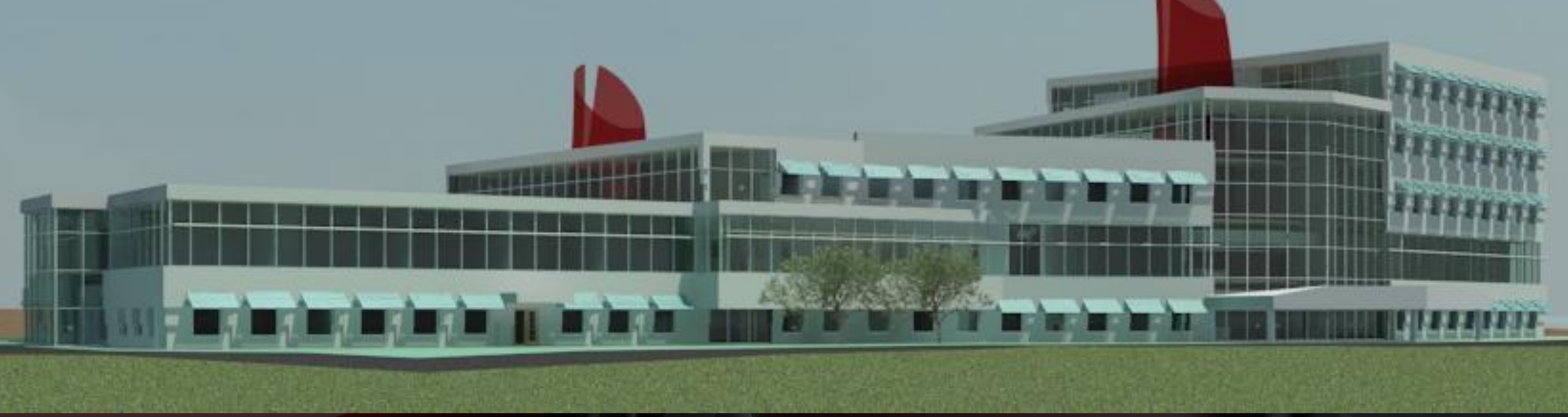

AB1420: 3D IDP (Integrated Design Process) Integration Using GIS and BIM Techniques

Charles McLean
BIM Consultant
cmclean@omgreengroup.org

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Class Summary

This class will explain how to use Google Earth™ to import GIS information using AutoCAD® Civil 3D® and Autodesk® Revit® software. Autodesk Revit and Autodesk® Ecotect® Analysis software will be used to properly analyze, place, and orient the design of the building. Autodesk® Revit® MEP and Autodesk® Revit® Structure software will be used to design the energy analysis and cost analysis for the class. Upon completion of any structural-related building within Autodesk Revit, an energy analysis template will be used to track all electrical and heating costs for the owner's operational use. A second template will dictate the cost of building construction using Autodesk Revit and Autodesk® Navisworks® software. Upon completion of the Revit 3D model and cost analysis templates, Autodesk Navisworks will be used to simulate the IDP construction process. The audience will see documentation on how 3D Integrated Design Process is integrated, from the Civil GIS phase to the construction and bidding phase.

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Learning Objectives

At the end of this class, you will be able to:

- Begin and complete the IDP process integrating a variety of 3D Autodesk® products.
- Become more familiar with integrating BIM information together.
- Connecting the "Real World to "BIM+BIM" (Building Information Model + Building Information Management) techniques and simulating the facts.
- Completing the architectural IDP process virtually within a 3D environment.
- Completing the 1D to 8D work scope.

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3D IDP

Integrated Design Process

Integrating 3D Analytical Technology to Achieve IDP

Consists of the Following:

1. Autodesk® Civil 3D
2. Project Vasari®
3. Autodesk® Revit®
4. Autodesk® Ecotect®
5. Autodesk® Revit® MEP®
6. Autodesk® Navisworks®

Bonus: Autodesk® Inventor® Fusion

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INTEGRATED DESIGN PROCESS

- *Facts To The Fast Track*

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IDP

Definition

- The design of buildings requires the integration of many kinds of information into a synthetic whole. An integrated process, or "whole building" design process, includes the active and continuing participation of users, code officials, building technologists, cost consultants, civil engineers, mechanical and electrical engineers, structural engineers, specifications specialists, and consultants from many specialized fields. The best buildings result from active, consistent, organized collaboration among all players.
- http://www.wbdg.org/design/engage_process.php

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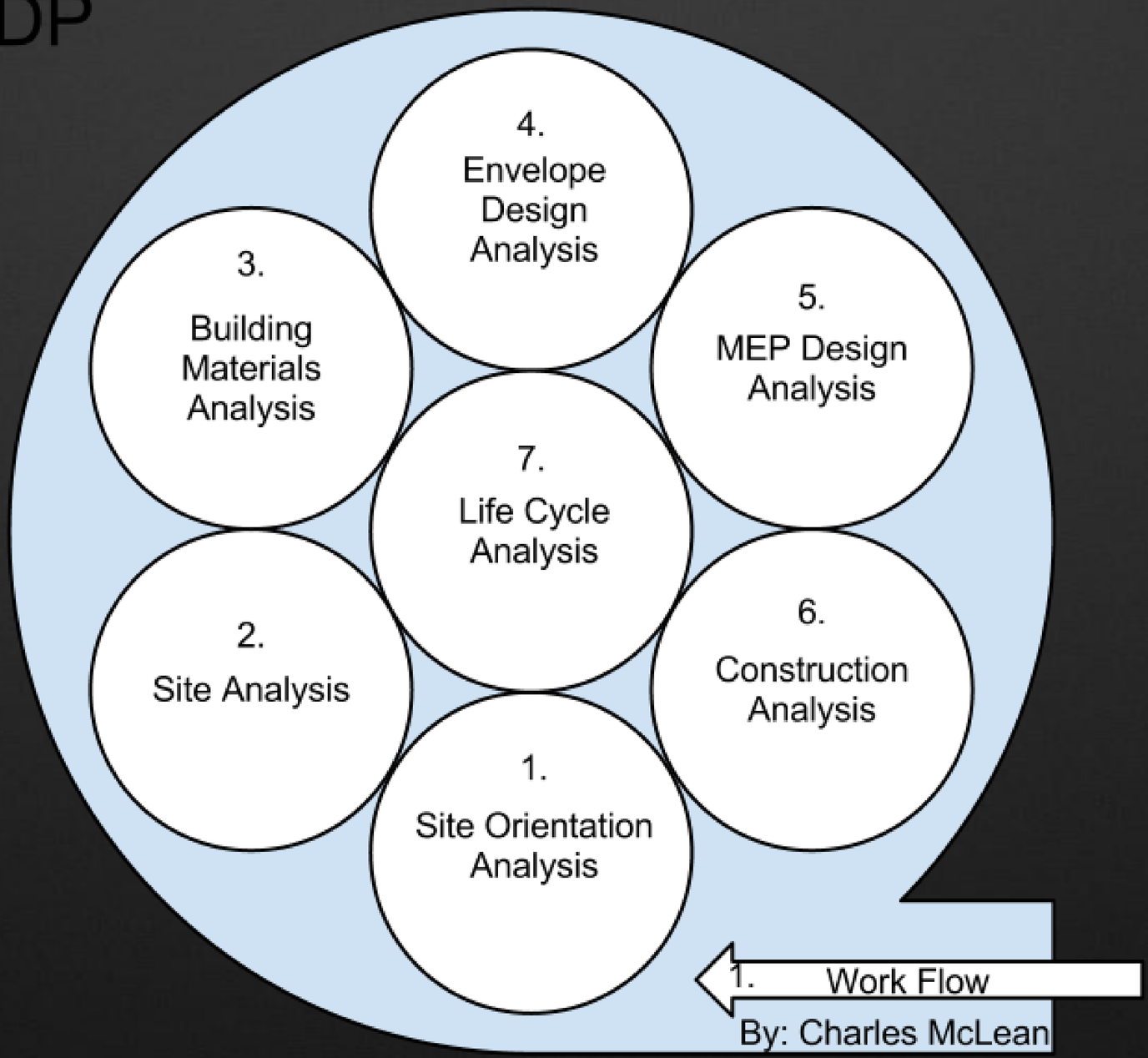
3D IDP

IDP

Work Flow



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AUTODESK CIVIL 3D

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AUTODESK CIVIL 3D

AutoCAD® Civil 3D® software is a Building Information Modeling (BIM) solution for civil engineering design and documentation. Civil 3D is built for civil engineers, drafters, designers, and technicians working on transportation, land development, and water projects. Stay coordinated and explore design options, analyze project performance

http://usa.autodesk.com/civil-3d/

© 2012 Autodesk

Autodesk Civil 3D

Beginning The 3D IDP Process

- Import GIS data from Google Earth online service or any BIM civil engineer.
- Use Autodesk Civil 3D and Google earth to produce a live model of the earth's contours.
- Autodesk Civil 3D controls grading design to coexist with a BIM model, civil layout plans and other landscaping details to kick off any project.

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Autodesk Civil 3D

Site Analysis

- Study Real Life Google Earth Maps
- Match GPS Data Information to Aerial Photo

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PROJECT VASARI

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PROJECT VASARI

Project Vasari is focused on conceptual building design using both geometric and parametric modeling. It supports performance-based design via integrated energy modeling and analysis features.

