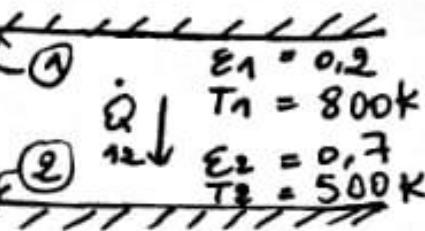


- From the previous example :
the heat transfer per Area is :

$$\dot{q}_{1 \rightarrow 2} = \frac{\dot{Q}_{1 \rightarrow 2}}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\gamma_{\epsilon_1} + \gamma_{\epsilon_2} - 1}$$

$$= \frac{5,67 \cdot 10^{-8} (800^4 - 500^4)}{\gamma_{0,2} + \gamma_{0,7} - 1}$$



$$\Rightarrow \boxed{\dot{q}_{1 \rightarrow 2} = 3625,4 \frac{W}{m^2}}$$

- A Heat transfer rate \dot{q}' is 1% of the upper case

$$\Leftrightarrow \dot{q}'_{1 \rightarrow 2} = \frac{\dot{q}_{1 \rightarrow 2}}{100} \Rightarrow \dot{q}'_{1 \rightarrow 2} = 36,254 \frac{W}{m^2}$$

- The number of shields "x" with $\epsilon = 0,1$ would be as :

$$\dot{q}'_{1 \rightarrow 2} = \frac{\dot{q}_{1 \rightarrow 2}}{100} = \frac{\sigma(T_1^4 - T_2^4)}{(\gamma_{\epsilon_1} + \gamma_{\epsilon_2} - 1) + x(\gamma_{\epsilon} - 1)}$$

$\dot{q}'_{1 \rightarrow 2}$ \propto shields

$$\Rightarrow \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1 \right) \dot{q}_{1 \rightarrow 2} + x \times \dot{q}_{1 \rightarrow 2} \left(\frac{1}{\epsilon} \times 2 - 1 \right) = 100 \sigma (\tau_1^4 - \tau_2^4)$$

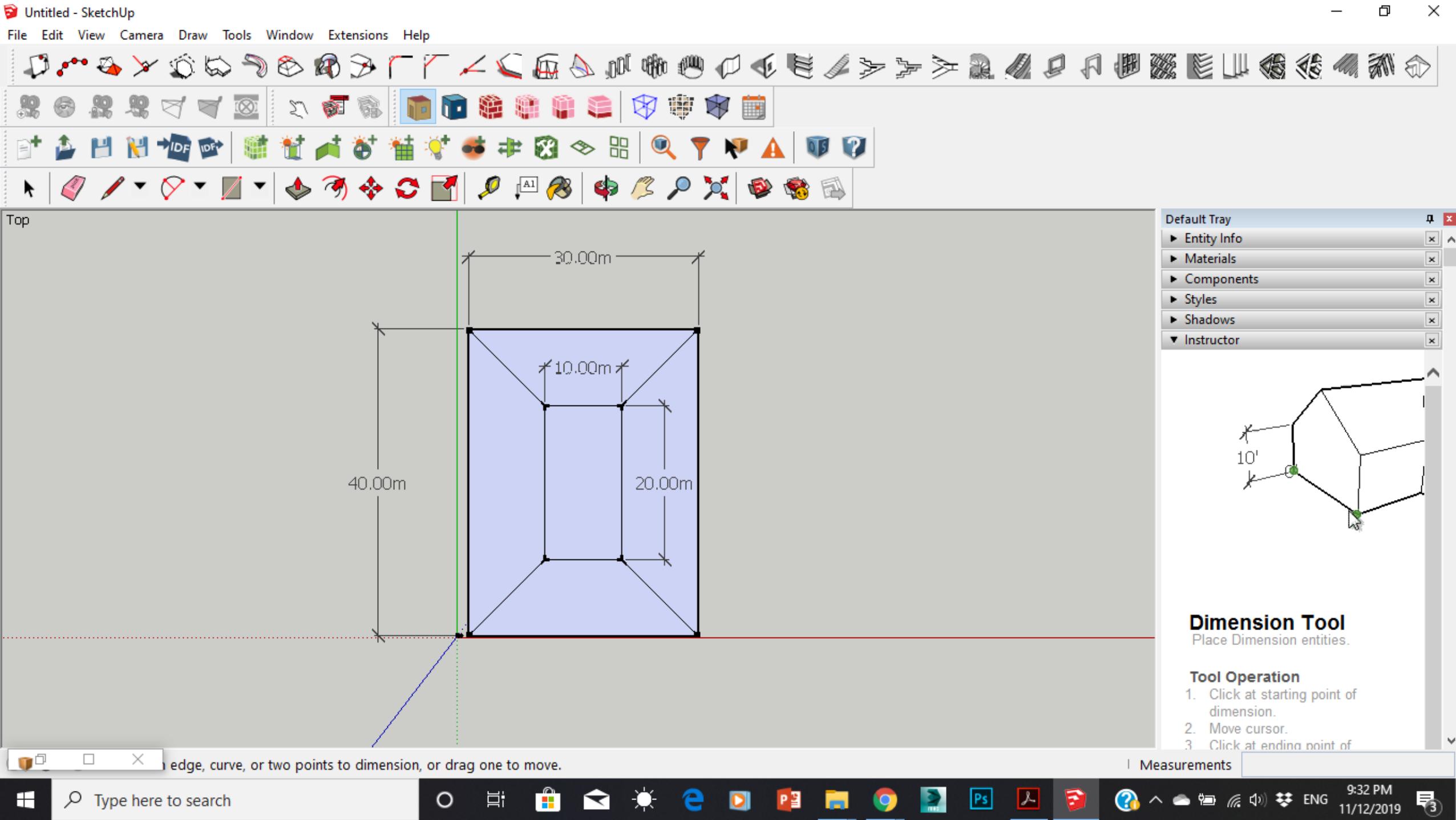
$$\Rightarrow x \left(\frac{2}{\epsilon} - 1 \right) = 100 \frac{\sigma (\tau_1^4 - \tau_2^4)}{\dot{q}_{1 \rightarrow 2}} - \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1 \right)$$

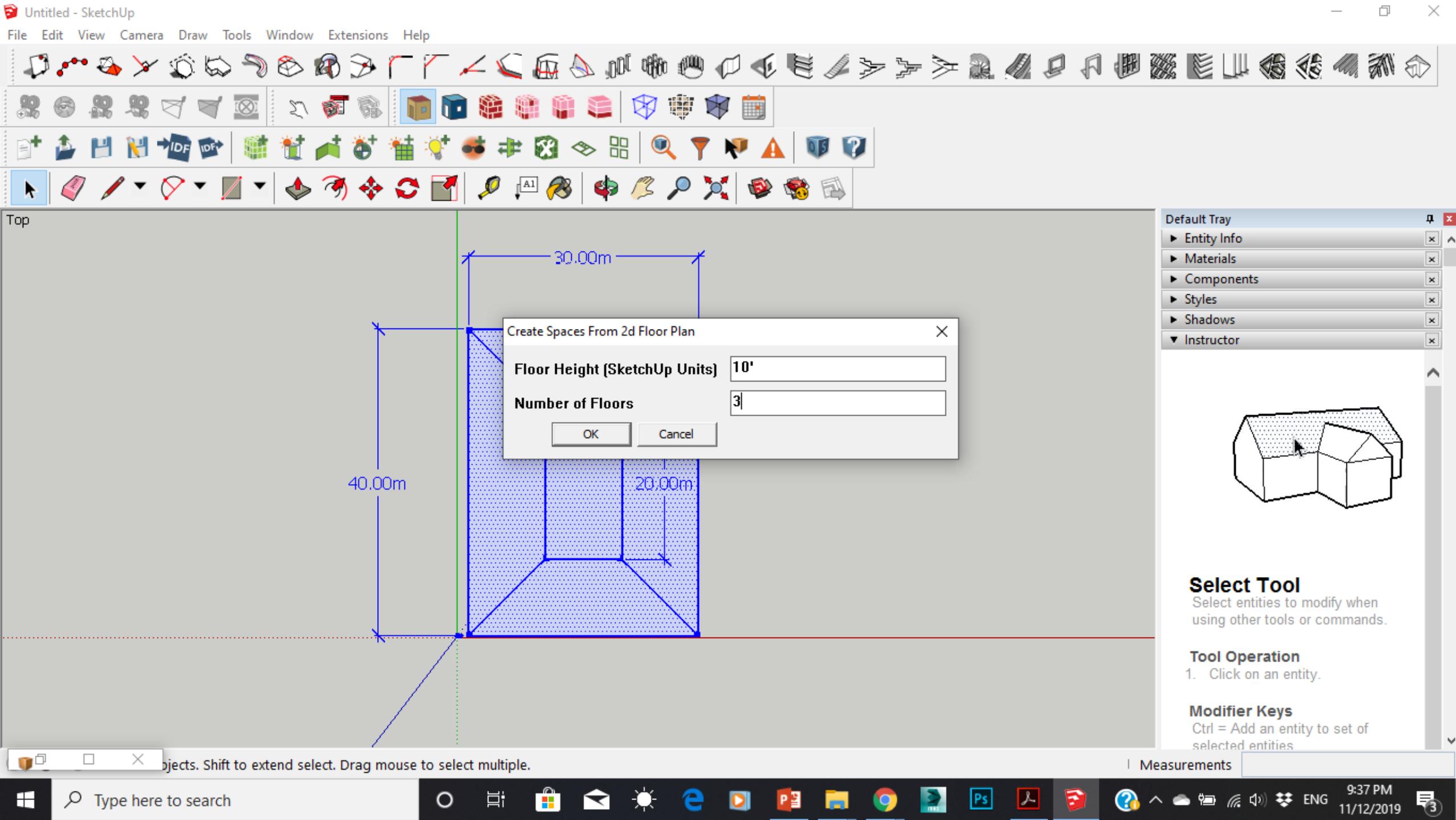
$$\Rightarrow x = \frac{99 \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1 \right)}{\left(\frac{2}{\epsilon} - 1 \right)}$$

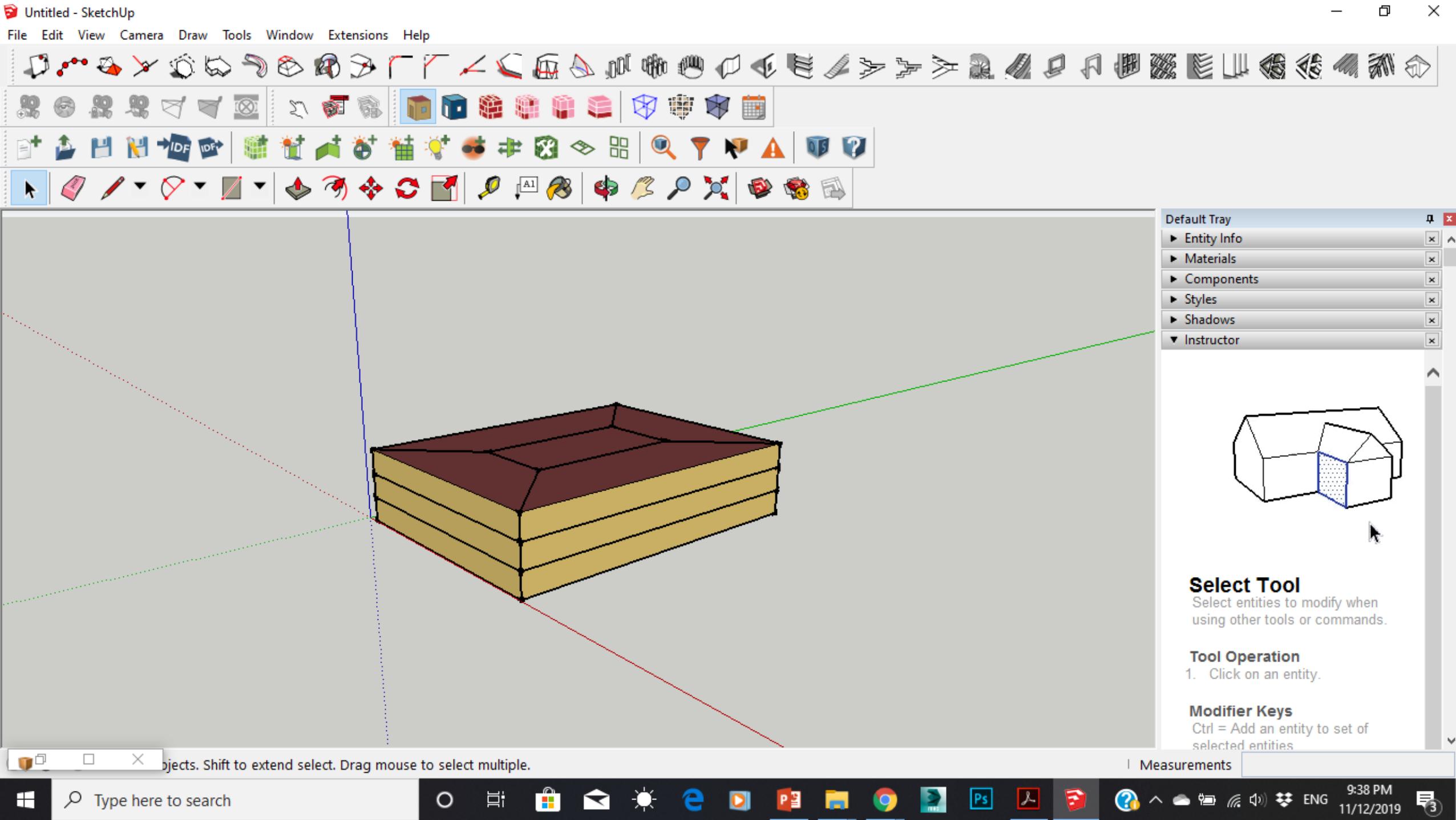
$$\Rightarrow x = 99 \times \frac{1}{19} \times \left[\left(\frac{1}{0.2} \right) + \left(\frac{1}{0.7} \right) - 1 \right]$$

