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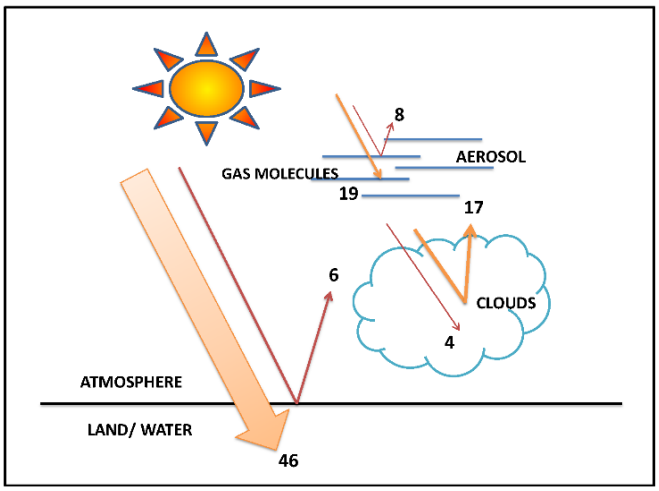
Student Number: 10701028
Submission Date: 19/11/2019
Assignment #: 7th Week

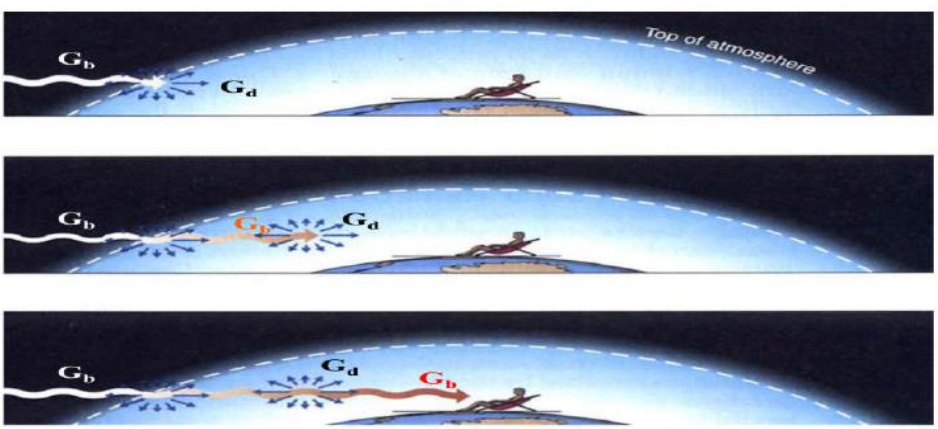
Summary

Solar radiation is the radiant energy emitted by sun which is within a specified wavelength range. Solar radiation has different densities until it reaches the Earth's surface. It has the average value of 1367 $\frac{W}{m^2}$ (which is called **solar constant**) on the edge of Earth's atmosphere and it can decrease to almost 1000 $\frac{W}{m^2}$ on Earth's surface.

The reason for this considerable reduction are shown in the adjacent picture. Almost 25% of solar radiation is scattered by molecules and particles (**dispersion**). and almost one fifth of this energy is absorbed by atmosphere. The remaining which is almost half of the originally emitted radiation eventually reached the Earth's surface.



The mentioned dispersion happens in two different ways; first is reflection of incident solar radiation (**back reflection**) and the second one is the deflected radiation in all directions (**diffuse solar irradiance** or $\mathbf{G_d}$). The incident radiation which was not absorbed, reflected or dispersed maintains its unique direction and is called **direct solar beam or direct irradiance $\mathbf{G_b}$** . The absorption happens by atmospheric elements and compounds like water, carbon dioxide which mostly absorbs infrared band of the energy and finally ozone which absorbs almost all the ultraviolet component of solar radiation.



