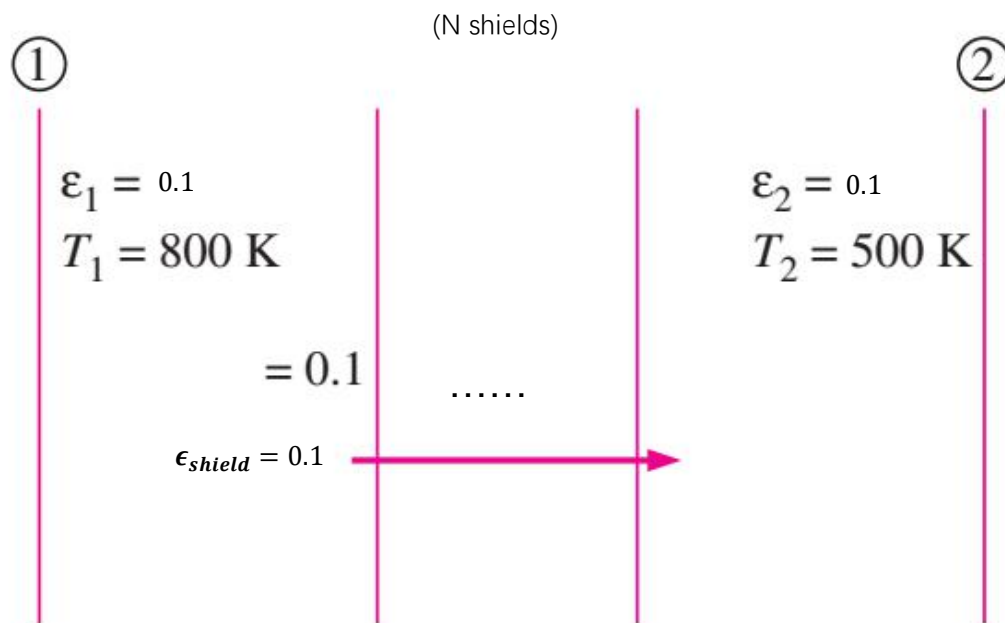


Task 1

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 ?

Last time, the case is

$$\dot{q} = \frac{\dot{Q}}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} = \frac{5.67 \times 10^{-8} \times (800^4 - 500^4)}{\frac{1}{0.1} + \frac{1}{0.1} - 1} \text{ W/m}^2 = 1035.8 \text{ W/m}^2$$



When the new heat transfer rate to be 1% of the case without shields, \dot{q}' should be

$$\dot{q}_{with \ N \ shields} = 1\% \times \dot{q} = 1\% \times \frac{\dot{Q}}{A} = 1\% \times \frac{\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1}$$

$$= \frac{\dot{Q}_{with \ N \ shields}}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + N \left(\frac{1}{\epsilon_{shield}} + \frac{1}{\epsilon_{shield}} - 1\right)}$$

Introduce $\epsilon_{shield} = \epsilon_1 = \epsilon_2 = 0.1$ to the equation above,