Autodesk® Project Vasari is an easy-to-use, expressive design tool for creating building concepts. Vasari goes further, with integrated analysis for energy and carbon, providing design insight where the most important design decisions are made. And, when it’s time to move the design to production, simply bring your Project Vasari design data into the Autodesk® Revit® platform for BIM, ensuring clear execution of design intent.

http://labs.autodesk.com/utilities/vasari/

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Project Vasari

Site Orientation

- Use Project Vasari to orientate the structural footprint to optimize the 3D IDP process.
  - Reduce the structure's energy usage and cost
  - Gain LEED credits
  - Optimize space design
  - Optimize circulation patterns
  - Plan for building materials
  - Infrastructure planning

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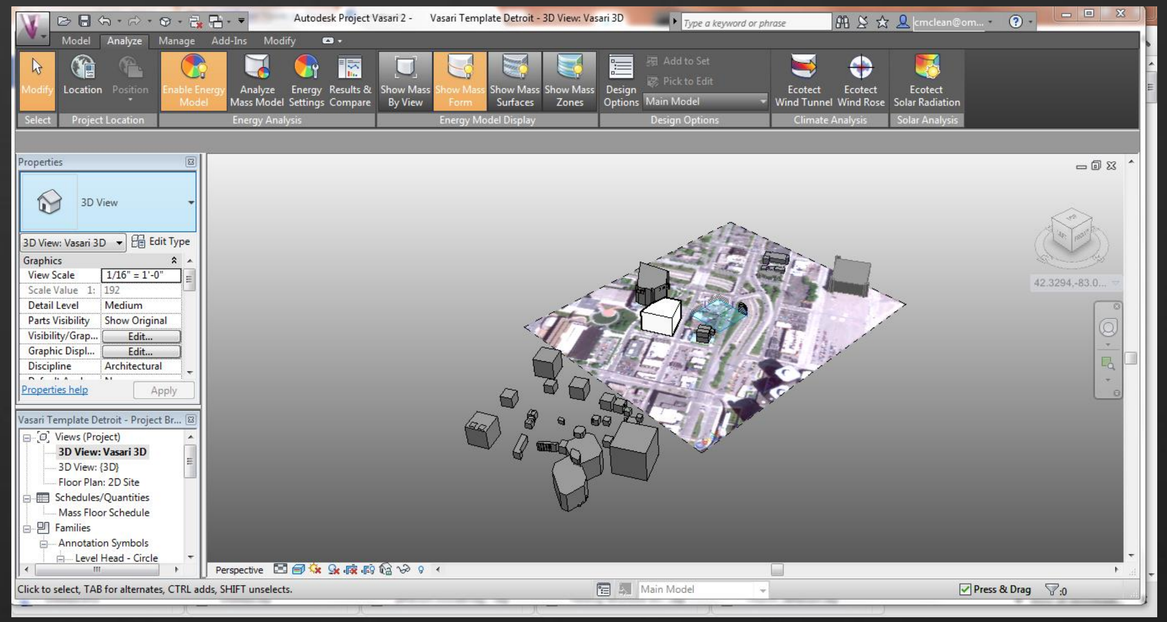
Project Vasari

Starting The Analysis

- Correlating The 3D Environment
- Analyze The 3D Environment
- Now Let's Make Some Cents



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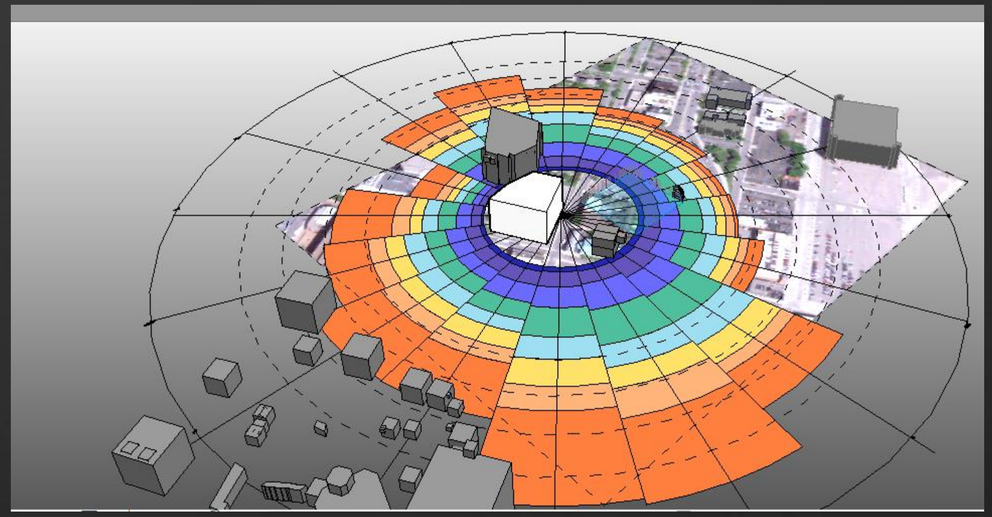
Project Vasari

Wind Rose

- Analyzing Wind Opportunities
- Are There Any Green Opportunities Utilizing Wind?
- Can We Use Natural Ventilation?



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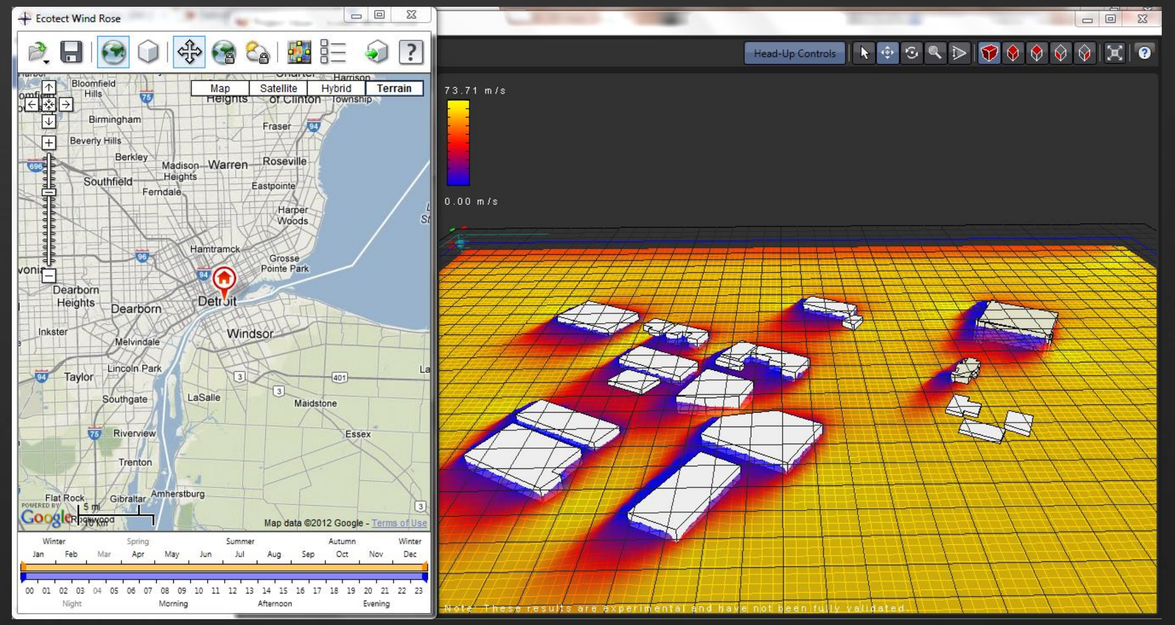
Project Vasari

Wind Tunnel Analysis

- Orientation Is Key
- Are Adjacent Properties A Factor?
- What Are My Design Options?



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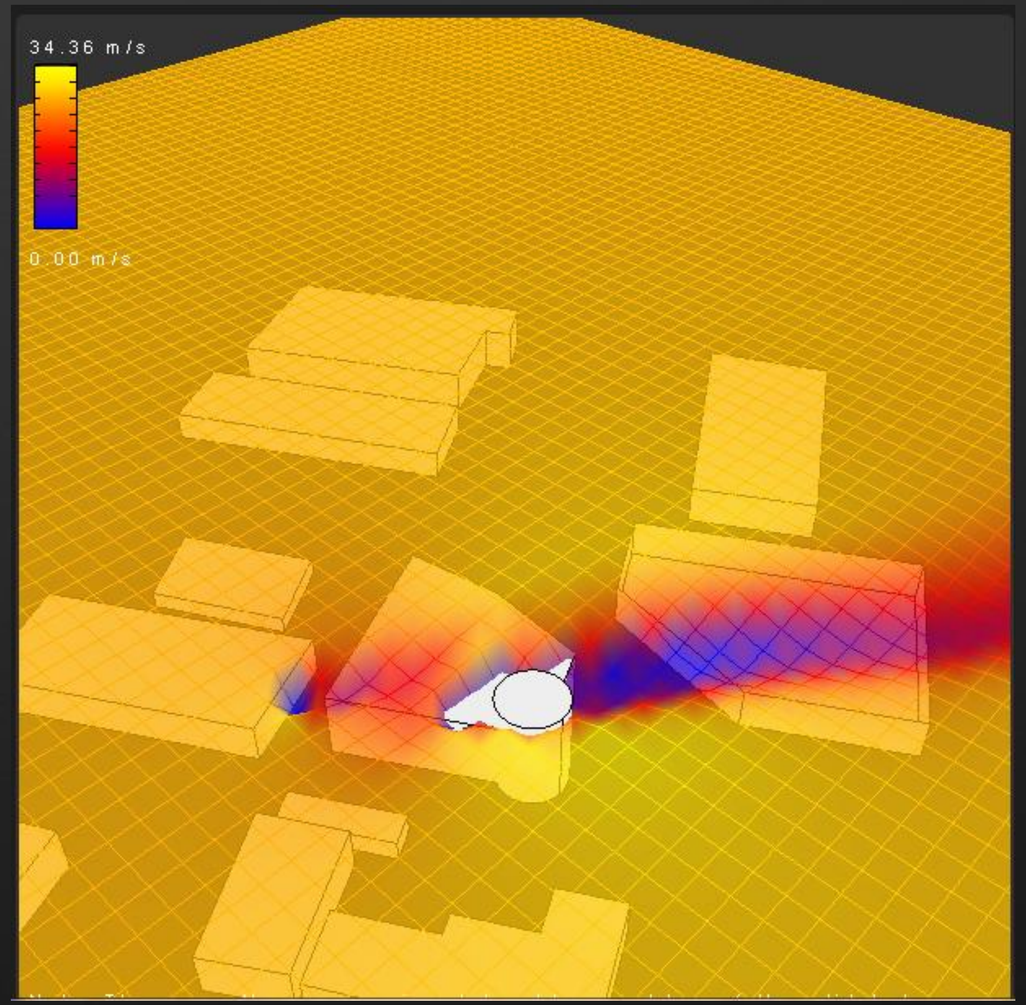
Project Vasari