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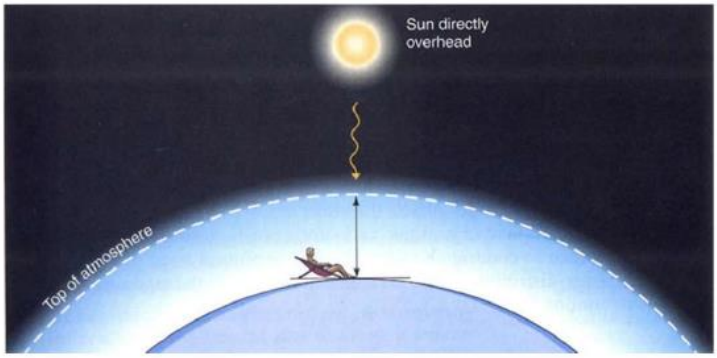
As we spoke during the session, there are some factors which can affect amount of receiving irradiation:

1- Air Mass: It represents how much of radiation can go through the atmosphere. The angle of the sun to Zenith is the main indicator of the mentioned amount. If the sun is perpendicular to the horizon then the radiation crosses the minimum possible thickness of volume air and in case of elevated Zenith angle the sun rays should cross a large thickness of atmosphere which causes the intensity to decrease.



2- Weather Condition: Which can highly affect the air mass phenomenon. Cloud coverage and moisture are the main elements which can decrease the amount of received irradiance.

3- Time and Season: Position of the sun in the sky can vary due to different seasons and times of a day. Distance to then sun in different months of the year as well as the angle of the sun during different hours of a single day can affect the direct solar radiation.

4- Location: Site altitude is another key factor in our scenario. The higher the elevation of a location is the more radiation is received by the surface.

