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Digital
Intersections

+

Integrated
Technology

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Introduction

BIM @ USC past

BIM @ USC present

BIM @ USC future

Questions

"Save often."

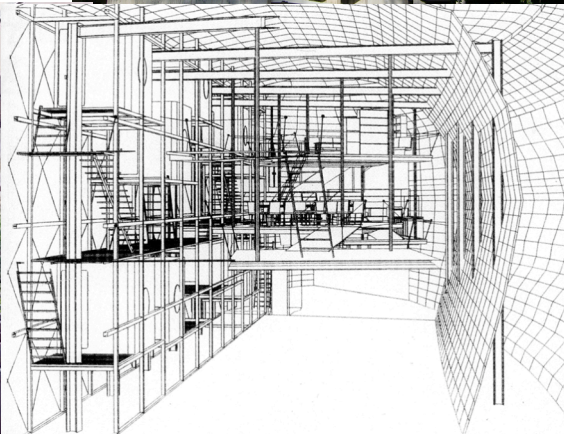
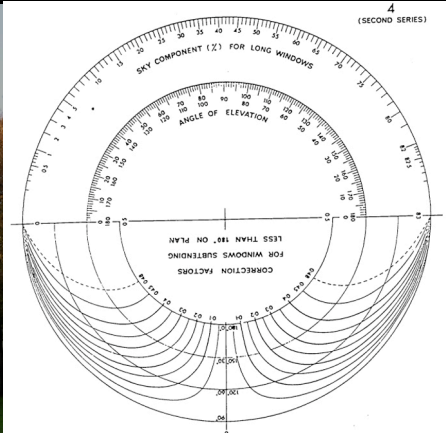
- Karen M. Kensek



Introduction

Places
Transformations

Background



“The only way forward, if we are going to improve the quality of the environment, is to get everybody involved.”

- Richard Rogers



Past Explorations

BIM

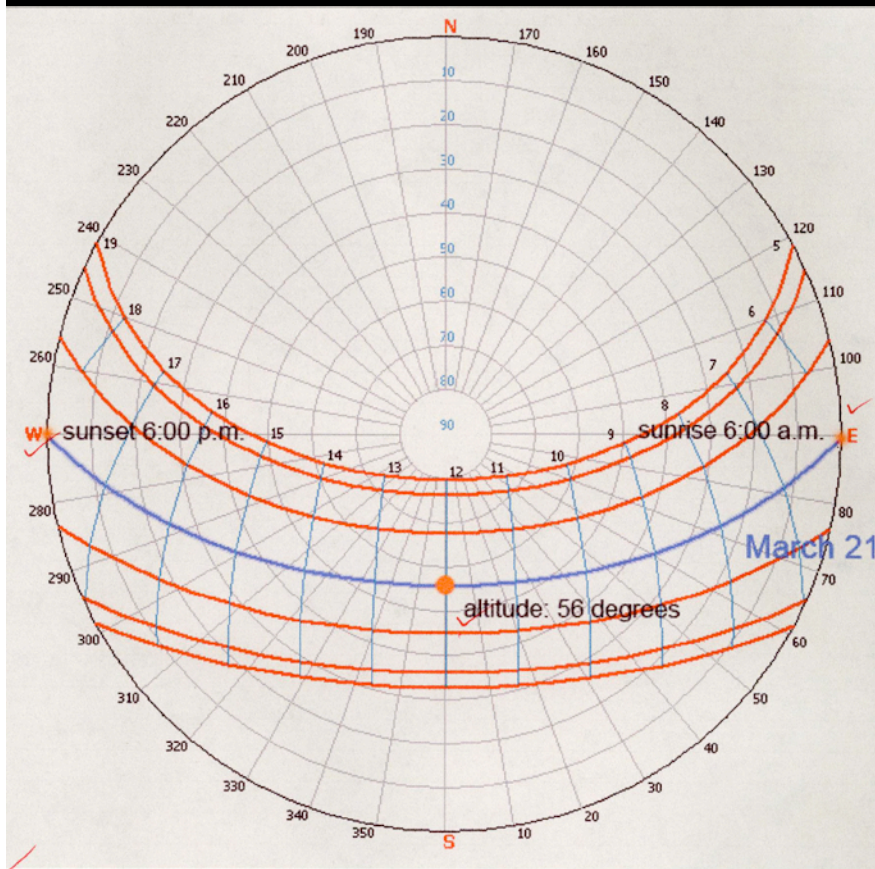
Sustainability
Integrated Technology

Intro BIM: elective courses as testing grounds

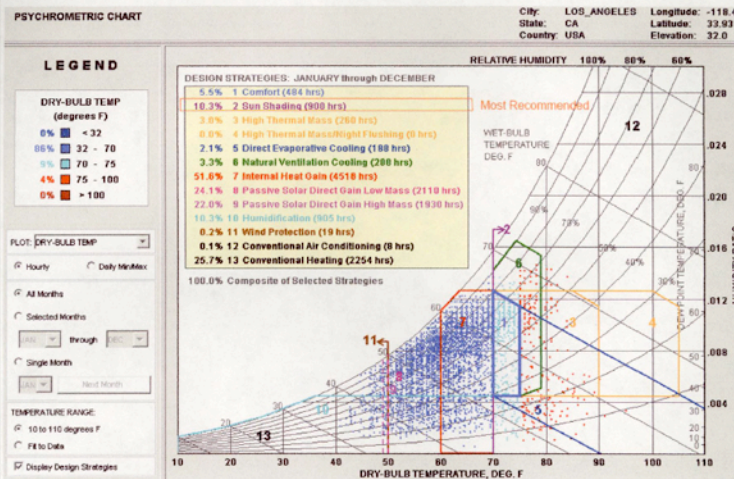
2d/3d integration, parametric modeling, interoperability



Connection to sustainable design

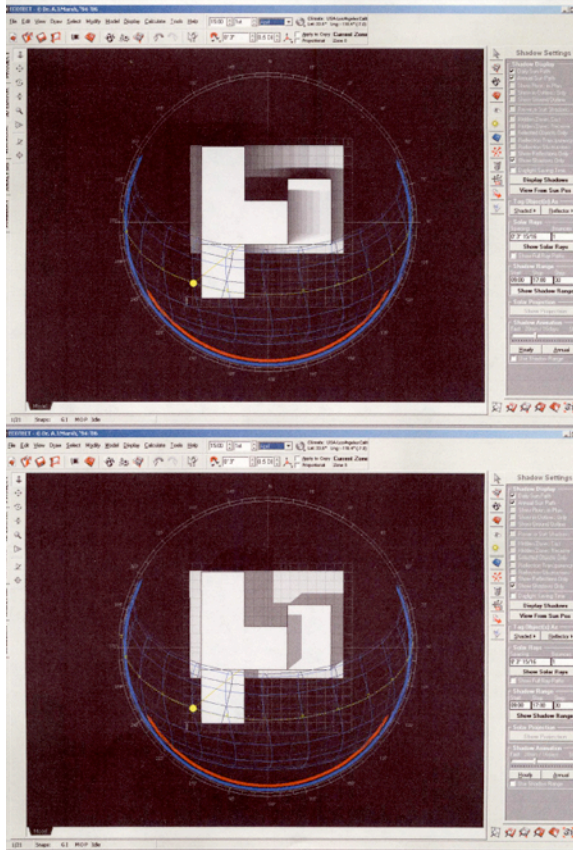


CLIMATE CONSULTANT 3 - PSYCHROMETRIC CHART

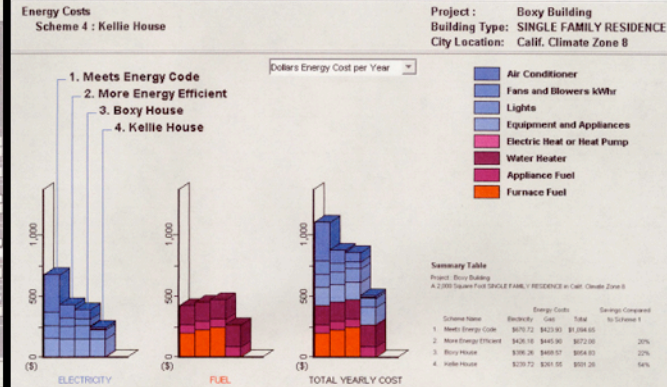


Psychrometric Chart: Dry Bulb Temperature for all months ✓
Most Recommended Design Strategy: Internal Heat Gain ✓
This can be achieved more effectively in the base building by utilizing greater amounts of glazing (more windows and openings) that allow heat and sunlight to enter the building on the southern exposures. This would add more buildings on the front, right and left (or west, south and east) sides of the building. This can be controlled through the use of shading devices as well, to block out unwanted sunlight. The California climate is conducive to buildings "opened" up to the environment with extensive amounts of glazing. In fact, glazing on the North side would also promote greater ventilation through the building due to the Northeast light winds that drift through Los Angeles.

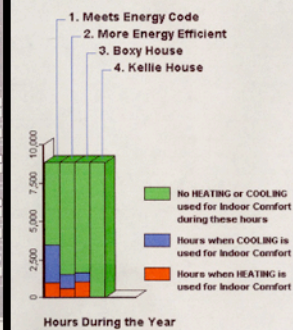
Ectotect and HEED, IES



HEED - SCHEME COMPARISONS AND IMPROVEMENT PROCEDURE

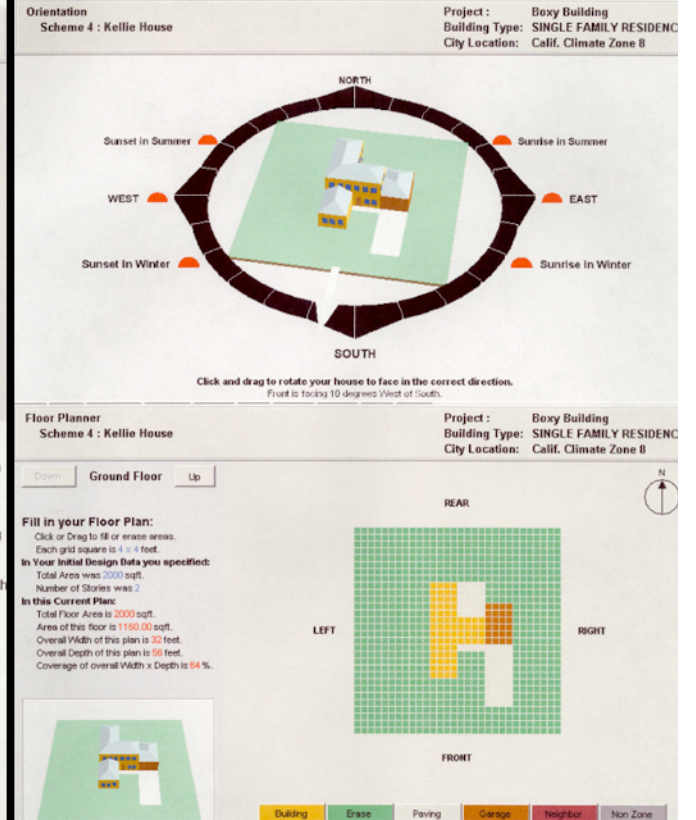


Energy Efficient Design Scheme 4 : Kellie House



PROCESS OF IMPROVING SCHEME 3: I lowered the energy use by simply removing the furnace and the air conditioner. However, in order for this to be a valid solution, I ensured that the natural ventilation and the maximum indoor temperature remains at a level of comfort throughout the year. I achieved a temperature maximum of 75 degrees F by changing the wall, window, and roof construction, maximizing windows on the south and east side, while placing overhangs and fins to shade the windows from harsh afternoon light, and reducing windows on the West side of the building. Ventilation was created by placing windows to the North of the building.

