

Assignment 6

Question 1

Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with $\epsilon = 0.1$ should you add in order to have the new heat transfer rate to be 1% of the case without shields ?

$$\epsilon_1=0.1$$

$$\epsilon_2=0.1$$

$$\sigma=5.670*10^{-8} \text{W/m}^2\text{K}^4$$

When the $\epsilon_1=\epsilon_2=0.1$;

$$\dot{Q}_{12} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} = A * 5.67 * 10^{-8} * \frac{800^4 - 500^4}{\frac{1}{0.1} + \frac{1}{0.1} - 1} = A * 1035.72 \text{ W/m}^2$$

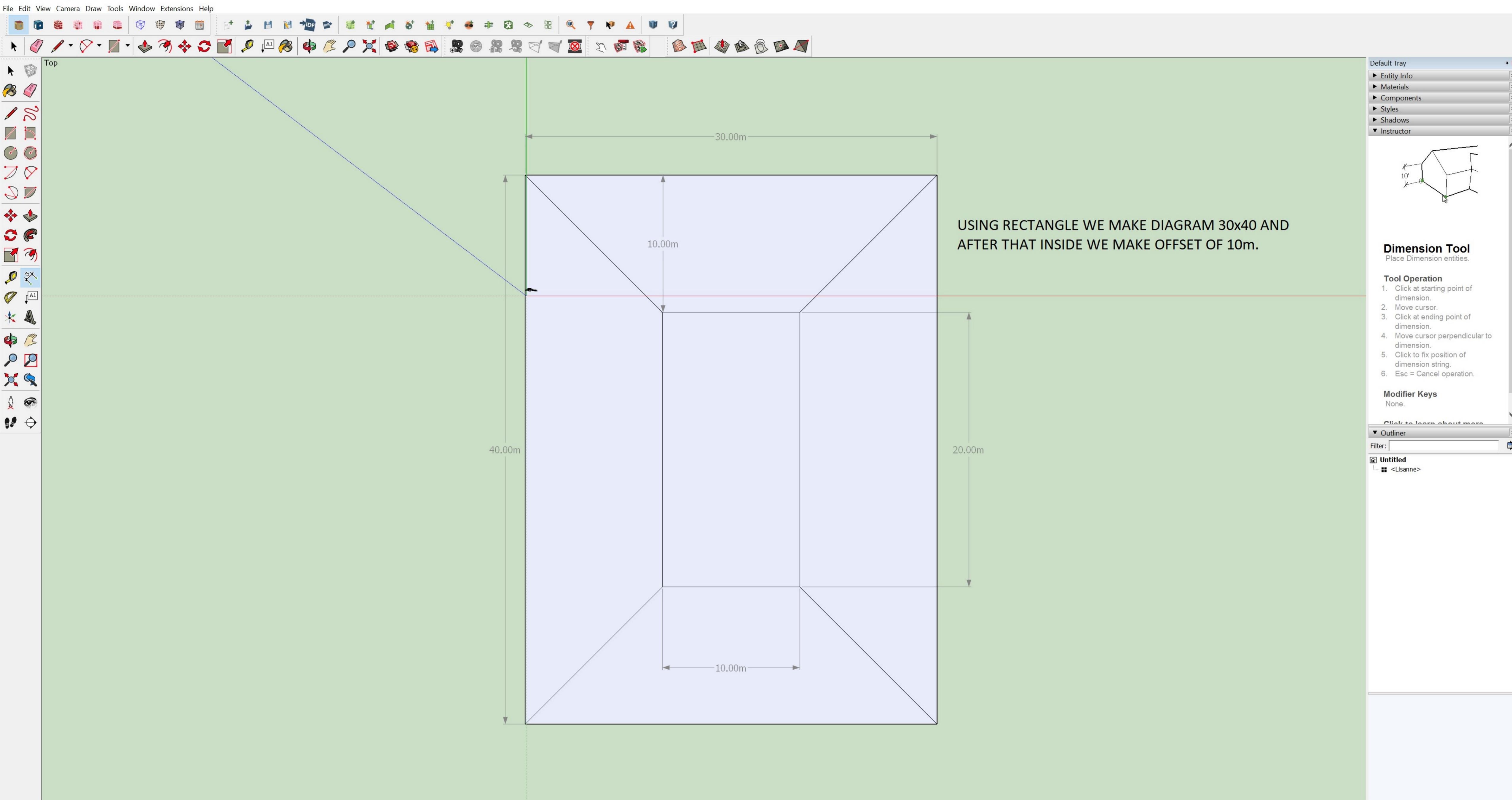
$$\dot{Q}_{N \text{ shields}} = \frac{A\sigma(T_1^4 - T_2^4)}{(N+1)\frac{1}{\epsilon} + \frac{1}{\epsilon} - 1} = \frac{1}{N+1} * \dot{Q} \text{ no shields}$$

