Technical Environmental Solutions/ Submission no.6/
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Task no.1
Summery

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

- **In case of without shields:**
  T1 = 800
  T2 = 500
  σ=5.67×10^(-8)
  $\epsilon_1 = 0.2$
  $\epsilon_2 = 0.7$

$$\dot{q} = \frac{\dot{Q}}{A} = 5.67 \times 10^{-8} \frac{800^4 - 500^4}{\frac{1}{0.2} + \frac{1}{0.7} - 1} = 3625.4 \frac{W}{m^2}$$

- **In case of with shields:**

- The new heat transfer rate to be 1% is =

$$\dot{q} = \frac{\dot{Q}}{A} = 3625.4 \times 1\% = 36.254 \ \frac{W}{m^2}$$

- Now we can calculate the number of shields required to reduce the radiative heat by using this formula:

$$\dot{Q}_{12}, N\ shield = \frac{A\sigma\left(T_1^4 - T_2^4\right)}{(N+1)\left(\frac{1}{\epsilon} + \frac{1}{\epsilon} - 1\right)} =$$

$\epsilon = 0.1$

$$36.254 = \frac{5.67 \times 10^{-8}\left(800^4 - 500^4\right)}{(N+1)\left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)} =$$

$$36.254 \times (N+1)\left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right) = 5.67 \times 10^{-8}\left(800^4 - 500^4\right) =$$

$$(N+1) = \frac{5.67 \times 10^{-8}\left(800^4 - 500^4\right)}{36.254 \times \left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)} =$$

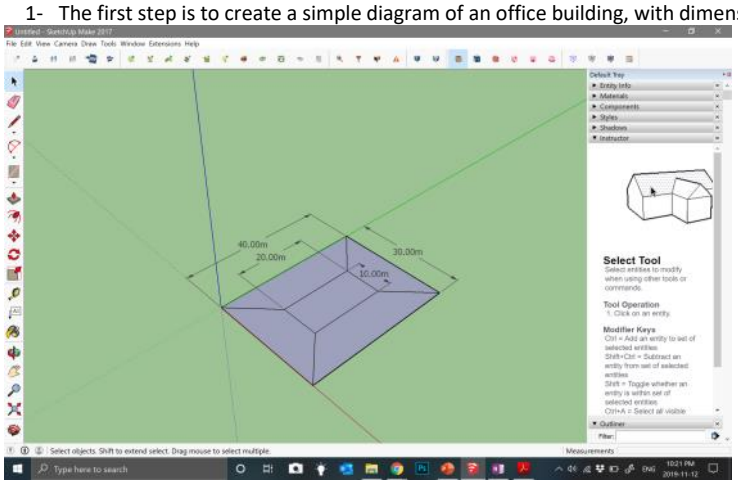
$$N = \frac{5.67 \times 10^{-8}\left(800^4 - 500^4\right)}{36.254 \times \left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)} - 1 = 27.5 \cong 28\ shields$$

The number of required shields is ≅ 28 shields in order to reduce the radiative heat transfer by 1%, and each shield have an

