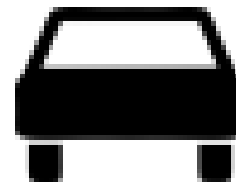
Central Utility Plant



Environmental Benefits

- **3,925** Metric Tons per year reduction of green house gas emissions below ASHRAE Baseline

= Reduction of emissions
of 750 Cars per year



= Reduction of 441,500 gallons
of gas or 9,145 barrels of oil
consumption per year



= Carbon sequestered annually
by 840 acres of forest per year



LEED Goals

Must Achieve:
LEED Silver

Goal:
LEED Platinum



1	0	0	0	0	SSc5.2	Protect or Restore Habitat
1	0	0	0	0	SSc6.1	Site Development Maximize Open Space
1	0	0	0	0	SSc6.2	Stormwater Design Quantity Control
0	1	0	0	0	SSc7.1	Stormwater Design Quality Control
0	1	0	0	0	SSc7.2	Heat Island Effect Non-Roof
0	1	0	0	0	SSc7.2	Heat Island Effect Roof
0	1	0	0	0	SSc8	Light Pollution Reduction
6	1	3	0	0	Water Efficiency	
4	0	0	0	0	Piered 1 Water Use Reduction	
4	0	0	0	0	WEc1	Water Efficient Landscaping Reduce by 50%; 100%
0	0	2	0	0	WEc2	Innovative Wastewater Technologies
2	1	1	0	0	WEc3	Water Use Reduction 30%, 35%, 40% Reduction
33	0	0	0	2	Energy and Atmosphere	
					EAp1	Fundamental Commissioning
					EAp2	Minimum Energy Performance
					EAp3	Fundamental Refrigerant Management
19	0	0	0	0	EAc1	Optimize Energy Performance
7	0	0	0	0	EAc2	On-Site Renewable Energy
2	0	0	0	0	EAc3	Enhanced Commissioning
2	0	0	0	0	EAc4	Enhanced Refrigerant Management
3	0	0	0	0	EAc5	Measurement & Verification
0	0	0	0	2	EAc6	Green Power

11	1	1	2	0	Indoor Environmental Quality	
					IEQp1	Minimum IAQ Performance
					IEQp2	Environmental Tobacco Smoke (ETS) Control
1	0	0	0	0	IEQc1	Outdoor Air Delivery Monitoring
					IEQc2	Increased Ventilation
1	0	0	0	0	IEQc3.1	Construction IAQ Management Plan During Construction
1	0	0	0	0	IEQc3.2	Construction IAQ Management Plan Before Occupancy
1	0	0	0	0	IEQc4.1	Low-Emitting Materials Adhesives & Sealants
1	0	0	0	0	IEQc4.2	Low-Emitting Materials Paints & Coatings
1	0	0	0	0	IEQc4.3	Low-Emitting Materials Flooring Systems
1	0	0	0	0	IEQc4.4	Low-Emitting Materials Composite Wood & Agrifiber Products
1	0	0	0	0	IEQc5	Indoor Chemical & Pollutant Source Control
0	1	0	0	0	IEQc6.1	Controllability of Systems Lighting
0	0	1	0	0	IEQc6.2	Controllability of Systems Thermal Comfort
1	0	0	0	0	IEQc7.1	Thermal Comfort, Design
1	0	0	0	0	IEQc7.2	Thermal Comfort, Verification
0	0	0	1	0	IEQc8.1	Daylight & Views, Daylight 75% of Spaces
0	0	0	1	0	IEQc8.2	Daylight & Views, Views for 90% of Spaces
6	0	0	0	0	Innovation & Design Process	
1	0	0	0	0	IDc1.1	Innovation in Design/Exemplary Performance: SSc5.2
1	0	0	0	0	IDc1.2	Innovation in Design/Exemplary Performance: EA2
1	0	0	0	0	IDc1.3	Innovation in Design: Acoustic Consultant
1	0	0	0	0	IDc1.4	Innovation in Design: Green Cleaning
1	0	0	0	0	IDc1.5	Innovation in Design: Green Education
1	0	0	0	0	IDc2	LEED Accredited Professional
4	0	0	0	0	Regional Priority	
1	0	0	0	0	RPc1.1	IDc1.1 Regional Priority: WEc1.1
1	0	0	0	0	RPc1.2	IDc1.2 Regional Priority: SSc1
1	0	0	0	0	RPc1.3	IDc1.3 Regional Priority: SSc4.1
1	0	0	0	0	RPc1.4	IDc1.4 Regional Priority: EA2

Yes	Likely	Unlikely	No
81	7	11	11

Next Steps:

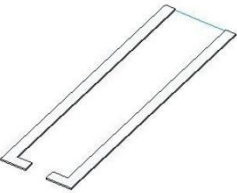
- **LEED Documentation**
 - Some credits are underway
 - Begin during S6
 - Energy Model – ongoing evolution
- **LEED-Online Design Review Schedule**
 - Typically allow 3-4 weeks after complete design information
 - Realizing tight schedule – Submit by 12/7

Certification Target	SILVER	Certified: 40-49
Anticipated	PLATINUM	Silver: 50-59
		Gold: 60-79
		Platinum: 80-110