Wind Tunnel Analysis (New Model)

- Improving Efficiency
- Making Sure The Design Works



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Project Vasari

Site Analysis (Concept Phase)

- Use wind and sun patterns to create key design elements using Project Vasari.
- Vasari has the ability to upload live Google Earth maps for site visualization.
- Exploit Vasari's modeling support to create efficient energy concept models

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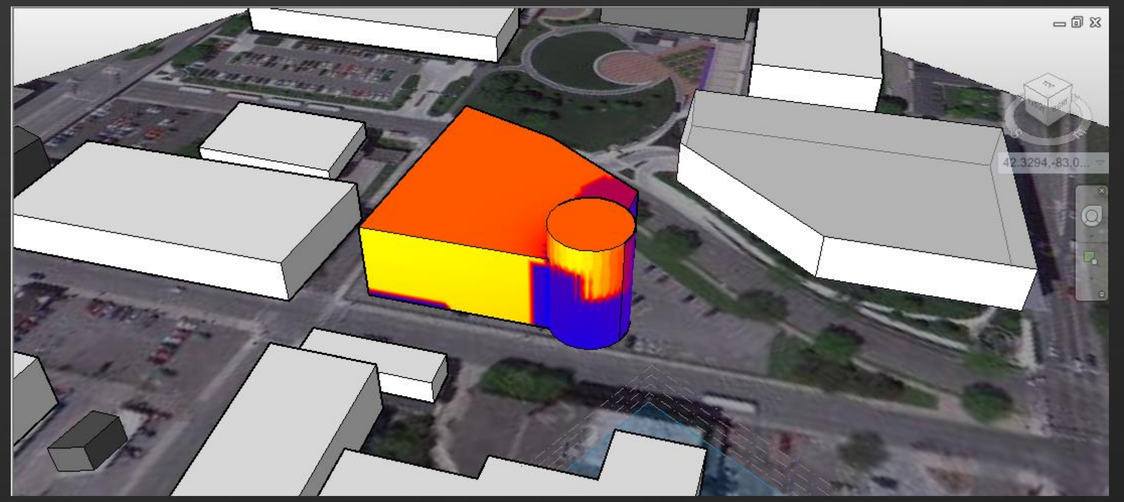
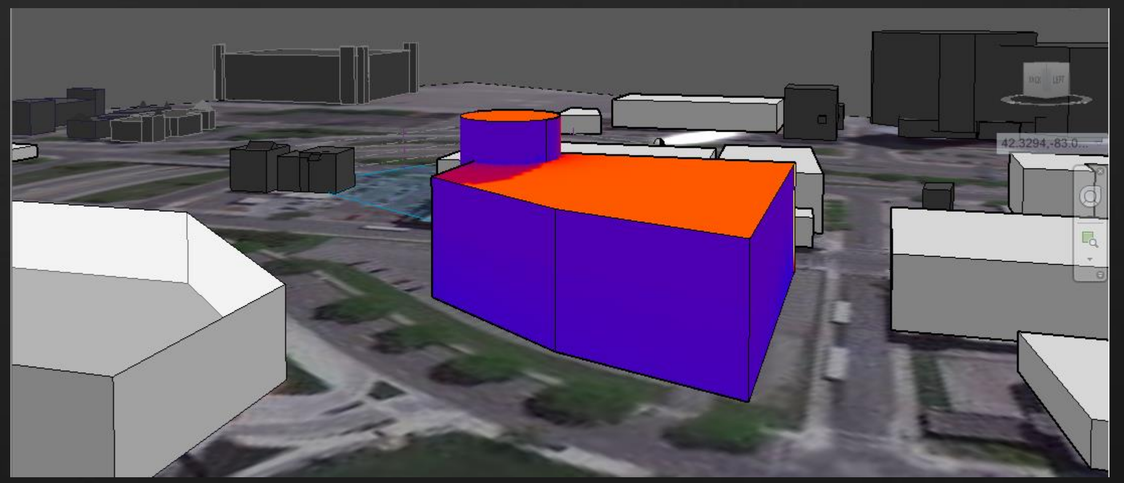
Project Vasari

Site Analysis

- Hot & Cold Spots
- Improving Low Performing Areas





ECOTECT

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AUTODESK REVIT

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AUTODESK REVIT

Built for BIM, Autodesk Revit helps you to model and analyze design concepts and more accurately maintain your vision through design, documentation, and construction. Use information-rich models to make more informed design decisions to support sustainable design, clash detection, construction planning, and fabrication. Any design change you make is updated throughout your project, keeping design and documentation coordinated and more reliable.

http://images.autodesk.com/adsk/files/autodesk_architecture_brochure_letter_en1.pdf

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Autodesk Revit

Building Material Analysis

- Manipulate Project Vasari analysis mass to create "real life" building materials.
- Revit Architecture support sustainable design decision-making early in the design process.
- Physical materials improve efficiency of BIM-based building performance workflows by assigning thermal and structural properties to the building envelope.
- Begin calculating costs and square footage counts pertaining to building materials. Keep track of all changes from the beginning process.
- Prepare pre heating and cooling loads based on cubic volume.

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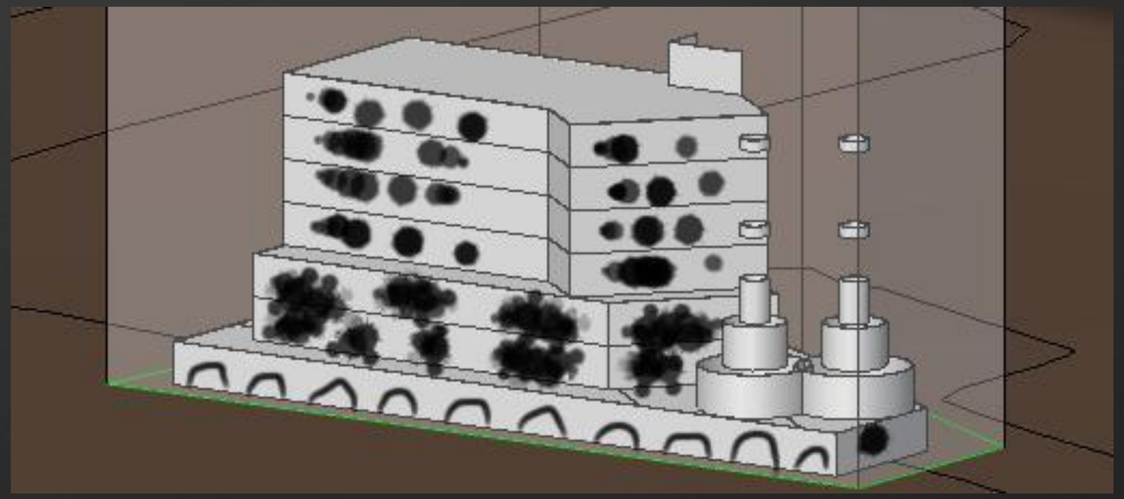
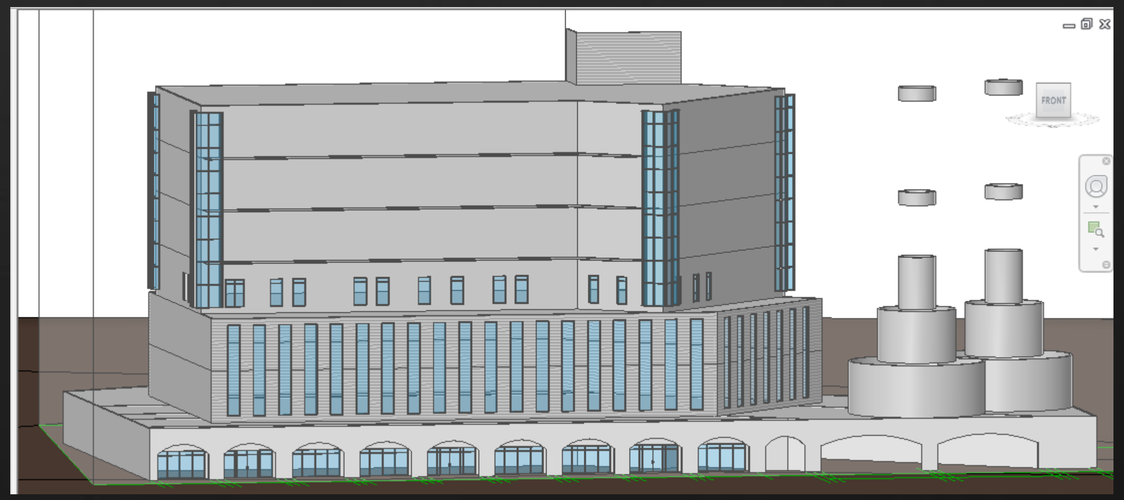
Autodesk Revit

Building Materials

- Applying Building Materials
- Pre Determine The Cost
- Make The Cents Make Sense

Bonus: Autodesk Sketchbook Pro





SKETCHBOOK

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Autodesk Revit, Structural & MEP

Envelope Design Analysis

- Design core and shell using the accuracy of Autodesk Revit. Accurately modeling the core and shell optimizes IDP results for further analytical development.
- Pre cost analysis are created using Autodesk Revit. Using schedules will allow for accurate cost analysis based on square footage, item amounts and etc. All cost are globally updated during the design process.

