WEEKLY SUBMISSION - TASK 06

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- DATE : 12 NOV 2019

1) Considering the same example of previous assignment how many shields with epsilon = 0.1 should be added in order to have the heat transfer rate to be 1% of the case without shields?

Soln: Case 1 : Without shields

$\epsilon_1 = 0.2$, $\epsilon_2 = 0.7$

T1 = 800k

T2 = 500k

$\sigma = 5.67 \times 10^{-8} \frac{w}{m^2 k^4}$

Net heat transfer without shields

$$\frac{\dot{Q}_{net}}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon 1} + \frac{1}{\epsilon 2} - 1}$$

$$= \frac{5.67 \times 10^{-8}(800^4 - 500^4)}{\frac{1}{0.2} + \frac{1}{0.7} - 1}$$

$$= 3625.41 \frac{w}{m^2}$$

Case 2 : With shields to reduce the heat transfer by 1%

$\epsilon_1 = 0.2$, $\epsilon_2 = 0.7$

T1 = 800k

T2 = 500k

$\sigma = 5.67 \times 10^{-8} \frac{w}{m^2 k^4}$

$\epsilon_n = 0.1$

Heat transfer with n shields in between = $1\% \text{ of } \frac{\dot{Q}_{net}}{A}$

$$\frac{\dot{Q}_n}{A} = \frac{1}{100} \left(\frac{\dot{Q}_{net}}{A}\right)$$

$$= 36.254 \frac{w}{m^2}$$

Heat transfer with n shields in between $\frac{\dot{Q}_n}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon 1} + \frac{1}{\epsilon 2} - 1\right)(N+1)}$

$$\frac{\dot{Q}_n}{A} = \frac{1}{(N+1)} \left(\frac{\dot{Q}_{net}}{A}\right) = \frac{1}{100} \left(\frac{\dot{Q}_{net}}{A}\right)$$

N = 99

Case 1 : Without shields

$\epsilon_1 = 0.1$, $\epsilon_2 = 0.1$

T1 = 800k

T2 = 500k

$\sigma = 5.67 \times 10^{-8} \frac{w}{m^2 k^4}$

Net heat transfer without shields

$$\frac{\dot{Q}_{net}}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon 1} + \frac{1}{\epsilon 2} - 1}$$

$$= \frac{5.67 \times 10^{-8}(800^4 - 500^4)}{\frac{1}{0.1} + \frac{1}{0.1} - 1}$$

$$= 1035.82 \frac{w}{m^2}$$

Case 2 : With shields to reduce the heat transfer by 1%

$\epsilon_1 = 0.1$, $\epsilon_2 = 0.1$

T1 = 800k

T2 = 500k

$\sigma = 5.67 \times 10^{-8} \frac{w}{m^2 k^4}$

$\epsilon_n = 0.1$

Heat transfer with n shields in between = $1\% \text{ of } \frac{\dot{Q}_{net}}{A}$

$$\frac{\dot{Q}_n}{A} = \frac{1}{100} \left(\frac{\dot{Q}_{net}}{A}\right)$$

$$= 10.358 \frac{w}{m^2}$$

Heat transfer with n shields in between $\frac{\dot{Q}_n}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon 1} + \frac{1}{\epsilon 2} - 1\right)(N+1)}$

$$\frac{\dot{Q}_n}{A} = \frac{1}{(N+1)} \left(\frac{\dot{Q}_{net}}{A}\right) = \frac{1}{100} \left(\frac{\dot{Q}_{net}}{A}\right)$$

N = 99

1

N = 99

$$36.254 = \frac{1}{(N+1)} 3625.41$$

N = 99

99 shields are required in between to reduce the heat transfer to 1 % in between the parallel sheet.

