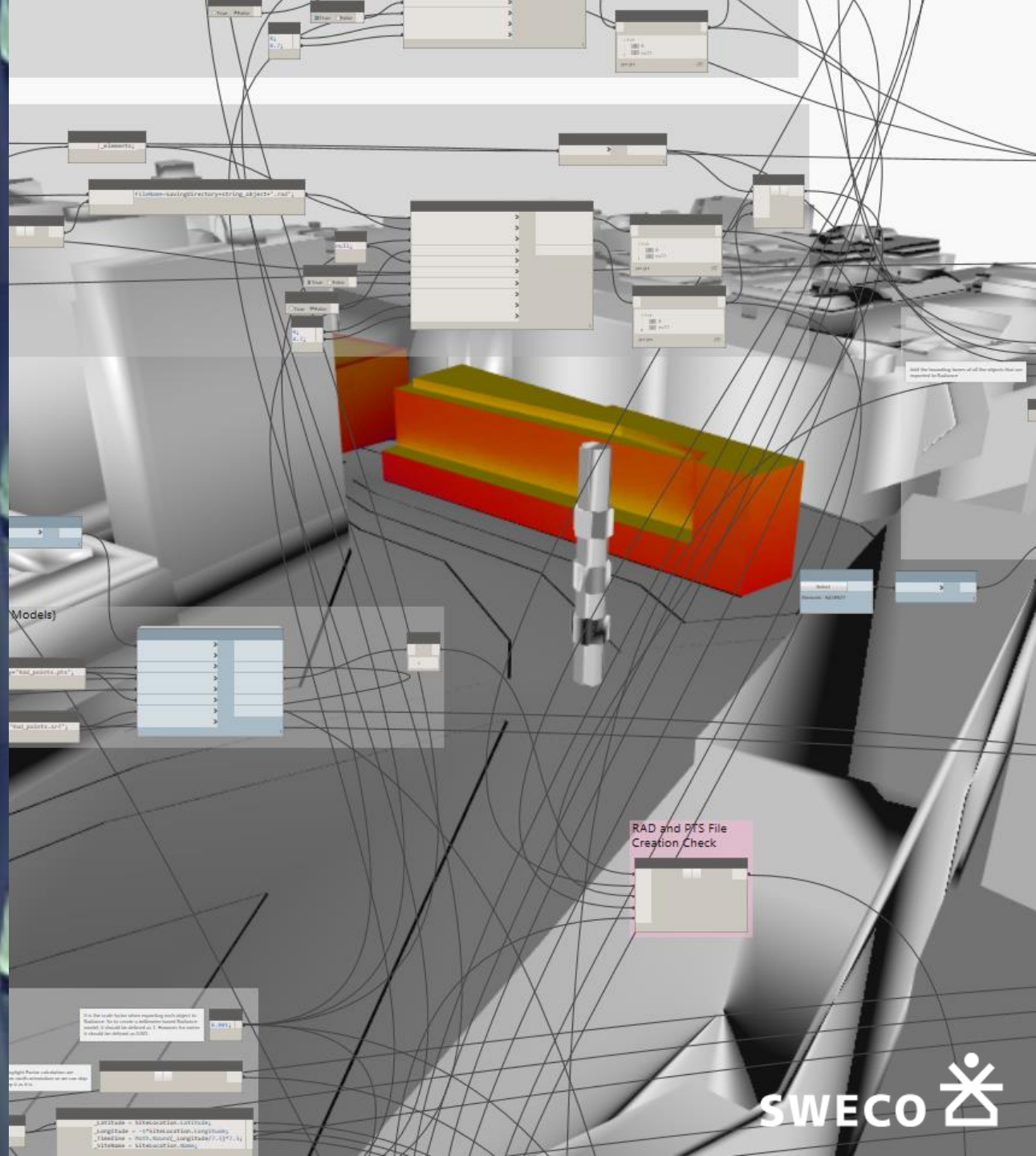
SWECO
Sustainable engineering and design

Majid Miri, August 2017
majid.miri@sweco.se


Models)
RAD and PTS File
Creation Check
SWECO

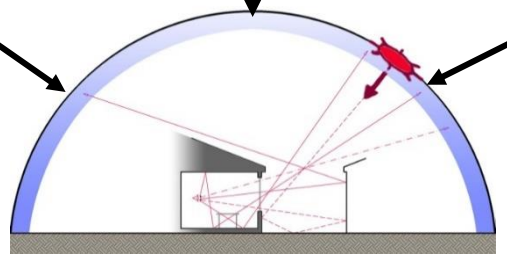
Daylight Simulation Program

scene
- scene geometry
- optical material properties
- surrounding landscape
- ground reflectance
- status of electrical lighting
- status of shading devices

area of interest
- viewpoint
- grid of sensor points

space usage
- space type (office, …)
- lighting requirements
- schedule (occupancy, lighting, …)

Sky condition
- date, time
- latitude, longitude
- sky condition (overcast, clear, …)
- weather data



Daylight simulation engine
(raytracing, radiosity, …)

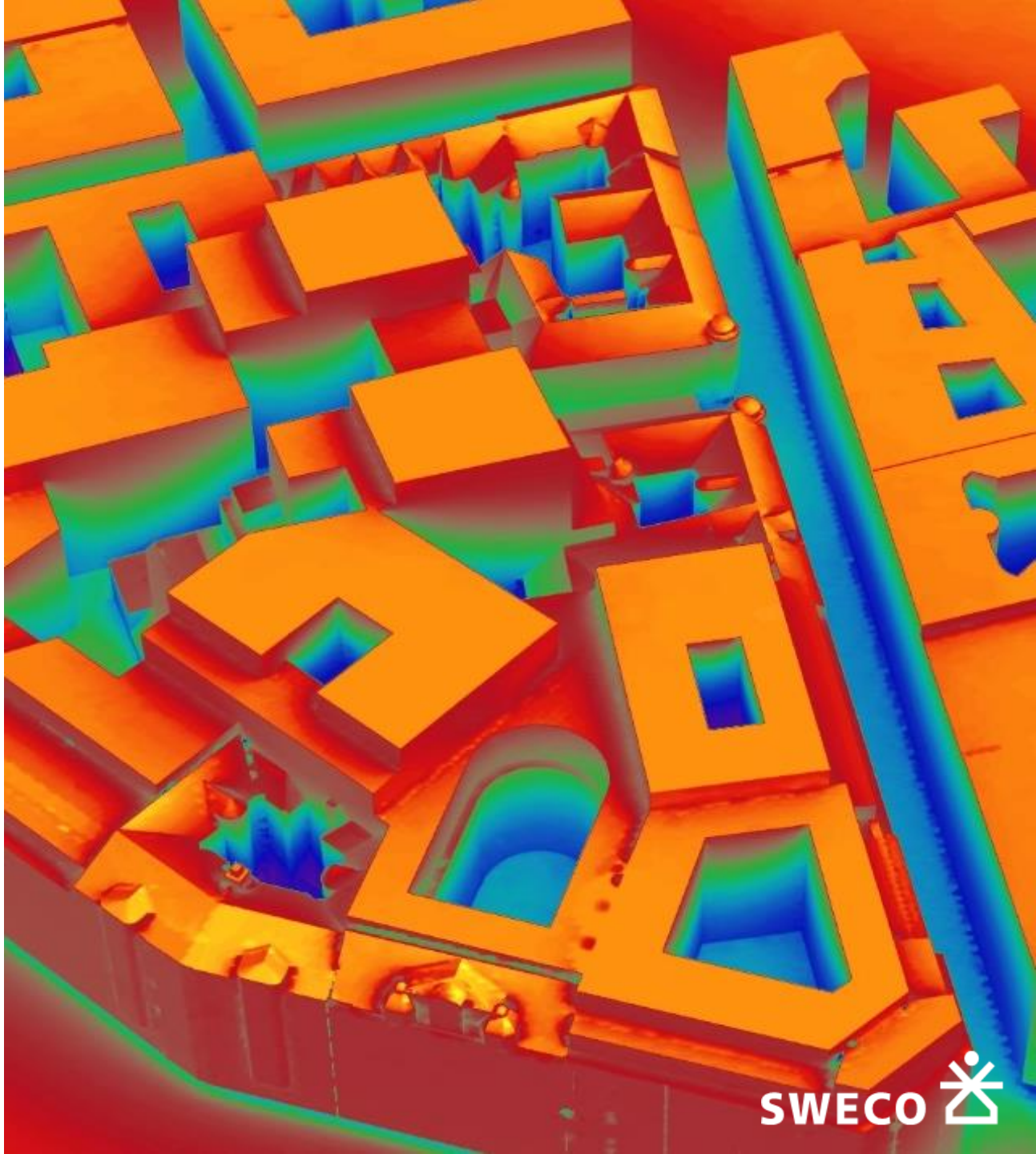
Intermediate results
illuminances
luminances, etc.

Results processor

Simulation outcome
Performance metrics
visualizations

Elements needed for a daylight simulation*

* Reinhart CF, Daylighting course lectures, MIT, 2012



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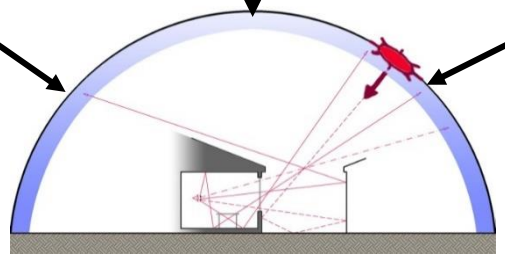

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3d Modelling software:

3ds MAX

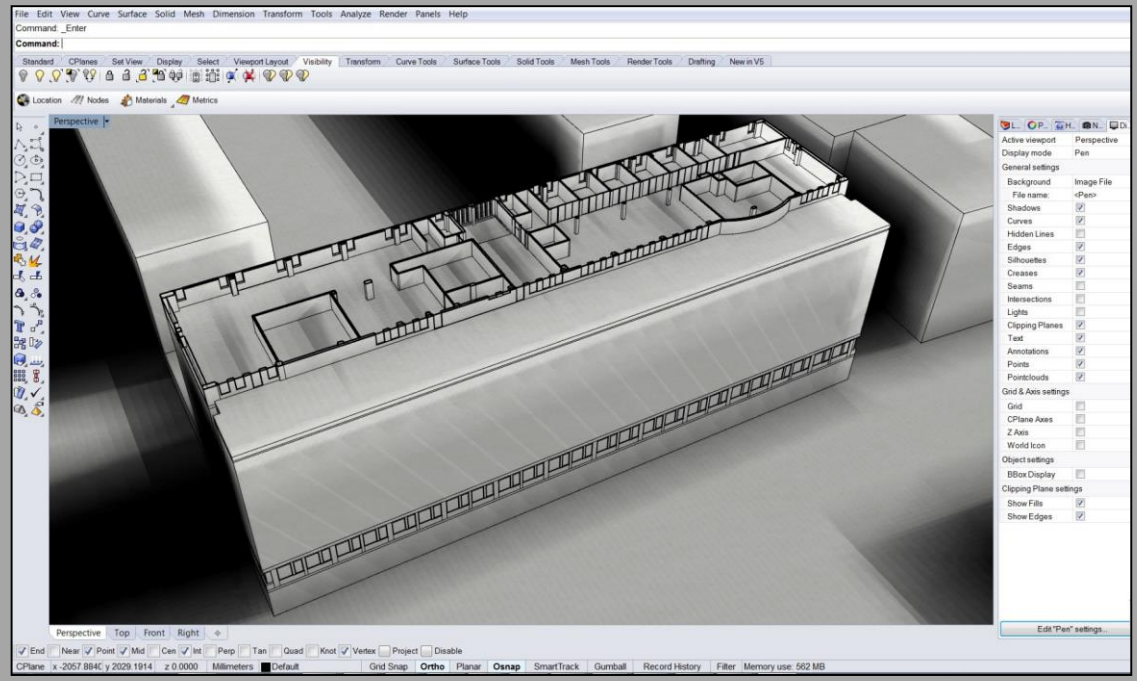
AUTODESK REVIT

Rhinoceros

AUTOCAD

SketchUp

GRAPHISOFT ARCHICAD



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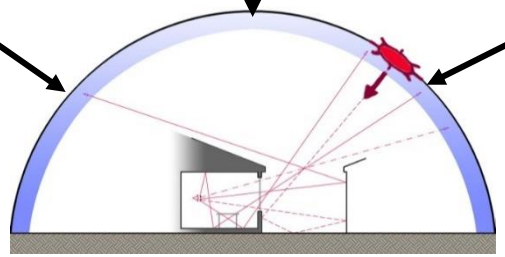

