Introduction to Multimodal Urban Transportation System
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Lecture – 60
Urban Transport and Sustainability:
Sustainable Strategies for Urban Transportation

Welcome friends. We have reached the last lecture in this course where we are now going to tell you some sustainable strategies that can be implemented in the transportation sector to make it environmentally viable, environmentally friendly and protect you from degenerating your health.

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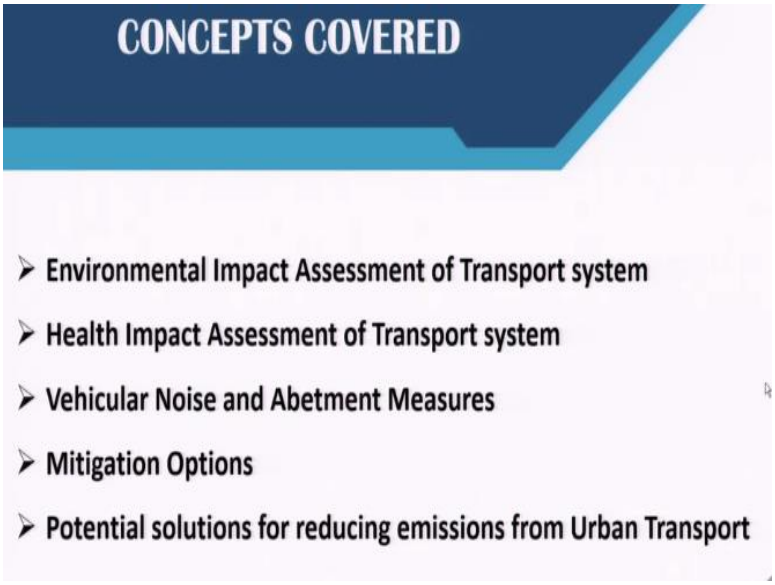

So, what we are going to talk about in this lecture are how to conduct environmental impact assessments for any transport related projects that is going on, give you a highlight on what is the next step from environmental impact assessment which is health impact assessment of any transport system. Look into one of the externalities that are not talked about much which is vehicular noise and how you can mitigate those and then give you some strategies that will help reduce the emissions or help mitigate the environmental impacts of urban transport.

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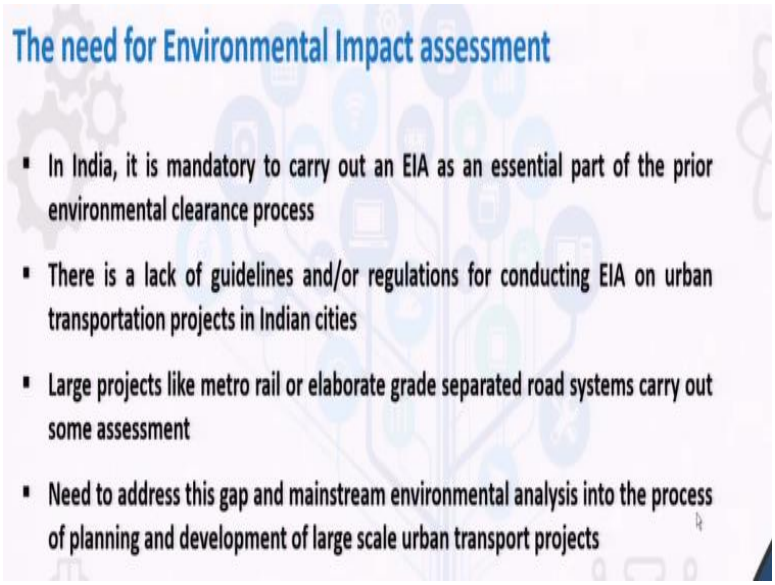

So environmental impact assessment is a tool that is required for any large project when it is implemented in India. So, this may be a non-transportation related project as well, but certainly any large highway projects, any highway widening projects which are beyond the threshold of a certain monetary number must follow the norms and conduct environment impact assessment.

You would see however that when it really comes to urban transportation projects which maybe are not of that large scale, EIA usually is not mandated, so they are not conducted. However, metro rail projects which are large enough they must go through this EIA process. So, we will tell you what this process is and make you aware that this is something that will help in reducing the environmental impacts of the transportation sector.

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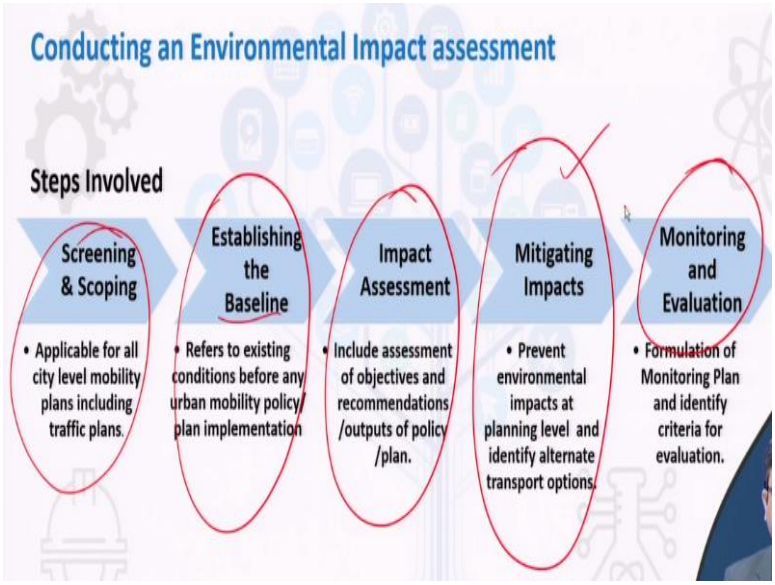