N = 99

$$10.358 = \frac{1}{(N+1)} 1035.82$$

N = 99

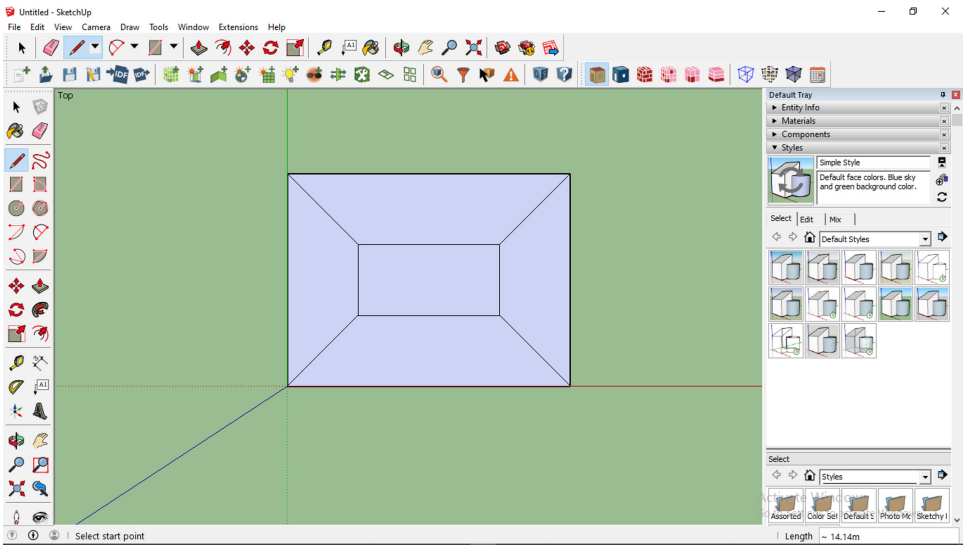
99 shields are required in between to reduce the heat transfer to 1 % in between the parallel sheets.

2) Explain step by step procedure with screenshots of your own work in open studio

Soln:

STEP 1 :

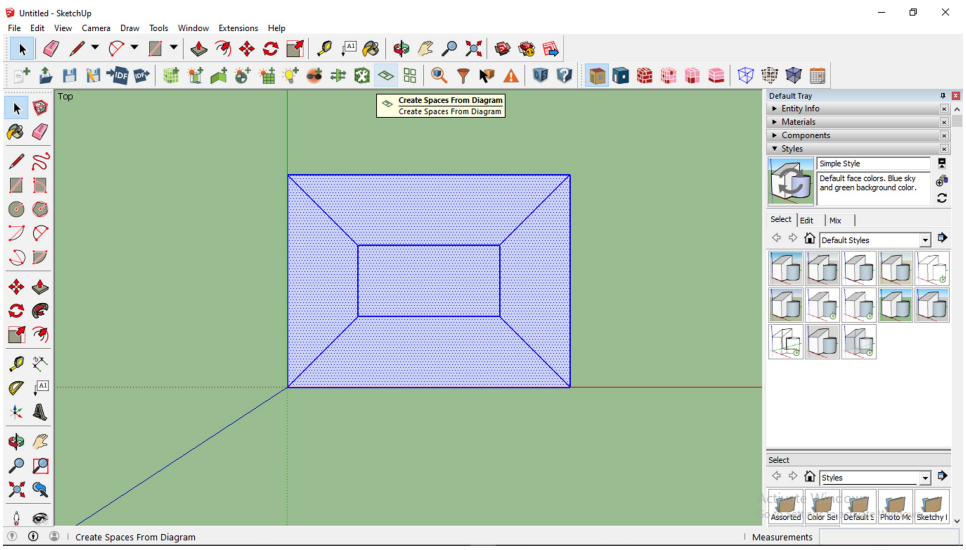
TO DRAW THE PLAN OF 30 X 40 M IN SKETCH UP