HEED - SCHEME 4 IMPROVEMENT: EXTRA CREDIT ADDITIONAL EXPLANATION DIAGRAMS



Autodesk Sustainability Curriculum +/-

Unit 2 Modeling the Sustainable Building Site Exercise: Permeable/Non-permeable

Permeable / Non-permeable Surface Analysis with Areas and Color Fills

Analysis type:	Software required:	Starting Point Dataset:
Visual Analysis	Revit® Architecture 2008	Unit 2_1_Start.rvt

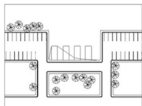
Permeable surfaces act to passively harvest rain water and enable it to percolate into the soil, where it can be used by onsite landscaping or to recharge the ground water system. Projects containing higher percentages of permeable surfaces also reduce the amount of pollutants (e.g. surface oils and litter) that are washed off site into the environment's water system.

The exercise for this unit outlines how to create a visual analysis that compares permeable and non-permeable surfaces in a site plan. To contrast the site's permeable surfaces with the non-permeable ones, use Revit Architecture software's Area object to delineate areas with different permeability characteristics. When you finish, apply a color scheme so you can visually analyze the site. You can use the Area tool to provide customized plan visualizations (with color fill schemes) or calculations. If you generate calculations, make sure that you also generate an area schedule after you are done. In this exercise, color schemes provide a visual representation of the permeable parameter you add to the areas. See Unit 18 in the Revit Educational Curriculum workbook for more information on schedules and color fill schemes.

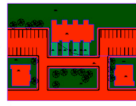
This exercise consists of the following tasks:

- Creating a new area scheme.
- Creating a new area plan and adjust the view settings to make the site elements visible.
- Creating boundaries and areas.
- Adding and applying a Permeable Project Parameter.
- Adding color fill.
- Creating a color fill scheme.

Use dataset Unit 2_1_Start.rvt as a starting point for this exercise. You may also use your own dataset. Even if you have only a drawing or image of your site, you can import these and draw the area lines directly on top of the image or drawing file. See Revit Educational Curricula, Unit 12, Exercise A for information on how to link an AutoCAD® drawing into a Revit project. Linking an image is a very similar process.



Before: Initial site plan from sample



After: A color-filled area plan that shows permeable and non-permeable site areas

Unit 5) Modeling the Design of the Building Envelope for Sustainability: Envelope Daylighting Exercise

Envelope Daylighting

Analysis type:	Software required:	Starting Point Dataset:
External Analysis	Revit® MEP 2008, IES <VE> toolkits for Revit MEP	Unit 5_1_Start.rvt (adapted from Convention Center Extensions.rvt)

Daylighting is intricately related to heat gain in a building. To minimize heat gain, you can reduce the window area, but that also reduces the amount of natural daylight. It also forces you to replace the natural daylighting with electric lights, which are inefficient and, in turn, produce heat.

This exercise illustrates how to perform a daylighting analysis using the FLUCS component of IES <VE>.

This exercise consists of the following tasks:

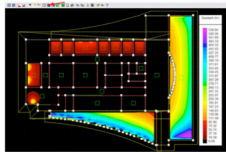
- Exporting the building model to IES <VE> using Revit MEP.
- Running the calculations using FLUCS, the artificial/natural lighting design and analysis tool in IES <VE>.



Before: Unit 5_1_Start.rvt

Export the Building Model to IES <VE> Using Revit MEP

Revit MEP now has a direct, built-in link to IES <VE> that enables you to easily import data from the building information model to IES <VE>. This



After: Unit 5_1_Start.rvt following daylight analysis using IES <VE>

Unit 3) Modeling Building Placement, Size, and Layout for Sustainability Exercise: Plant Shade Cover of Hardscape

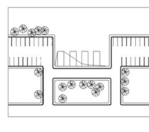
Plant Shade Cover of Hardscape Various Methods

Analysis type:	Software required:	Starting Point Dataset:
Visual Analysis	Revit® Architecture 2008	Unit 3_1_Start.rvt

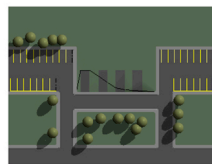
Site hardscape (concrete, paving, etc.) acts as a heat sink, storing solar energy and contributing to the heat island phenomena found in most cities. Shading the hardscape can help minimize this effect.

This exercise provides three methods for analyzing how shade from nearby trees falls on the hardscape:

- Rendering a 3D view from above to show shadow on the site.
- Editing a plant family to show an approximation of the area shaded by the plant.
- Editing a plant family to add a solid element that casts a shadow with Revit Architecture software's Advanced Model Graphics shadow function.



Before: Sample dataset site plan



After: A color-filled area plan that shows how nearby trees cast shadows on the hardscape

Render A 3D View

Revit Architecture Tree families are model lines that do not cast shadows in a plan view. However, when you use the internal Accurender function to

Unit 6) Modeling the Design of Mechanical, Electrical, and Plumbing Systems for Sustainability Exercise: Energy Analysis Packages

This unit has 3 standalone exercises. Each of the exercises outlines how to perform a distinct type of energy analysis on a building. As stated in the introduction, there are more than 350 different energy analysis software packages. This workbook unit demonstrates how to use three of those packages that work directly with the building information model produced by Revit MEP software. In Exercise 6A, you use the Heating and Cooling Loads tool built into Revit MEP. In Exercise 6B, you use IES <VE> toolkits to analyze building energy usage. Finally, in Exercise 6B, you learn how to create a gbXML file, and also how to perform an analysis using Green Building Studio tools.

The Analytical Model

One concept common to all three packages is the analytical model. The analytical model is a simplified version of the building information model created by the analysis software specifically for its calculations. In Revit MEP, you use walls, doors, floors, and roofs to create a model of the building. The analytical model is much more limited in scope. It contains only those surfaces and objects that hold parameters directly relevant to the energy loading analysis. This process is not unlike the radically rendering process, which creates a separate internal model to process light bouncing from surface to surface within the building. Rather than attempting to understand all of the different software object classes from different software packages (for example, a Revit wall is not the same as an AutoCAD® Architecture wall), you simply create a model specifically for the analysis software. For IES <VE>, the process of creating the analytical model is built into the analysis tools. For Green Building Studio, you export the Revit model as a gbXML file, or green building xml file. In most cases, the analysis package produces more accurate results if you optimize the Revit model to make conversion to the analytical model easier for the translating software. What might make sense to an architect (room stops at ceiling) might not make sense for energy analysis (room stops at underside of floor above because an acoustical ceiling does not necessarily provide any real barrier to the air flow through a room).

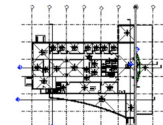
If you are working at a conceptual level or early schematic design level, when the fenestration changes frequently, or you are studying the effects of a particular solar light shelf, you may only be concerned with differences in design options rather than with the final heating and cooling load numbers. When you are more concerned with a percentage change rather than an end total, the validity of rooms may be a non-issue. However, if you wish to get more accuracy, you will need to verify a few things about the rooms prior to running the heating and cooling load calculations.

building_performance_analysis_using_revit.pdf

The compressed file for this unit also contains the PDF file *building_performance_analysis_using_revit.pdf*. This document outlines the differences between the Revit model and the analytical model, and gives some advice on how to optimize the Revit model for the most accurate analysis results.

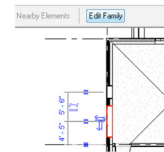
Exercise 6A, B and C Prerequisite: Modifying the Revit Model for Analysis Tools

Analysis type:	Software required:	Starting Point Dataset:
N/A	Revit® Architecture 2008 or Revit® MEP 2008	There are no datasets for this prerequisite exercise. However there is the document referenced <i>building_performance_analysis_using_revit.pdf</i> in the zip file for Unit 6.

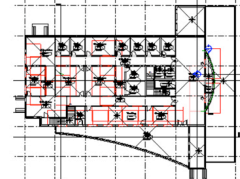


Before: Sample dataset Unit 4_1_start.rvt

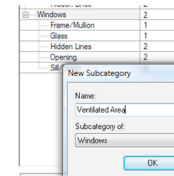
Edit One of the Window Families from the Sample Project



To open the family for editing, click one of the windows. Then, on the Options bar, click Edit Family. To add the new window subcategory, click Settings menu > Object Styles. Click the New button and enter "Ventilated Area" as the new subcategory name.



After: A single modified window that illustrates the rough guide of the natural ventilation areas



Generate Revit Schedules to Find Total square Footages of the roof, exterior Walls, Interior Walls, and Floor Systems

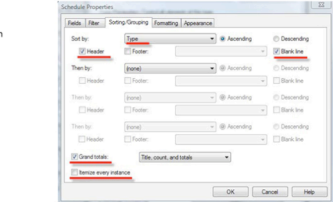
To generate the schedules, use the filter.



Before: Unit 7_1_Start.rvt

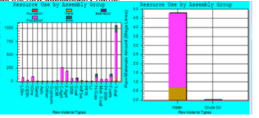
Generate Revit Schedules to Find Total square Footages of the roof, exterior Walls, Interior Walls, and Floor Systems

To generate the schedules, use the filter.



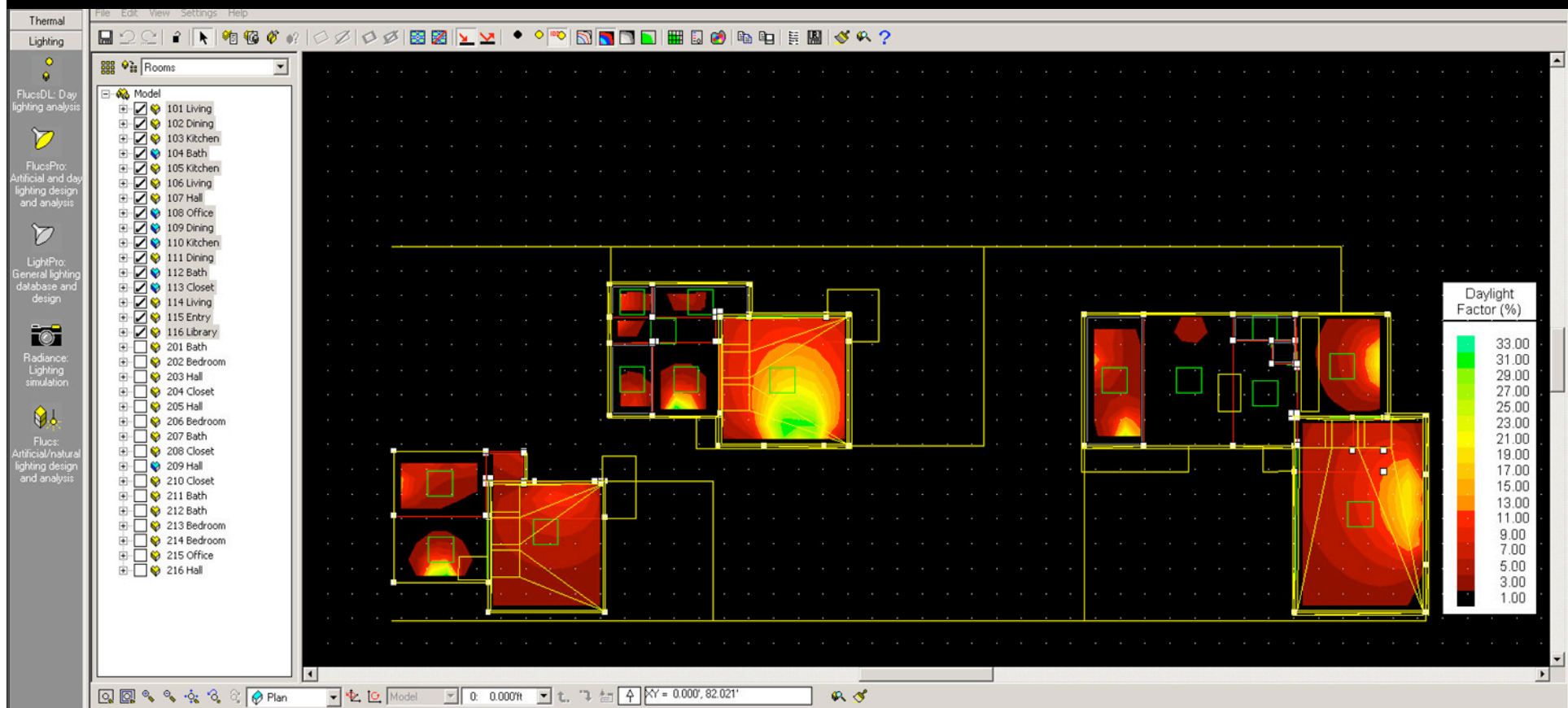
To generate a new wall schedule, on the Views design bar, click Schedule/Quantity. Add fields Type, Area, and Length. On the tabs listed below, follow the bulleted suggestions:

- Filter: Filter By = None.
- Sorting/Grouping: As shown in the screen capture above.
- Formatting: Click Calculate totals for both Area and Length.