$$\Rightarrow x \approx 28,28$$

The number of shields is 28







Untitled - SketchUp

File Edit View Camera Draw Tools Window Extensions Help

Info Tool: a very useful tool because it understands the surfaces and spaces... etc., because it creates a real building.

OS:Surface,
{942cc7d0-6991-4021-9f73-cc48a72c471d}, !- Handle
Surface 74, !- Name
Wall, !- Surface Type
, !- Construction Name
Space 303, !- Space Name
Outdoors, !- Outside Boundary Condition
, !- Outside Boundary Condition Object
SunExposed, !- Sun Exposure
WindExposed, !- Wind Exposure
, !- View Factor to Ground
, !- Number of Vertices
0, !- Vertex X-coordinate 1 {m}
-40, !- Vertex Y-coordinate 1 {m}
3.048, !- Vertex Z-coordinate 1 {m}
0, !- Vertex X-coordinate 2 {m}
-40, !- Vertex Y-coordinate 2 {m}
0, !- Vertex Z-coordinate 2 {m}
0, !- Vertex X-coordinate 3 {m}
0, !- Vertex Y-coordinate 3 {m}
0, !- Vertex Z-coordinate 3 {m}
0, !- Vertex X-coordinate 4 {m}
0, !- Vertex Y-coordinate 4 {m}

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

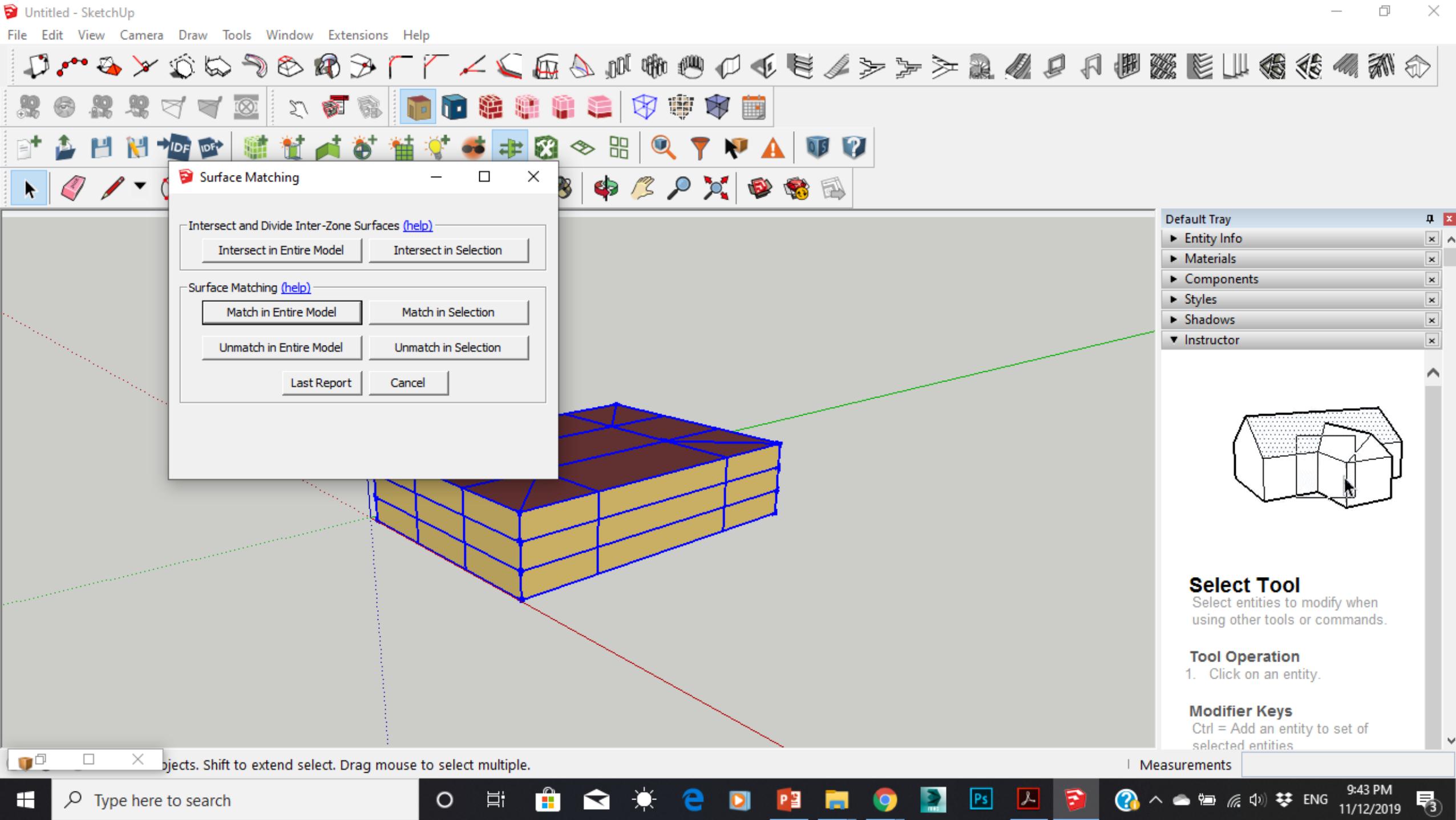
Tool Operation
1. Click on an entity.

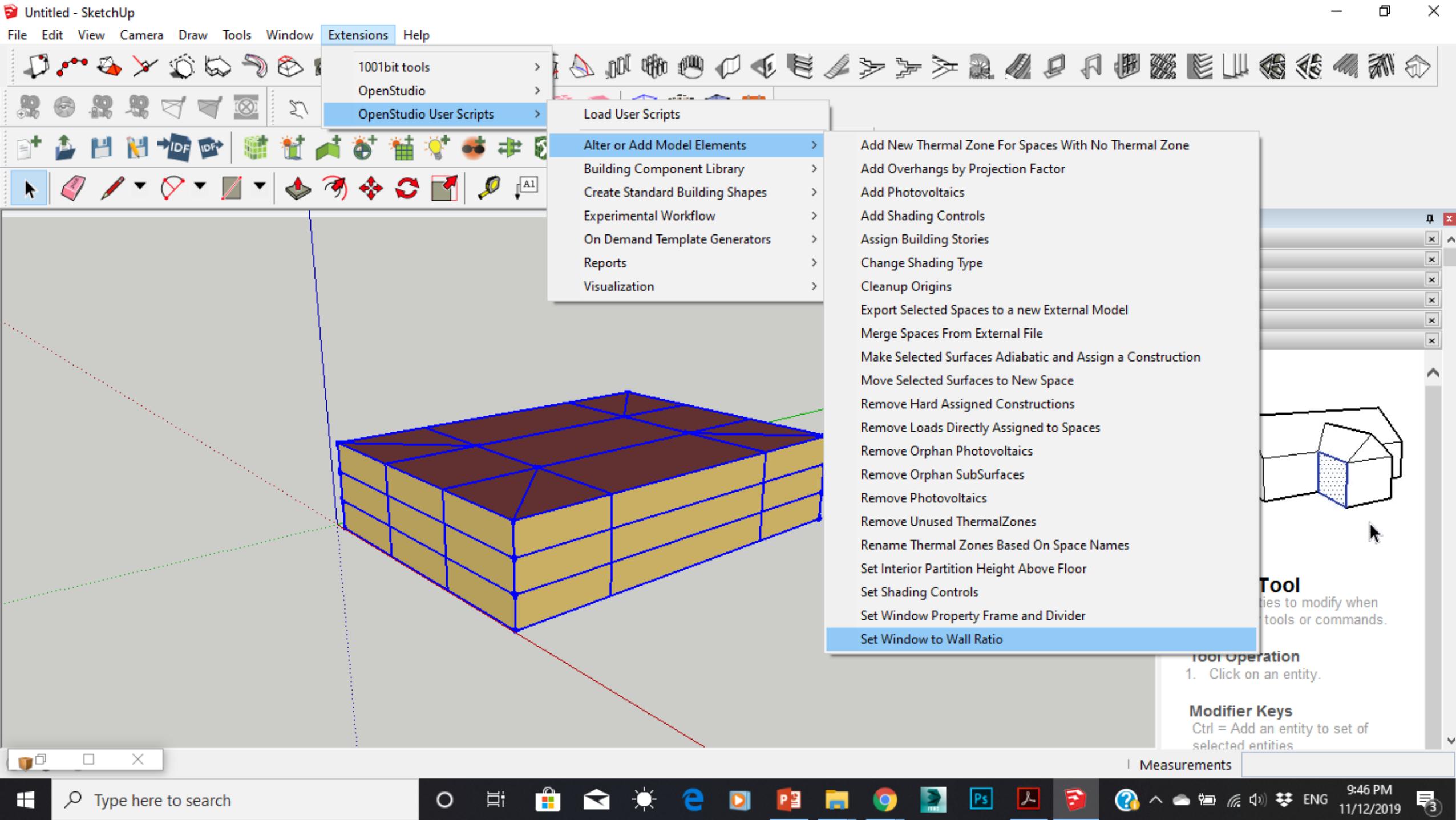
Modifier Keys
Ctrl = Add an entity to set of selected entities

