

Sustainable Architecture
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Lecture - 52
Whole Building Performance - II

Good morning, welcome back to the second lecture for the ongoing online course of Sustainable Architecture where in this week we are discussing about the Whole Building simulation software and how to assess the Whole Building Performance. So, in yesterday's lecture just to summarize we had discussed how to create a new file, how to import DXF and I did not mention it yesterday, but if you do not have the DXF you can also bring in the PDF file and you can create the building out of a PDF also.

But as I had mentioned yesterday and I will mention it today again that try to make the DXF as easy and as simple as possible without multiple layers. Especially in case of baseline building base case building we do not need to bring in the fenestration details, because it is going to be taken as a uniformly divided fenestration on all the sides. So, we do not really require any of those details in a base case DXF.

So, we learned how to import the DXF, we also learned how to create a building a new building. I advise that you try choosing different options. So, here I showed you only the extruded building. So, it is a simple building where there are straight walls and straight roof, but you should try using the sloped walls, you should try using the dome and that is how you can really explore that what all different types of buildings you can create.

Due to limitation of time I cannot really go and explore all the options with you. But I would really encourage you to be experimental with the software, there is no harm. And in fact, this is the best time when you can learn doing that.

In addition to that we also saw how to change the weather data, how to choose the location and also how to choose how to change the orientation. So, for base case building we will be simulating with 4 different orientations and then averaging out the performance to get the baseline building performance. So, that is mandatory as per the ECBC and ASHRAE 90.1 both.

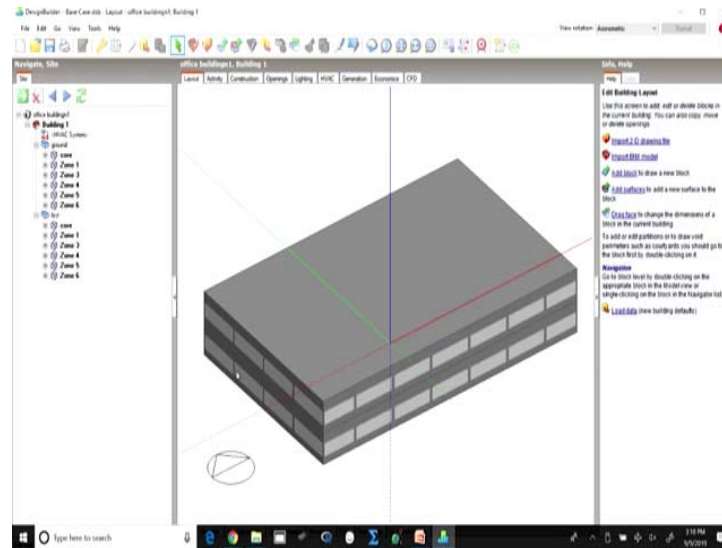
So, this is what we did yesterday and today once we have this building and we have already divided the different zones. What we would be doing is looking at the activities which are going to be performed in this building. Now activities and the human factors are very important and they change the actual consumption of electricity from what has been simulated even when all other parameters remain the same. It is simply because how occupants use the building.

So, we may have the lighting controls on, yet we might have manual overrides where the occupants turn on the artificial lights and the real data on site after the building has been constructed and occupied might vary from the simulation data. However, we are not going to compare the base case or even propose case with that of real building for the compliance purposes.

For compliance we will only be comparing the base case with the propose case. So, what we will be doing is we will be proposing a set of activities and we will be giving the input parameters for the base case and the same activity schedules we will be keeping the same as that in proposed building. So, this activity template and schedule will remain the same. So, we are assuming that whichever way the occupants are going to use building base is going to be the same as they are going to be using the proposed building.

Thereby understanding or calculating the energy savings which will come in because of the design of the building, because of the construction materials which are going in the building and because of the active systems like lighting and HVAC which are going to be used in the building, but not really the occupancy which is going to be taken as common. So, let us go ahead and start working with the software and let us start working on the activity template.

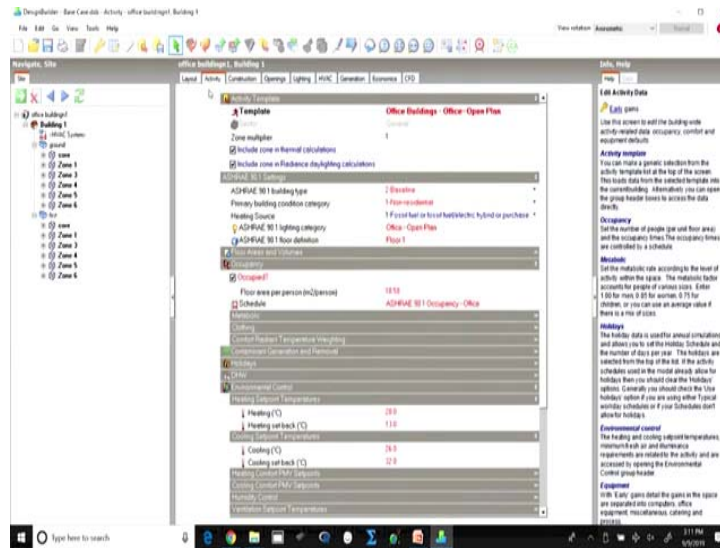
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So, let us switch to the screen now on the design builder screen and go ahead. So, today we are going to start from the same point where we left yesterday. So, I hope you already have your buildings with you, you have already created the geometries. In case you have any problem while working on with the software you can always send me the queries through the communication mode that has already been provided to you by chats or mails. I will be able to respond to you and we will also have an open session where you can ask your queries later.

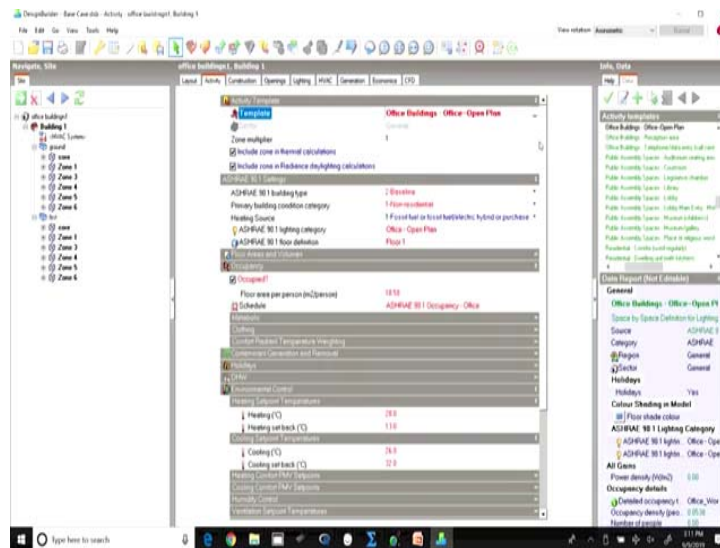
So now we have this building, where yesterday we created this building which was a two floor building it has a core zone and it has perimeter zones and the same is repeated on the upper floor. So, if you remember we have taken the default template of ASHRAE 90.1 using which the default values are already there. Now let us see each one of these tabs and understand what are the possibilities what are the changes that we can bring in.

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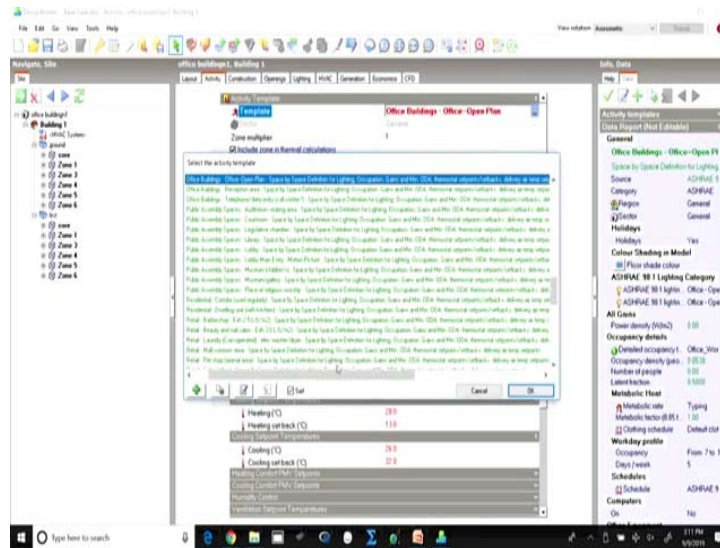


So, if we look at the activity template. Now what kind of building this is will determine what kind of template we should be choosing. So, this building is an office building a commercial building an open plan office building.