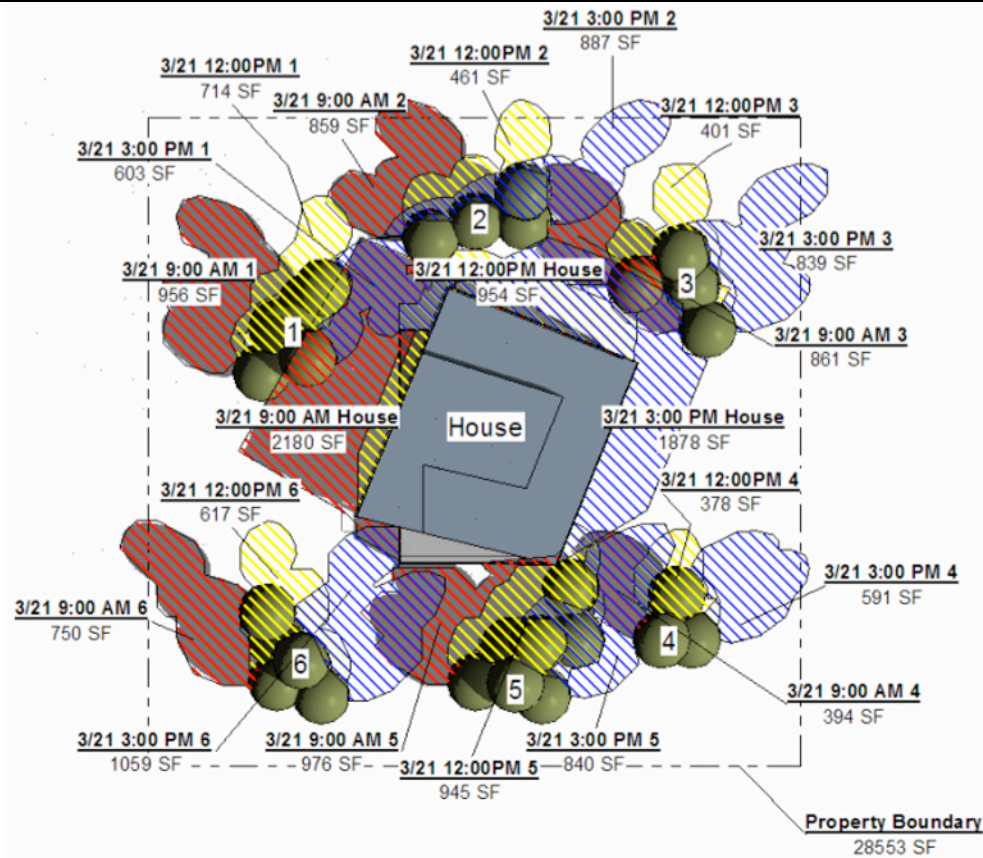


After: Analysis reports in Athena EIE

Simple daylighting; LEED compliance



Landscaping and shadows



Revit Architecture 2008 - [shadow workshop - Schedule: Shadow calculations]

File Edit View Modeling Drafting Site Tools Settings Window Help

Plane

Headers: Group Ungroup Rows: New Delete Show

Basics View

Modify

Floor Plan...

Ceiling Plan...

Plan Region

Elevation

Section

Callout

Drafting View...

Camera

Walkthrough

Legend...

Matchline

View Reference

Schedule/Quan

Sheet...

Add View...

shadow workshop - P...

Views (all)

Floor Plans

Level 1

Level 2

Site

Ceiling Plans

Level 1

Level 2

Elevations (Building)

East

North

South

West

Legends

Schedules/Quantities

Shadow calculations

Sheets (all)

Families

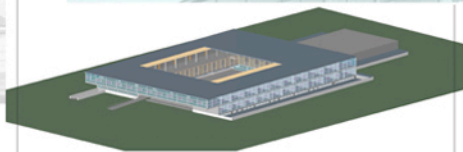
Groups

Revit Links

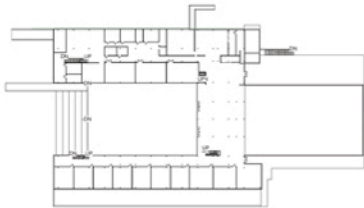
Name	Mark	Area	Area Total
Property Boundary		28553 SF	
blue			
3/21 3:00 PM 1	blue	603 SF	
3/21 3:00 PM 2	blue	887 SF	
3/21 3:00 PM 3	blue	839 SF	
3/21 3:00 PM 4	blue	591 SF	
3/21 3:00 PM 5	blue	840 SF	
3/21 3:00 PM 6	blue	1059 SF	
3/21 3:00 PM House	blue	1878 SF	
green			
3/21 12:00PM 1	green	714 SF	
3/21 12:00PM 2	green	461 SF	
3/21 12:00PM 3	green	401 SF	
3/21 12:00PM 4	green	378 SF	
3/21 12:00PM 5	green	945 SF	
3/21 12:00PM 6	green	617 SF	
3/21 12:00PM House	green	954 SF	
red			
3/21 9:00 AM 1	red	956 SF	
3/21 9:00 AM 2	red	859 SF	
3/21 9:00 AM 3	red	861 SF	
3/21 9:00 AM 4	red	394 SF	
3/21 9:00 AM 5	red	976 SF	
3/21 9:00 AM 6	red	750 SF	
3/21 9:00 AM House	red	2180 SF	
Grand total: 22			

Structural analysis

Revit Architecture PHYSICAL MODEL



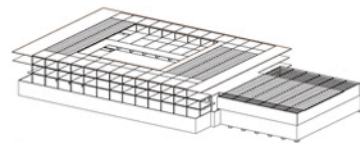
3D VIEW, SOUTH EAST
Scale: 1"=50' 0"



FLOOR PLAN, 1 LEVEL
Scale: 1"=50' 0"



Revit Structure ANALYTICAL MODEL



Structural 3D View, Elevation
Scale: 1"=50' 0"

Oasys Demo Licence

ANALYSIS LAYER
Scale: 1"=20' 0"
Node Labels: Frame: 1,000 Mipps
Beam Labels: Frame: 1,000 Mipps
Moment Labels: Frame: 1,000 Mipps
Case 1: Analysis case 1

Oasys Demo Licence

DESIGN LAYER
Scale: 1"=20' 0"

Oasys Demo Licence

ANALYSIS LAYER
Scale: 1"=20' 0"
Node Labels: Frame: 1,000 Mipps
Beam Labels: Frame: 1,000 Mipps
Moment Labels: Frame: 1,000 Mipps
Case 1: Analysis case 1

Oasys Demo Licence

Record	Nodes	Load Case	Axis	Direction	Value
1	1	1	Global	X	1.0
2	1	1	Global	Y	1.0
3	1	1	Global	Z	1.0
4	1	1	Global	X	1.0
5	1	1	Global	Y	1.0
6	1	1	Global	Z	1.0

Oasys GSA

STRUCTURE ANALYSIS MODEL

Rendering

Final Project: Interoperability

Description: exporting Revit model into 3DSMAX and render with VRAY renderer.

Steps: 1) Model building in Revit, 2) Create lights and cameras in Revit and render, 3) Export File to .Dwg. and open in 3DSMAX, 4) Delete lights and cameras of Revit file and create new lights and cameras in 3DSMAX, 5) Assign VRAY renderer and render views

Additional Software: 3DS MAX, VRAY renderer

Comments: My objective was to figure out the most quick, precise and beautiful way to create 3D renderings for student projects.

Although Revit is more well known as a BIM software, its modeling function is great for creating simple orthogonal projects. Compared to other software such as Rhino, AutoCAD 3D, 3DS MAX, SketchUP etc., I believe that Revit is able to model simple objects much quicker and accurately. In addition,



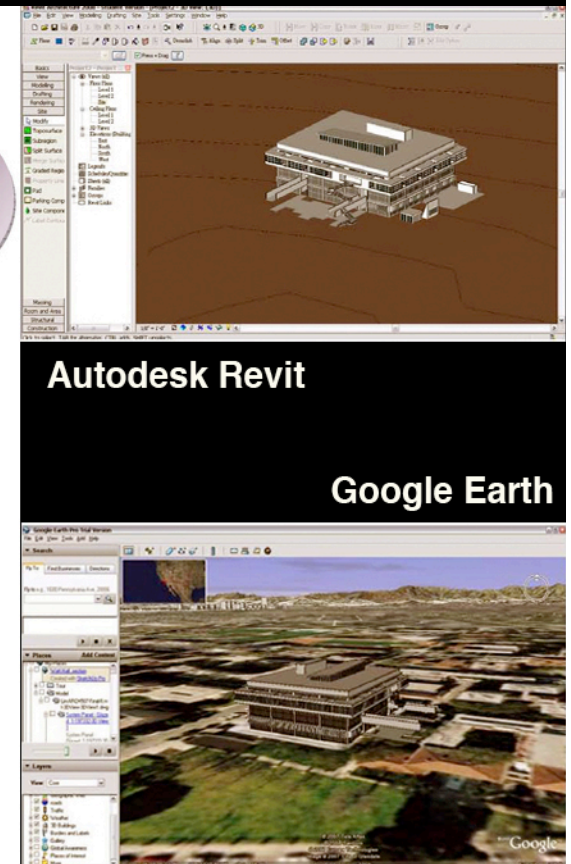
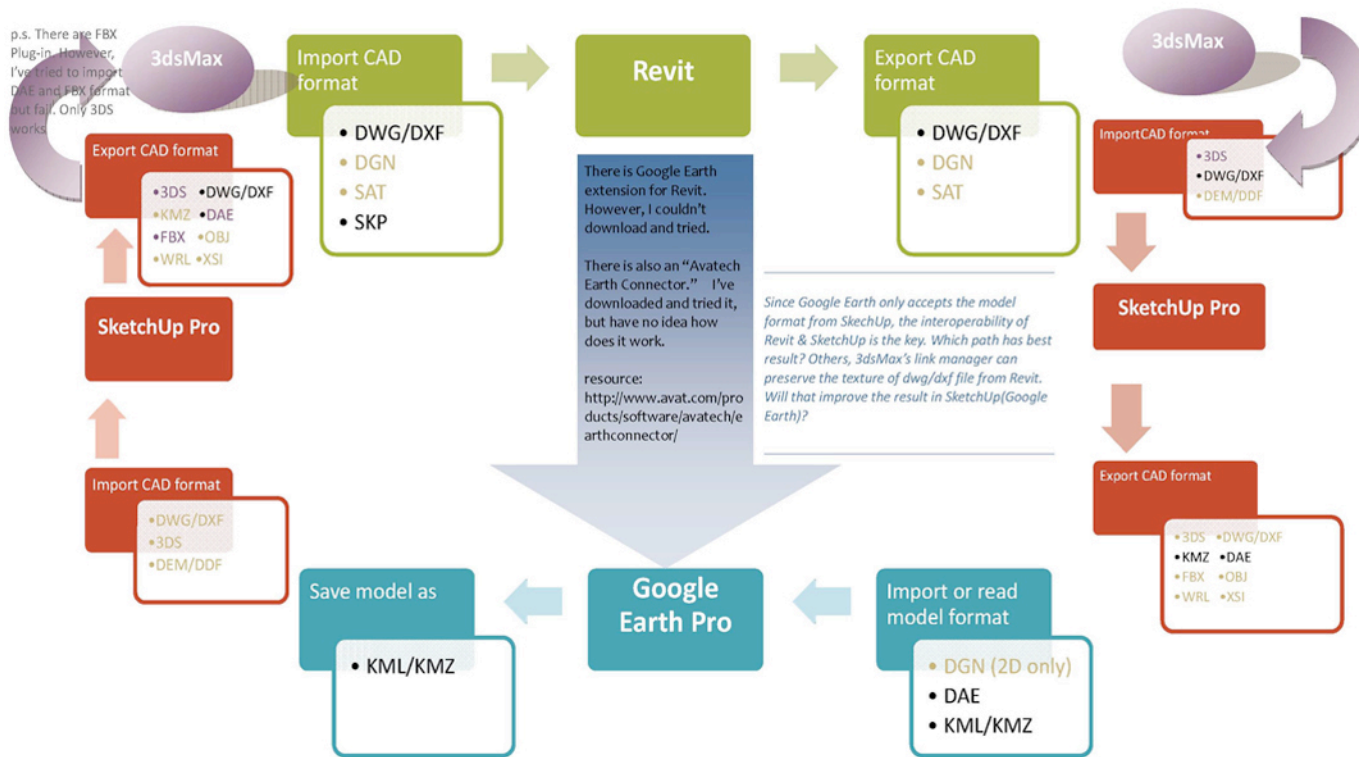
Rendering



