Sustainable Architecture
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Lecture – 60
Whole Building Performance-X

Good morning, welcome to the last lecture of this ongoing online course on Sustainable Architecture and I congratulate you on completing all the lectures of this course and coming to this point where you are attending the last lecture of this course. We have completed whole lot of topics during this course of 60 lectures and today is the last one on Whole Building Performance where we are concluding whatever we have done so far in whole building performance actually.

So, we have completed the whole building performance simulation we have also completed the daylight simulation. And to tell you very honestly the last 9 lectures or rather the last 8 lectures on whole building performance which I have been telling you was more tedious and difficult process. So, today what I am going to tell you is the simpler process which has been made simpler just by virtue of the tool itself. So, what we have done so far is we created a proposed building and we created a baseline building.

We averaged the baseline buildings performance by rotating it to the four different orientations and then we compared the performance of proposed building with that of the average of base building that was for compliance. We also did variation in adding the energy conservation measure to the proposed building and we checked whether it is worth adding a particular energy conservation measure that was for a payback analysis.

We can do a payback analysis through that. If we are only concerned with compliance using green building rating program we can do it very simply using a tool like; this where we can we only need to create a proposed building and baseline building automatically gets generated. So, in today's lecture we are going to see how to create automatically create the Baseline building and how to generate a compliance report to be submitted to different green building rating programs. So, let us switch to the Design Builder screen now and let us see how to create this automatic baseline building baseline model.

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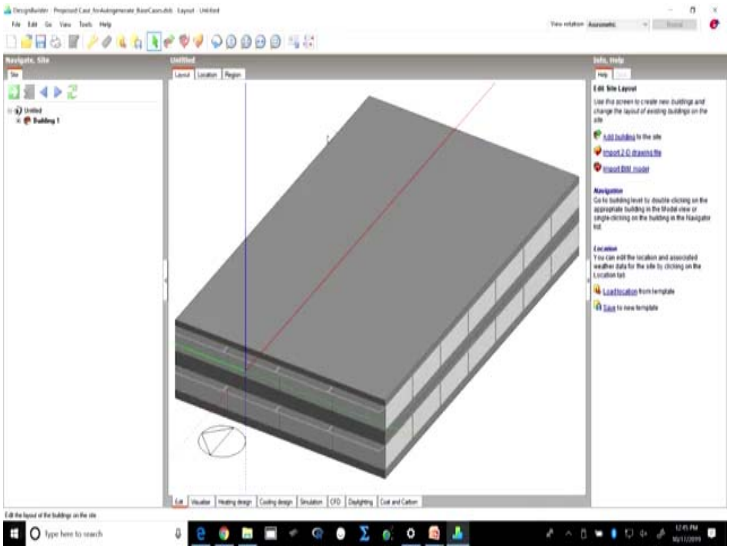

So, we have already completed how do we make the base case, how do we make the propose case and how do we introduce different energy conservation measures, how do we check their performance how do we do the daylight calculation simulations using the software.

So, now these software's are also evolving and the one which we are using here the, one which we have been seeing for the last 10 lectures is Design Builder and there is a very interesting feature which Design Builder's latest version has introduced and this is very easy for us to develop the base cases. So, what we have taken here is the proposed case we have already made all the changes in the proposed case this is the same building. So, we already have the proposed case here.

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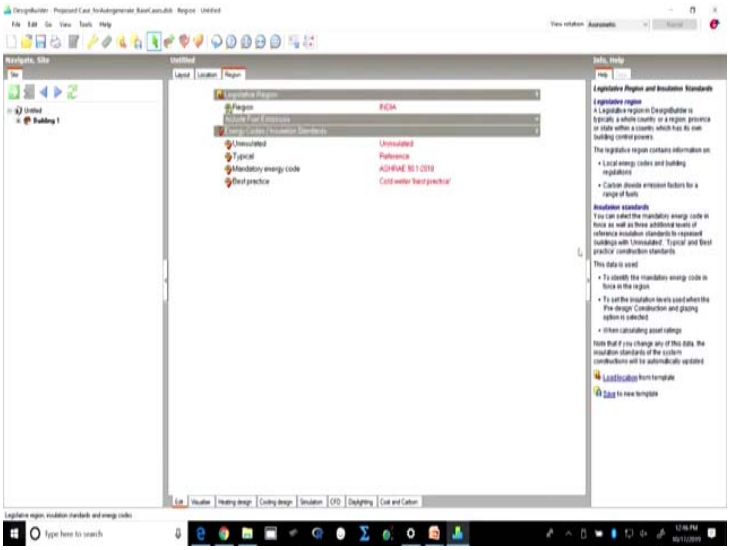