So, this is a process, which is a proactive process, that can be implemented to understand what the negative or positive impacts on the environment because of an upcoming project or an existing transportation project may be that is in your city. So, what you usually must do first is to go to the local bodies or the implementing bodies and go through a screening or a scoping stage where they would try to see if an EIA is needed.

Like I said if the project is not of a magnitude that is going to impact a lot of people or is going to have a poor impact on the environment, then usually EIA is not conducted and only an environmental statement is given, and the project can be constructed. However, if it is a large project and sometimes it is associated with funding as well for example if it is the funding agency mandates that any project to which for example World Bank provides any money, EIA is necessary for the implementing agency to perform. So, in screening and scoping what they would see is decide whether the project must go through an EIA or not, there are different criteria which they must check and make sure that the project either falls or meets or does not meet those criteria. If it goes ahead and says that yes EIA must be conducted, then there must be a baseline assessment. So, first what are the existing conditions must be assessed.

Then after you establish the existing conditions or the baseline conditions, you must assess the impacts of not only the alternative that is preferred for construction but also at least one or two other alternatives. So, it is important that when a project is being built maybe the final alignment of a road or the alignment of a metro route is decided upon, however when you are doing an environmental impact assessment you have to also look at the impact that alternative designs might have. So, in other words maybe the alternate design is expensive, but that should not be a reason for it to be considered or disregarded because maybe the expense is large but maybe it is not impacting the environment in a poorer form, so how can we then balance these two alternatives. So, it is always important to assess the impact of not only the preferred alternative but also one or two other alternatives.

Once you have identified the impacts, then you must suggest mitigative steps. It is not only good to just understand what the impacts or negative or positive impacts are, you must also propose, and those proposed measures must be implemented to mitigate the impacts of your transportation project. And once those are implemented, then you must continuously monitor and evaluate it throughout the next couple of years or at least throughout the operational

period of that facility. So, these are the broadly 5 steps that must be followed in an environmental impact assessment.

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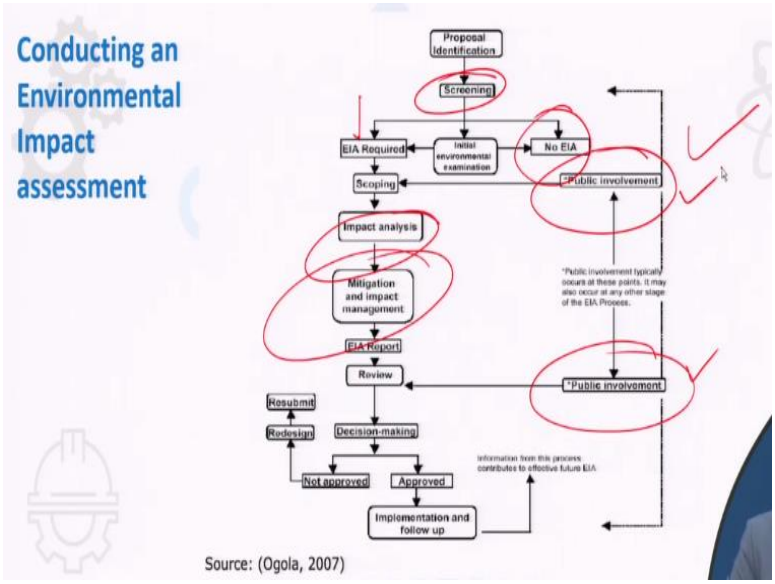

The same thing is shown in the form of a flow chart here. You see in the screening stage if no EIA is required then you can go ahead and proceed to develop the project whereas if EIA is required then you do your impact assessment to give your mitigation steps. One of the important things in this environmental impact assessment process is public involvement at multiple stages. So, you would see that public are often informed about a project at a very later stage where everything is ready, and the project is about to begin.

And the affected people are only informed at the very last minute which then causes a lot of litigations in the project, delay in the project and cost escalation because of that. So, you have to have to always take into consideration the public; involve them in the project from a very early stage and also involve them in later stages of the project so that there is no delay in executing it and they are already taken into confidence.