LEED Validation Documents



Bicycle rack



Standard Bicycle Rack Space

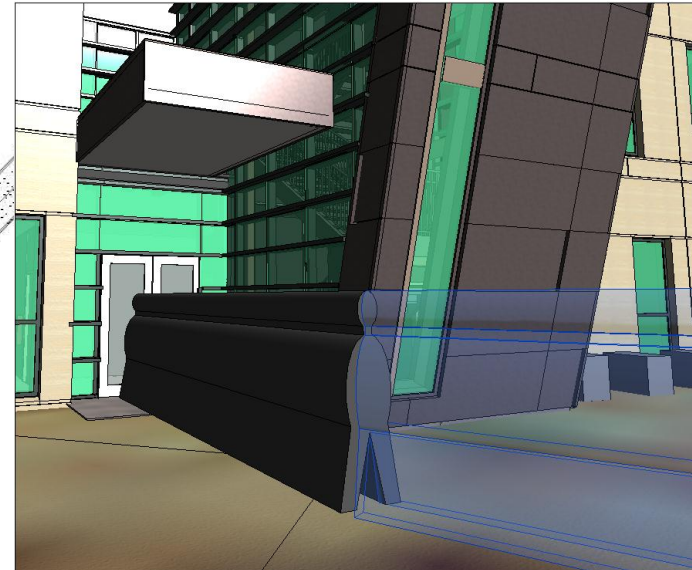
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1	0	0	0	
3	0	0	0	R
2	0	0	0	R

- SSc4.1 Alternative Transportation
Public Transportation Access
- SSc4.2 Alternative Transportation
Bicycle Storage & Changing Rooms
- SSc4.3 Alternative Transportation
Low-Emitting & Fuel-Efficient Vehicles
- SSc4.4 Alternative Transportation
Parking Capacity



LEED-SS 4.2 Bicycle Rack Count Schedule			
No of Occupants	% of Occupants	Type	Count
283	14.15	Bicycle Rack	12

LEED-SS 4.2 Bicycle Rack Path - Running Length Schedule		
Exit Route	Distance	Distance in Yards
Path A	155' - 8 1/8"	467.03
Path B	131' - 4 3/32"	394.03



U.S. Army Corps of Engineers
Sacramento District

PROJECT: **PORT IRWIN HOBBY & RECREATION CENTER**

LOCATION: **PORT IRWIN, CALIFORNIA**

DATE: **10/10/11**

DESIGNED BY: **URS**

CHECKED BY: **URS**

APPROVED BY: **URS**

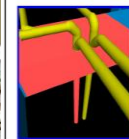
CALIFORNIA
PORT IRWIN HOBBY & RECREATION CENTER
ALTERNATIVE TRANSPORTATION BICYCLE STORAGE & CHANGING ROOMS

Sheet Reference Number
SS 4.2

SHEET **01**

IF SHEET MEASURES LESS THAN 22" X 34" IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY