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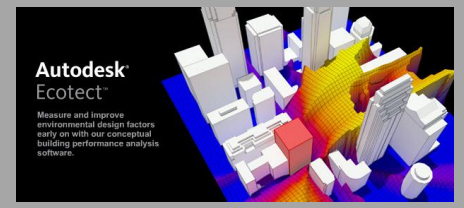
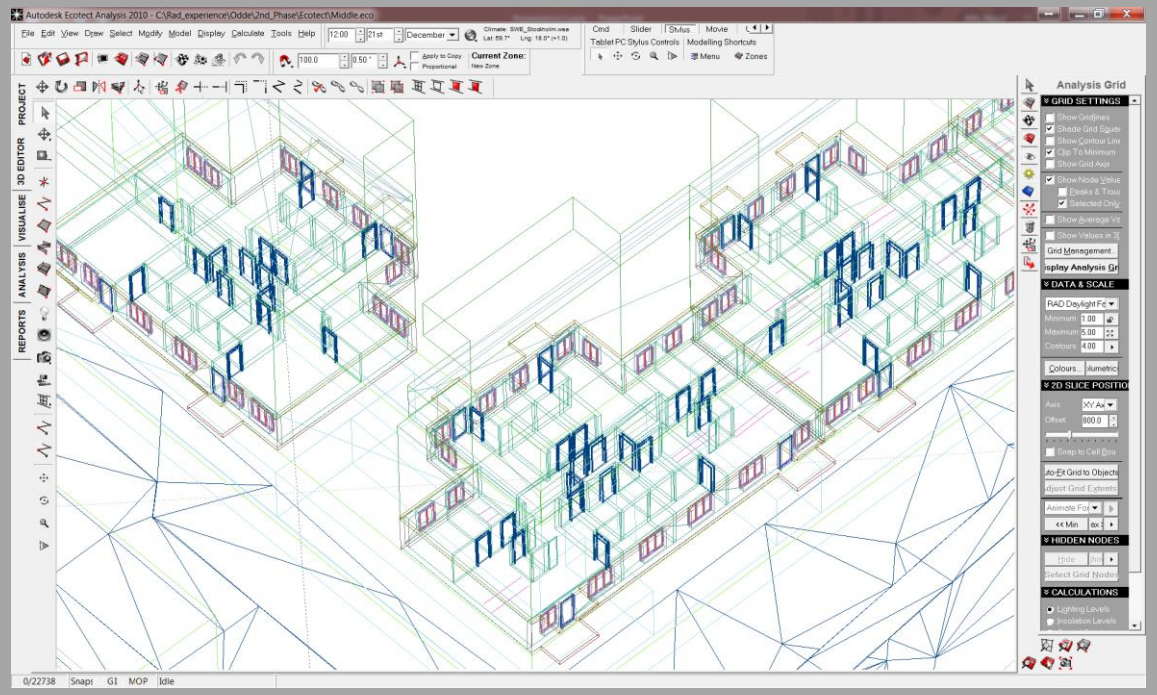
Translator Software (with user friendly interface):





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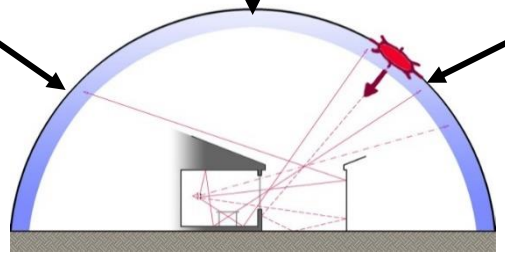

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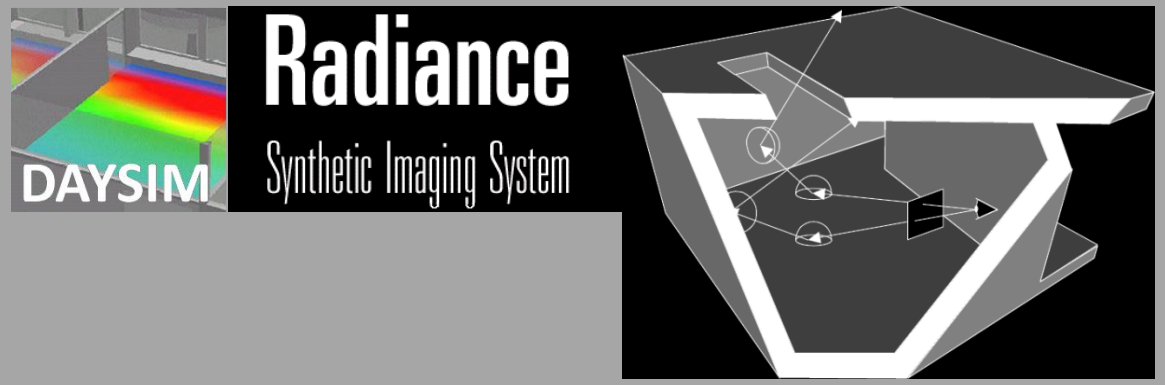
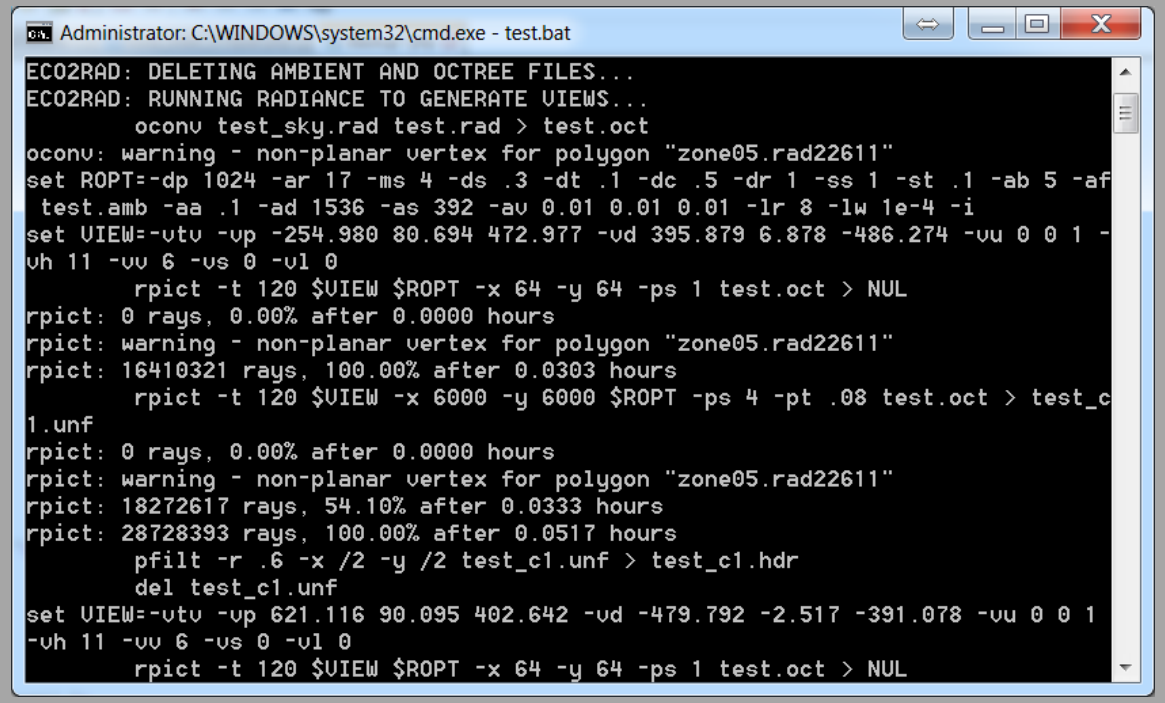
Calculator/Simulator software:





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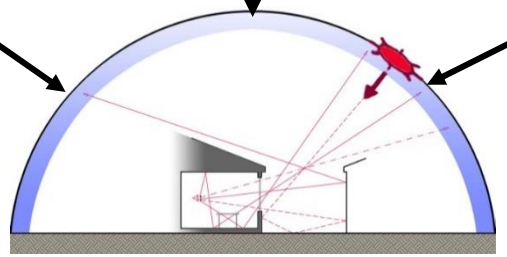

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Presenter Software:

grasshopper
GENERATIVE MODELING FOR RHINO

Autodesk Ecotect
Measure and improve environmental design factors early on with our conceptual building performance analysis software.

SPOT
Sensor Placement + Optimization Tool

DIVA FOR RHINO
ENVIRONMENTAL ANALYSIS FOR BUILDINGS

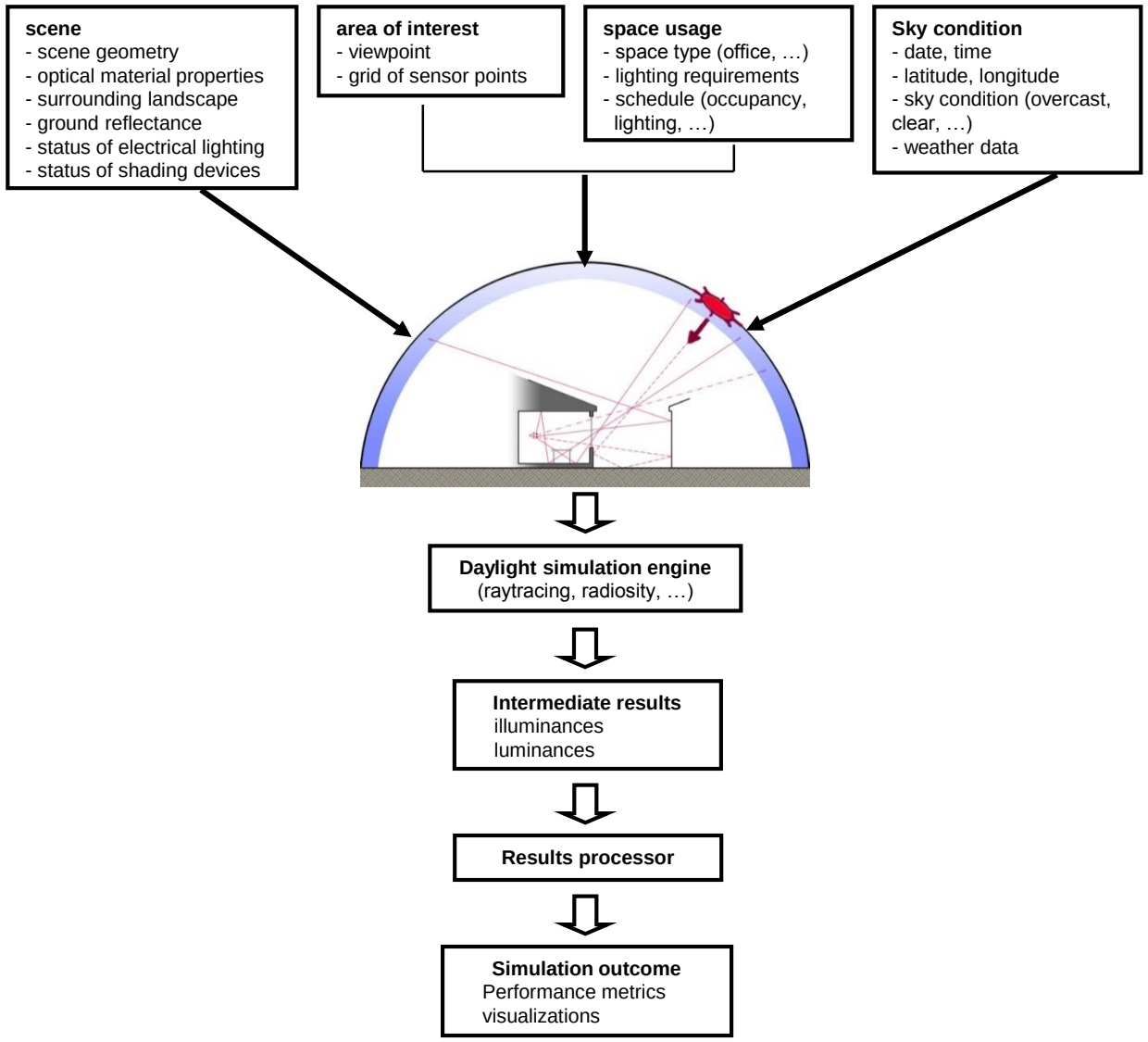
umi

DesignBuilder

ies INTEGRATED ENVIRONMENTAL SOLUTIONS

OpenStudio

BIM Model + Daylight Simulation Program



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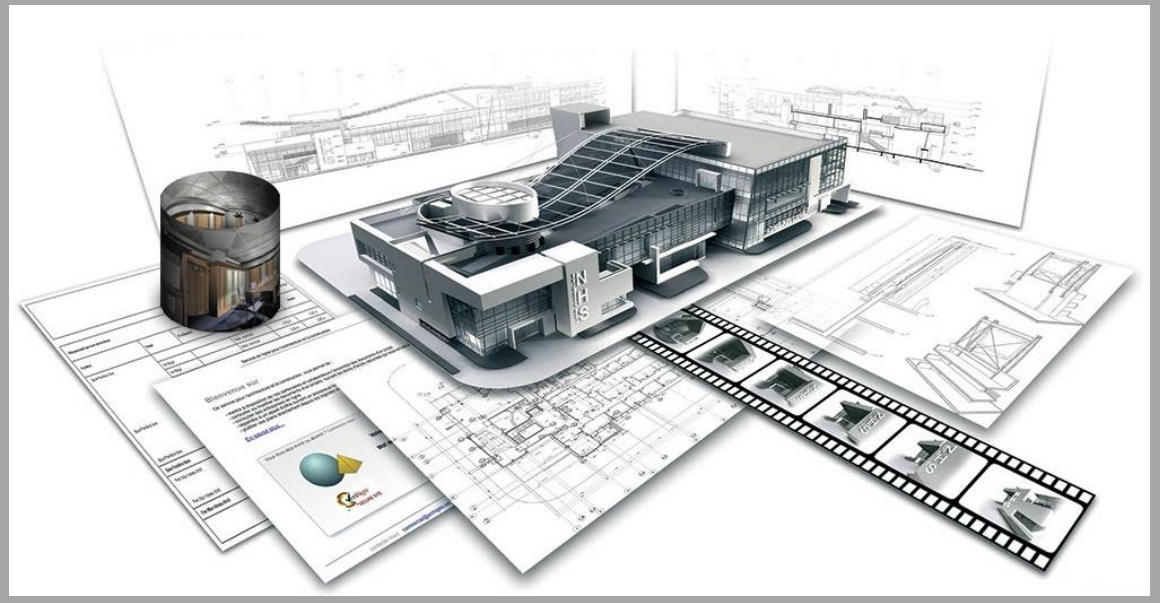
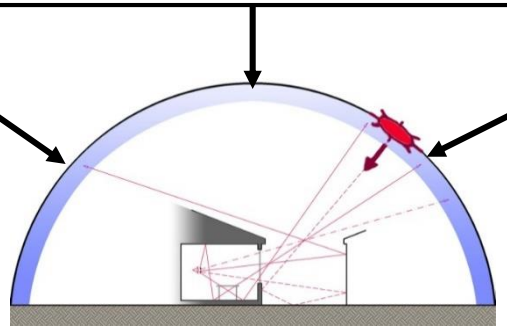
Building Information Modeling (BIM):