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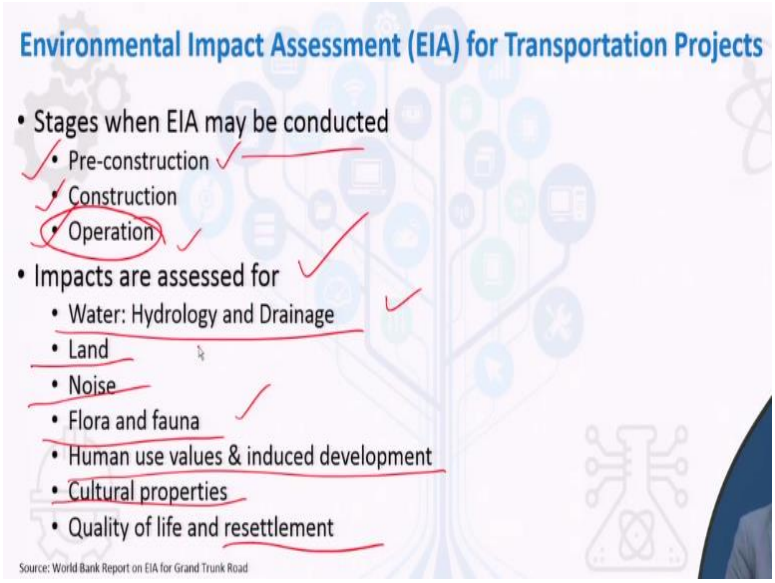

Now EIA can be conducted at any of these stages, pre-reconstruction, construction, or operation stages. So, for example a road has been there for the last 10 or 20 years, but you are seeing that there is growing pollution or growing poor environmental quality along that existing corridor. So, you may order one of the agencies to conduct an independent EIA to understand what the current impact of that road is, and can they suggest any mitigation measures which may reduce the environmental impact.

So, it can be conducted at operational stage, but as you may understand at an operational stage any mitigation measures have to take into considerations the restrictions of the landlocked nature of the project for example and may be large scale mitigation measures may not be possible. So, it is always recommended that EIA be conducted at a pre-construction stage and then subsequently at other stages also. Now what are assessed during EIA. The impact on hydrology and drainage is assessed. During the construction and after construction a project may have a lot of impact on the adjoining water body, so that must be mitigated obviously the impact on land, what is happening to people residing alongside these projects, how the land, may be the land use is changing from say an agricultural land to now becoming semi residential or semi-industrial.

So how / what impact does that bring about to the environment. Noise is one of the impacts that we are going to look at. Flora and fauna, how the vegetation there and the animals living in around the project are going to be affected, birds, etc., are going to be affected by the project. What is going to happen to induce development and the existing human being or human life in that area, are their quality of life going to improve, deteriorate, what is going to

happen? Do they need to be resettled? If so, where, and how do you do that? If there are any cultural properties, historic heritage properties along the way of your project or at your project site, then how do you take care of that? Do you change the alignment of your project? Do you avoid such cultural sites? How do you do all that? What is the impact on such facilities as well?

So, you see when you are conducting an EIA, it must be a very detailed report, an impact on various entities have to be taken into consideration and mitigation steps for each one of these has to be identified and implemented in order to reduce the impact of a transportation project on the environment.

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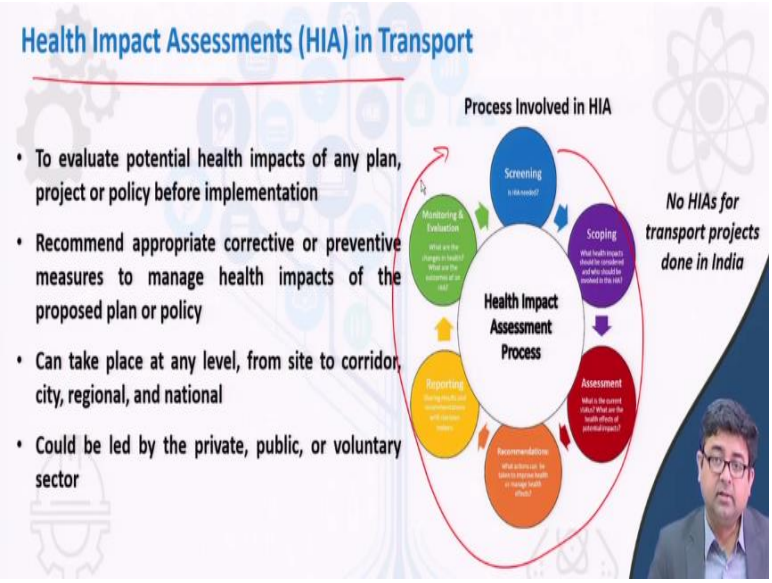

Now while EIA has been in place for a long time, but the next step in assessing the impacts of transportation projects is to look at how it impacts health. So, like an EIA process, the steps may be similar but now like we had mentioned in the earlier lecture any transportation project will determine whether it is resulting in a decrease or increase in pollutants in that area. So based on that impact assessments are being sought or at least they are in an early stage of understanding what the impact of a for example a large mall that is coming out in your suburban area and there will be roads leading up to the mall, so what is that going to do to the air quality in otherwise purely residential suburban area. So that is the kind of health impact assessments that is happening.

This must be a very multi-disciplinary approach, only transportation engineers or traffic engineers cannot conduct this, you need health experts, you need experts from even vehicular technology to understand all the impacts on health due to transportation.