$$\dot{Q}_{12} \text{ from previous case} = 1035.72 \text{ AW/m}^2$$

$$1\% \text{ of } \dot{Q}_{12} = 36.25 \text{ AW/m}^2$$

$$10.36 = \frac{1}{N+1} * 1036$$

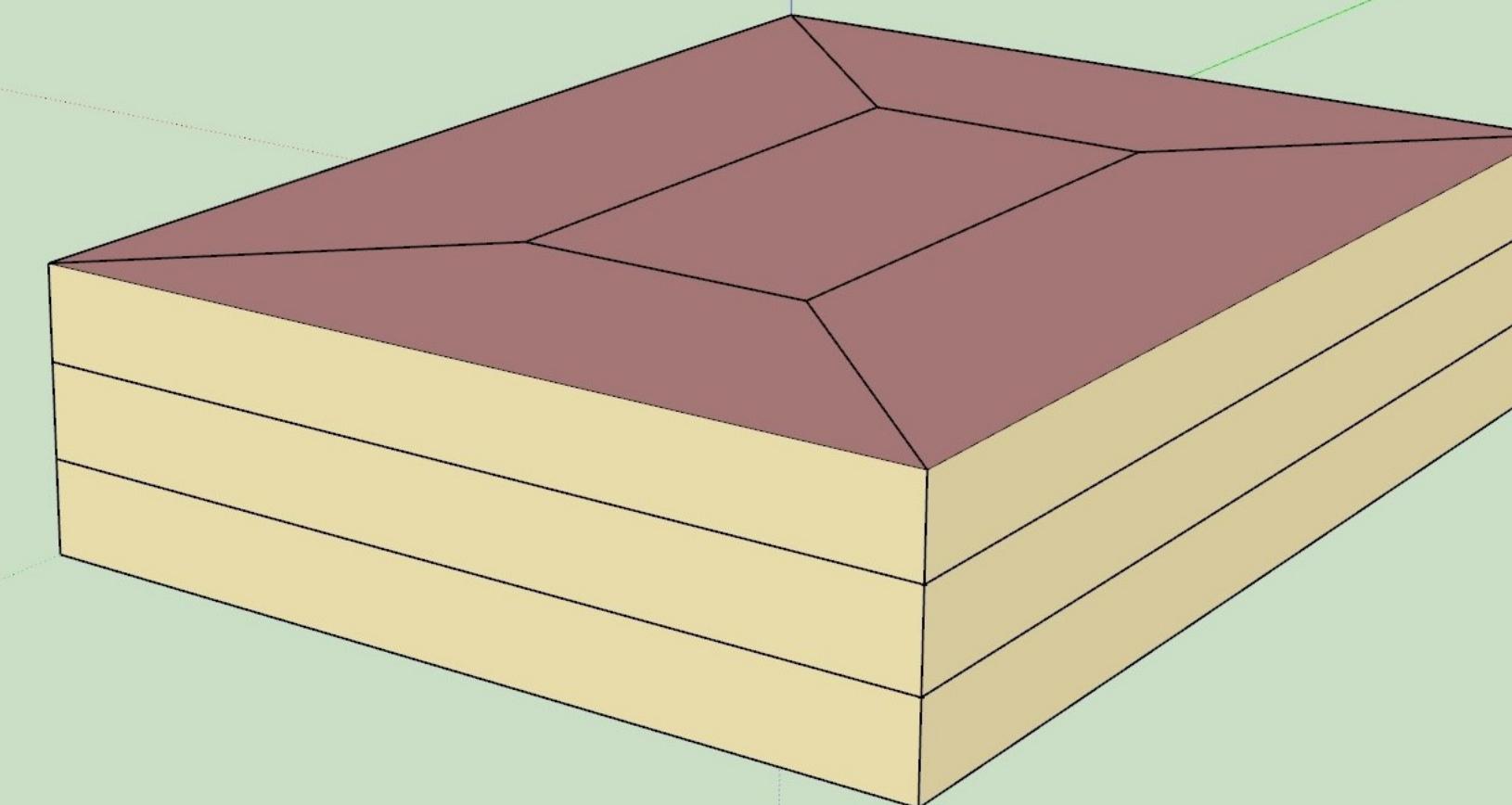
$$\underline{N=99 \text{ shields}}$$



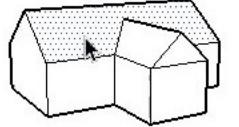


WE MAKE BUILDING USING CREATE SPACES FROM DIAGRAM TOOL, AFTER WE SELECT ALL DIAGRAM

WITH INFO TOOL WE CAN SEE ALL INFORMATION ABOUT OUR BUILDING



Default Tray
► Entity Info
► Materials
► Components
► Styles
► Shadows
▼ Instructor



Select Tool

Select entities to modify when using other tools or commands.

Tool Operation

1. Click on an entity.

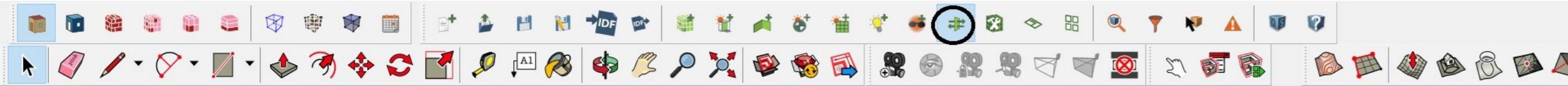
Modifier Keys

Ctrl = Add an entity to set of selected entities
Shift+Ctrl = Subtract an entity from set of selected entities
Shift = Toggle whether an entity is within set of selected entities
Ctrl+A = Select all visible entities in model

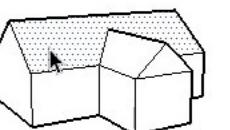
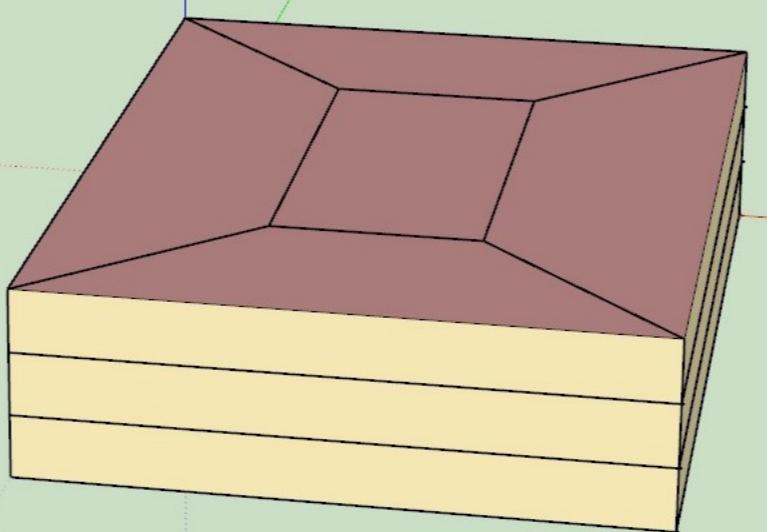
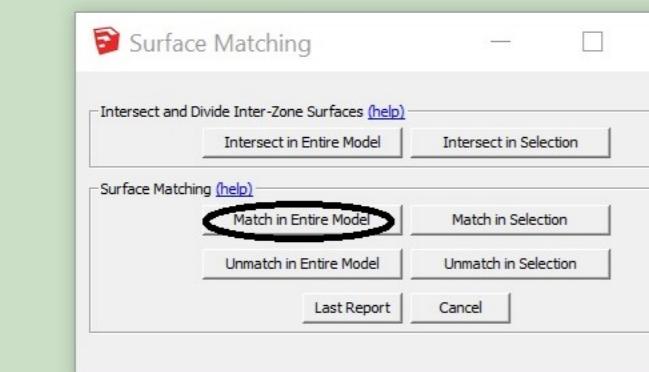
Click to learn about more advanced operations...

