

Week 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 ?

$$\varepsilon_1=0.1$$

$$\varepsilon_2=0.1$$

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

When the $\varepsilon_1=\varepsilon_2=0.1$;

$$\dot{Q}_{12} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} = A * 5.67 * 10^{-8} * \frac{800^4 - 500^4}{\frac{1}{0.1} + \frac{1}{0.1} - 1} = A * 1035.72 \text{ W/m}^2$$

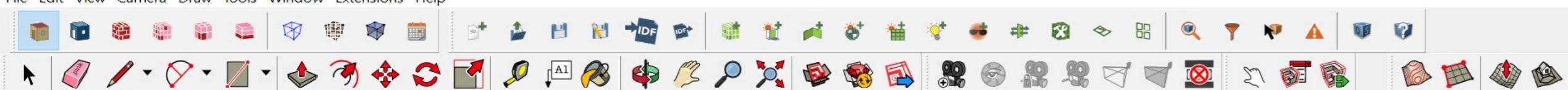
$$\dot{Q}_{N \text{ shields}} = \frac{A\sigma(T_1^4 - T_2^4)}{(N+1)\frac{1}{\varepsilon} + \frac{1}{\varepsilon} - 1} = \frac{1}{N+1} * \dot{Q} \text{ no shields}$$

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

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

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

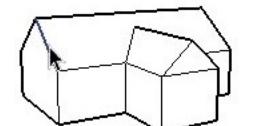
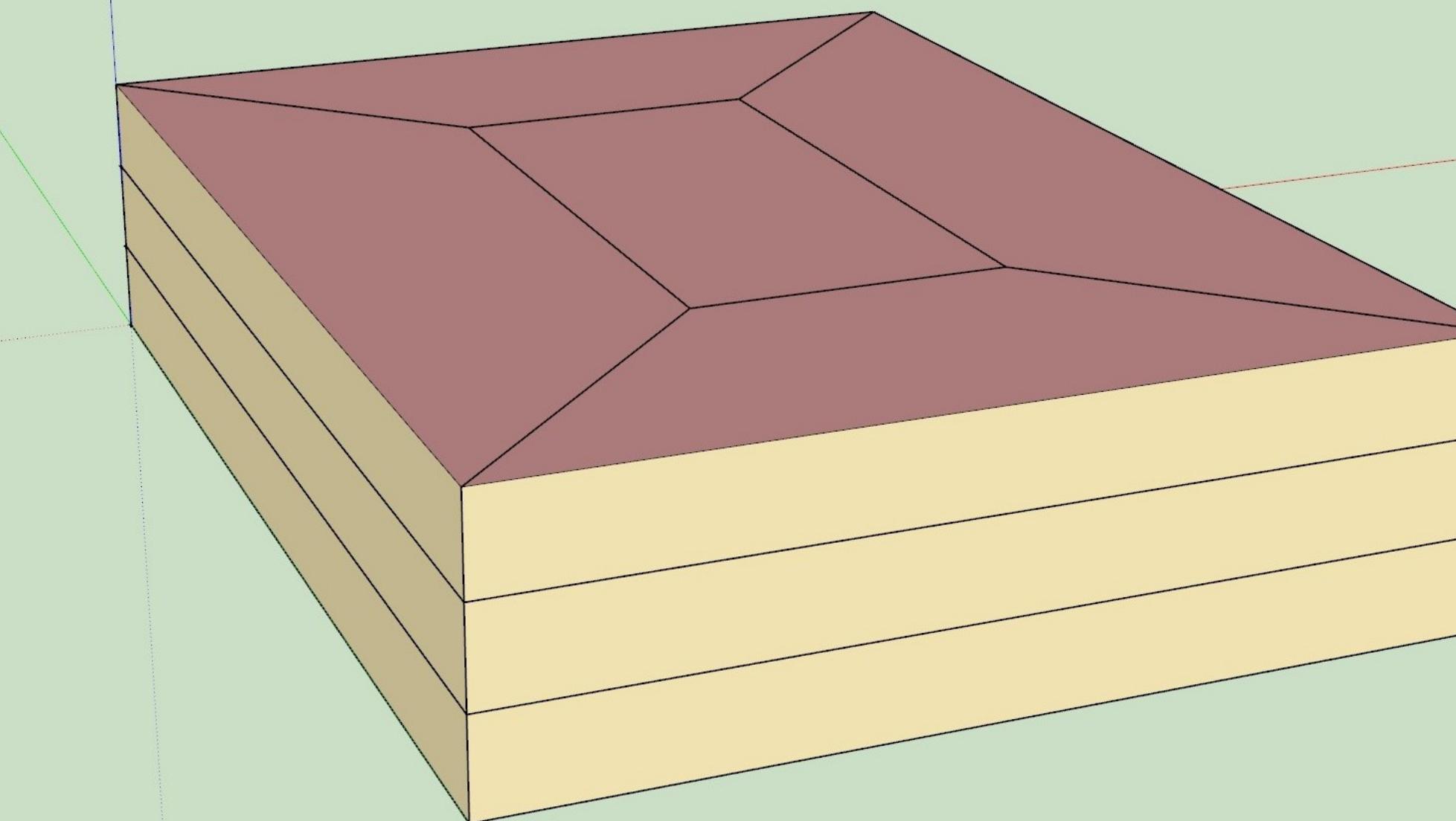
N=99shields





WE SELECT DIAGRAM
AND WITH CREATE
SPACES TOOL WE MAKE
BUILDING

WITH INFO TOOL WE HAVE
ALL INFORMATION ABOUT
OUR BUILDING



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

Tool Operation
1. Click on an entity.