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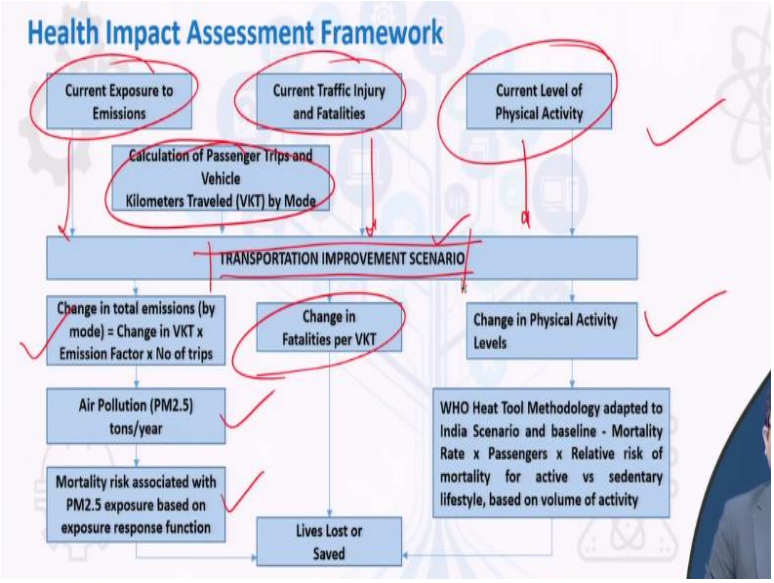

This is a kind of a flowchart that allows you to understand the big picture of how health impact assessment is done. So, if you know the current exposure like we have told you in the earlier ones if you know the current traffic injuries and fatalities and the current level of physical activity in people if the transportation facility that is coming out there is going to help change their physical activity? Are they going to make it more active?

Is it going to make them less active? So, what impact will that going to have? So, all of this can be the input to your transportation improvement scenario because of the project that you are going to construct. You also know your vehicle kilometers of travel, existing vehicle kilometers of travel and because of this improvement scenario is it changing any fatalities per VKT? Is it reducing the actual amount of VKT? As a result, what is happening to your pollutants that are being emitted? Is the mortality risk based on exposure to certain kinds reducing and does it impact the physical activity of the people? For example, if you are putting in a metro project, maybe a person who was now using the two-wheeler to go to work maybe now would walk to the metro station and take metro to work.

Now by walking he or she is improving his or her physical activity or they are becoming more active. So, by becoming more active your health is improving, so that is the kind of impact assessment that is being now sought for many of the transportation improvement

projects. This has not taken off in very many countries yet, but it is at a research phase, but this is something that is interesting and challenging.

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This is something that I have already talked about. There is a need for intersectoral cooperation, you must be working with actual doctors and transportation engineers, must be working together in order to assess the health impact of transportation improvement projects.

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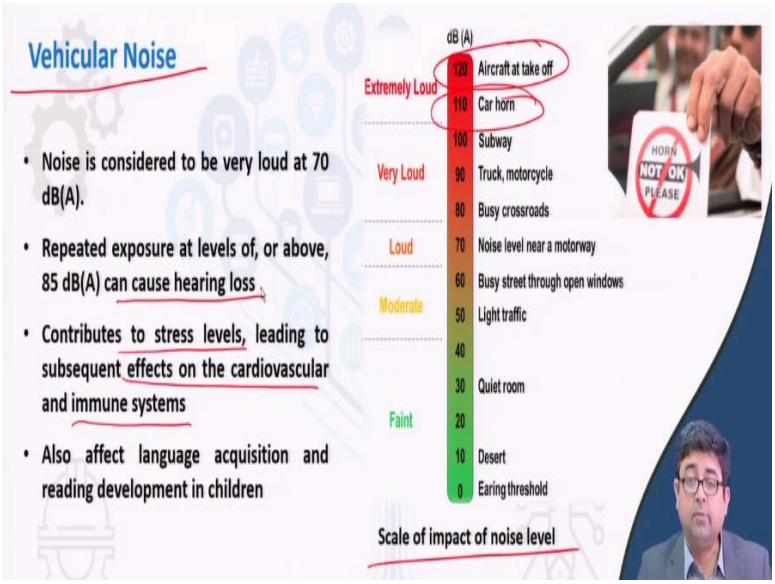

Let us look at now one externality that usually we do not look at a whole lot but in our Indian context it is something that we are always exposed to which is a vehicular noise. So, if you start looking at the scale of impact of the noise level, you will see that we are constantly listening to this. A car horn which is almost at an extremely loud level of 110 decibels or more which is almost like an aircraft taking off. So, imagine how much of a vehicular noise

are we exposed to every day. So, what is that going to do? It may contribute to stress levels, maybe it will lead to subsequent effects of cardiovascular and immune system or is a cause of hearing loss. So, you would see that people who operate heavy machinery all the time, they use ear plugs, otherwise they may be prone to hearing losses. So, the next time you are in a taxi or in our car we should always make sure that we are not unnecessarily honking our horn.

