Introduction to Multimodal Urban Transportation System
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Lecture-24
Non-Motorized Transportation (NMT) Planning: Complementarity and Selection of Interventions

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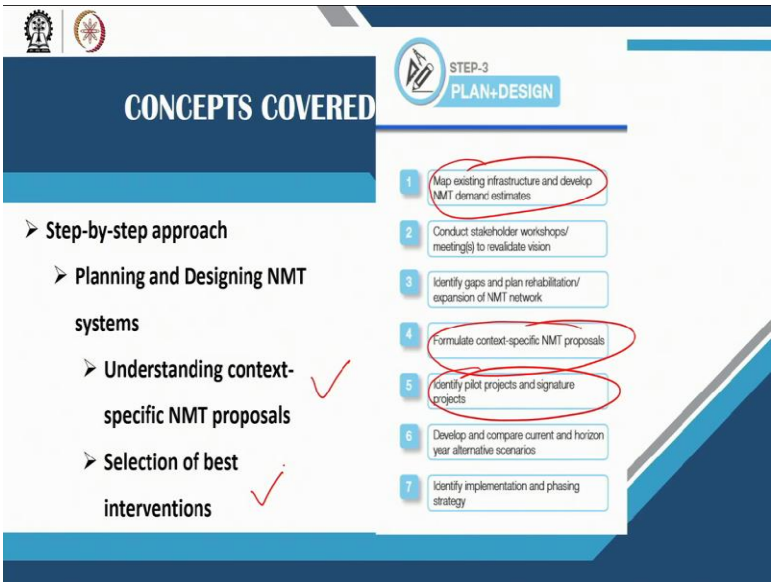

Hello everybody, and welcome to the next lecture in the module of non motorised transportation planning. In the last lecture, we had covered the first step in the planning and design, which is actually the third step in the 5 step process. We had looked at how to map existing infrastructure and develop NMT demand estimates. In today's lecture, we are going to go ahead and look at how to develop context specific NMT proposals as well as how to develop some or have some methodology in identifying which are the best possible NMT solutions in your context. So, these are the 2 steps and we will be looking at some of the examples of how to develop these priority proposals or how to pick the best intervention.

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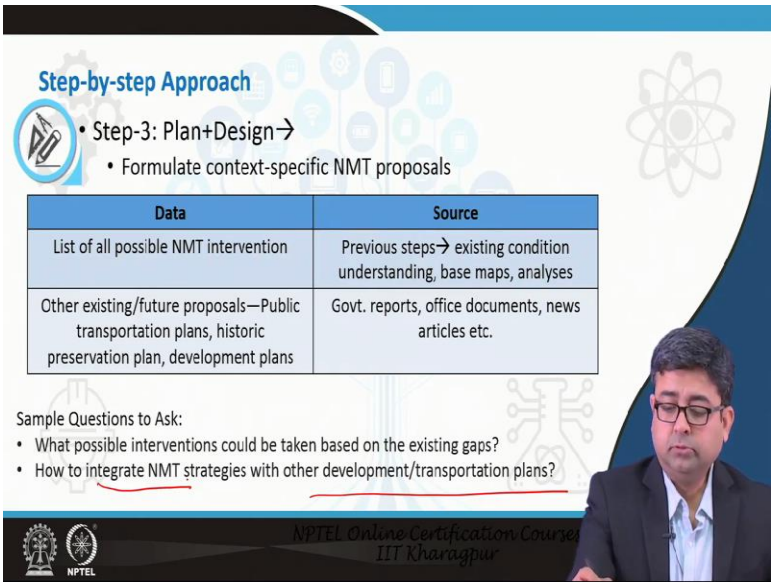

When we talk about context specific NMT proposals, what we need to keep in mind or the questions that we need to ask is, what possible interventions could be taken based on the existing gaps? In the previous step we have already mapped the existing NMT infrastructure in your city. And now, we have to ask based on the gaps, what is the best possible NMT solution that you can provide? And then, the second question to be asked is that, whether and how does that NMT solution integrate with other transportation modes or other transportation plans? So, it is not a good thing to develop NMT solution in isolation; it has to be well integrated with other transportation modes as well. So, for example, when we are talking about different types of interventions, you could be having interventions such as developing a new zebra crossing at an intersection versus you may want to put foot over bridge at the same intersection. Now, how do you prioritize between these two for example? This is a very common example in many of the Indian cities. Some of the junctions or intersections have foot over bridges for pedestrians to cross over, whereas some have good zebra crossings and signalized intersections. So, given these 2 context specific proposals, how do you actually pick between these two. Again, you will need a lot of data. We have shown you what are the different sources from which you can get the data, government reports, and existing condition surveys, and so on and so forth.

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So, what are some of these specific context sensitive solutions? By saying context sensitive you have to understand in which environment you are providing the non motorised transport solution. Is it an urban environment? Within urban is it only a residential environment? Is it a commercial environment? Or is it a more of a mixed use environment? Understanding the environment gives you an understanding about the potential users of these NMT facilities. And by knowing the users then you can actually design and provide these solutions. So, for example, if there are a lot of users who are of older age, and there is an intersection where the population is mostly of elderly population. You would stay away from providing a foot-over bridge, for example, at that intersection, as it is difficult for elderly people to cross over using a foot over bridge. So, maybe you will provide a good at-grade solution which may be a good zebra crossing along with a signalized intersection. So, these are kind of context specific. There are different types of contexts that you can look at. You can either look at the physical environment as a context, you can either look at policy as a context, sometimes you can look at the traffic engineering as a context and sometimes it can be a system based context. For example, if I look at a traffic engineering as a concept, you will see that in a 4 lane divided road, two lanes in one direction, two lanes in the other direction and it is divided by a median. Now, it has no pedestrian or bicycle facilities. How can this be converted into a better NMT facility? Something what we usually call in transportation engineering or traffic engineering is a road diet, diet meaning the road has to be narrowed down for motorised vehicles. So, what happens is we usually convert the