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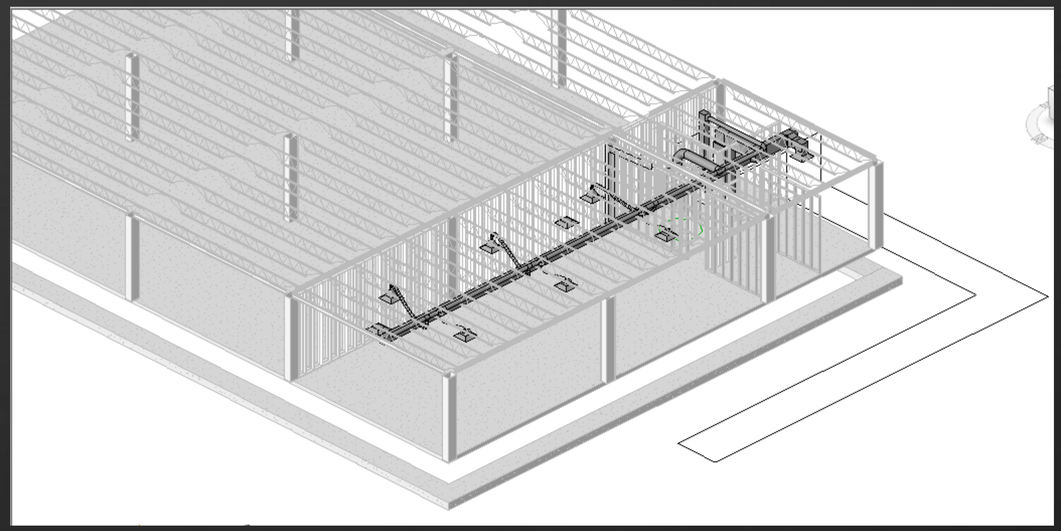
Autodesk Revit, Structural & MEP

Envelope Design Analysis

- Determine The Facts
- Improving The Life Cycle Analysis
- Minimize RFI's



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AUTODESK REVIT MEP

Autodesk® Revit® software provides mechanical, electrical and plumbing (MEP) engineers with the tools to design even the most complex building systems. Revit supports Building Information Modeling (BIM), helping you drive accurate design, analysis, and documentation of more efficient building systems from concept through to construction. Use information-rich models to support building systems design throughout the building lifecycle.

http://usa.autodesk.com/revit/mep-engineering-software/

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Autodesk Revit MEP

MEP Design Analysis

- Check to see if elements are fully connected and contributing to system load requirements for more accurate sizing. See the total electrical load, air flow, or pipe flow at any point within a system.
- Design Ducts to ASHRAE Standards with Duct Fitting Database.
- Calculating Engineering Spaces.
- Calculating Pressure and Flow for Duct and Pipe

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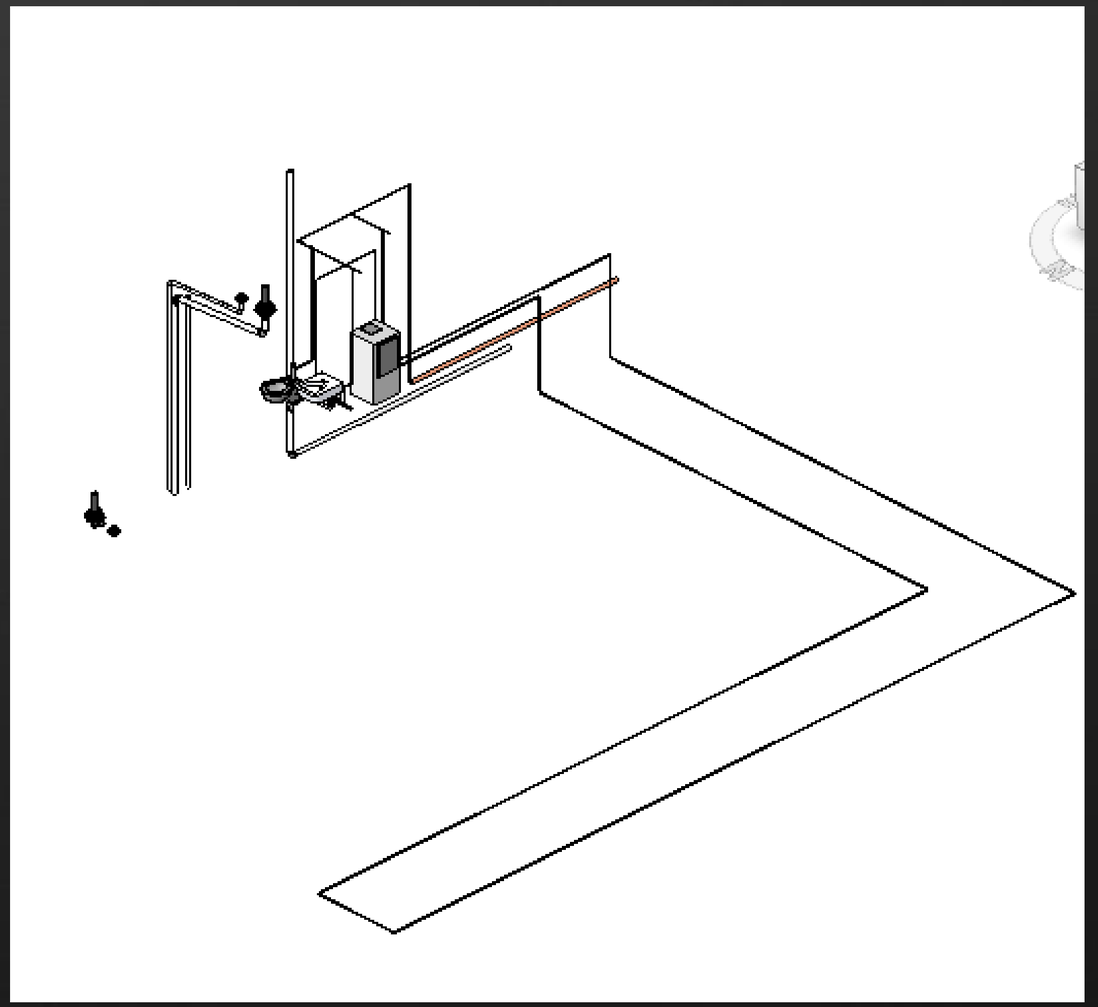
Autodesk Revit MEP

MEP Design Analysis

- Perceiving The Facts
- Improve Green Plumbing
- Can The System Work Together?



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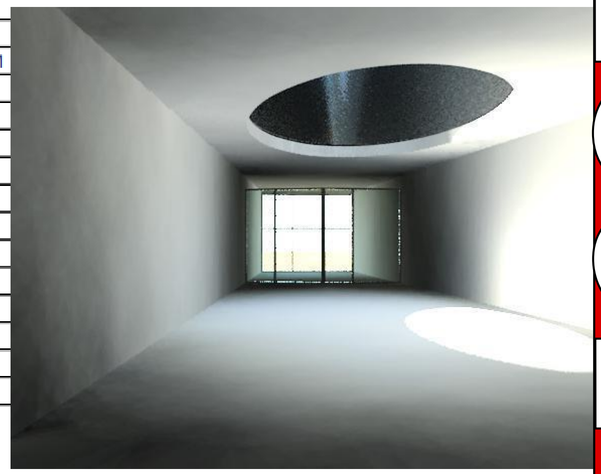
Autodesk Revit MEP

MEP Design Analysis

- Heating & Cooling Loads
- Check All Of Your Results

Zone Summary - Default

Inputs	
Area (SF)	157,963
Volume (CF)	1,676,649.65
Cooling Setpoint	74 °F
Heating Setpoint	70 °F
Supply Air Temperature	54 °F
Air Volume Calculation Type	Split System(s) with Natural Ventilation
Relative Humidity	40.00% (Calculated)
Psychrometric Message	None
Calculated Results	
Peak Cooling Load (Btu/h)	**3,571,745.7**
Peak Cooling Month and Hour	September 2:00 PM
Peak Cooling Sensible Load (Btu/h)	3,316,188.0
Peak Cooling Latent Load (Btu/h)	255,557.8
Peak Cooling Airflow (CFM)	110,509
Peak Heating Load (Btu/h)	**1,029,163.6**
Peak Heating Airflow (CFM)	33,742
Checksums	
Cooling Load Density (Btu/(h·ft²))	22.61
Cooling Flow Density (CFM/SF)	0.70
Cooling Flow / Load (CFM/ton)	371.28
Cooling Area / Load (SF/ton)	530.71
Heating Load Density (Btu/(h·ft²))	6.52
Heating Flow Density (CFM/SF)	0.21



Default Spaces

Space Name	Area (SF)	Volume (CF)	Peak Cooling Load (Btu/h)	Cooling Airflow (CFM)	Peak Heating Load (Btu/h)	Heating Airflow (CFM)
1 Conference	1,686	15,178.29	27,622.1	872	12,498.9	410
2 Conference	1,034	9,307.29	30,766.5	971	10,838.0	355
3 Conference	893	8,034.19	22,021.4	695	5,993.3	196
4 Resources	542	4,875.54	18,018.5	569	5,532.8	181
5 Resources	482	4,333.70	5,777.0	182	1,336.0	44
6 IC	42	337.38	555.9	18	99.7	3

ECOTECT

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AUTODESK ECOTECT

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AUTODESK ECOTECT

Autodesk® Ecotect® Analysis sustainable design analysis software is a comprehensive concept-to-detail sustainable building design tool. Ecotect Analysis offers a wide range of simulation and building energy analysis functionality that can improve performance of existing buildings and new building designs. Online energy, water, and carbon-emission analysis capabilities integrate with tools that enable you to visualize and simulate a building's performance within the context of its environment.

http://usa.autodesk.com/ecotect-analysis//

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Autodesk Ecotect

MEP Design Analysis

- Calculate heating and cooling loads for models and analyze effects of occupancy, internal gains, infiltration, and equipment.
- Autodesk Ecotect creates a separate BIM model for energy analysis calculations.
- Utilize sun and shading studies to improve orientation, exterior and interior design.
- Compare and contrast data from multiple analysis reports to finalize design options.