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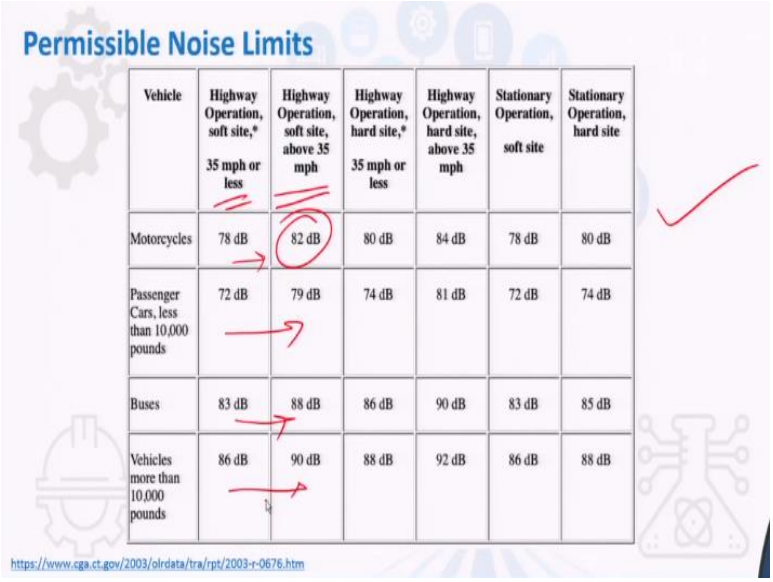

Vehicle	Highway Operation, soft site,* 35 mph or less	Highway Operation, soft site, above 35 mph	Highway Operation, hard site,* 35 mph or less	Highway Operation, hard site, above 35 mph	Stationary Operation, soft site	Stationary Operation, hard site
Motorcycles	78 dB	82 dB	80 dB	84 dB	78 dB	80 dB
Passenger Cars, less than 10,000 pounds	72 dB	79 dB	74 dB	81 dB	72 dB	74 dB
Buses	83 dB	88 dB	86 dB	90 dB	83 dB	85 dB
Vehicles more than 10,000 pounds	86 dB	90 dB	88 dB	92 dB	86 dB	88 dB

So, there is some vehicular noise that comes out because of the interaction of the tires and the road, but apart from that the artificial noise that we bring about because of honking our horns for no real reason must be really taken into account and really minimized. So, this chart gives you the noise limits which are not taking into consideration the honking of your horn, but this is just based on the noise that is generated between the tires and the surface of the road.

So again, it has a relationship with the speed limit. So, if you start going faster and faster, the noise levels keep on increasing in case of motorcycles, passenger cars, buses, and any kind of heavy vehicles as well. So that is the other benefit of driving at or below the speed limit so that not only you emit less but you also create less noise. So, if you get into noise and transportation, you will see there is some research that is going on what is called as quiet pavements.

Pavements that make less noise when meeting your tires. So how do you reduce these noises, or you would look at newer highway projects that are going through a very congested neighborhood, they would build what is called sound walls on both sides of the highway or

even metro projects in some cases because these sound walls are then going to shield the houses that are close to the transportation project so that the noise does not go into the houses beyond the stipulated limit.

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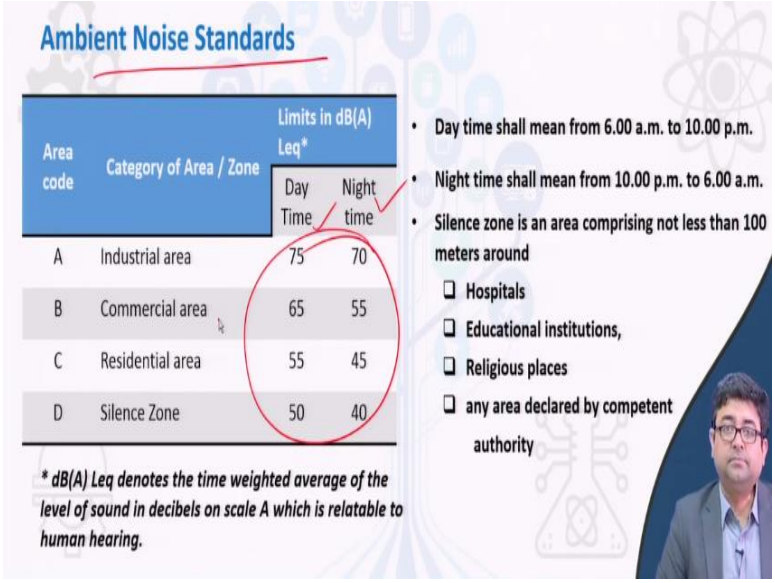

So, these are the ambient noise standards during daytime and nighttime which should be followed especially when a project or a metro rail or highway project is very next to your house because all these noise measurements are usually done 50 meters away from the center line of the transportation project to assess its impact not at exactly where the noise is generated but how it dissipates at least 50 meters away from where it is generated. So, all these ambient noise standards must be considered when you are talking about noise and transportation.