Outliner

Filter:
Untitled <ul style="list-style-type: none">Space: Space 101Space: Space 102Space: Space 103Space: Space 104Space: Space 105Space: Space 201Space: Space 202Space: Space 203Space: Space 204Space: Space 205Space: Space 301Space: Space 302Space: Space 303Space: Space 304Space: Space 305



WE ARE USING THIS SURFACE
MATCHING TOOL TO MAKE SURE
THAT WE WILL NOT HAVE WINDOWS
INSIDE OUR BUILDING

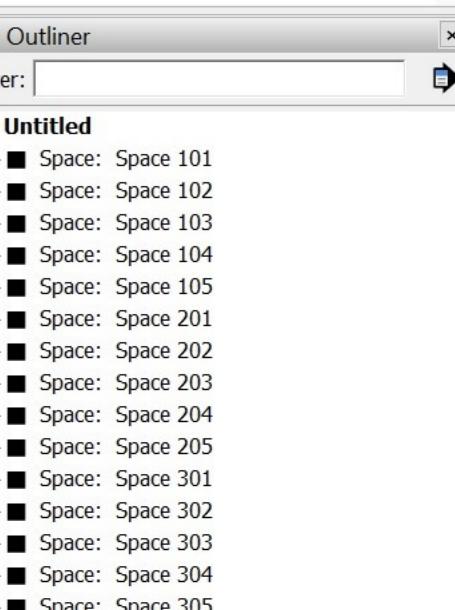


Select Tool
Select entities to modify when using other tools or commands.

Tool Operation
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Click to learn about more advanced operations...



File Edit View Camera Draw Tools Window Extensions Help

OpenStudio
OpenStudio User Scripts >
Load User Scripts
Alter or Add Model Elements >
Building Component Library
Create Standard Building Shapes
Experimental Workflow
On Demand Template Generators
Reports
Visualization

Add New Thermal Zone For Spaces With No Thermal Zone
Add Overhangs by Projection Factor
Add Photovoltaics
Add Shading Controls
Assign Building Stories
Change Shading Type
Cleanup Origins
Export Selected Spaces to a new External Model
Merge Spaces From External File
Make Selected Surfaces Adiabatic and Assign a Construction
Move Selected Surfaces to New Space
Remove Hard Assigned Constructions
Remove Loads Directly Assigned to Spaces
Remove Orphan Photovoltaics
Remove Orphan SubSurfaces
Remove Photovoltaics
Remove Unused ThermalZones
Rename Thermal Zones Based On Space Names
Set Interior Partition Height Above Floor
Set Shading Controls
Set Window Property Frame and Divider
Set Window to Wall Ratio