Name
Distance
Description
Clash Point
Date Created

Clash35
-0.805ft
Hard
-663.351ft, -762.312ft, 9
2010/3/13 08:41:48

Item 1

Reference Level Name
Element Category
Item Name
Element ID Value

Item 2

Reference Level Name
Element Category
Item Name
Element ID Value

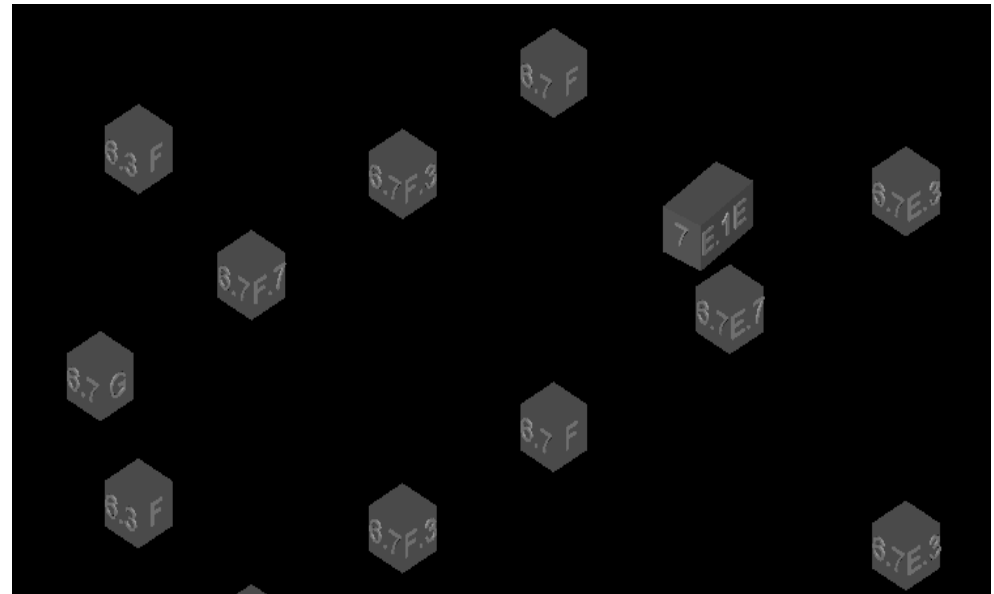
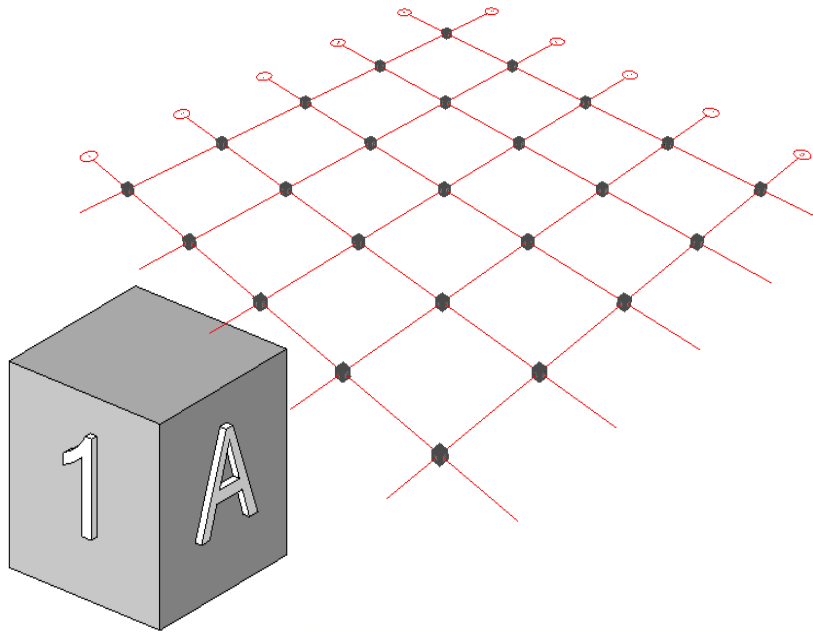
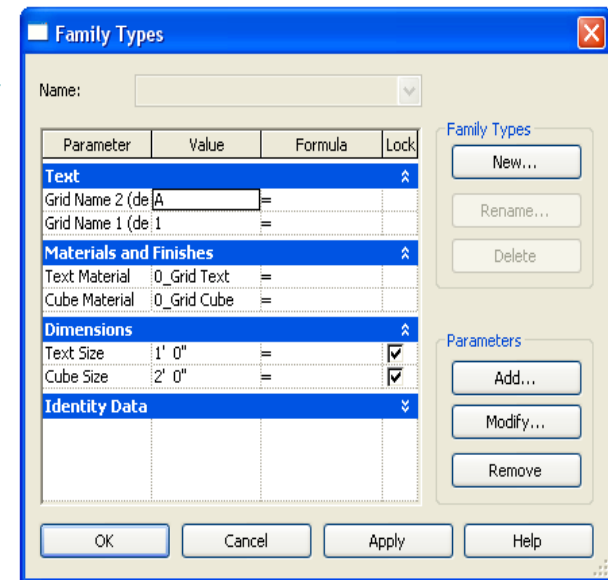
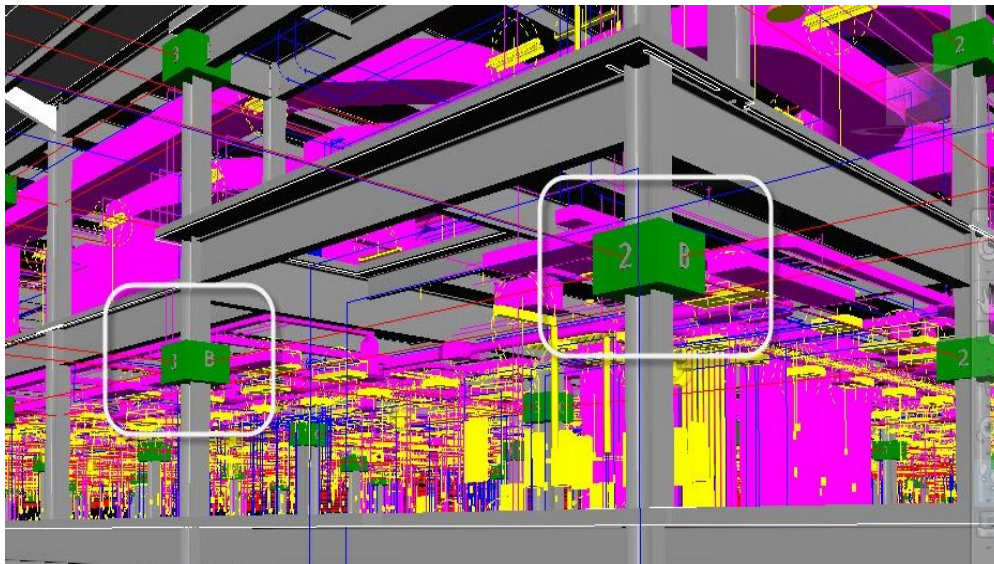
Level C5
Pipes
RW
1352141