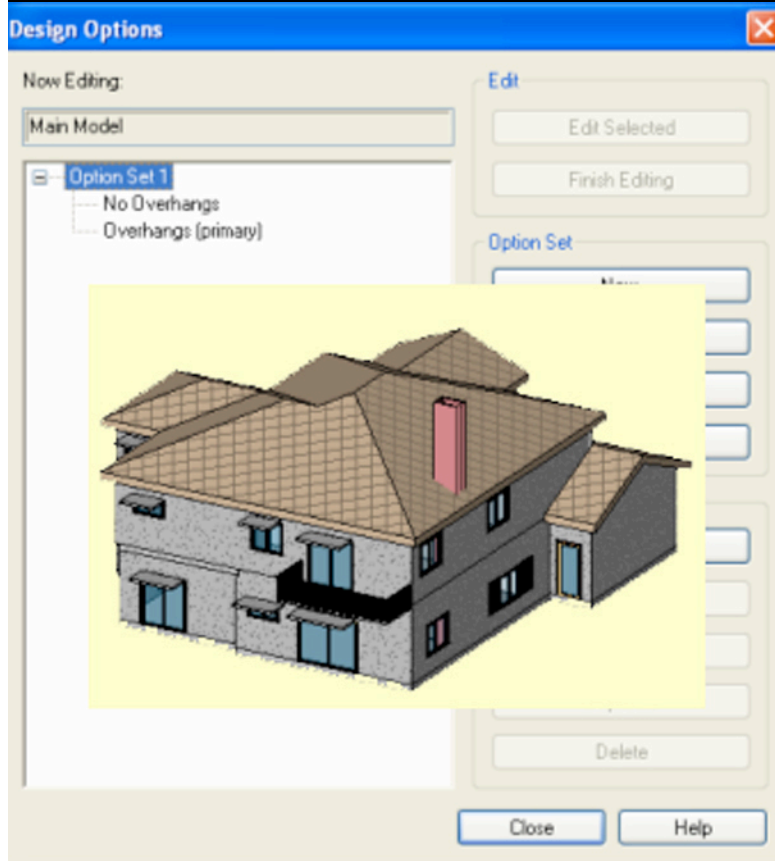
Google Earth

Thinking

1. The connection between Revit and Google Earth reserch



Evidence based design



Analysis

Using steps 1 through 8 above it is now possible to look at the impact of alternative design options on the total solar gain. The goal is to maximize solar gain during the winter and minimize solar gain during the summer. The following design options should be evaluated in this exercise.

1. Site orientations – 0, 45, 90, 135, 180, 225, 270, 315
2. Glazing – Double glazing, low-e double glazing
3. External shading – no shading, 3' shading overhangs on south facing windows

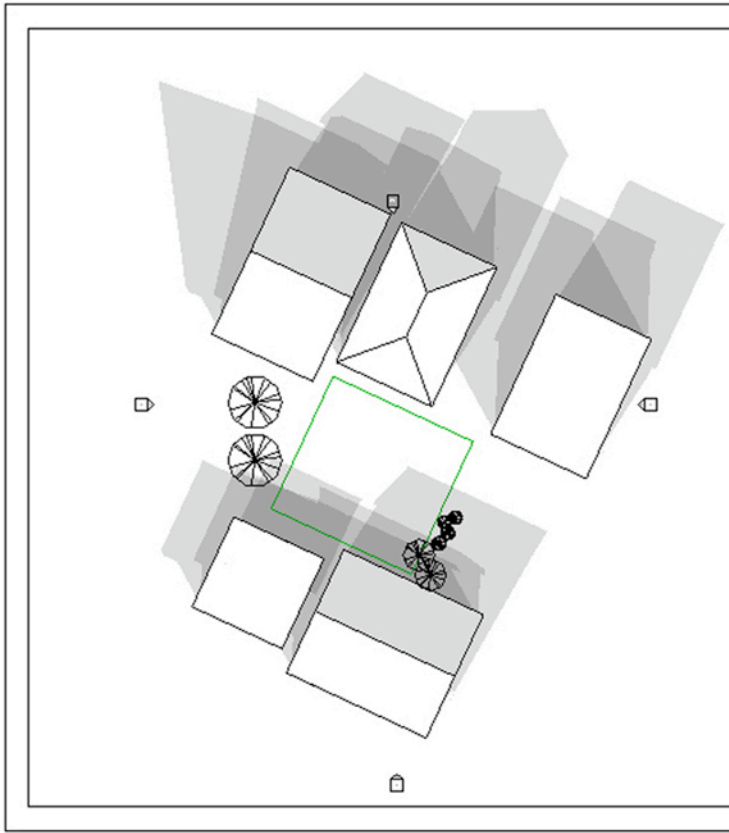
Results

Using the steps outlines in the exercise above the following results were calculated for monthly solar gain.

Solar gain (MMBtu)										South Window Overhangs	
Glazing Type	DG-0	DG-0	DG-0	DG-0	DG-0	DG-0	DG-0	DG-0	DG-0	LE-0	LE-0
Site Rotation (Degrees)	0	45	90	135	180	225	270	315	180	180	180
Jan 01-31	2,981	3,236	4,206	4,945	5,241	4,435	3,792	3,088	4,416	3,771	3,771
Feb 01-28	3,555	3,846	4,875	5,487	5,744	5,007	4,417	3,585	4,835	4,071	4,071
Mar 01-31	4,387	4,729	5,578	5,985	6,081	5,723	5,149	4,418	5,126	4,245	4,245
Apr 01-30	5,233	5,921	6,123	6,365	6,096	6,408	5,619	5,301	5,141	4,387	4,387
May 01-31	5,762	6,439	6,143	6,203	5,939	6,599	5,887	5,922	5,011	4,644	4,644
Jun 01-30	6,054	6,573	6,091	5,955	5,778	6,403	5,989	6,111	4,88	4,646	4,646
Jul 01-31	5,88	6,41	6,019	6,036	5,869	6,563	6,012	6,072	4,953	4,66	4,66
Aug 01-31	5,309	5,992	6,011	6,232	5,957	6,461	5,64	5,466	5,005	4,43	4,43
Sep 01-30	4,526	5,004	5,704	6,078	6,072	5,961	5,309	4,613	5,116	4,149	4,149
Oct 01-31	4,098	4,413	5,572	6,151	6,383	5,632	5,013	4,128	5,377	4,479	4,479
Nov 01-30	3,234	3,513	4,5	5,206	5,477	4,662	4,023	3,295	4,615	3,925	3,925
Dec 01-30	2,854	3,159	4,113	4,949	5,241	4,419	3,693	3,006	4,416	3,793	3,793
Summed total	53,872	59,237	64,935	69,591	69,874	68,273	60,542	55,004	58,91	51,2	51,2
Winter d/W	3,700	4,031	5,186	6,034	6,360	5,429	4,667	3,802	5,358	4,560	4,560
White gain relative to 0 degrees	9%	40%	63%	72%	47%	26%	3%	45%	23%	23%	23%
Summer d/W	6,742	7,448	7,111	7,159	6,900	7,628	6,896	6,908	5,823	5,387	5,387
Summer gain relative to 0 degrees	10%	5%	6%	2%	13%	2%	2%	-14%	-20%	-20%	-20%

DG-0 = Double Glazing Domestic
LE-0 = Low-e Double Glazing Domestic

Less successful



External glazing

Process Steps

1. Compare heating & cooling load of a building with different exterior glazing type

- Open the file in Revit MEP.
- From Design Bar>Mechanical call out Heating and Cooling Load window.

