

WEEK ASSIGNMENT 6

Task 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 $\epsilon_1=\epsilon_2=0.1$;

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

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

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

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

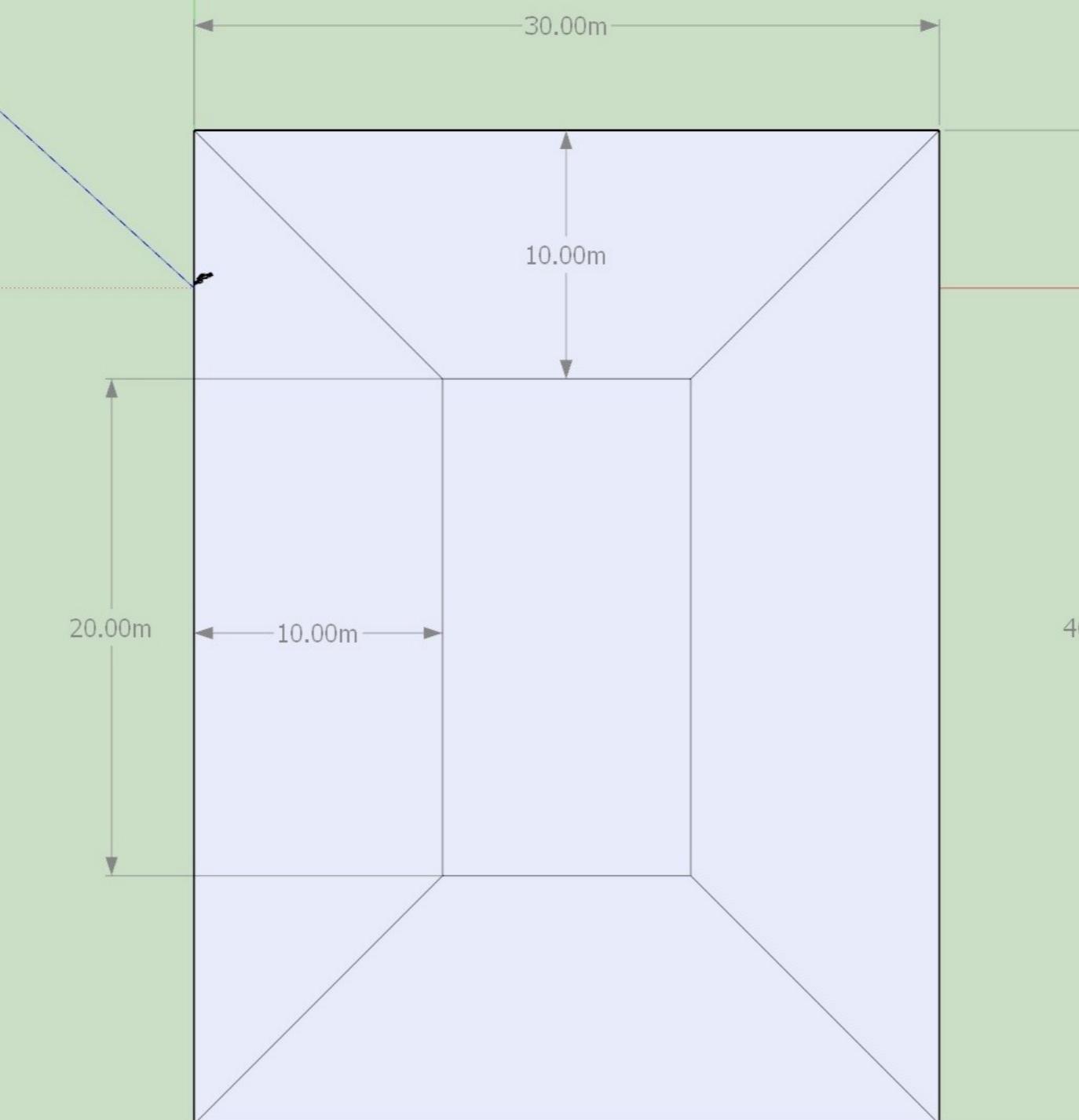
$$10.36 = \frac{1}{N+1} * 1036$$

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

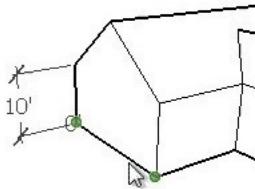


Top

STEP 1 IS TO CREATE RECTANGLE
40x30 AND TO CREATE ONE MORE
RECTANGLE INSIDE THIS ONE WITH
OFFSET OF 10m, WHEN FINISH WE
CONNECT EDGES WITH 4 LINES



Default Tray
Entity Info
Materials
Components
Styles
Shadows
Instructor



Dimension Tool
Place Dimension entities.

- Tool Operation**
1. Click at starting point of dimension.
 2. Move cursor.
 3. Click at ending point of dimension.
 4. Move cursor perpendicular to dimension.
 5. Click to fix position of dimension string.
 6. Esc = Cancel operation.

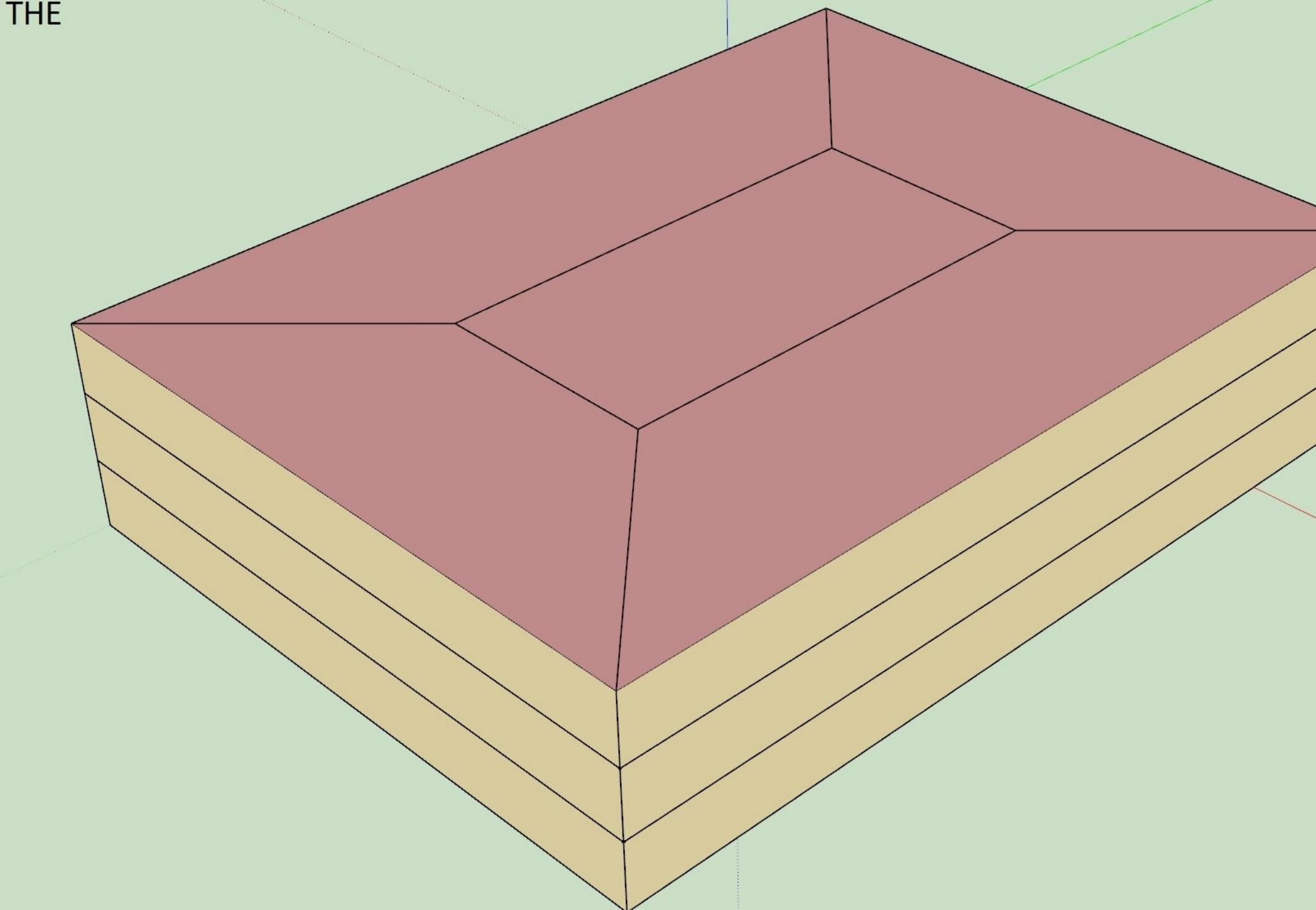
Modifier Keys
None.