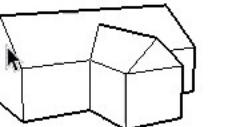
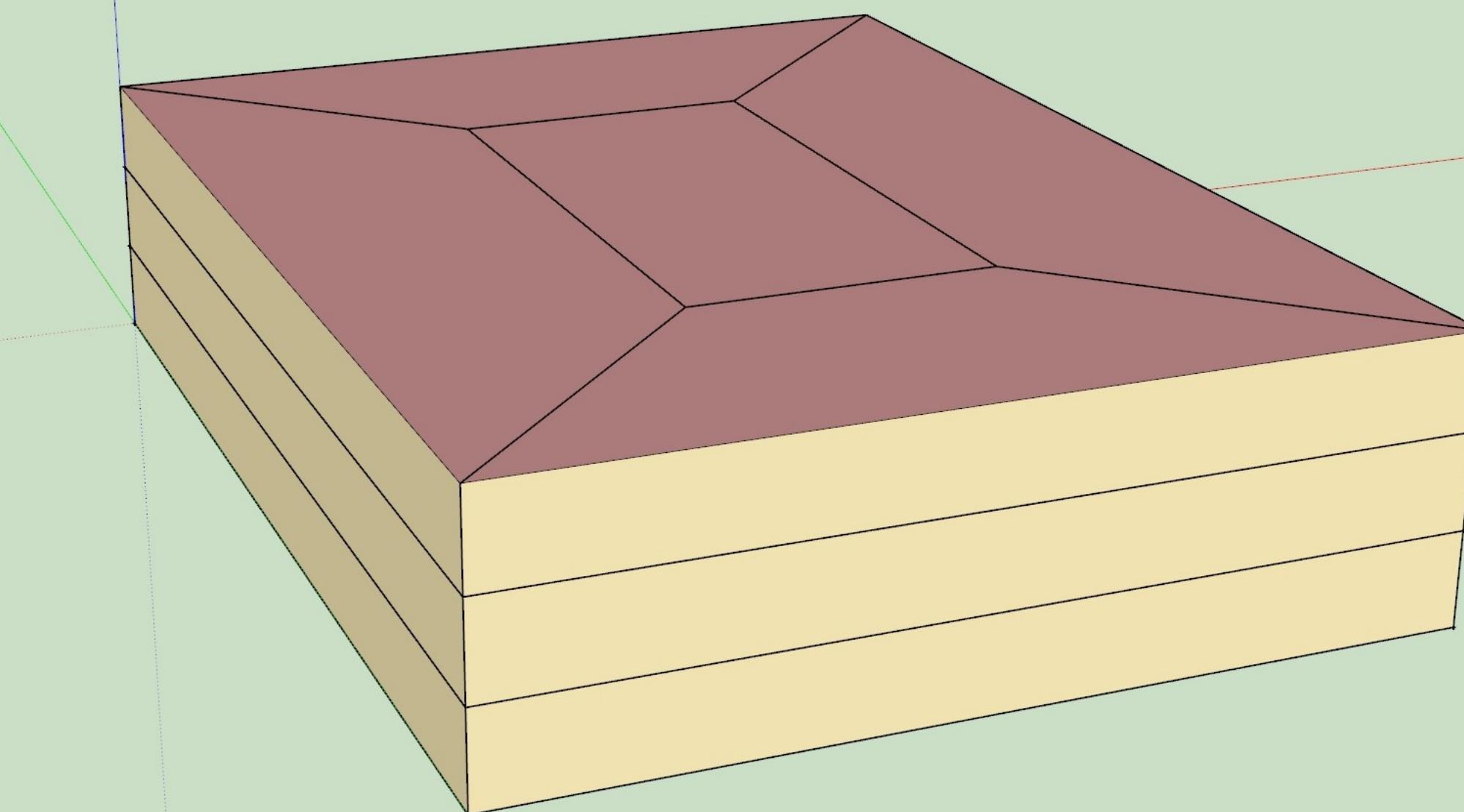
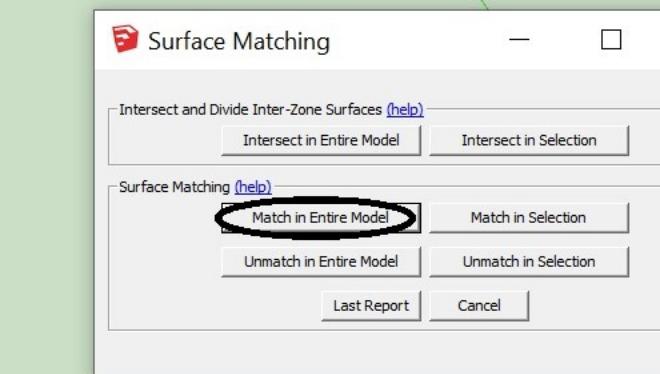
Modifier Keys
Ctrl = Add an entity to set of selected entities
Shift+Ctrl = Subtract an entity from set of selected entities
Shift = Toggle whether an entity is within set of selected entities
Ctrl+A = Select all visible entities in model