The only thing which we have to do while we are intending to develop a base case out of a proposed case is that when we are starting to create the file we select this mandatory energy code whatever the reference code is. Currently, Design Builder does not have a lot of options given here. So, ASHRAE 90.1 is what the reference code is? Once we have generated the complete proposed case which we have here we select this building and what we have to do here is we have to generate a baseline building.

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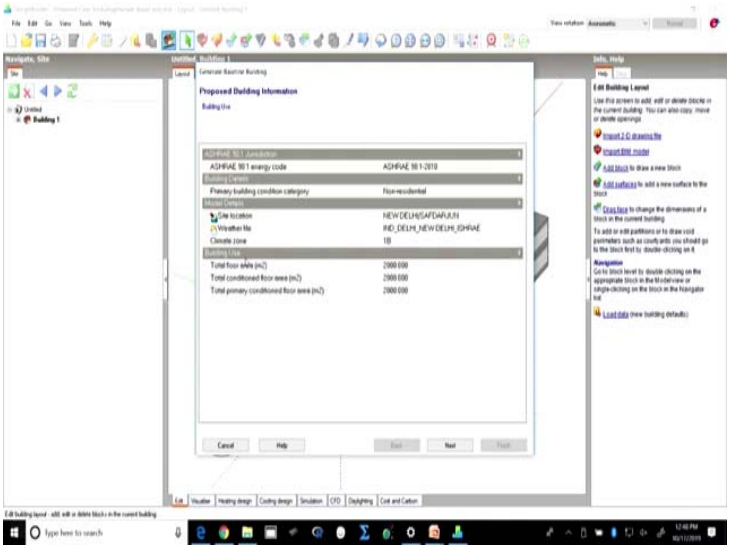

Now, this baseline building will be generated as per the code which is, which has already been selected while creating a new file. So, here in our case we have already selected for ASHRAE 90.1 the Site location which we have taken is New Delhi and it keeps the same floor area, conditioned area, the primary conditioned area. So, it keeps the basic information as the same it develops.

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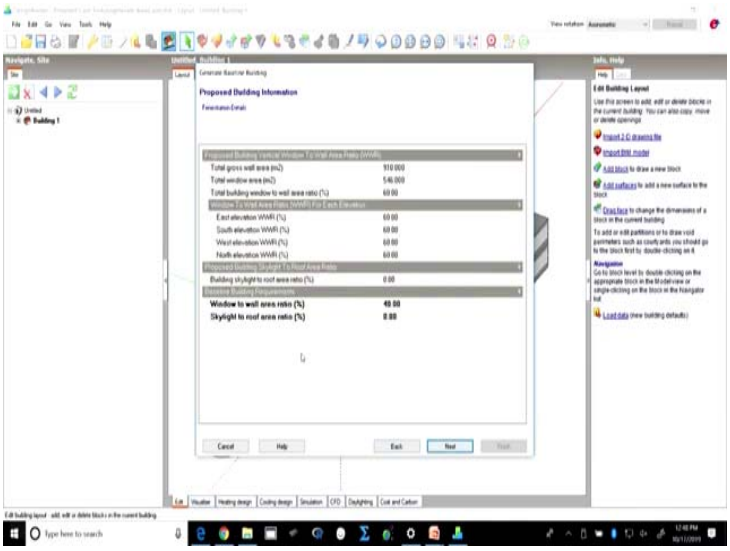

So, if you remember we have the proposed case with 60 percent WWR, but when it generates the base case it is automatically taking the window wall ratio to be 40 percent.