Building Information Modeling (BIM) is an intelligent 3D model-based process that equips architecture, engineering, and construction professionals with the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure. (https://www.autodesk.com/solutions/bim)



Daylight Simulation Program

BIM Model



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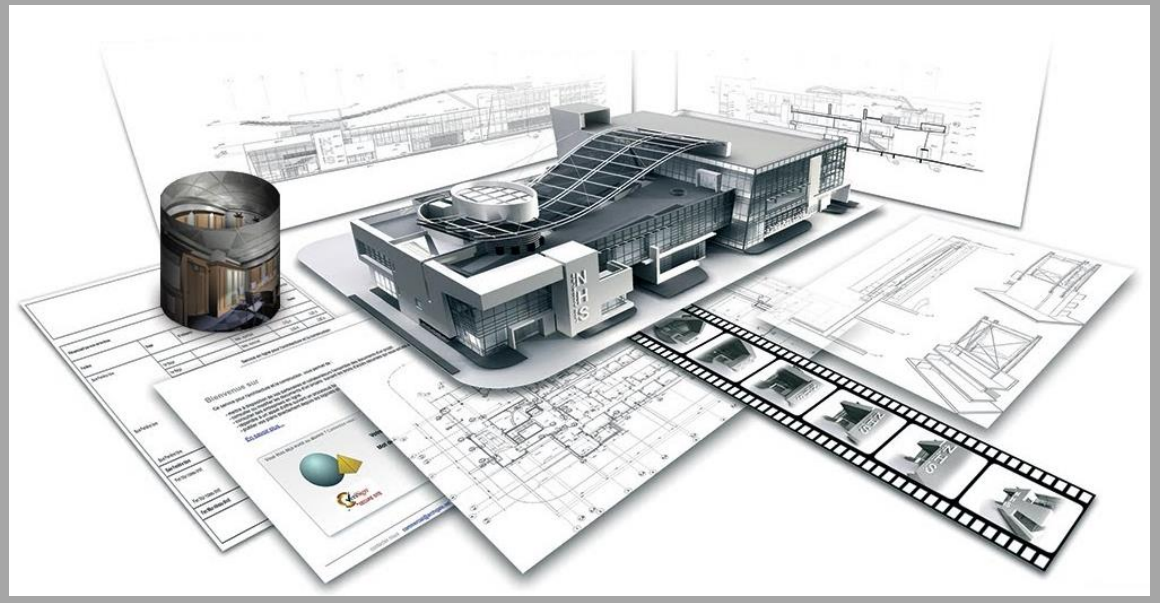

Daylight Simulation Program

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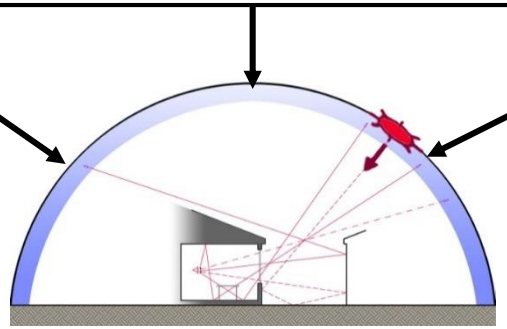

Daylight simulation engine
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in BIM Software

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Revit

Dynamo

Radiance
Synthetic Imaging System
python™

Advantages:

- No need to have an extra software to communicate between the modelling software and Radiance
- No need to specify scene geometry / optical material properties / space usage / geographical specifications / building orientation
- No need to manually explode and change each solid glass object to a one surface object

Such a tool can be helpful during each step in Architectural design process from the beginning to the end.

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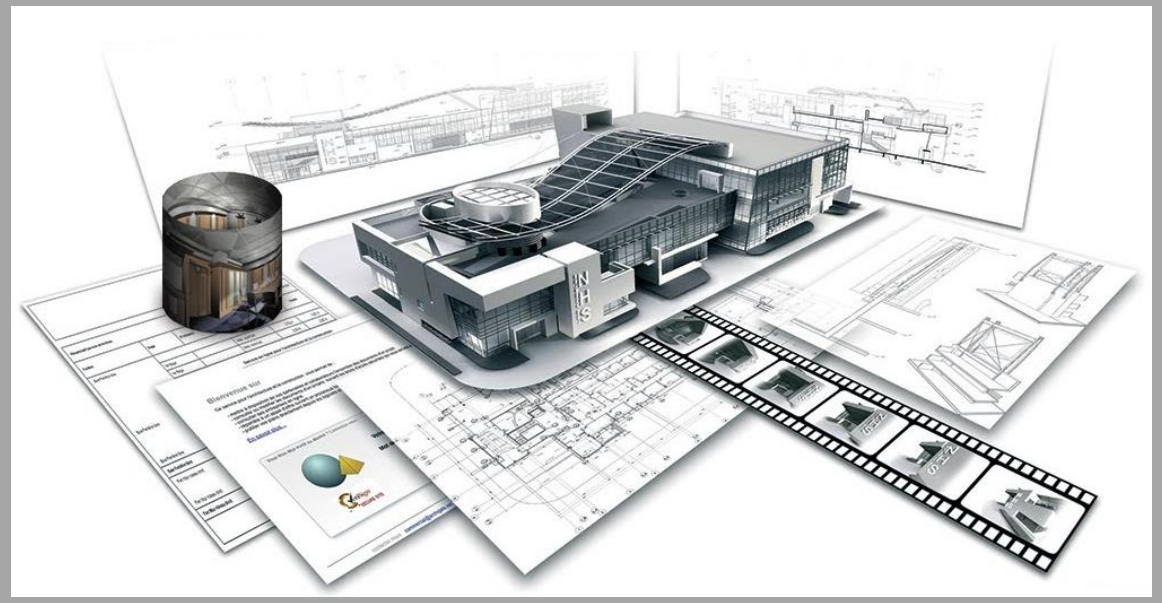

Revit

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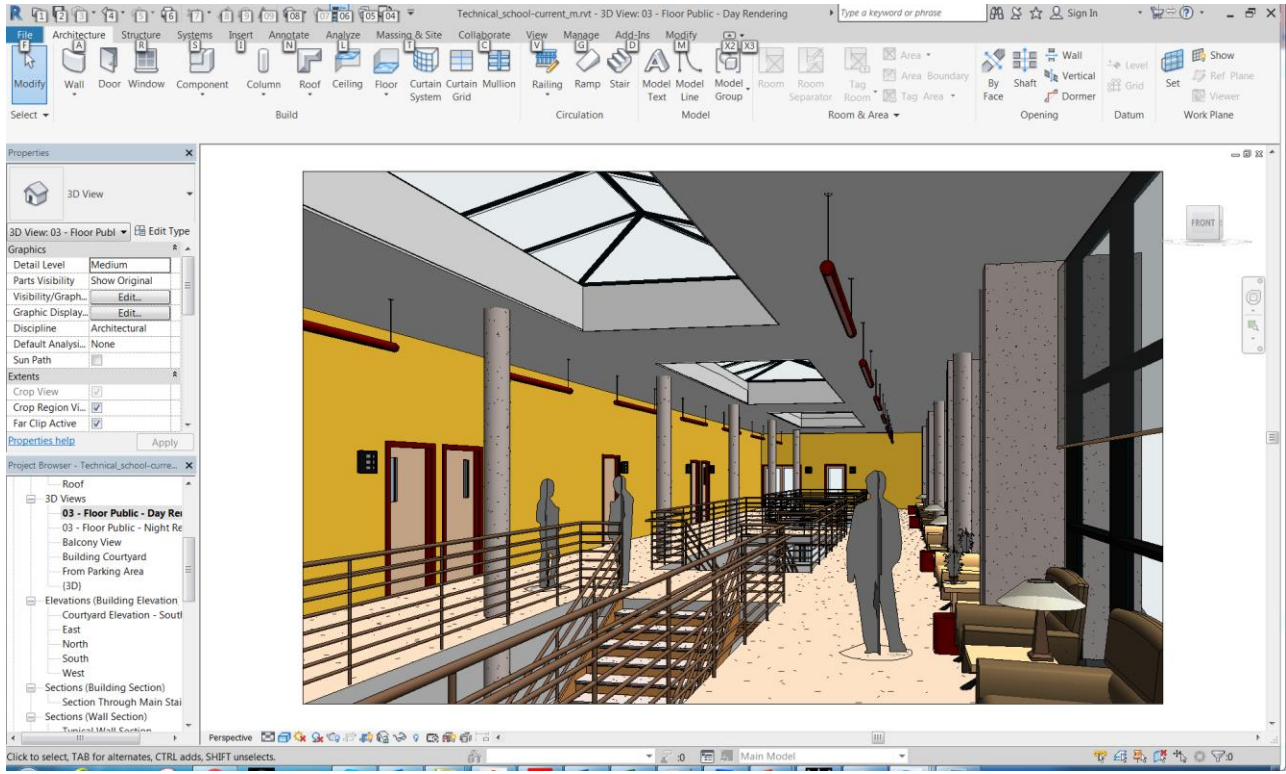
Radiance

Synthetic Imaging System

python™

Disadvantage/Weakness:

- At the moment, there is not any possibility to export Revit view specifications to Dynamo



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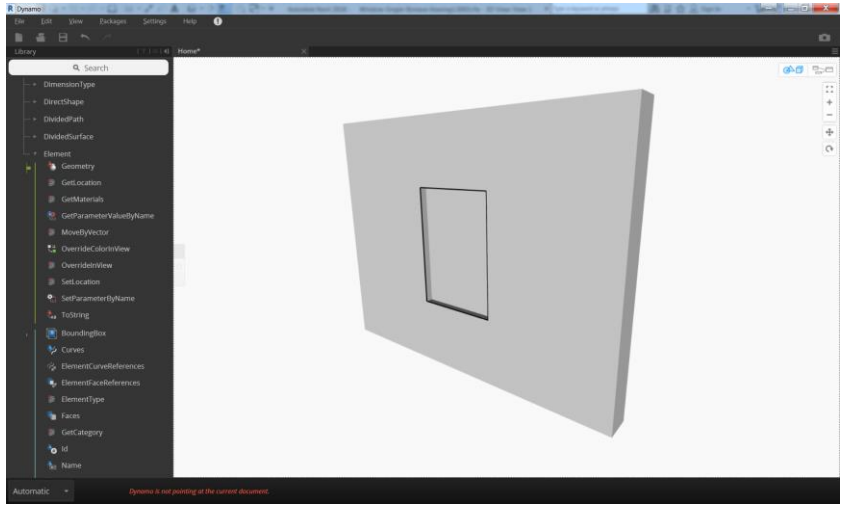
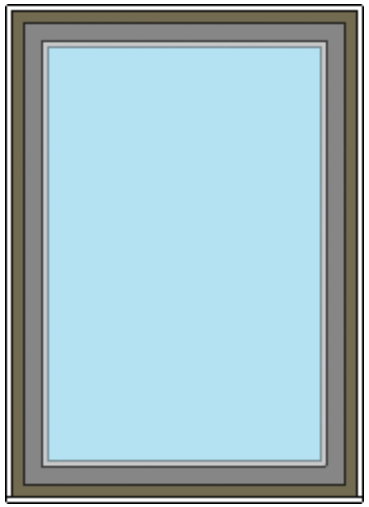
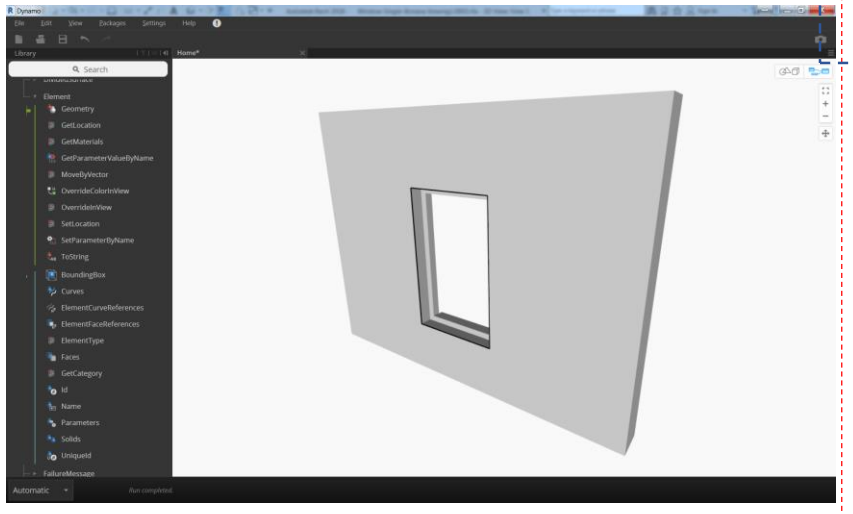
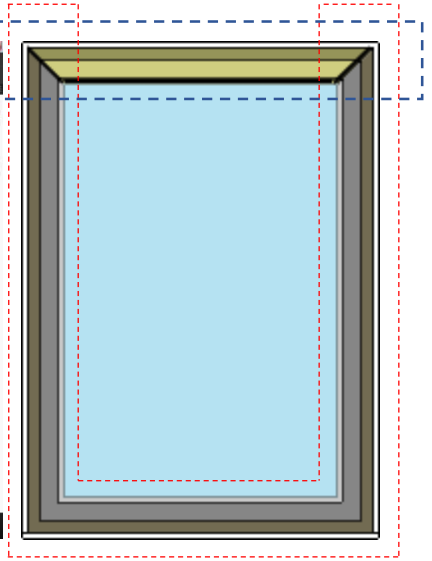




Disadvantage/Weakness:

- No Revit view specifications in Dynamo
- At the moment, there is a ploblem with unwanted filling the hole in some **closed** Solid Sweep, Swept Blend or Extruded objects (mostly in more complex frames in doors and windows families) in Dynamo
  - Solution is to split them to two objects