Clash Detection Reports

Building Systems: Full Exposure



TAP Faster Forward 2011

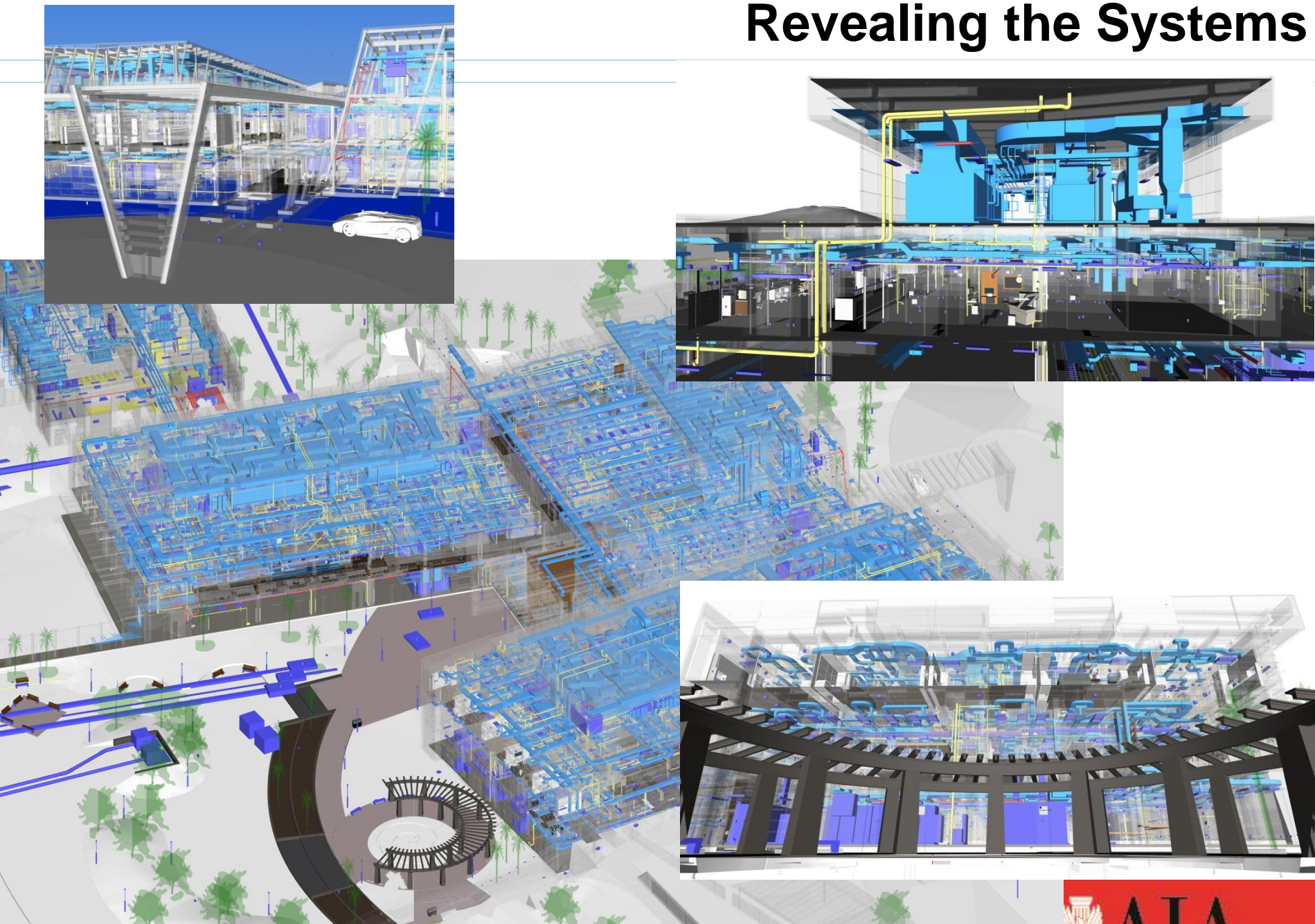


Finding Your Way in Navisworks

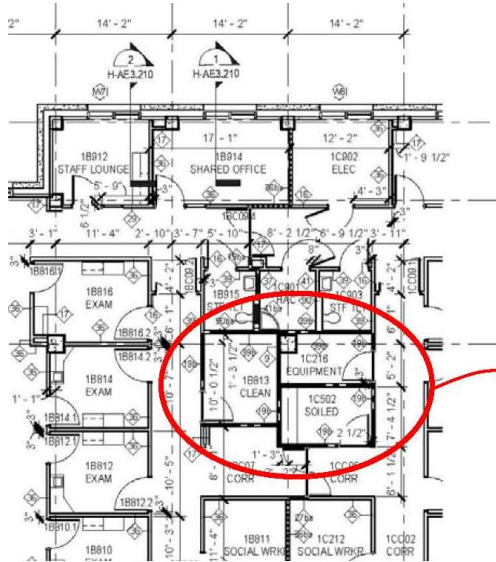
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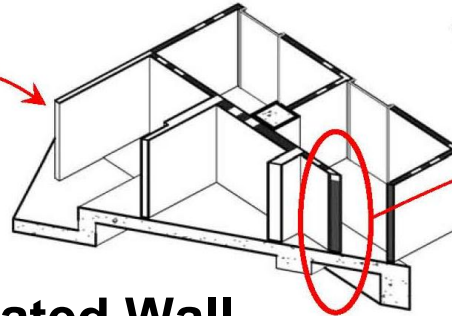
Revealing the Systems



NEW CONTRACT DOCUMENT STANDARDS



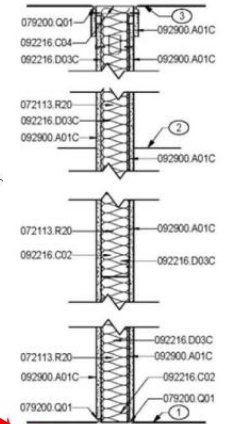
- G. DIMENSIONS ARE TO COLUMN GRID, FACE OF MASONRY OR CONCRETE, INSIDE FACE OF SHAFT WALL OR TO FACE OF METAL STUD.
- H. SEE H-A5.7 SERIES FOR WINDOW AND LOUVER TYPES.
- I. REFER TO PLUMBING PLANS, H-MP1 SERIES, FOR FLOOR DRAIN LOCATIONS.
- J. REFER TO SHEET H-AE5.210 FOR TYPICAL EXPANSION JOINT DETAILS.