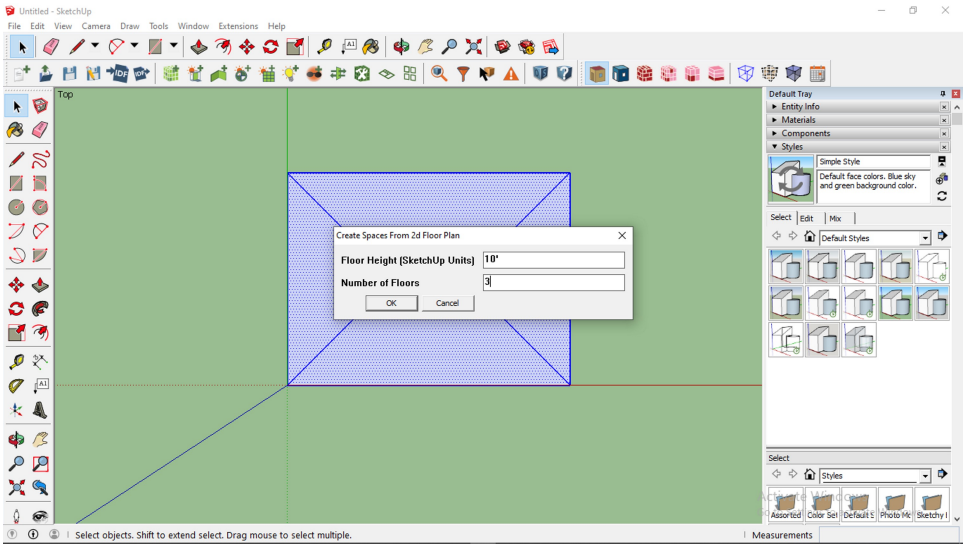


STEP 2 :