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

Outliner
Filter:
Untitled
■ 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



WE NEED TO USE SURFACE
MATCHING TOOL SO WE DO NOT
HAVE WINDOWS INSIDE BUILDING

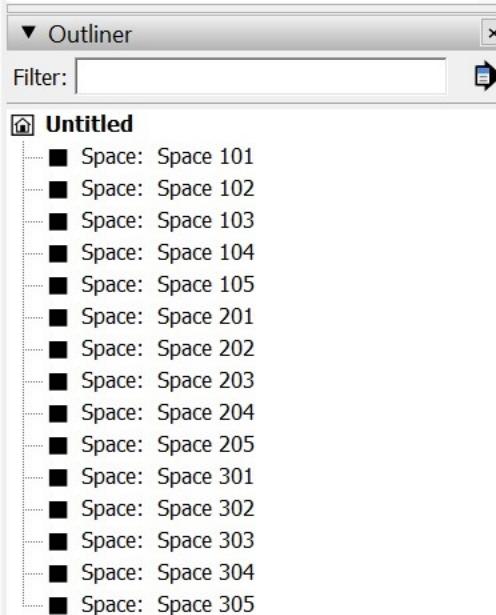


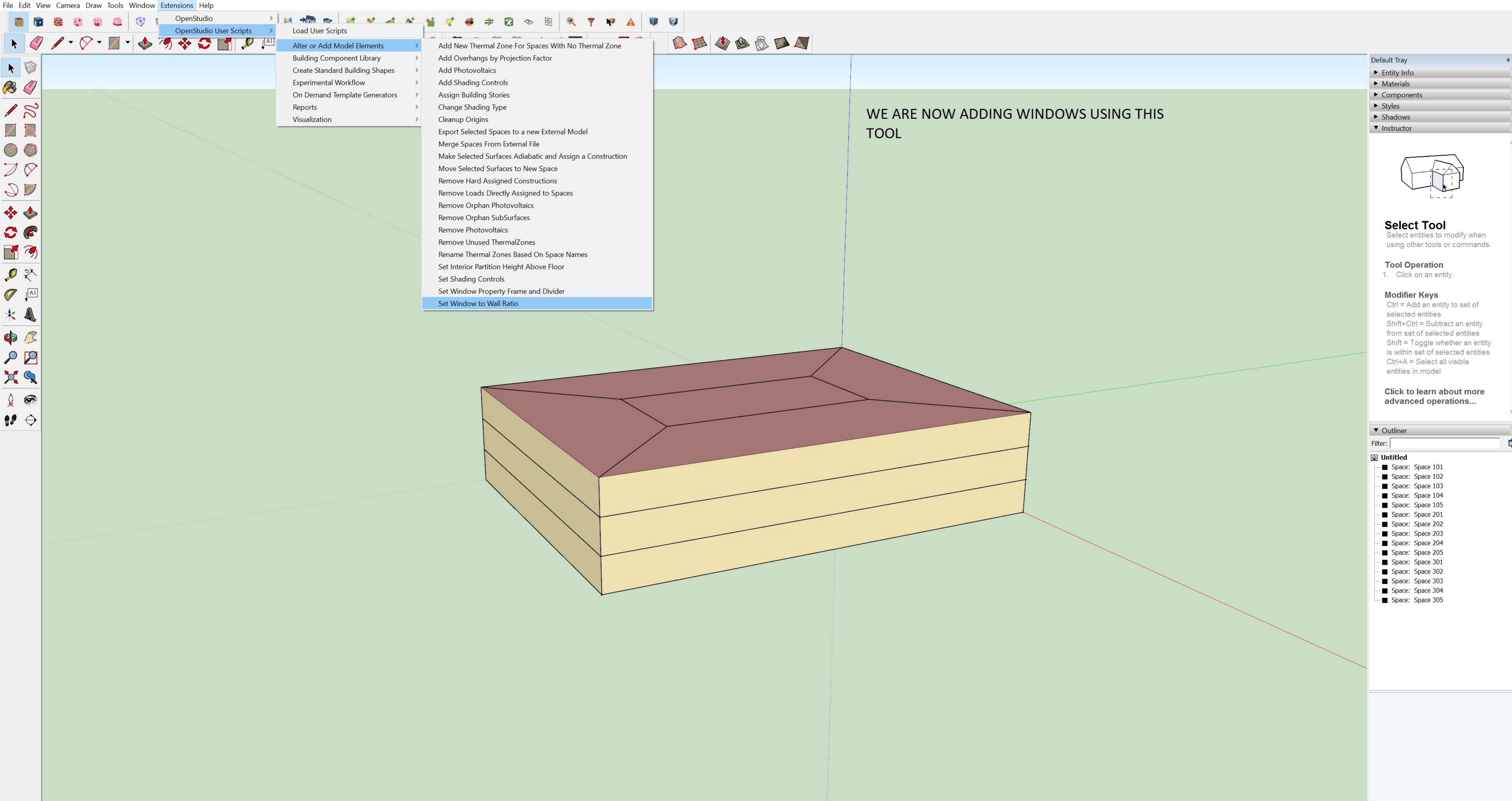
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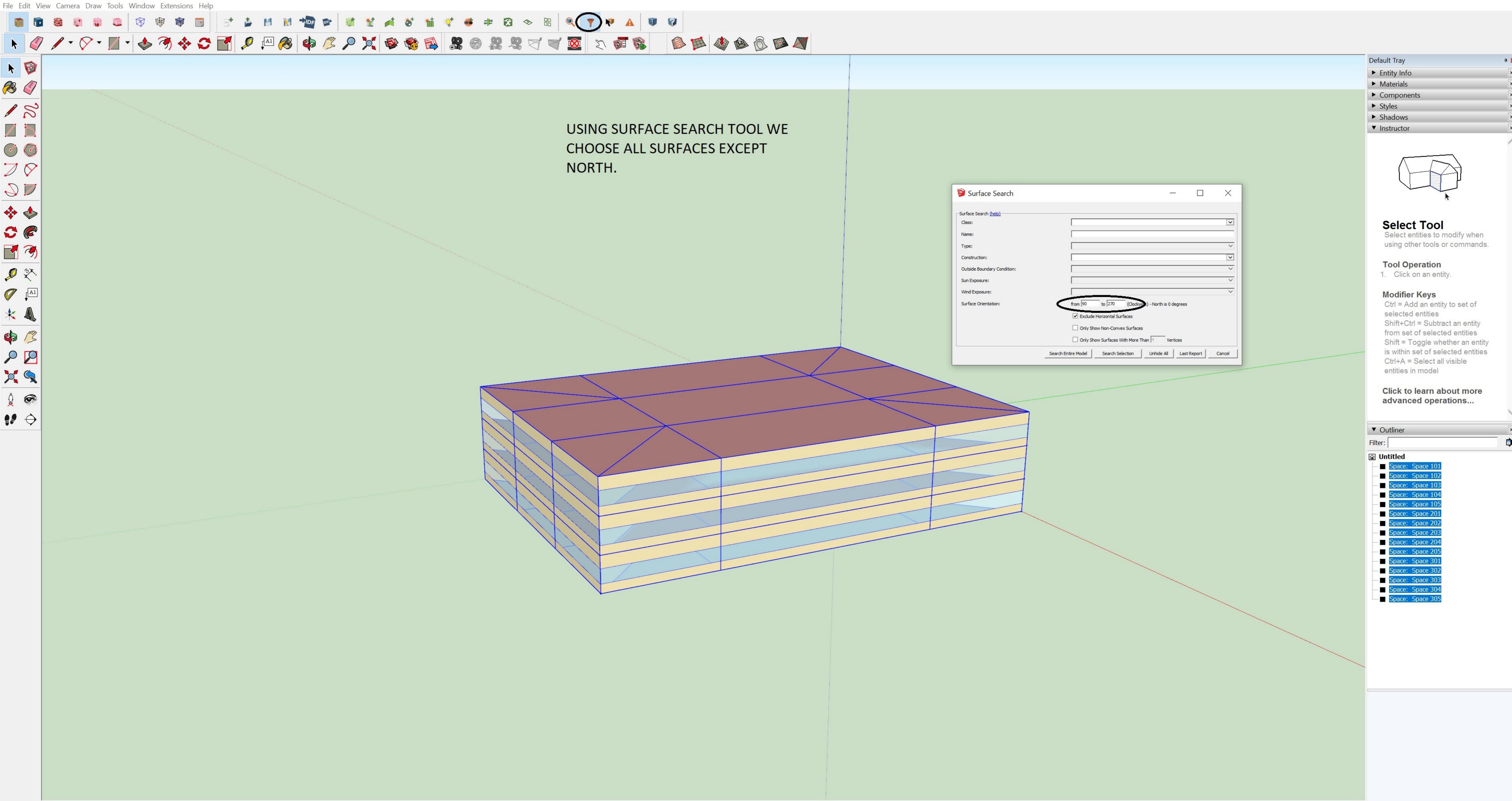
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Click to learn about more advanced operations...







File Edit View Camera Draw Tools Window Extensions Help

OpenStudio
OpenStudio User Scripts >

Load User Scripts

Alter or Add Model Elements >

- 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

Select Tool

Select entities to modify when using other tools or commands.

Tool Operation

- Click on an entity.

Modifier Keys

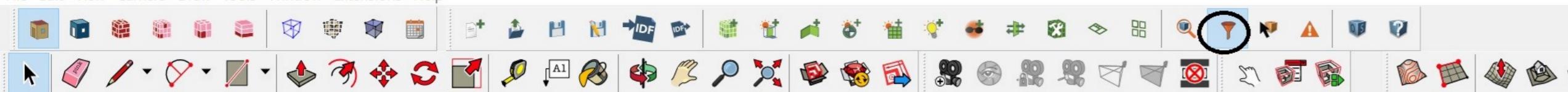
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Click to learn about more advanced operations...