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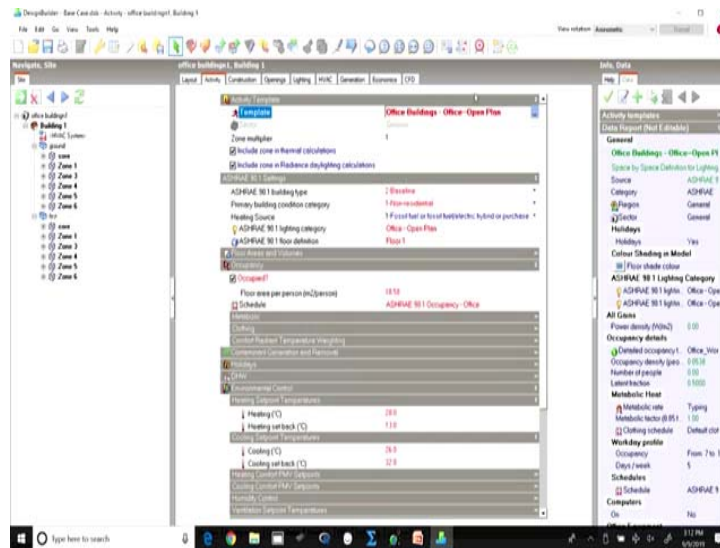


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So, we can choose some other different types of activity schedules as well. So, within office buildings we have the open plan, we have reception area. In case it is a large office building where different zones are there that can also be checked. However, in this one the large portion is the office building open office plan.

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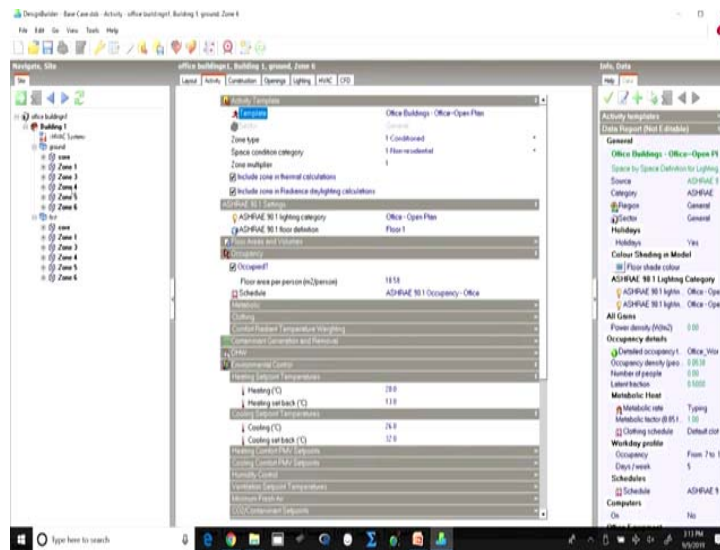


So, we have selected the same and the moment we select this a lot of things here they come as a default. Now if we look at this building, this is the default which is percolated passed on to each of these zones. If we want to change anything in an individual zone,

we can go to that particular zone and then change these values. Otherwise whatever has been defined at the building level will be taken for all the zones as a default.

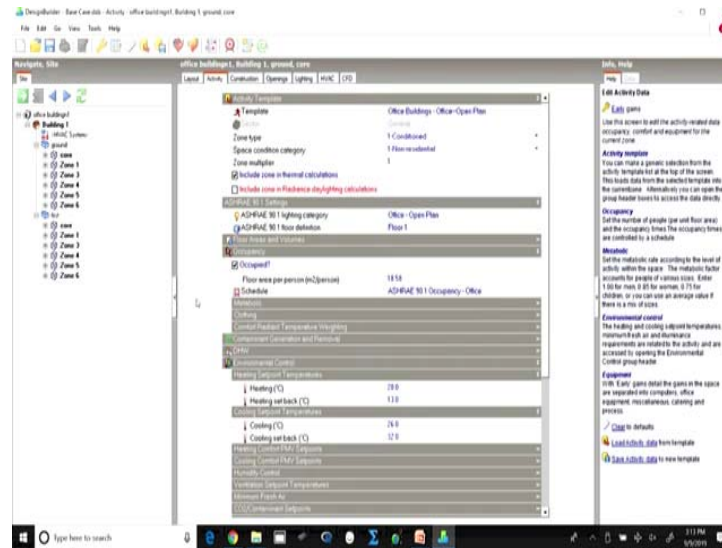
So, here if we see include zone and thermal calculation. So, for now all these zones have been included in thermal calculations, include zone and radiance day lighting calculations, all the zones currently have been included in day lighting calculations. In for compliance to green building rating programs, some zones are excluded from the daylight calculations.

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In that case some of such zones so suppose zone 6 or suppose say core zone. If you do not want to include the core zone in the daylight calculations, we may just check off this box however here we will retain it as it is.

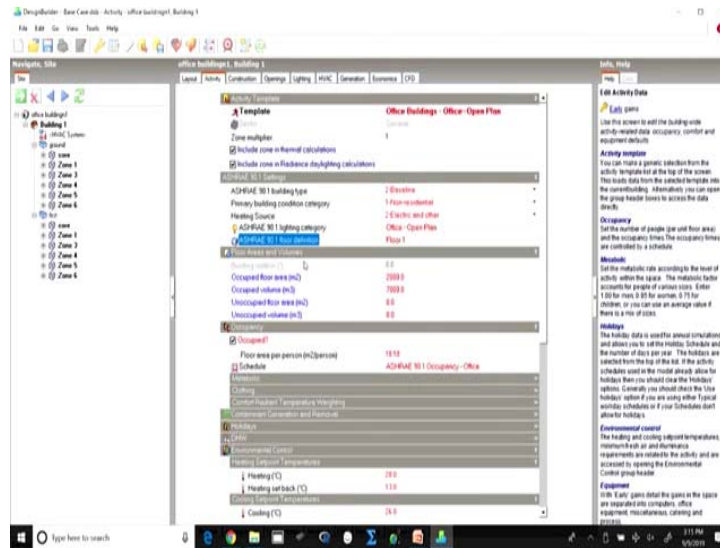
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Also if you see the moment I went to this core zone and I changed this, all others appear to come in blue which imply that these are the default values. While the one that we change will start appearing in red, clearly indicating that this is a value different from the rest of the building or whatever has been defined at the building level.

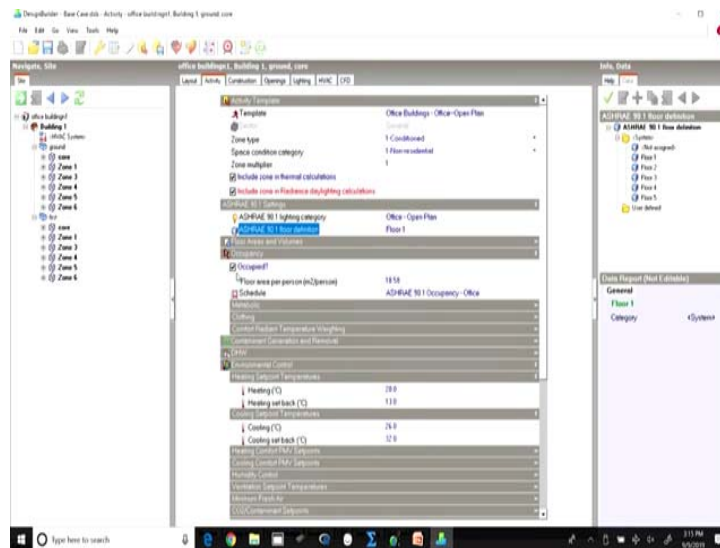
So, here we are talking about the building level currently and these are the templates. So, we already know that we have selected the ASHRAE 90.1 baseline building and it is a non residential building that we have taken. Here the heating source is purchased electricity, purchased heating. So, usually it is like that if you want to change it to electricity which is how in New Delhi it will be. So, we can change the heating source to electric and other.

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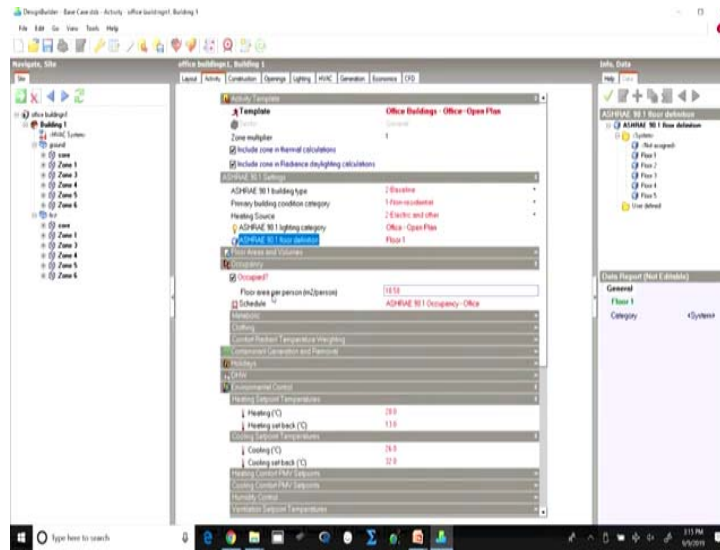


So, the lighting category which is by default available here is open plan lighting category, floor areas and volumes are directly calculated based upon the geometry. We do not have to change this we do not have to modify it.