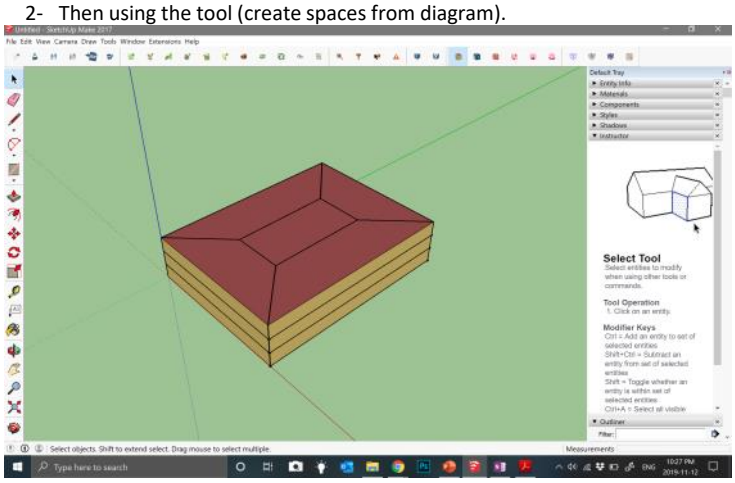
epsilon value = 0.1

Task no.2

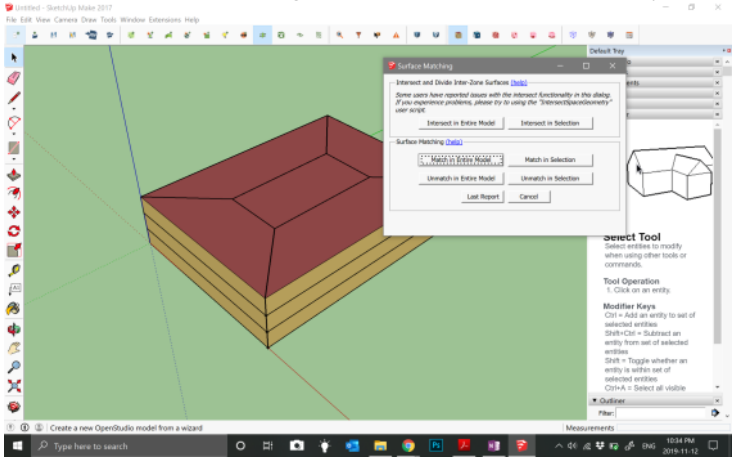
1- The first step is to create a simple diagram of an office building, with dimensions of 30 x 40 m2



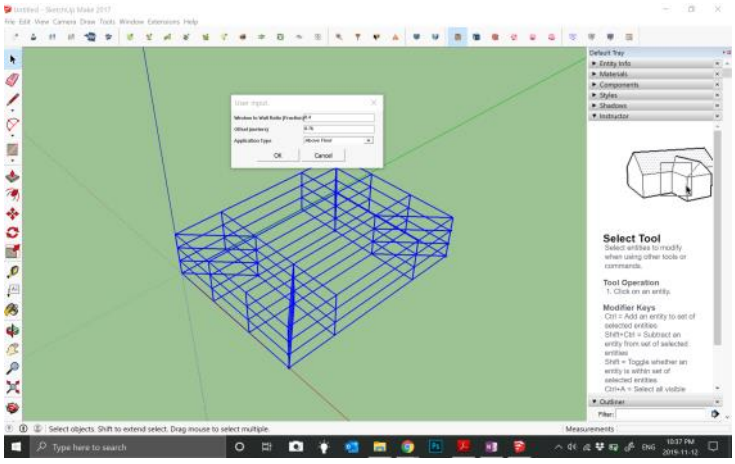
2- Then using the tool (create spaces from diagram).



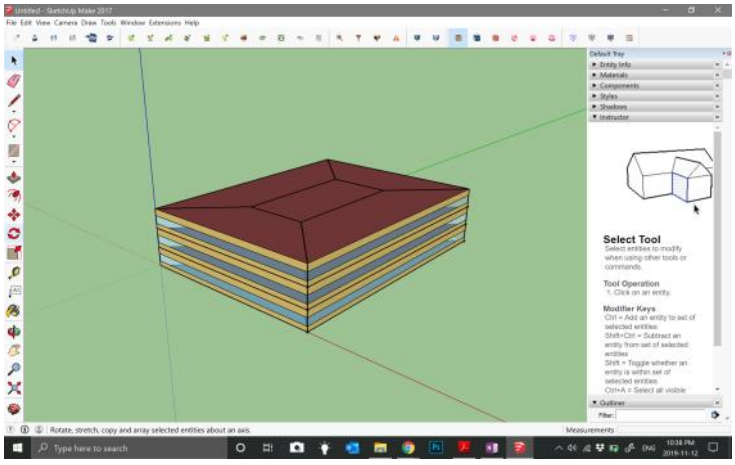
3- In order to make a building with intersections and divisions in its space, we select the tool (surface matching).