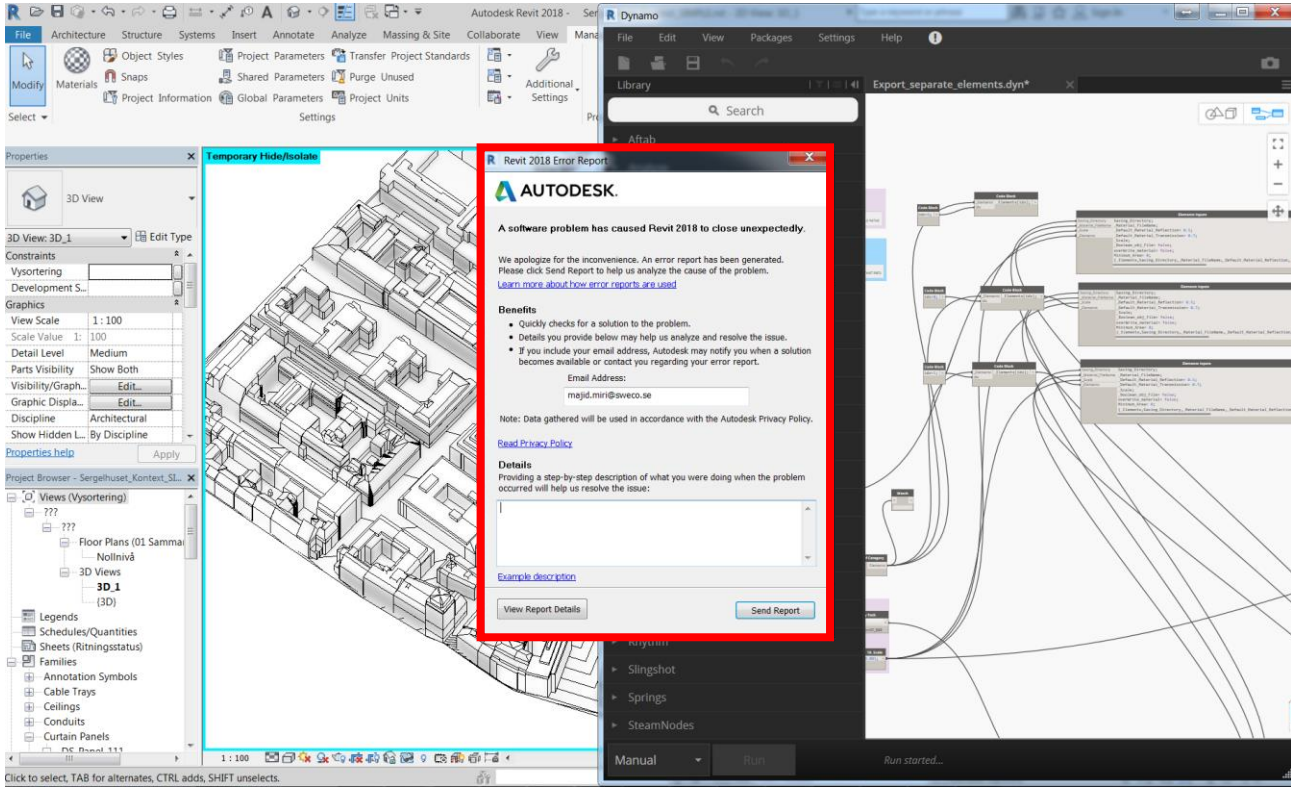




Revit Dynamo Radiance Synthetic Imaging System python

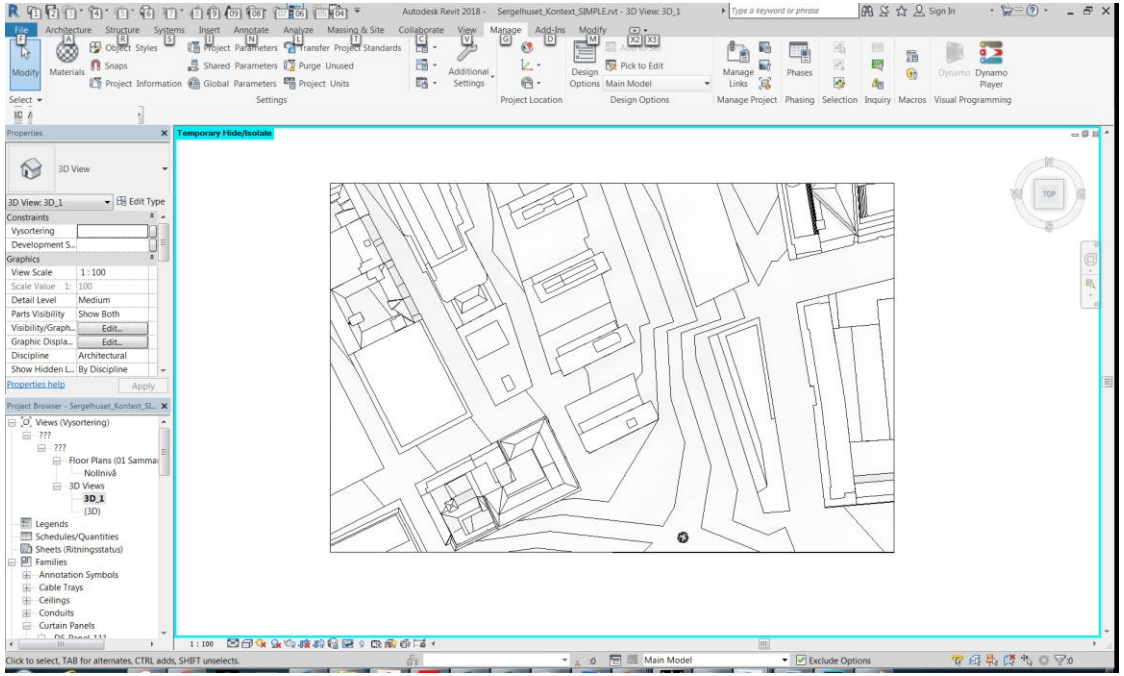
Disadvantage/Weakness :

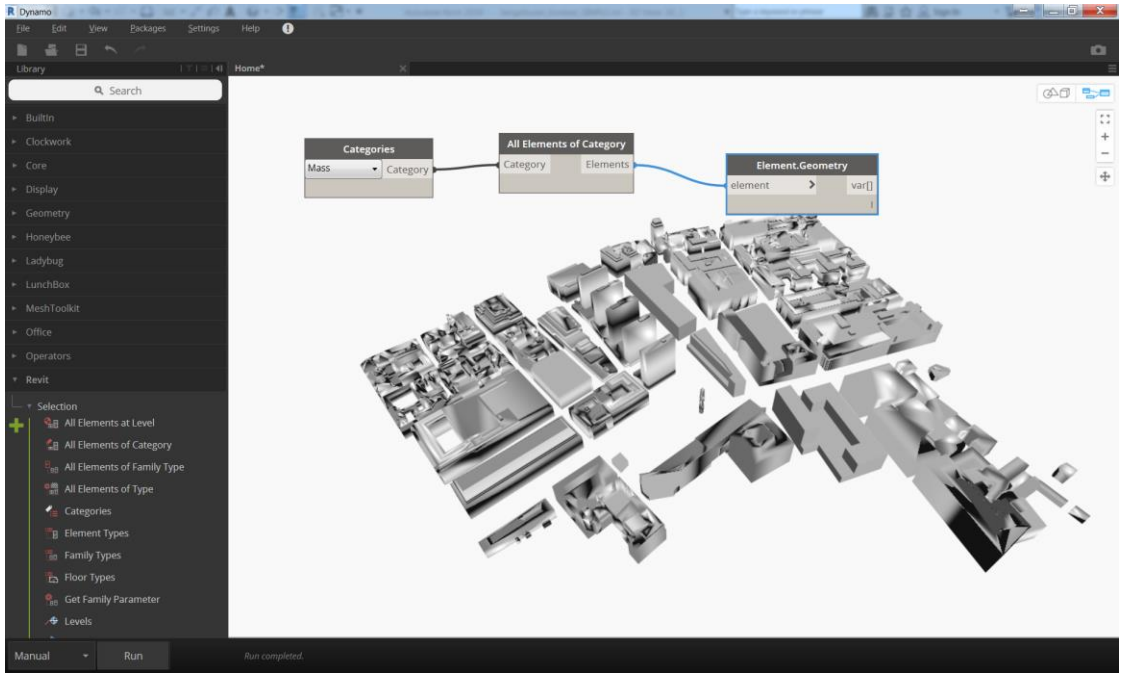
- No Revit view specifications in Dynamo
- Ploblem with closed Solid Sweep, Swept Blend or Extruded objects in Dynamo
- At the moment, Dynamo has some memory issues for complex models, so it crashes quite often.
  - Solution is to split the model and then export one by one



Disadvantage/Weakness :

- No Revit view specifications in Dynamo
- Ploblem with closed Solid Sweep, Swept Blend or Extruded objects in Dynamo
- Memory issues for complex models
- Dynamo is not very stable for complex models
- Section box in Revit is not working in Dynamo; hidden objects are also shown in Dynamo when we select the objects by **Category**, **Type** or **Family Type**





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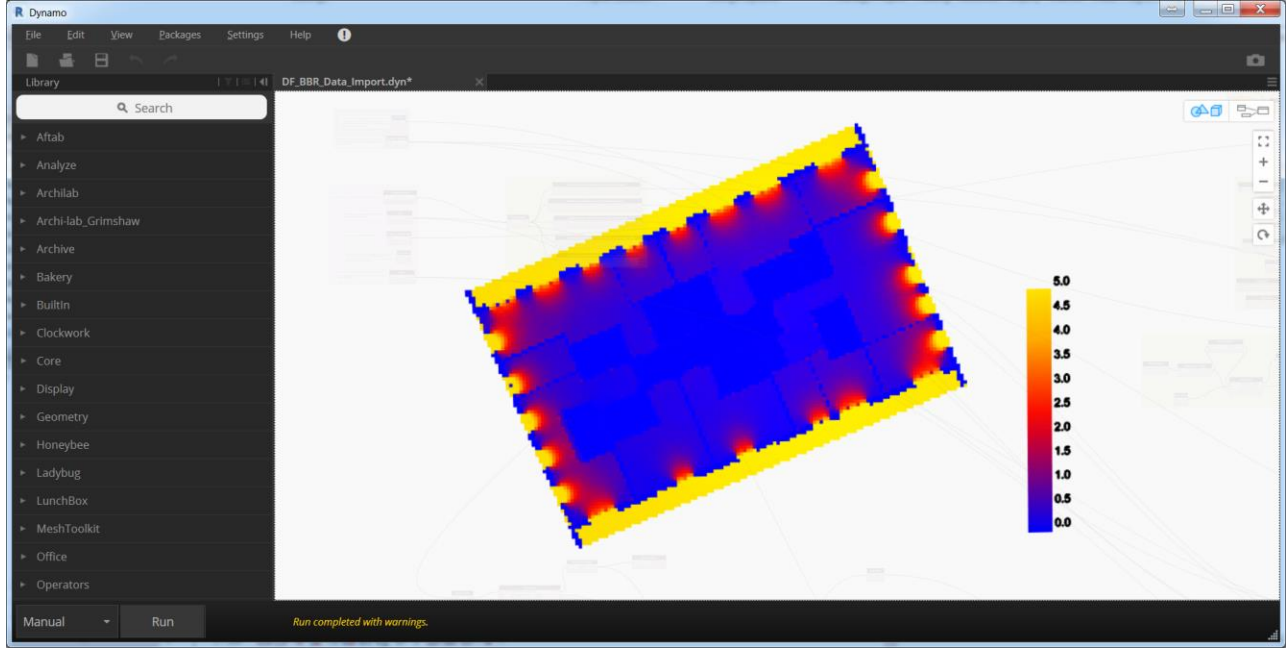
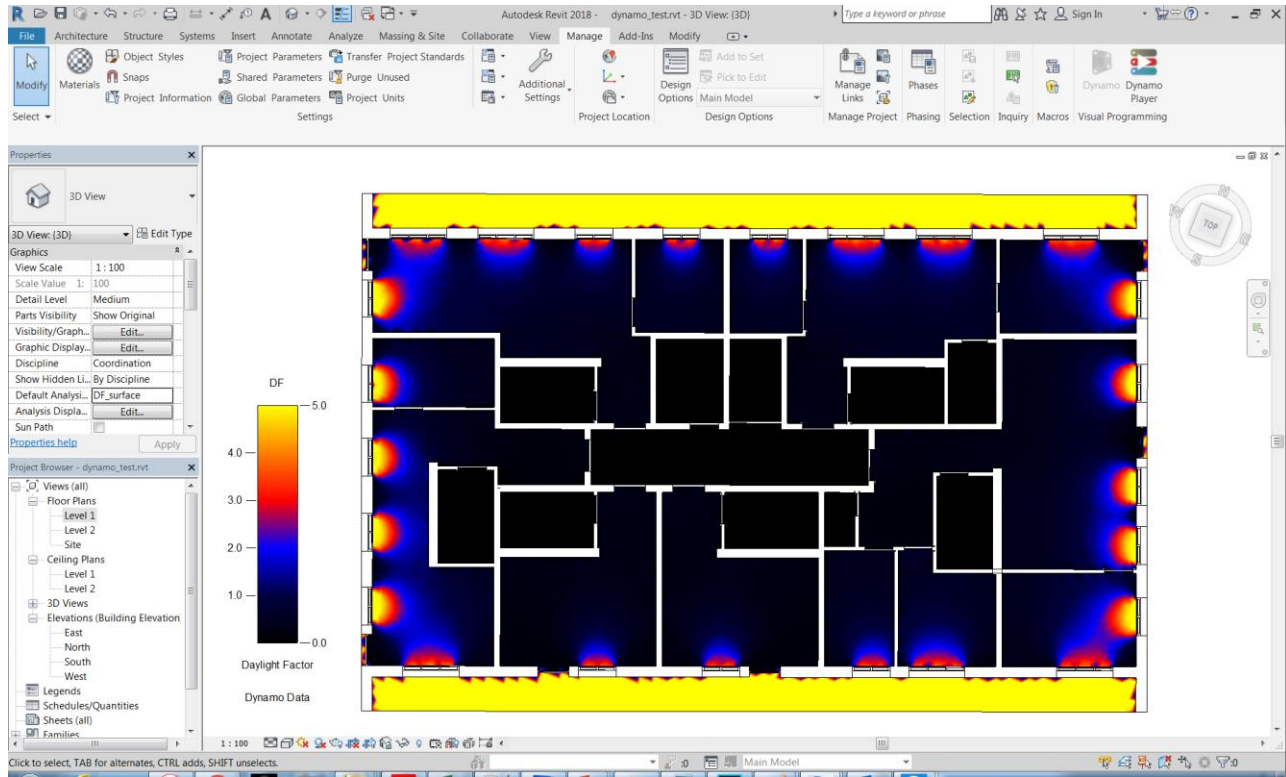
- Section box is not working in Dynamo; hidden objects are shown in Dynamo
- At the moment, Only one surface can be imported to Revit to be presented as analysis surface, but there is no limitation in Dynamo. However we cannot make a section view in Dynamo