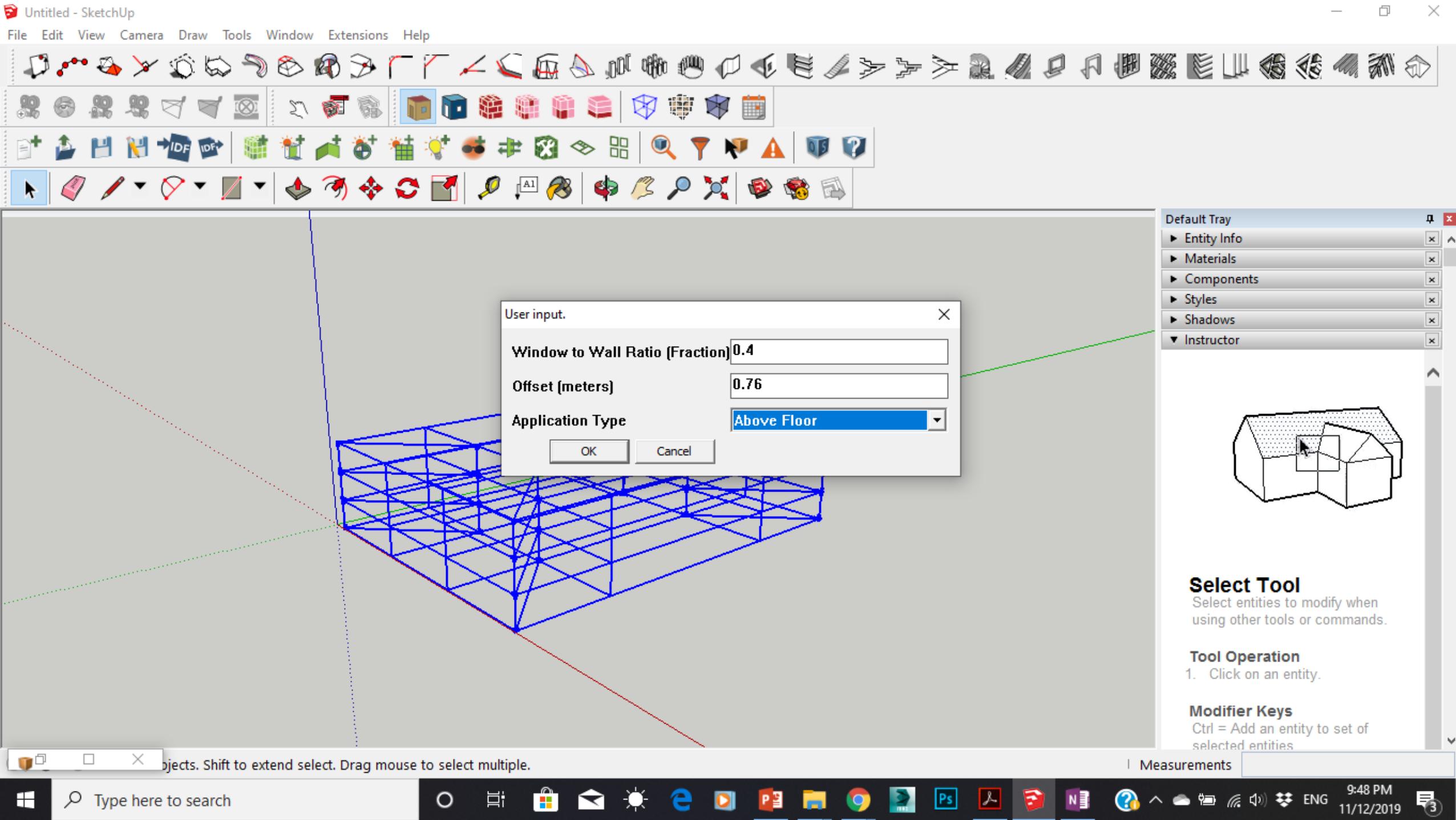
Measurements

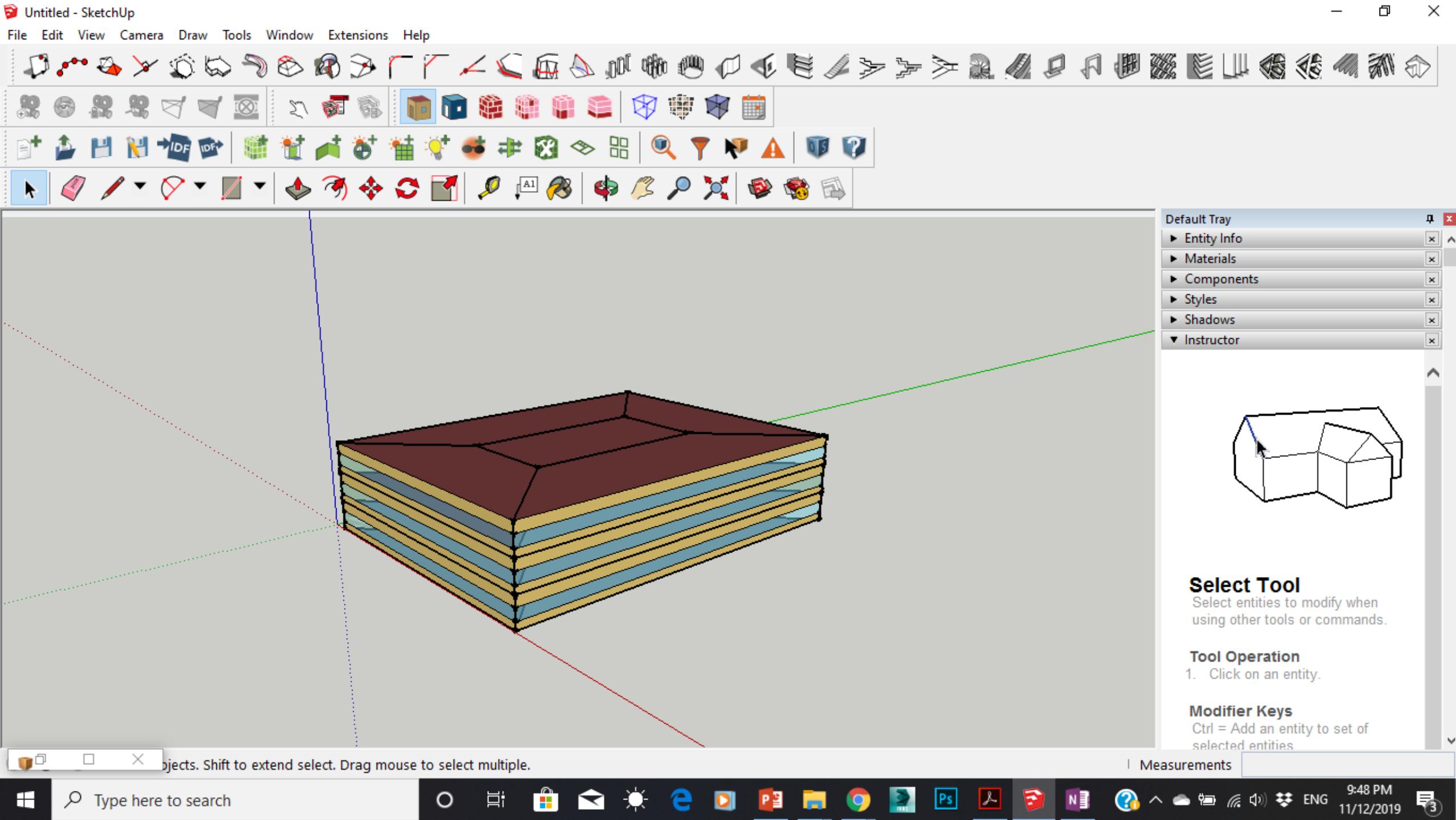
Type here to search

9:39 PM
11/12/2019









Untitled - SketchUp

File Edit View Camera Draw Tools Window Extensions Help

Surface Search

Surface Search (help)

Class: [dropdown]

Name: [text input]

Type: [dropdown]

Construction: [dropdown]

Outside Boundary Condition: [dropdown]

Sun Exposure: [dropdown]

Wind Exposure: [dropdown]

Surface Orientation: from 45 to 270 (Clockwise) - North is 0 degrees

Exclude Horizontal Surfaces

Only Show Non-Convex Surfaces

Only Show Surfaces With More Than 4 Vertices

Search Entire Model | Search Selection | Unhide All | Last Report | Cancel

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

Ctrl = Add an entity to set of selected entities

Measurements

Objects. Shift to extend select. Drag mouse to select multiple.

Type here to search

9:50 PM 11/12/2019

File Edit View Camera Draw Tools Window Extensions Help

Surface Search

Surface Search (help)

Class: [dropdown]

Name: [text input]

Type: [dropdown]

Construction: [dropdown]

Outside Boundary Condition: [dropdown]

Sun Exposure: [dropdown]

Wind Exposure: [dropdown]

Surface Orientation: from 45 to 270 (Clockwise) - North is 0 degrees

Exclude Horizontal Surfaces

Only Show Non-Convex Surfaces

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Search Entire Model | Search Selection | Unhide All | Last Report | Cancel

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- Materials
- Components
- Styles
- Shadows
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Select entities to modify when using other tools or commands.

Tool Operation

- Click on an entity.

Modifier Keys

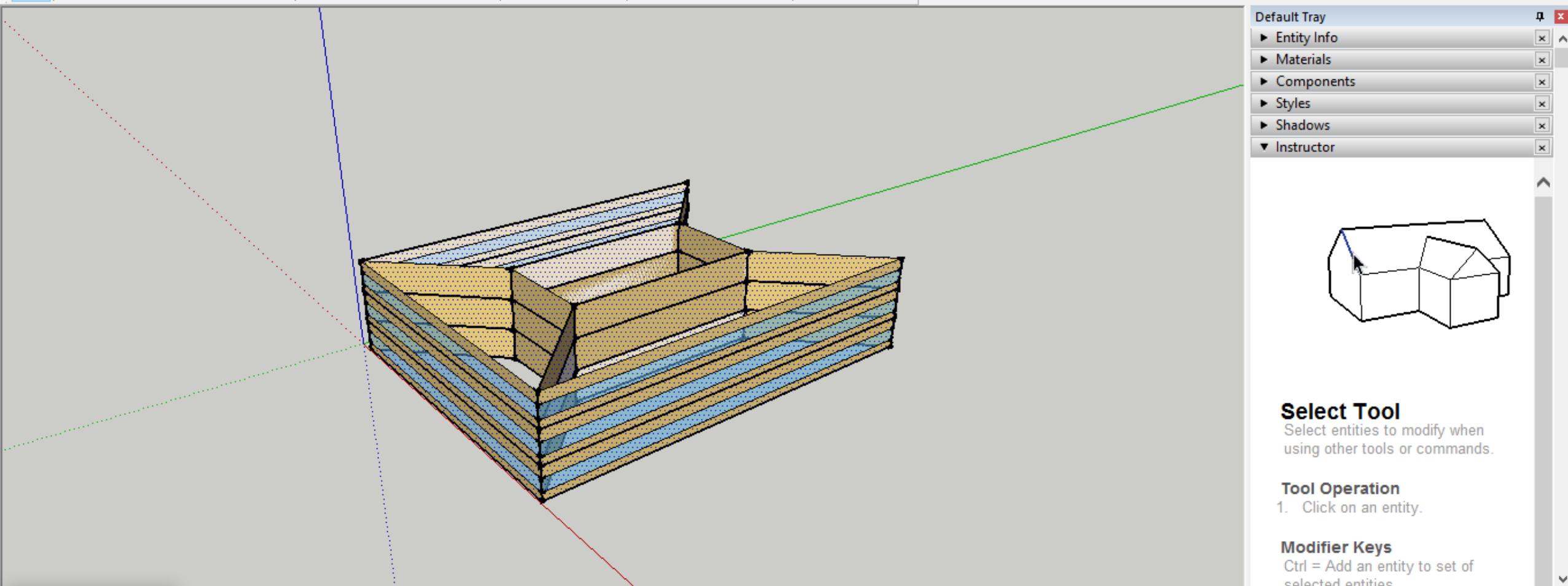
Ctrl = Add an entity to set of selected entities

Measurements

Objects. Shift to extend select. Drag mouse to select multiple.

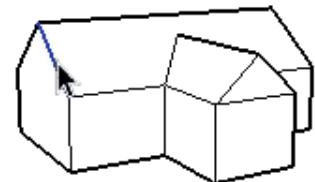
Type here to search

9:50 PM 11/12/2019



Default Tray

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



Select Tool

Select entities to modify when using other tools or commands.