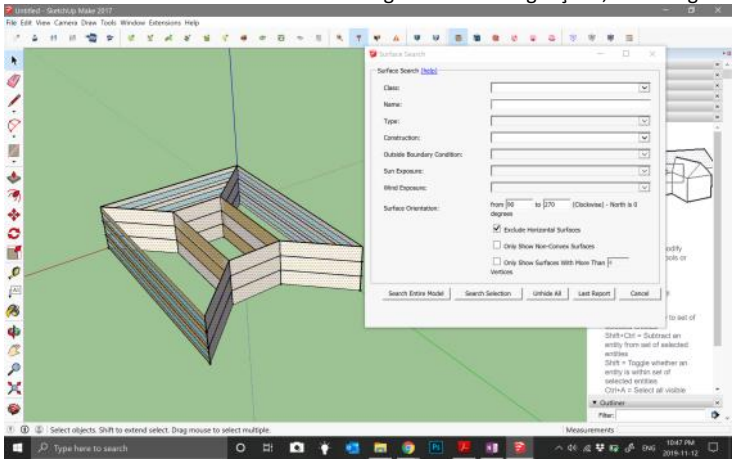
4- To create windows and openings in the building façade, we use the tool (set window to wall ration) which is in the drop down menu (Extensions-open studio user script- Alter or add model elements)



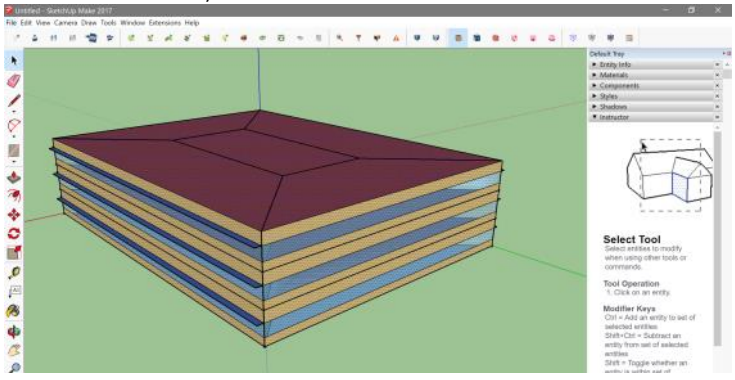
5- Windows are created.

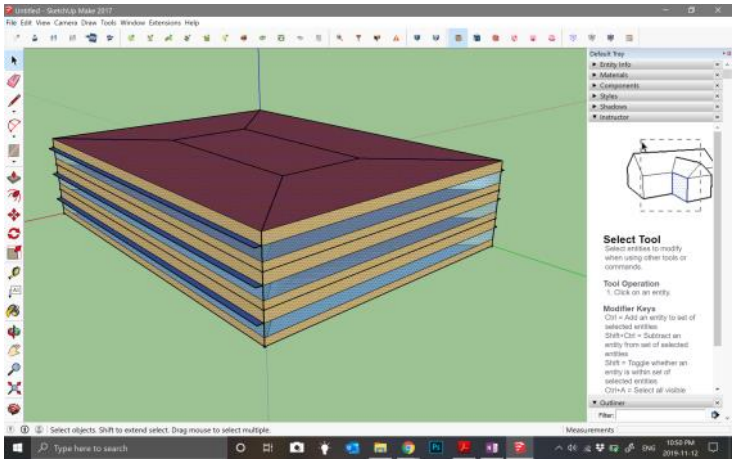


6- Now we need to create the overhangs in our building façade, excluding the northern one. This excluding can be made by using t he tool (surface search).