2 Layers Gyp. Bd.

Metal Stud Layer with Fire Rating Fill Pattern applied

1 Layer Gyp. Bd.



Section

Plan

Section

Parametric Rated Wall Patterns

AL / CLINIC AREA A, ZONE 2 CONSTRUCTION PLAN		A NEW HOSPITAL FOR VAMC ORLANDO, FLORIDA		Project Number 673-950		OFFICE OF FACILITIES MANAGEMENT	
Location Orlando, Florida		Building Number 01 AND 02		Drawing Number H-AE1.1FA2		Department of Veterans Affairs	
Date 9 DECEMBER, 2009	Checked BKH	Drawn EB / RLF		Dwg. of			

B. Partition Type Detail

WALL SCHEDULE				
Type Mark	Partition Type Code	Description	Area	Length
9	09P2103	2 1/2" Metal Stud, 5/8" Gypsum Board on 1 Side 6" above Ceiling	4252.1 SF	444' - 8 65/128"
13c	09P2702c	4" "C-H" Metal Stud, Batt Insulation, 5/8" Gypsum Board on 2 Sides at Full Height	2897.0 SF	134' - 0 181/256"
16	09P4101	3 5/8" Metal Stud, 5/8" Gypsum Board on 2 Sides 6" above Ceiling	17006.8 SF	4967' - 7 9/32"
17	09P4103	3 5/8" Metal Stud, 5/8" Gypsum Board on 1 Side 6" above Ceiling	28713.6 SF	2233' - 9 85/128"
20c	09P4109c	3 5/8" Metal Stud, 2 layer of 5/8" Gypsum Board on 2 Sides at Full Height	9598.4 SF	568' - 9 39/256"
26	09P4201	3 5/8" Metal Stud, Batt Insulation, 5/8" Gypsum Board on 1 Side at Full Height	1372.3 SF	247' - 9 21/128"
			63840.3 SF	8596' - 8 123/256"

Is the Object Identifiable and Can You Count it ?

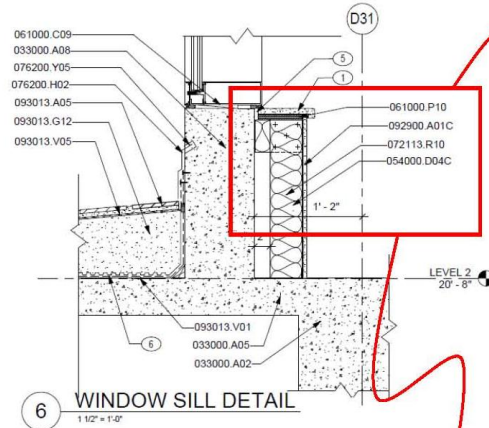
TAP Faster Forward 2011



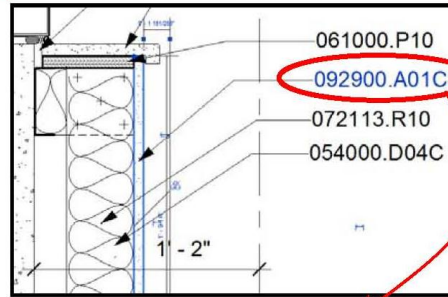
WALL SECTION AND DETAIL INTELLIGENCE

BIM Material Notation:

Rather than using loose text, BIM software allows linking model objects to an editable text file that holds specification data for Construction Document notation purpose via the object's parameters. This notation shall have the ability to be shown by either numeric specification section or description:



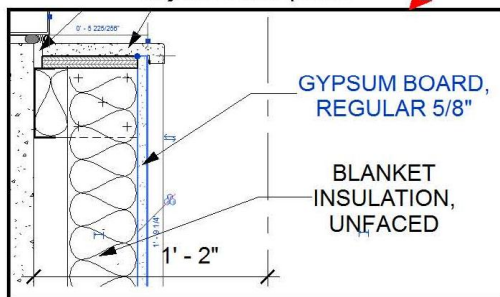
Specification Section:



092900.A01C

Specification Section Catalog Sorting Digits

Object Description:



GYPSUM BOARD,
REGULAR 5/8"

BLANKET
INSULATION,
UNFACED

060000	WOOD AND PLASTIC
070000	THERMAL AND MOISTURE P
080000	DOORS AND WINDOWS
090000	FINISHES
092216	NON-STRUCTURAL METAL F
092400	PORTLAND CEMENT PLASTE
092600	VENEER PLASTERING
092900	GYPSUM BOARD
092900.A01	GYPSUM BOARD, REGULAR
092900.A01A	GYPSUM BOARD, REGULAR 15MM
092900.A01B	GYPSUM BOARD, REGULAR 16MM
092900.A01C	GYPSUM BOARD, REGULAR 5/8"
092900.A02	GYPSUM BOARD, FIRE RESISTANT 5/8"
092900.A02A	GYPSUM BOARD, FIRE RESISTANT 15MM

Keynote Text:

GYPSUM BOARD, REGULAR 5/8"

NOTES:

SHEET NOTES:

- REFER TO SHEET G-011 FOR GENERAL ABBREVIATIONS AND ARCHITECTURAL SYMBOLS.
- EXTEND GYPSUM BOARD TO BOTTOM OF CEILING PLATFORM IN AREAS WHERE A CEILING IS SCHEDULED.
- REFER TO FIN FOR FINISH IN.
- SEE SHEETS FOR SAFETY PLAN.