Tool Operation

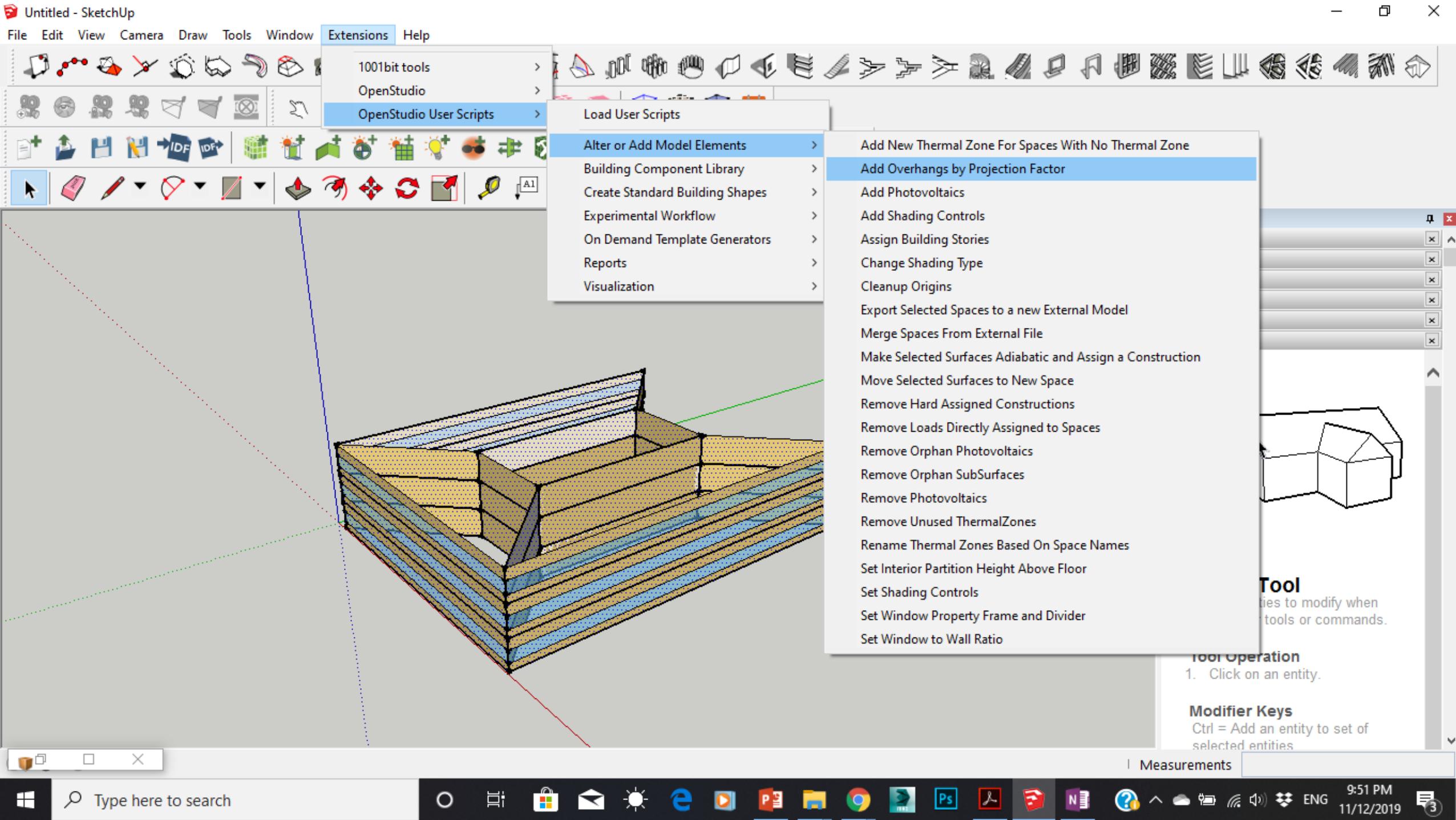
- ## 1. Click on an entity.

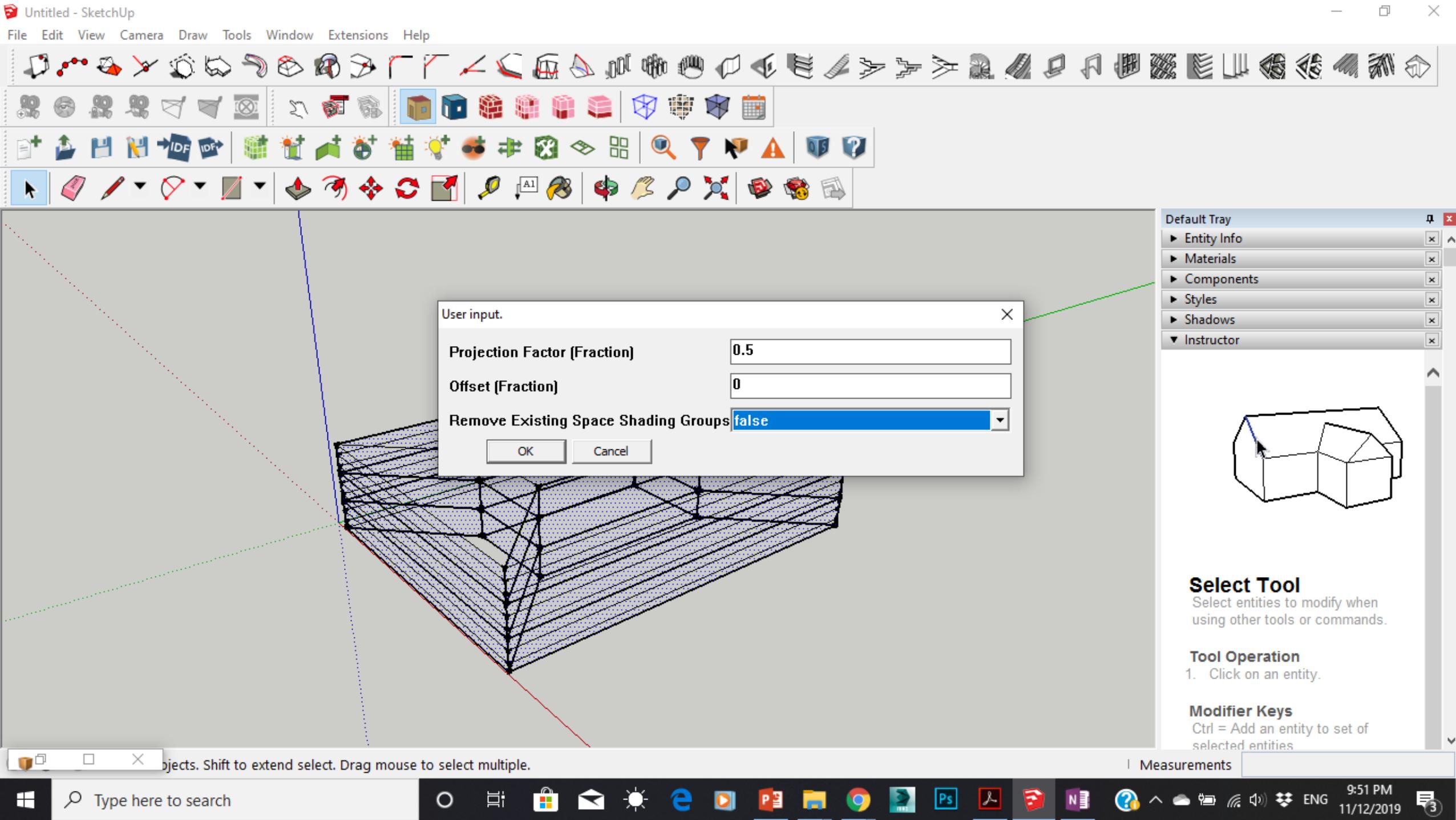
Modifier Keys

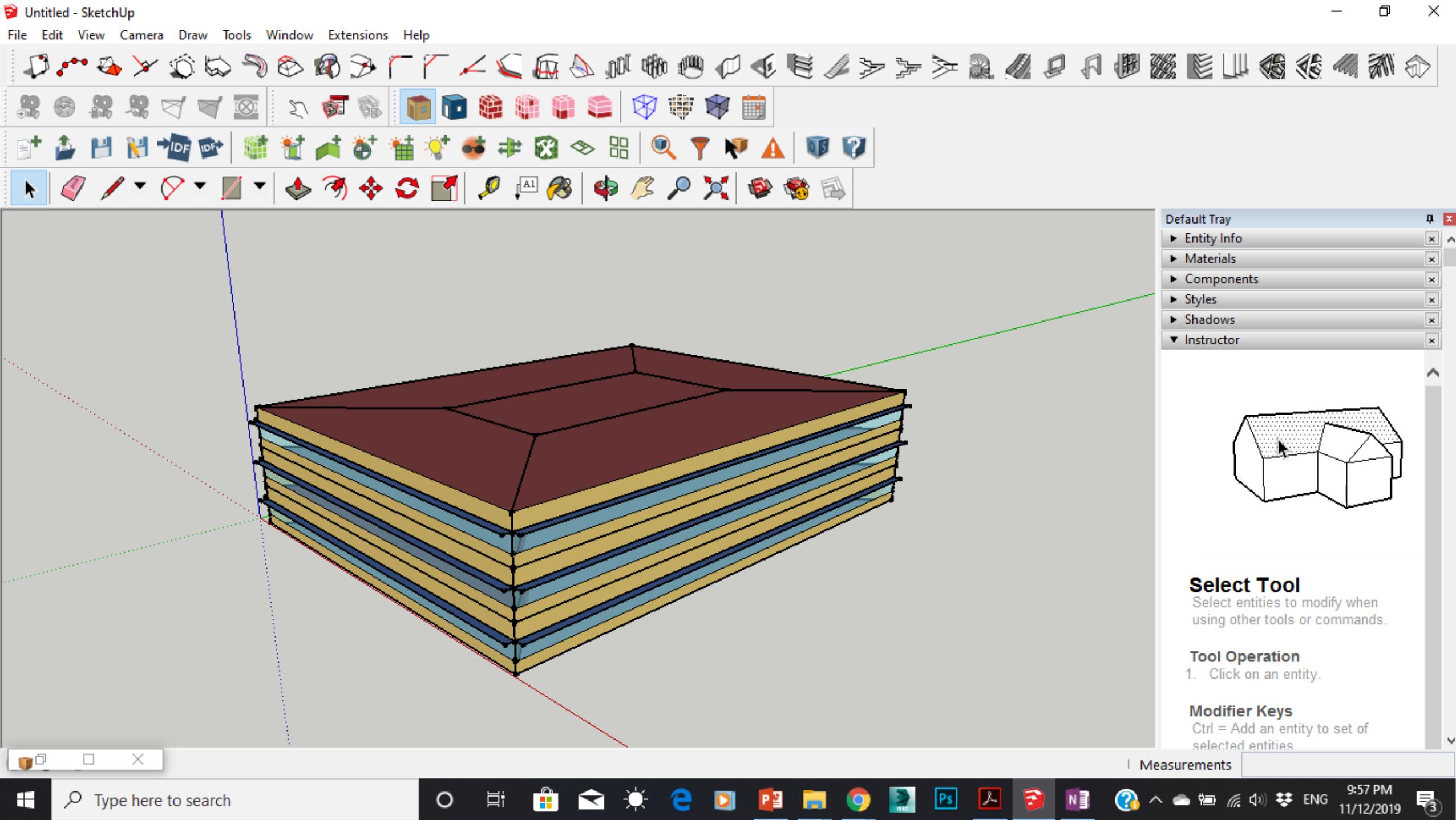
Ctrl = Add an entity to set of selected entities

objects. Shift to extend select. Drag mouse to select multiple objects.

I Measurements







Untitled - SketchUp

File Edit View Camera Draw Tools Window Extensions Help

Default Tray

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

Pan Tool

Move camera (your view) vertically or horizontally.

Tool Operation

1. Click anywhere in the drawing area.
2. Move cursor in any direction to pan.

The north elevation of the building isn't added to it an overhang when selecting as the north elevation doesn't require any shadow elements.

Measurements

Type here to search

10:49 PM
11/12/2019

Untitled - SketchUp

File Edit View Camera Draw Tools Window Extensions Help

Default Tray >

- Hide Tray
- Rename Tray
- Entity Info
- Materials
- Components
- Styles
- Layers
- Scenes
- Shadows
- Fog
- Match Photo
- Soften Edges
- Instructor
- Outliner

Entity Info Materials Components Styles Layers Scenes Shadows Fog Match Photo Soften Edges Instructor Outliner

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.