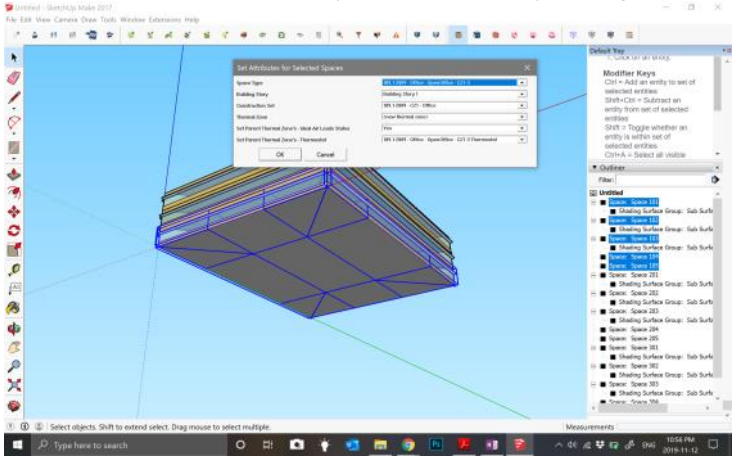


7- To add the overhangs we use the tool (add overhangs by projection factor) from the drop down menu (extensions - open studio user scripts - alter or add model elements)

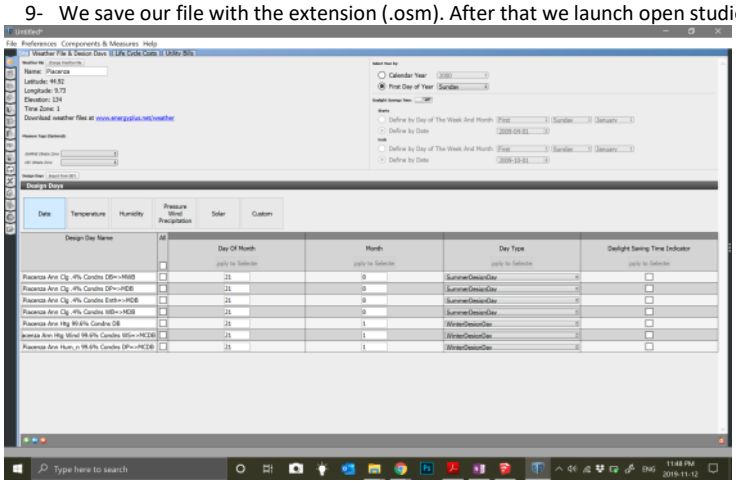




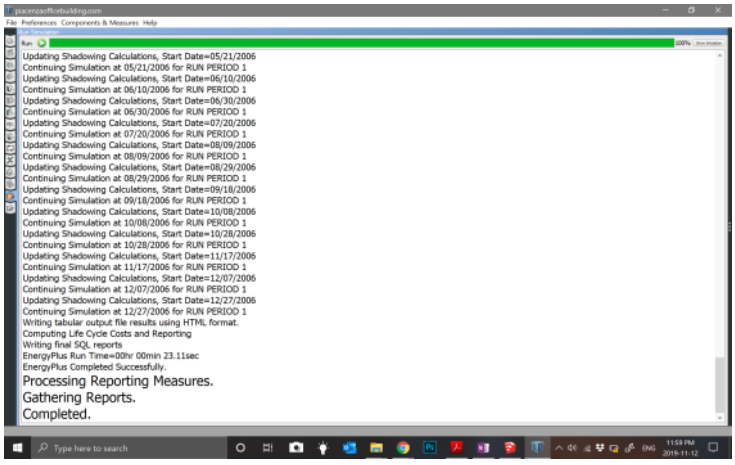
8- Thermal zones and their descriptions can be added by selecting the tool (set attributes for selected spaces).



9- We save our file with the extension (.osm). After that we launch open studio software, and open our file. Upload the weather data and design days file.



10- Run the simulation.



11- We can have the results in the (results summary).