side of the roads into bicycle lanes and the center of the road into a 2-way reversible lane. Anybody who wants to just cross the road the traffic will only come in there, otherwise that lane will not be used for more motorised vehicles. So, now we have converted a 4 lane divided road into a 3 lane road, 1 traffic lane in the up direction 1 traffic lane in the down direction and 1 dual lane with 2 cycle lanes. So, now we have increased the potential of bicycles using this lane and made them a safe facility. So, that is a kind of a context sensitive. If you look at policy, we can develop different parking policies that can disincentives parking in the commercial business district. So that that can encourage again use of non-motorised modes. So these are different types of context sensitive solutions that you can implement.

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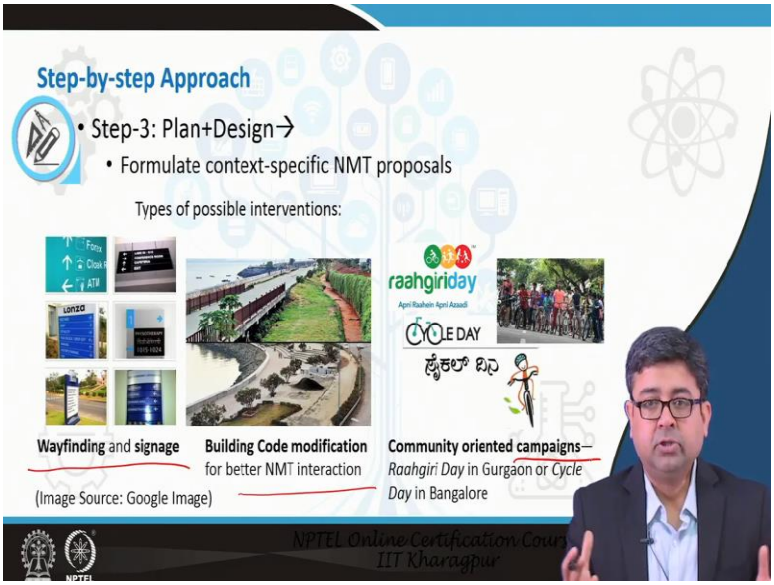

Similarly, more context sensitive solutions could be better wayfinding and signage. So we usually assume that pedestrians would know their way. Nowadays, even Google is now putting some emphasis on giving directions for pedestrians based on not just whether there is a road or not, but based on whether there are good sidewalks facilities or not. People can walk on the road also, but it is usually not safe. So, there are newer techniques in which wayfinding is being provided for especially NMT user. For example, Google will not show the route if there is no pedestrian facility on that route, it will show an alternate route which may be a longer route, but it at least has pedestrian facilities. So that is an example of wayfinding and signage. Building code modification: there can be several bylaws that can be put in saying that if you have frontage on a major road, the builder has to put in a footpath. Without putting in a footpath, you cannot

finalize or construct your residential complex, similarly with commercial complexes and so on and so forth. And then there are other strategies or other campaigns and strategies that are possible as well. Many of the cities are now making some of the some of the days in the week as cycle days or some of the days in the week as pedestrian zones so on and so forth. So, those are also context sensitive solutions. Now, you cannot make an area or a zone as pedestrian only zone if there are no people walking on that in that zone. So, in the context of lot of people walking in a zone on a Saturday or a Sunday, a decision could be taken that every second Saturday of the month, this zone will be restricted to only a pedestrian zone. So, that is also a context sensitive solution.

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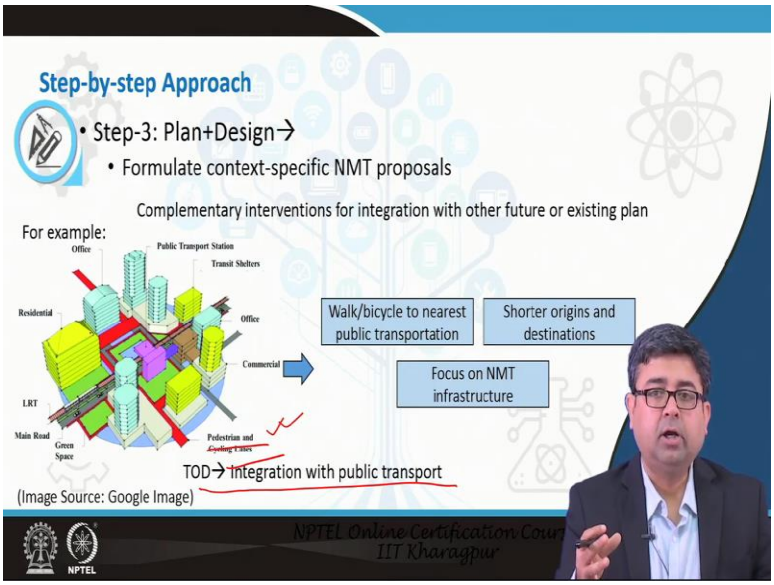