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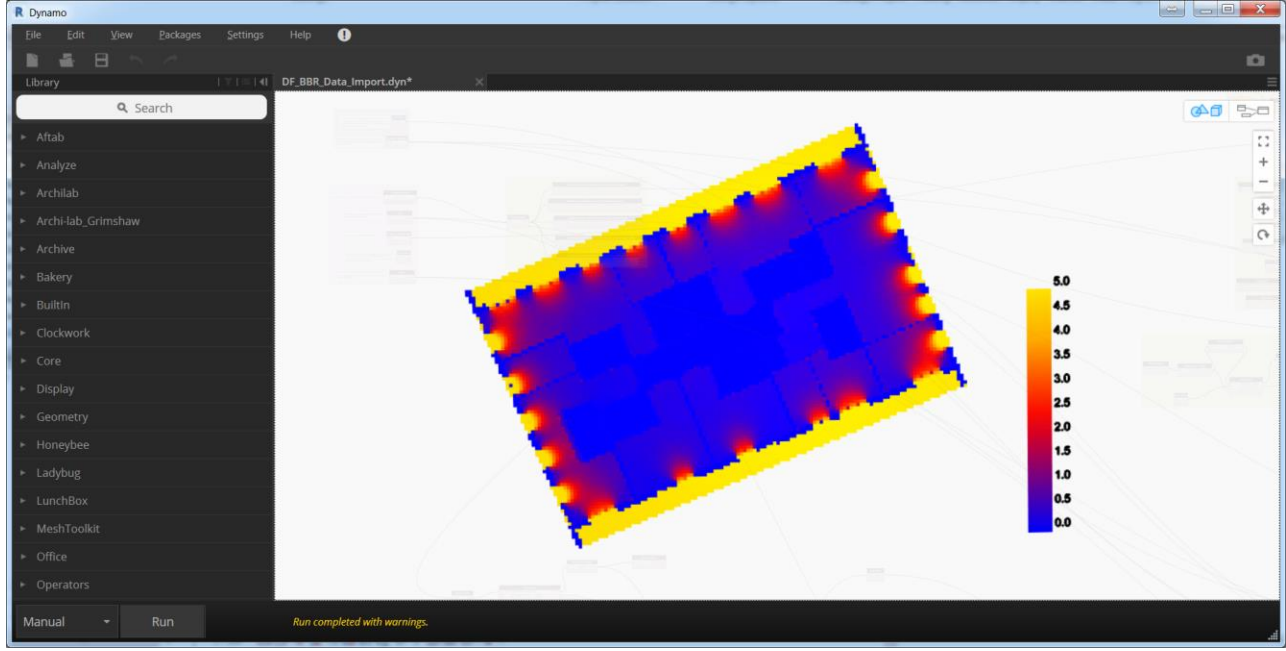
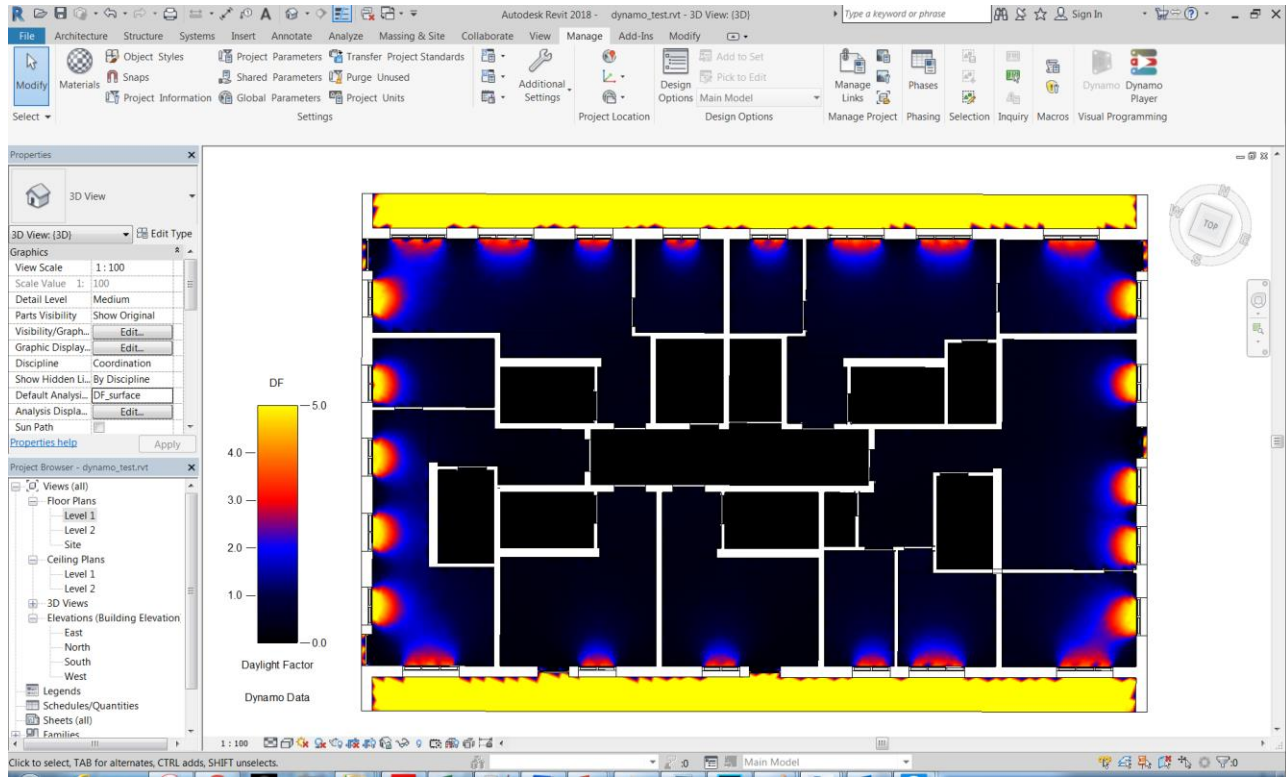
  However we cannot make a section view in Dynamo to be able to see the falsecolor surface grid together with all other building elements such as walls, floors, windows, doors, etc.





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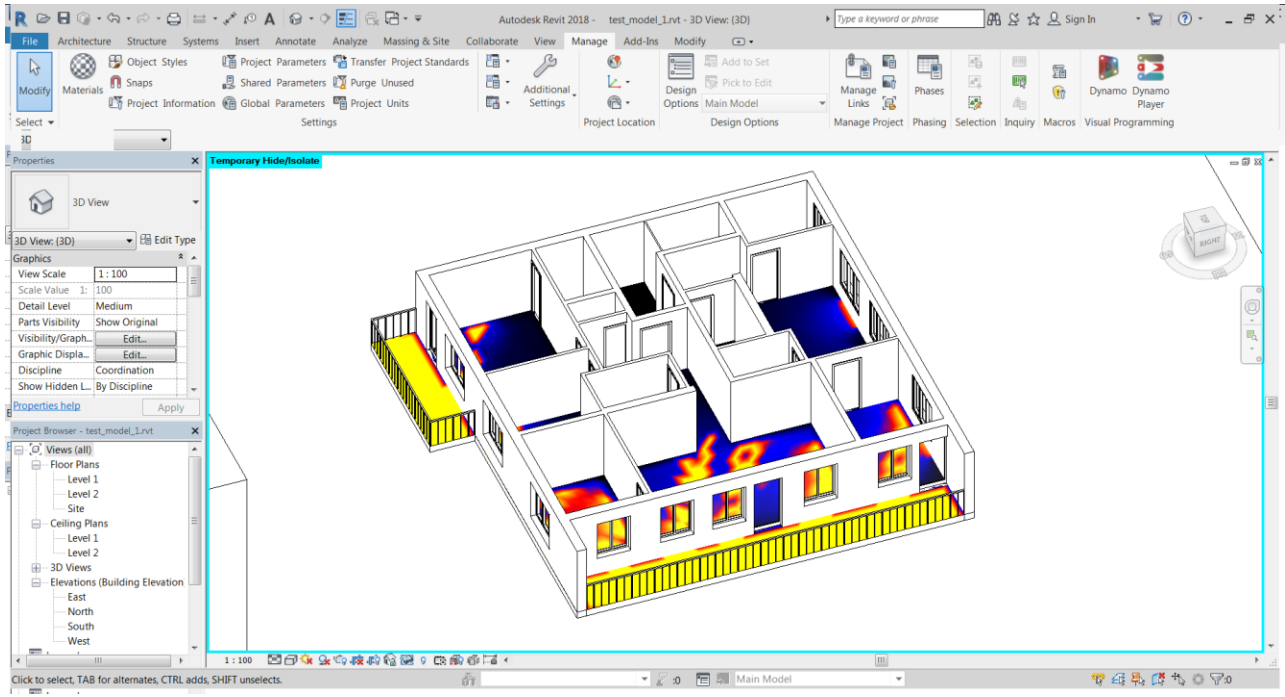
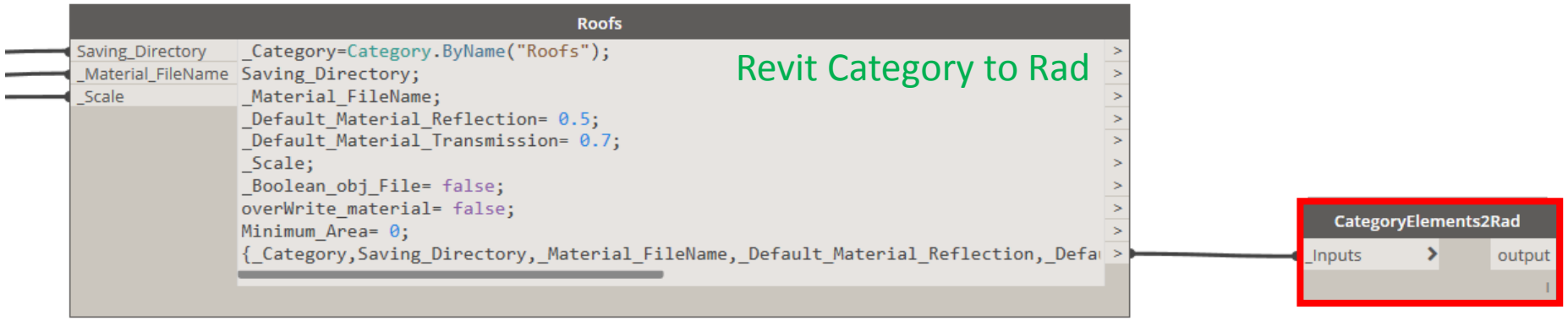
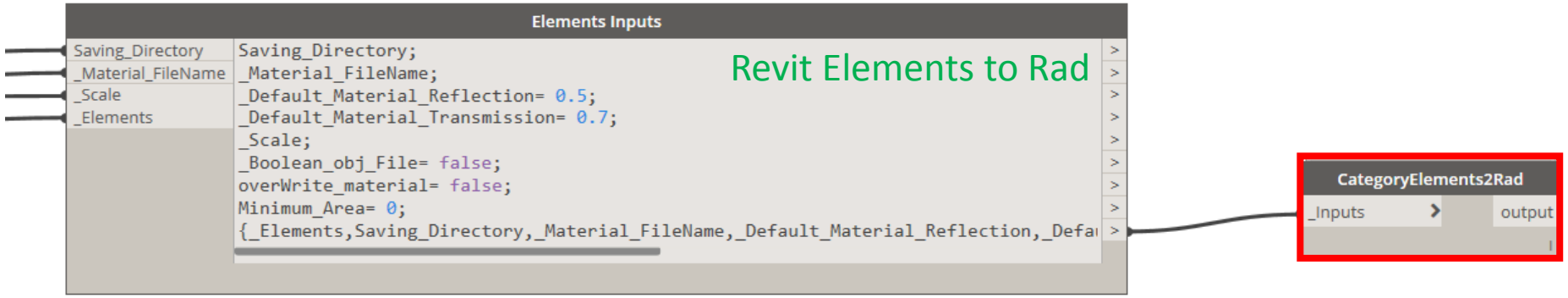
- Analysis Surface grid cannot be offset against the selected Revit surface in Revit, so we cannot see how much the surface grid is above the selected floor in Revit.