[Click to learn about more](#)

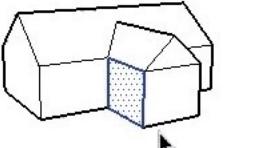


SELECTING THE
DIAGRAM AND USING
OPTION CREATE
SPACES FROM
DIAGRAM THE

WITH INFO TOOL WE ARE
ABLE TO SEE
INFORMATIONS OF EACH
SURFACE OF THE
BUILDING



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



Select Tool

Select entities to modify when using other tools or commands.

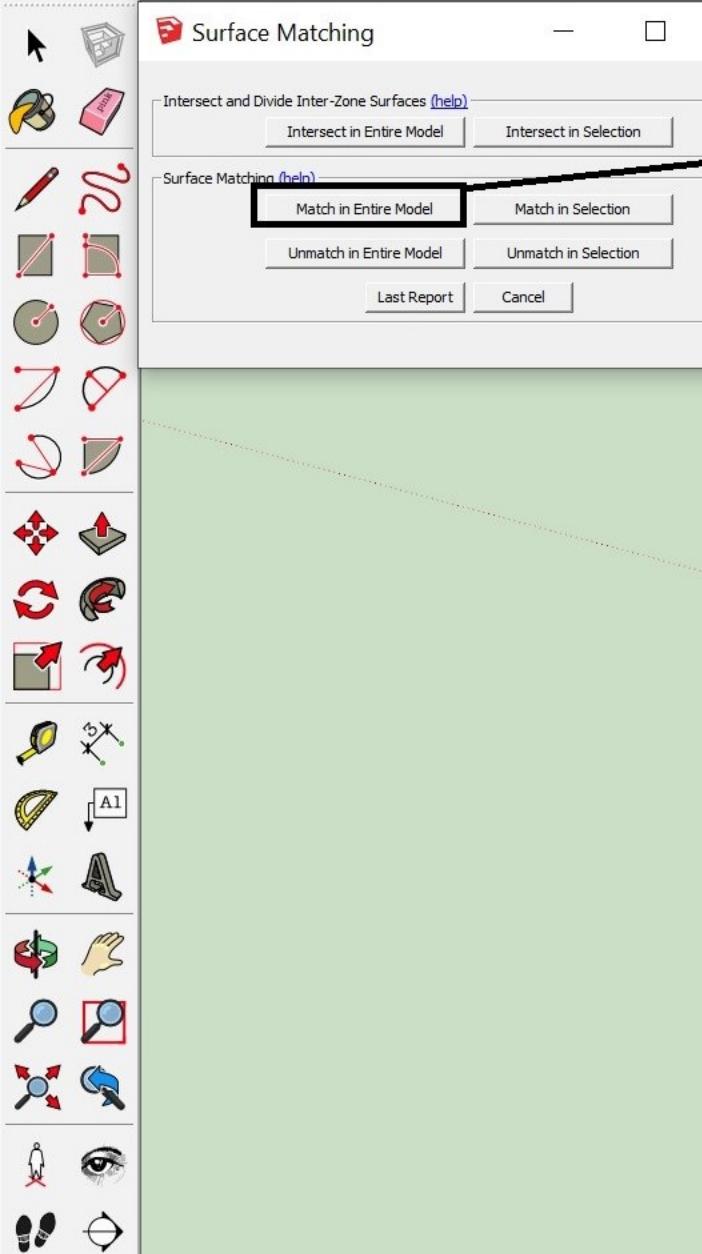
Tool Operation

1. Click on an entity.

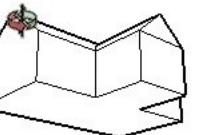
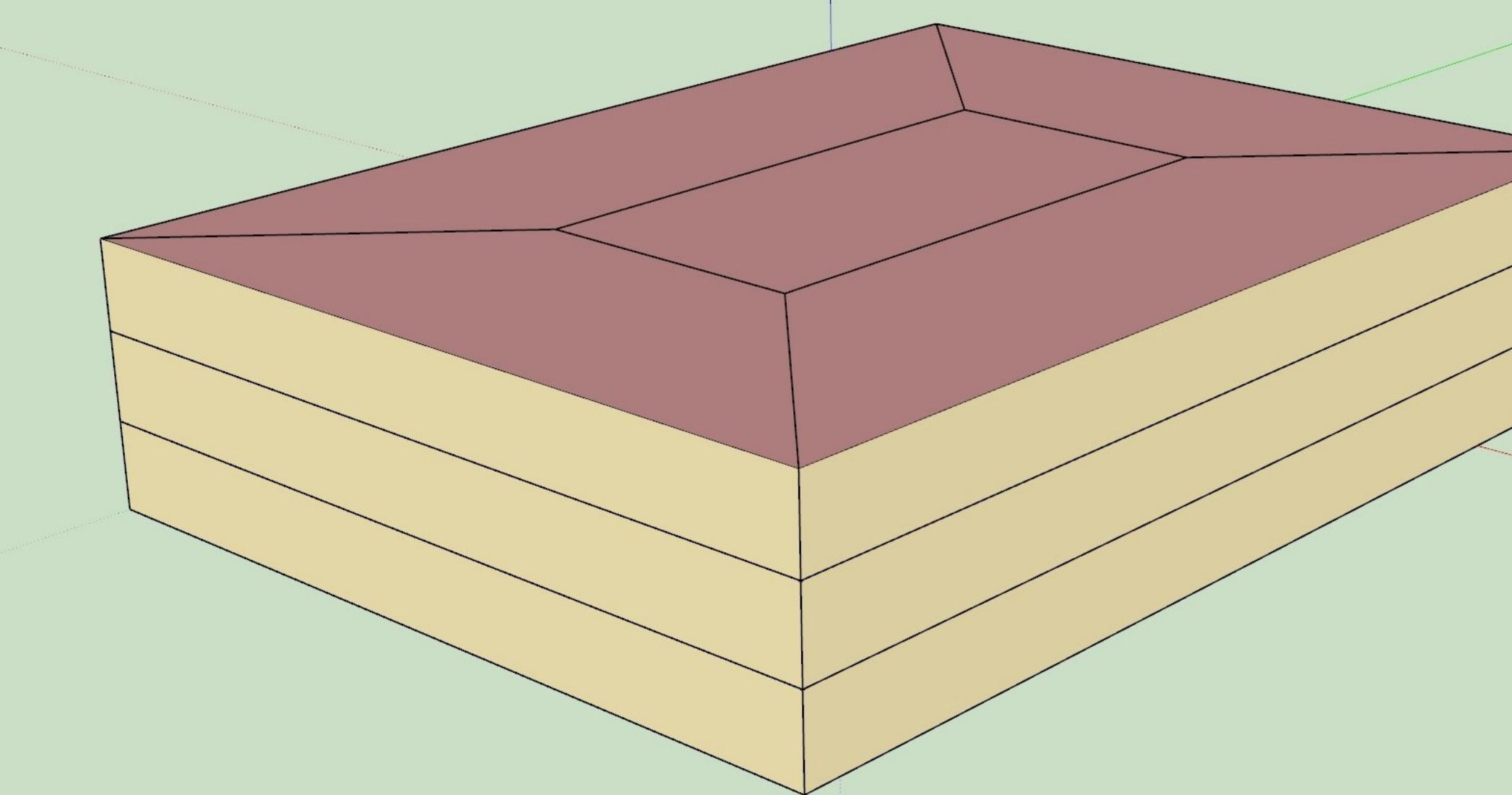
Modifier Keys

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...](#)



USING THIS SURFACE
MATCHING TOOL WE
MAKE SURE THAT WE
DO NOT HAVE
WINDOWS INSIDE THE
BUILDING



Orbit Tool

Rotate camera about model.

Tool Operation

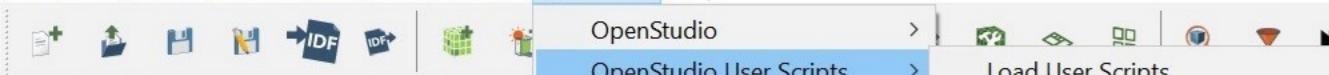