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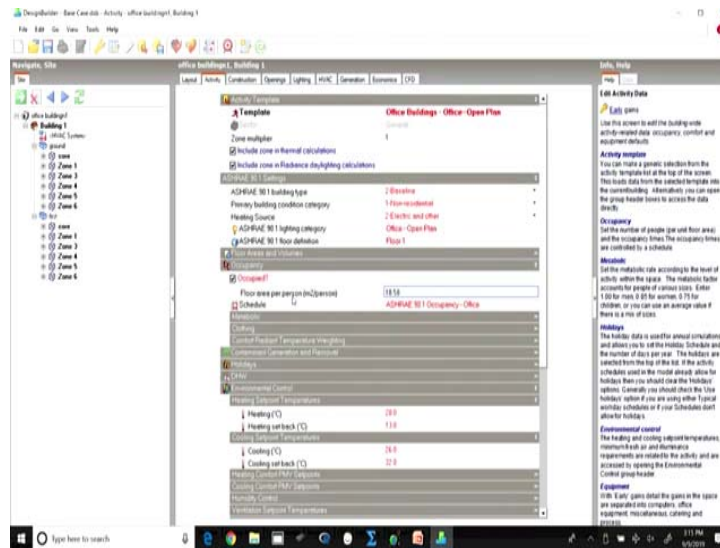


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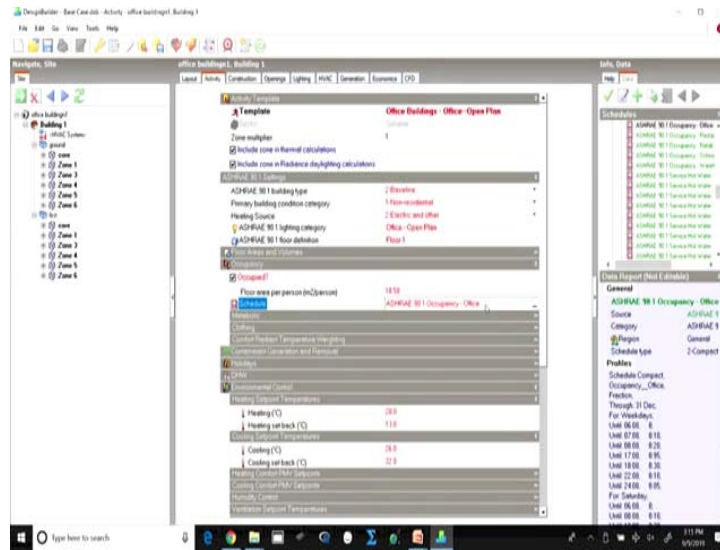
We can change the occupancy currently suppose the core zone is an unoccupied zone we may change it to an unoccupied one. However, normally most of the zones in a building would remain occupied. Now, the floor area per person density is again taken as default from the template that is coming here.

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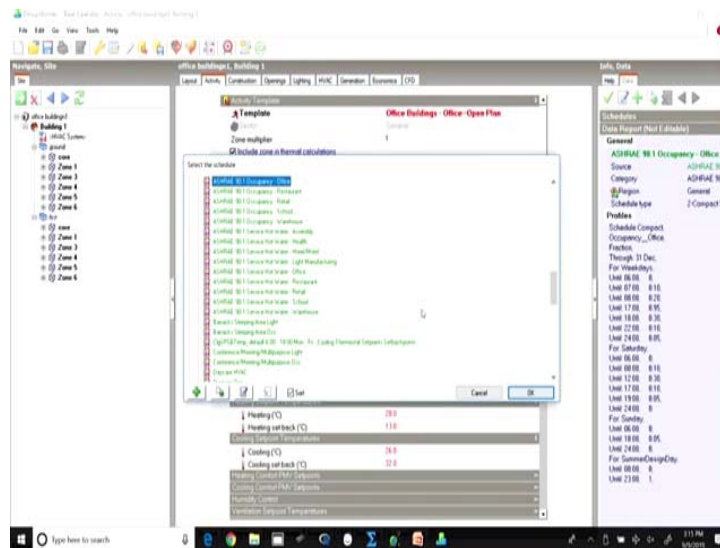


However if we know the floor area per person the density we can change it to bring in those values.

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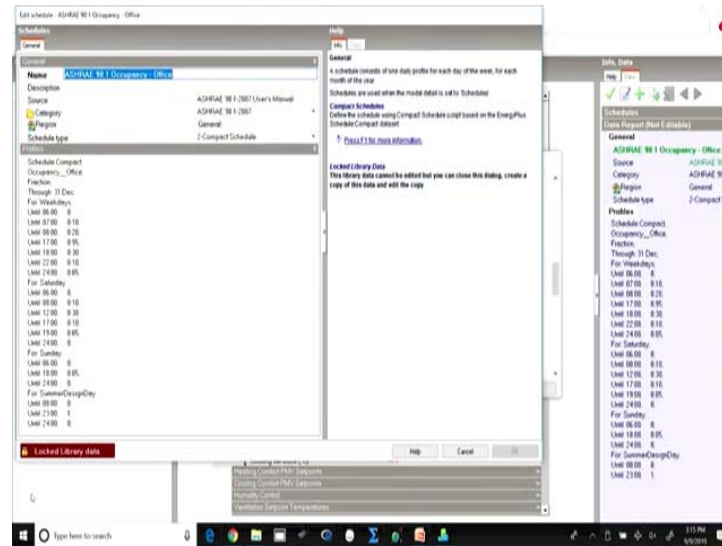


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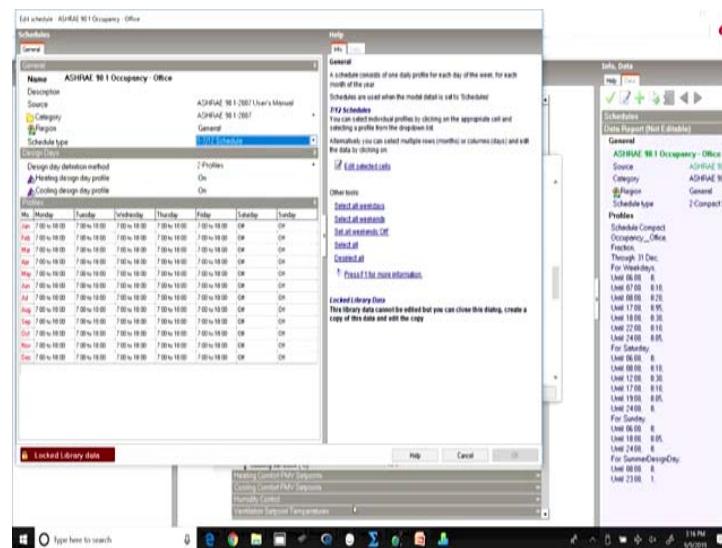


Now, the occupancy schedule which is taken here is also the default schedule which is ASHRAE 90.1 occupancy for office.

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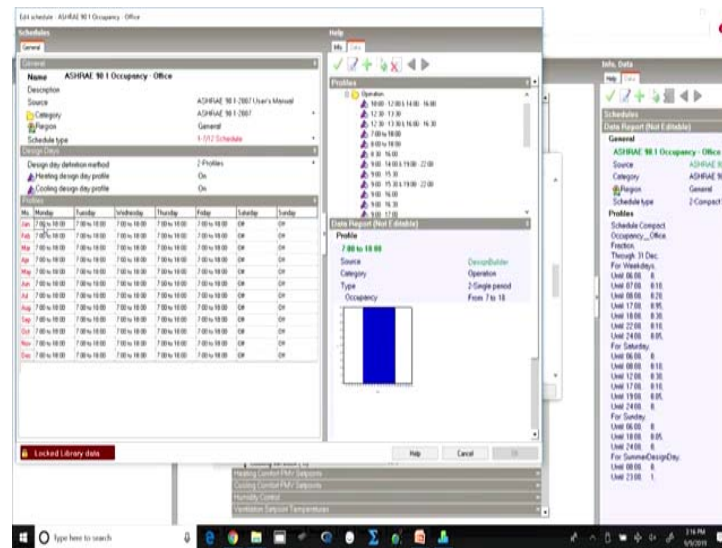


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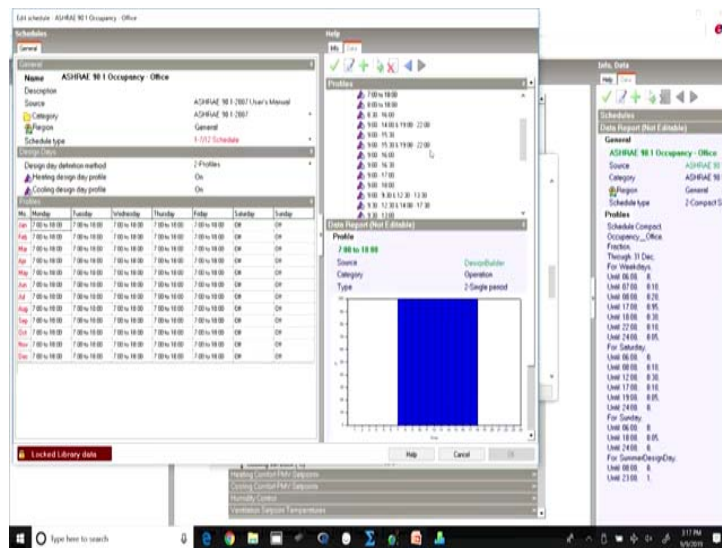
If you want to create let us look at this schedule here.

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So, if we look at this schedule which is taken here it is a 5 day week morning 7 to evening 6 is the schedule and Saturdays and Sundays have been taken as off. And for each one if we look at this schedule it is 100 percent occupancy for the defined duration from morning 7 until evening 6 it is taken as 100 percent occupancy.