The other thing is, you talked about integrating your NMT solutions into the larger transportation network. Now, that is also very, very important, you cannot just have an isolated foot over bridge that crosses from point A to point B, those are becoming, not so wise decisions because people are not (a) using it very much; (b), they are only connecting point A to point B. They are not connecting any land uses with each other. Usually what we will recommend is that if you provide grade separated facility for pedestrians, it has to not only cross over the intersection, but then finally, connect to other types of land uses. For example, maybe there is a metro station on the other side so it connects, connects directly to the metro station. Maybe there is a mall on the other side. It connects directly to the mall, so there have to be different connections integrated into this one solution of a foot over bridge. Then it becomes an effective solution. Here is what

we call transit oriented development or TOD. TOD has several aspects to it, it has a metro station or a mass rapid transit station, it has high rise buildings it has a mixed land use. So, density is high, land uses are mixed. It has public transport integrated with it. Similarly, it has all the pedestrian and cycle lanes. So, all the non motorised transport solutions are also integrated with your land use as well as public transportation.

So, you have to have good sidewalks that are actually connected to your offices connected to your residences connected to the public transportation mode. You just cannot have a sidewalk in isolation. We just cannot have a cycle track in isolation. That will not solve the purpose. Although many times you will see that there are some isolated sidewalks but they are part of the process. So they may have built it in phases. So the first phase might have been built, so the second phase might not have taken off. That is why you see an isolated sidewalk or isolated bicycle paths. However, if the plan is to have the isolated sidewalk, then that is not a good plan. The plan should have an integrated solution for all the NMT modes.

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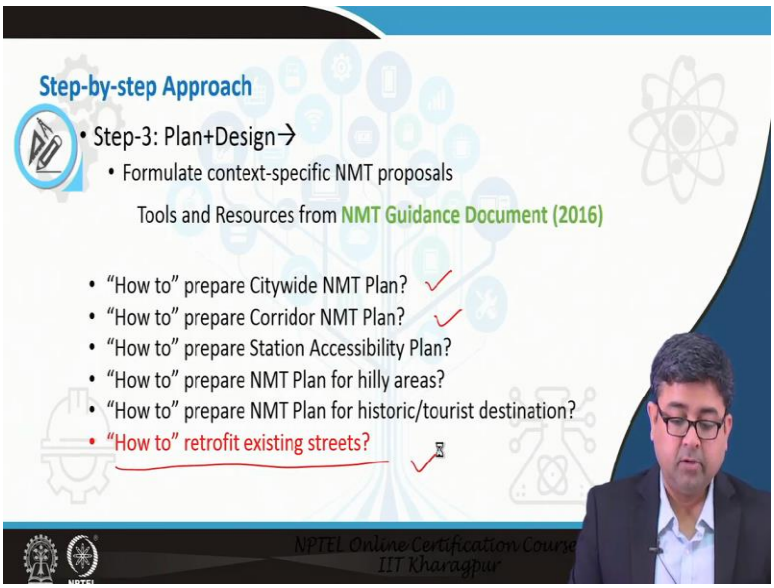

Now, this guidance document also tells you how to do different kinds of things, how to prepare a citywide NMT plan, corridor plan, etc. So for just the benefit of this class, we will take up how to retrofit existing streets with NMT infrastructure. This is one of the key requirements today in many of the cities across the world as well as in India, whereas we already have the street network in place. But we do not have any bicycle tracks or we do not have any sidewalks or footpaths. So what we have to do is to retrofit it in. We cannot expand the roads anymore

because we have no space. So using the existing road, how do you retrofit new NMT integrated infrastructure? So let us look into a step-by-step quick example of how to do that.

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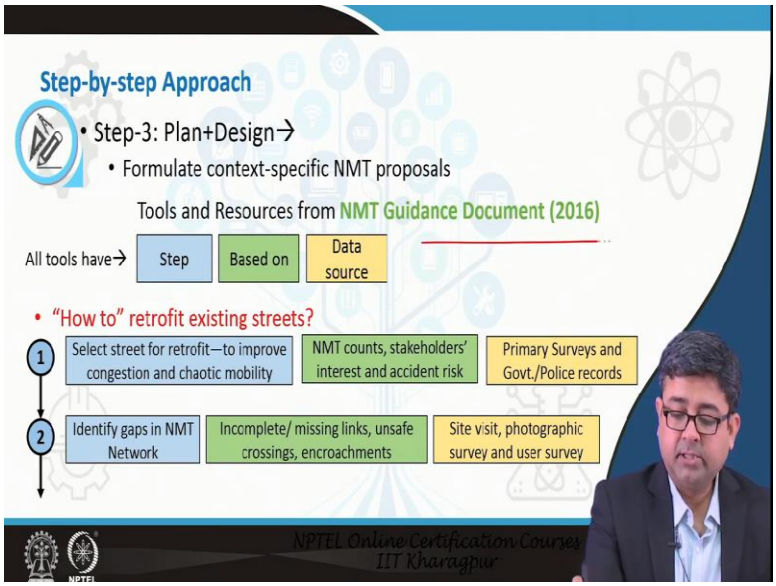