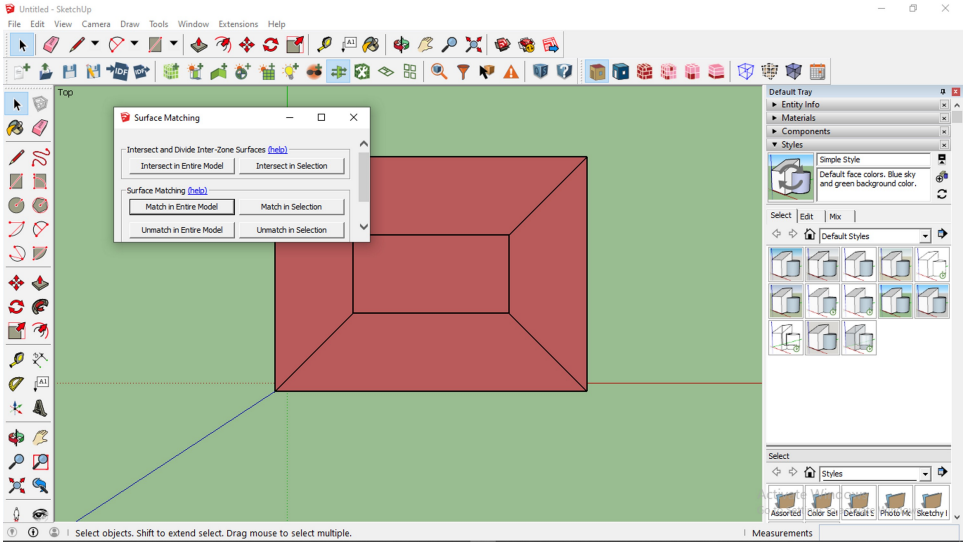
MAKE 3D BY USING CREATE SPACE FROM DIAGRAM OF OPEN STUDIO

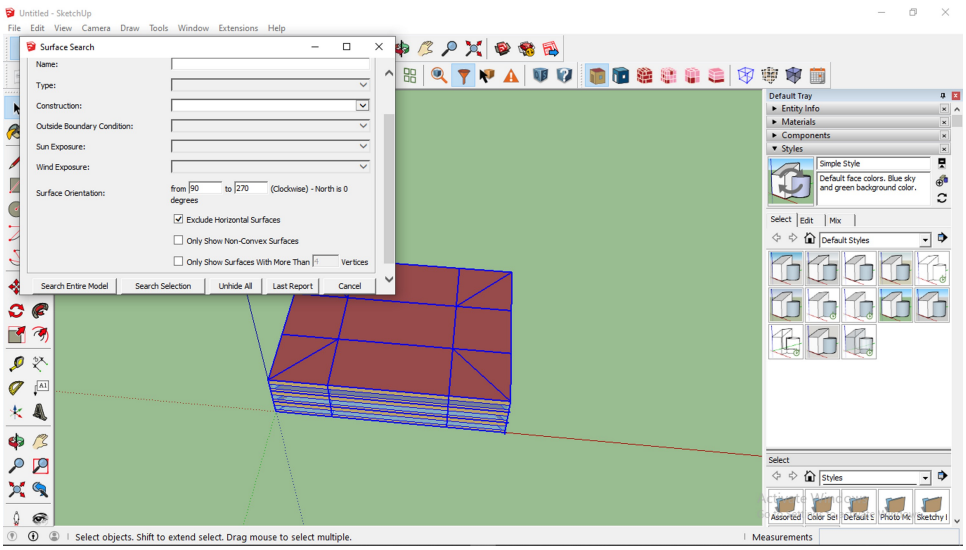
GIVE THE HEIGHT AND NUMBER OF FLOORS