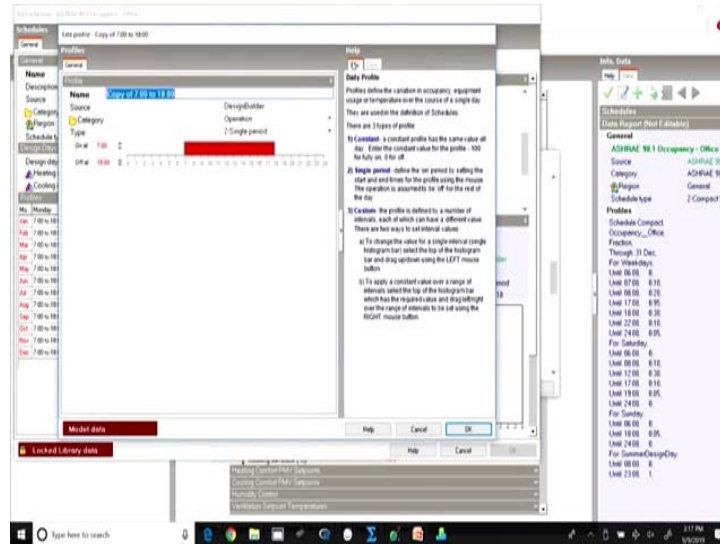
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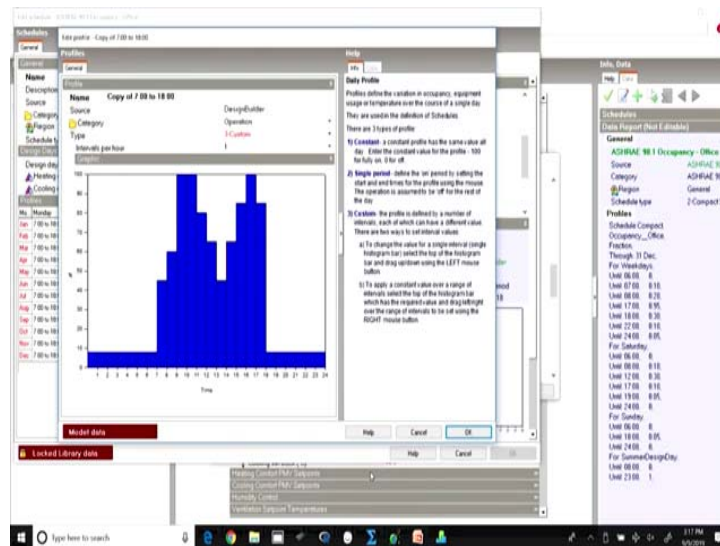
Now, if we want to edit it, first of all these are all logged library data's which are available as default templates. If we want to create our own template we just simply copy it, the copied file you can rename. So, suppose this is office New Delhi occupancy

schedule that we create and this one we can select and edit. The moment we start editing it.

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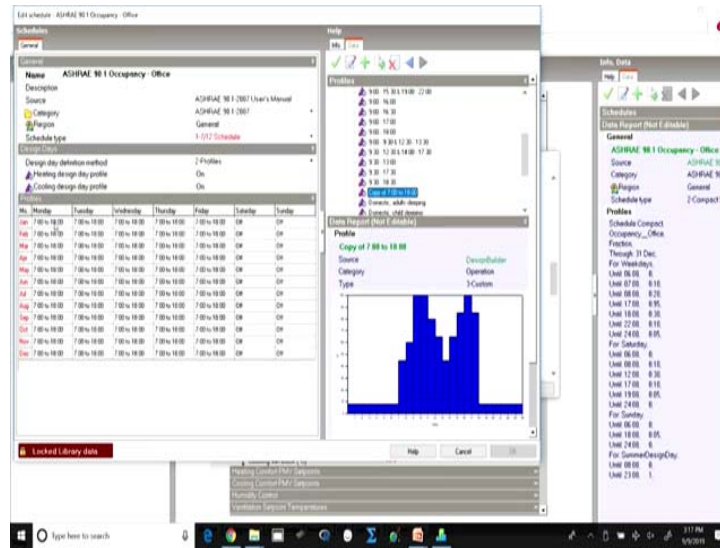
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We can define so currently for all the 24 hours of the day it is taking as the same occupancy, here we can change this data by changing the occupancy hour wise.

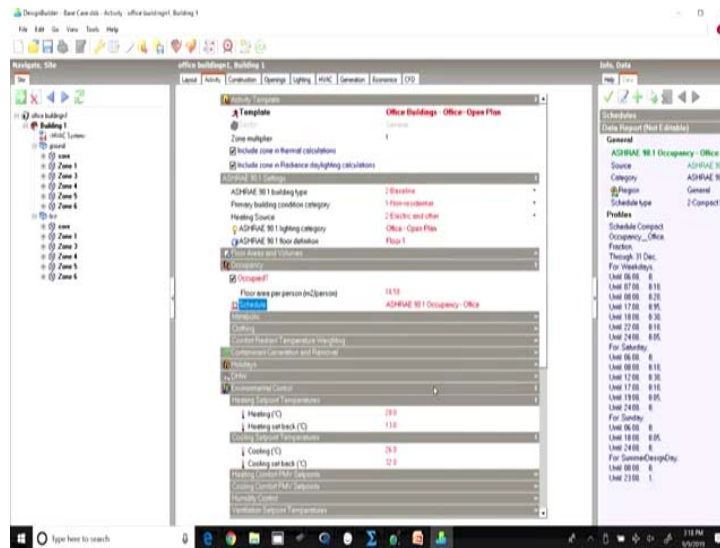
So, depending upon whatever your schedule is you can create a schedule for yourself and save it and use the same here.

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So, we can change the schedules depending upon the occupancy. So, this has been changed to the new schedule that we have defined and it can be copied to the rest of the days and weeks as well. This is how we can define the schedules here for the base case, we are retaining the same schedule as has been given.

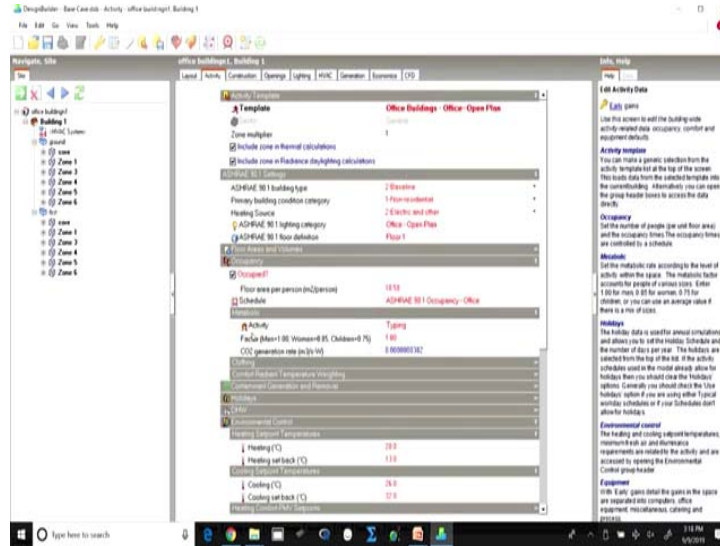
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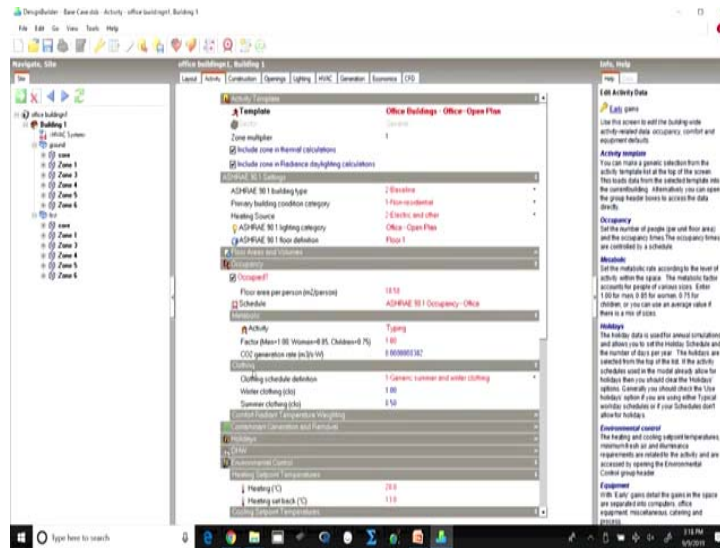
However the density and schedule whatever is changed for defining the base case in our case will have to be retained as the same in the proposed case. So, it would not make

much of a difference, but it will bring it much closer to the real building. If the actual values of occupancy and the occupancy zone schedule is followed.