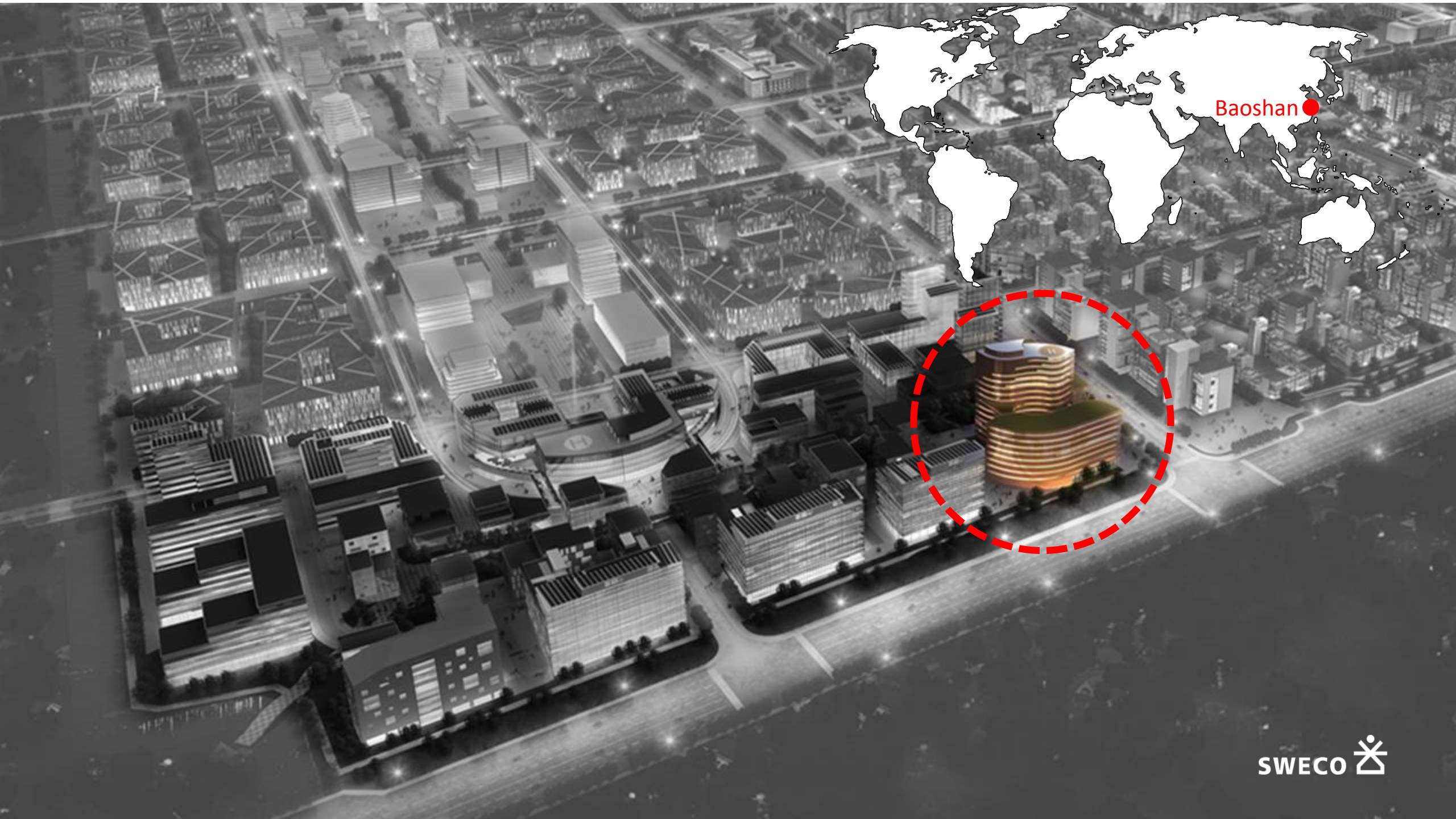




For more information about the package and nodes, please go to http://aftabsoft.net/aftab-rad.html