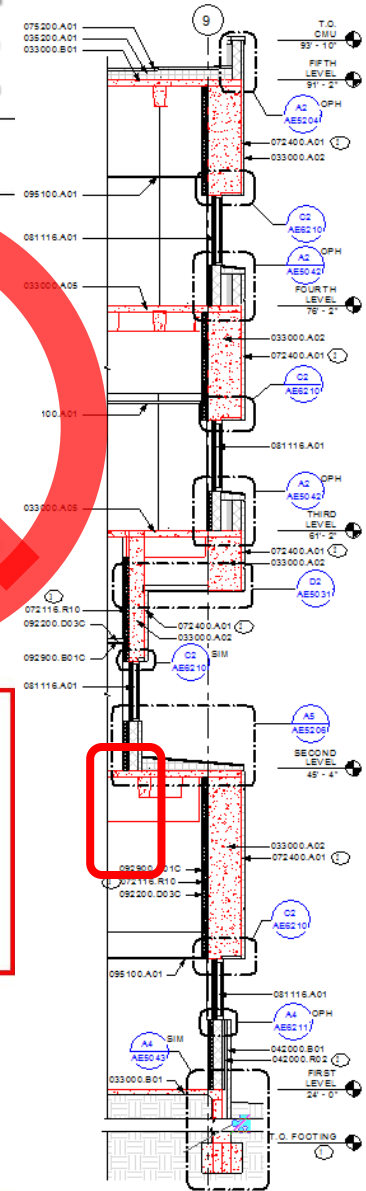
KEYNOTES

- SOLID SURFACE STOOL ON PLYWOOD 1/2" FROM CONCRETE CURB AND LOOSE PACK w/INSULATION
- REFER TO REFLECTED CEILING PLAN FOR CEILING HEIGHTS
- DRAWERY POCKET
- PARTITION TYPE 77C
- HOLD BACK OF STOOL & PLYWOOD 1/2" FROM CONCRETE CURB AND LOOSE PACK w/INSULATION
- DRAINAGE MAT

Loose Text / Lines

MATERIAL NOTES

072113.R20	SOUND ATTENUATION BATTS
078400.Q01	FIRESTOPPING SEALANT
079200.Q01	JOINT SEALANT
092216.C02	STEEL STUD RUNNER TRACK
092216.D03C	STEEL STUD 3 5/8"
092900.A01C	GYPSUM BOARD, REGULAR 5/8"
092900.A02C	GYPSUM BOARD, FIRE RESISTANT 5/8"
092900.B01C	GYPSUM BOARD, GLASS MAT FACED 5/8"
092900.C01C	GYPSUM BOARD, IMPACT RESISTANT 5/8"
092900.M05	REVEAL TRIM
093013.A01	CERAMIC TILE

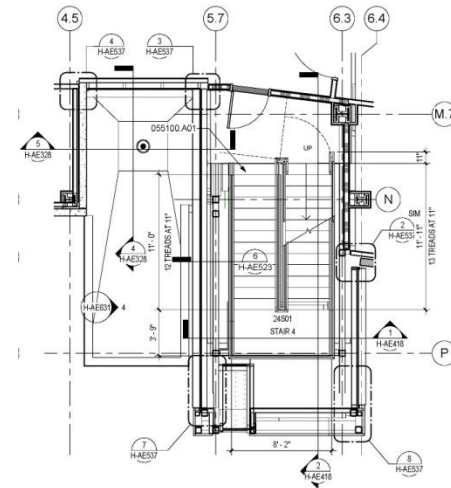
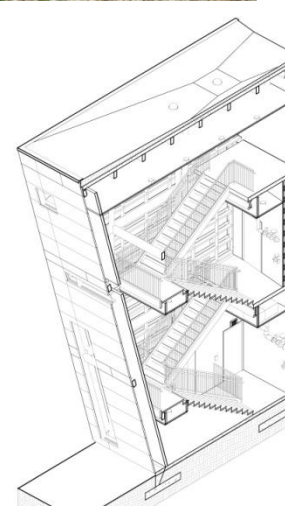
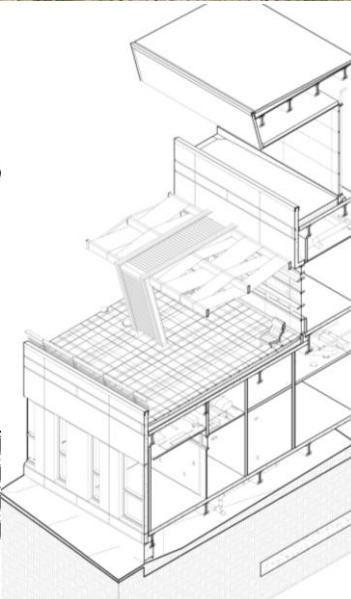
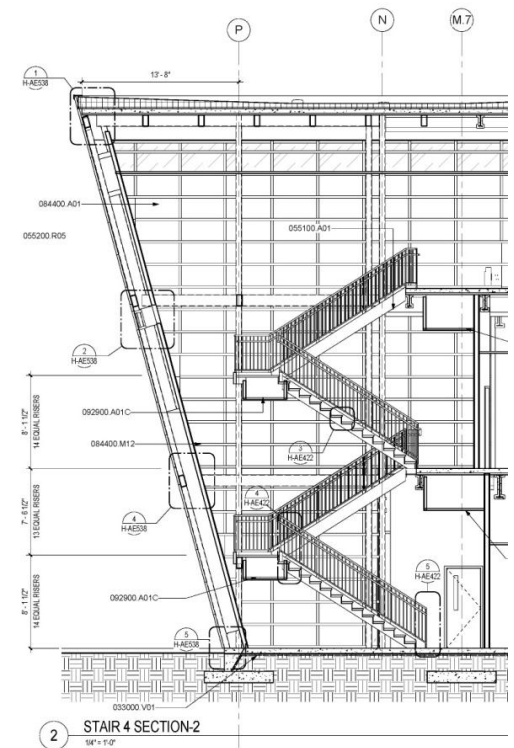
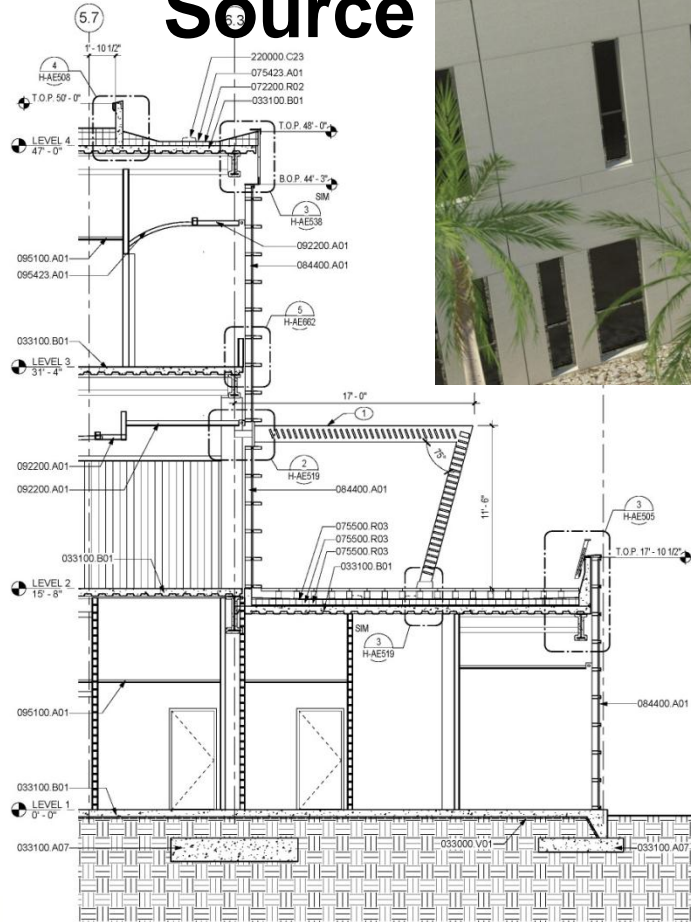