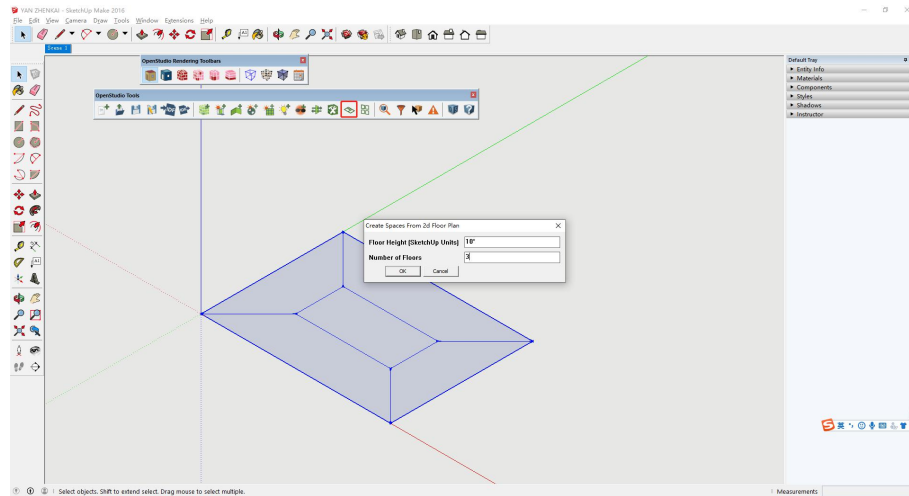
Then,

$$\rightarrow \frac{1}{(N+1)\left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)} = \frac{1}{100\left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)}$$

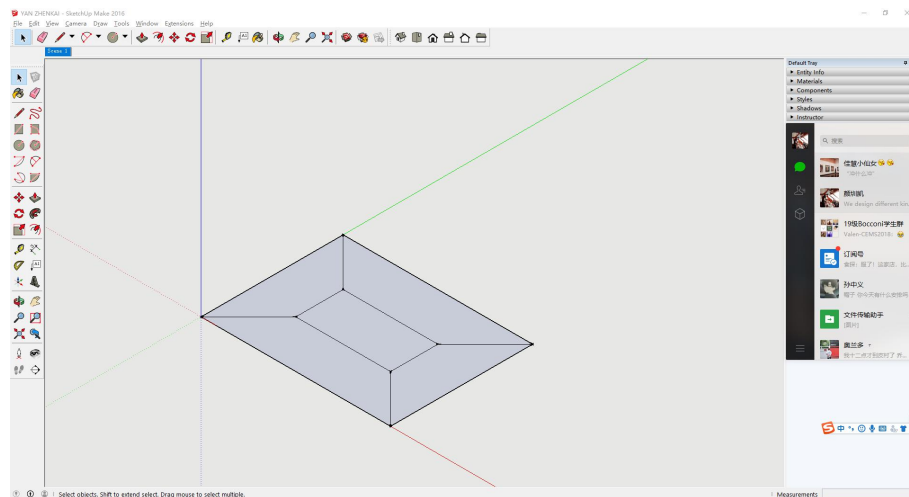
$$\therefore N = 99$$

Task 2

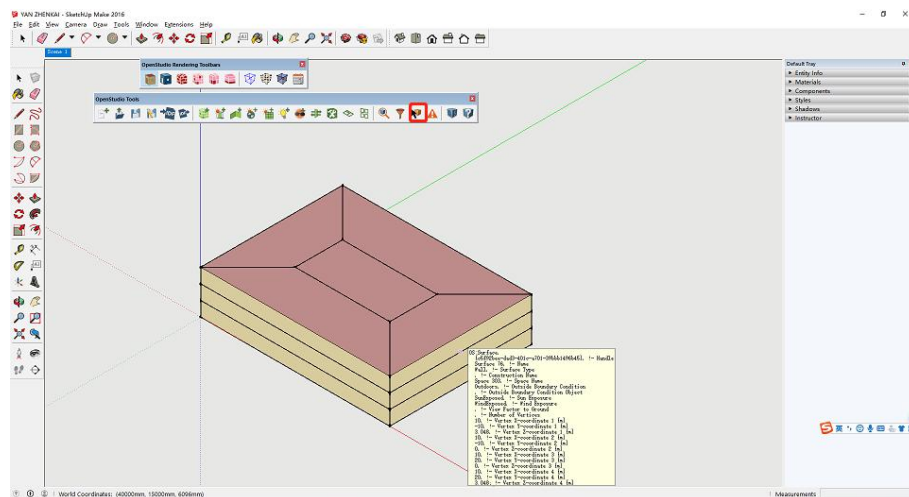
1. Draw the outline and shape of the building in Sketchup. (by creating a 40×30 rectangle then create another rectangle inside it with the offset of 10 m)