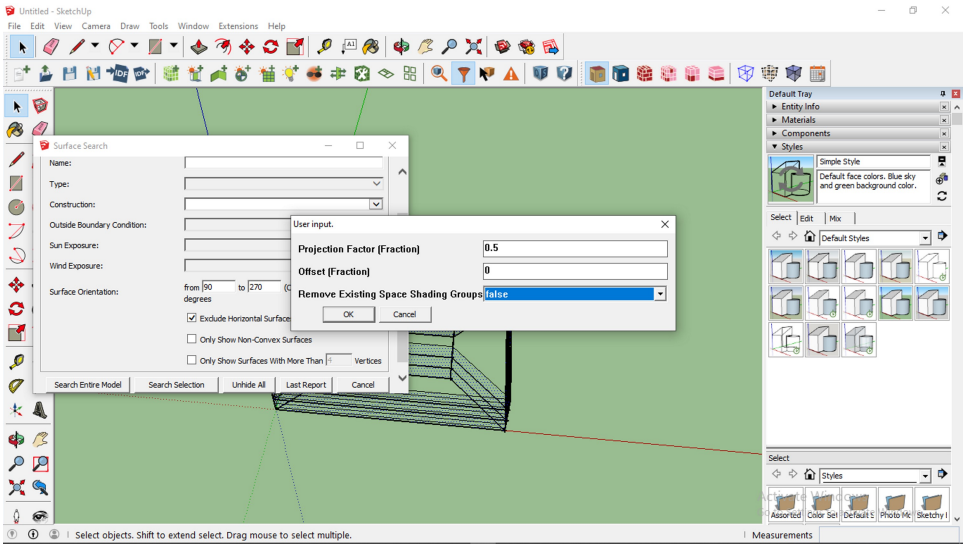


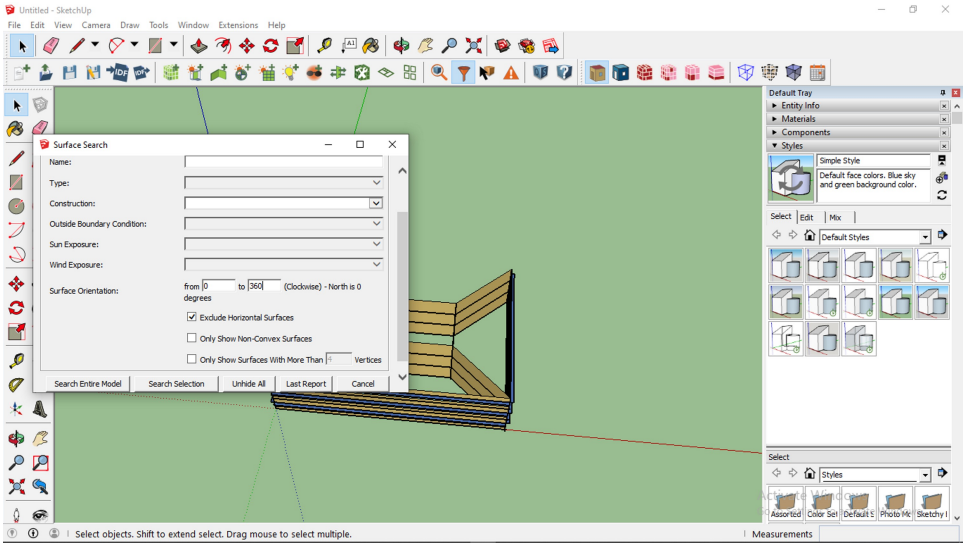


STEP 3:
SELECT ALL SURFACES AND CREATE WINDOWS USING OPEN STUDIO EXTENSIONS AFTER THAT ADD OVERHANGS EXCEPT ON NORTH SIDE