So all of the tools in the guidance document are usually colour coded. And they have these 3 things involved in it so that it shows what to do. So what is the step? What is that step based on? And where do you get the data from? So for example, how to retrofit existing streets. First, you have to select the street which has to be retrofitted to improve congestion and chaotic mobility. So selection of the street also needs some criteria based on which you would say that there are so many streets in our city, but we have identified this street to be retrofitted with a sidewalk or a cycle track. So, that street has to be identified. Based on what, then you may have to conduct counts of non-motorised traffic that is plying on that street. You may also look at the stakeholders. So, there may be a lot of shops there, or there may be a lot of offices, or there may be a metro station there. So, you have to look at all the users of these facilities to see that if that is what they really want at that location, and you have to maybe also look at the accident risk. So, it is an area where there is a lot of non-motorised transport, but also the speed is very high or the facilities are not very good then there is an accident risk increases. So, that is an example of what will you base your decision on for identifying a street to retrofit with NMT infrastructure? And where do you get this information from? What is the data source, you can get it from either conduct primary surveys, or get it from, for example, accident records, you can get it from police records, or government and police records. So, that is how you can go about this first step in

retrofitting existing streets. Similarly, the second step now that you know, that which street you want to retrofit, you have to now find out what are the gaps? What are the exact gaps in that street network or along that street? Is it only that it does not have sidewalks or is it that there are sidewalks but they are encroached upon, or so on and so forth. So you are to identify the gaps. You have to base it on, counts again, missing links, maps that you have developed so on and so forth. And where are you going to get data from, you can either collect your data by site visits or do user surveys.

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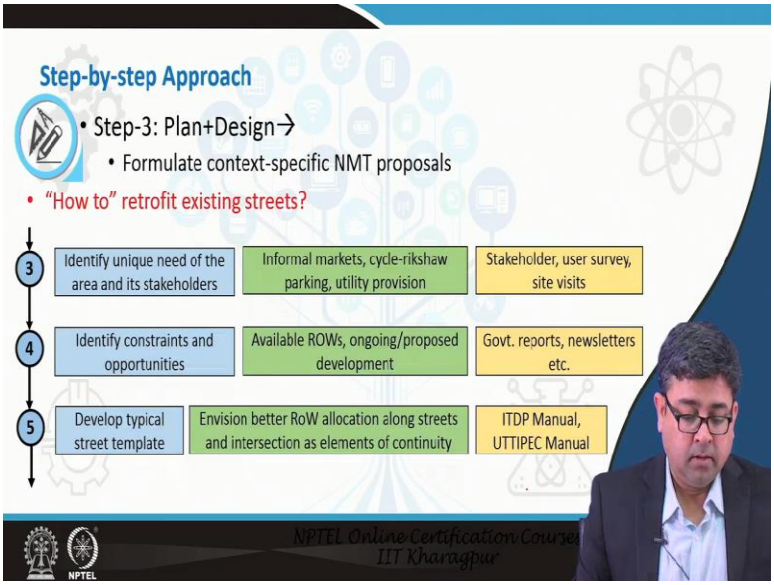

The third step would be to identify the unique needs of the area. So, now, you know that here are here is the existing street network, the street has to be retrofitted with NMT facilities, here are the gaps in the NMT facilities, then you have to look at the user needs. So, maybe there are a lot of office goers in that area, maybe there are a lot of markets in that area. So what do the users of that area need? Their needs may be different based on their needs, you have to develop your an NMT facilities. Like we talked about, are there informal markets, the cycle rickshaw parking? Again you are to maybe collect user surveys and do your own surveys to see these situations. Where you have to do a lot of primary surveys means that there are not very many existing records, public records that are available. NMT facilities usually do not have much public record because it has been neglected for a long time. So, initial effort will be high, because you may have to conduct a lot of primary surveys. Now that you know the stakeholders needs, you will have to identify what are the opportunities and constraints, there may be some constraint you

may want to build a very good sidewalk, but there may be very little space so, you may have to look at a narrower sidewalk. You may not be able to provide the ideal width of the sidewalk just because there are some constraints on the site. So it is better to provide narrower sidewalks rather than saying that, well, we cannot build ideally 1.5-meter sidewalk, so I am just going to let it go and not have any sidewalk. So always you have to work with the constraints, you have to work with the opportunities, and then go ahead and provide your infrastructure. That is what this says. Again, you can find various information from different reports or collect your own data, then develop a final the fifth step would be to develop a typical street template. So now you have to envision, you have to design before designing, I mean, before putting it on pen and paper, you have to at least have a sketch or an idea of what you need to do and how it will look once you implement it. So you have to have the right tools to envision this. So all these tools are now being developed and are available as manuals, ITDP manual or the UTTIPEC, which is a manual developed for Delhi. There are different kinds of manuals that are available that will tell you what are the interventions that you can put in, that are context sensitive for you. And then you can envision your entire street. So, the entire street may have multiple interventions, it may not be just one intervention that you are working towards it may be a cycle track, it may be a zebra crossing, it may be pedestrian signal, it may be multiple things along that street that you want to do. So, you have to have idea you have to have a clear picture once you know all the other 4 steps that you have completed.

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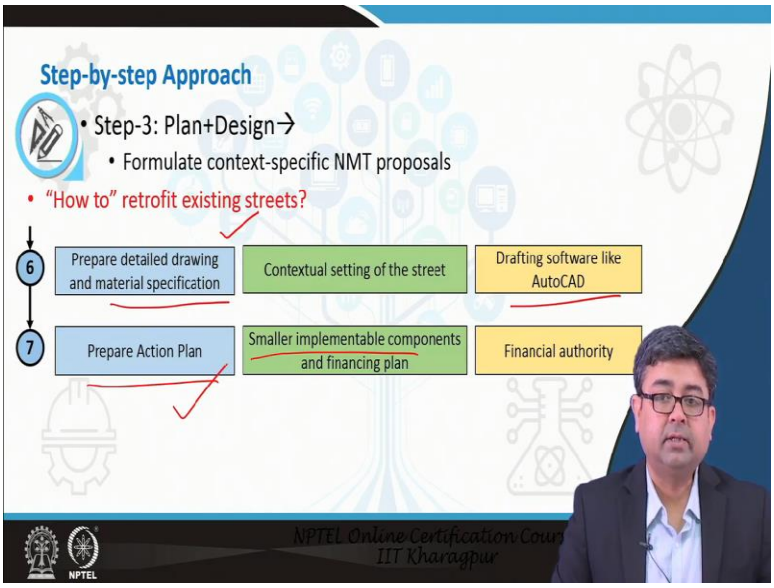