Default Tray
Entity Info
Materials
Components
Styles
Shadows
Instructor

WITH THIS TOOL WE ADD WINDOWS

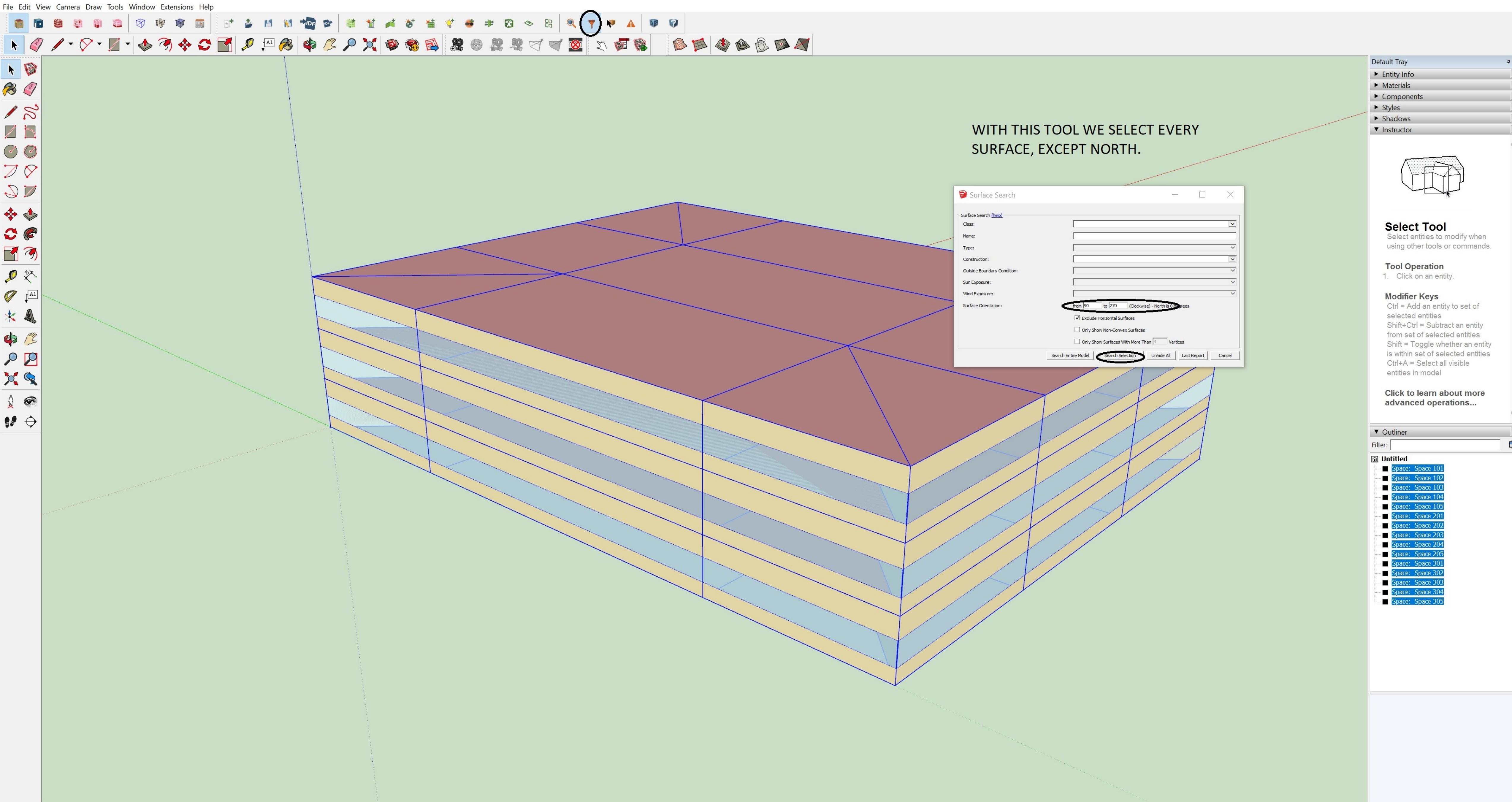
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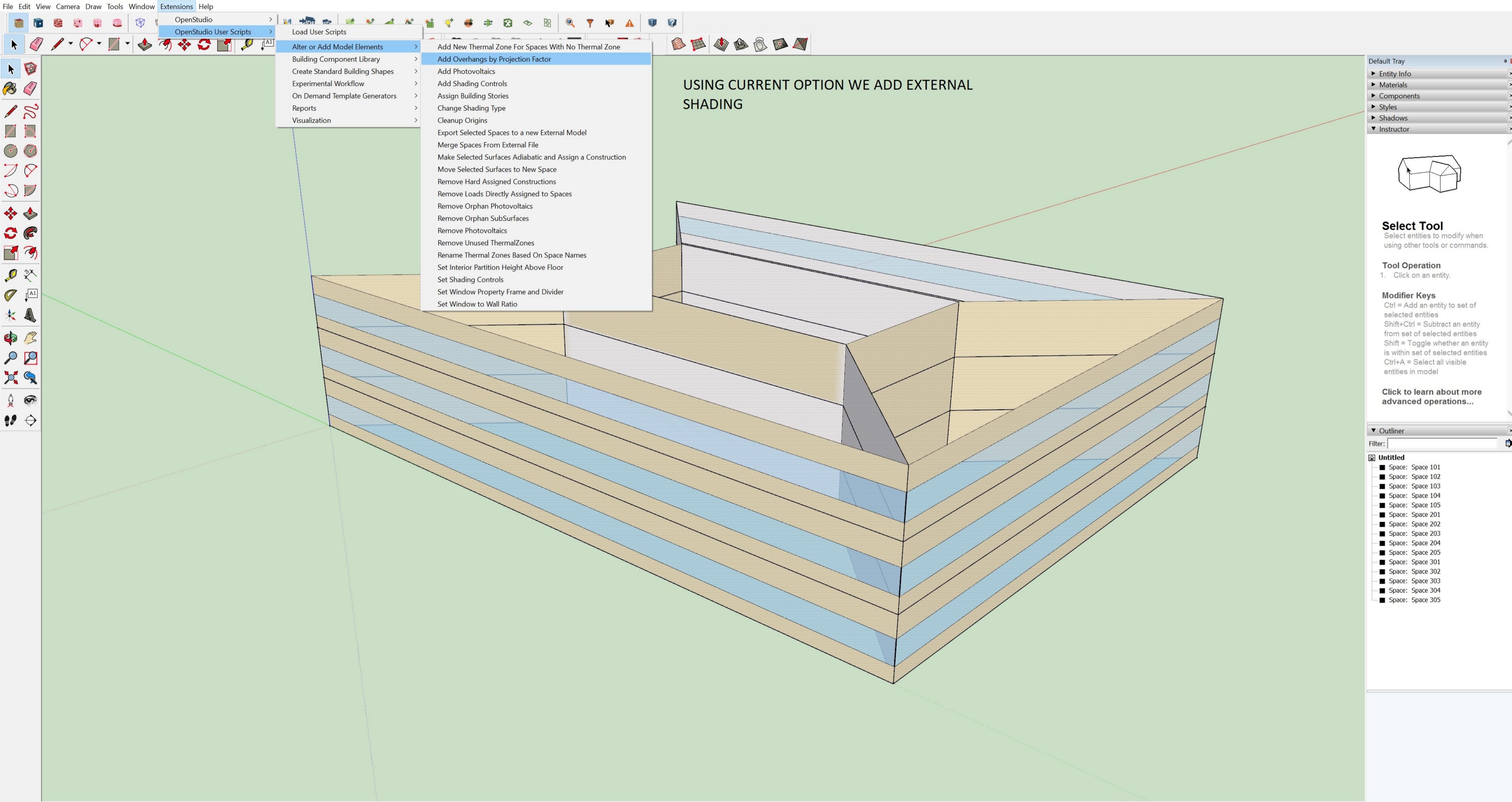
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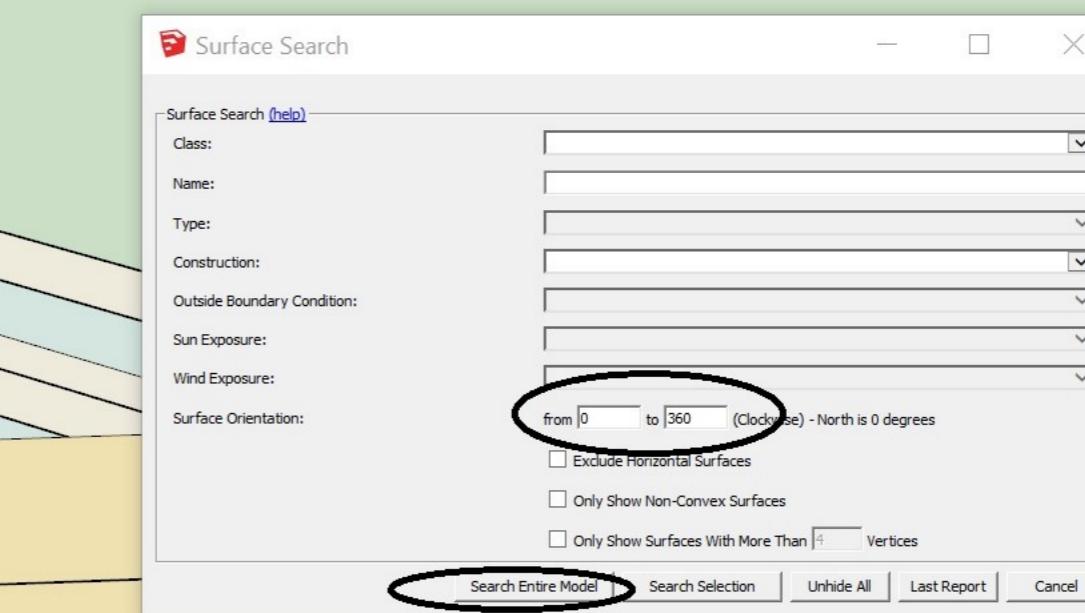