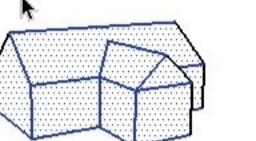
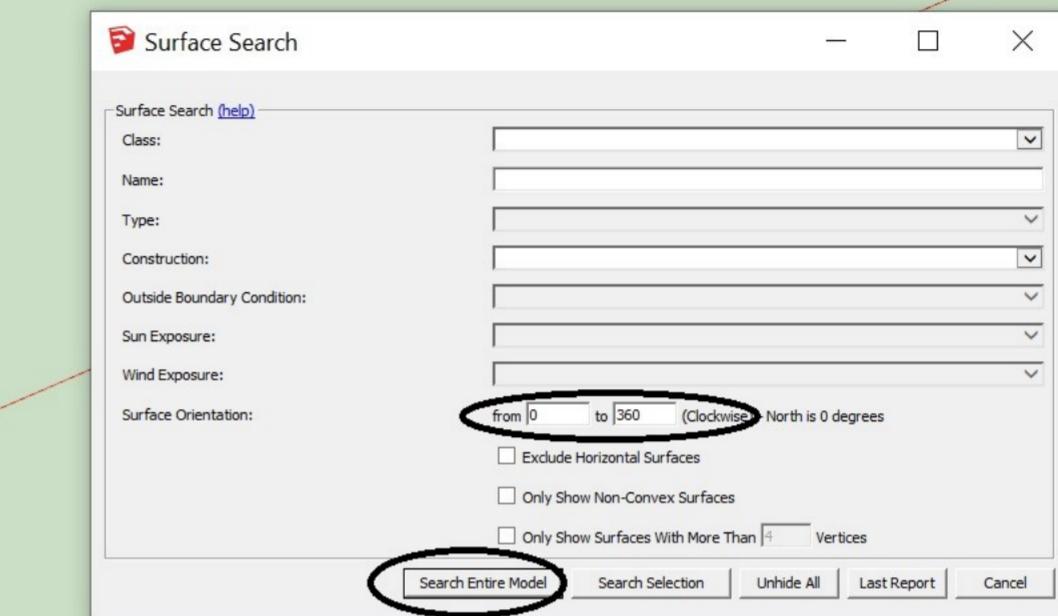
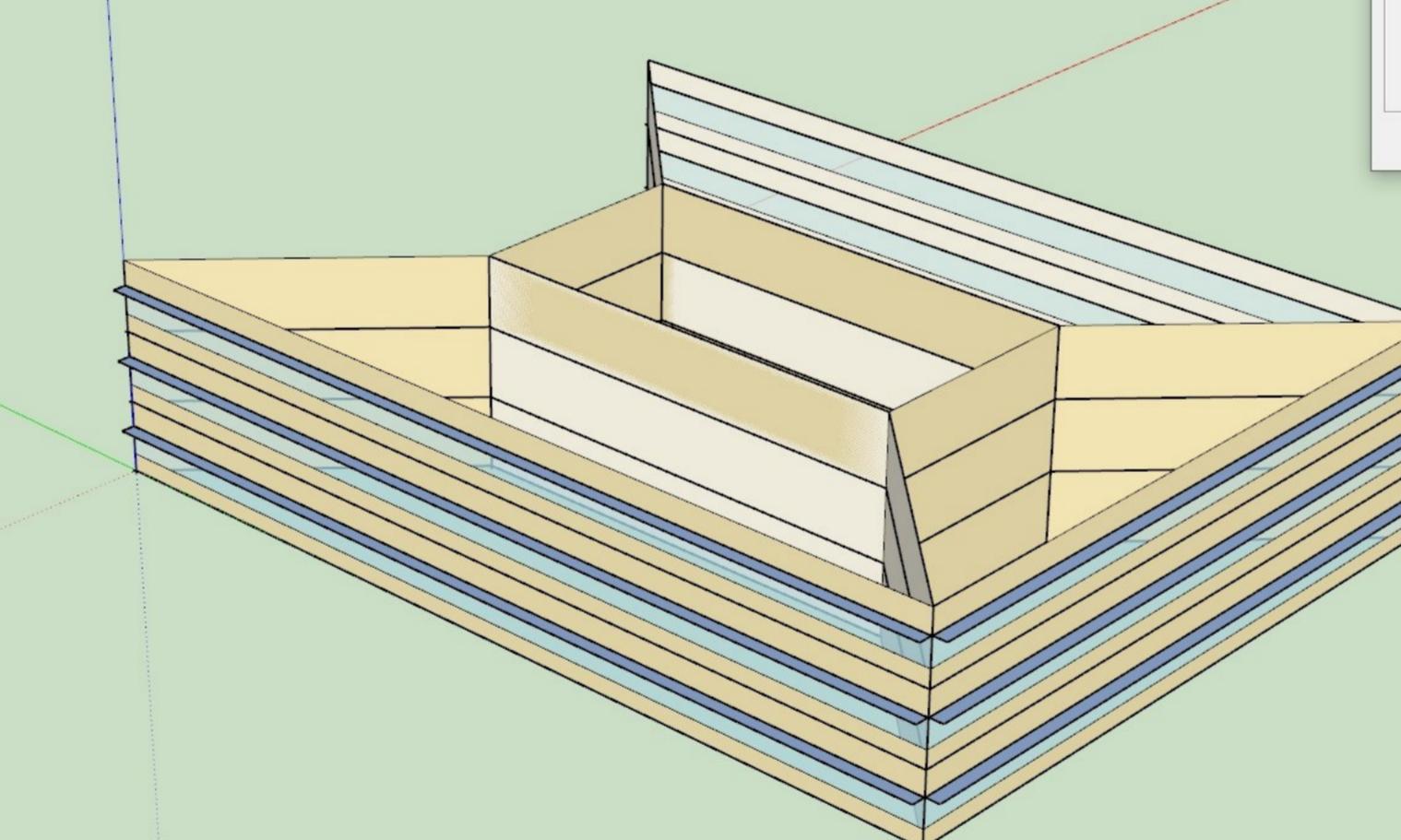
Outliner

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



NOW WE JUST GO BACK TO OUT
PREVIOUS SELECTION, USING
SURFACE SEARCH TOOL.