Finally, you have to always have a detailed drawing with material specification. So materials specification is very important because pedestrians may have a different understanding or different feeling about the track on which they walk versus cyclists. The bicyclists are more likely to favor a surface that is similar to where the motorised vehicles travel, whereas pedestrians may want a different type of surface to walk on. So, what kind of material will you use to build these facilities is something that you have to detail out while you are developing your drawing; you have to have a knowledge about AutoCAD and so on and so forth. Then, once you have developed this design, you have to develop or prepare an action plan for implementing this design. Now this is where your phasing and financing of the project comes in. You may not be able to find finance for the entire street project. So but you should not be disheartened by that. Money comes in chunks so you may be able to do only one part of the project now. And maybe in the next 6 months, you can do a next part of the project, and so on and so forth. So even if that happens, you have to plan and prepare for it. We always want money upfront, but money may not be available upfront. So you have to have the items that you can do immediately with the available funding, so that you can get started with the project. Inertia is a big risk. So you should not leave your projects at the drawing stage, but also prepare an action plan on how to implement it. So those are kind of the broad steps of how to retrofit existing streets with NMT infrastructure. Similarly, the guidance document provides you different "how to" methods for different items of NMT.

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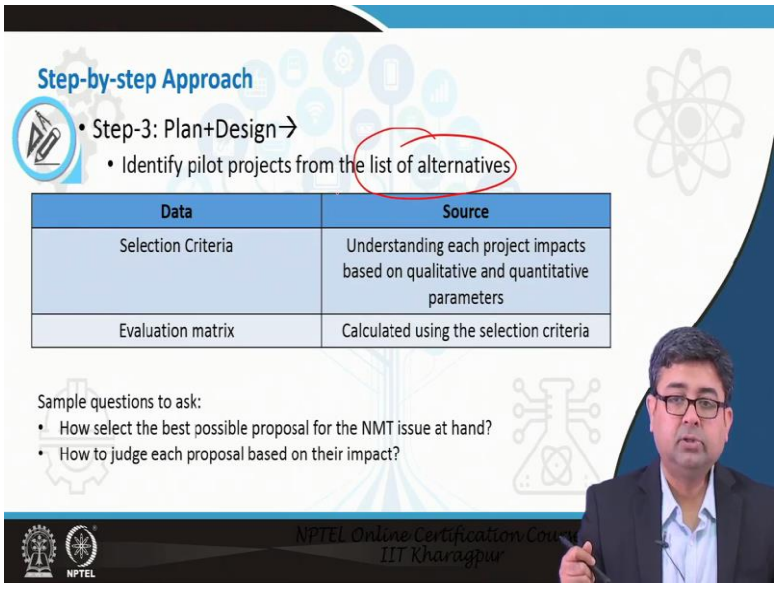

Now that you know what context sensitive solutions are and how they can be executed, you have to now identify pilot projects, from the list of alternatives. Now, you may have developed a list of what you want to do. You may want to do A, B, C, D but how do you prioritize from this list? How do you develop an action plan that can be objective in nature and performance based, so that it can be implemented in a timely fashion? So, you have to always prioritize your alternatives. This is especially helpful if you have multiple projects in your list. What we will tell you in this lecture and give you some simple methods, which will help you to develop a scheme by which you can prioritize from the list of alternatives.

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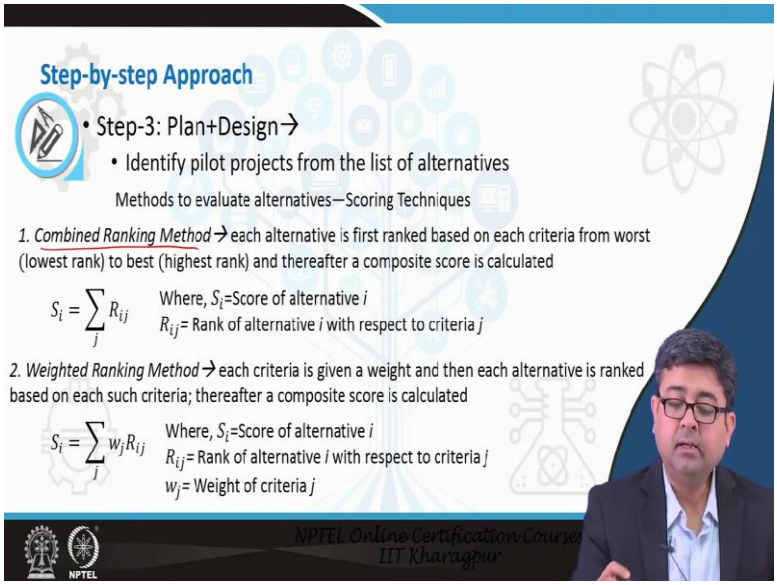

So, the first very simple method is called a combined ranking method. So you just have different alternatives. And based on some criteria in each of the alternatives, you rank them and then whichever ranked the highest, you pick that as the first alternative for you to go ahead and implement, that is the simplest one, but it may have lots of constraints. Some of the constraints are answered by the second method, which is called a weighted ranking method. So it just adds a certain weight for each of the criteria, but there may be multiple criteria and one criteria may be less important, whereas the other criteria may be more important. So rather than giving those equal weights, we give them some different weightages and as a result of giving different weightages your final alternative may change. Suddenly, the alternative which you had calculated just using his combined ranking method may now no longer be the best alternative if

you use the weighted ranking method. So, these are all different tools that allow you to rank different alternatives and then you can pick the best alternative to implement.