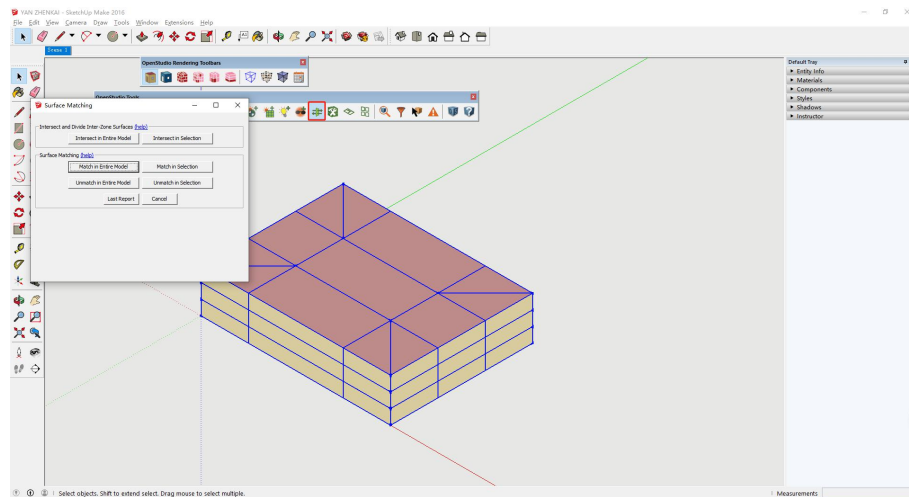
2. Click "CREAT SPACES FROM DIAGRAM" button create a 3-floor building.



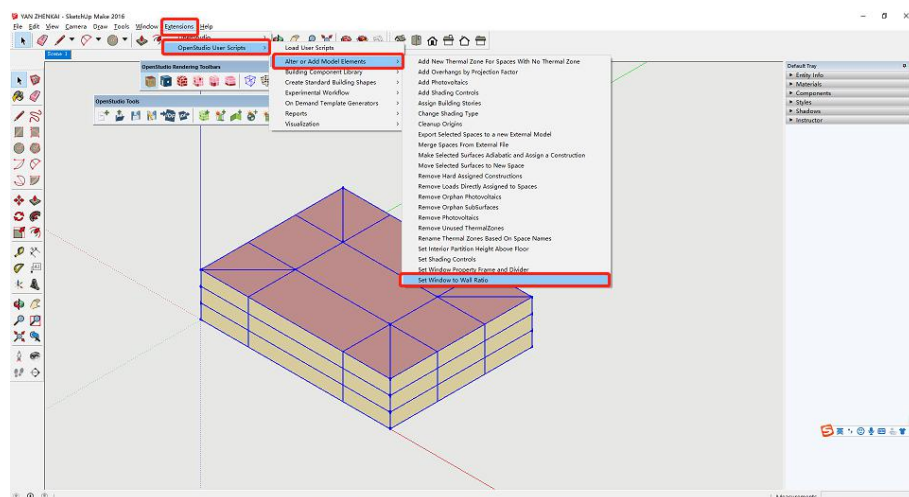
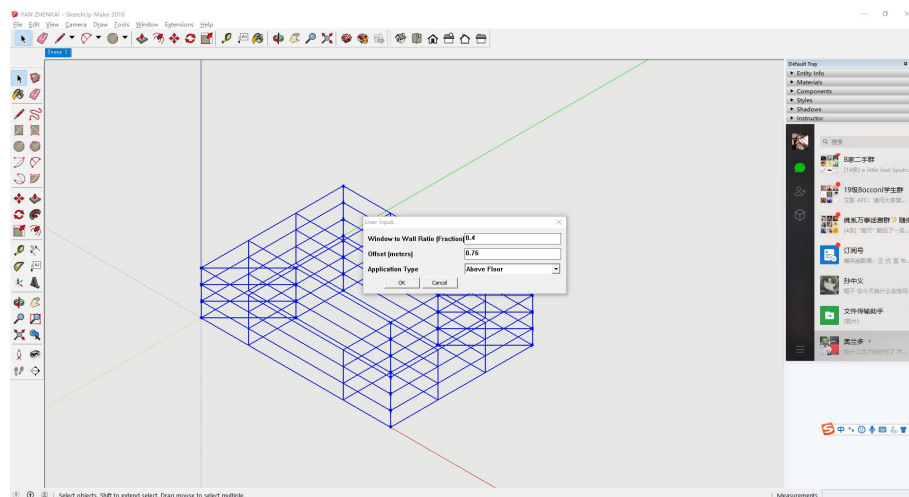
3. Click the "INFO TOOL" to see the material detail information.