Select Tool

Select entities to modify when using other tools or commands.

Tool Operation

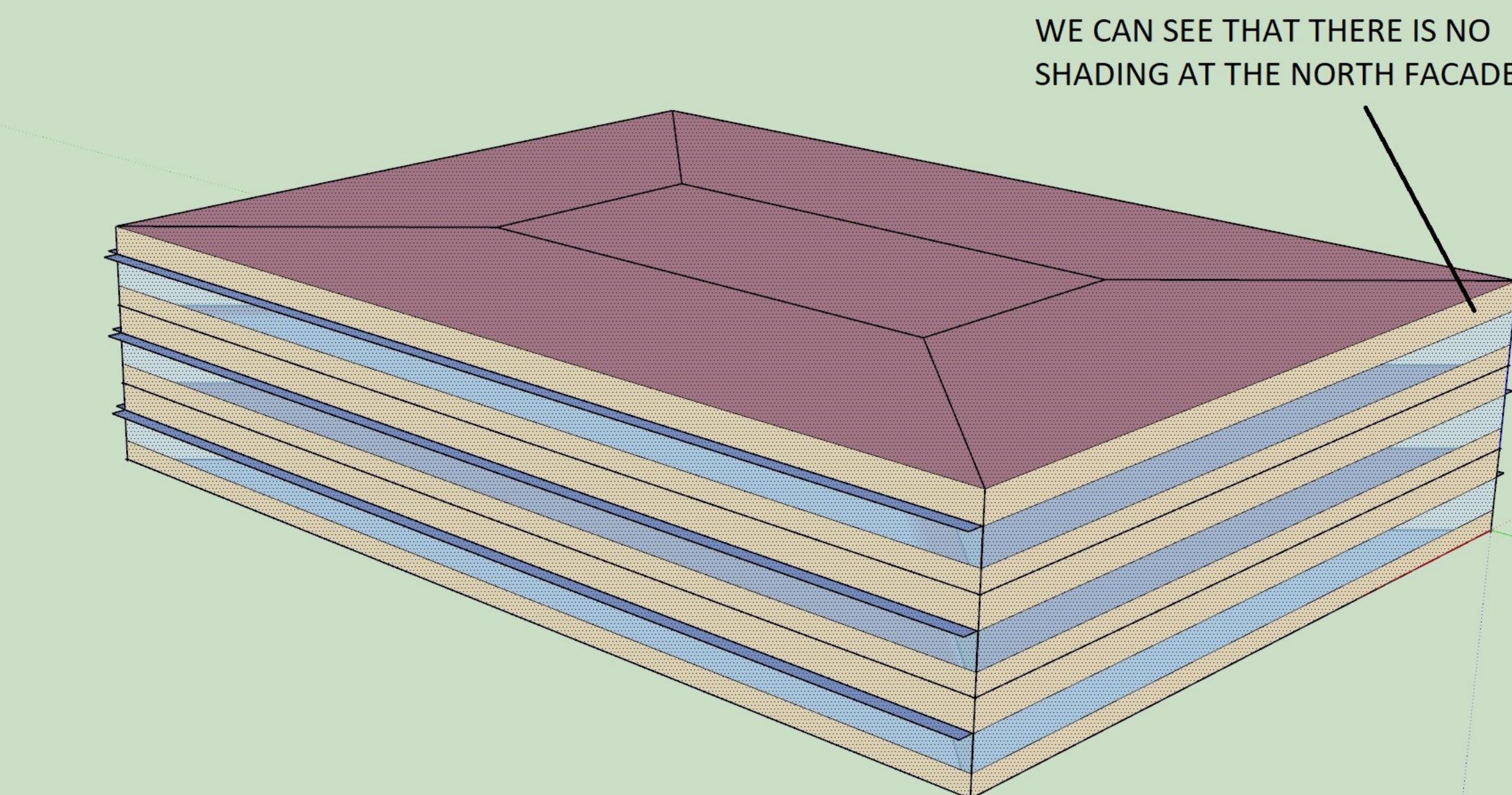
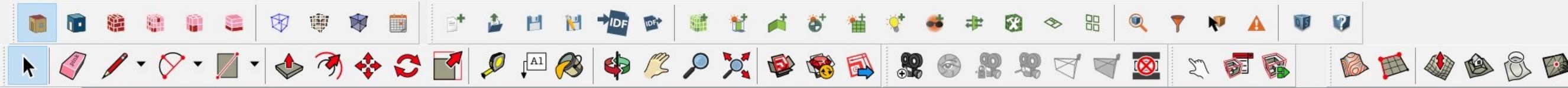
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Modifier Keys

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Shift+Ctrl = Subtract an entity from set of selected entities
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Click to learn about more advanced operations...