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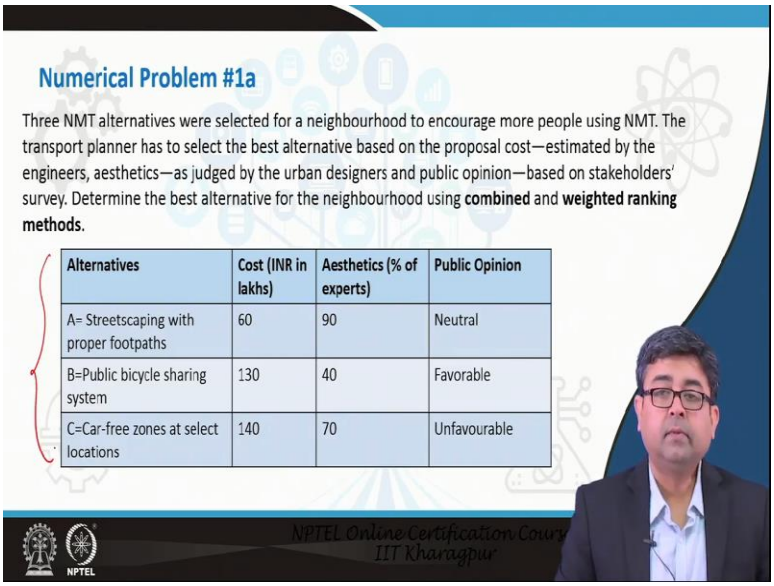

For example, we have given you 3 alternatives first is a streetscaping with proper footpaths, that is your alternative A, second maybe you are wanting to implement a public bicycle sharing system. The other project that you may be looking at is creating these car free zones at select locations. So, now you have these 3 possibilities, alternatives that you want to implement, but you want to know which the best possible alternative is. So, here in this example, let us see which is the best possible alternative using both the techniques, the combined and weighted ranking methods. Now, what you usually say the 3 criteria or they may be other criteria's on which you might have data, but here we are showing that we have 3 criteria on which we have data for these 3 projects. First criterion is cost. Second criterion is the percentage of experts who say that aesthetically this will look good. And the third criterion is public opinion. Now in the cost of the project, we see that project A is the least in cost. Project B is the second highest and project C is the most expensive whereas, when it comes to the experts who think that which of the projects will be aesthetically the best, they say that the project A which is the least expensive will be the most aesthetically good looking project. Whereas, project C would be the second best or 70% of the experts think that that will be aesthetically good whereas, a public bicycle sharing system only 40% of the experts think. For the last criteria, which is public opinion. Public opinion is favorable for a public bicycle system, the most favorable, meaning the users of that

area of that neighborhood, you are doing it for a neighborhood. So, the users in that neighborhood have said that public bicycle sharing system are mostly favorable to, whereas, they are not favorable to having a car free zone and they are neutral to a streetscape. So, now that you have these 3 different criteria, how do you determine which is the best alternative?

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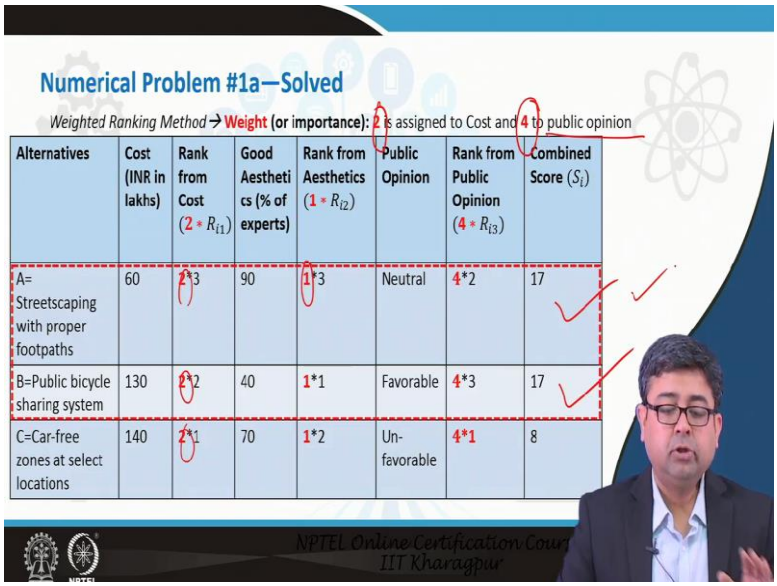

So, if you just use the combined ranking method, you would see that we just give ranks based on cost. So, the most expensive, gets 1, then 2 then 3. Similarly, the lowest, public bicycle system for aesthetics, lowest one gets 1, gets 2, gets 3, similarly, unfavorable gets 1, neutral gets 2, favorable gets 3, so you just rank them, and then you just add these rankings. So, 3 + 3= 6 + 2= 8 similarly, 2 + 1= etc.