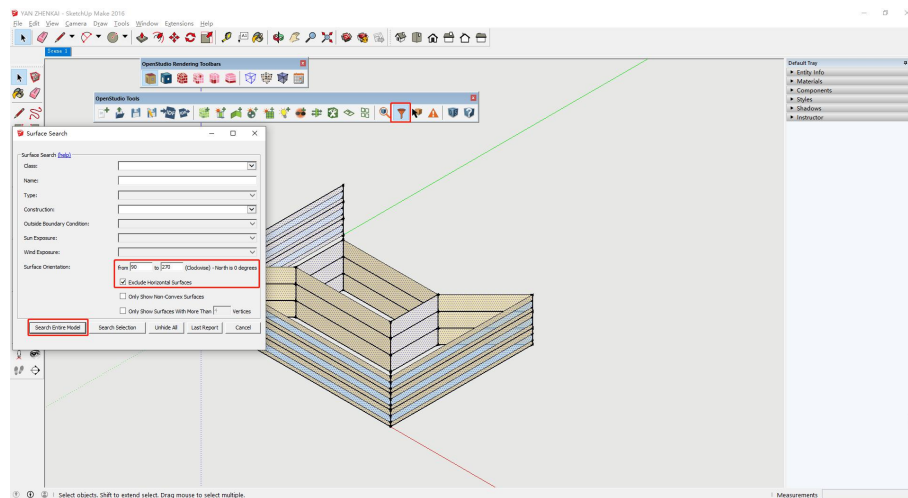
4. Click "SURFACE MATCHING" button



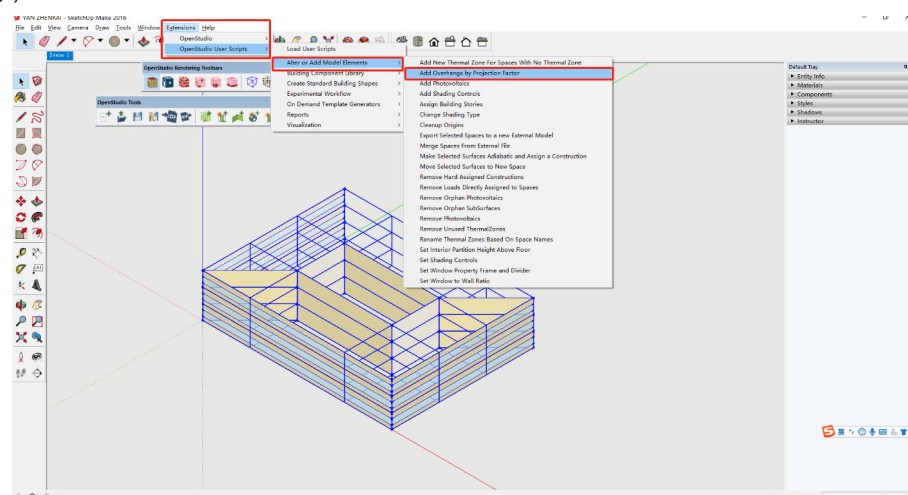
5. Click "SET WINDOW TO WALL RATIO" button to add windows.