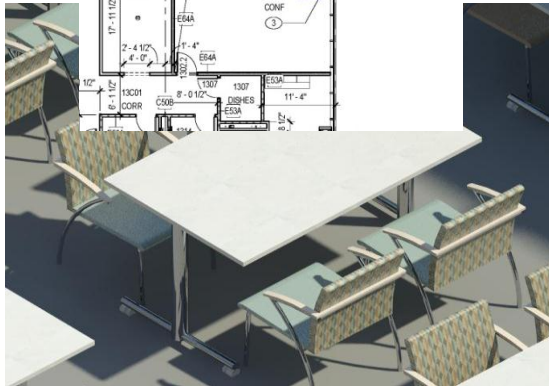
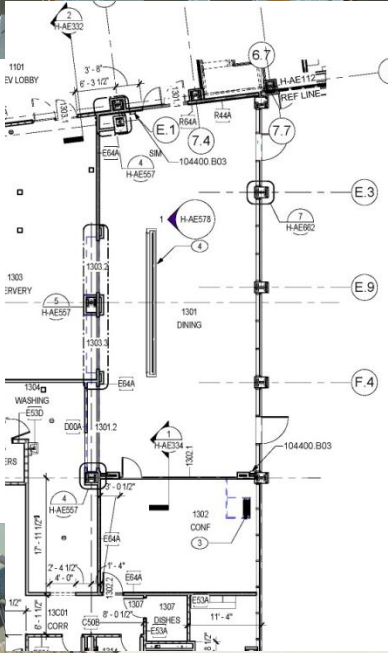
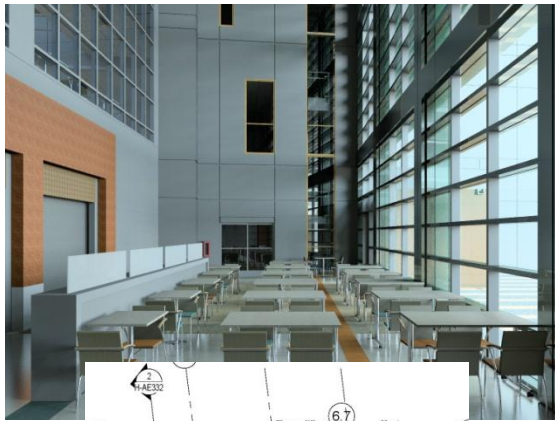
Element Based Integration of Schedules, Drawings and Specifications