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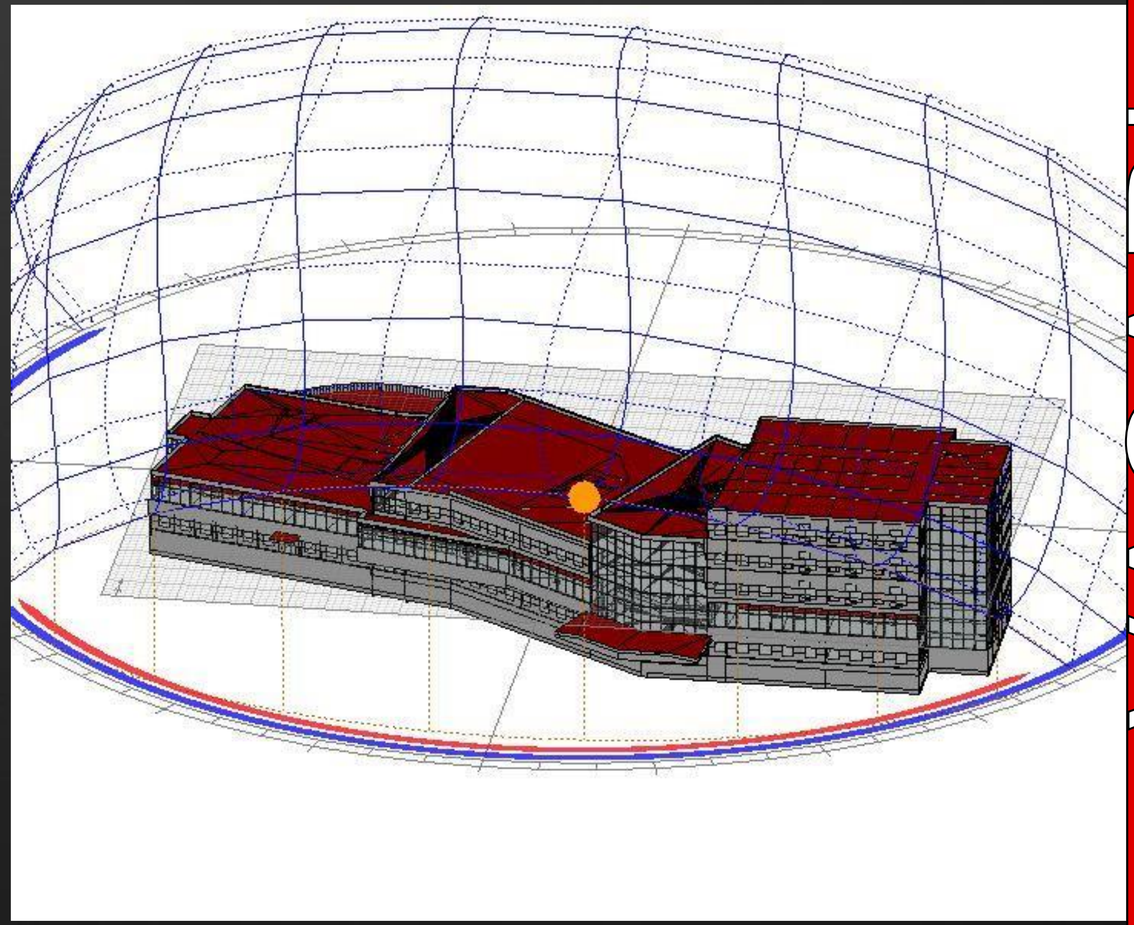
Autodesk Ecotect

Site Orientation

- Heat and Light Makes The Overall Difference
- Comfortable Spaces Improves Employee Productivity



VASARI

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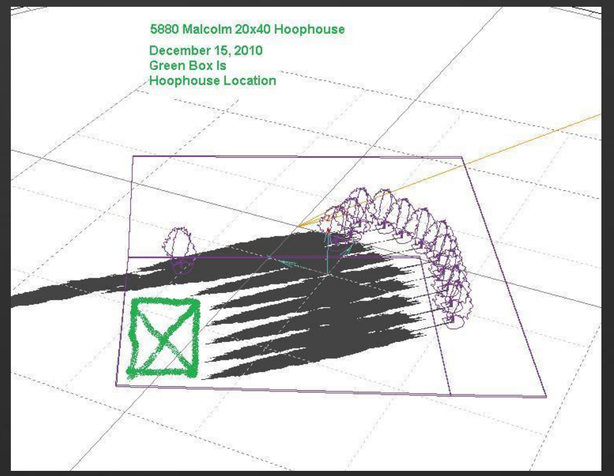
Autodesk Ecotect

Site Analysis

- Determine The Efficient Location
- Shadows Can Make A Difference
- All Of The Light



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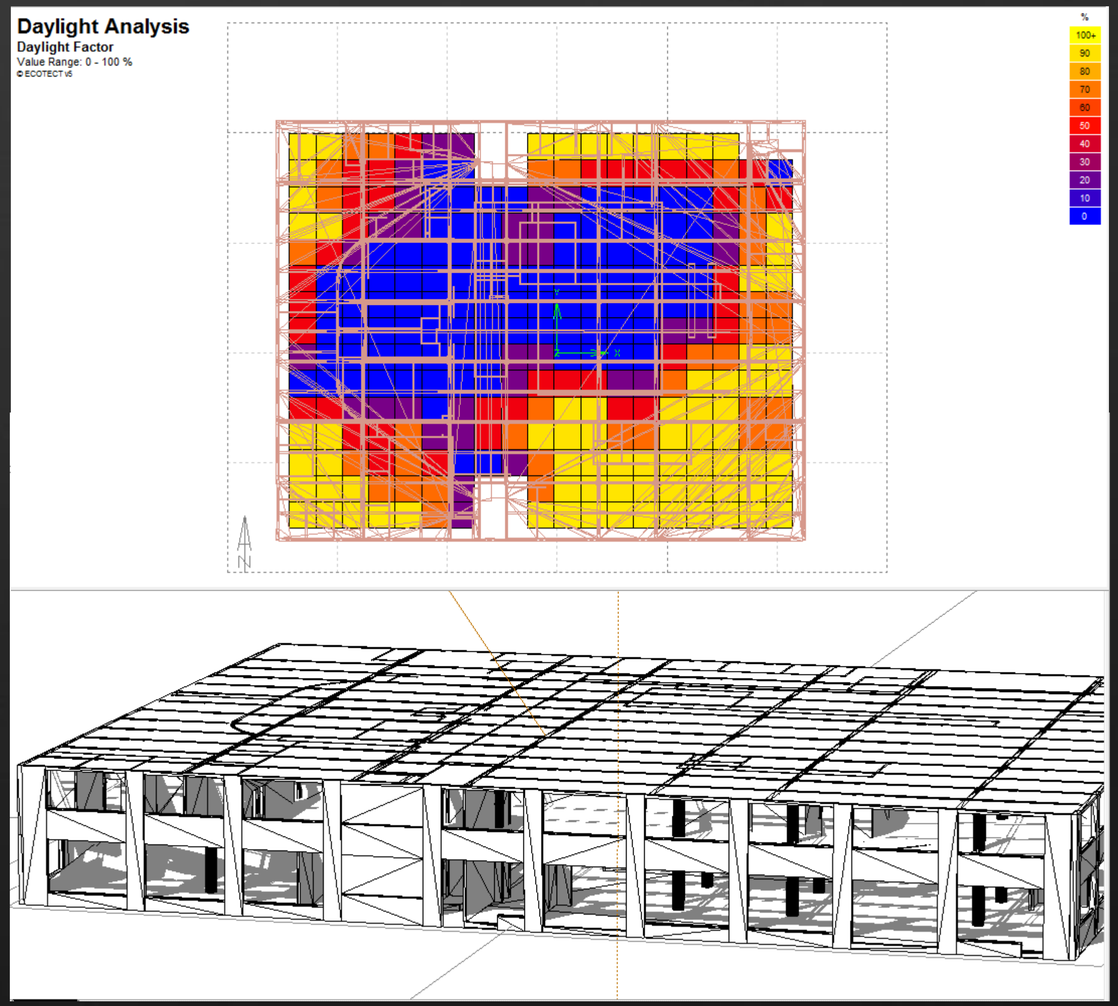
Autodesk Ecotect