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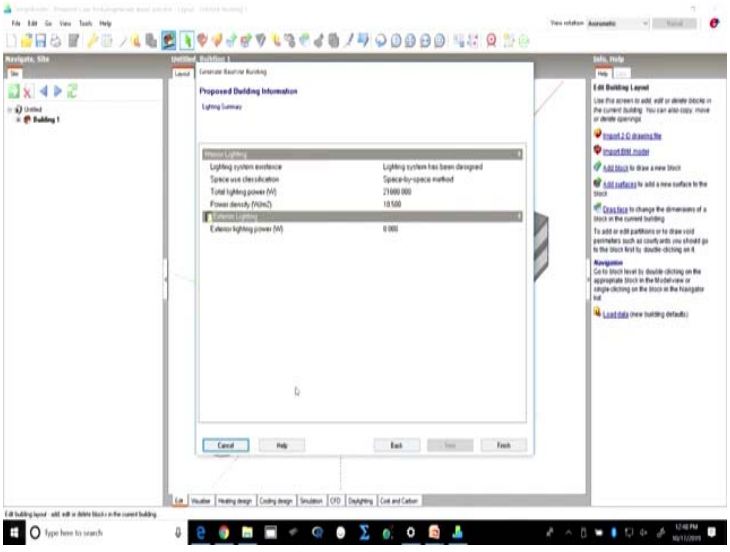

The next it designs the lighting system for us taking the lighting power density and it does it using space use classification. So, the lighting power density here has automatically changed to 10.5 which if you remember in the proposed case we had given to be 7.6.

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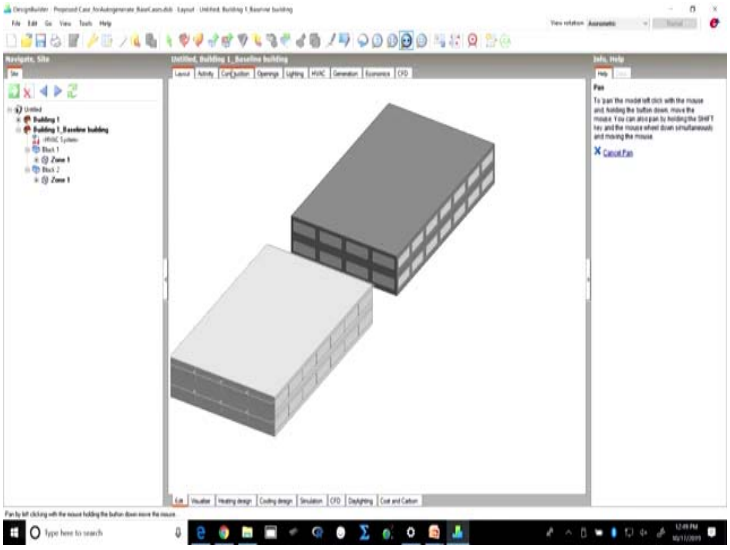

Once we have done that, we create an ASHRAE baseline building which will automatically be added in the same file which besides the same building in the same file. So, once we have this now you can see that it has automatically created a baseline building you can see that in this baseline building there are no shading devices added while in the proposed case we had already added the shading devices in proposed case we had 60 percent WWR while in the base case the WWR has been reduced to 40 percent and not just these.

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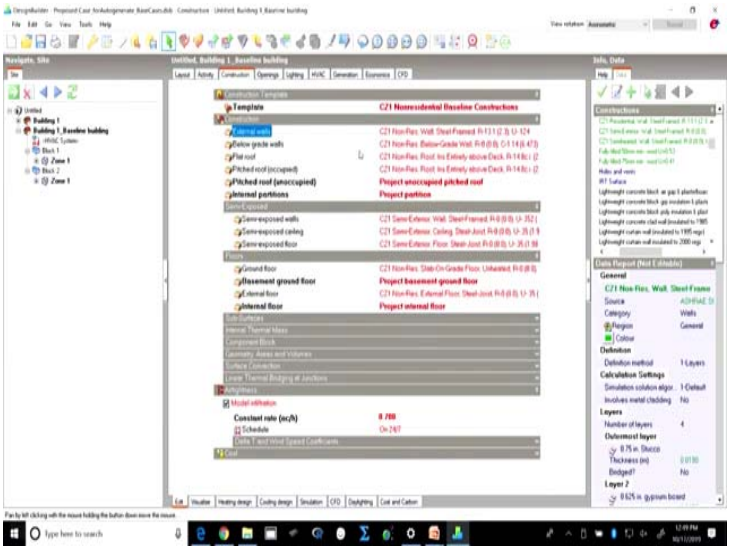

But if we go and check in detail the automatically the specifications for the walls have been changed. If you remember the specification for the external wall the template that we had taken was ECBC wall copy of ECBC wall all of this has been changed to take it directly from ASHRAE 90.1 these specifications which are available prescription, prescriptive values which are available in ASHRAE 90.1.