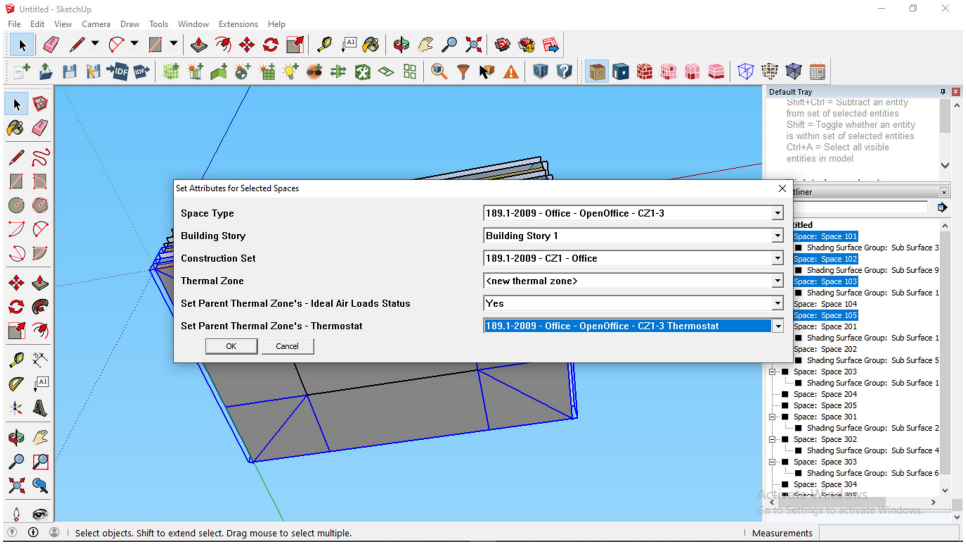




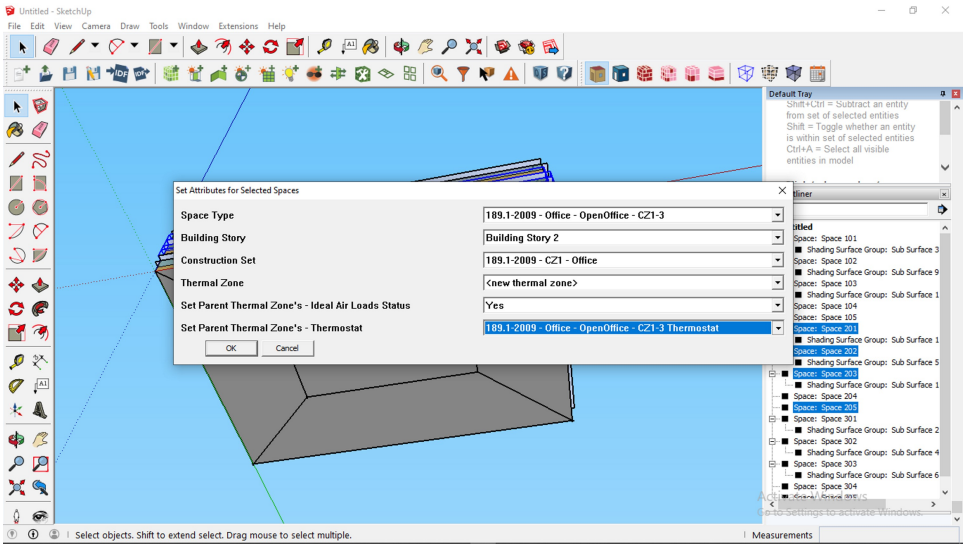


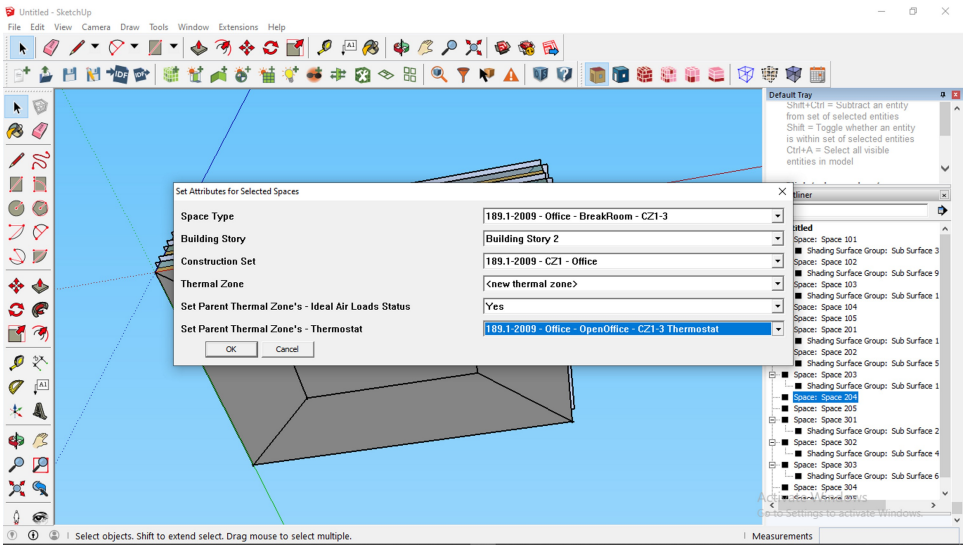