Baoshan
SWECO

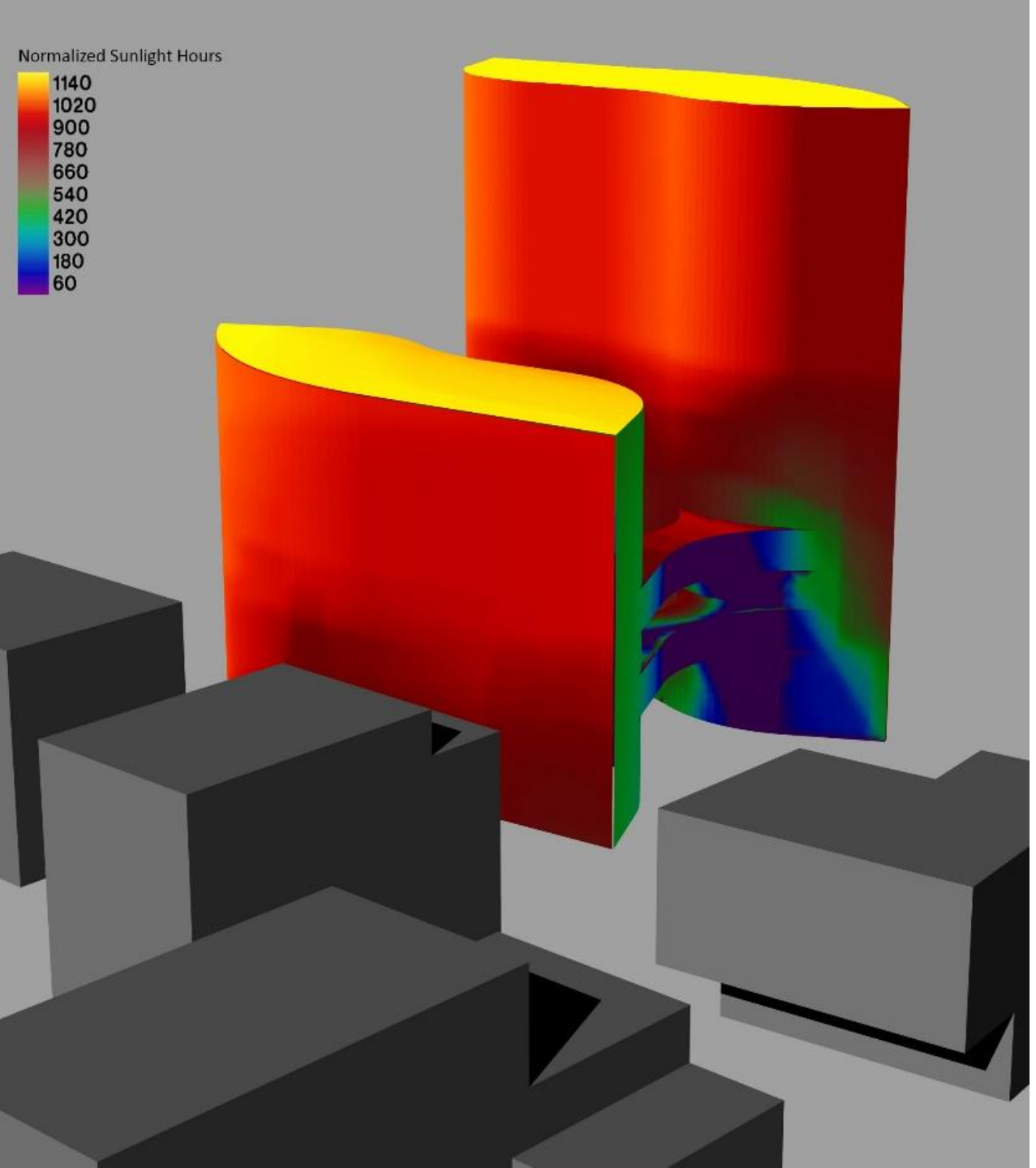

Baoshan
SWECO

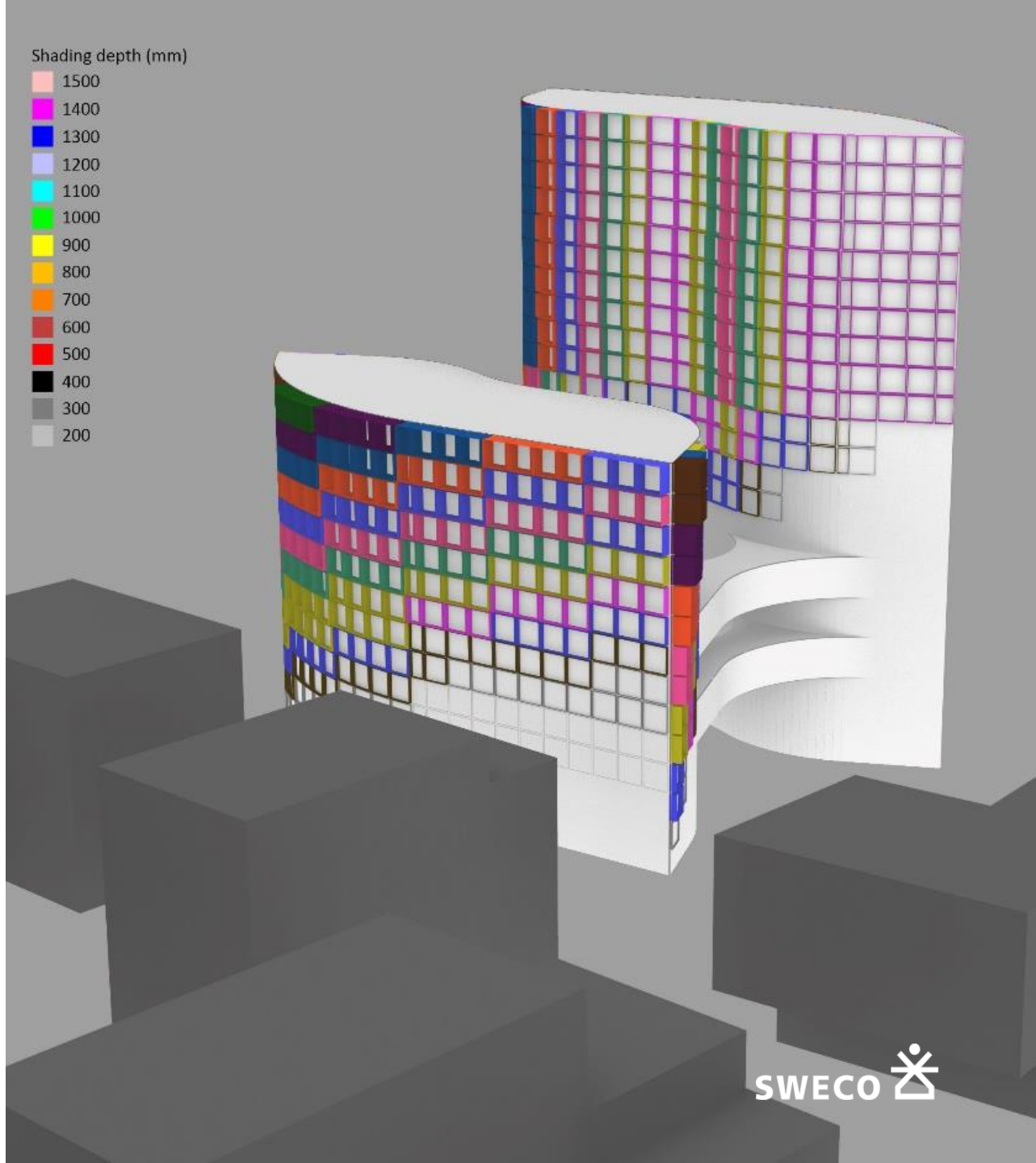

Baoshan

Baoshan Industrial Park, images by Sweco Architects

SWECO

A1 Building - Baoshan Industrial Park, images by Sweco Architects

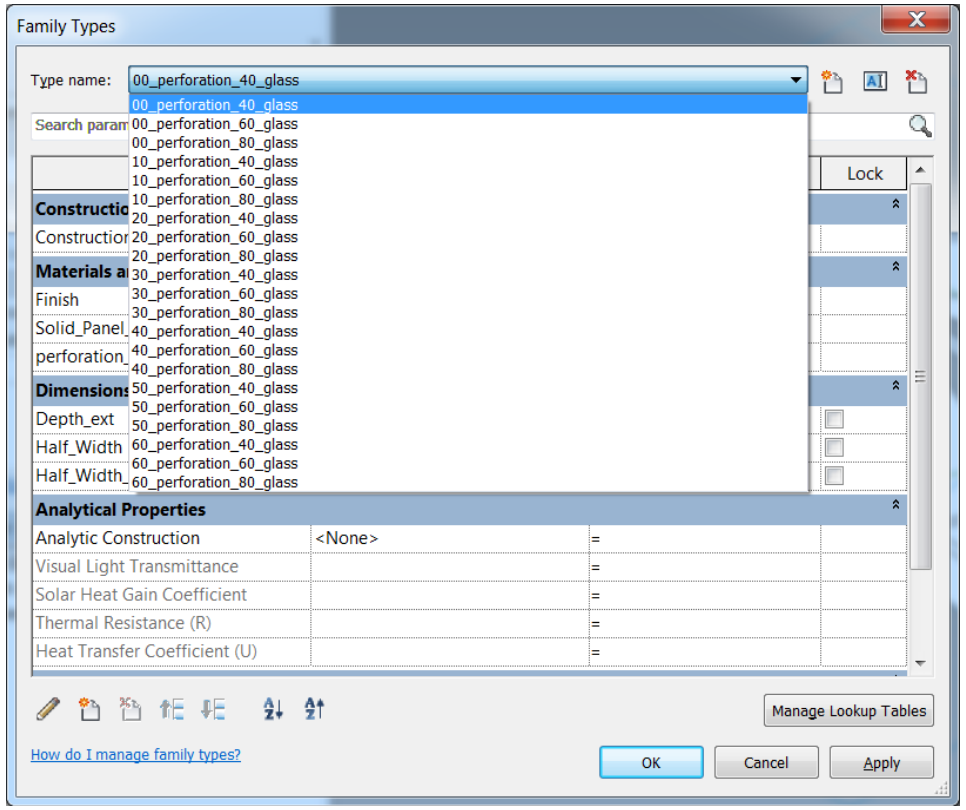

Normalized Sunlight Hours
1140
1020
900
780
660
540
420
300
180
60

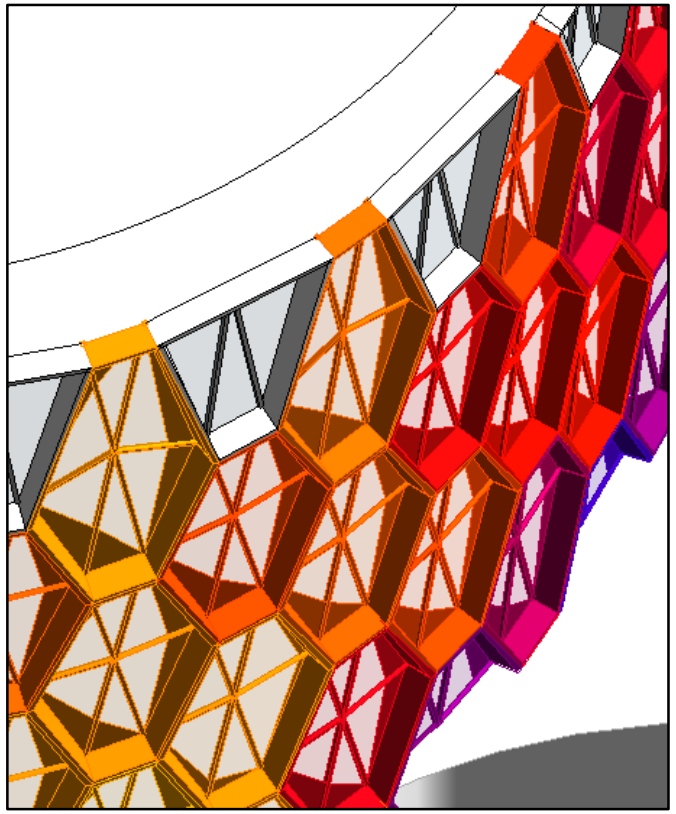

Shading depth (mm)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
SWECO

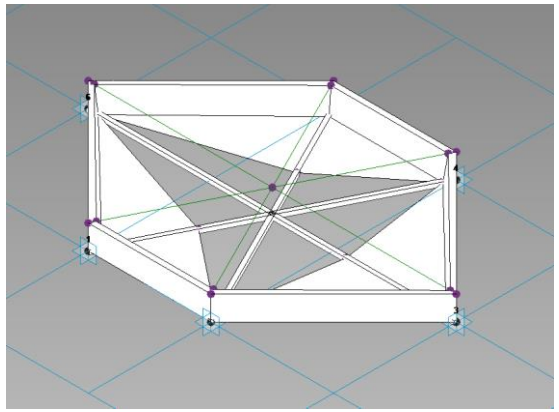
Find Perforation Percentage

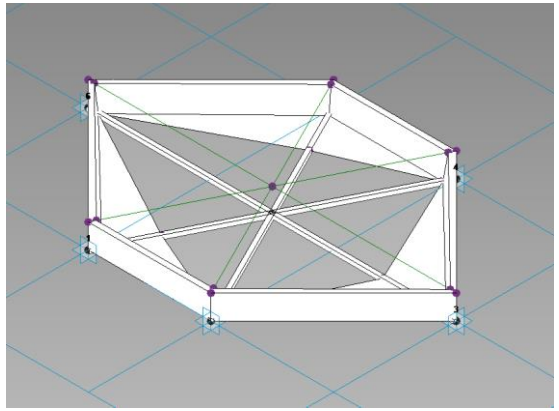
Acceptable Radiation = 300 kW/h^2
Maximum = 600 kW/h^2 →Minimum Perforation
Minimum = 100 kW/h^2 →Maximum Perforation

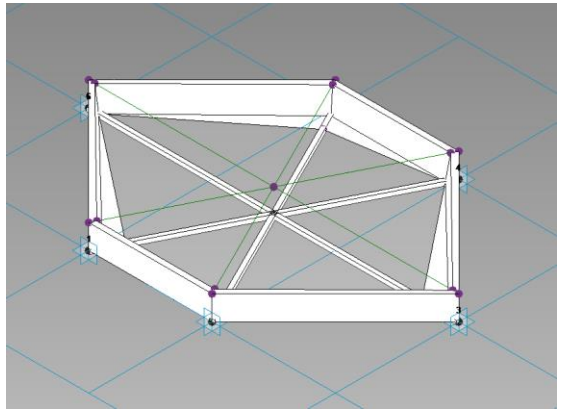
Perforation Range = 0%-60%
Glass area = 40%, 50%, 60%