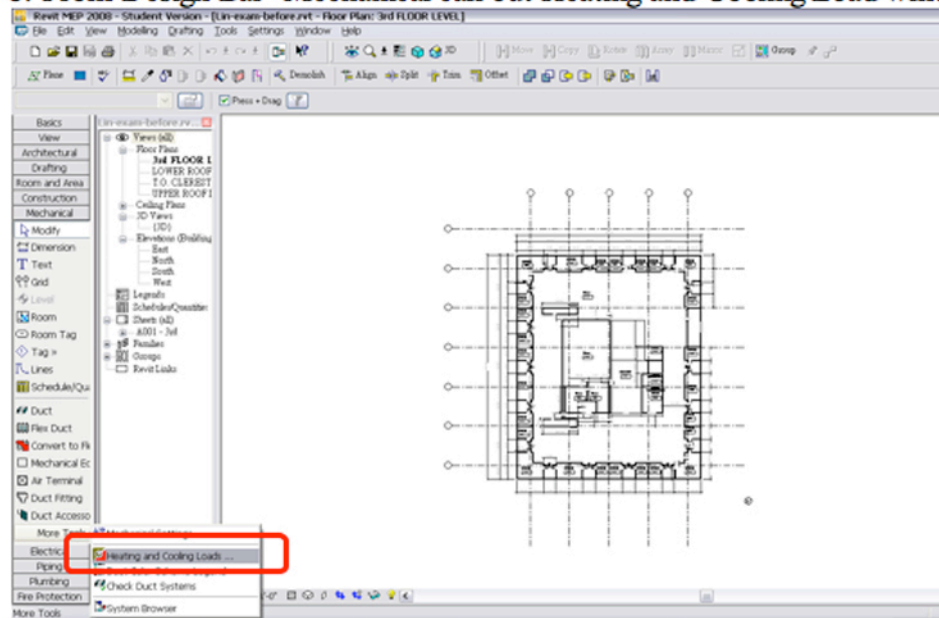


FIGURE 4 SELECT HEATING AND COOLING LOAD FROM DESIGN BAR

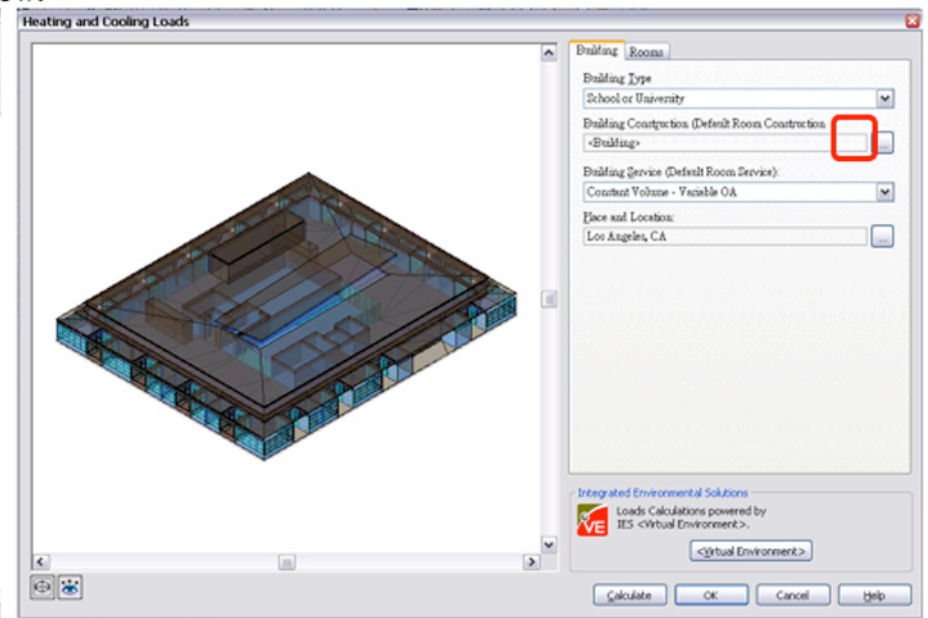


FIGURE 5 CHANGE EXTERIOR GLAZING FROM BUILDING CONSTRUCTION SETTING

Studies building on other research

FIGURE 14 Use LIGHTING ANALYSIS TO UNDERSTAND THE IMPACT OF DIFFERENT EXTERNAL GLAZING

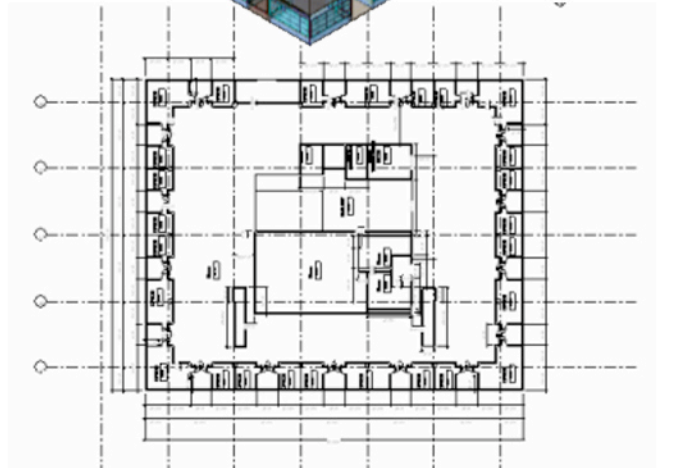
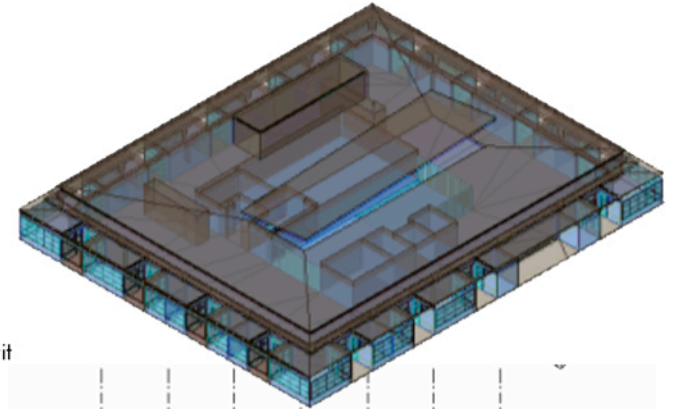
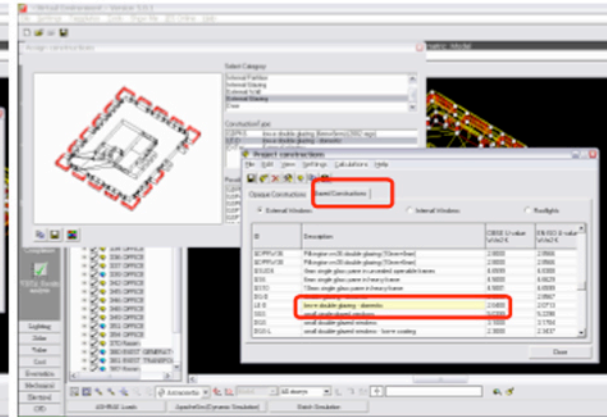
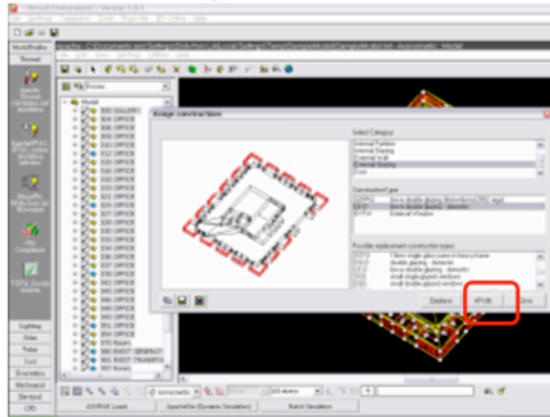
h. Copy & paste the results to Excel to compare the results of different external glazing

Room 0004AB5f (312 OFFICE)					Room 0004AB5f (312 OFFICE)					Room 0004AB5f (312 OFFICE)				
Reflectance					7%					30%				
Transmittance					70%					8%				
Analysis calculation for room 0004AB5f (312 OFFICE)					Analysis calculation for room 0004AB5f (312 OFFICE)					Analysis calculation for room 0004AB5f (312 OFFICE)				
Summary results for working planes and floor					Summary results for working planes and floor					Summary results for working planes and floor				
Surface	Quantity	Values			Uniformity (Min./Ave.)	Diversity (Min./Max.)	Surface	Quantity	Values			Uniformity (Min./Ave.)	Diversity (Min./Max.)	
		Min.	Ave.	Max.					Min.	Ave.	Max.			
Working plane 1	Daylight factor						Working plane 1	Daylight factor						
Reflectance=0%							Reflectance=0%							
Transmittance=100%							Transmittance=100%							
Grid size=0.81 m							Grid size=0.81 m							
Area=18.724m2							Area=18.724m2							
Margin=0.00 m	Daylight Illuminance	66.22 lux	1514.39 lux	1583.66 lux	0.04	0.02	Margin=0.00 m	Daylight Illuminance	17.57 lux	154.50 lux	420.99 lux	0.04	0.02	

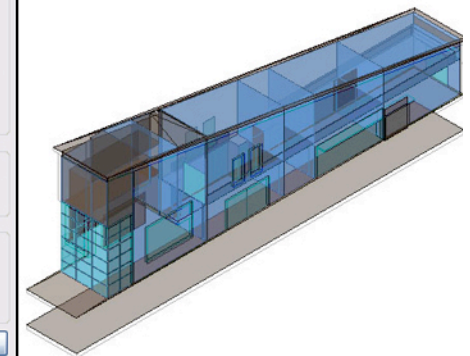
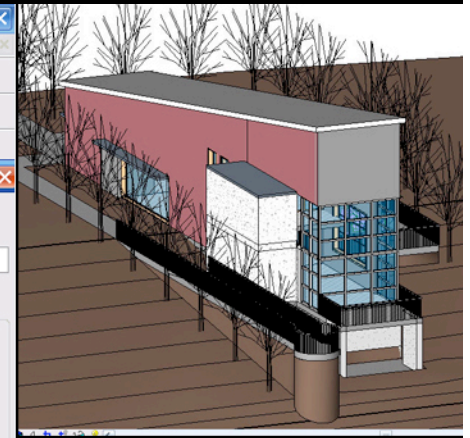
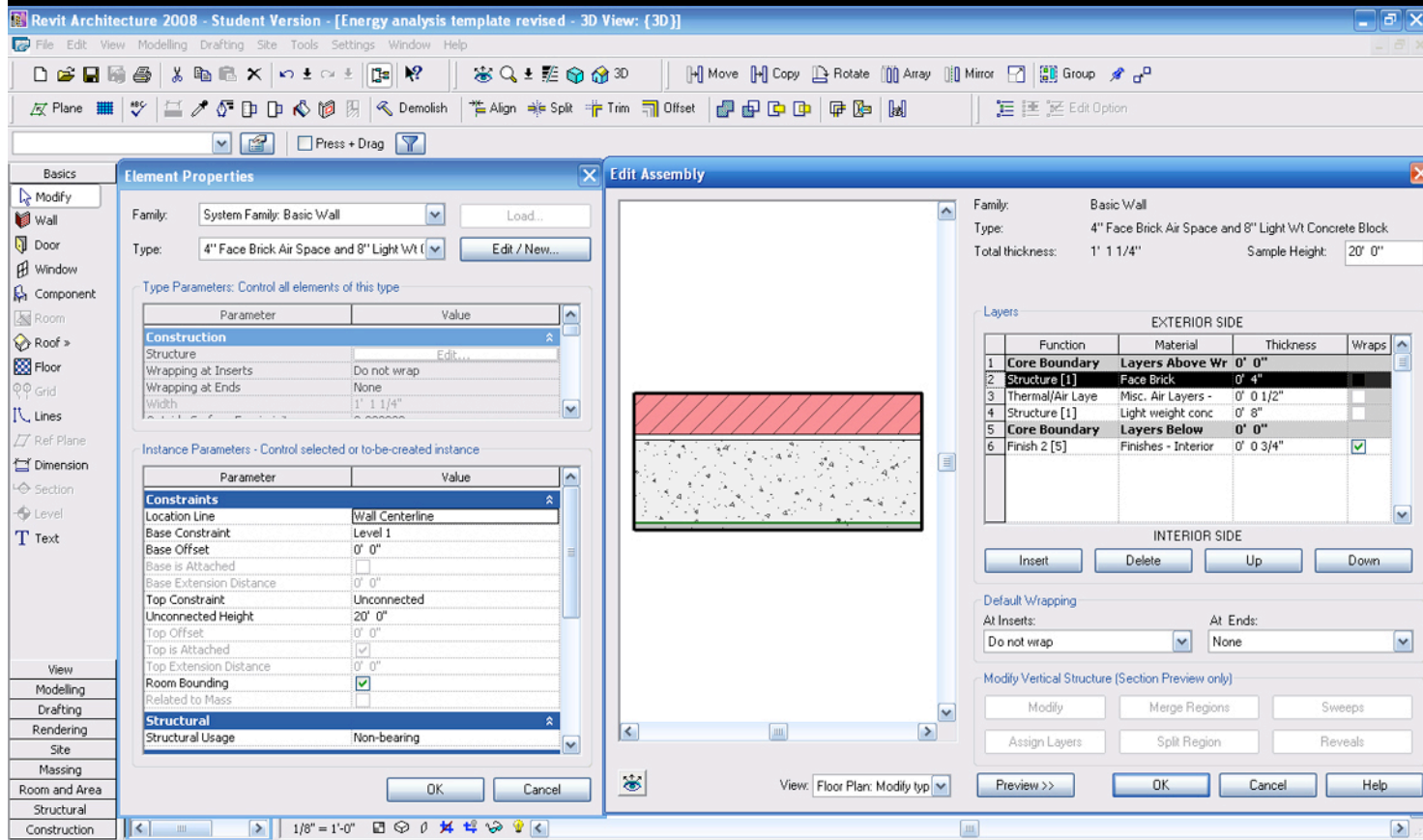
FIGURE 15 COPY AND PASTE THE RESULTS OF DIFFERENT EXTERNAL GLAZING TYPE TO EXCEL TO COMPARE THE DAYLIGHT IMPACT OF DIFFERENT GLAZING TYPE