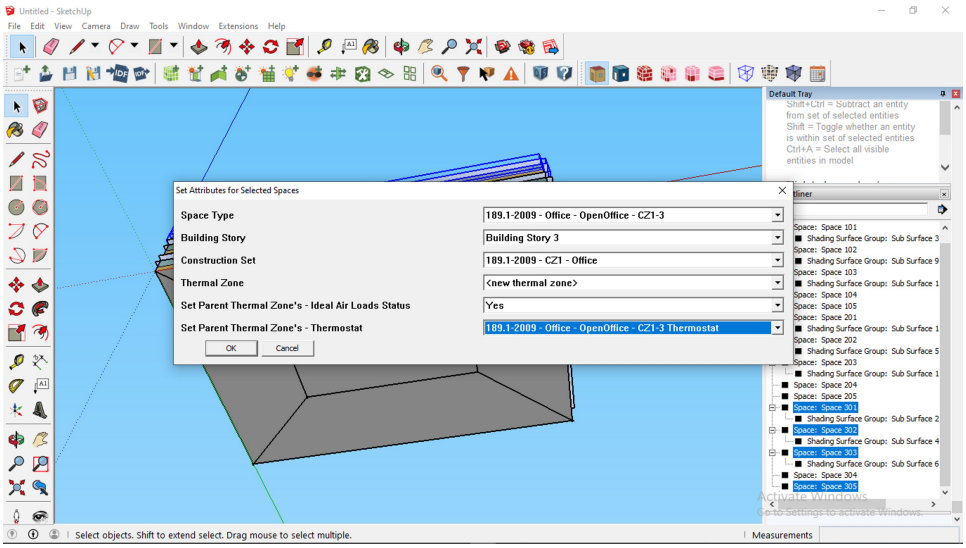
STEP 4:
NOW ADD THE THERMAL ZONE TO EACH SPACE OF 1ST FLOOR