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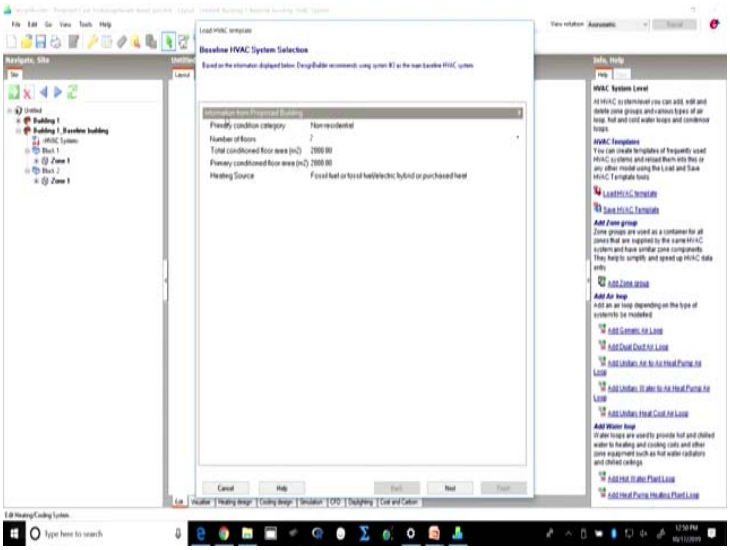

If we look at the HVAC system so, this HVAC system it gives us the information related to the baseline HVAC system and it allows us to select. Here it is from the proposed building automatically coming from the proposed building.

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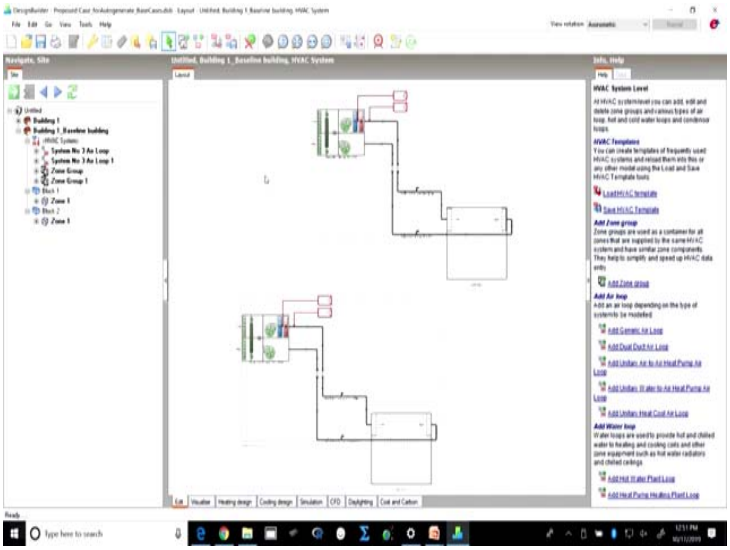

And we select. So, it gives us the default system if you remember while we were creating the base case we had taken the same system as a base case system, which we had selected specifically here it automatically, suggests to us that as per ASHRAE 90.1 this is the HVAC template that we need to take. And once we have done that we finish and it automatically applies the HVAC system to our building. Once we have done that the Baseline building is also available and then we go on to simulate the building.