Envelope Design

- Got Heat?
- Where Is The Light?
- Improving Interior Spaces



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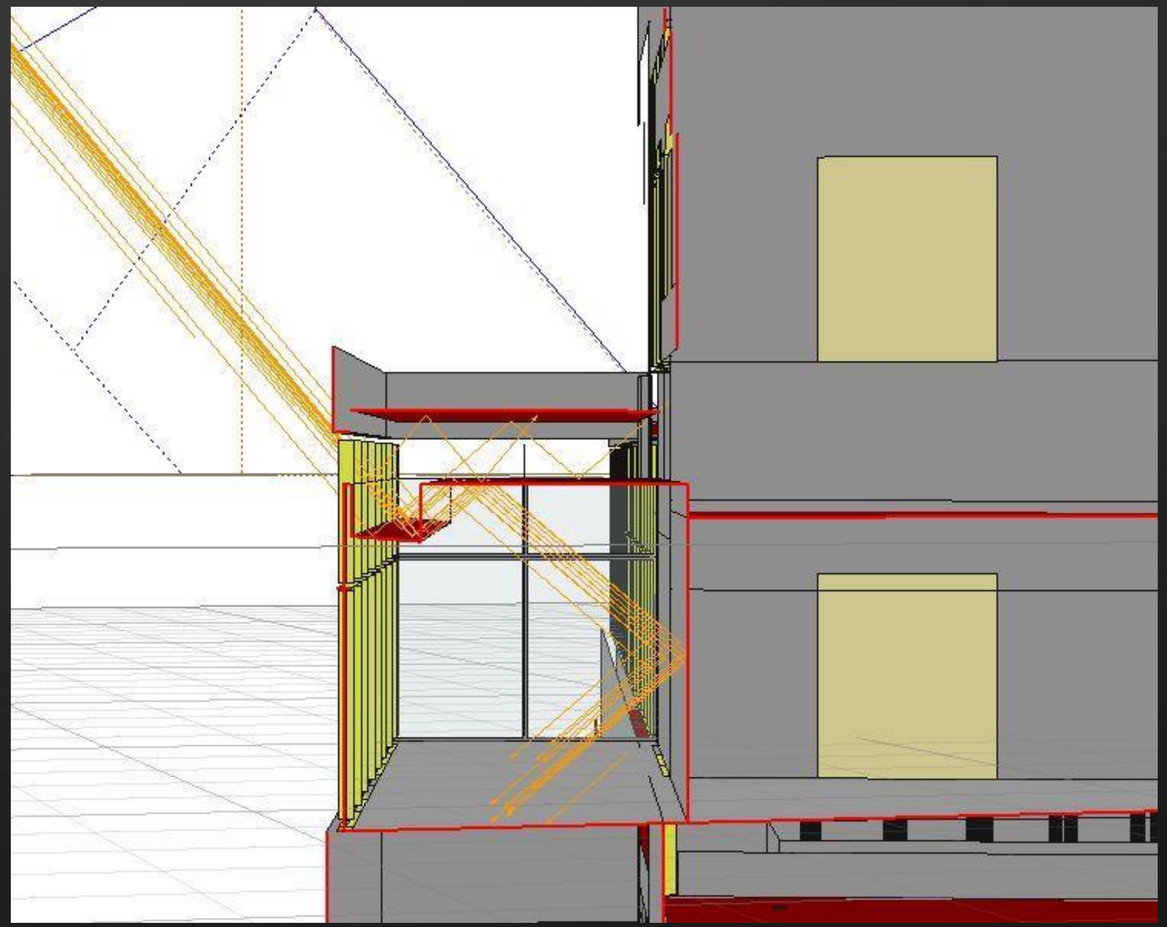
Autodesk Ecotect

Envelope Design

- What Can We Do About This?
- Can We Design Around The Sun And It's Various Angles?



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Autodesk Ecotect

Interior Design

- I ForeSee The Light!

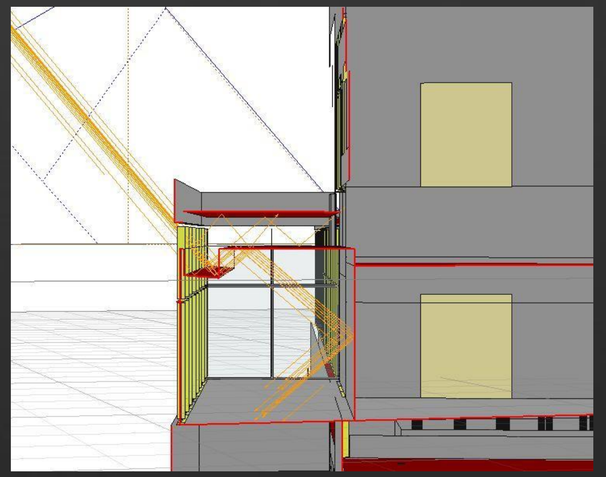

Image: Autodesk Revit

REVIT

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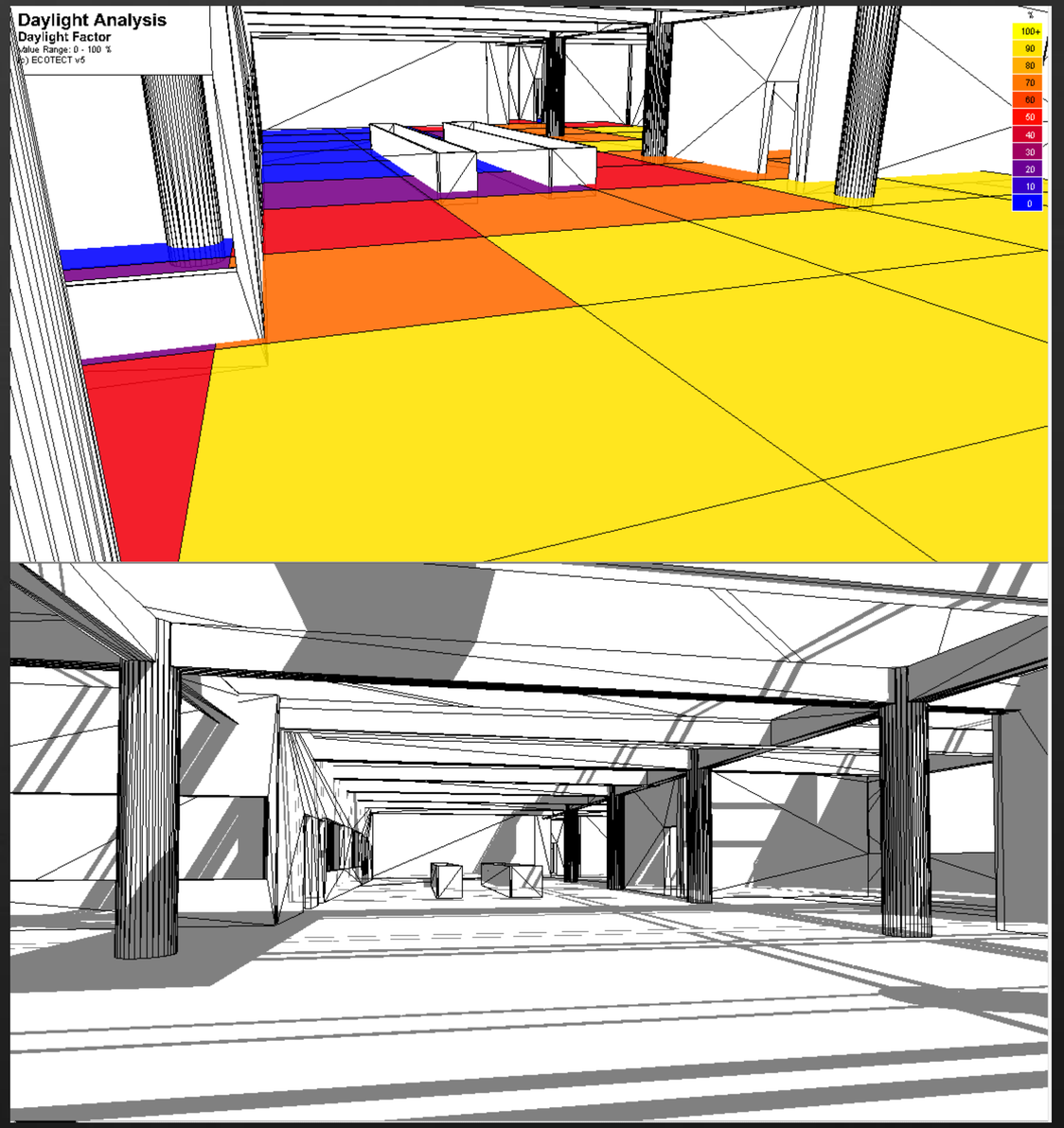
Autodesk Ecotect

Interior Design

- Can You Move The Picture Frame A Little To The Right?



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AUTODESK REVIT MEP

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AUTODESK INVENTOR FUSION

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AUTODESK INVENTOR BONUS:

Autodesk® Navisworks® project review software products help architecture, engineering, and construction professionals gain control over project outcomes. Integrate, share, and review models and multi format data with all your project stakeholders. A comprehensive set of integration, analysis, and communication tools helps teams better coordinate disciplines, resolve conflicts, and plan projects before construction or renovation begins. Navisworks supports Building Information Modeling (BIM) for building and infrastructure, as well as 3D model-based design for process and power plants.

http://usa.autodesk.com/navisworks/

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Autodesk Inventor

BONUS:

Construction Analysis

- Supports the creation of a single, coordinated model to facilitate collaboration, encouraging shared learning and helping to provide a platform for interdisciplinary workflows.
- Comprehensive schedule, cost, animation, and visualization capabilities enable you to demonstrate design intent and simulate construction, promoting insight and predictability.
- Provides a comprehensive range of markup, review, and commenting tools to support collaboration among all design disciplines.