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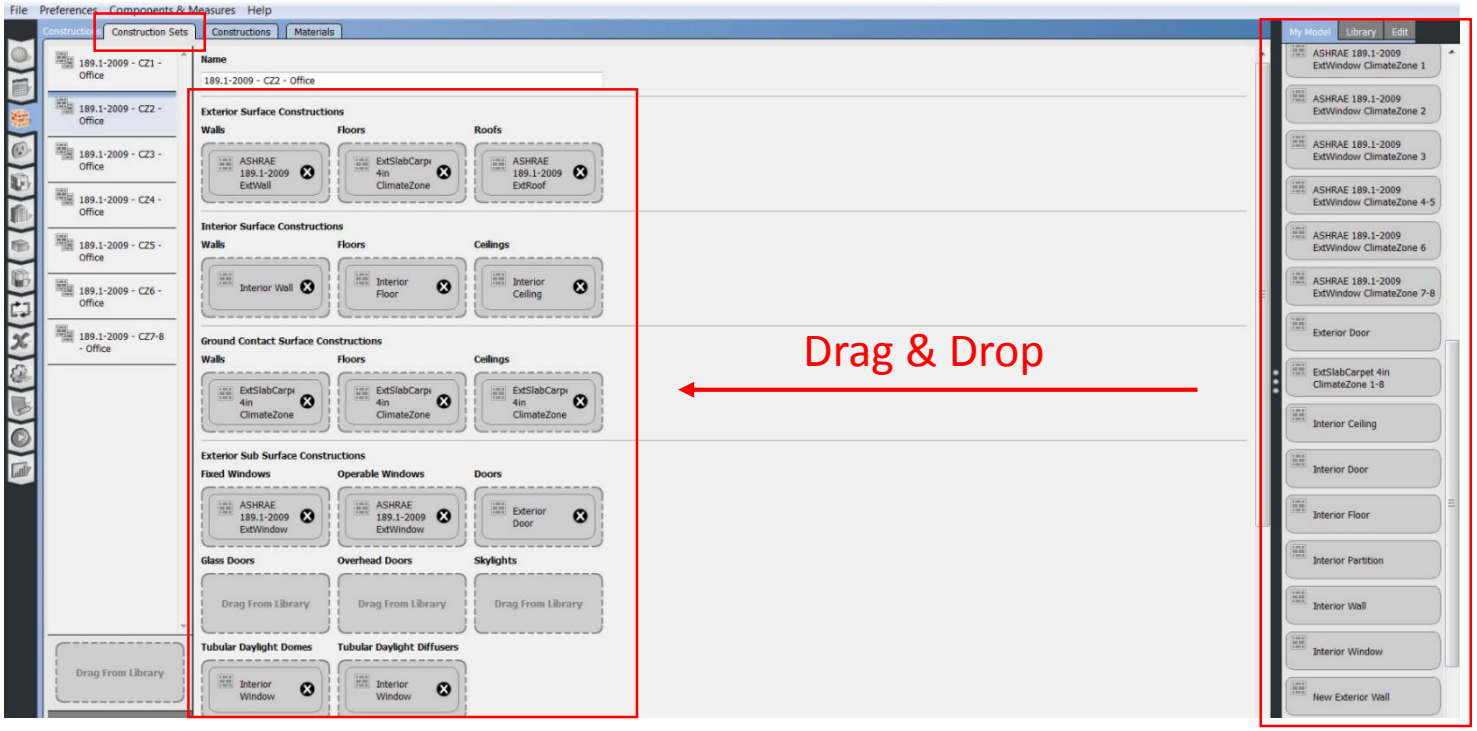
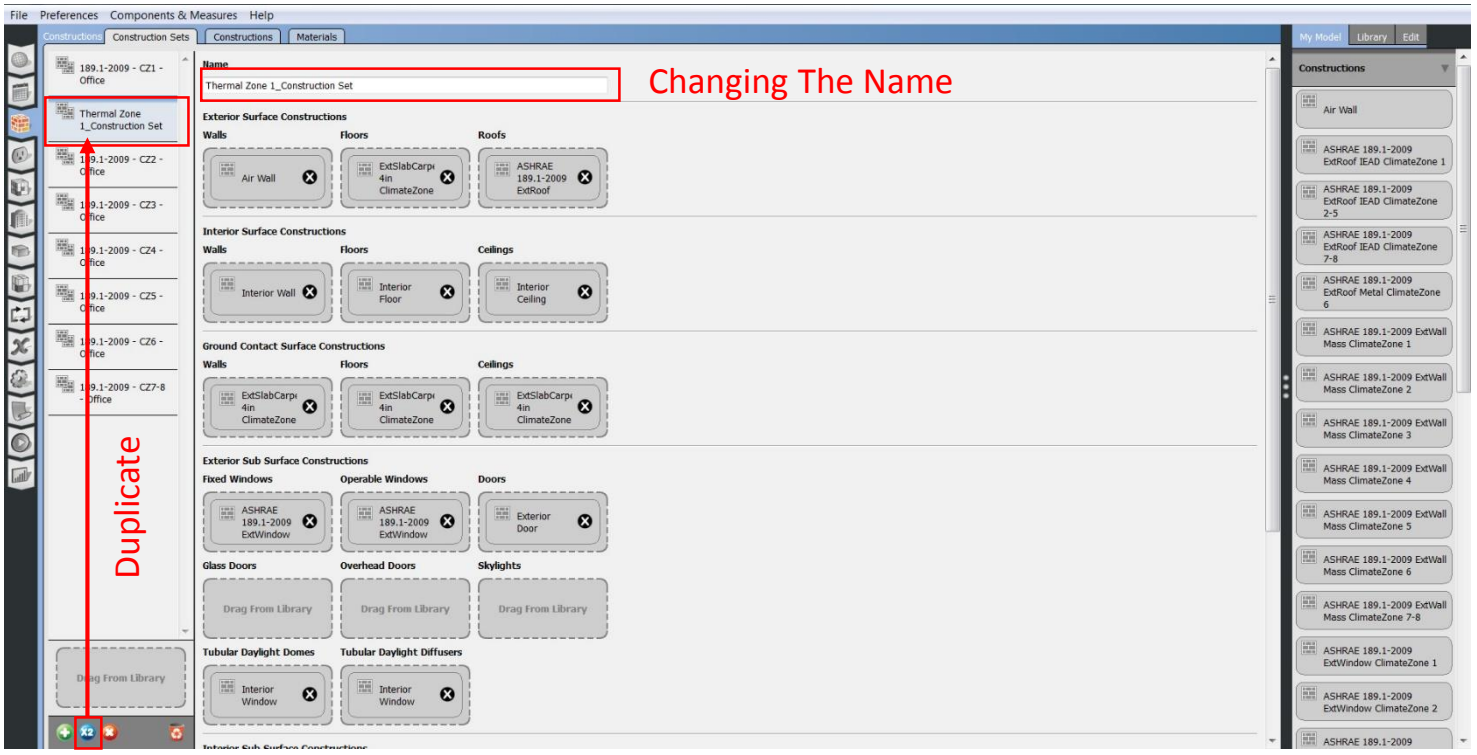
Open Studio Exercise