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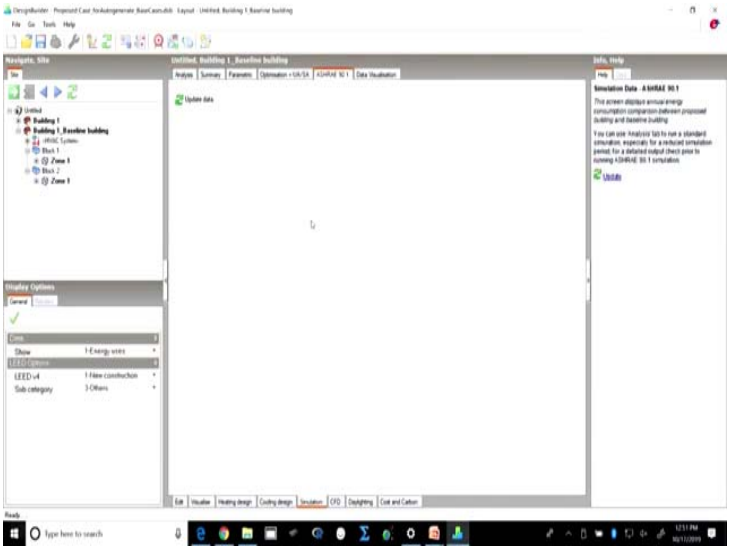

So, we simulate it for the annual. So, we simulate it for a year for a complete year and we go to the ASHRAE 90.1 calculations here and we update the data.

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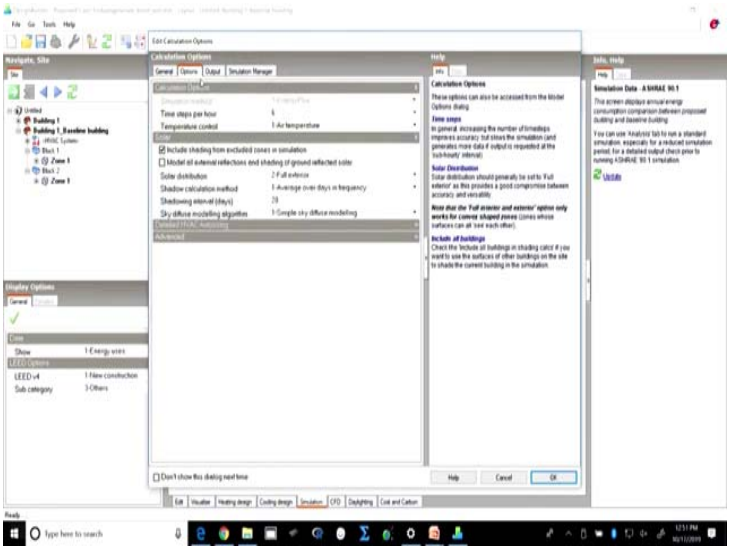

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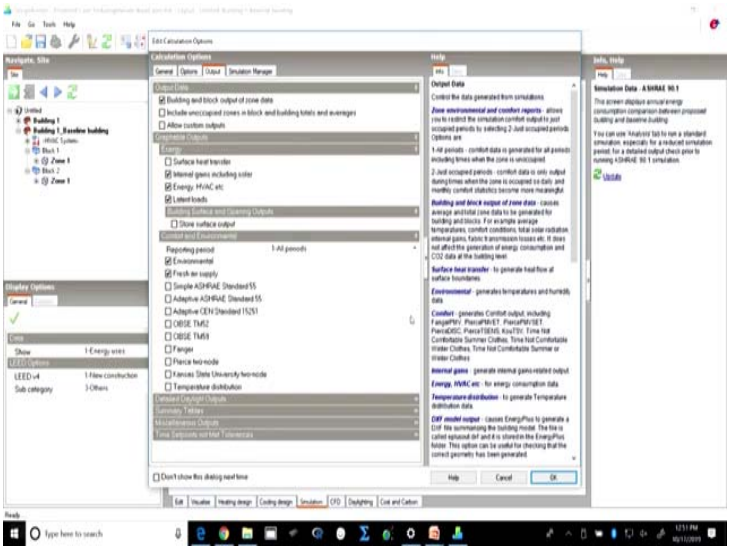

So, if you look at this is an annual calculation so we go ahead with the annual calculation.