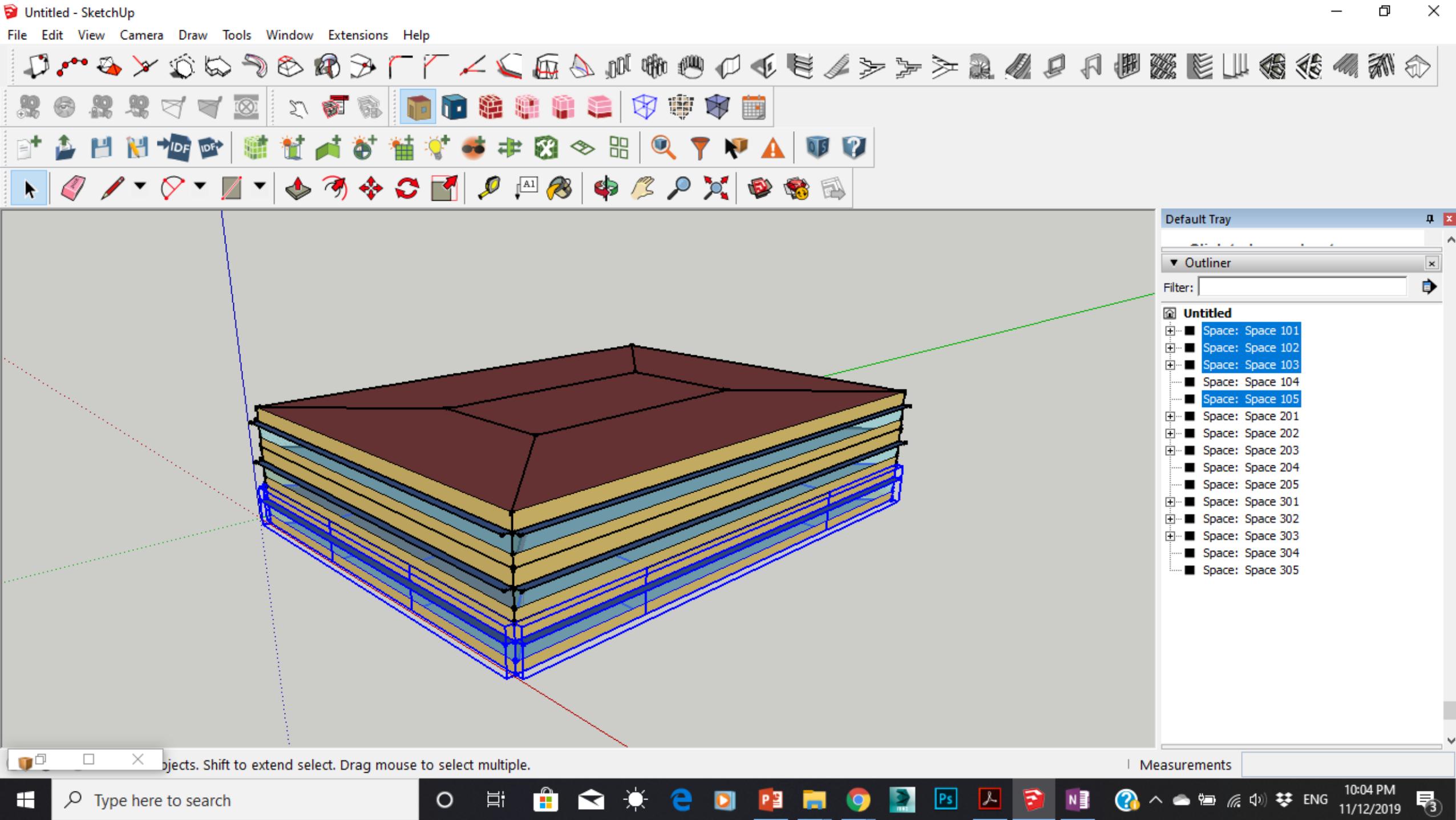
Modifier Keys Ctrl = Add an entity to set of selected entities