1. Click anywhere in drawing area.
2. Move cursor in any direction to rotate around center of drawing area.

Modifier Keys

Shift = Pan Tool
Ctrl = Suspend gravity (do not try to keep vertical edges up and down)

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

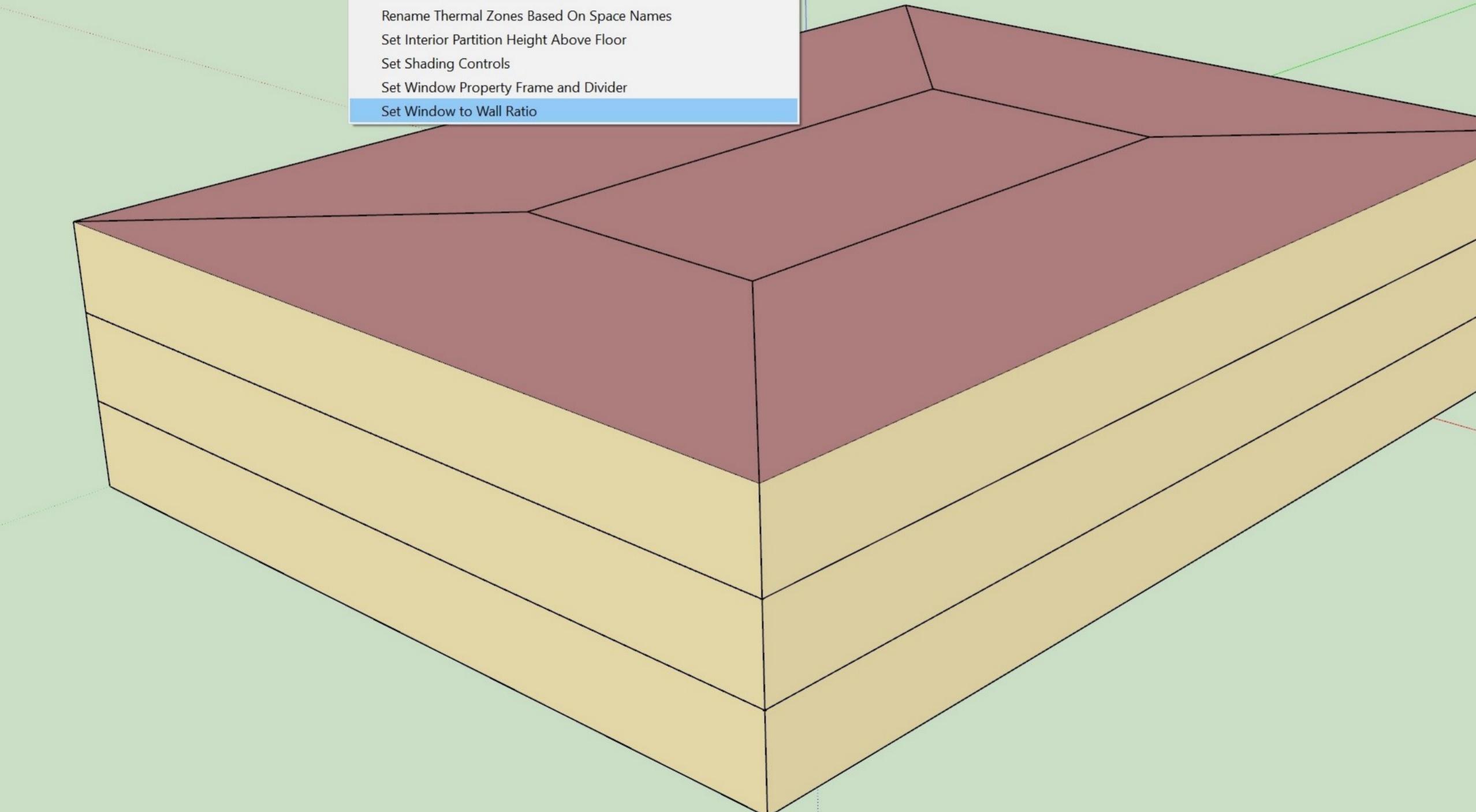
File Edit View Camera Draw Tools Window Extensions Help



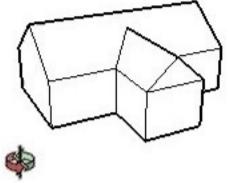
OpenStudio
OpenStudio User Scripts
Alter or Add Model Elements
Building Component Library
Create Standard Building Shapes
Experimental Workflow
On Demand Template Generators
Reports
Visualization

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

WITH THIS TOOL WE ADD
WINDOWS



Default Tray
Entity Info
Materials
Components
Styles
Shadows
Instructor



Orbit Tool

Rotate camera about model.