3. Understand the external glazing detail in Revit Model

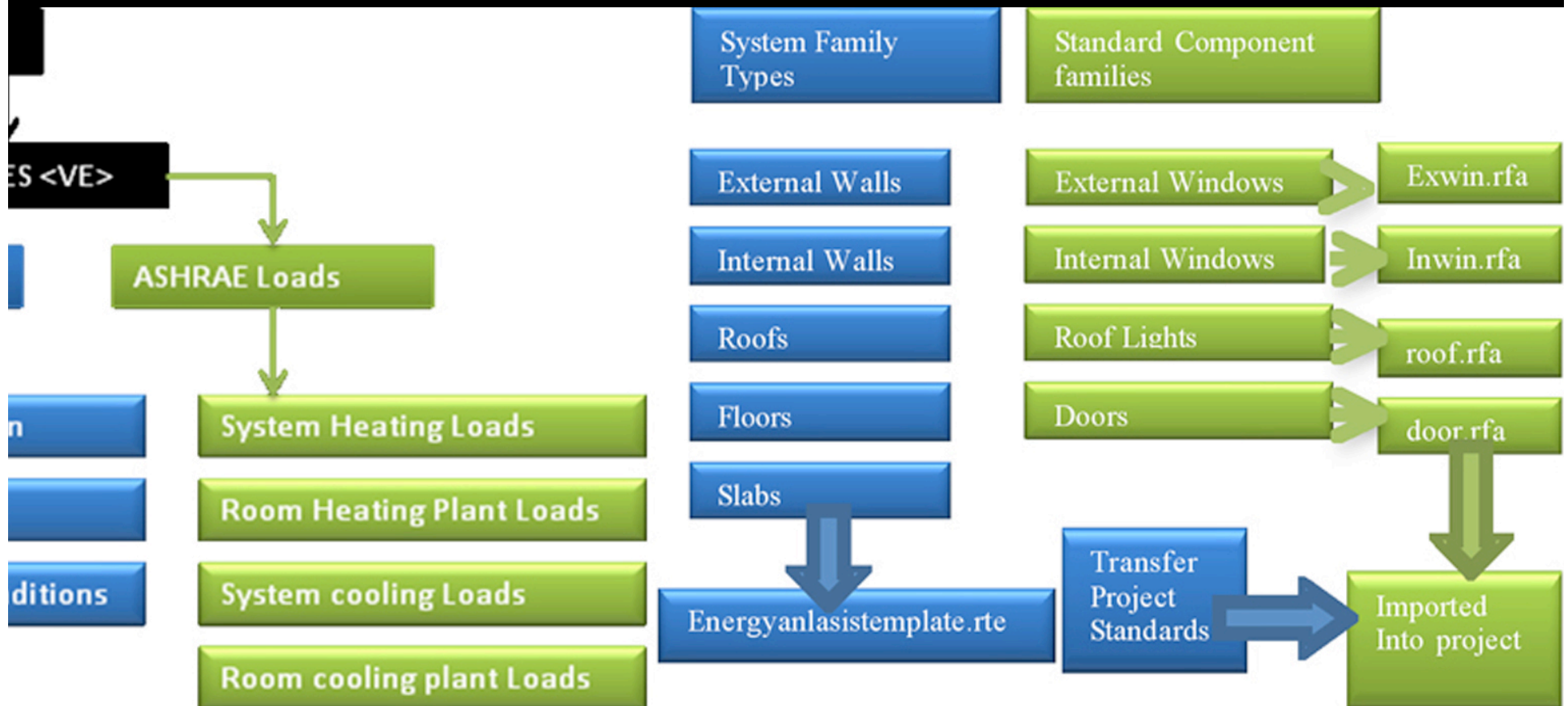
a. Repeat 2.b to 2.d. In "Assign Construction" window, under "Construction Type" select the type which you defined in Revit model, the model on the right side will high light your external glazing. Then, click "APCdb", the "Project constructions" window will show up.



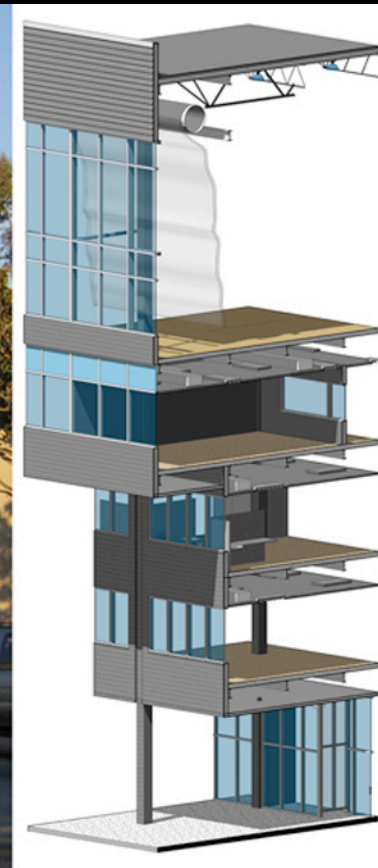
BIM + IES



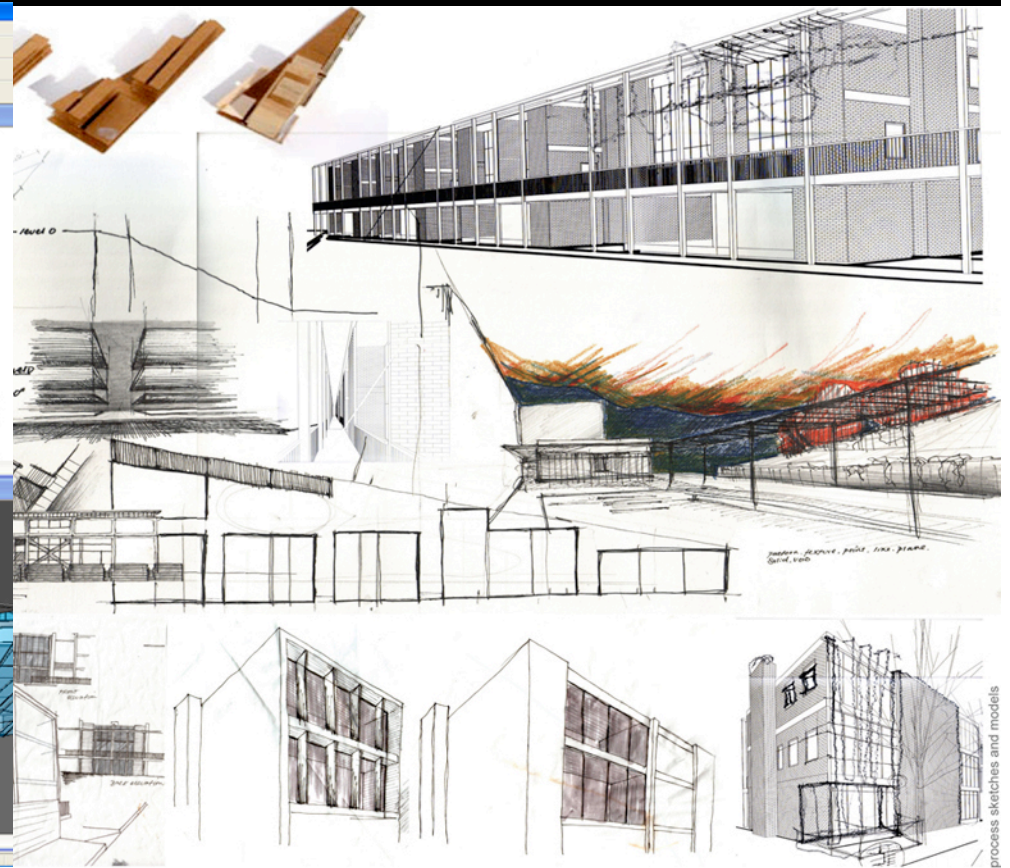
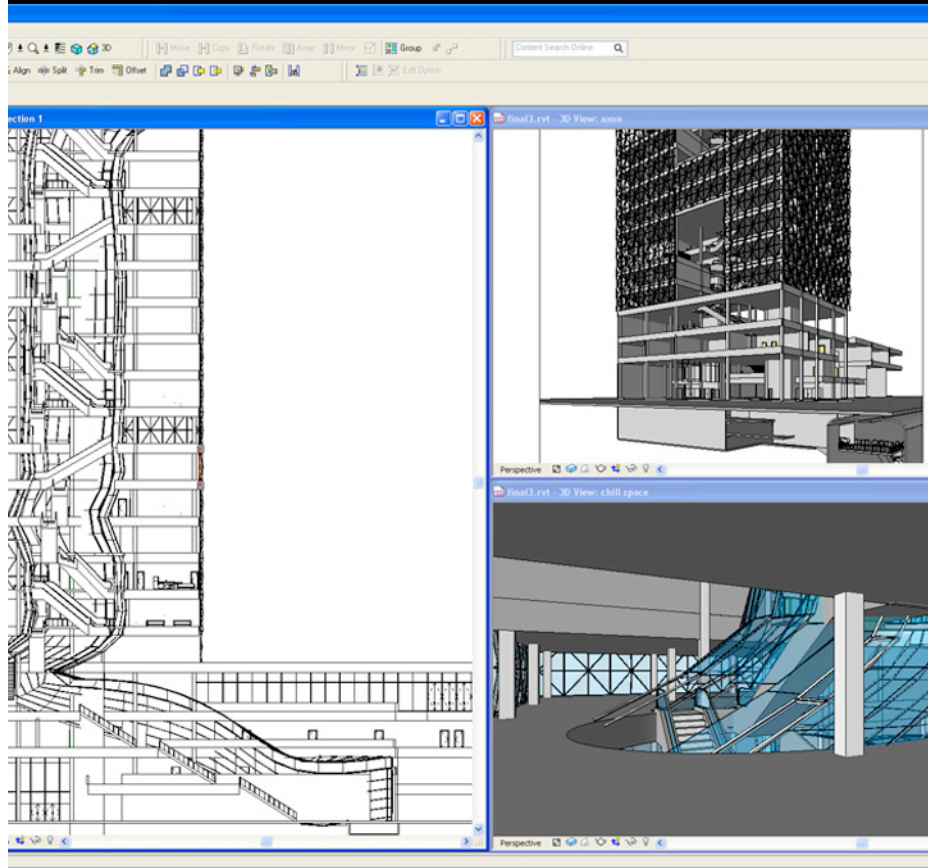
Seed for master's thesis; new PhD program



Studio work



Studio work: not yet another “CAD” battle!



Conferences and connections to profession

BIM BOP 2008

The Second Annual USC Symposium on
Building Information Modeling + Sustainable Design

Autodesk
Bentley
Ecotect
Gehry Technology
Graphisoft
IES

BUILDING INFORMATION MODELING SOFTWARE
Thursday, July 10, 2008, 12 noon - 4:00pm

ARCHWAY SYSTEMS, INC., representing BENTLEY SYSTEMS, INC.
Bentley Suite: Architecture, Structural, Mechanical, Electrical, EA
Tom Larson, Archway Systems, Inc.

AUTODESK, INC.
Revit, Navisworks, Quantity Take Off
Scott Davis, AEC Technical Specialist, Autodesk, Inc.

U.S. CAD, representing INTEGRATED ENVIRONMENTAL SOLUTIONS
IES V8iWare, Sustainability Toolkit, and Virtual Environment +VE+
Carlini Ochoa, Technical Specialist, U.S. CAD

BOBROW CONSULTING GROUP, representing GRAPHISOFT
ArchCAD
Eric Bobrow, AIA, AIA, Bobrow Consulting Group

BOBROW CONSULTING GROUP, representing SQUARE ONE
Estate
Eric Bobrow, AIA, AIA, Bobrow Consulting Group

GEHRY TECHNOLOGIES
Digital Project
Samer Kishiyop, Gehry Technologies

BIM + SUSTAINABLE DESIGN IN PRACTICE
Friday, July 11, 2008, 8:30 am - 5:15 pm

Keynote:
LEVERAGING BIM FOR SUSTAINABLE DESIGN:
NOTES FROM THE FIELD
Edly Krugel, AIA, LEED AP, Associate, BNIM Architects

NBBJ: BIM + SUSTAINABLE DESIGN
Jonathan Ward, AIA, LEED AP, Partner, NBBJ

BIM + AN INTEGRATED APPROACH TO SUSTAINABLE DESIGN
Jon Mills, AIA, LEED AP, LPA
Eric Jones, Project Manager, LPA
Miguel Correo, Project Manager, LPA

INTEGRATING BIM AND GREEN
David Markot, AIA, DNM Architect

BIM AND SUSTAINABILITY AT HOK
Patrick McLennan, FAIA, Chief Executive Officer, HOK
Jon Gortelowski, LEED AP, Assoc. AIA, BIM Designer, HOK

**GAME-CHANGING INNOVATION: INCREMENTAL IMPROVEMENTS
VERSUS A TRANSFORMATIONAL APPROACH**
Michael Hirsch, FAIA, Principal, Michael Hirsch Architects

Karen M. Kenek
School of Architecture
University of Southern California
Los Angeles, California 90089-0291 USA
kenek@usc.edu

Coming next year: BIM BOP 2009: BIM + Construction / Fabrication

CoPE
BNIM
DNM
HOK
LPA
MHA
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USC
UNIVERSITY OF SOUTHERN CALIFORNIA



Conferences: academy, software firms, AEC professionals

BIM BOP 2008

The Second Annual USC Symposium on
Building Information Modeling + Sustainable Design

Autodesk
Bentley
Ecotect
Gehry Technologies
Graphisoft
IES

BUILDING INFORMATION MODELING SOFTWARE Thursday, July 10, 2008, 12 noon - 6:00pm

ARCHWAY SYSTEMS, INC., representing BENTLEY SYSTEMS, INC.
Bentley Suite: Architecture, Structural, Mechanical, Electrical, RA
Tom Lazear, Archway Systems, Inc.