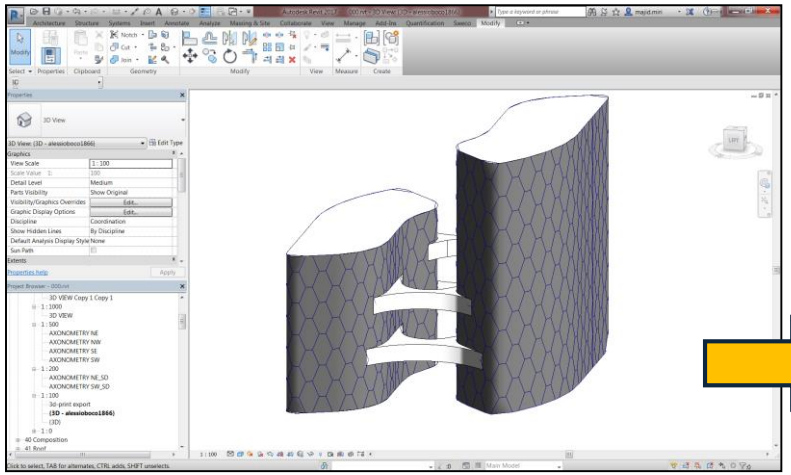


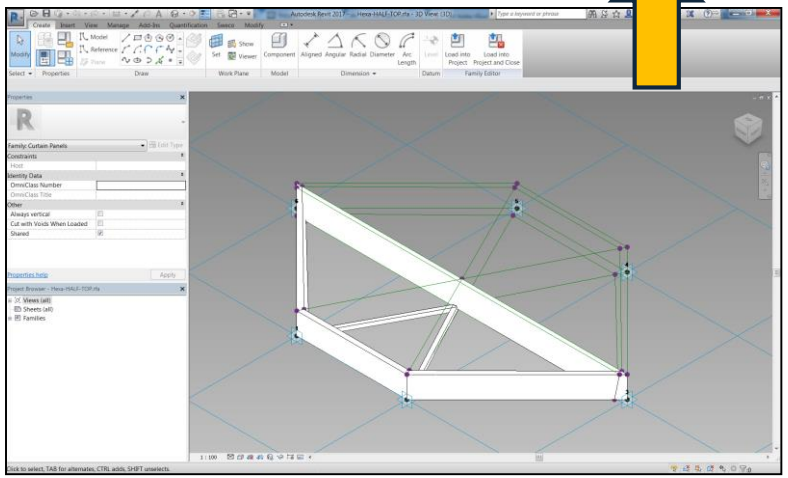


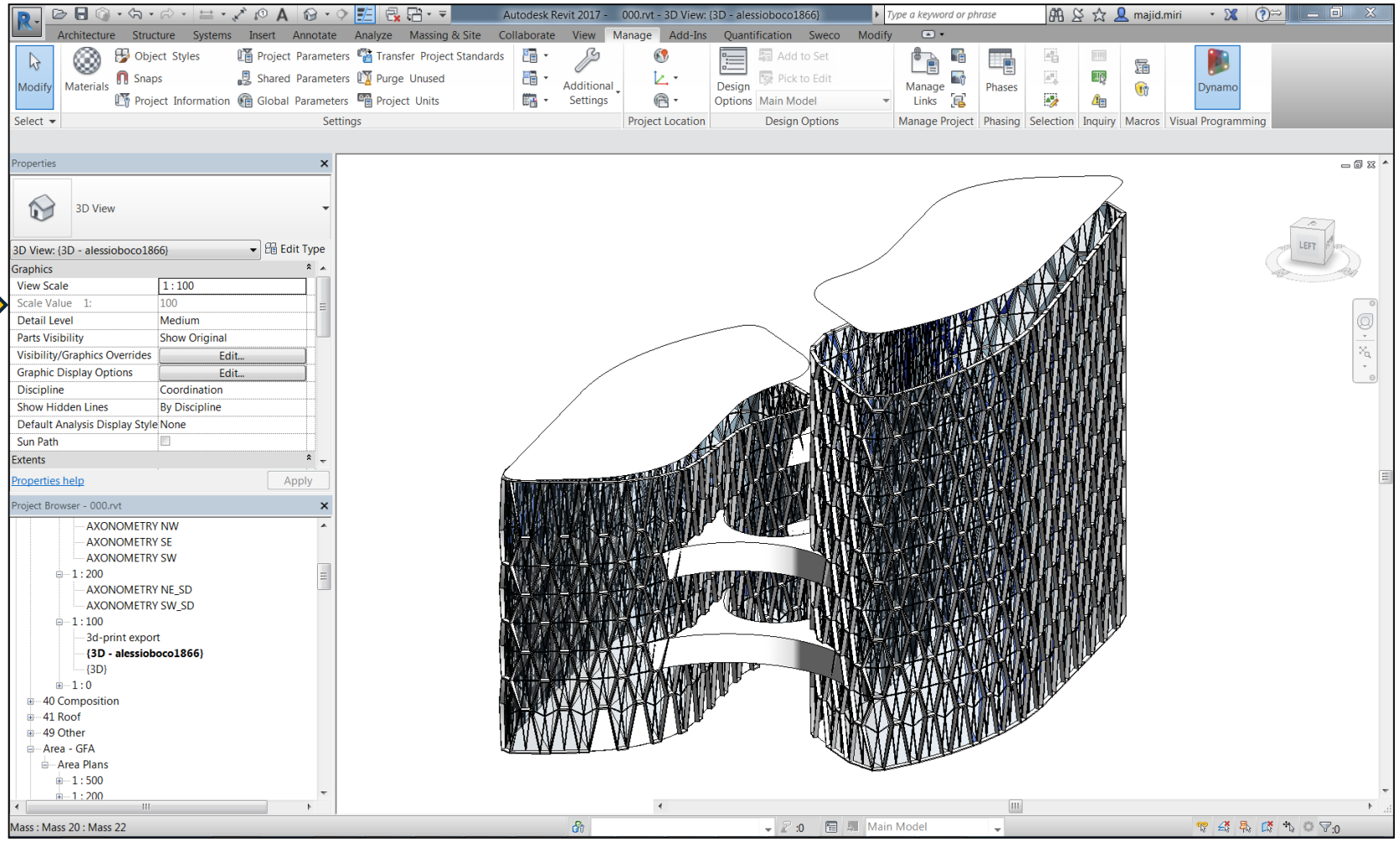


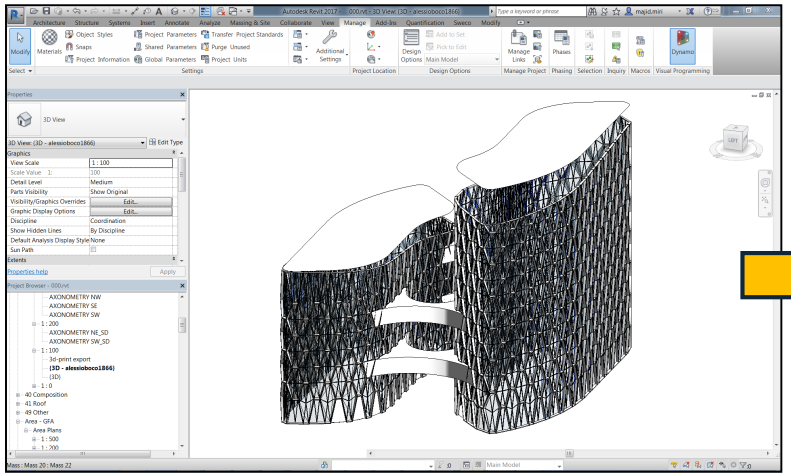


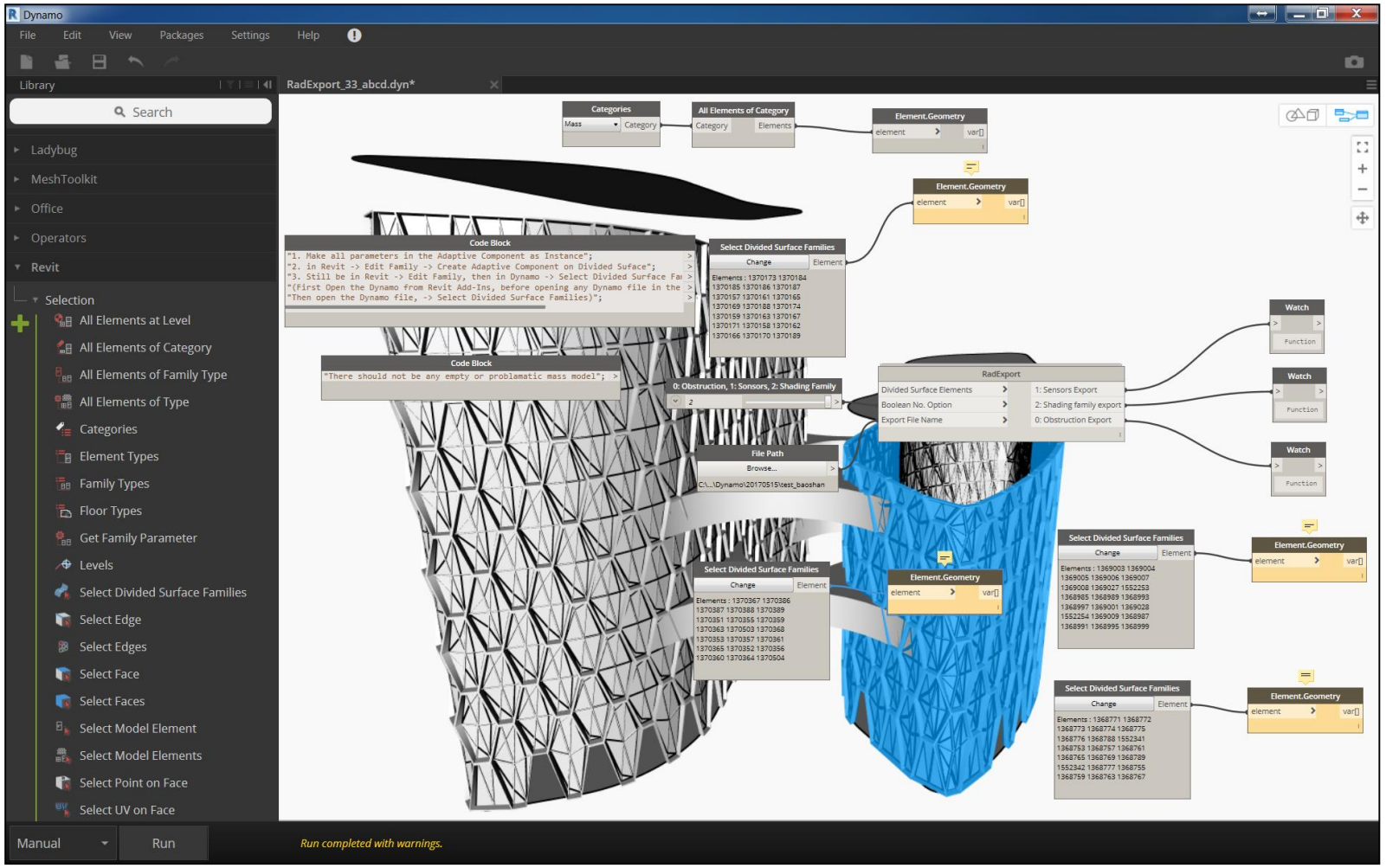







Autodesk Revit 2017 - 000.rvt - 3D View: {3D - alessioboco1866}
Architecture Structure Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins Quantification Sweco Modify
Modify Materials Object Styles Snaps Project Information Project Parameters Shared Parameters Global Parameters Transfer Project Standards Purge Unused Project Units Additional Settings Design Options Add to Set Pick to Edit Main Model Manage Links Phases Dynamo
Settings Project Location Design Options Manage Project Phasing Selection Inquiry Macros Visual Programming
Properties
3D View
3D View: {3D - alessioboco1866}
Edit Type
Graphics
View Scale 1 : 100
Scale Value 1: 100
Detail Level Medium
Parts Visibility Show Original
Visibility/Graphics Overrides Edit...
Graphic Display Options Edit...
Discipline Coordination
Show Hidden Lines By Discipline
Default Analysis Display Style None
Sun Path
Extents
Properties help
Apply
Project Browser - 000.rvt
AXONOMETRY NW
AXONOMETRY SE
AXONOMETRY SW
1 : 200
AXONOMETRY NE_SD
AXONOMETRY SW_SD
1 : 100
3d-print export
{3D - alessioboco1866}
{3D}
1 : 0
40 Composition
41 Roof
49 Other
Area - GFA
Area Plans
1 : 500
1 : 200
LEFT
Mass : Mass 20 : Mass 22
Main Model



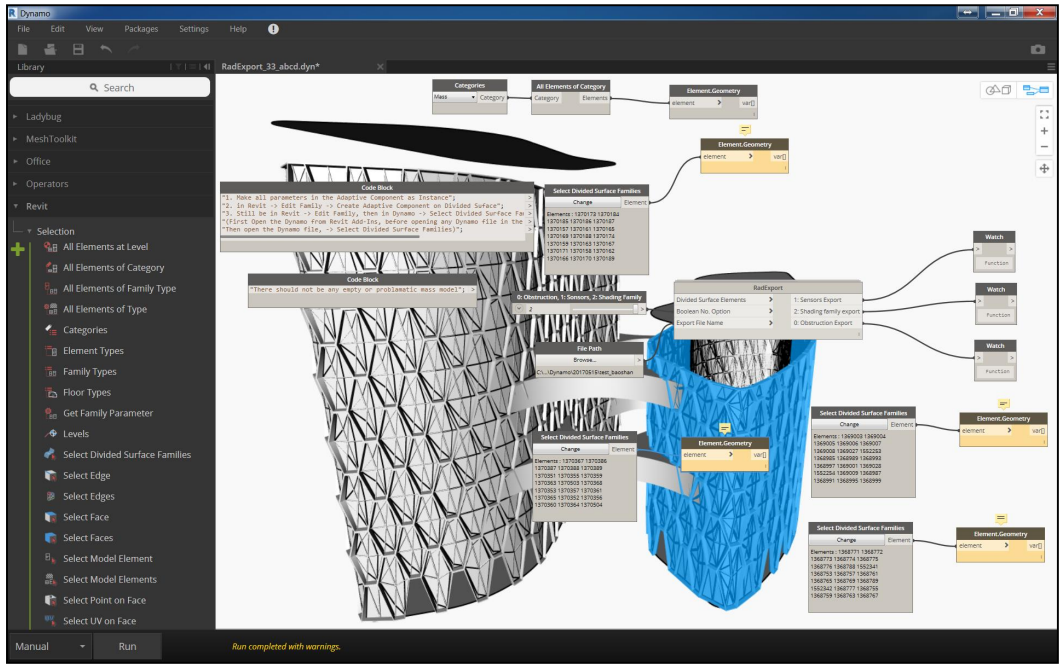

Dynamo
File
Edit
View
Packages
Settings
Help
Library
Search
Ladybug
MeshToolkit
Office
Operators
Revit
Selection
All Elements at Level
All Elements of Category
All Elements of Family Type
All Elements of Type
Categories
Element Types
Family Types
Floor Types
Get Family Parameter
Levels
Select Divided Surface Families
Select Edge
Select Edges
Select Face
Select Faces
Select Model Element
Select Model Elements
Select Point on Face
Select UV on Face
RadExport_33_abcd.dyn*
Code Block
"1. Make all parameters in the Adaptive Component as Instance";
"2. in Revit -> Edit Family -> Create Adaptive Component on Divided Suface";
"3. Still be in Revit -> Edit Family, then in Dynamo -> Select Divided Surface Fa
"(First Open the Dynamo from Revit Add-Ins, before opening any Dynamo file in the
"Then open the Dynamo file, -> Select Divided Surface Families)";
Code Block
"There should not be any empty or problamatic mass model";
Categories
Mass
Category
All Elements of Category
Category
Elements
Element.Geometry
element
var[]
Select Divided Surface Families
Change
Element
Elements : 1370173 1370184
1370185 1370186 1370187
1370157 1370161 1370165
1370169 1370188 1370174
1370159 1370163 1370167
1370171 1370158 1370162
1370166 1370170 1370189
0: Obstruction, 1: Sonsors, 2: Shading Family
2
File Path
Browse...
C:\...\Dynamo\20170515\test_baoshan
RadExport
Divided Surface Elements
Boolean No. Option
Export File Name
1: Sensors Export
2: Shading family export
0: Obstruction Export
Watch
Function
Select Divided Surface Families
Change
Element
Elements : 1370367 1370386
1370387 1370388 1370389
1370351 1370355 1370359
1370363 1370503 1370368
1370353 1370357 1370361
1370365 1370352 1370356
1370360 1370364 1370504
Element.Geometry
element
var[]
Select Divided Surface Families
Change
Element
Elements : 1369003 1369004
1369005 1369006 1369007
1369008 1369027 1552253
1368985 1368989 1368993
1368997 1369001 1369028
1552254 1369009 1368987
1368991 1368995 1368999
Element.Geometry
element
var[]
Select Divided Surface Families
Change
Element
Elements : 1368771 1368772
1368773 1368774 1368775
1368776 1368788 1552341
1368753 1368757 1368761
1368765 1368769 1368789
1552342 1368777 1368755
1368759 1368763 1368767
Element.Geometry
element
var[]
Manual
Run
Run completed with warnings.

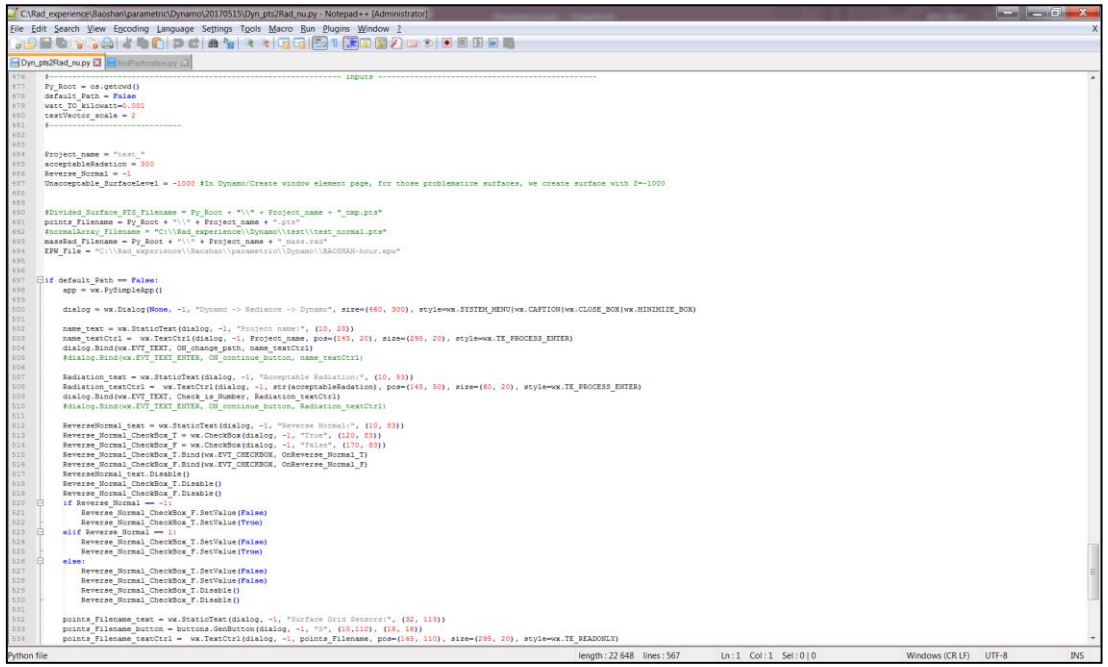
Radiance

Synthetic Imaging System

python™

SWECO





- Translate Revit model into Radiance object (*.rvt to *.rad file)
- Export geographical and orientation information from Revit to Radiance

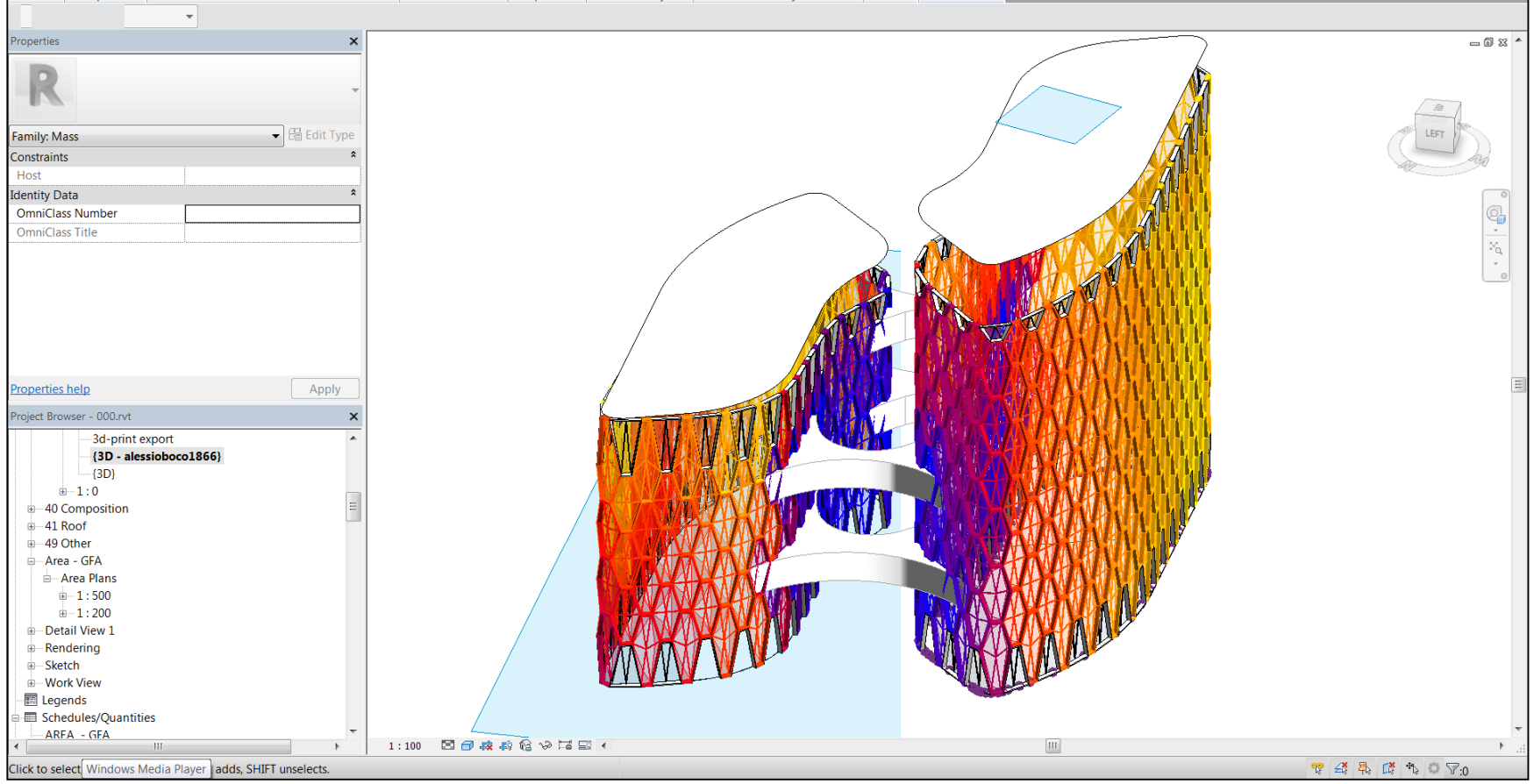
- Sunlight hours analysis for the whole year
- Find the optimum perforation for each panel

Radiance

Synthetic Imaging System

python™

SWECO




Thank you so much
SWECO