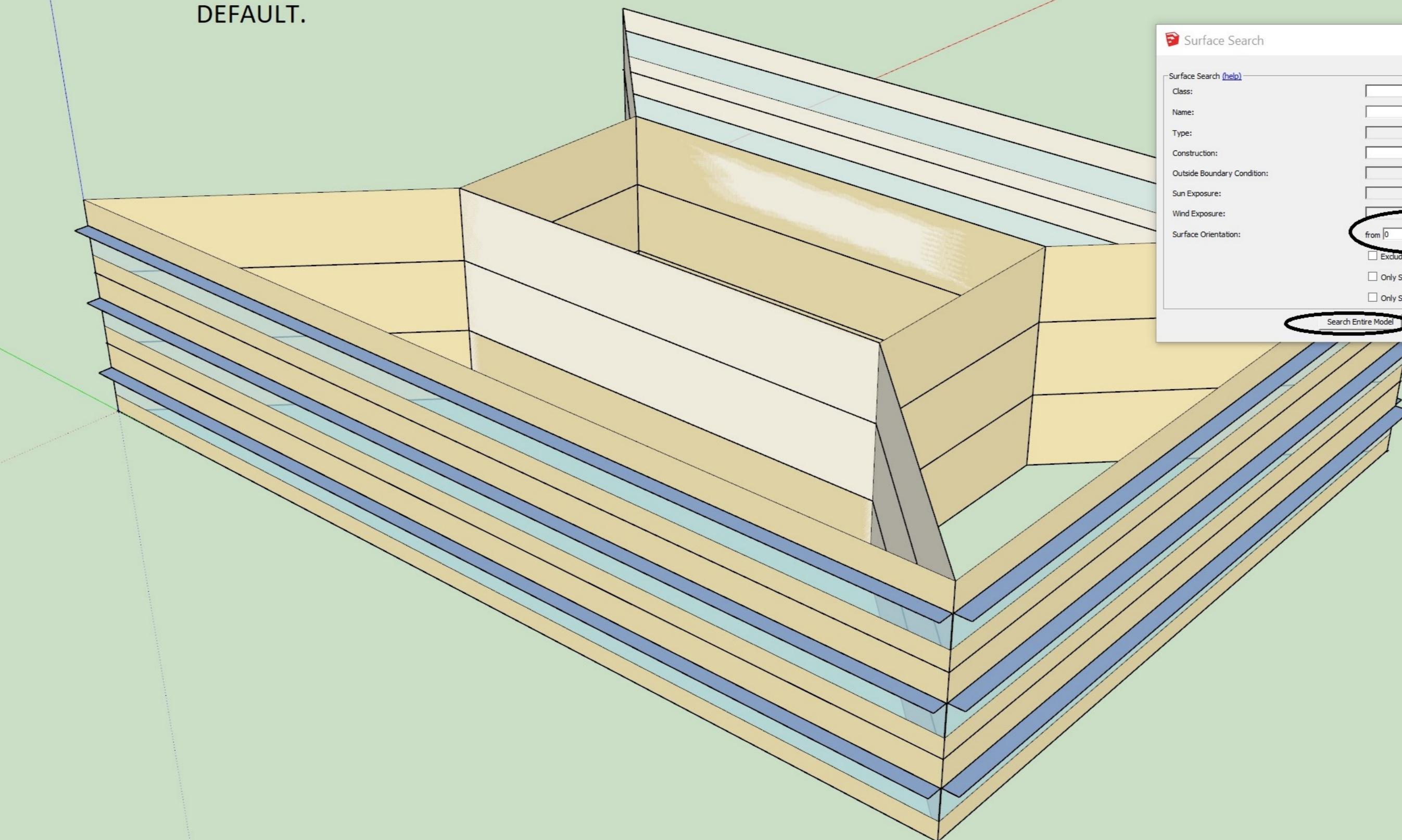
Outliner
Filter: Untitled
Space: Space 101
Space: Space 102
Space: Space 103
Space: Space 104
Space: Space 105
Space: Space 201
Space: Space 202
Space: Space 203
Space: Space 204
Space: Space 205
Space: Space 301
Space: Space 302
Space: Space 303
Space: Space 304
Space: Space 305