AUTODESK, INC.
Revit, Navisworks, Quantity Take Off
Scott Davis, AEC Technical Specialist, Autodesk, Inc.

U.S. CAD, representing INTEGRATED ENVIRONMENTAL SOLUTIONS
IES VE-Ware, Sustainability Toolkits, and Virtual Environment <VE>
Carlos Orona, Technical Specialist, U.S. CAD

BOBROW CONSULTING GROUP, representing GRAPHISOFT
ArchiCAD
Eric Bobrow, Affil. AIA, Bobrow Consulting Group

BOBROW CONSULTING GROUP, representing SQUARE ONE
Ecotect
Eric Bobrow, Affil. AIA, Bobrow Consulting Group

GEHRY TECHNOLOGIES
Digital Project
Dennis Shelden, Gehry Technologies

Green BIM

SUCCESSFUL SUSTAINABLE
DESIGN WITH BUILDING
INFORMATION MODELING

EDDY KRYGIEL, BRADLEY NIES
FOREWORD BY STEVE MCDONNELL, AIA, LEED AP
PRINCIPAL AT BNIM ARCHITECTS

BNIM

DNM

HOK

LPA

MHA

NBBJ

BIM + SUSTAINABLE DESIGN IN PRACTICE Friday, July 11, 2008, 8:30 am - 5:15 pm

Keynote:
LEVERAGING BIM FOR SUSTAINABLE DESIGN:
NOTES FROM THE FIELD
Eddy Krygiel, AIA, LEED AP, Associate, BNIM Architects

NBBJ: BIM + SUSTAINABLE DESIGN
Jonathan Ward, AIA, LEED AP, Partner, NBBJ

BIM+: AN INTEGRATED APPROACH TO SUSTAINABLE DESIGN
Jon Mills, AIA, LEED AP, LPA
Eric Jones, Project Manager, LPA
Miguel Cuevas, Project Manager, LPA

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BIM AND SUSTAINABILITY AT HOK
Patrick MacLeamy, FAIA, Chief Executive Officer, HOK
Jon Gardzelewski, LEED AP, Assoc. AIA, BIM Designer, HOK

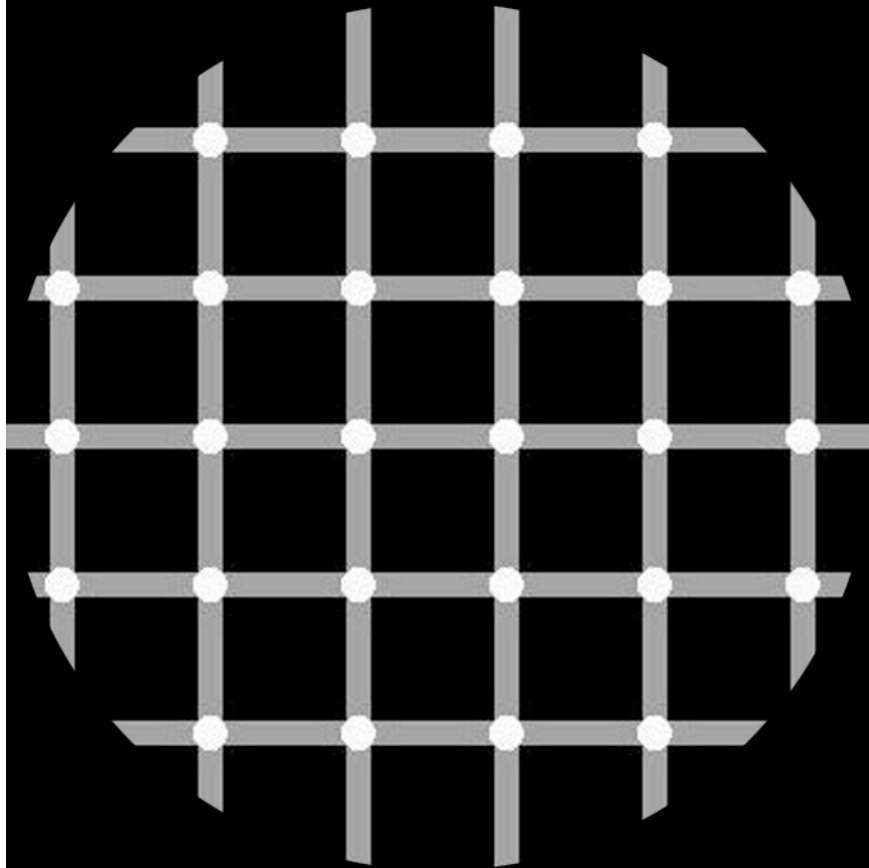
**GAME-CHANGING INNOVATION: INCREMENTAL IMPROVEMENT
VERSUS A TRANSFORMATIONAL APPROACH**
Michael Hricak, FAIA, Principal, Michael Hricak Architects

Karen M. Kensek
School of Architecture
University of Southern California
Los Angeles, California 90089-0291 USA

kensek@usc.edu

Coming next year: BIM BOP 2009: BIM + Construction / Fabrication

"If it's there and you can see it — it's real.
If it's not there and you can see it — it's virtual.
If it's there and you can't see it — it's transparent.
If it's not there and you can't see it — you erased it !"

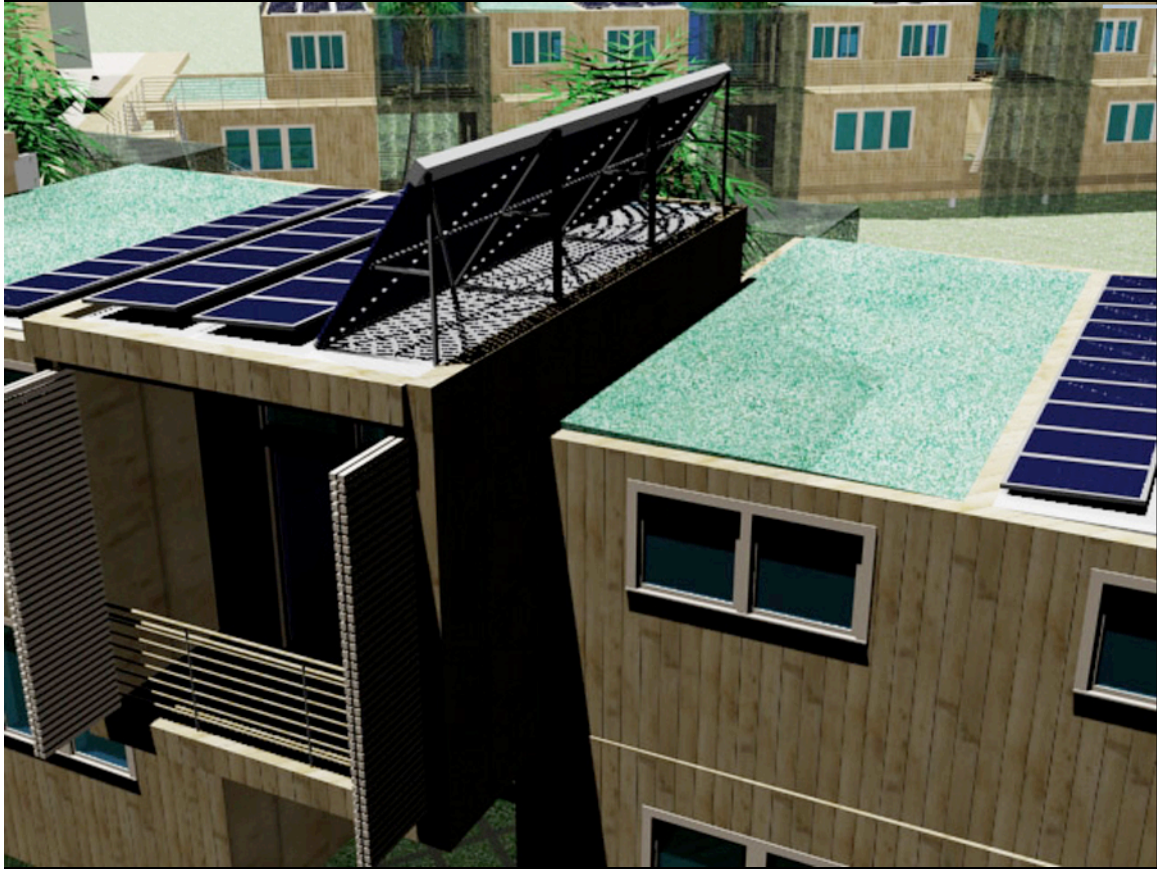


Current Musings

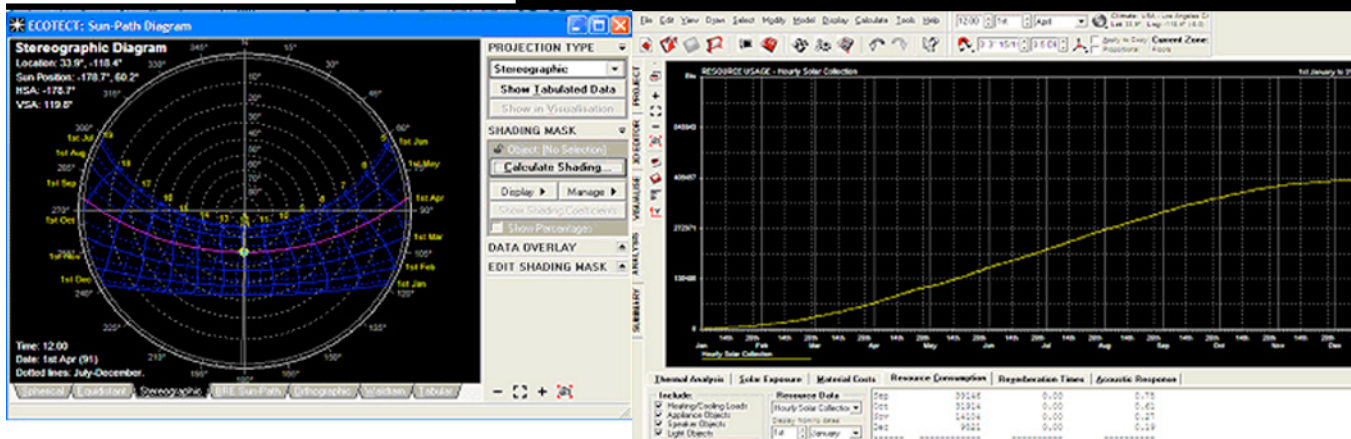
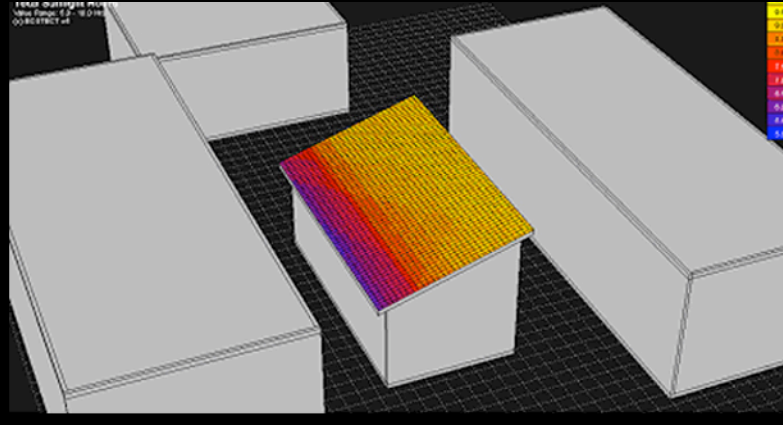
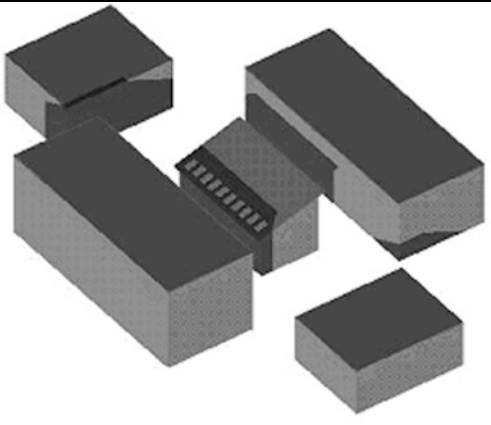
Connections

Interdisciplinary

Renderings <> Simulation



Insolation



Sustainable Design Issue: Photovoltaic Energy

Determining the Best Location for Solar Panels on a Roof

Software Required: Revit Architecture 2008 & Ecotect

Starting Point Dataset: loghmani-exam-before.rvt

When incorporating solar panels into a design, it is important to analyze the solar access of a particular building or site. Once you know which surfaces of your building provide the most annual sun exposure, then you can efficiently integrate a photovoltaic system into your building.