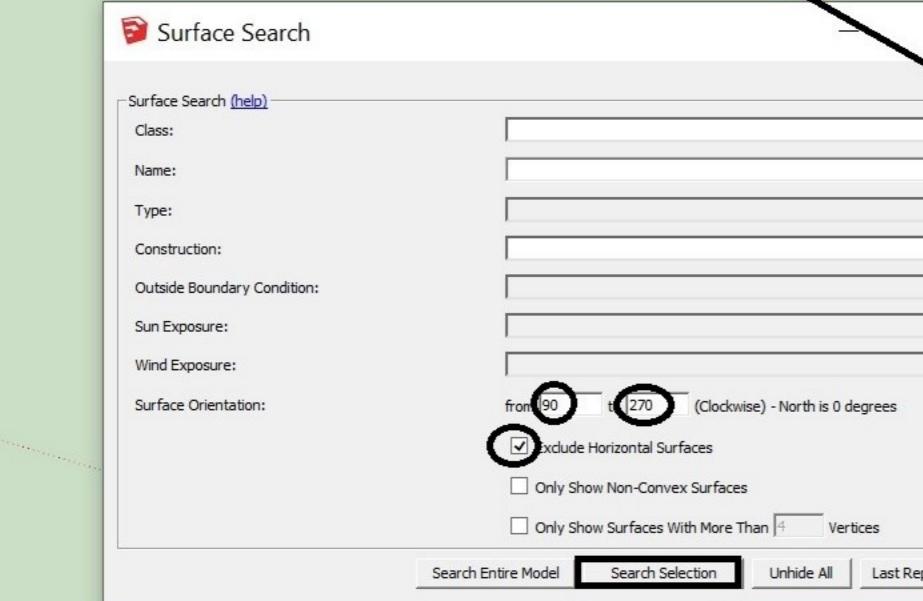
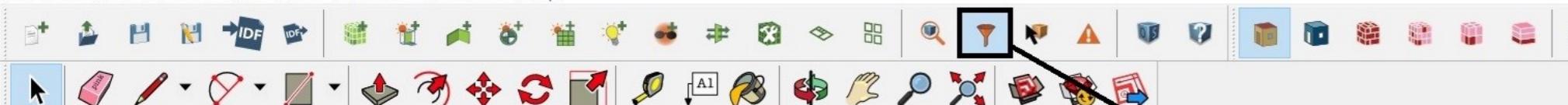
Tool Operation

1. Click anywhere in drawing area.
2. Move cursor in any direction to rotate around center of drawing area.

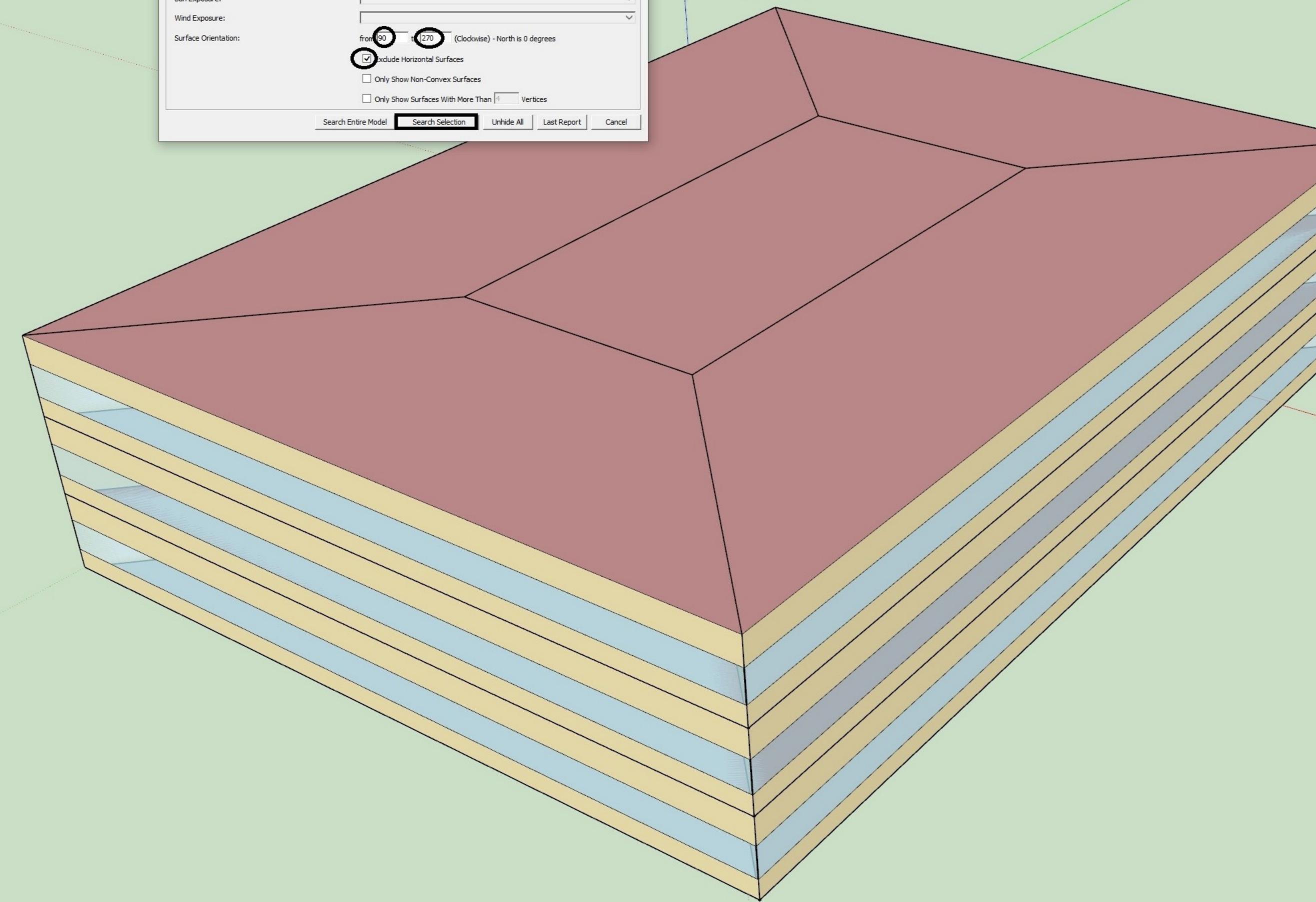
Modifier Keys

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Click to learn about more advanced operations...