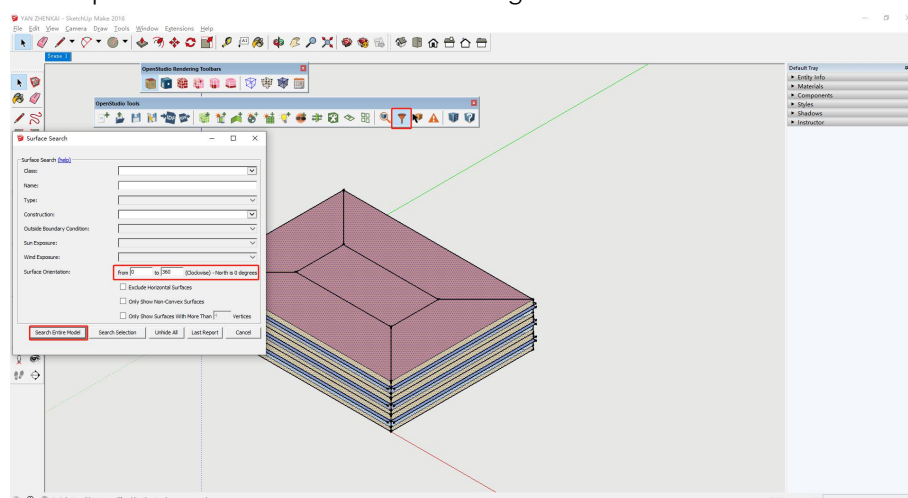
6. Before adding the overhangs, choose the surfaces except north direction with the help of “SURFACE SEARCH” button.



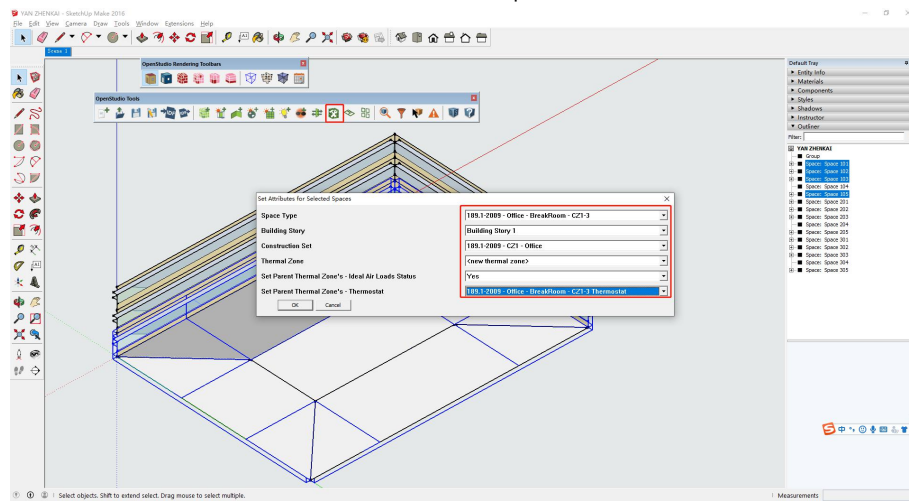
7. Click “ADD OVERHANGES BY PROJECTIO FACTOR” button, to add overhang (external shading)



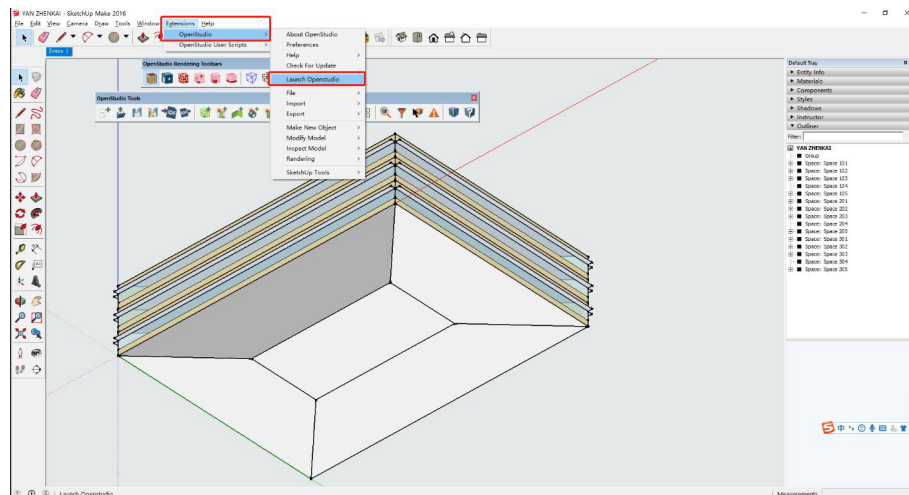
8. With the help of “SURFACE SEARCH”button to go back to the 0-360° version