WE CAN SEE THAT THERE IS NO
SHADING AT THE NORTH FACADE.



Select Tool

Select entities to modify when using other tools or commands.

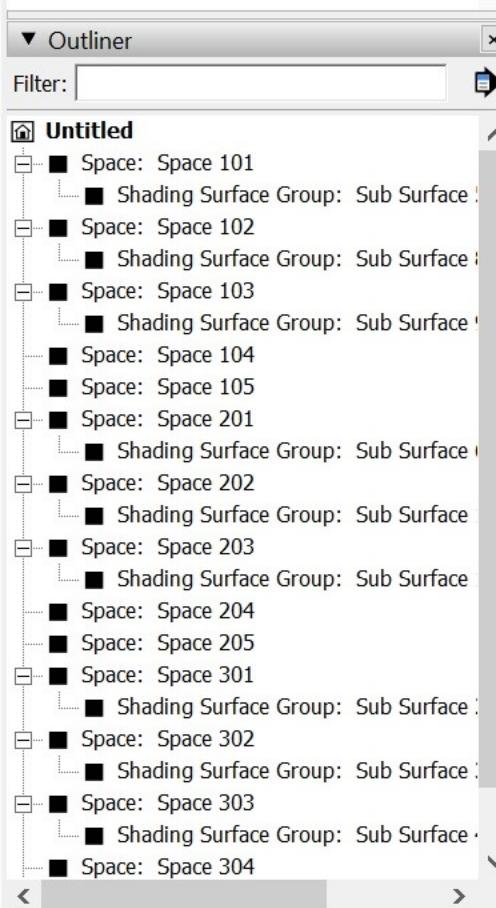
Tool Operation

1. Click on an entity.

Modifier Keys

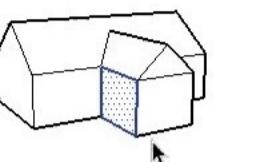
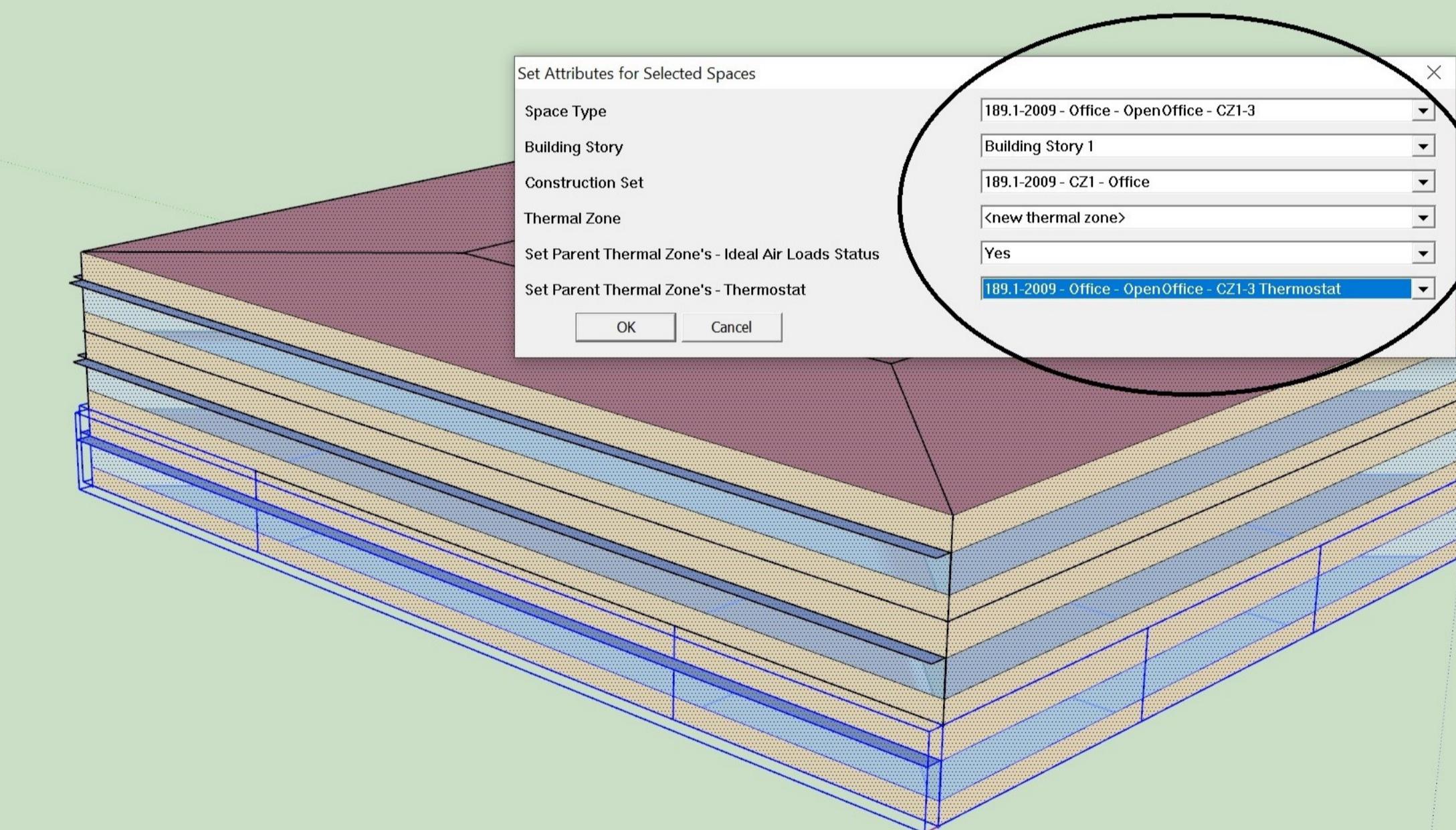
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Click to learn about more advanced operations...