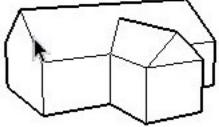


TO CREATE EXTERNAL
SHADING WE NEED TO
CHOOSE ALL OF THE
SURFACES EXCEPT THE
NORTH



Default Tray

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



Select Tool

Select entities to modify when using other tools or commands.

Tool Operation

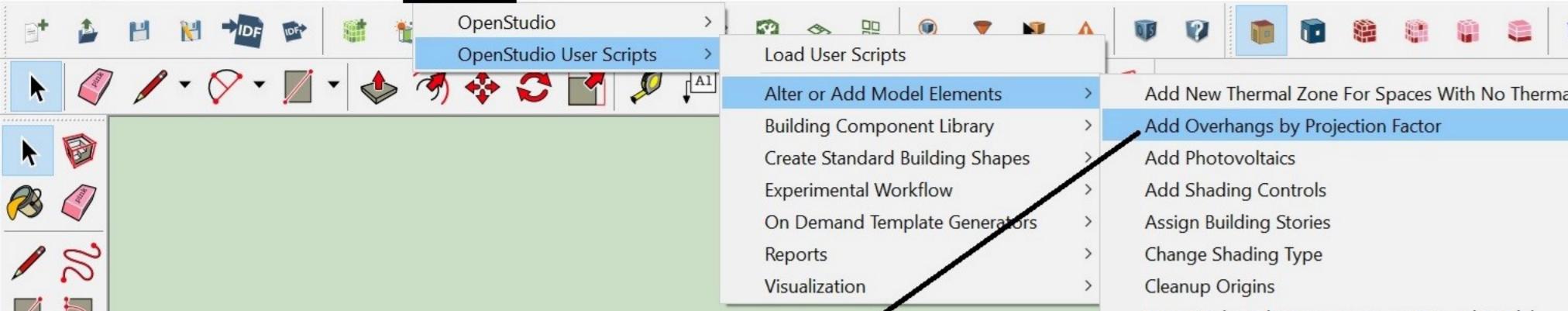
1. Click on an entity.

Modifier Keys

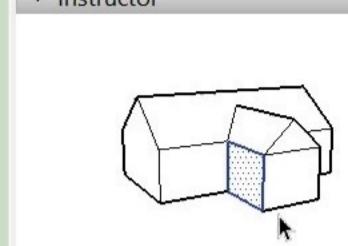
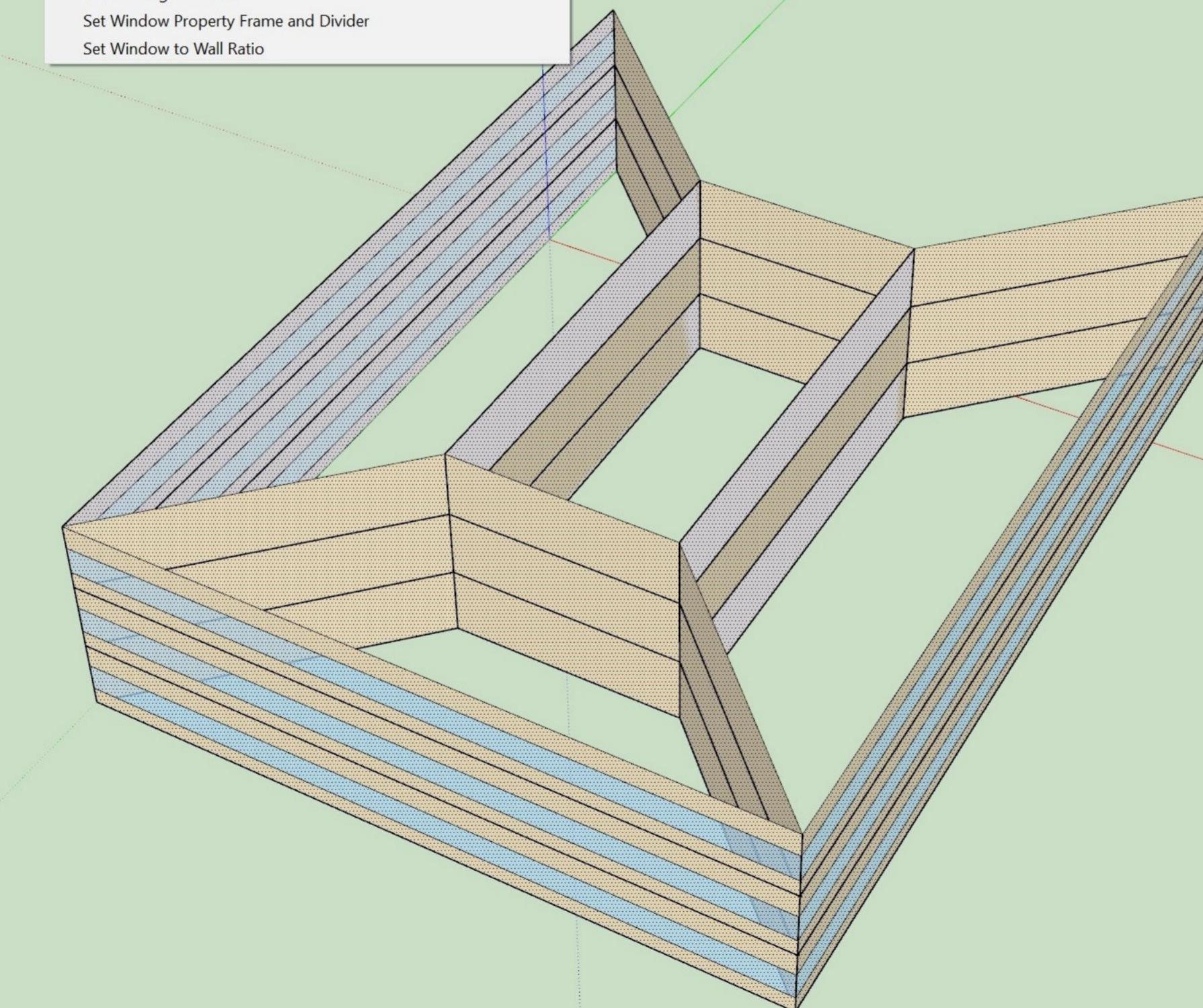
Ctrl = Add an entity to set of selected entities
Shift+Ctrl = Subtract an entity from set of selected entities
Shift = Toggle whether an entity is within set of selected entities
Ctrl+A = Select all visible entities in model

Click to learn about more advanced operations...

File Edit View Camera Draw Tools Window Extensions Help



NOW WE ARE ADDING
OVERHANG WHICH IS EXTERNAL
SHADING



Select Tool

Select entities to modify when using other tools or commands.