This exercise consists of the following tasks:

- Analyzing the roof with a solar access study to determine which areas have the most annual sun exposure.
- Applying a solar collector material to the solar panels in its initial location to determine how much annual electricity it will produce.
- Relocating the solar panels according to the solar access study.
- Calculating the amount of electricity produced from the relocated solar panels on the roof.
- Comparing the before and after results from the solar collectors.

Photovoltaics

Revit Architecture 2008 - Student Version - [Bassam-exam-MB-af - 3D View: {3D}]
File Edit View Modeling Drafting Site Tools Settings Window Help
Plane
Move Copy Rotate Align Split Trim Offset
Unit MB) Sustainability exercise: Modeling an array of Solar Panels and estimating the produced energy

Basics
View
Modify
Floor Plan...
Ceiling Plan...
Plan Region
Elevation
Section
Calcut
Drafting View...
Camera
Walkthrough
Legend...
Matchline
View Reference
Schedule/Quan
Sheet...
Add View...
Modeling
Drafting
Rendering
Site
Massing
Room and Area
Structural
Construction

Views (all)
Floor Plans
Typical Floor An
Ceiling Plane
3D Views
Copy of (3D)
(3D)
Elevations (Building
East
North
South
West
Sections (Building S
Section 1
Legends
Schedules/Quantitie
Solar Panels
Sheets (all)
A102 - Unnamed
Families
Groups
Revit Links

Schedule Properties
Fields
Filter
Sorting/Grouping
Formatting
Appearance
Available fields:
Description
Family
Family and Type
Keynote
Level
Manufacturer
Mark
Model
Type
Type Comments
Type Mark
URL
Scheduled fields (in order):
Angle
Length
Width
Add ->
<- Remove
Add Parameter...
Calculated Value
Edit...
Delete
Edit...
Delete
Select available fields from:
Specialty Equipment
Include elements in linked files
Move Up
Move Down
OK
Cancel
Help

Unit MB) Sustainability exercise: Modeling an array of Solar Panels and estimating the produced energy

In this exercise you will learn how to model a solar panel in Revit Architecture and how to estimate the energy it produces. There are numerous parameters that govern the energy output of solar collectors. Some are related to the technical methods used to manufacture them and some are determined by the location, orientation and design of the building. For the scope of this exercise we only want to learn how to use schedules in Revit to calculate the total area of solar panels in a building and using a formula to estimate the energy output. We assume all factors to be fixed except the Width, Length and tilt angle, which we determine as a family property in Revit.

Solar Panels:

Semiconductors that convert solar energy directly into electricity are called photovoltaic (PV) devices or solar cells. Although there are about 30 different types of PV devices under development, there are three main technologies in commercial production – Monocrystalline cells, Polycrystalline cells and thin-film cells. Solar cells are encapsulated into modules, several of which are combined into an array. The amount of power from a PV array is directly proportional to the intensity of the light hitting the array. Photovoltaic arrays produce direct-current (DC) electricity but can be configured to produce any required combination of voltage and current-including conventional residential alternating current (AC) voltages.

Solar Energy:

-Location

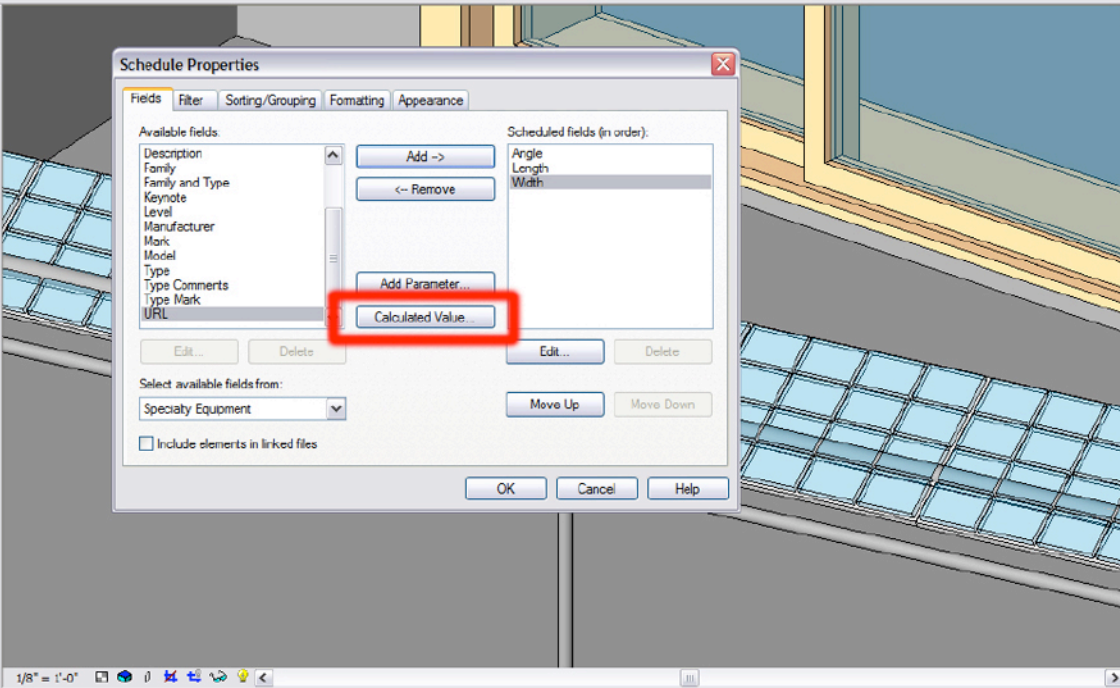
The amount of sunlight available will affect the amount of energy produced. Actual predictions of energy that will be generated can only be made for a given location by use of statistical weather data. Programs such as Ecostest have an incorporated weather data that can be used to arrive at an average for the solar gain in a given location.

-Orientation

The orientation of the building and the relative positioning of the solar array are critical factors in maximizing energy production. In northern latitude a south facing facade collects more light throughout a year and so will produce the maximum amount of energy. The converse applies in southern latitudes. East and west facing facades although not the optimum can still produce significant quantities of energy from PV.

-Tilt Angle

Inclining the solar panels towards the sun will increase the level of light falling on the surface and will therefore increase its output. The most appropriate angle of inclination depends upon the latitude of the proposed site. Solar panels located on the equator will produce the maximum possible amount of energy when laid horizontally. By referring to the table you can find the optimum tilt angle, by latitude and longitude of some major cities around the globe. For this exercise we assume the location to be Los Angeles; thus the ideal tilt angle is 33 °.



Professional Practice Undergraduate Course

one topic of many

Building information modeling

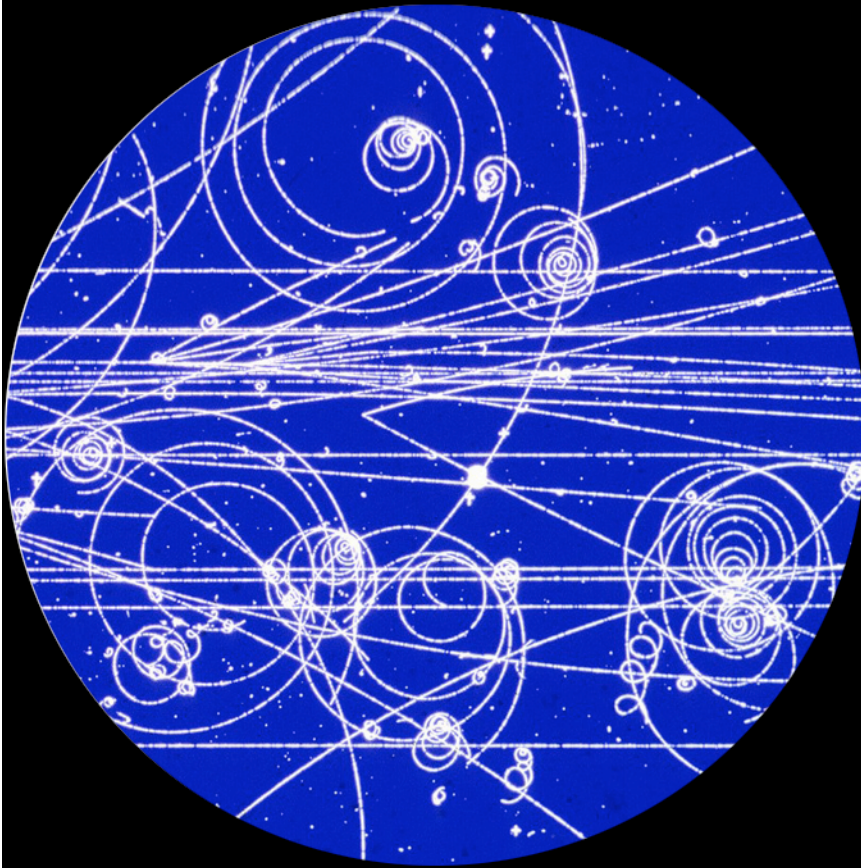
Detailing

Coordination

Collaboration

“The areas of consensus shift unbelievably fast: the bubbles of certainty are constantly exploding.”

- Rem Koolhaas



Future

Paradigm shift or
Call to battle or promised integration

Collaborations!

University of Southern California

USC

Sonny Astani
Department of Civil and Environmental Engineering

USC Viterbi
School of Engineering

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Becerik-Gerber, Burcin

Burcin Becerik-Gerber, Assistant Professor of Civil Engineering

Research Interests

- Building Information and Construction Management
- Information Management and Technology
- Infrastructure and Urbanization
- Sustainable Practices
- Integrated Practice Management



Dr. Burcin Becerik-Gerber

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For information about a Ph.D. in Civil Engineering with a focus on Construction Management, please [CLICK HERE](#)

Biographical Information

- DDes – 2006 – Information Systems and Project Management – Harvard University
- M.S. – 2002 – Civil & Environmental Engineering – University of California, Berkeley
- M.S. – 2001 – Architecture – Istanbul Technical University
- B.S. – 1999 – Architecture – Istanbul Technical University

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http://www.aia.org/aiarchitect/thisweek06/1103/1103d_pwlucas.cfm

http://la.curbed.com/uploads/2008_01_usc-cinema2.jpg

BIM

BIM SYM

BIM BOP

BIM FAB

BIM CON

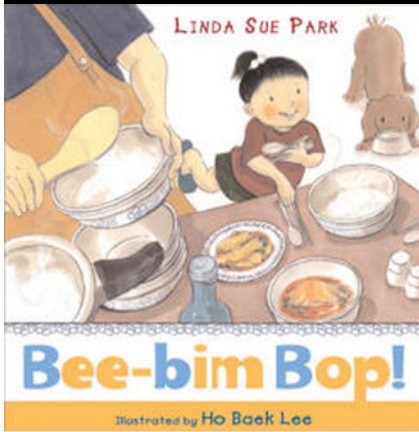
... kill bim?

Integrated practice, integrated teaching

Design intelligence, evidence based design

Research

The different meanings of BIM from Google Images - a subset.



BIM Impact on AECOO Industry

- All professional project work