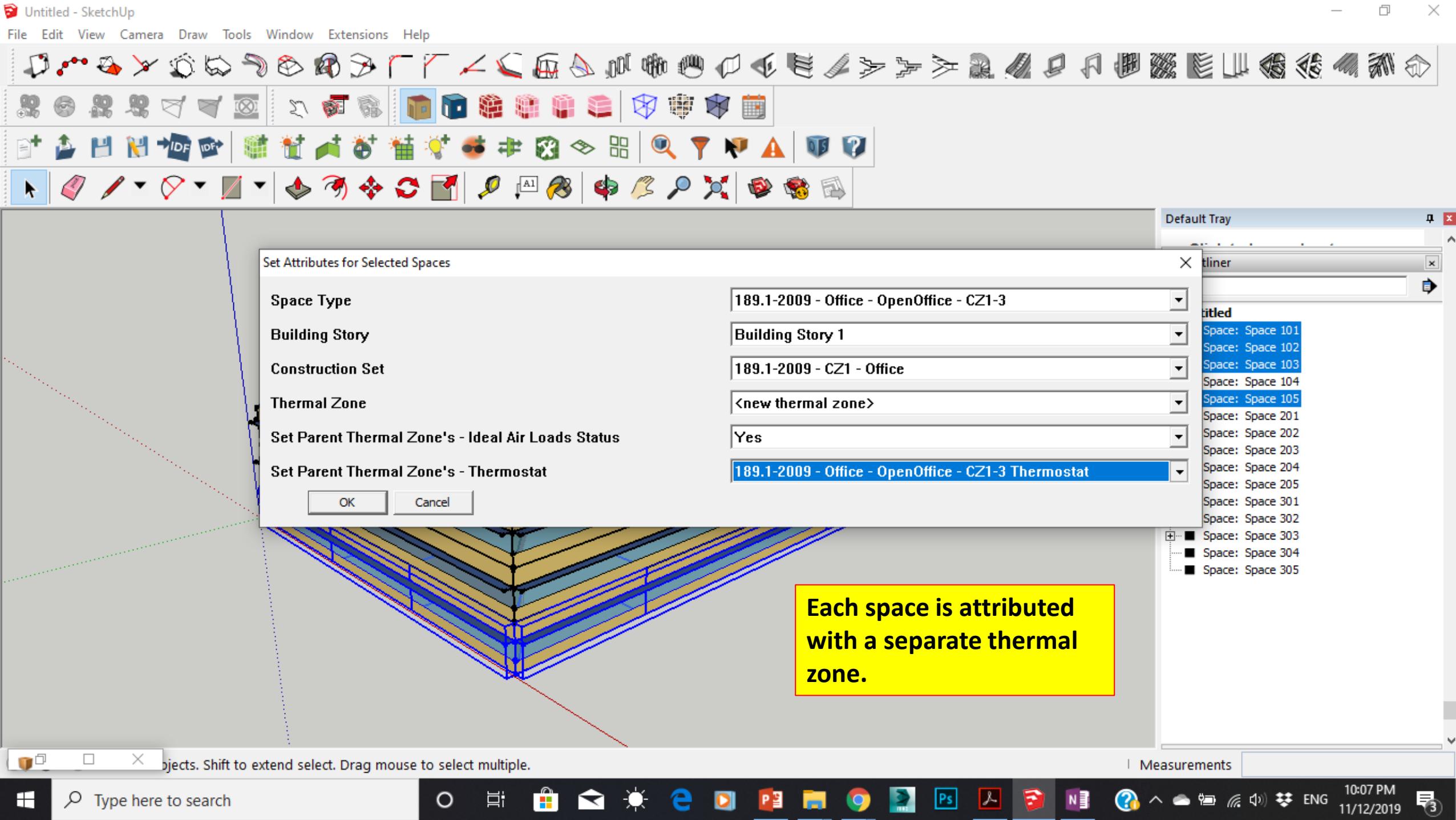
Measurements

Type here to search

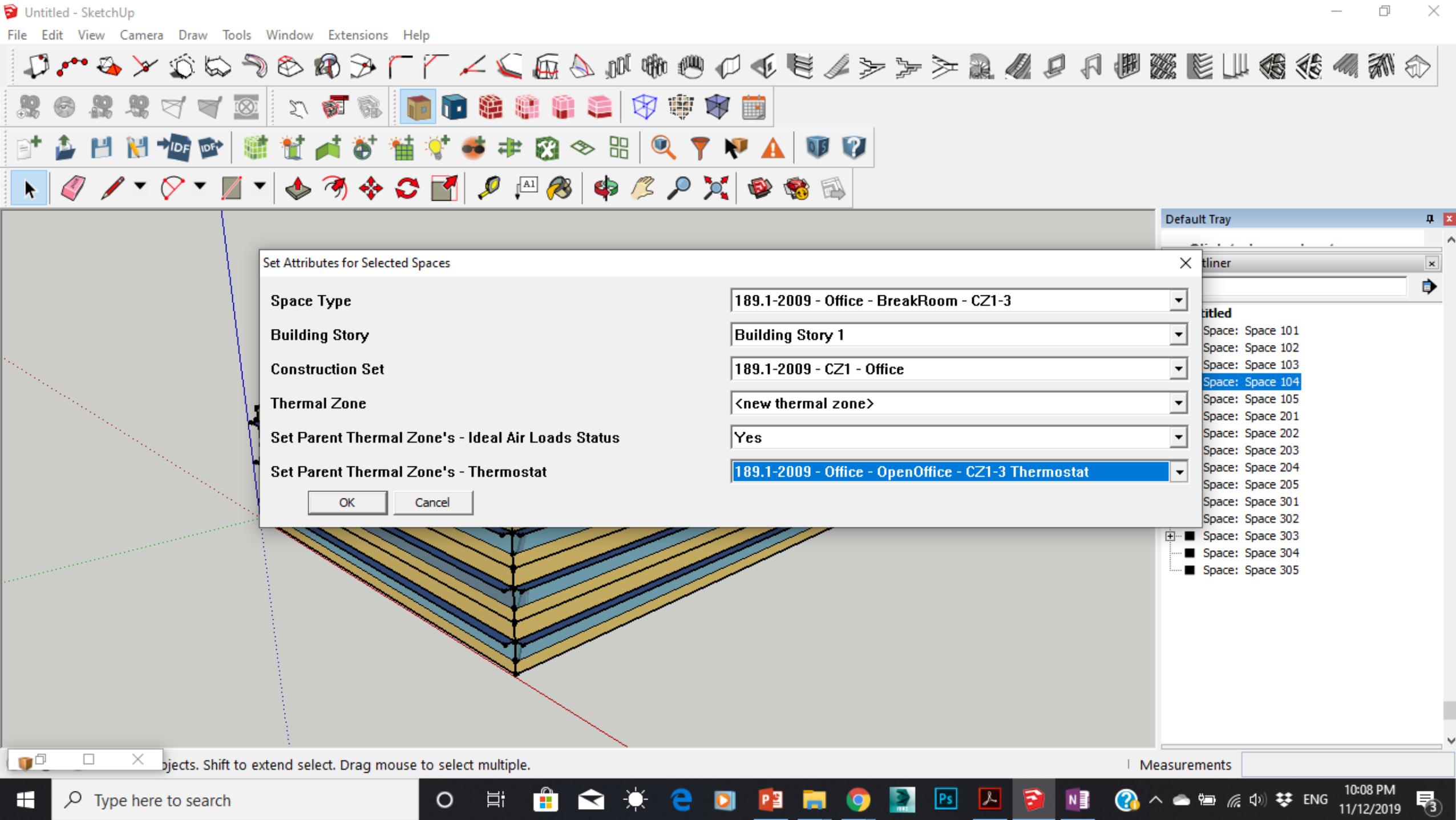
9:58 PM 11/12/2019

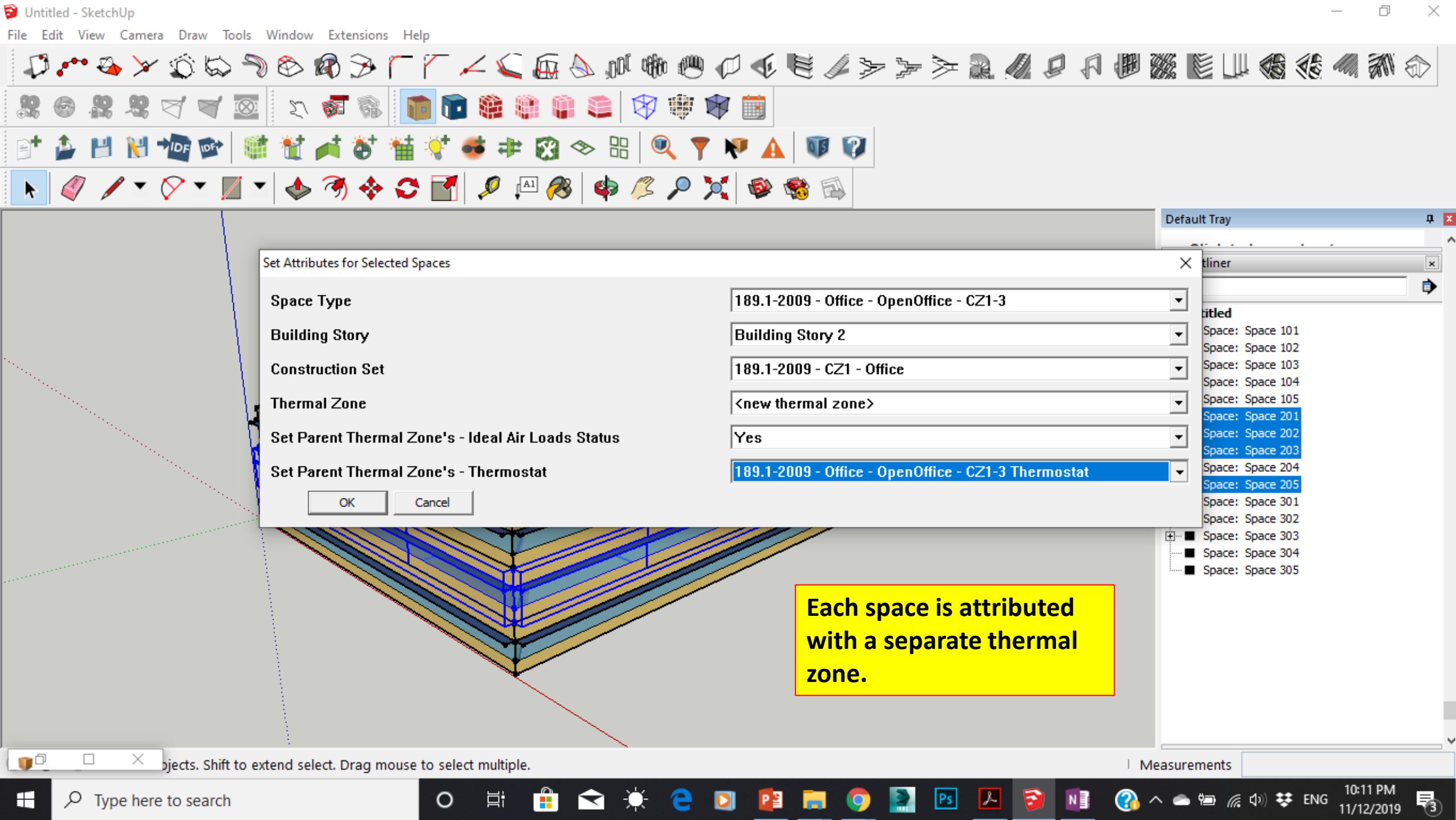
The image shows a 3D rendering of a stack of books in SketchUp. The books have different colored layers (blue, yellow, brown) and are arranged in a stepped pattern. A context menu is open over the top book, with 'Outliner' selected. The 'Window' menu is also open, showing options like 'Default Tray', 'Entity Info', 'Materials', etc. On the right, there's a 'Select Tool' panel and a 'Tool Operation' guide. The bottom has a taskbar with icons for various Windows apps.