Tool Operation

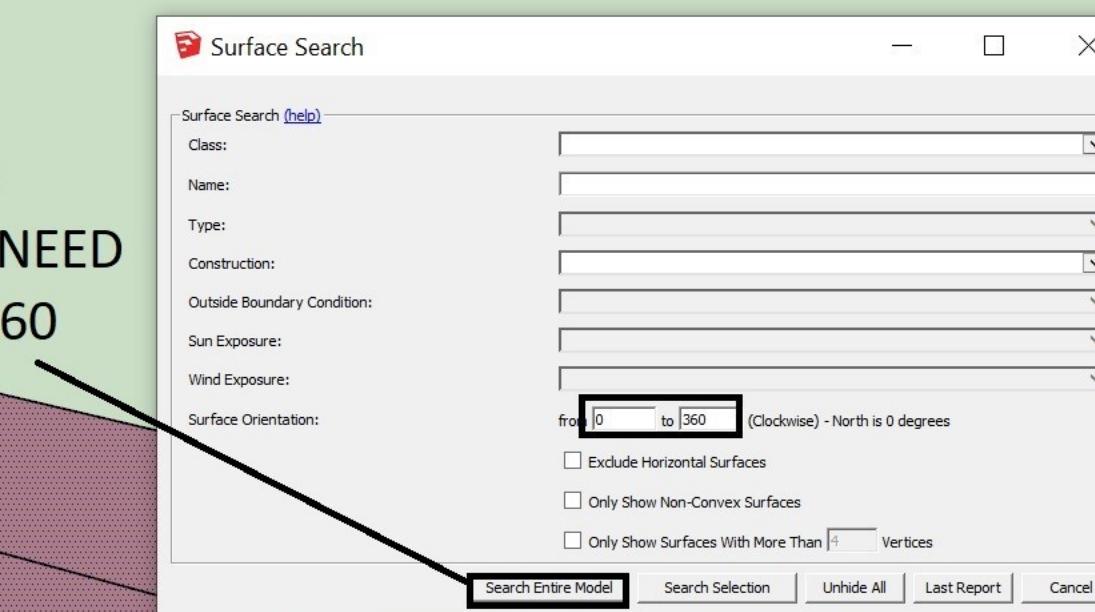
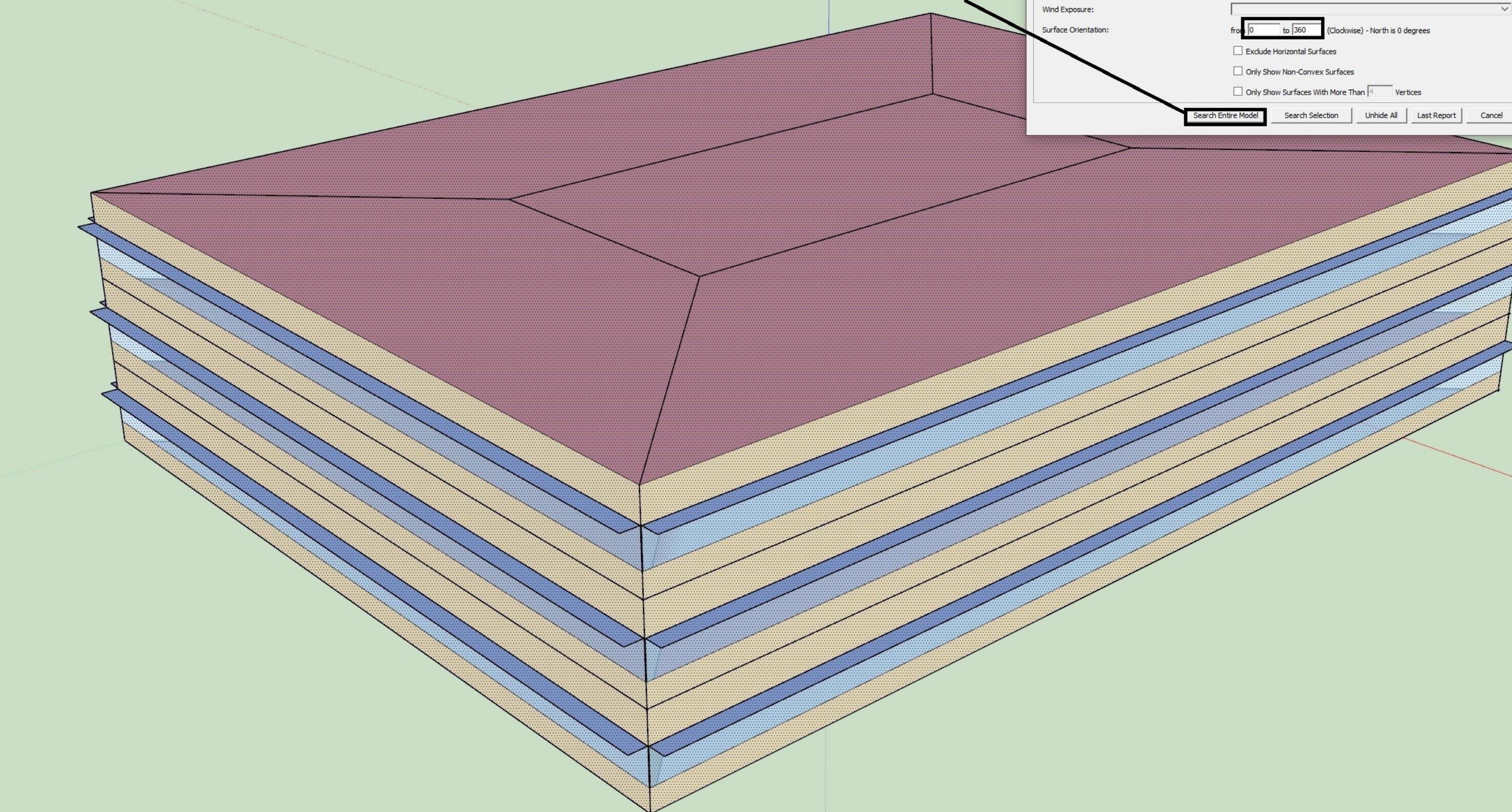
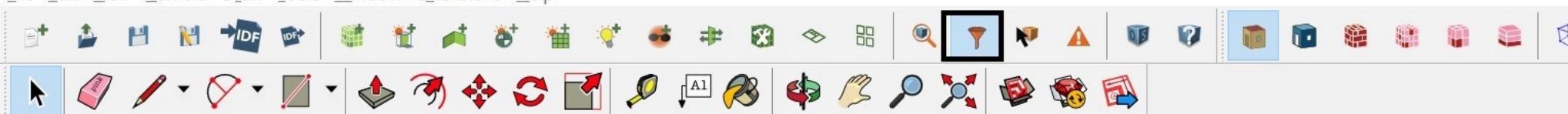
1. Click on an entity.

Modifier Keys

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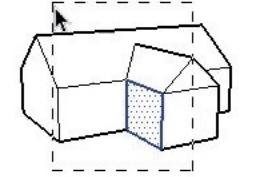
Click to learn about more advanced operations...