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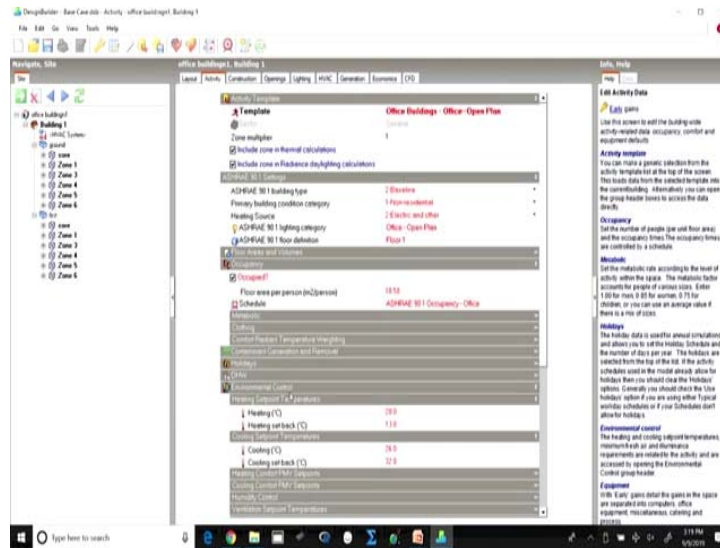


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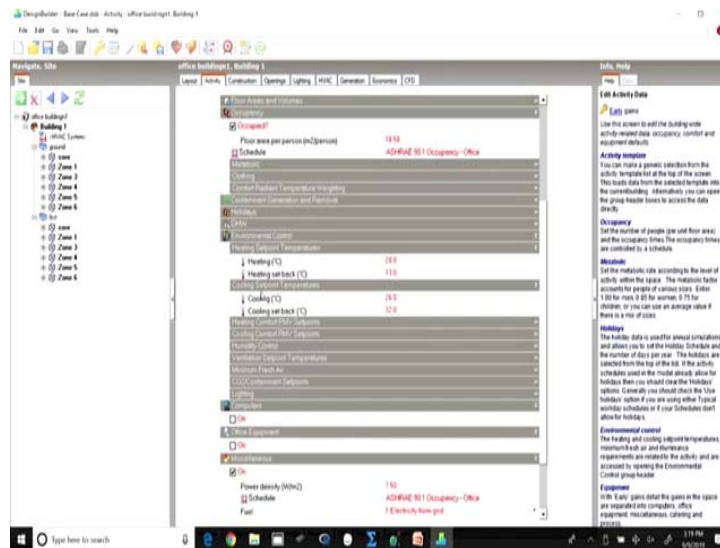


We will keep the metabolic rates and the values for clothing as default values, because these are directly related. These are directly attached with the templates of these buildings. So, the metabolic rate depending upon the activity in an office building is taken as default and also the clothing.

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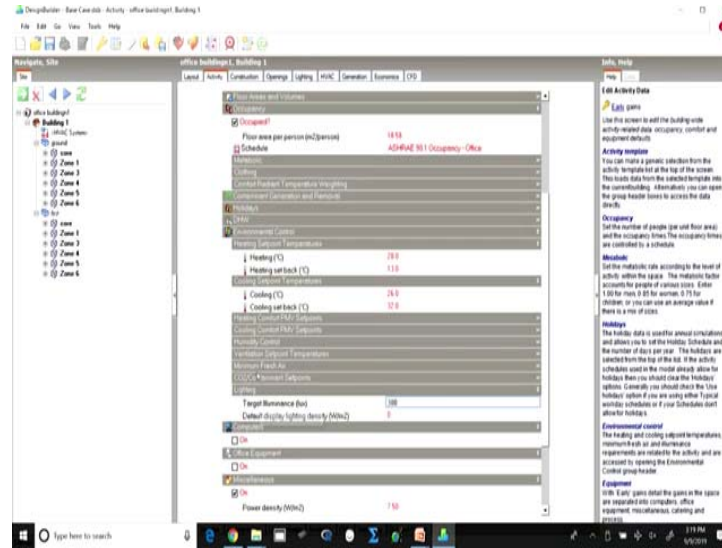


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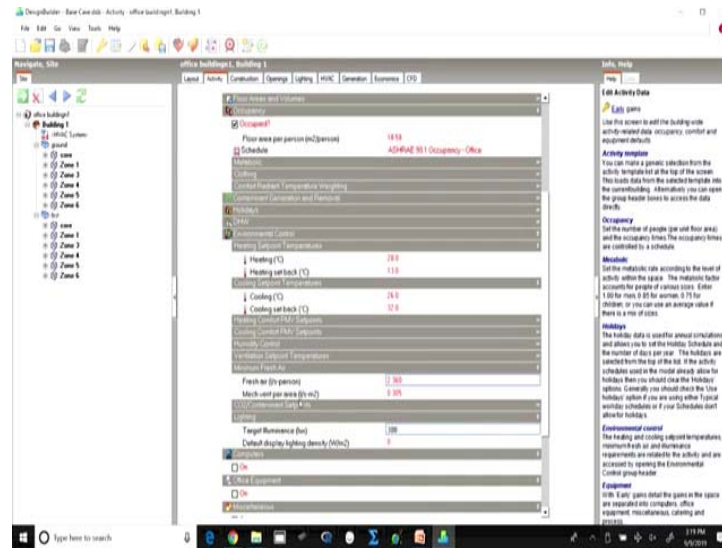
If you look at these environmental controls, we can change the set point temperatures for heating as well as cooling. So, the cooling set point as well as the set back can be changed. However, these default values keep in mind the ASHRAE comfort conditions and they take these values from ASHRAE 55. So, for the base case we should not be changing these values and we keep the set point temperatures and the set back temperatures as the same.

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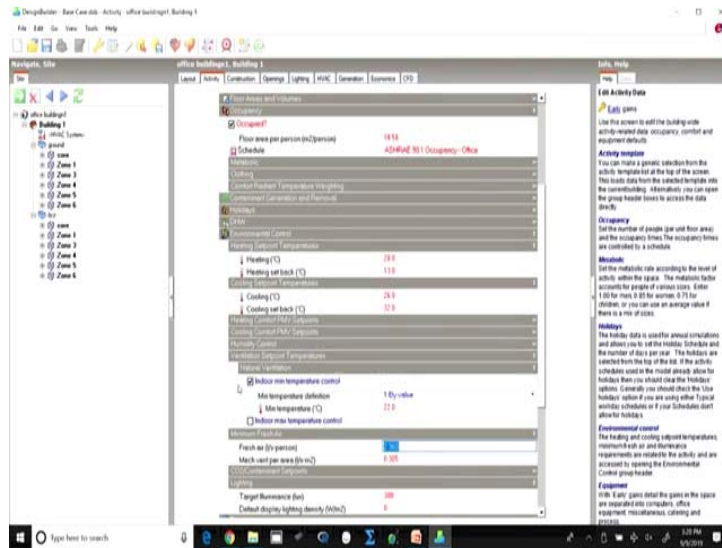
Same as for lighting, so here the target luminance has been taken as 300 lux which is what NBC also defines. So, 300 lux for an office building is the default target luminance.

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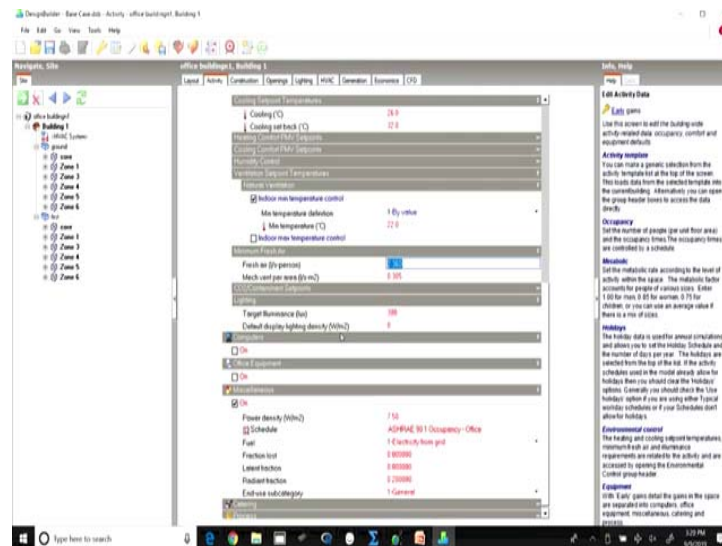
For the minimum fresh air which is like fresh air per person which has been defined. In case we have different values given in our codes NBC, we can define these values as well.

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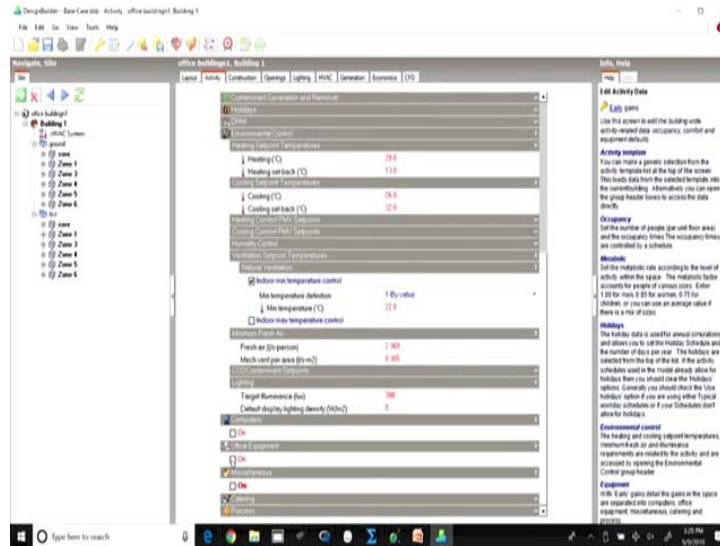
For ventilation set point it will come into picture only when the natural ventilation has been enabled. In this case we are taking an air conditioned building fully air conditioned and when we will move on to the HVAC template, then we will see that whatever value we define here will really not make much of a difference or it will not make any difference, simply because the building has been assumed to be an air conditioned building.