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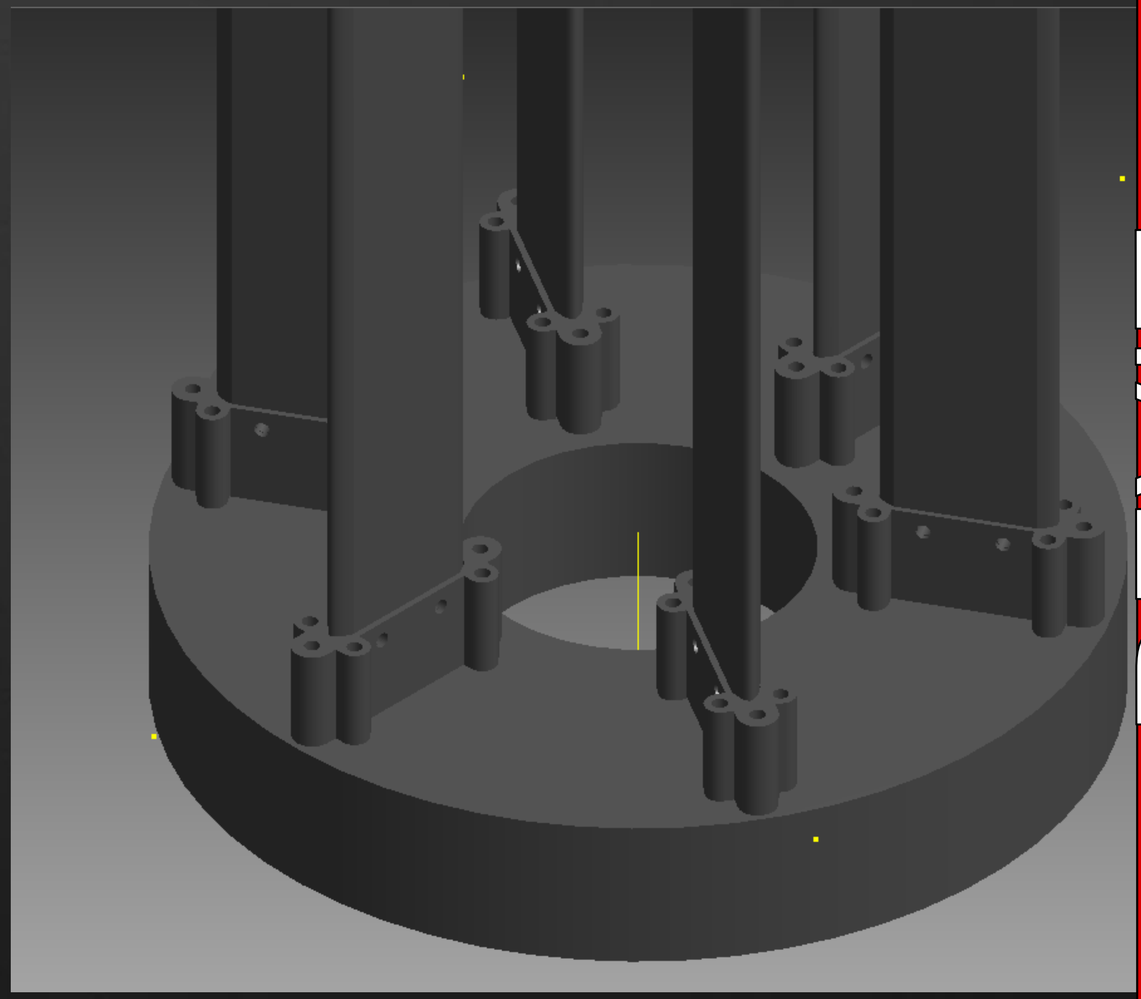
Autodesk Inventor

BONUS:

Manufacturing & Fabrication

- Procurement & Documentation
- Revised Schedule Changes
- Concise Fabricated Details
- Inventor/Revit Interoperability
- Detailed Fabricated Shop Drawings



REVIT

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Autodesk Inventor

BONUS:

Manufacturing & Fabrication

- Procurement & Documentation
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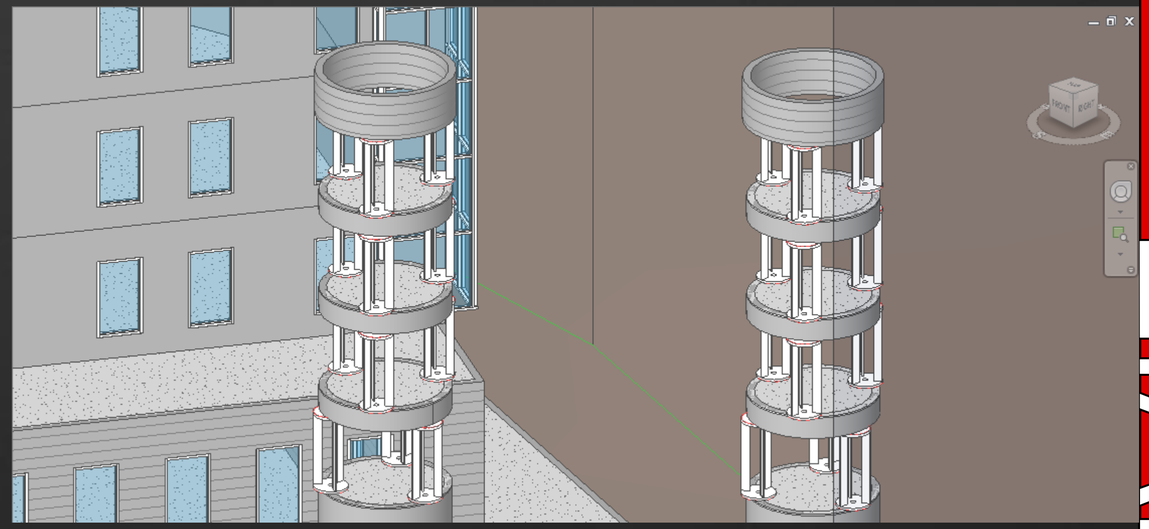
- Concise Fabricated Details
- Inventor/Revit Interoperability
- Detailed Fabricated Shop Drawings



REVIT

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DATA ENTRY

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Data Entry

Advanced Schedules

- Check to see if elements are fully connected and contributing to system load requirements for more accurate sizing. See the total electrical load, air flow, or pipe flow at any point within a system.
- Design Ducts to ASHRAE Standards with Duct Fitting Database.
- Calculating Engineering Spaces.
- Calculating Pressure and Flow for Duct and Pipe

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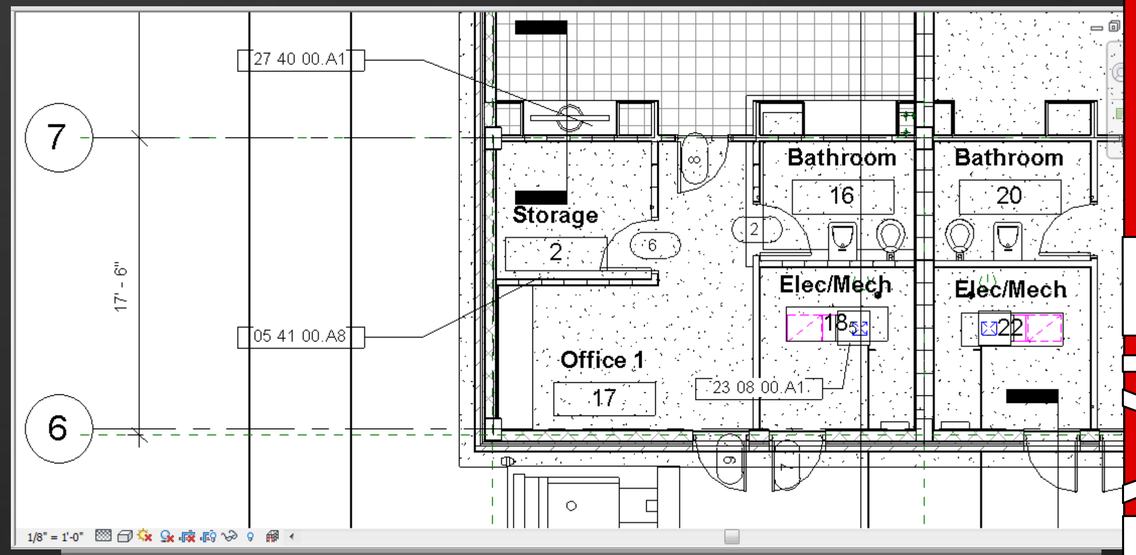
Data Entry

Advanced Schedules

- Client's Notice Design Flaws
- Stating The Facts
- Facility Management



Keynote Legend	
Key Value	Keynote Text
03 31 00.	18" x 12" Concrete Footing
05 41 00.	6" Metal Stud
23 08 00.	Geothermal Heat Pump and Condensor
27 40 00.	Flat Screen Telivision

REVIT

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Data Entry

Advanced Schedules

xxqs-Wall Demolition Schedule

Area	Family and Type	Demolition Cost	Cost Per Sf
35 SF	Basic Wall: Foundation Wall 11"	$6.75	$239.06
12 SF	Basic Wall: Foundation Wall 11"	$6.75	$81.00
24 SF	Basic Wall: Foundation Wall 11"	$6.75	$161.25

Lighting Calcs

Name	Number	Floor Level	Family and Type	Wattage(Room)	Lighting Load per SF	Net Lighting Wattage Cost Per SF	HoursYr	Fixture Count	Lamps	Total Lighting Electrical Cost	Utility
Bathroom	16	Level 1	Philips_Day-Brite-FL-SA-Design	0.09 kW	1.34 W/ft²	$0.16	2000	1	2	$20.40	$0.12
Bathroom	20	Level 1	Philips_Day-Brite-FL-SA-Design	0.09 kW	1.33 W/ft²	$0.16	2000	1	2	$20.40	$0.12
Bathroom	24	Level 1	Philips_Day-Brite-FL-SA-Design	0.09 kW	1.33 W/ft²	$0.16	2000	1	2	$20.40	$0.12
Bathroom	28	Level 1	Philips_Day-Brite-FL-SA-Design	0.09 kW	1.33 W/ft²	$0.16	2000	1	2	$20.40	$0.12
Elec/Mech	18	Level 1	Pendant Light - Linear - 2 Lamp:	0.06 kW	0.74 W/ft²	$0.09	2200	1	2	$16.90	$0.12
Elec/Mech	22	Level 1	Pendant Light - Linear - 2 Lamp:	0.06 kW	0.73 W/ft²	$0.09	2000	1	2	$15.36	$0.12
Elec/Mech	26	Level 1	Pendant Light - Linear - 2 Lamp:	0.06 kW	0.73 W/ft²	$0.09	2000	1	2	$15.36	$0.12
Elec/Mech	30	Level 1	Pendant Light - Linear - 2 Lamp:	0.06 kW	0.73 W/ft²	$0.09	2000	1	2	$15.36	$0.12
Office 1	17	Level 1	Philips_Day-Brite-FL-SA-Design	0.26 kW	1.45 W/ft²	$0.52	3300	3	6	$302.94	$0.12
Office 2	21	Level 1	Philips_Day-Brite-FL-SA-Design	0.26 kW	1.48 W/ft²	$0.53	3300	3	6	$302.94	$0.12
Office 3	29	Level 1	Philips_Day-Brite-FL-SA-Design	0.26 kW	1.48 W/ft²	$0.53	3300	3	6	$302.94	$0.12
Office 4	25	Level 1	Philips_Day-Brite-FL-SA-Design	0.26 kW	1.46 W/ft²	$0.53	2800	3	6	$257.04	$0.12
Retail 1	1	Level 1	Philips_Day-Brite-FL-SA-Design	2.04 kW	1.66 W/ft²	$4.79	3360	24	48	$19740.67	$0.12
Retail 2	9	Level 1	Philips_Day-Brite-FL-SA-Design	2.04 kW	1.69 W/ft²	$4.85	3360	24	48	$19740.67	$0.12
Retail 3	10	Level 1	Philips_Day-Brite-FL-SA-Design	2.04 kW	1.69 W/ft²	$4.85	3360	24	48	$19740.67	$0.12
Retail 4	11	Level 1	Philips_Day-Brite-FL-SA-Design	2.04 kW	1.66 W/ft²	$4.78	3360	24	48	$19740.67	$0.12
Storage	2	Level 1	Pendant Light - Linear - 2 Lamp:	0.06 kW	0.87 W/ft²	$0.10	2000	1	2	$15.36	$0.12
Storage	19	Level 1	Pendant Light - Linear - 2 Lamp:	0.06 kW	0.91 W/ft²	$0.11	2000	1	2	$15.36	$0.12
Storage	23	Level 1	Pendant Light - Linear - 2 Lamp:	0.06 kW	0.88 W/ft²	$0.11	2000	1	2	$15.36	$0.12
Storage	27	Level 1	Pendant Light - Linear - 2 Lamp:	0.06 kW	0.91 W/ft²	$0.11	2000	1	2	$15.36	$0.12
Grand total:						$22.81		120	240	$80334.56	