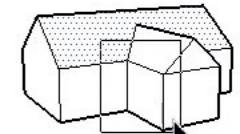


WITH THIS TOOL WE GO BACK TO OUR PREVIOUS SELECTION BY CHANGING OUR SURFACE ORIENTATION TO DEFAULT.



Default Tray

- Entity Info
- Materials
- Components
- Styles
- Shadows
- Instructor



Select Tool

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Tool Operation

1. Click on an entity.

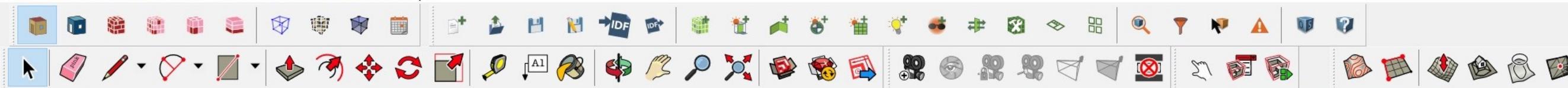
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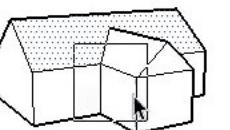
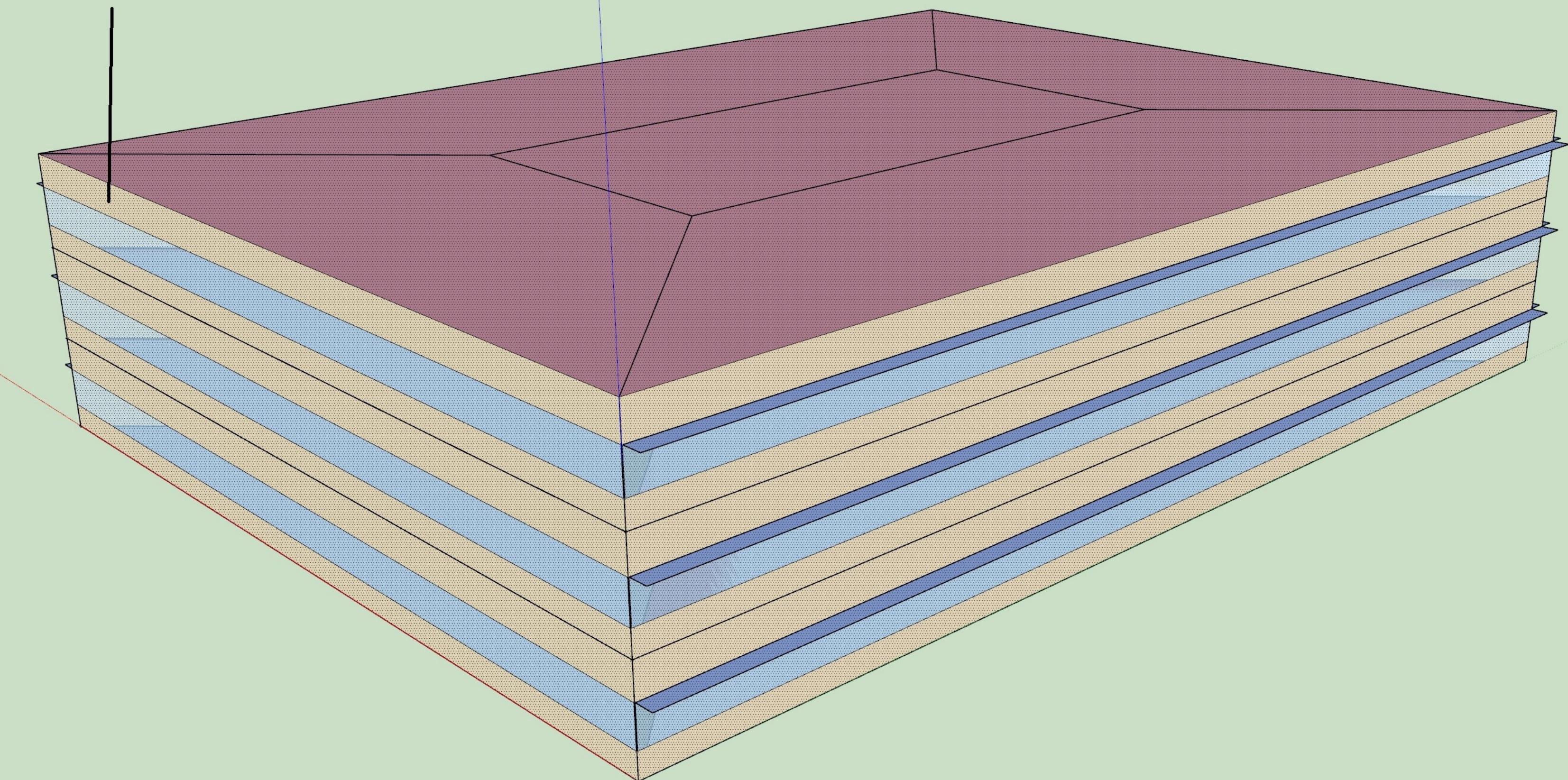
[Click to learn about more advanced operations...](#)

Outliner

- Filter:
- Untitled
 - Space: Space 101
 - Space: Space 102
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 - Space: Space 201
 - Space: Space 202
 - Space: Space 203
 - Space: Space 204
 - Space: Space 205
 - Space: Space 301
 - Space: Space 302
 - Space: Space 303
 - Space: Space 304



THERE IS NO SHADING ONLY AT NORTH SURFACE.



Select Tool

Select entities to modify when using other tools or commands.