Another ability is OpenStudio is to load **Construction Sets** for all of our thermal zones by accessing the **"Constructions"** menu and click on one of the predefined available options from the first tab.



In order to define a new construction set, we should duplicate one of the existing ones by clicking on the X2 icon and preferably change the name.



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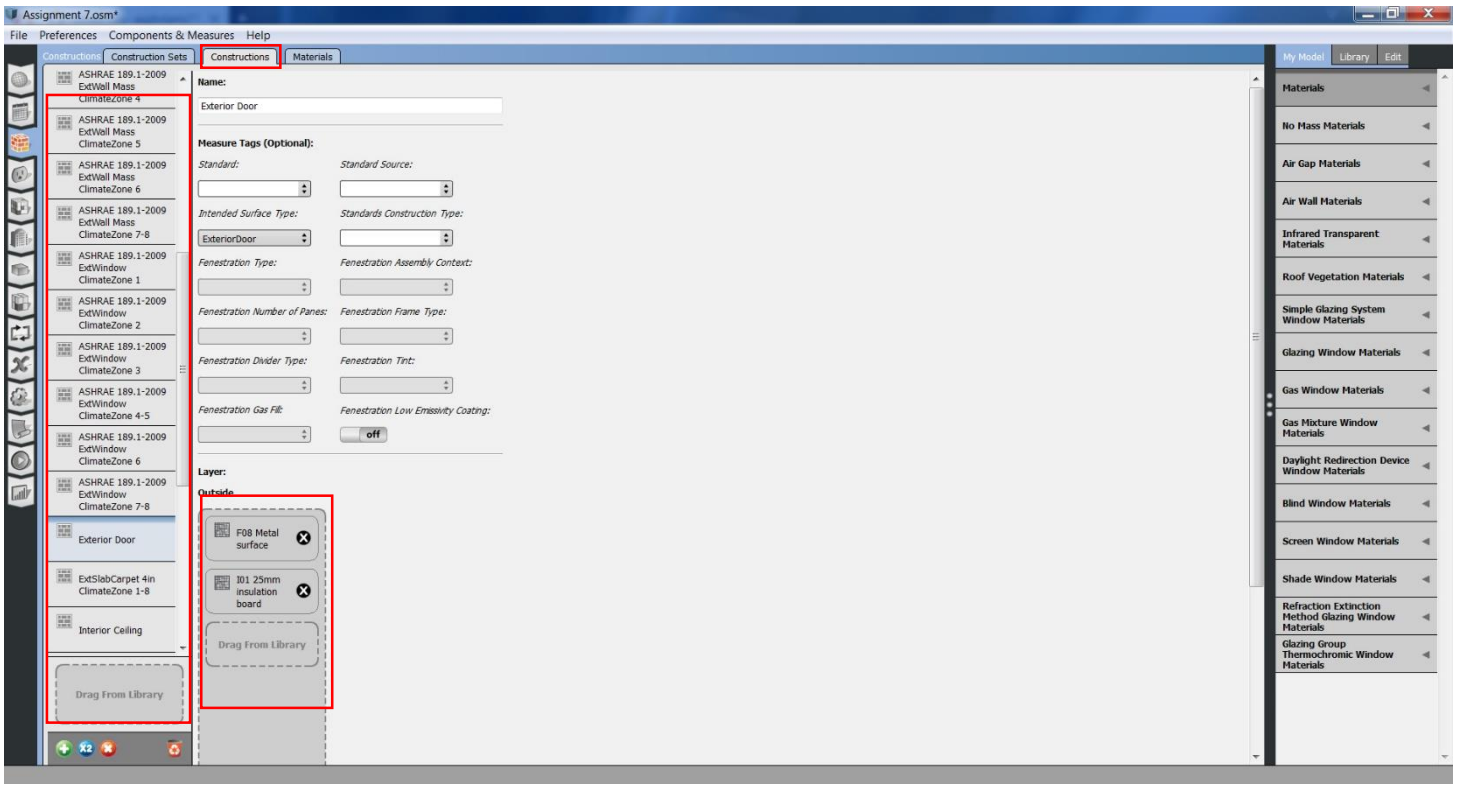
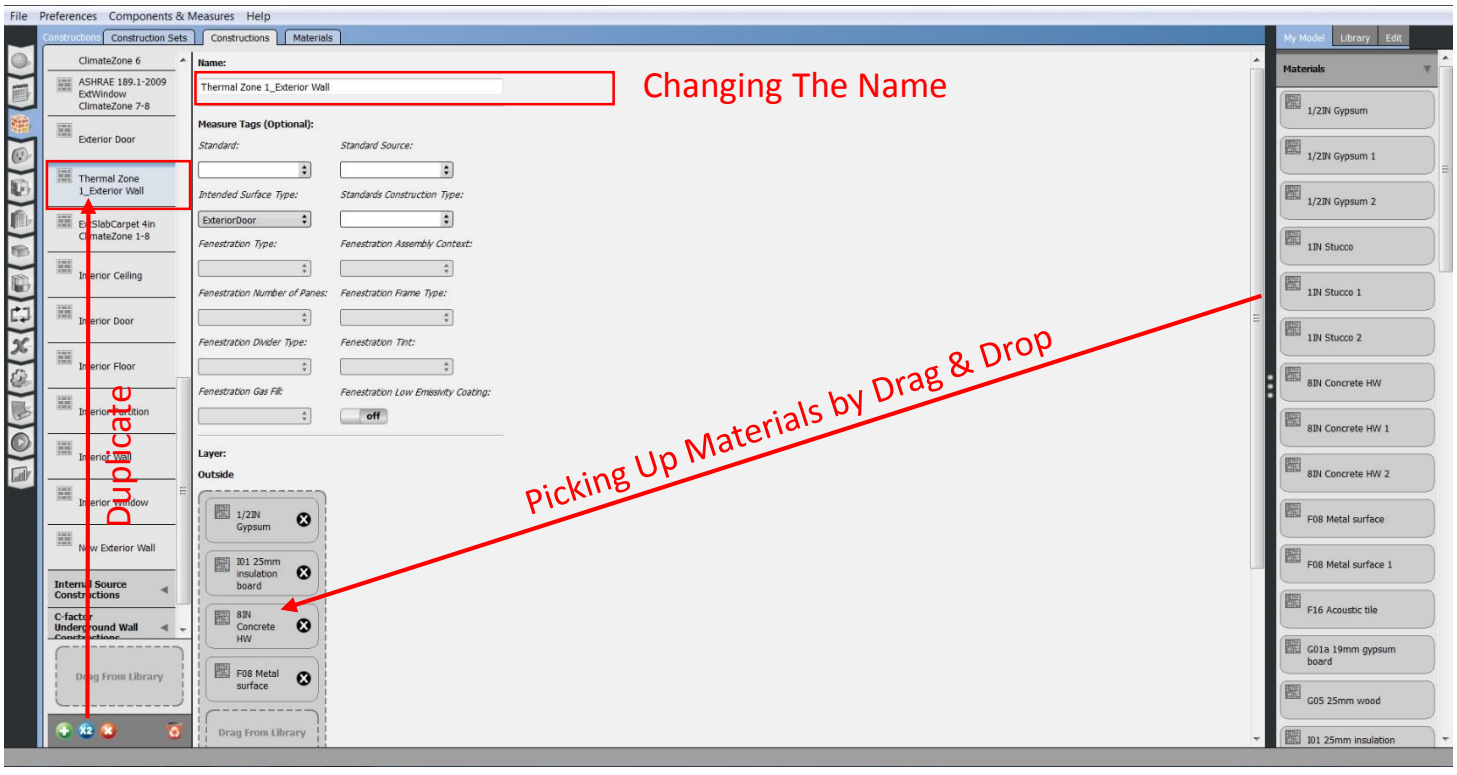
By accessing the second tab "**Constructions**", we can modify one of the existing layers or to define a new one which creates our surfaces. The order starts from the outside layer towards the last one inside.