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



Default Tray

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

**Select Tool**

Select entities to modify when using other tools or commands.

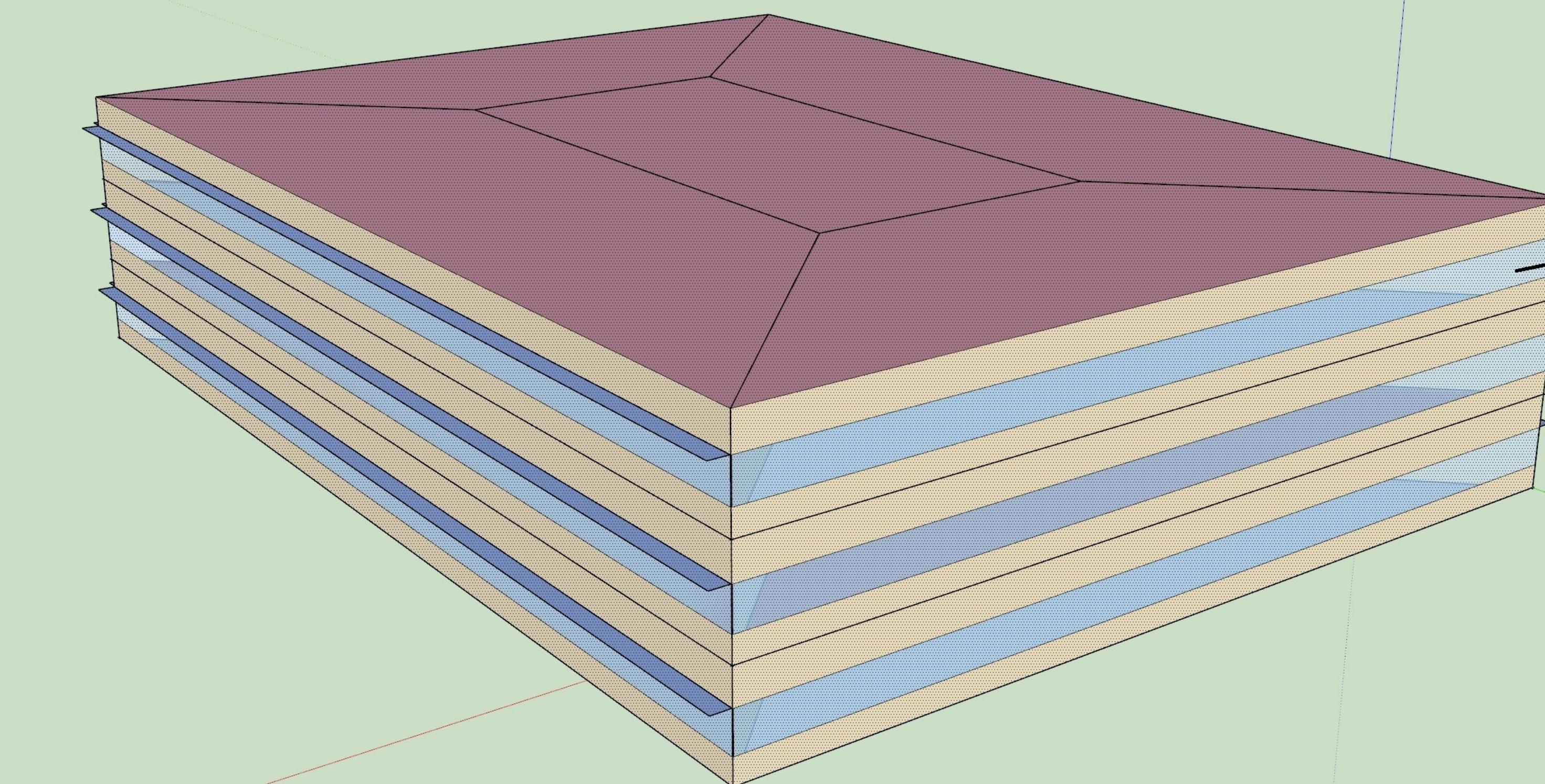
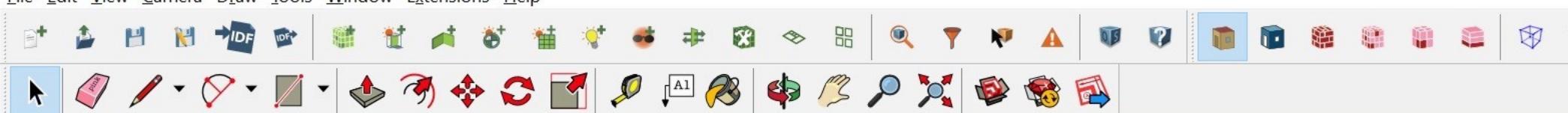
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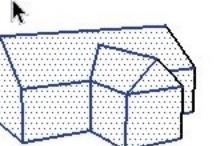
Click to learn about more advanced operations...



THIS SURFACE (NORTH)
IS THE ONLY SURFACE
WHICH DOES NOT
HAVE SHADING

Default Tray

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



Select Tool

Select entities to modify when using other tools or commands.