Tool Operation

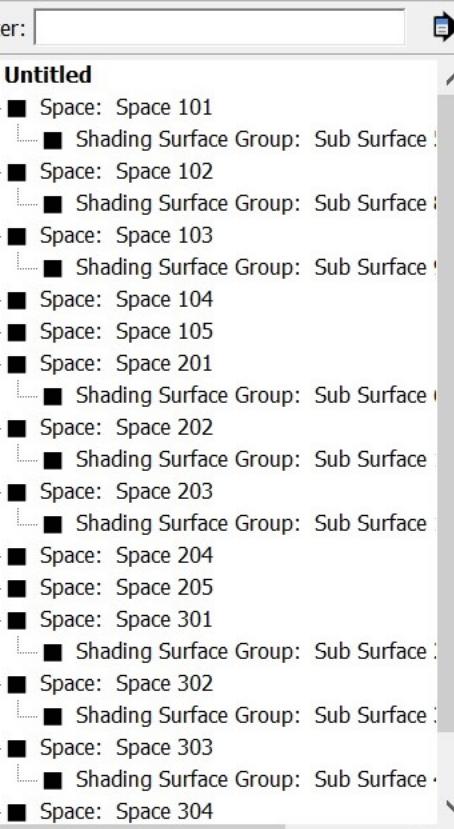
1. Click on an entity.

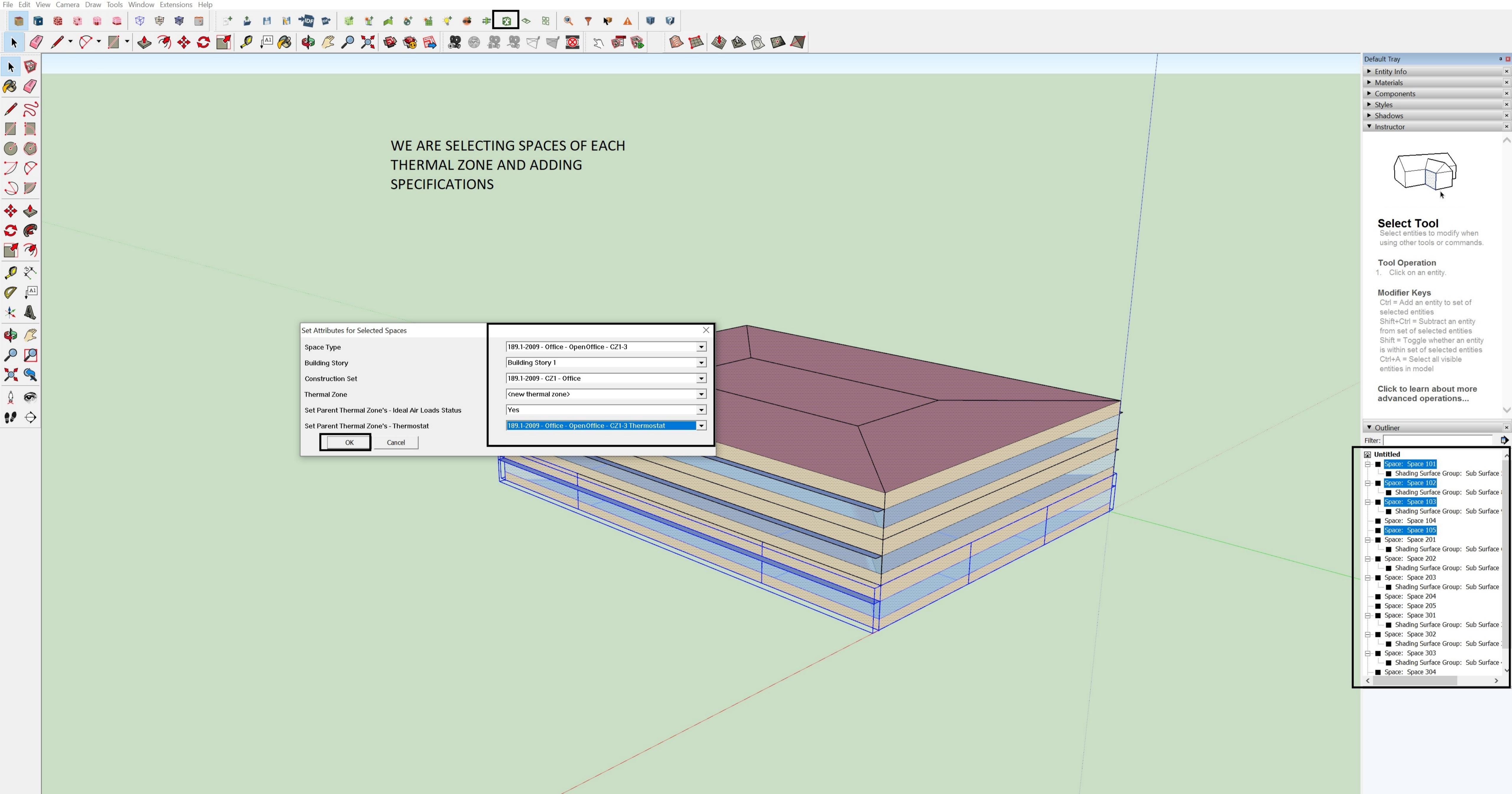
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Click to learn about more advanced operations...

Outliner





Weather File

Name: Piacenza

Latitude: 44.92

Longitude: 9.73

Elevation: 134

Time Zone: 1

Download weather files at www.energyplus.gov

Measure Tags (Optional):

ASHRAE Climate Zone CEC Climate Zone Design Days

Design Days

Date	Temperature	Humidity	Pressure Wind Precipitation	Solar	Custom
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Design Day Name	All	Day Of Month	Month	Day Type	Daylight Saving Time Indicator
		<input type="button" value="Apply to Selected"/>	<input type="button" value="Apply to Selected"/>	<input type="button" value="Apply to Selected"/>	
Piacenza Ann Clg .4% Condns DB=>MWB	<input type="checkbox"/>	21	8	SummerDesignDay	<input type="checkbox"/>
Piacenza Ann Clg .4% Condns DP=>MDB	<input type="checkbox"/>	21	8	SummerDesignDay	<input type="checkbox"/>
Piacenza Ann Clg .4% Condns Enth=>MDB	<input type="checkbox"/>	21	8	SummerDesignDay	<input type="checkbox"/>
Piacenza Ann Clg .4% Condns WB=>MDB	<input type="checkbox"/>	21	8	SummerDesignDay	<input type="checkbox"/>
Piacenza Ann Htg 99.6% Condns DB	<input type="checkbox"/>	21	1	WinterDesignDay	<input type="checkbox"/>
Piacenza Ann Htg Wind 99.6% Condns WS=>MCDB	<input type="checkbox"/>	21	1	WinterDesignDay	<input type="checkbox"/>
Piacenza Ann Hum_n 99.6% Condns DP=>MCDB	<input type="checkbox"/>	21	1	WinterDesignDay	<input type="checkbox"/>