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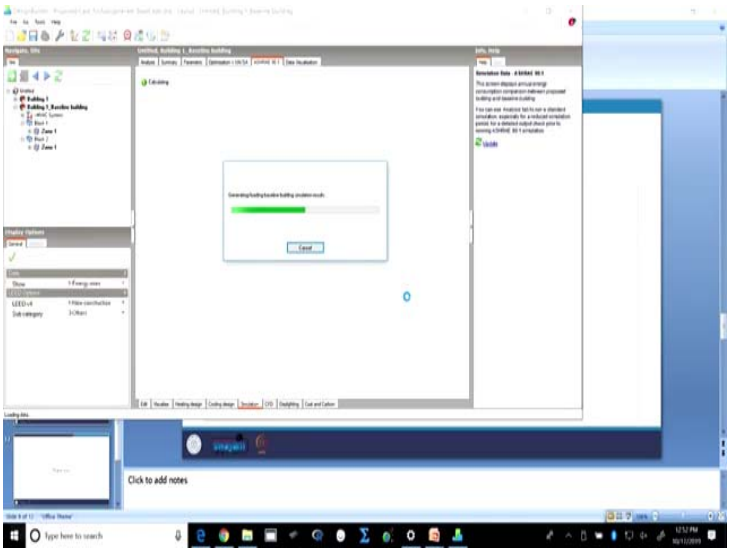

And the baseline building is now being simulated to calculate the total energy which is being which has been consumed. Now, this becomes this makes our job much easier. So, for any given design, for any given proposed case it will automatically create a base case without the manual intervention.

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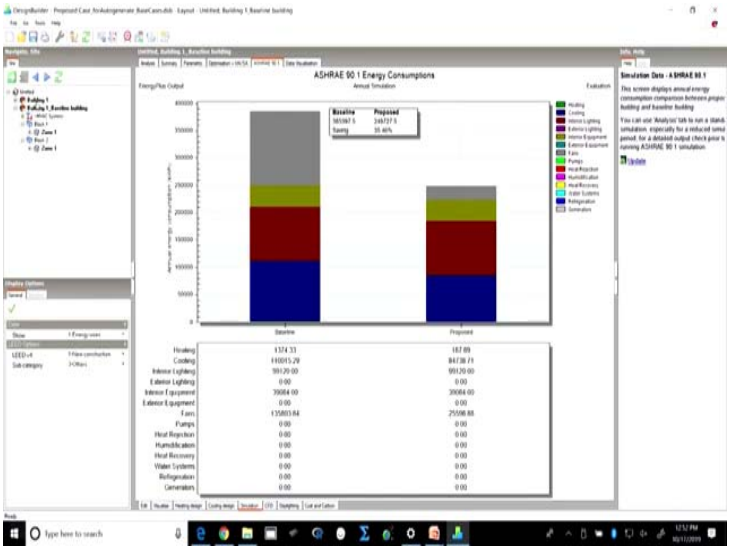

So, it becomes much easier if we are going in for green building certification and it allows us to generate the reports much more conveniently. If we look at this now it automatically compares the Proposed case which was building one with that of the base case and it tells us that here in this case the savings as compared to the Baseline building in the Proposed case is to the tune of 35.46 percent.

Now, you might be wondering that when we took the same Proposed case why did the saving percentage change actually if you look at the Proposed case here what we have taken is slightly different from what we had in the previous lectures.

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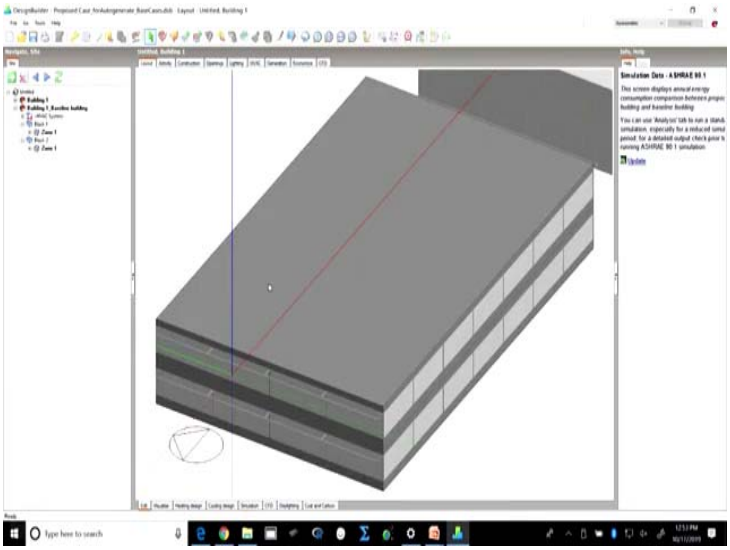

So, this proposed case is slightly changed from what we had otherwise the values would have come exactly the same.