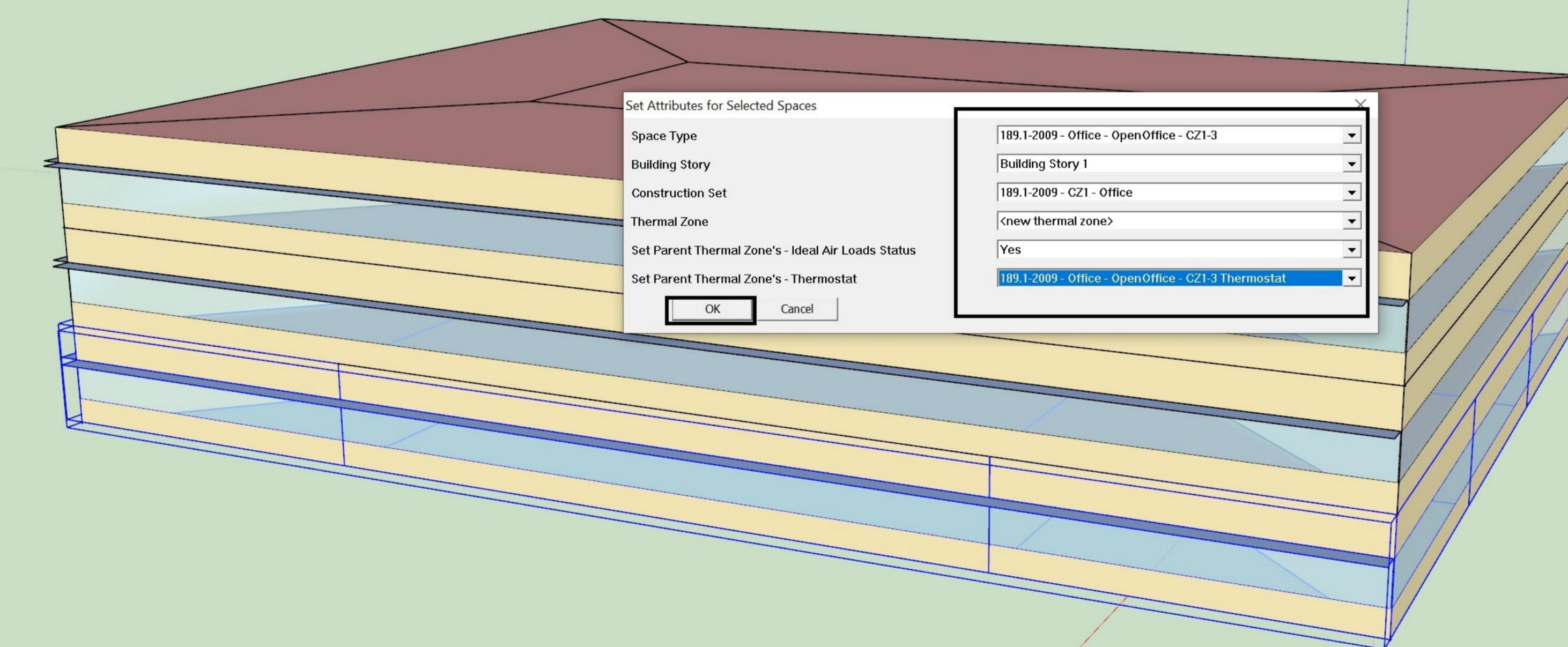
Tool Operation

1. Click on an entity.

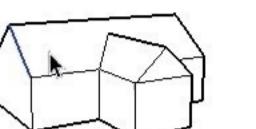
Modifier Keys

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Ctrl+A = Select all visible entities in model

Click to learn about more advanced operations...



NOW WE ADD
SPECIFICATIONS OF
CHOOSING SPACES OF
EACH THERMAL ZONE



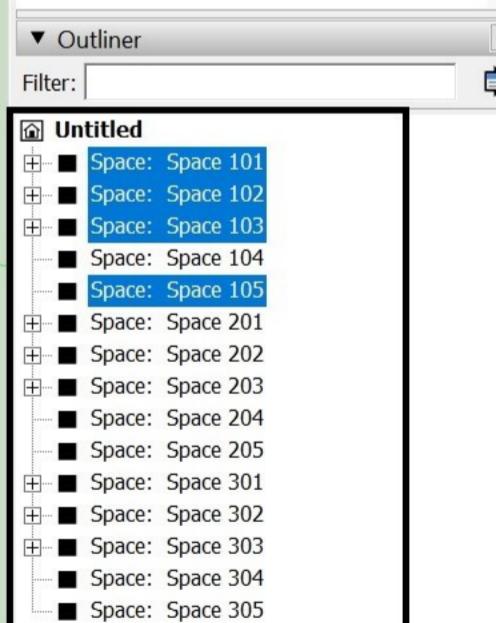
Select Tool
Select entities to modify when using other tools or commands.

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...



Site Weather File & Design Days Life Cycle Costs Utility Bills

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: [dropdown]
CEC Climate Zone: [dropdown]

Design Day 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 type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Piacenza Ann Clg .4% Condns DB=>MWB			21	8	SummerDesignDay	<input type="checkbox"/>
Piacenza Ann Clg .4% Condns DP=>MDB			21	8	SummerDesignDay	<input type="checkbox"/>
Piacenza Ann Clg .4% Condns Enth=>MDB			21	8	SummerDesignDay	<input type="checkbox"/>
Piacenza Ann Clg .4% Condns WB=>MDB			21	8	SummerDesignDay	<input type="checkbox"/>
Piacenza Ann Htg 99.6% Condns DB			21	1	WinterDesignDay	<input type="checkbox"/>
Piacenza Ann Htg Wind 99.6% Condns WS=>MCDB			21	1	WinterDesignDay	<input type="checkbox"/>
Piacenza Ann Hum_n 99.6% Condns DP=>MCDB			21	1	WinterDesignDay	<input type="checkbox"/>

Select Year by:

Calendar Year 2000
 First Day of Year Sunday

Daylight Savings Time: off

Starts

Define by Day of The Week And Month First Sunday January

Ends

Define by Day of The Week And Month First Sunday January

BEFORE THIS STEP WE NEED TO SAVE OUR MODEL LIKE OPEN STUDIO, AND THEN AFTER WE OPEN IT IN OPEN STUDIO WE ADD WEATHER INFORMATION FILE BECAUSE OF THE FURTHER CALCULATIONS



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 7.02sec
```

```
Script executing from: C:/Users/Ira Kovinic/AppData/Local/Temp/OpenStudio.y27308/resources/run/6-UserScript-0
```

```
Found UserScript 'OpenStudio Results'.
```

```
result = true
```

```
Processed 1 base script and 0 merged scripts
```

AFTER THIS STEP WE JUST RUN THE MODEL

AND THE FINAL RESULTS CAN BE SEEN IN THE LAST TAB, WE CHOOSE REPORTS FROM ENERGYPLUS RESULTS!

Report: Annual Building Utility Performance Sum

For: Entire Facility

Timestamp: 2019-11-12 22:51:5

Values gathered over 8760.00 hours

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	
Net Site Energy	1417.50	472.50	
Total Source Energy	4018.10	1339.37	
Net Source Energy	4018.10	1339.37	

Site to Source Energy Conversion Factors

	Site=>Source Conversion Factor
Electricity	3.67
Natural Gas	1.00
District Cooling	1.00
District Heating	3.67
Steam	0.00
Gasoline	1.00
Diesel	1.00
Coal	1.00
Fuel Oil #1	1.00
Fuel Oil #2	1.00
Propane	1.00
Other Fuel 1	1.00
Other Fuel 2	1.00

Building Are

	Area [m ²]
Total Building Area	3000.0
Net Conditioned Building Area	3000.0
Unconditioned Building Area	0.0

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	V
Heating	0.00	0.00	0.00	0.00	356.80	
Cooling	0.00	0.00	0.00	298.57	0.00	
Interior Lighting	371.18	0.00	0.00	0.00	0.00	
Exterior Lighting	0.00	0.00	0.00	0.00	0.00	
Interior Equipment	390.95	0.00	0.00	0.00	0.00	
Exterior Equipment	0.00	0.00	0.00	0.00	0.00	
Fans	0.00	0.00	0.00	0.00	0.00	
Pumps	0.00	0.00	0.00	0.00	0.00	
Heat Rejection	0.00	0.00	0.00	0.00	0.00	
Humidification	0.00	0.00	0.00	0.00	0.00	
Heat Recovery	0.00	0.00	0.00	0.00	0.00	
Water Systems	0.00	0.00	0.00	0.00	0.00	
Refrigeration	0.00	0.00	0.00	0.00	0.00	
Generators	0.00	0.00	0.00	0.00	0.00	
Total	1161.13	560.40	0.00	595.57	255.60	