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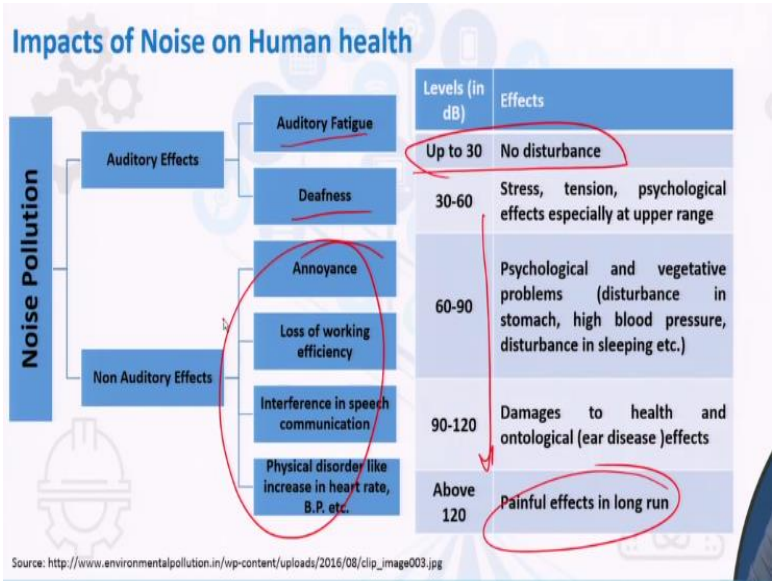

Again, noise pollution, as we have already talked abou,t if it is anywhere up to 30 decibels that does not create any disturbance, however as you see it starts increasing it may have even long-term impacts as well. Beyond just fatigue, it may lead to deafness and these are nonauditory effects which must be taken into consideration.

So, the next time you are conducting impact assessment of any transportation projects along with conducting environmental impact assessment you have to make sure that there is some noise impact assessment that is also taken into consideration and some mitigation measures are taken.

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Usually, you would find such sound level meters which will give you an idea of what is the road noise that is coming out of a project that is a handle device gives you a gross decibel level at the road, but of course if you must know what each vehicle is emitting, then you have to use multiple equipment and understand the impact of different vehicles on the noise levels that are coming out.

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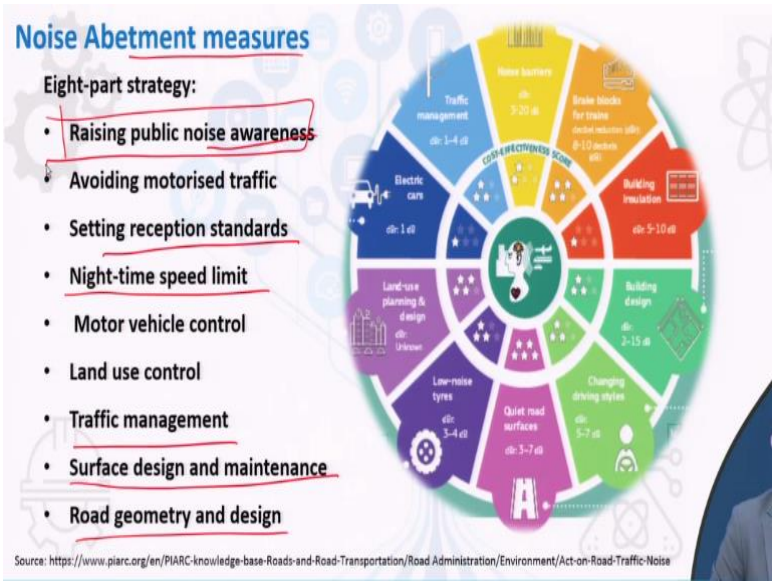

What are some of the mitigation measures or abutment measures raising of course noise awareness is something that we must make people aware or we must be aware of that noise might create a problem and not just neglected. Reception standards must be put up especially when the project is close to you. Nighttime speed limits must be really enforced because if the ambient noise levels are increased or are heightened during the nighttime that causes greater health impacts to us.

Like I was saying there is some surface design and maintenance issues, traffic management must be such that there is not a lot of people using their horns all the time. So, there are different soft initiatives that can be done, different hard initiatives that can be implemented, but one thing that must be done is to raise awareness about this, especially if you have vulnerable users such as children and elderly people living close to such noisy places you must be very careful about their exposure to high decibel levels.

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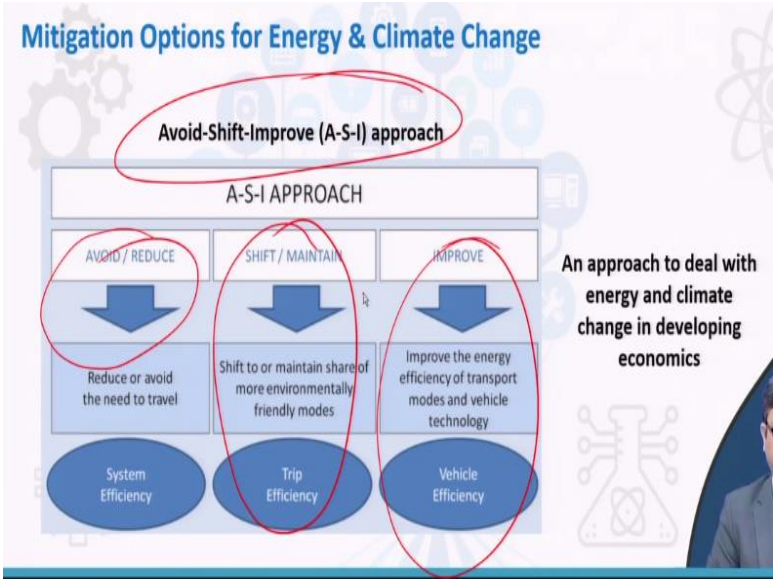

As we come close to the end of this course, what I would like to make you aware of is the approach that is known as avoid-shift-improve. This is a broad level approach that is being used by various urban local bodies or by various governments across the world to reduce the impact of transportation, not only on environment, but its impact on climate change as well. So, what it usually says is we must avoid or reduce the use of personalized travel vehicles. Let us not unnecessarily travel on the roads, let us not always use our personal vehicles for every other purpose, let us shift or let us create a scenario where we shift to alternate modes of transport, we use public transport a lot, we should use non-motorized modes of transport that will help mitigate the transport impacts on environment.