We can do this again by duplicating one of the existing layers and then add the consisting materials from the table on the right.



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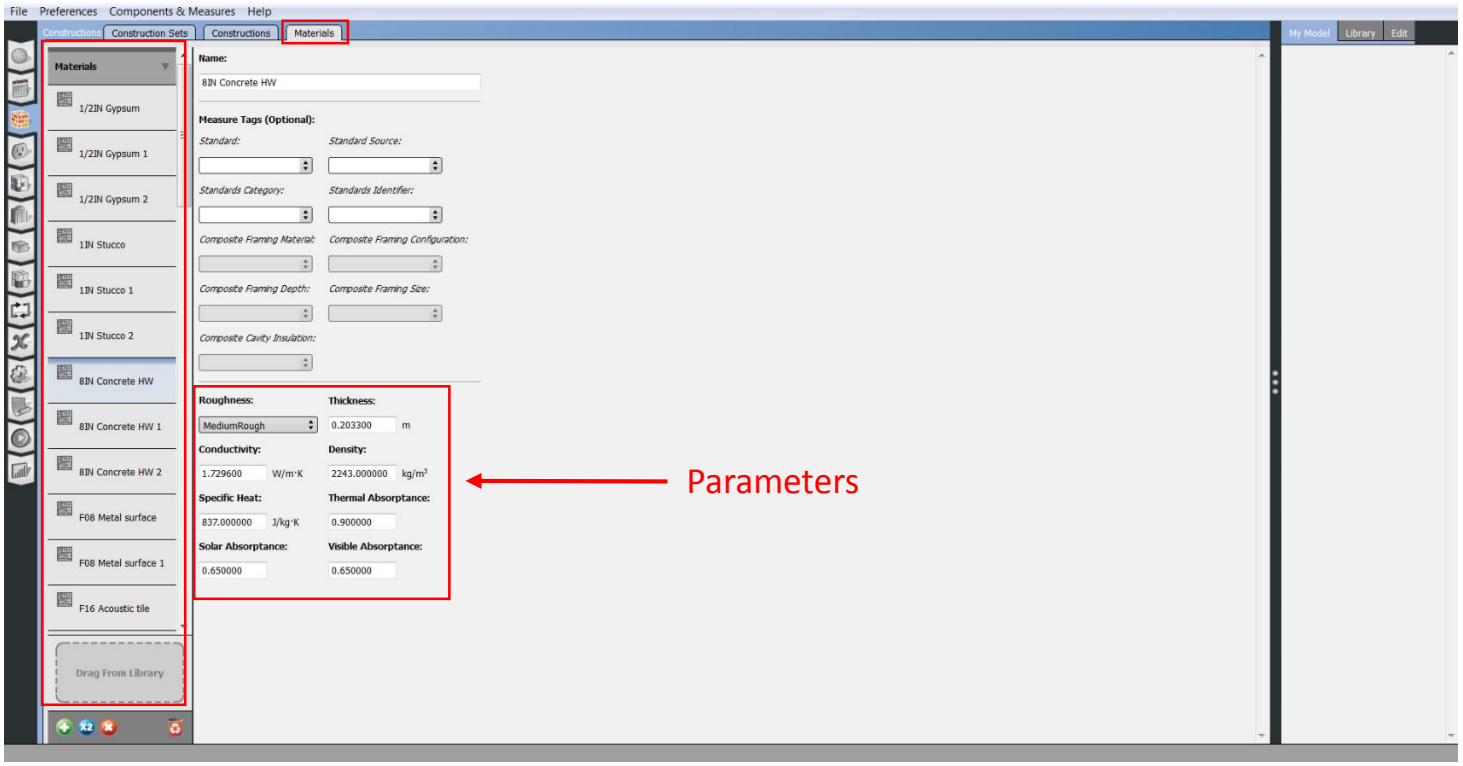
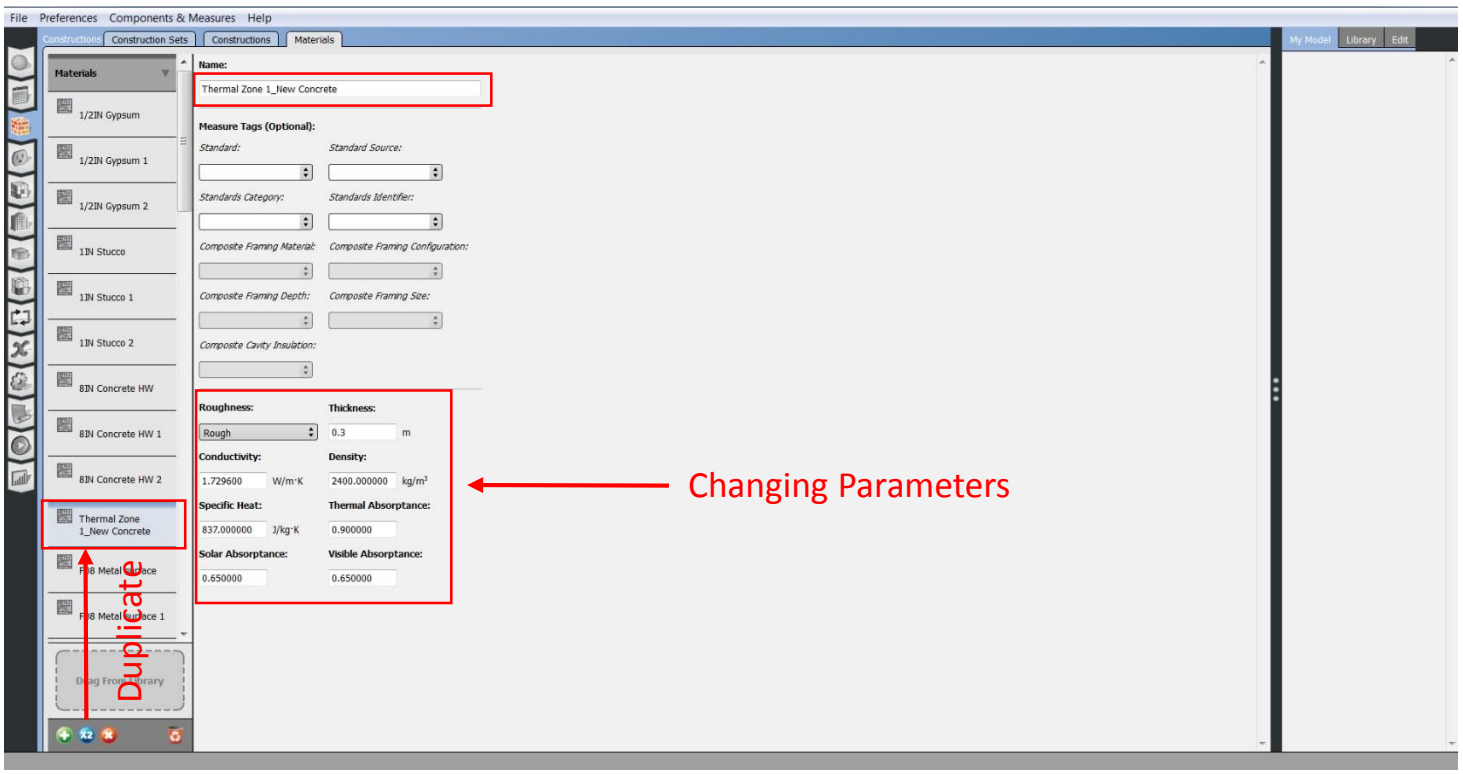
In the last tab "**Materials**", we can modify the parameters of the existing defined materials (Thickness, Density and …) or duplicate them and insert our values.





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Now we can insert our modified materials inside our layers and then go back to "**Construction Sets** ", and drag our data to our final set.