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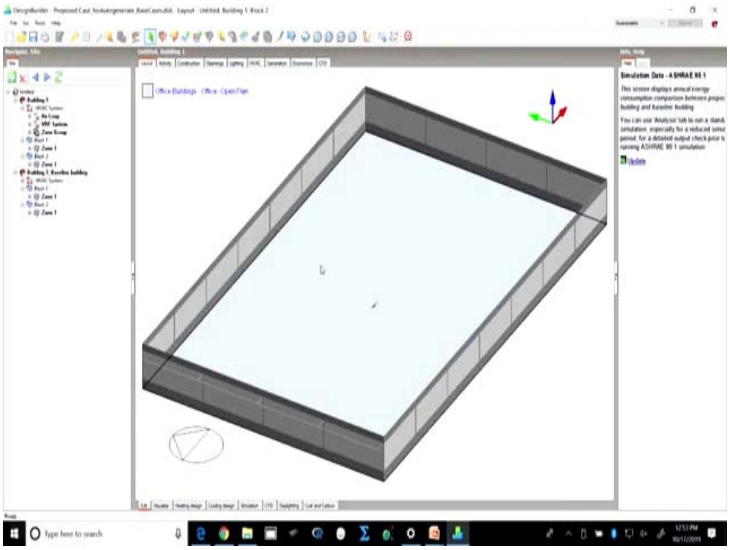

So, we have we do not have the zones here currently we do not have the exact design of the same building, but it is largely the same. So, if we go again to look at these results we can see that just by creating the Proposed case it automatically generates this base case here. There is no possibility of any flaw happening here while creating the base case because whenever, so that that is the basic intent of whole building simulations and this

entire, entire exercise we are actually comparing apples to apples this is none of these two buildings is a real building these are all these are both simulated cases. The only thing is what we are doing here is we are keeping the all the parameters the external factors as the same. So, the weather data files remains the same. So, both the cases which are hypothetical cases in literal sense are being subjected to the same environmental conditions they are being simulated, using the same equations they are being simulated using the same parameters which affect and then their performances are being compared simultaneously.

So, the moment we are comparing these two under the same experimental setup we automatically get to know whether this proposed case is better or not. Unfortunately, sometimes if we are doing if you are making the base case building the Baseline building manually we might make human errors we might commit certain mistakes while assigning the specifications to say the walls, the roofs (Refer Slide Time : 11:16) U values, the window wall ratio, we might just humanly make some errors and those errors might be reflected in the performance of the Baseline building and there we might not really be showing what exactly is the saving of proposed case over the baseline building.

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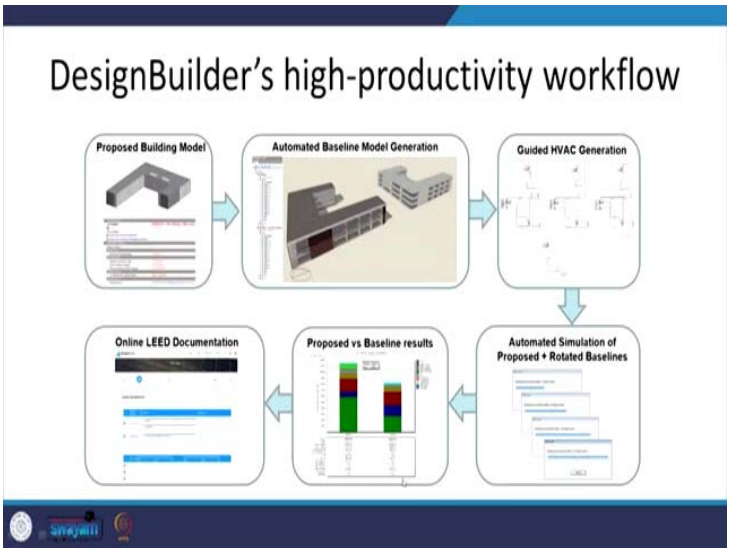

So, if we look at that this becomes quite easy and interesting. So, if I have to concise it if I have to put it in a concise format this is what we can understand. So, we work only on the proposed building model, we do not make the baseline model manually whatever is

the proposed building model it automatically generates a baseline model. The only thing we have to remember is while we starts to make the proposed building model we just have to select the reference code and once we have selected the reference code and we have completed making the proposed building.