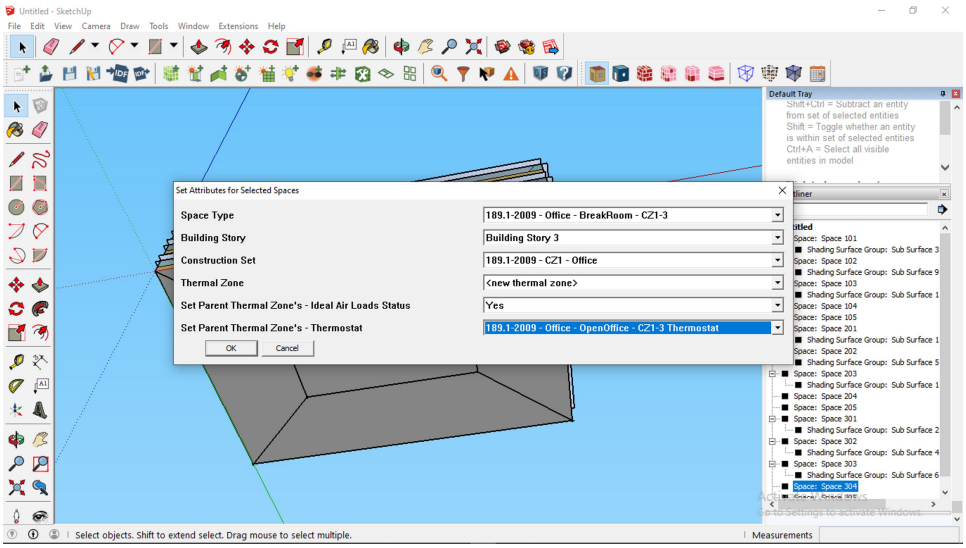


STEP 5:
REPEAT FOR THE OTHER TWO FLOORS

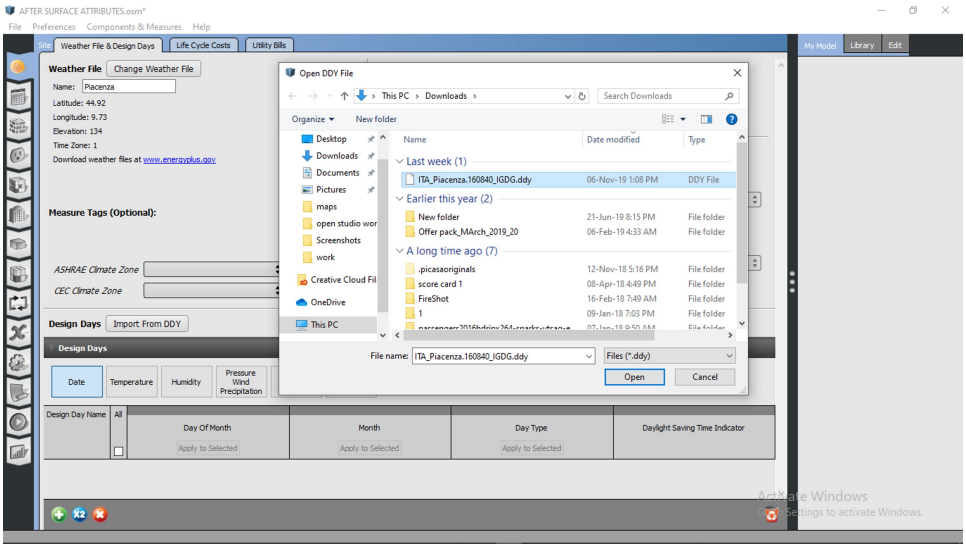

Untitled - SketchUp
File Edit View Camera Draw Tools Window Extensions Help
Default Tray
Set Attributes for Selected Spaces
Space Type
189.1-2009 - Office - OpenOffice - CZ1-3
Building Story
Building Story 2
Construction Set
189.1-2009 - CZ1 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
189.1-2009 - Office - OpenOffice - CZ1-3 Thermostat
OK
Cancel
Select objects. Shift to extend select. Drag mouse to select multiple.
Measurements

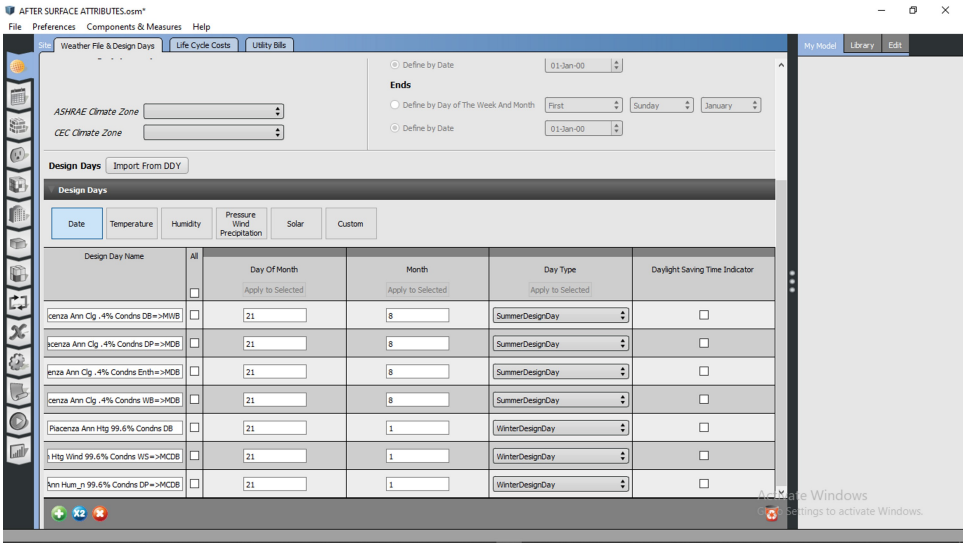

Untitled - SketchUp
File Edit View Camera Draw Tools Window Extensions Help
Default Tray
Set Attributes for Selected Spaces
Space Type
189.1-2009 - Office - BreakRoom - CZ1-3
Building Story
Building Story 2
Construction Set
189.1-2009 - CZ1 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
189.1-2009 - Office - OpenOffice - CZ1-3 Thermostat
OK
Cancel
Select objects. Shift to extend select. Drag mouse to select multiple.
Measurements


Untitled - SketchUp
File Edit View Camera Draw Tools Window Extensions Help
Default Tray
Set Attributes for Selected Spaces
Space Type
189.1-2009 - Office - OpenOffice - CZ1-3
Building Story
Building Story 3
Construction Set
189.1-2009 - CZ1 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
189.1-2009 - Office - OpenOffice - CZ1-3 Thermostat
OK
Cancel
Select objects. Shift to extend select. Drag mouse to select multiple.
Measurements



STEP 6:
NOW SAVE THE FILE IN OPEN STUDIO FORMAT AND LAUNCH THE OPEN STUDIO TO ADD THE WEATHER DATA TO KNOW THE ENERGY PLUS RESULTS.





STEP 7:
AFTER ADDING THE CLIMATE DATA NOW RUN THE MODEL TO GET RESULTS