So, that is a very simple ranking system and then you see that the combined score of these 3 criteria is 8, and this has the highest score. So, you think that this is the best alternative to go out and implement. But now that if you apply the weights and say the weights meaning which criteria which of these 3 criteria should have the highest weight based on maybe by experts, maybe by the users or whoever it is, because you may think that cost may not be the most important criteria or aesthetics may not be the most important criteria. So, it is not fair to give all of them the same weights. So, now, you say that aesthetics is the least weighted 1 whereas, cost is 2 that is double of the weighted of the aesthetics, whereas, public opinion has the highest weighted which is double of the weightage given to cost. That is how weights are usually given. So, public opinion has the highest ratings. So, if people agree of that neighborhood, which type

of project they want, it is only that project that will get implemented. So, all you do is after you have ranked them, you multiply them by their individual weights. If you do the same thing now and then you add up all the numbers again. Now, you suddenly see that not only is the streetscaping a good alternative, but also public bicycle sharing system is a good alternative. Now, you in the previous method, you had looked that there was one clear winner, project A but now you suddenly see that there are 2 projects that are tied with each other. So, that gives you an idea that maybe there is another method that you have to use in order to differentiate between these 2 projects. So, these are 2 very simple examples to show you how to rank different kinds of projects.

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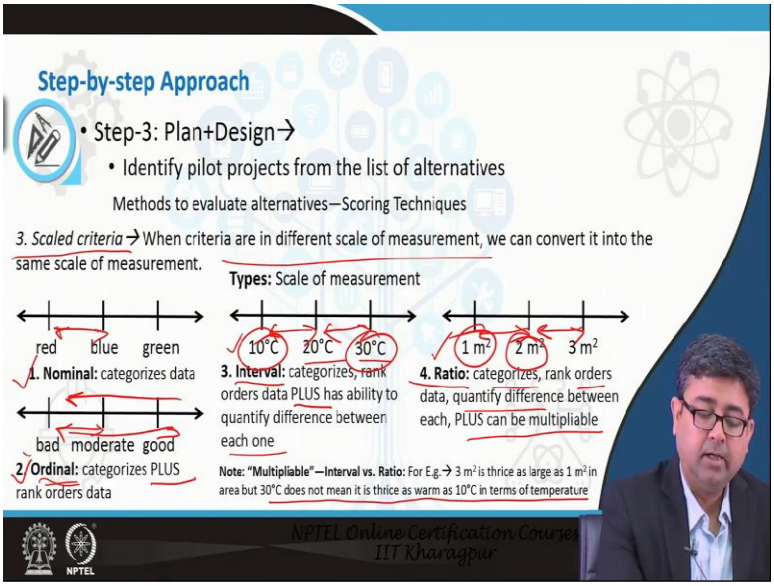

The third example is of scaled criteria. Now, when the criteria in different scales of measurement, you need to combine them into 1 scale. For example, we will use the same example but before going to that example, let us see what are the different scales of measurement, usually the easiest scale would be a nominal scale that only categorises data, these are red marbles, these are blue marbles, these are green. So, that is just a categorical scale that only categorizes data or a nominal scale. The second one is an ordinal scale; the ordinal scale categorizes plus ranks them in order. So, when you say a scale which is "good", "moderate", "bad", it is not only categorizing them, but also is an order. So, this is a decreasing order if you think in that way or this is an increasing order from "bad" to "good". So, that is an ordinal scale. The third type of scale is an interval scale. So, it categorizes ranks plus has the ability to quantify

the difference between each one. So now the difference between each is quantified. Here if you see in the nominal scale, the difference between these two there is no quantification of the difference. "Bad" to "moderate", there is no quantification, it is qualitatively you can tell, but there is no quantification. So, what an interval scale does is, now you can quantify. So you can not only categorize, you cannot only rank but you can also quantify the difference, you know, what is the exact difference between 20 degrees Celsius and 30 degree Celsius. Similarly, there is another scale; the last scale is called a ratio scale. So, it does all of these three—categorizes, ranks, and quantifies the difference plus it can be multipliable. What that means is, now you know the difference between these two, but you can also exactly say that this is 2 times of this. 2 meter square is 2 times larger than 1 meter square, but here you cannot exactly say that 30 degrees centigrade is 3 times warmer than 10 degrees centigrade. So, that is a difference between a ratio scale and an interval scale ordinal scale and a nominal scale.

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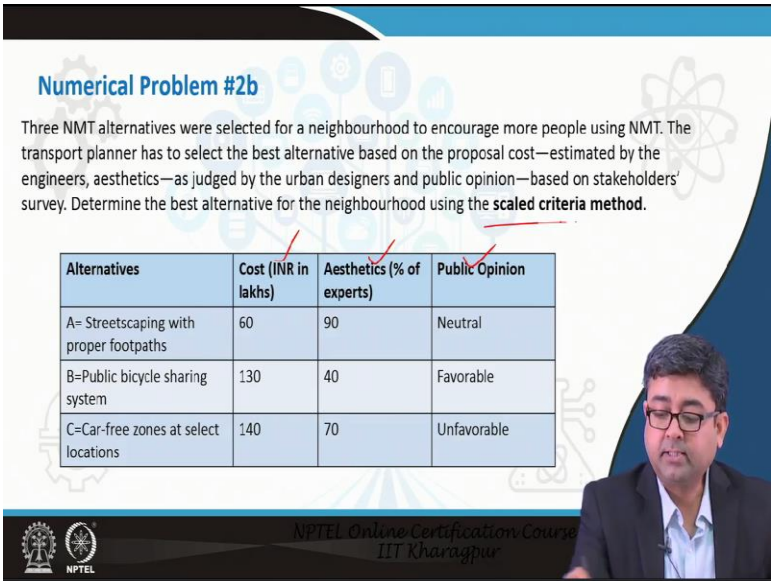

Now, in this example, it is the same, you have these 3 different criteria cost, aesthetics and public opinion and all of them are in different scales. Now, how do you determine the best alternative using the scaled criteria method?