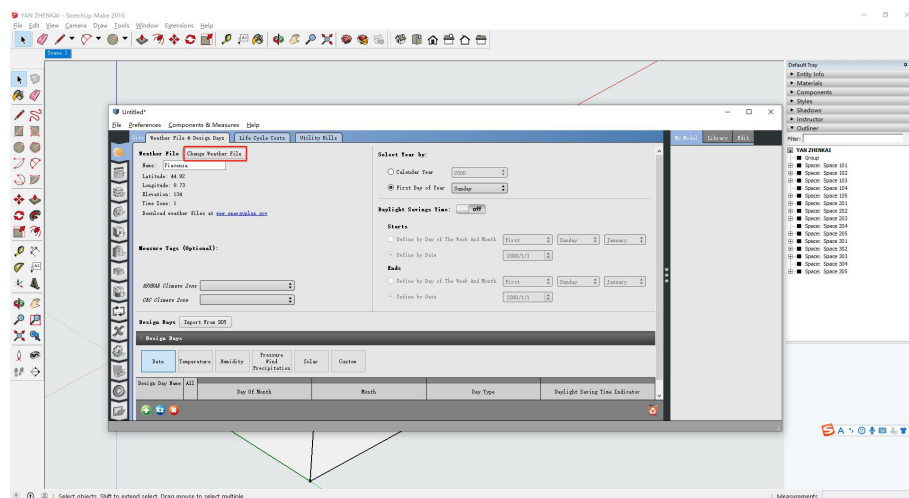
9. Open the “OUTLINER”, choose the space of each thermal zone, then click the “SET ATTRIBUTES FOR SELECTED SPACE” button to set parameters, with details showed below.



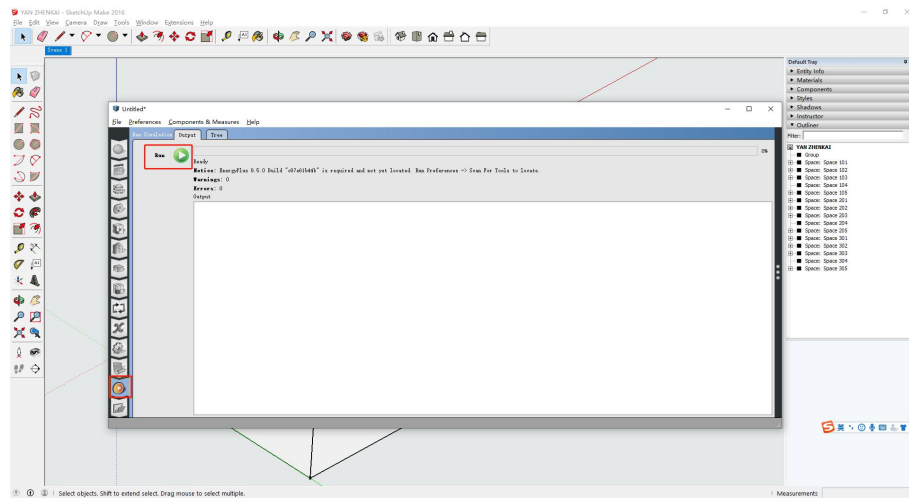
10. Click the “LAUNCH OPENSTUDIO” button



11. Add weather data of Piacenza.



12. Then run the openstudio.



13. Review the results in the last tap.