At the same time, we must improve the vehicle technology, the fuel technology that is available, maybe move towards renewable energy sources. So, all the 3 things must happen parallelly. Avoid, shift, and improve. Unless you do each of these things at the same time or parallelly, you may not see the complete benefits of mitigating the impacts of transportation on the environment.

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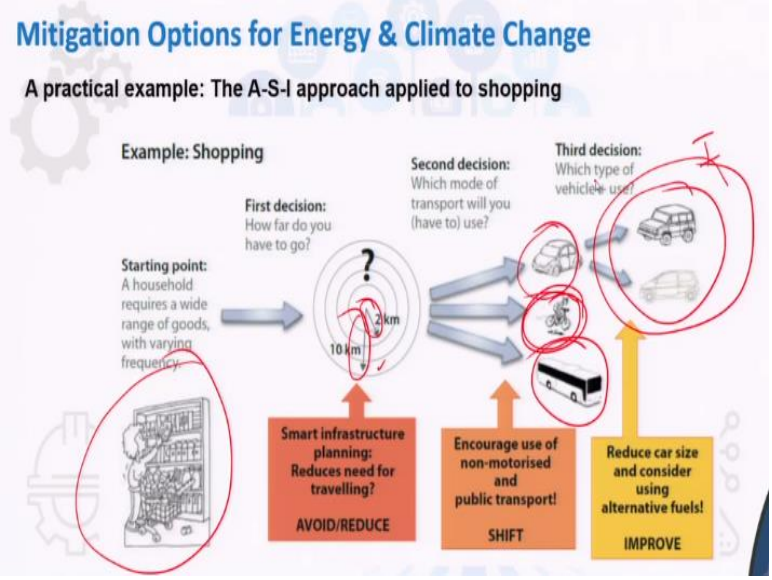

So, one example of this is to make a city compact. So, when people are now as a part of smart cities you will see that lot of people are trying to make cities compact or develop zones such as transit oriented development, TOD zones around metro stations and so on and so forth. What they are trying to essentially do is to reduce the impact of or one of the things that they are trying to do is to reduce the negative externality of transportation on the environment.

So, if you want to for example if your house and your shopping places are close to each other, so when you want to go from your home to your shopping complex you would now only have to travel 2 kilometers versus that if your shopping complex was too far and 10 kilometers away then you had to choose a different kind of a mode. Then you decide that okay well it is so close that I do not need to take out my car, maybe I can just use my bicycle to go there.

So even if you decide to take a car maybe you then have an improved car. So, this is the improved part of it, so maybe you have bought an electric vehicle or a hybrid vehicle or vehicle which meets Bharat stage 6 norms. So, you have not only avoided going farther distance, but you have also now tried to shift to cleaner vehicles, and you have now tried to shift to alternate modes of transport.

And, you have tried to improve your existing vehicle that you have, you have tried to have better vehicles that you own. So that is in a nutshell what this ASI strategy allows you to do.

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At a larger city level if you want to see land use planning obviously plays an important role, make land uses close to each other which will allow you to have a compact city and as we said in the first in the A, part of the approach you are going to then avoid travelling for longer distances.

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Finally shift, there are lots and lots of strategies that are being now implemented in urban areas to attract you to a public transportation mode or a nonmotorized travel mode. You will see metro rail, you will see BRTS, you would see bicycle lanes that are coming out. You are seeing lot of pedestrian improvements. Sidewalks being laid out on all your streets. All of these is to encourage you to shift to different alternate transportation modes as compared to just using your private transportation mode.

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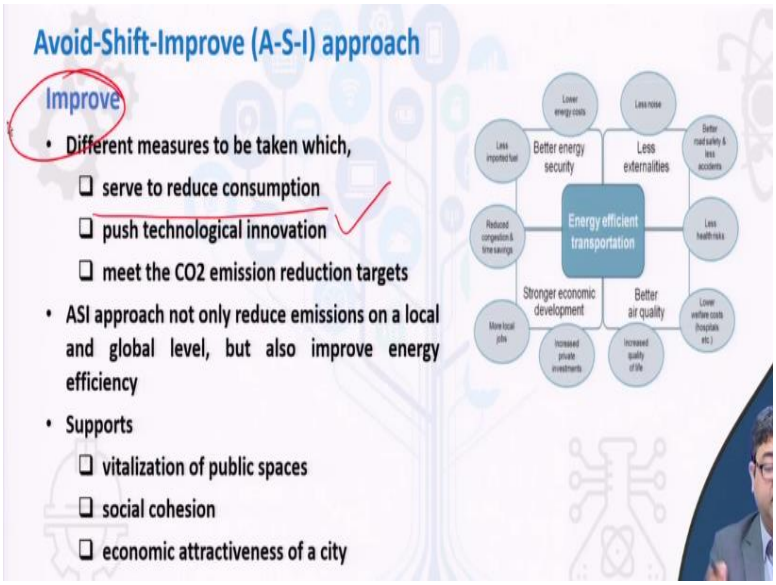