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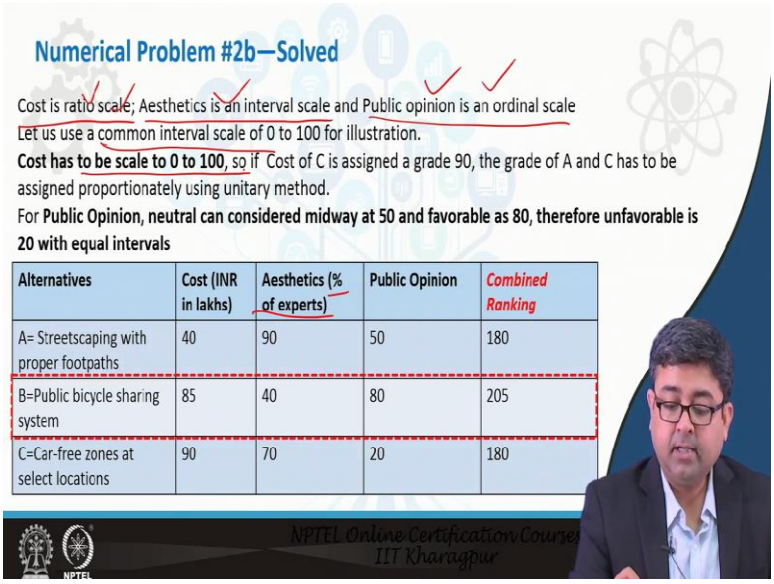

So, for example, the cost is in ratio scale you know the cost. So, when you know the cost you can tell the ratio between each of the costs, i.e. they are quantified. Aesthetics is percentage of experts, in an interval scale. So it is an interval you know the exact difference between the 2, but you cannot say that 1 is n-times the other. And whereas public opinion is an ordinal scale public opinion is "neutral", "favorable" or "unfavorable", that is an ordinal scale. So, now that you now there are 3 different scales, you have to convert all those 3 scales into one common scale. So, for this example, say that we have converted all of them into an interval scale. So, we have to convert a ratio scale into an interval scale and we have to convert an ordinal scale into an interval scale. So for cost, which is a ratio scale, we can convert it into a 0 to 100 kind of an interval scale easily saying that cost C is assigned a grade of 90, C is the highest cost, so on a scale of 0 to 100, let us give it 90 and proportionately we can give the other 2 projects their values in what proportion this is; if 140 is 90 that how much is 130. So, maybe it is 85. Similarly, project A is 40. Similarly, now for public opinion neutral may be given 50 on a scale of 0 to 100. If streetscaping is neutral, then we give it a score of 50 and then we say that the rest of the other two are equal distant to 50. So, if it is unfavorable, it is 20, 50 minus 30. Whereas, if it is this favorable then it is 50 plus 30 so, we convert this is already in interval scale so, we do not need to convert this. So, once we convert the other 2 into interval scale and then add it up, then you suddenly see that now you have project B as the best alternative. So, if you use the first method, it was project A, if you use the second method, it was both project A and B, the third method if it

is project B only. So, you see the final results depends upon which scaling criteria or which ranking criteria you use, and it usually gives you different results. So, you have to be very careful in when you use criteria to develop these alternatives. We have given you 3 different examples, there may be others that you can use, but you can use these to quickly get an understanding of what you need.

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Here are the references for this lecture that we have used. Again, please go through this PDF document that is available for free download and access these textbooks from different libraries for this part of the lecture.

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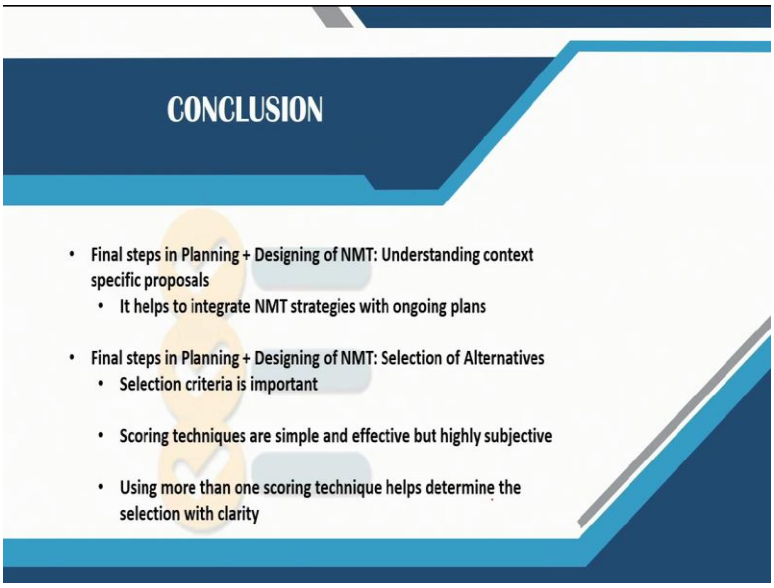

So in conclusion, what we looked at today was how to integrate NMT solutions with ongoing plans, always has to be context sensitive, context specific as well as integrated solutions. And how do we select alternatives? You always will have different alternatives for same problem, but how do we select them, objectively? So we have showed you some scoring techniques that will help you select the best alternative. Thank you very much.