We just have to click a button select certain basic parameters tick them and then we get a baseline building available here made available here. And then we generate the HVAC for this baseline model and then it automatically does the simulation of the proposed case and the rotated baselines. So, what we did manually like rotating the base case to 90 degree, 270 degree and 180 degrees it will automatically do it, calculate it, average it out and give us the result in the form of the performance of the proposed and the base case buildings the baseline results.

It automatically puts them in a comparative format and tells us how much of the saving has been achieved and not just that it tells us how much of the savings have been achieved it also tells us the different heads under which the energy is being consumed and how the energy has been saved. So, if you look at this on heating or cooling rather a lot of energy has been saved this was only because of selecting a very good HVAC system in the proposed case if you remember.

Some building has some energy has also been saved towards the interior lighting. So, it very clearly tells us the different heads under which the energy is being saved and also consumed. So, we can see very clearly that where is it making the difference. So, what parameters what changes in the proposed building are bringing about this difference in the energy consumption energy savings and then we can also go ahead and make some more changes based upon this comparison that where exactly energy is being saved and where we need to save more energy or where there is a possibility of saving more energy.

So, with this we will be able and it we will be able to generate a baseline model compare the proposed and baseline and it helps us to develop the LEED documentation as is required for the compliance using LEED US for LEED certification for any building. So, it is it becomes a complete tool. So, it becomes a complete tool and much easier and very high on productivity. So, all we have done is we have reduced a work tremendously to making only the proposed building model and all others, which we saw earlier; all others

have been taken care of by the tool and we also have the LEED documentation ready in the form of a submitter a report which can directly be submitted.

So, this helps us to increase the productivity and also the accuracy where there is no manual intervention in making the baseline building or there is no possibility of the results being different from what they should ideally have been in case of the baseline building. So, with this we have completed the module on whole building simulation tool we have seen how to start with making a baseline building and a proposed building manually to how to do it automatically using the tool, tool and also to generate the documentation.

With this we also come to the end of our course which was on sustainable architecture and starting from the theory of sustainability and gradually moving on to sustainable built environment and sustainable architecture and getting into the details of how green buildings can be made and what are the environmental parameters which need to be considered and what are the compliance criteria, what are the different strategies. We moved on to this learning of this whole building simulation software.

With this we complete our course on sustainable architecture which had 60 lectures which all of you have already attended and during the course of these 60 lectures we have covered a vast variety of topics we started with the very fundamental definitions and understanding building up our understanding on what is sustainability not sustainable architecture, but sustainability in general, how did we start talking about sustainability. So, the historic origins of sustainability the discussion around sustainability how the definition of sustainability changed from period to period from time to time.

And what it is currently understood as today and then we moved on to sustainable architecture how Sustainable architecture definitions have changed and how our understanding of sustainable architecture has changed over the course of time. We compared sustainable architecture with that of traditional architecture and then we moved on to go deeper into how do we create sustainable architecture, sustainable buildings what do they really mean what all is required to design them, to construct them, to operate them.

So, we read about the climatic parameters we read about the different strategies, the passive design strategies and then we moved on to more contemporary strategies for example, selection of materials selection of appliances selection of equipment the design of it and then we moved on to very efficient and robust tools like whole building performance which enable us to evaluate the performance of a building holistically taking into account all of it as far as its energy performance is concerned.

So, this whole building performance tool was mainly to evaluate the buildings energy performance. And we looked at the different options that we can have while we want to simulate the building what are the different measures that we can incorporate and how we can evaluate the performance of the building and with this discussion on whole building performance we conclude our course as a holistic course.

I hope you all have enjoyed being part of this course and I hope that this course would have proved to be useful to you. You will soon be entering into the examination for this course and you would have already completed all the tutorials that you got each week for this course and I am sure if you have diligently worked you would have understood the course and you would score really well in the exam. So, all the best to you for appearing in the exam and for taking the exams which will be held very shortly you will be knowing about it soon.

Kindly do not hesitate in contacting us if you have any queries if you want to ask us any questions we would be happy to respond back to you and all the best once again for your exams.

Thank you again for being a part of this course.

Thank you bye.