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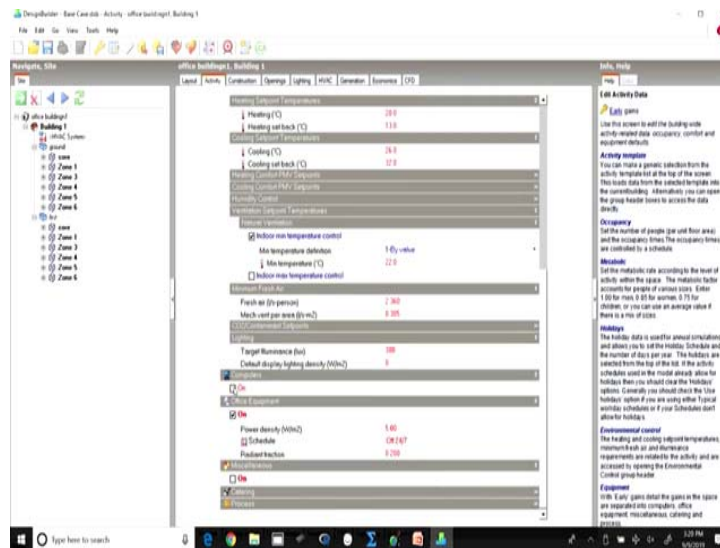


Now, by default if we look at the office load ah. So, there are three different components there is miscellaneous load on power.

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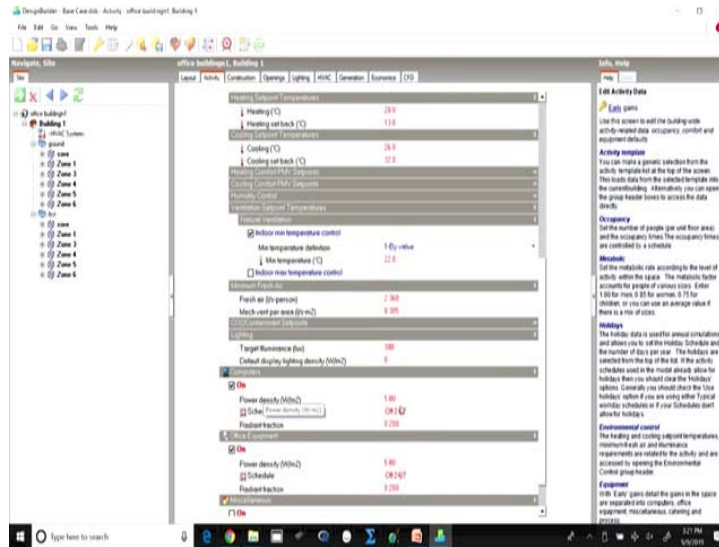


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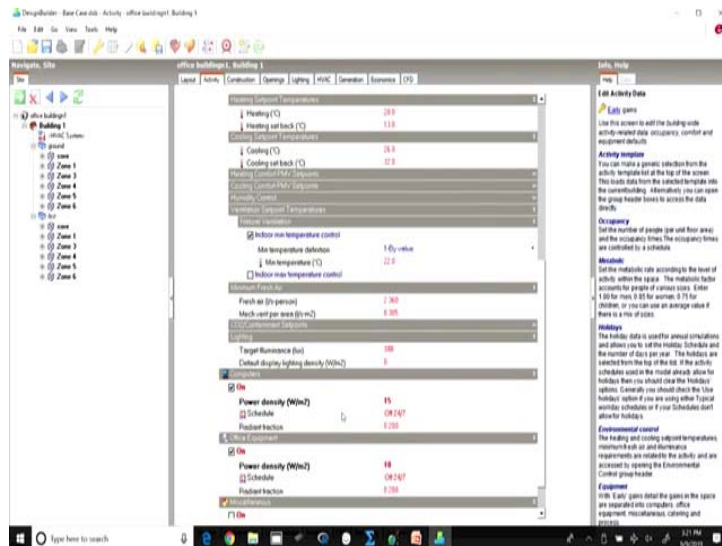
So, suppose I turn it off and I have office equipment on and I may also have computers on.

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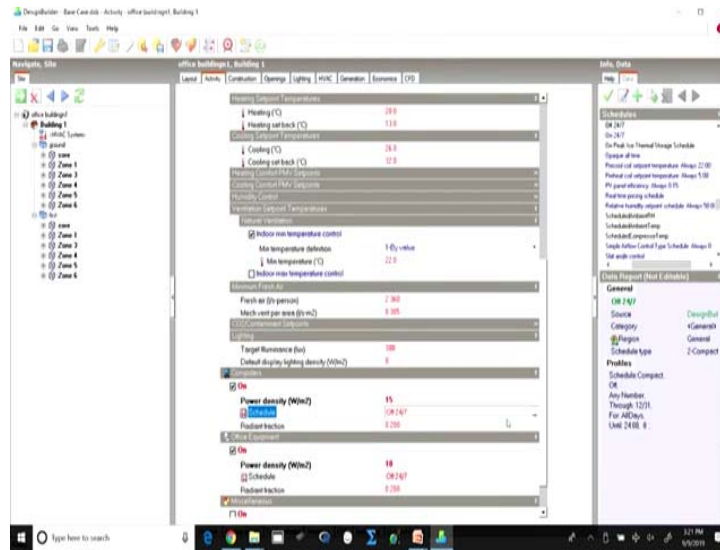


So, together this makes it a load of 10 watts per meter square. However, if we look at a regular office we will have it somewhere between 25 to 30 watts per meter square. So, we may have around 15 watts per meter square as computer and 10 watts per meter square as the office equipment load.

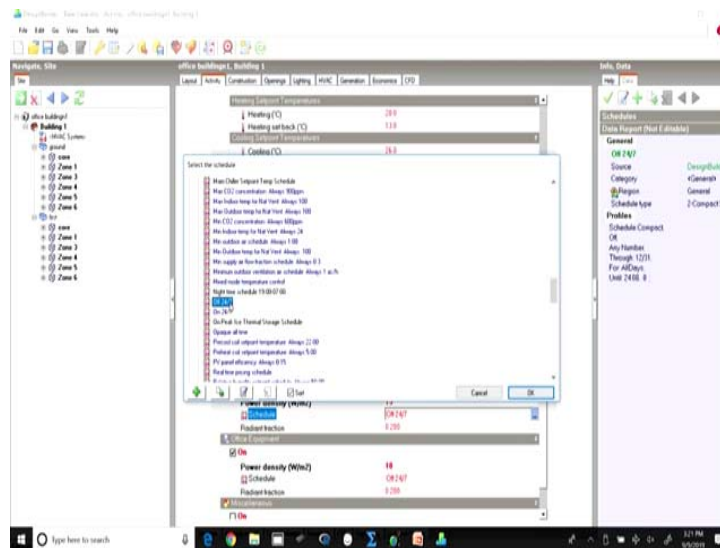
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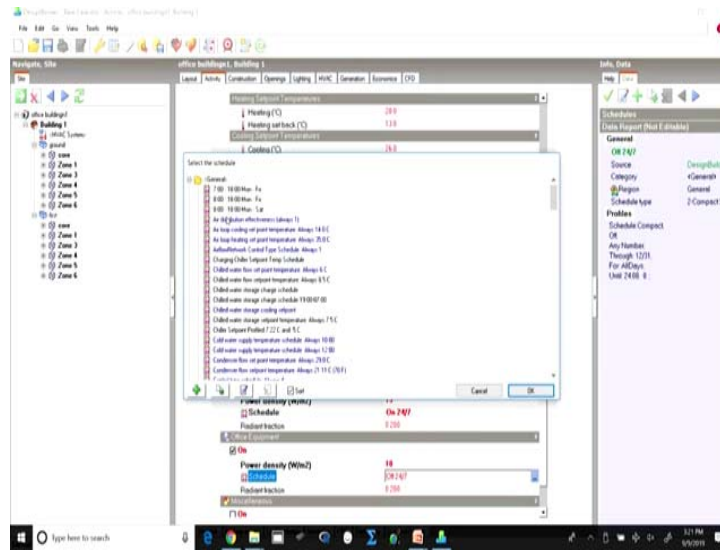


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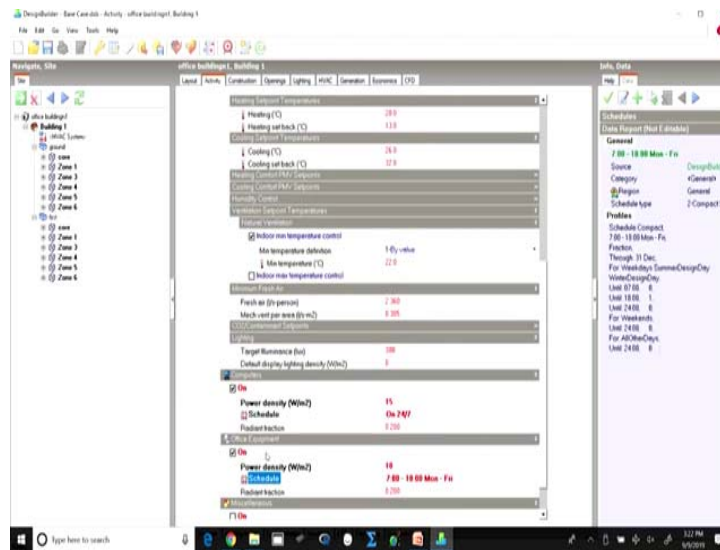
However if you look at the schedule here the schedule has been taken as off24/7. However, we may want to have a different schedule altogether we may have on24/ 7 schedule say for computers.