NOW WE CHOSE SPACES BETWEEN
EACH THERMAL ZONE AND WE ARE ADDING SPECIFICATIONS



Select Tool

Select entities to modify when using other tools or commands.

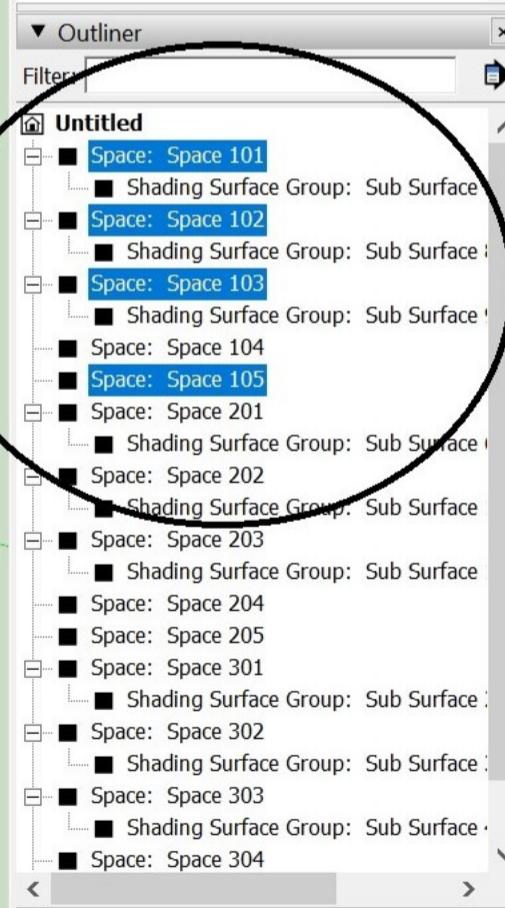
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Click to learn about more advanced operations...



Weather File Change 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 Import From DDY

Design Days

Date Temperature Humidity Pressure Wind Precipitation Solar Custom

Design Day Name	All	Day Of Month	Month	Day Type	Daylight Saving Time Indicator
		<input style="width: 150px; height: 20px; border: 1px solid black; border-radius: 5px; padding: 2px 10px;" type="button" value="Apply to Selected"/>	<input style="width: 150px; height: 20px; border: 1px solid black; border-radius: 5px; padding: 2px 10px;" type="button" value="Apply to Selected"/>	<input style="width: 150px; height: 20px; border: 1px solid black; border-radius: 5px; padding: 2px 10px;" type="button" value="Apply to Selected"/>	<input type="checkbox"/>
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

```
Warming up {5}
Warming up {6}
Starting Simulation at 08/21 for PIACENZA ANN CLG .4% CONDNS DP=>MDB
Initializing New Environment Parameters
Warming up {1}
Warming up {2}
Warming up {3}
Warming up {4}
Warming up {5}
Warming up {6}
Starting Simulation at 08/21 for PIACENZA ANN CLG .4% CONDNS ENTH=>MDB
Initializing New Environment Parameters
Warming up {1}
Warming up {2}
Warming up {3}
Warming up {4}
Warming up {5}
Warming up {6}
Starting Simulation at 08/21 for PIACENZA ANN CLG .4% CONDNS WB=>MDB
Initializing New Environment Parameters
Warming up {1}
Warming up {2}
Warming up {3}
Warming up {4}
Warming up {5}
Warming up {6}
Starting Simulation at 01/21 for PIACENZA ANN HTG 99.6% CONDNS DB
Initializing New Environment Parameters
Warming up {1}
Warming up {2}
Warming up {3}
Warming up {4}
Warming up {5}
Warming up {6}
Starting Simulation at 01/21 for PIACENZA ANN HTG WIND 99.6% CONDNS WS=>MCDB
Initializing New Environment Parameters
Warming up {1}
Warming up {2}
Warming up {3}
Warming up {4}
Warming up {5}
Warming up {6}
Starting Simulation at 01/21 for PIACENZA ANN HUM_N 99.6% CONDNS DP=>MCDB
Initializing New Environment Parameters
Warming up {1}
Warming up {2}
Warming up {3}
Warming up {4}
Warming up {5}
Warming 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
```

Report: 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

Table of Contents

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

AT LAST TAB WE CAN SEE OUR RESULTS.

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m ²]	Energy Per Conditioned Building Area [MJ/m ²]
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 [m ²]
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 [m ³]
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