Select Year by:

 Calendar Year First Day of Year Daylight Savings Time:

Starts

 Define by Day of The Week And Month Define by Date

Ends

 Define by Day of The Week And Month Define by Date

File Preferences Components & Measures Help

Run Simulation Output Tree 100%

Run Finished

Warnings: 24
Errors: 0
Output

```
Warning up {5}
Warning up {6}
Starting Simulation at 08/21 for PIACENZA ANN CLG .4% CONDNS DP=>MDB
Initializing New Environment Parameters
Warning up {1}
Warning up {2}
Warning up {2}
Warning up {3}
Warning up {4}
Warning up {5}
Warning up {6}
Starting Simulation at 08/21 for PIACENZA ANN CLG .4% CONDNS ENTH=>MDB
Initializing New Environment Parameters
Warning up {1}
Warning up {2}
Warning up {3}
Warning up {4}
Warning up {5}
Warning up {6}
Starting Simulation at 08/21 for PIACENZA ANN CLG .4% CONDNS WB=>MDB
Initializing New Environment Parameters
Warning up {1}
Warning up {2}
Warning up {3}
Warning up {4}
Warning up {5}
Warning up {6}
Starting Simulation at 01/21 for PIACENZA ANN HTG 99.6% CONDNS DB
Initializing New Environment Parameters
Warning up {1}
Warning up {2}
Warning up {3}
Warning up {4}
Warning up {5}
Warning up {6}
Starting Simulation at 01/21 for PIACENZA ANN HTG WIND 99.6% CONDNS WS=>MCDB
Initializing New Environment Parameters
Warning up {1}
Warning up {2}
Warning up {3}
Warning up {4}
Warning up {5}
Warning up {6}
Starting Simulation at 01/21 for PIACENZA ANN HUM_N 99.6% CONDNS DP=>MCDB
Initializing New Environment Parameters
Warning up {1}
Warning up {2}
Warning up {3}
Warning up {4}
Warning up {5}
Warning up {6}
Starting Simulation at 01/01 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=01/21
Continuing Simulation at 01/21 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=02/10
Continuing Simulation at 02/10 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=03/02
Continuing Simulation at 03/02 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=03/22
Continuing Simulation at 03/22 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=04/11
Continuing Simulation at 04/11 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=05/01
Continuing Simulation at 05/01 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=05/21
Continuing Simulation at 05/21 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=06/10
Continuing Simulation at 06/10 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=06/30
Continuing Simulation at 06/30 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=07/20
Continuing Simulation at 07/20 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=08/09
Continuing Simulation at 08/09 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=08/29
Continuing Simulation at 08/29 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=09/18
Continuing Simulation at 09/18 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=10/08
Continuing Simulation at 10/08 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=10/28
Continuing Simulation at 10/28 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=11/17
Continuing Simulation at 11/17 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=12/07
Continuing Simulation at 12/07 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=12/27
Continuing Simulation at 12/27 for RUN PERIOD 1
Writing tabular output file results using HTML format.
Computing Life Cycle Costs and Reporting
Writing final SQL reports
EnergyPlus Run Time=00hr 00min 6.75sec
Script executing from: C:/Users/Ira Kovinic/AppData/Local/OpenStudio.M10828/resources/run/6-UserScript-0
Found UserScript 'OpenStudio Results'.
result = true
Processed 1 base script and 0 merged scripts
```

NOW WE PRESS RUN

Reports: EnergyPlus Results

Open ResultsViewer
for Detailed Reports

Program Version: EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019.11.13 00:42

Table of Contents

Tabular Output Report in Format: HTML

Building: Building 1

Environment: RUN PERIOD 1 ** Piacenza - ITA IGDG WMO#=160840

Simulation Timestamp: 2019-11-13 00:42:13

Report: Annual Building Utility Performance Summary

Table of Contents

For: Entire Facility

Timestamp: 2019-11-13 00:42:13

Values gathered over 8760.00 hours

AND HERE WE CAN SEE OUR RESULTS.

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	1417.50	472.50	472.50
Net Site Energy	1417.50	472.50	472.50
Total Source Energy	4018.10	1339.37	1339.37
Net Source Energy	4018.10	1339.37	1339.37

Site to Source Energy Conversion Factors

	Site=>Source Conversion Factor
Electricity	3.167
Natural Gas	1.084
District Cooling	1.056
District Heating	3.613
Steam	0.300
Gasoline	1.050
Diesel	1.050
Coal	1.050
Fuel Oil #1	1.050
Fuel Oil #2	1.050
Propane	1.050
Other Fuel 1	1.000
Other Fuel 2	1.000

Building Area

	Area [m2]
Total Building Area	3000.00
Net Conditioned Building Area	3000.00
Unconditioned Building Area	0.00

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	356.80	0.00
Cooling	0.00	0.00	0.00	298.57	0.00	0.00
Interior Lighting	371.18	0.00	0.00	0.00	0.00	0.00
Exterior Lighting	0.00	0.00	0.00	0.00	0.00	0.00
Interior Equipment	390.95	0.00	0.00	0.00	0.00	0.00
Exterior Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Fans	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00
Heat Rejection	0.00	0.00	0.00	0.00	0.00	0.00
Humidification	0.00	0.00	0.00	0.00	0.00	0.00
Heat Recovery	0.00	0.00	0.00	0.00	0.00	0.00
Water Systems	0.00	0.00	0.00	0.00	0.00	0.00
Refrigeration	0.00	0.00	0.00	0.00	0.00	0.00
Generators	0.00	0.00	0.00	0.00	0.00	0.00