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Autodesk® Navisworks® project review software products help architecture, engineering, and construction professionals gain control over project outcomes. Integrate, share, and review models and multi format data with all your project stakeholders. A comprehensive set of integration, analysis, and communication tools helps teams better coordinate disciplines, resolve conflicts, and plan projects before construction or renovation begins. Navisworks supports Building Information Modeling (BIM) for building and infrastructure, as well as 3D model-based design for process and power plants.

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- Provides a comprehensive range of markup, review, and commenting tools to support collaboration among all design disciplines.

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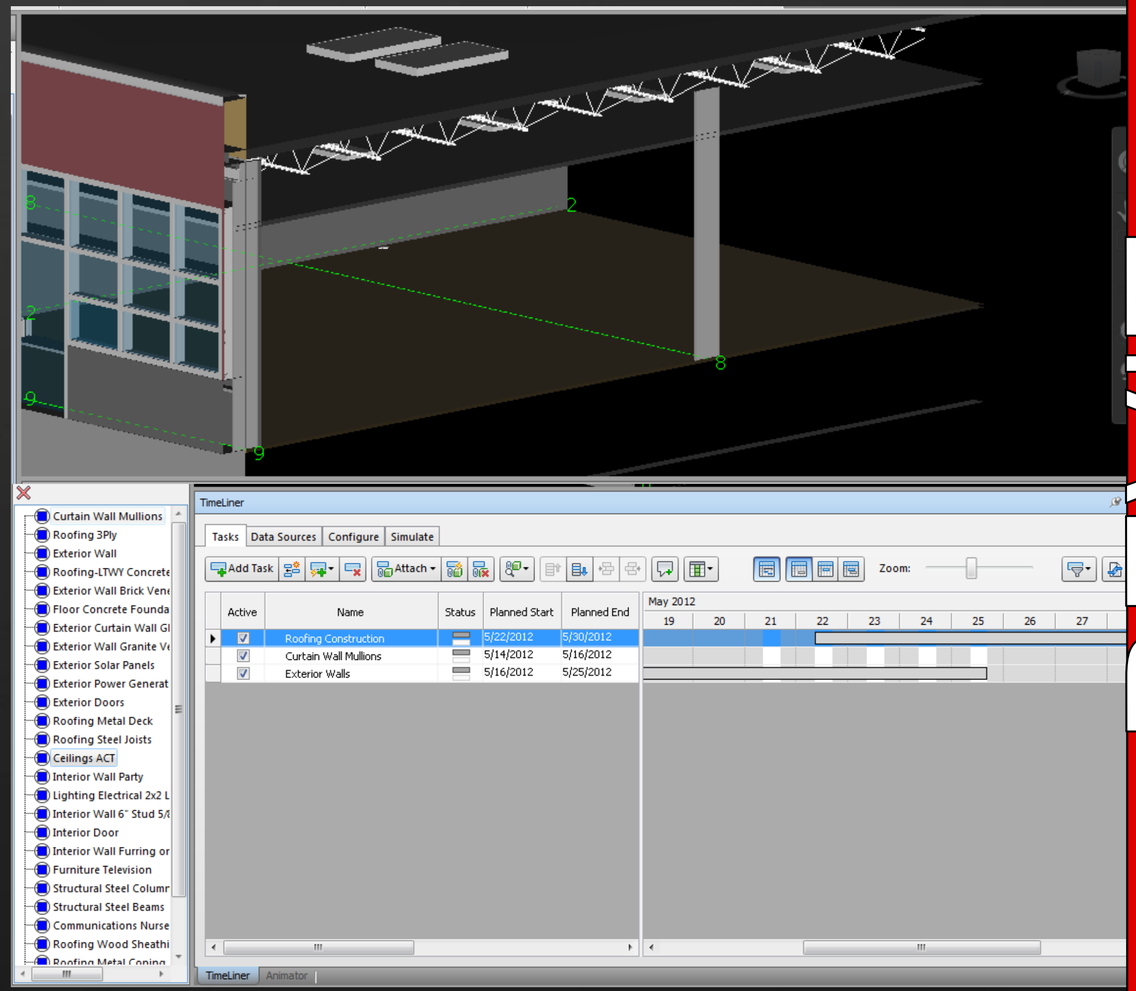
Construction Analysis

- Procurement & Documentation
- Revised Schedule Changes



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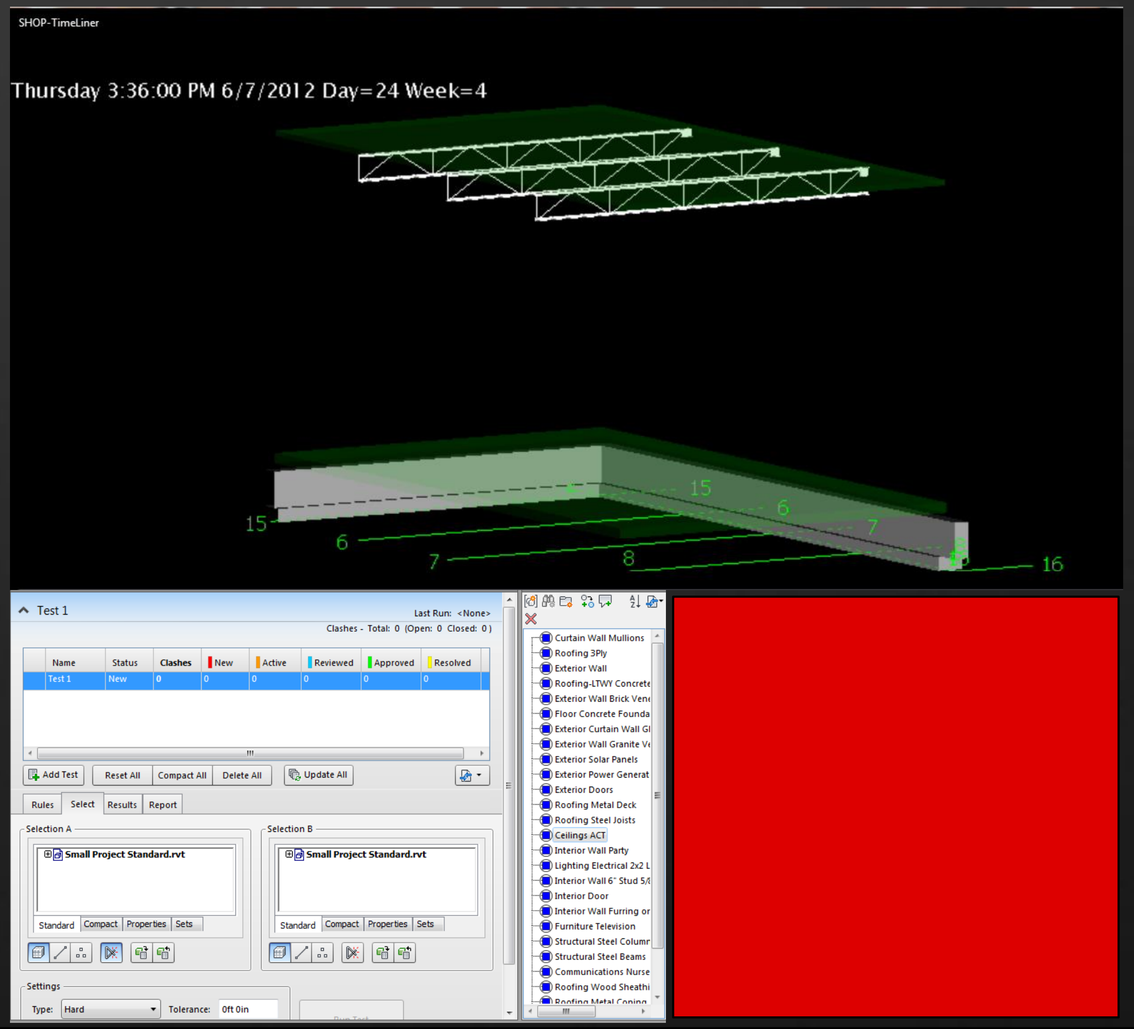
Construction Analysis

- Construction Simulation
- Clash Detection Tolerance



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