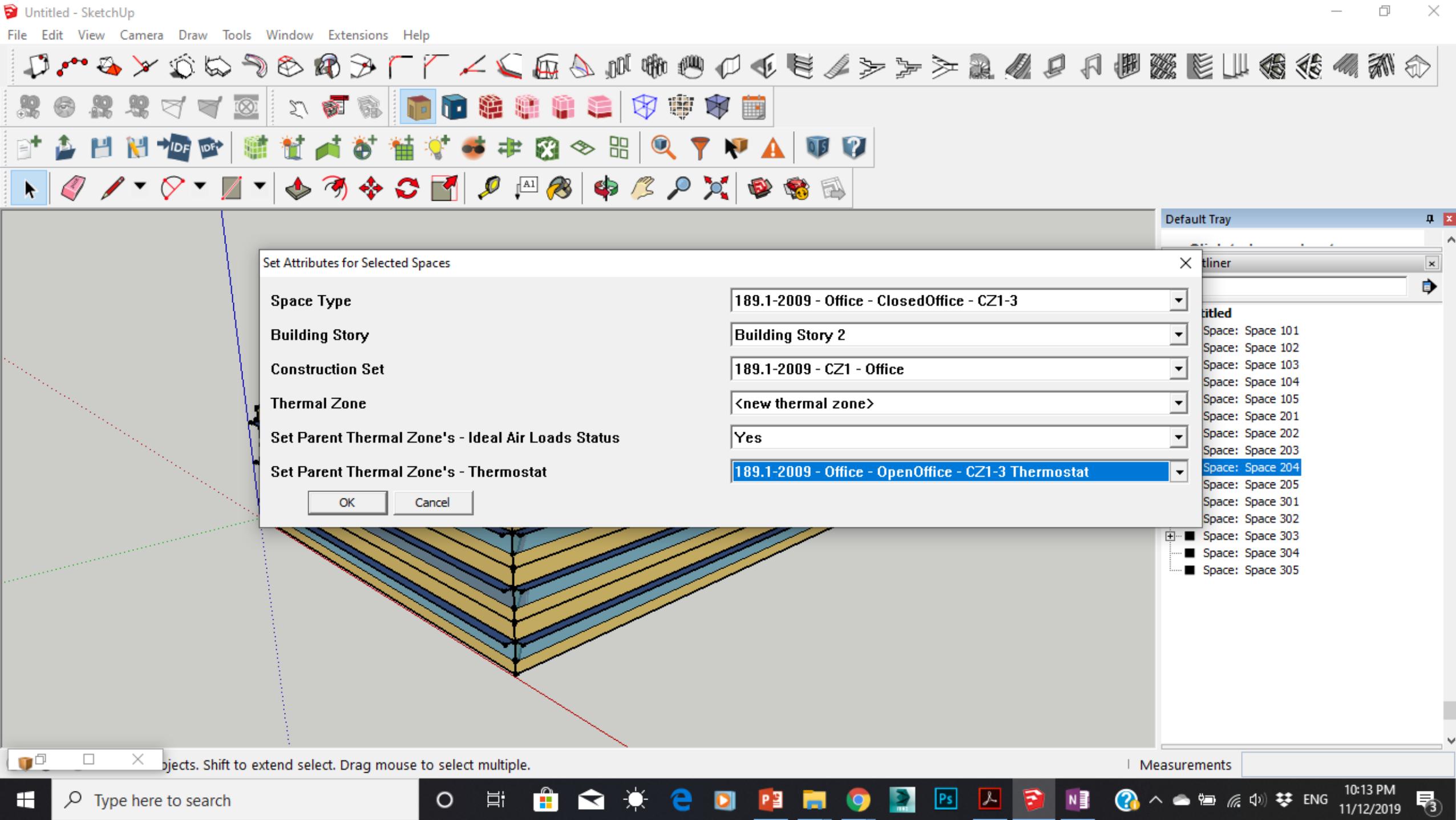


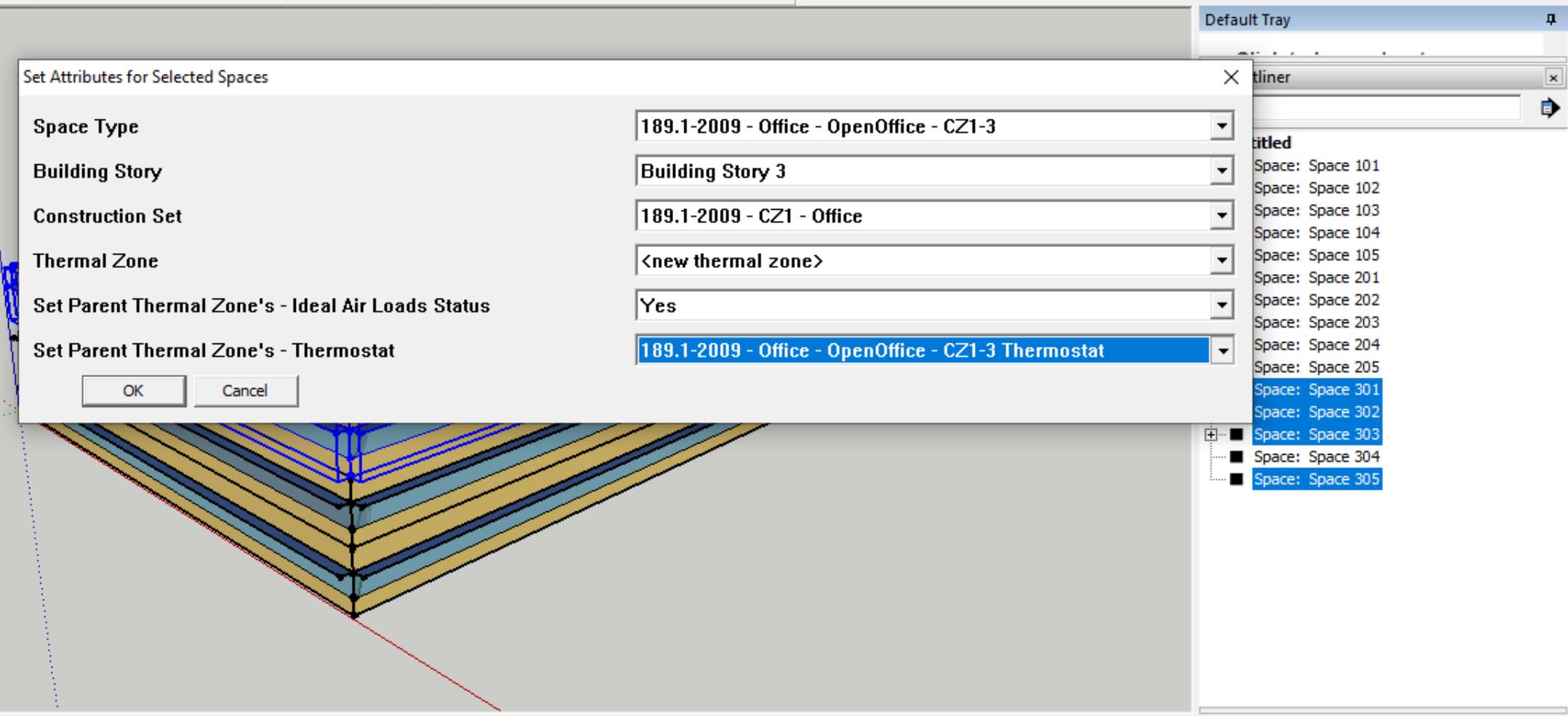


Type here to search



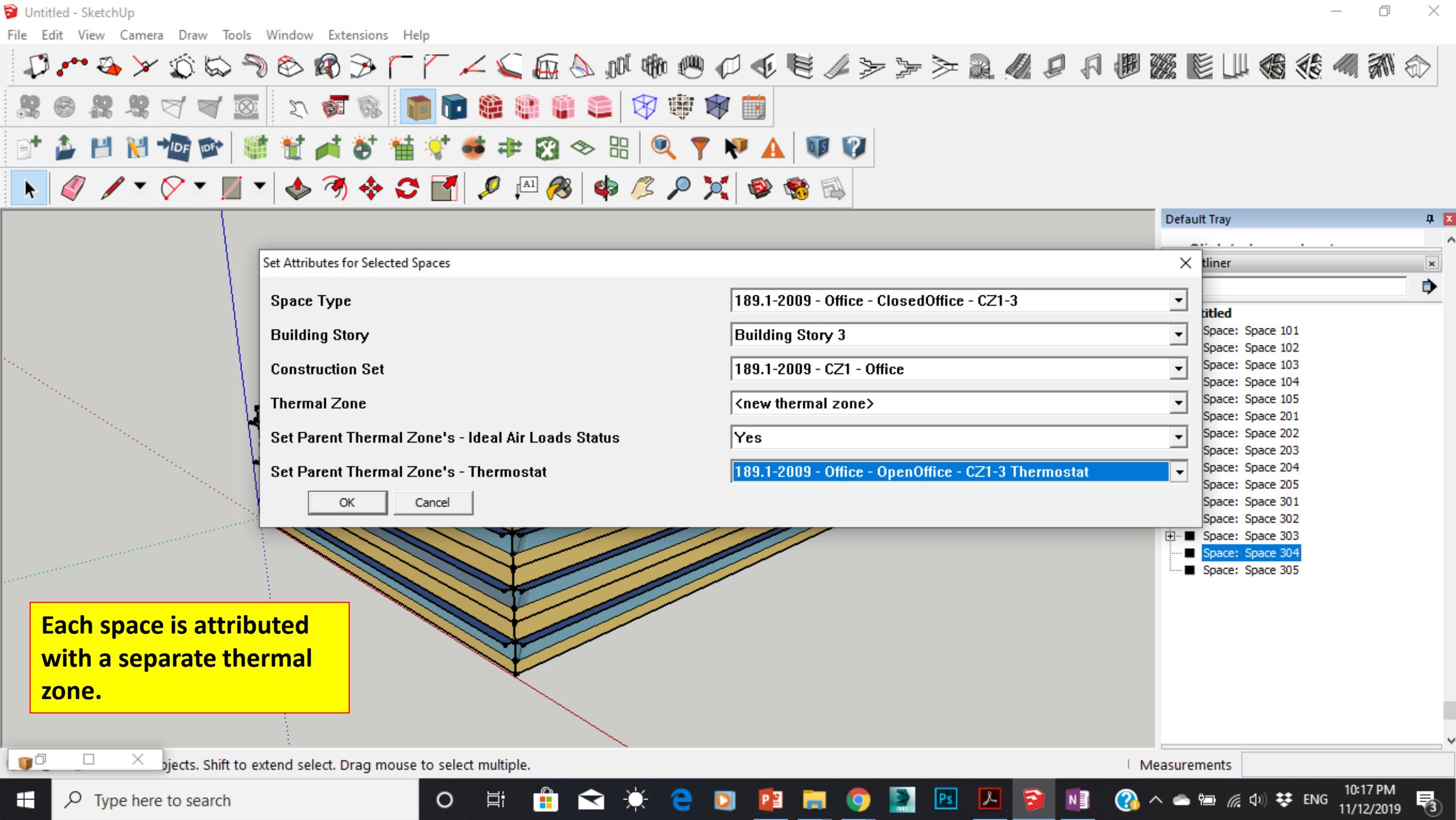


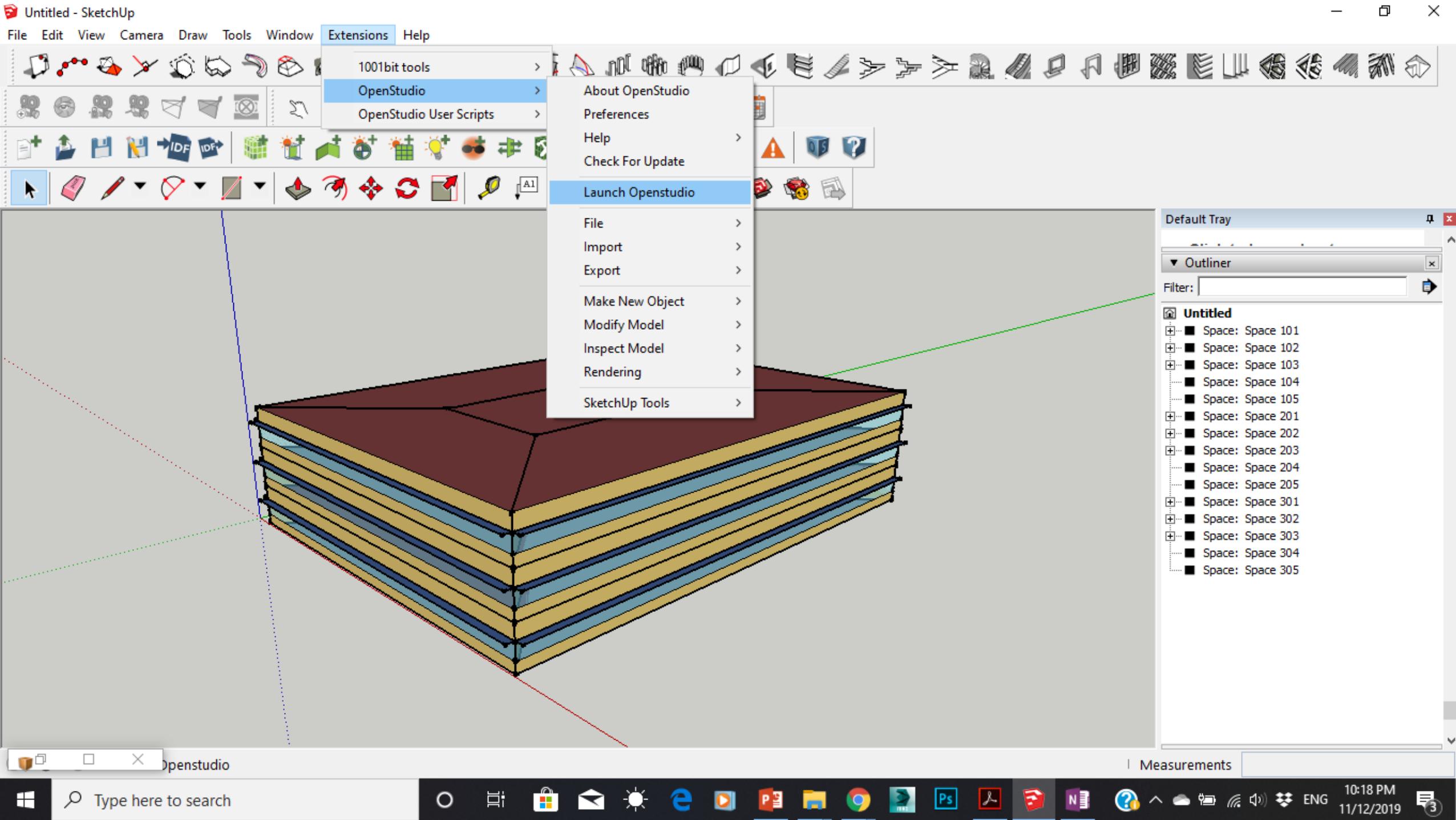




objects. Shift to extend select. Drag mouse to select multiple objects.

Measurements





Untitled - SketchUp

File week 6.osm

File Preferences Components & Measures Help

Site Weather File & Design Days Life Cycle Costs Utility Bills

My Model Library Edit

Weather File Set Weather File

Name: []

Latitude:

Longitude:

Elevation:

Time Zone:

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

Select Year by:

Calendar Year 2000

First Day of Year UseWeatherFile

Daylight Savings Time: off

Starts

Define by Day of The Week And Month First Sunday January

Define by Date 1/1/2000

Ends

Define by Day of The Week And Month First Sunday January

Define by Date 1/1/2000

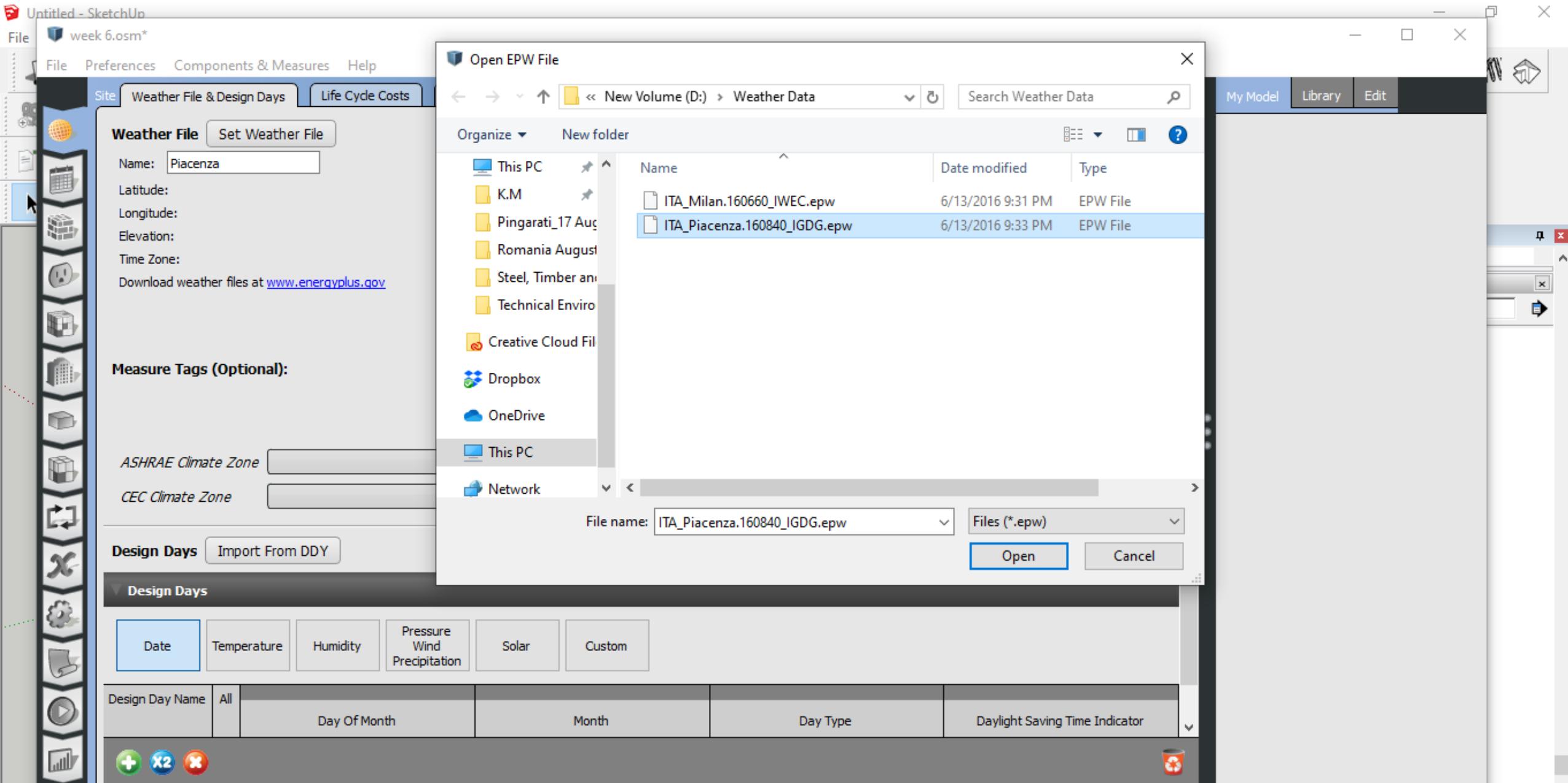
We need to choose the location in order to set the weather file and import DDY files, so we can go further with the simulation.