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We may also have some other schedule as we have created. So, depending upon whatever schedule you want we can pick up the schedule. So, it is 7 to morning 7 to 6 Monday to Friday 8 to 6 Monday to Saturday or we also created a copy.

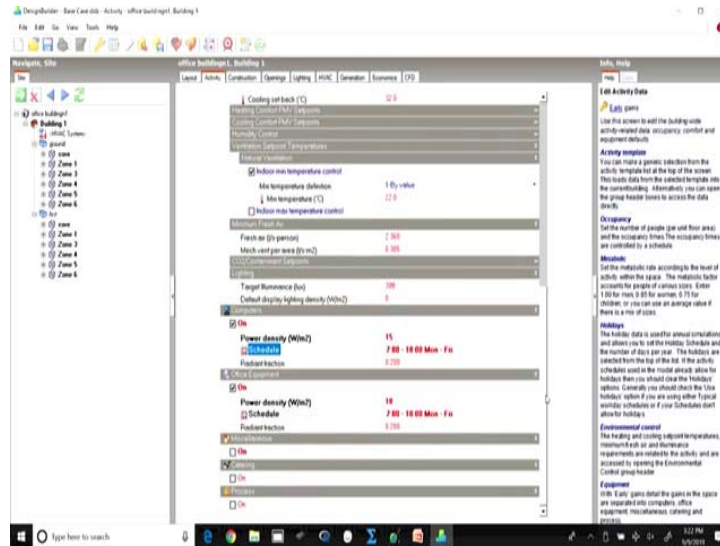
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So that was in occupancy schedule, so this is a different schedule but however, suppose I select this one. So, the office equipment will be on from Monday to Friday from morning 7 to 6 is what it means. The computers suppose we want to change it to the same schedule, so we can select from the already available schedules or we could also create

our own templates. If you have miscellaneous you could have miscellaneous loads on the catering and the processed loads.

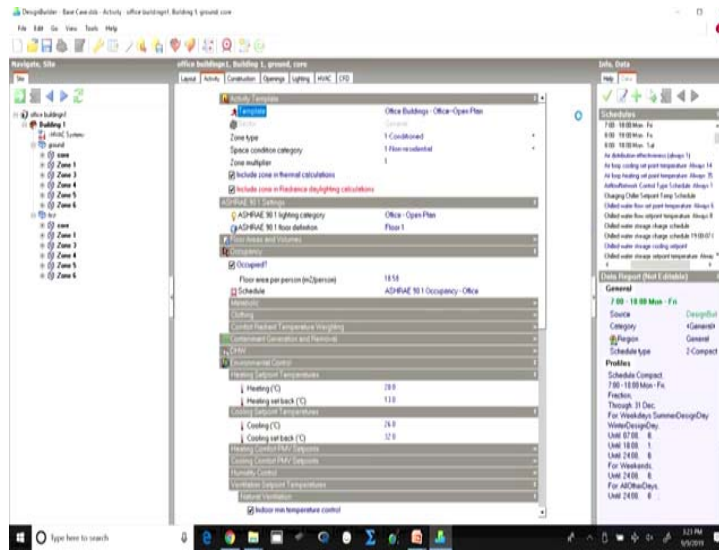
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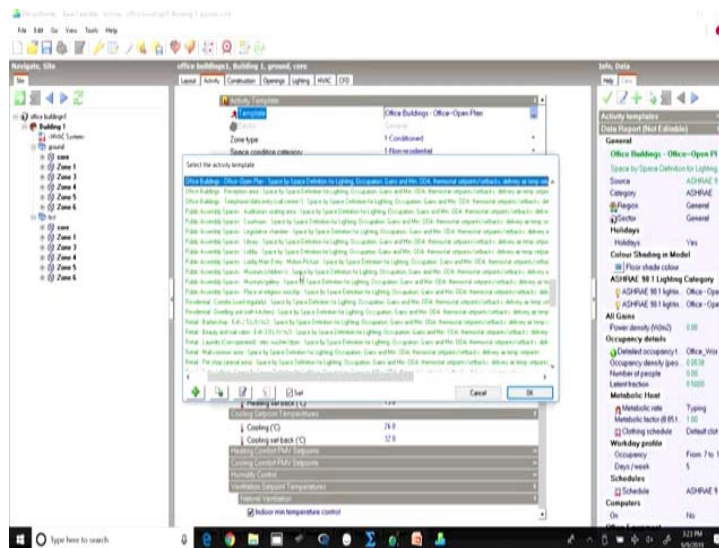
So, since it is an office building there is no process load or miscellaneous load, the load which could possibly be there we have already incorporated it in. So, this was about the activity for an office building. Now here we must save. In case we are creating a different template we must name and save the template because the activity template will have to remain same in both base case and proposed case, no changes in the activity the occupancy schedule the density are permitted from base case to the proposed case.

So, whatever is used here will have to be kept exactly the same in proposed case is what we have to ensure. So, with this we have already defined the activity. So, we have already defined the activity for the office building, now this activity schedule which has been defined here and all other details are at the building level.

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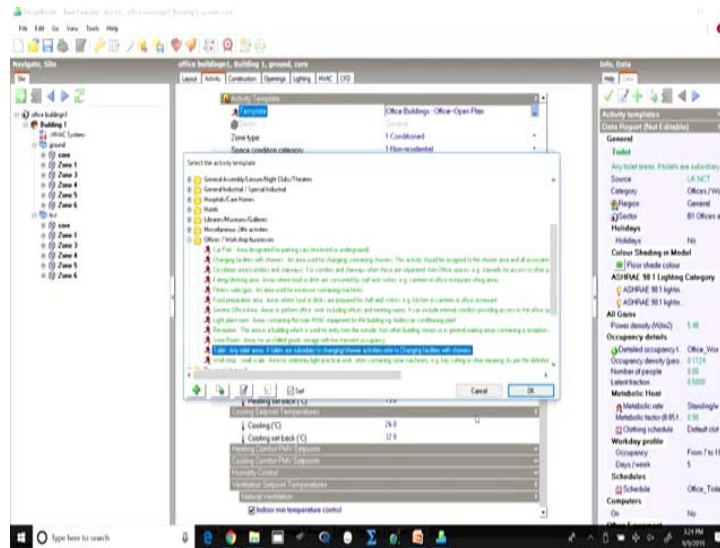


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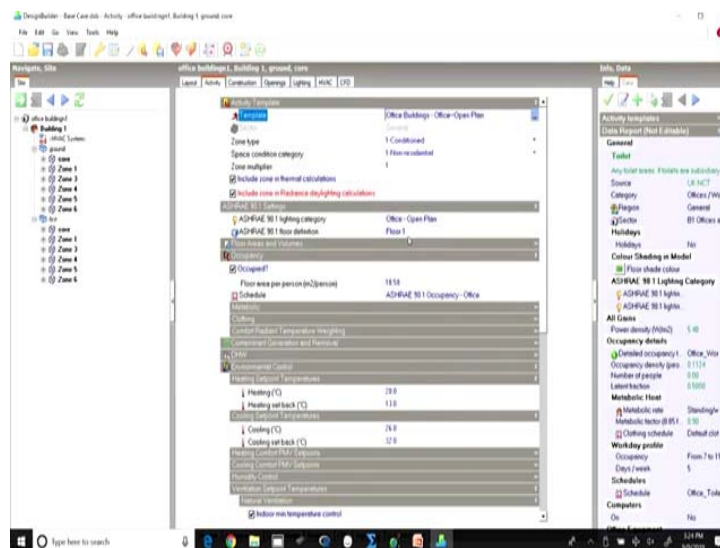


Suppose we go to the core zone. Now this is not an office open office plan, we may change it to some other areas. So, we can select a different template here. So, if we go to the office buildings and we select the toilet area.