TAP Faster Forward 2011



Renderings Contract Documents Same Source



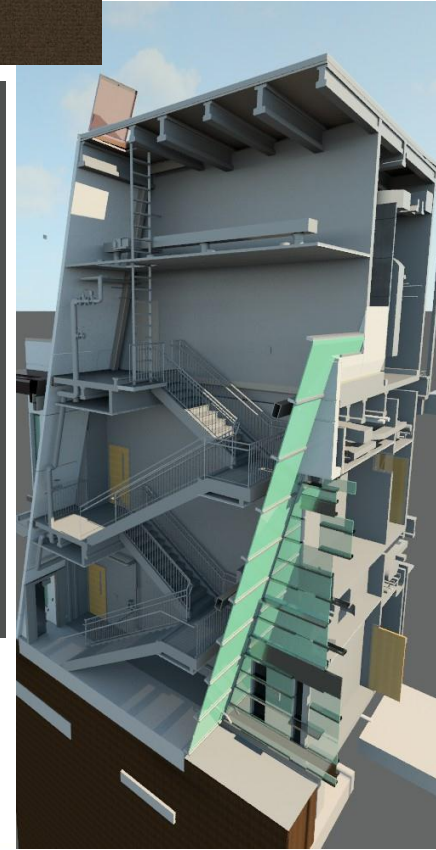
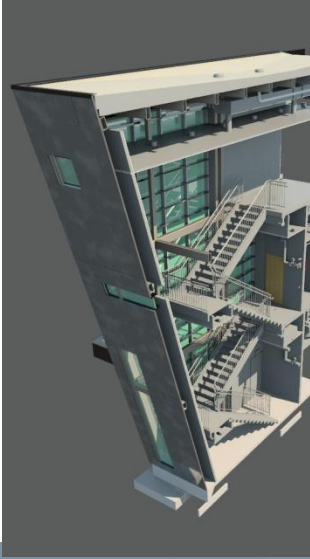
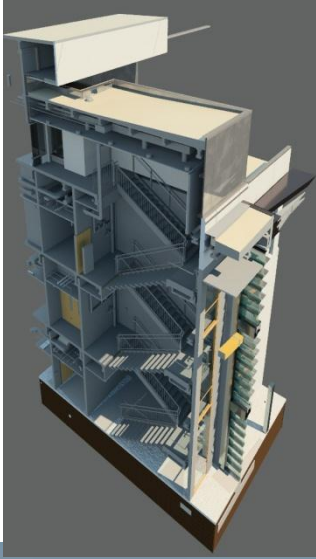
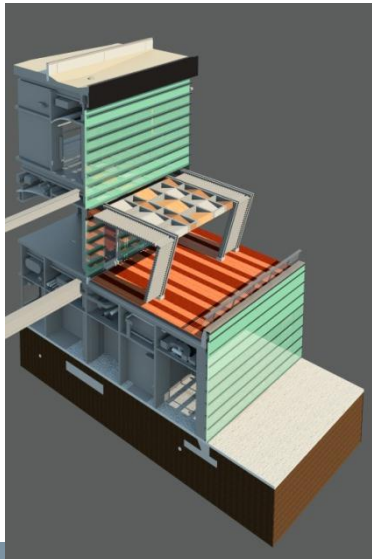


Virtual Dining Experience

1 WALL SECTION
1/4" = 1'-0"



Building Information Model Slices

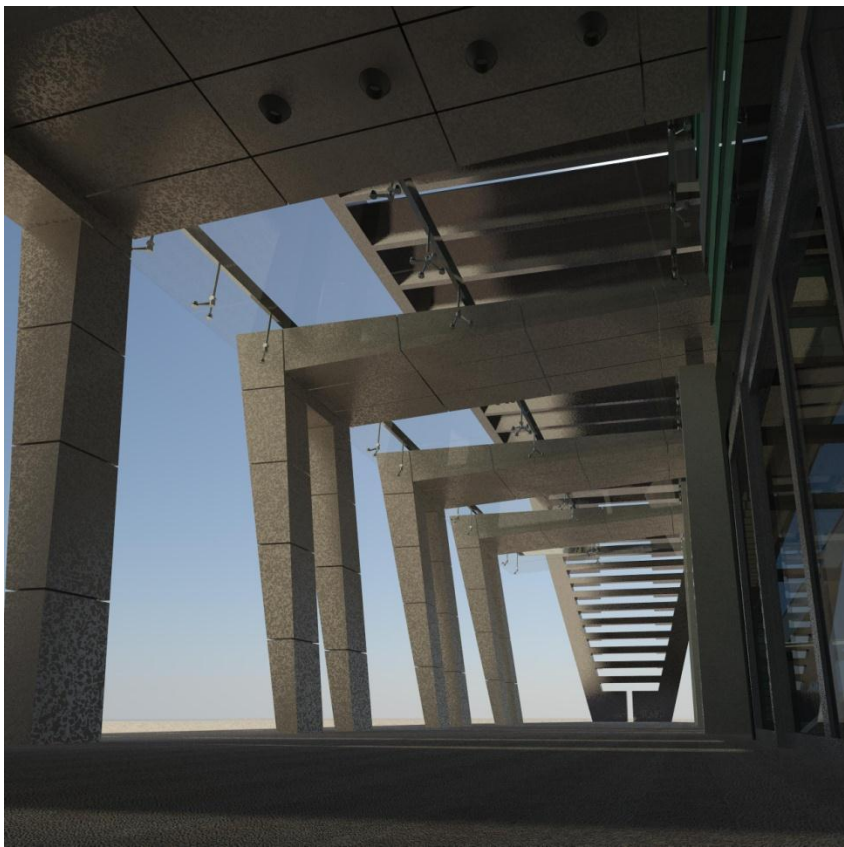




Virtual Interior Experience

TAP Faster Forward 2011





- Identify appropriate influences and standards to follow
- Analysis begins at project Award
- Identify your end goal at the beginning
- Last thought...

**Challenge Current Processes
and Expose the True Critical path of
Information Flow**

WRAP-UP

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Project and BIM Technology Manager
bkh@rlfae.com

David Fishel, PE LEED AP
Senior Energy Analyst
dcf@rlfae.com

RLF architecture | engineering | interiors
PH: 407-647-1039
www.rlfae.com



Good design
makes a difference[™]