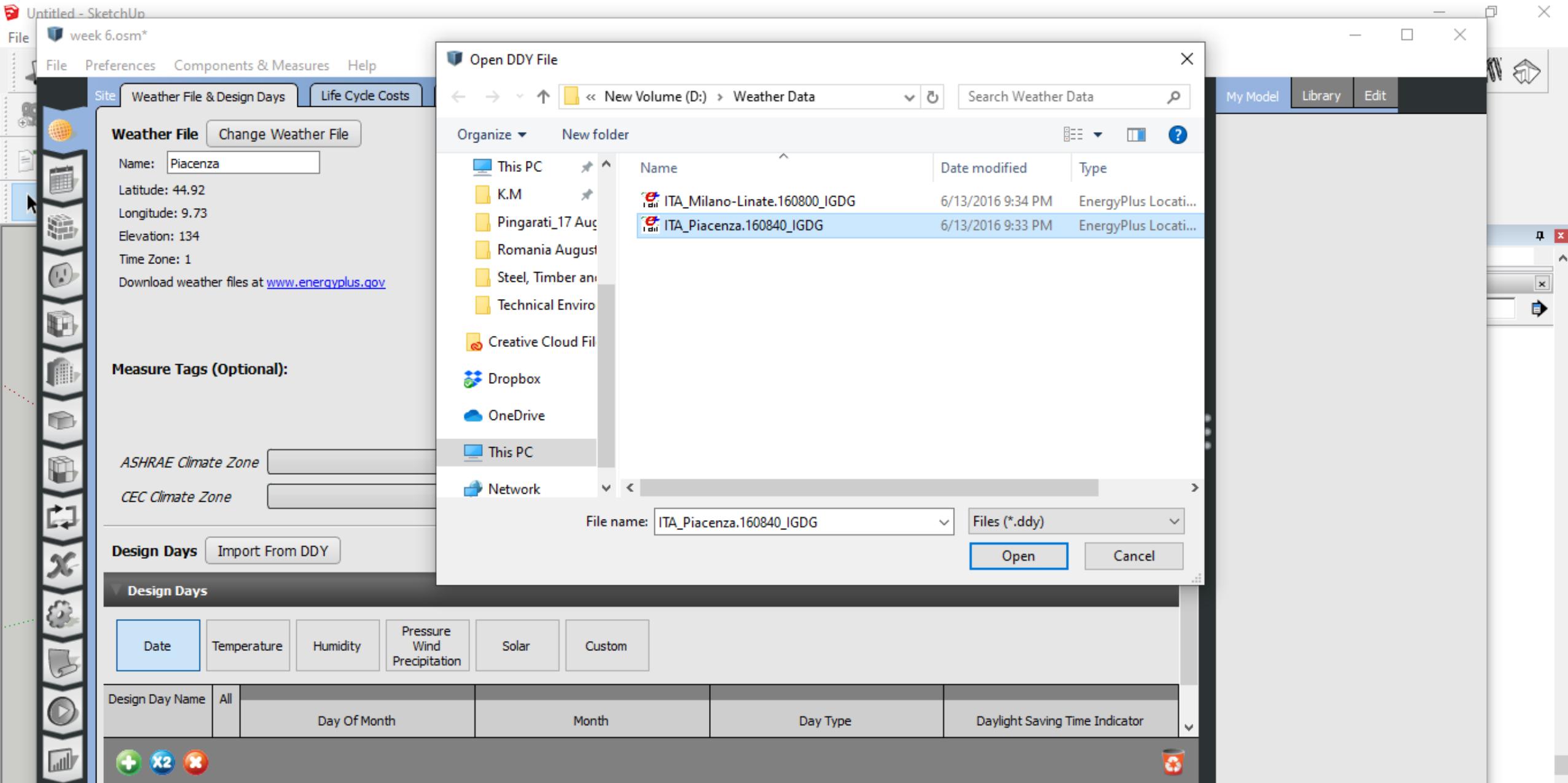
Objects. Shift to extend select. Drag mouse to select multiple.

Measurements

Type here to search

10:20 PM 11/12/2019 ENG





week 6.osm*

File Preferences Components & Measures Help

Site Weather File & Design Days Life Cycle Costs Utility Bills

My Model Library Edit

CEC Climate Zone Define by Date 1/1/2000

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
1a Ann Clg .4% Condns DB=>MWB	<input type="checkbox"/>	21	8	SummerDesignDay	<input type="checkbox"/>
2a Ann Clg .4% Condns DP=>MDB	<input type="checkbox"/>	21	8	SummerDesignDay	<input type="checkbox"/>
3a Ann Clg .4% Condns Enth=>MDB	<input type="checkbox"/>	21	8	SummerDesignDay	<input type="checkbox"/>
4a Ann Clg .4% Condns WB=>MDB	<input type="checkbox"/>	21	8	SummerDesignDay	<input type="checkbox"/>
5acenza Ann Htg 99.6% Condns DB	<input type="checkbox"/>	21	1	WinterDesignDay	<input type="checkbox"/>
6Wind 99.6% Condns WS=>MCDB	<input type="checkbox"/>	21	1	WinterDesignDay	<input type="checkbox"/>
7Hum_n 99.6% Condns DP=>MCDB	<input type="checkbox"/>	21	1	WinterDesignDay	<input type="checkbox"/>

+ X2 X

week 6.osm*

File Preferences Components & Measures Help

Spaces Properties Loads Surfaces Subsurfaces Interior Partitions Shading

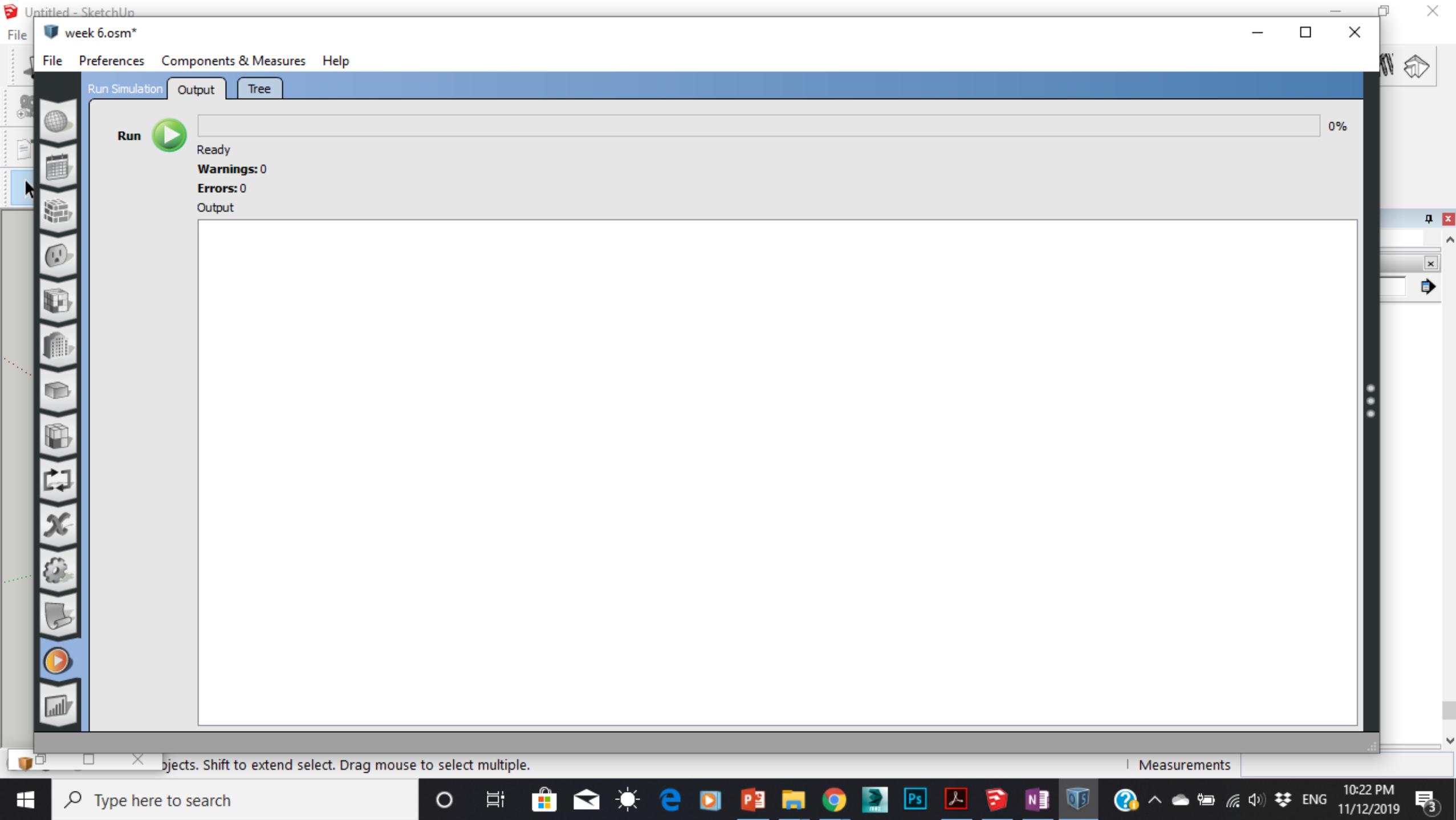
General Airflow Custom

Filters: Story Thermal Zone Space Type

Space Name	All	Story	Thermal Zone	Space Type	Default Construction Set	Default Schedule Set	Part of Total Floor Area
Space 101	<input type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - OpenOffice	189.1-2009 - CZ1 - Office		<input checked="" type="checkbox"/>
Space 102	<input type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - OpenOffice	189.1-2009 - CZ1 - Office		<input checked="" type="checkbox"/>
Space 103	<input type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - OpenOffice	189.1-2009 - CZ1 - Office		<input checked="" type="checkbox"/>
Space 104	<input type="checkbox"/>	Building Story 1	Thermal Zone 2	189.1-2009 - Office - BreakRoom	189.1-2009 - CZ1 - Office		<input checked="" type="checkbox"/>
Space 105	<input type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - OpenOffice	189.1-2009 - CZ1 - Office		<input checked="" type="checkbox"/>
Space 201	<input type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - OpenOffice	189.1-2009 - CZ1 - Office		<input checked="" type="checkbox"/>
Space 202	<input type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - OpenOffice	189.1-2009 - CZ1 - Office		<input checked="" type="checkbox"/>
Space 203	<input type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - OpenOffice	189.1-2009 - CZ1 - Office		<input checked="" type="checkbox"/>
Space 204	<input type="checkbox"/>	Building Story 2	Thermal Zone 4	189.1-2009 - Office - ClosedOffice	189.1-2009 - CZ1 - Office		<input checked="" type="checkbox"/>

My Model Library Edit

- Interior Partition Surface
- Building Stories
- Thermal Zones
- Space Types
- Default Construction Sets
- Default Schedule Sets
- Design Specification Outdoor Air
- People Definitions
- Lights Definitions
- Luminaire Definitions
- Electric Equipment Definitions
- Gas Equipment Definitions



File week 6.osm

File Preferences Components & Measures Help

Run Simulation Output Tree

Run  12%

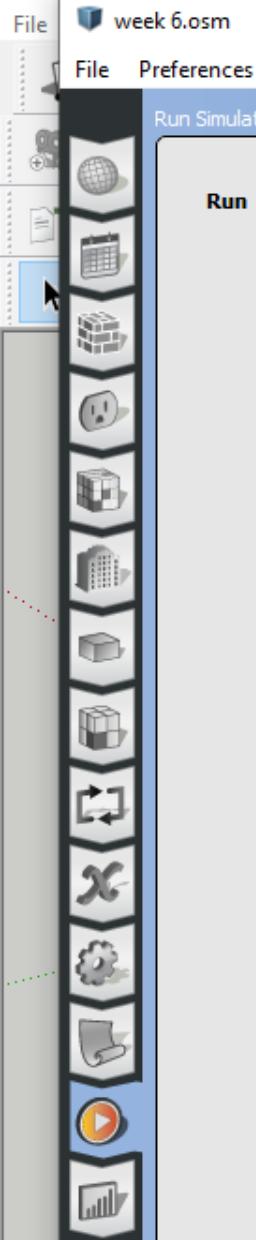
Running

Warnings: 0

Errors: 0

Output

```
ExpandObjects Started.  
Begin reading Energy+.idd file.  
Done reading Energy+.idd file.  
ExpandObjects Finished. Time: 0.141
```



Objects. Shift to extend select. Drag mouse to select multiple.

Measurements



Type here to search



10:24 PM
11/12/2019

Untitled - SketchUp

File week 6.osm

File Preferences Components & Measures Help

Results Summary

Reports: OpenStudio Results ▾

Open ResultsViewer for Detailed Reports

Model Summary

Annual Overview

Monthly Overview

Utility Bills/Rates

Envelope

Space Type Breakdown

Space Type Summary

Interior Lighting Summary

Plug Loads Summary

Exterior Lighting

Water Use Equipment

HVAC Load Profiles

Zone Conditions

Zone Overview

OpenStudio Results

Model Summary

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	1,754,912	kBtu
Total Building Area	38,750	ft ²
EUI (Based on Net Site Energy and Total Building Area)	45.29	kBtu/ft ²
OpenStudio Standards Building Type		

Weather Summary

We can choose whether the report's result is in OpenStudio units or EnergyPlus units.

Objects. Shift to extend select. Drag mouse to select multiple.

Measurements



week 6.osm

File Preferences Components & Measures Help

Results Summary

Reports: EnergyPlus Results ▾ Open ResultsViewer for Detailed Reports

Program Version: EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019.11.12 22:23

Tabular Output Report in Format: HTML

Building: Building 1

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

Simulation Timestamp: 2019-11-12 22:23:45

We can choose whether the report's result is in OpenStudio units or EnergyPlus units.

Report: Annual Building Utility Performance Summary [Table of Contents](#)

For: Entire Facility

Timestamp: 2019-11-12 22:23:45

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	1851.53	514.31	514.31
Net Site Energy	1851.53	514.31	514.31