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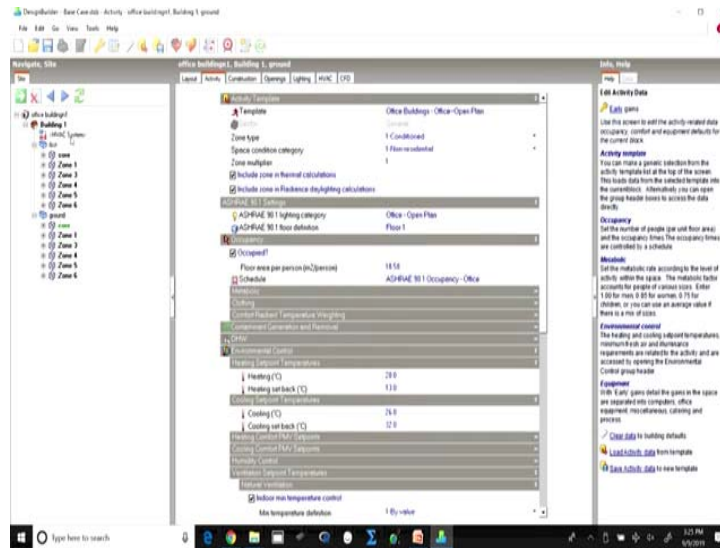


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So, this is the template which I have selected for the core zone of this building, automatically we can see that some changes have come.

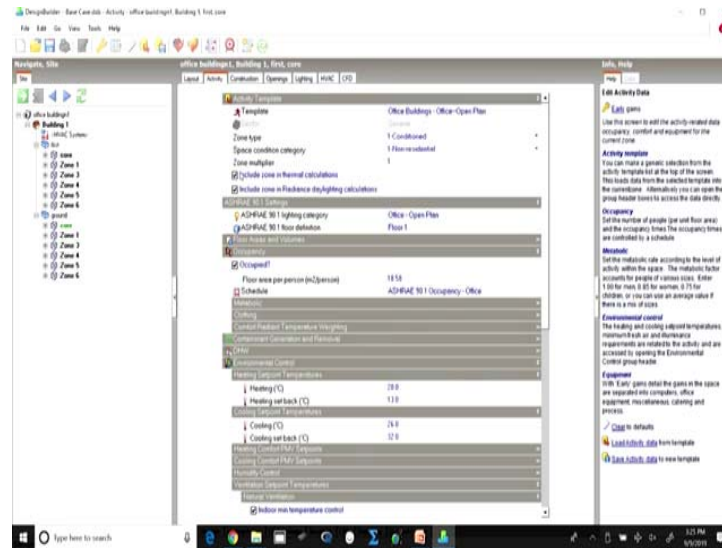
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So, the occupancy has changed the schedule has changed the schedule is now office toilet. The zone type is still taken as condition while we can change it to the unconditioned zone. However, we can keep it ventilated there may be ventilation made available. So, depending upon your design you can select these options.

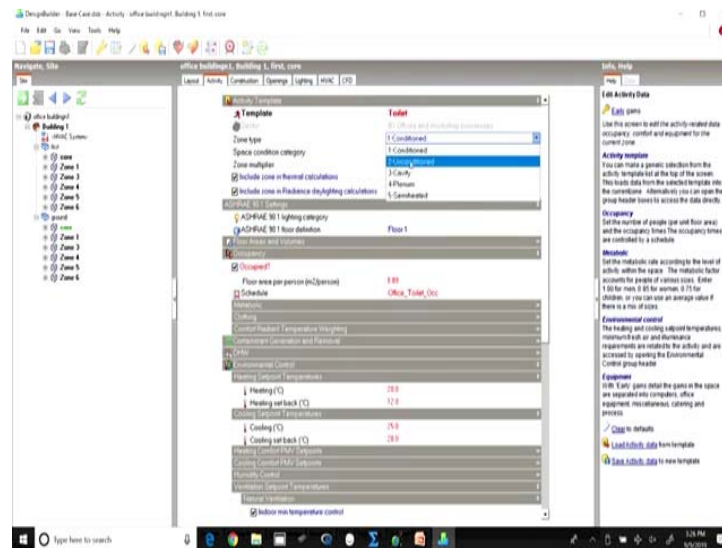
Even when it is not conditioned, but it is ventilated we will include the zone in thermal calculations. Here we may want to include the zone in day lighting calculations as we were seeing earlier or we may not want to. So, depending upon the requirement of your building you may change that. Now let us go back and look at this first floor, if you see the first floor still has the default values which we define at the building level and the ground floor also has the default values.

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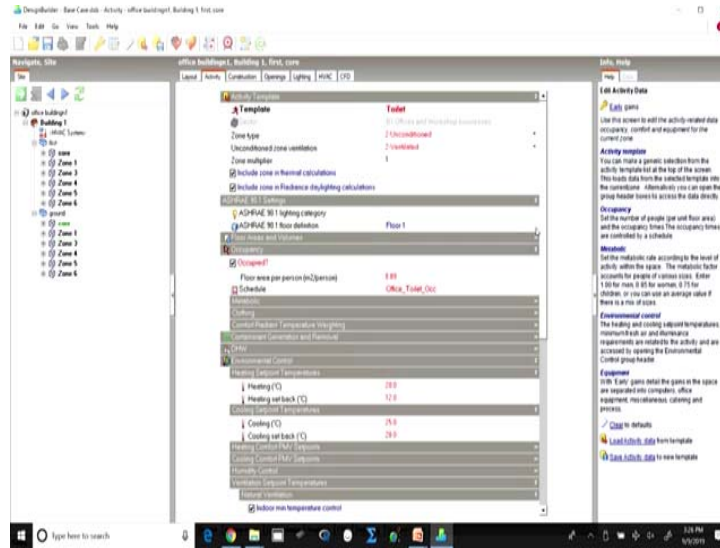


Now, since we did not change the values in the core of the first floor it still comes to be the same While we change it in the core of ground floor which has come as toilet and unconditioned and ventilated.

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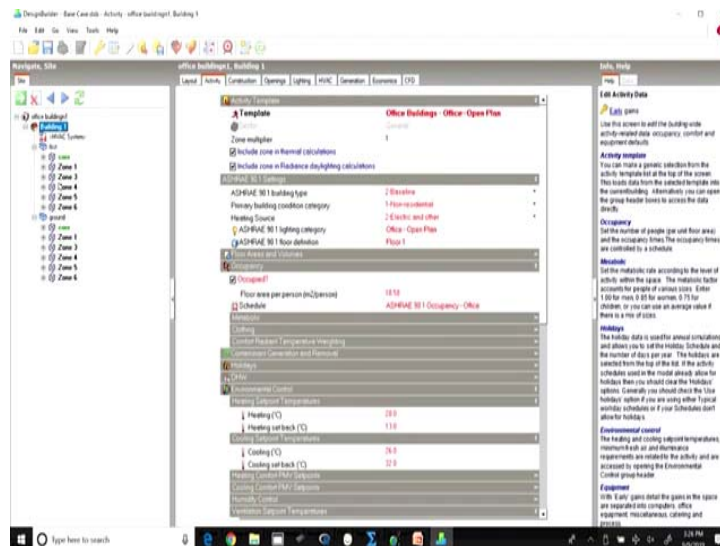
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So, we can change it back to the toilet template, which we can find in the office toilet of office and convert it to the unconditioned and ventilated.

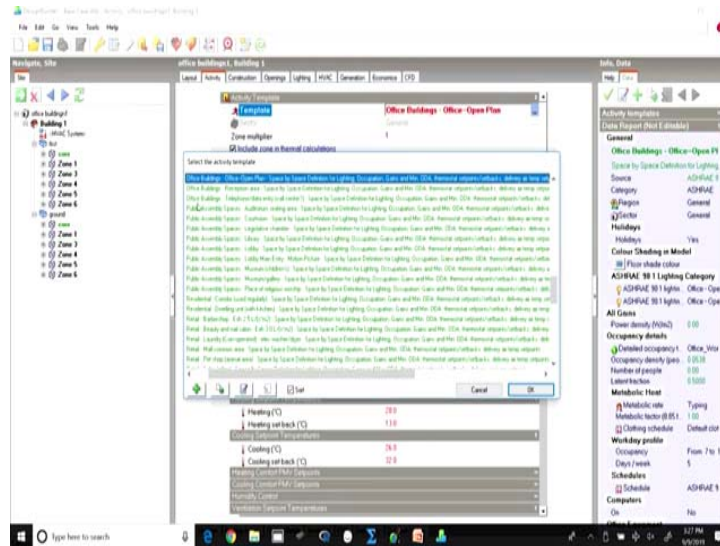
So, this is how we have now defined all the zones whatever changes we needed to make in the activity and we have individually defined all the zones. But again to remind you whatever changes we make at the zone level will never be reflected at the block level or the building level. At the building level and block level the schedules the activity is all these different parameters will have to be defined at the top level.

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However once we have defined we have changed the core / any individual zone, any change made at building level will not be reflected in this particular zone.

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So, suppose I have to again set this core back to what the building level definitions are. Suppose I change it to office buildings not an open plan but say some other plan, in that case this change will not be reflected in the core zone now.

So, we have to define the individual zones only in the end. So, that whatever changes whatever templates are being defined at the building level at the higher level are percolated down to the zone levels to the smallest levels and then we define which go on to change the individual zone level. So, I hope you have already followed what we have done and what we have changed.

It is not necessary that all of you create an office building for this tutorial for this part of the exercise, you can create any type of the building and select any type of schedule and building type and experiment with this data. But you can and you can also define the occupancy and all these parameters here and come back to us if you have any questions.

So, I will stop here for this lecture and in the next lecture I hope that you come prepared and your buildings would already have the geometry and the activity as we have discussed so far. And we will start with the construction templates in the next lecture. So, see you again in the next lecture.

Thank you.