Finally, to improve to different types of vehicular modes, fuel technology and so on and so forth you are looking to reduce consumption, have technological innovations. Now you can even work from home, so teleworking is something that will reduce the impact of transportation on the environment. You can use an electric two-wheeler currently or a four-wheeler to reduce the impact.

However, yes, we must also at the same time move towards renewable energy sources to see the real benefits. So that is to have improvement or that is what we mean when we say to improve the scenario. So, avoid-shift-improve is something we are always focusing on.

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This is something which I have already told you. What are some of the solutions? How do you improve pedestrian facilities? We have talked in detail about this in our NMT section as

well, have proper zebra crossings, pedestrian signals, may be improve the sidewalks that are there in your area.

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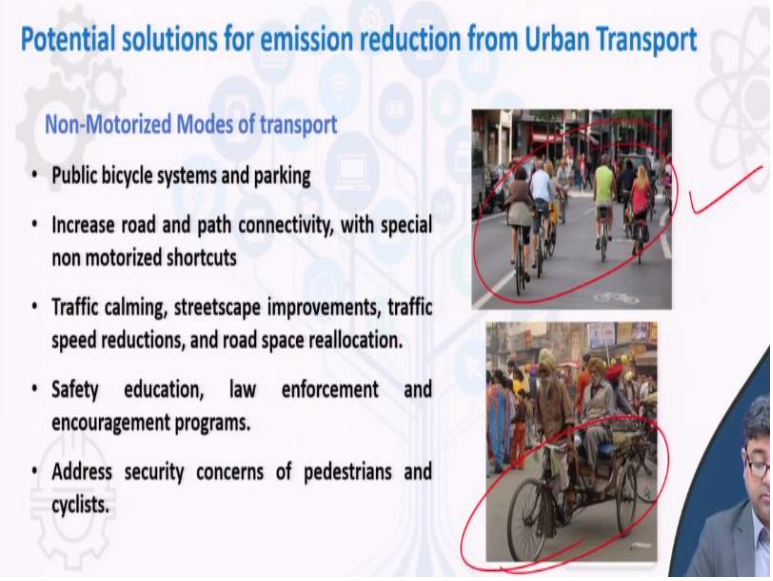

Provide specialized facilities for nonmotorized modes. Do improve the nonmotorized infrastructure, provide better maintenance of nonmotorized modes.

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Make rapid transit attractive to people. Let them see the real benefits of using public transportation. Provide integrated ticketing so that they can use a simple smart card to buy fares on different types of public transportation that are available in the city.

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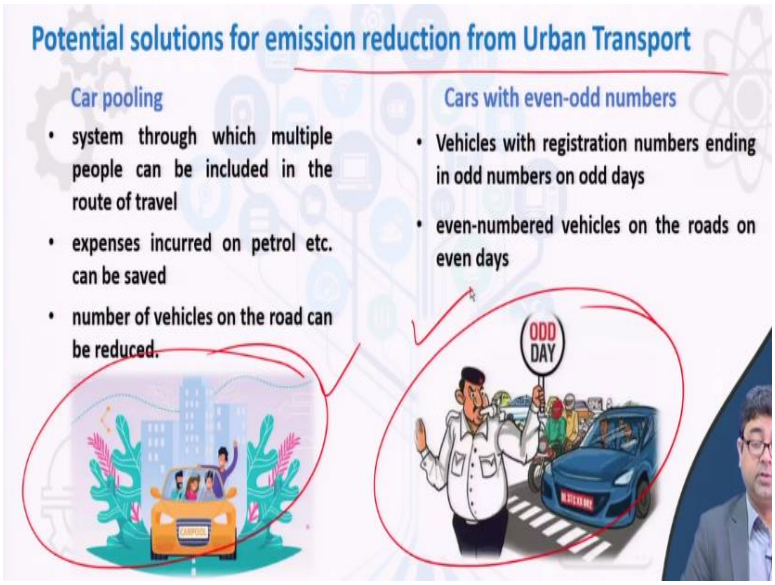

All these strategies put together would help in attracting people to other modes of transport and help the emission reduction or help in reducing emissions of urban transport. You have already seen one such step that has been taken in New Delhi where you say the Delhi government usually applies this during the winter season when it says that on a particular day only vehicles with odd numbered registration plates can ply on the Delhi roads, and the next day there will be even numbered vehicles. Similarly, you would see a lot of carpooling that is happening, even the latest Ola and Uber transportation network companies encourage you to carpool so that your cost of traveling also goes down, but at the same time now there are 4 people in a vehicle versus 4 people in 4 different vehicles that are emitting a much larger amount of emissions. So that carpooling also helps in reducing pollutants.

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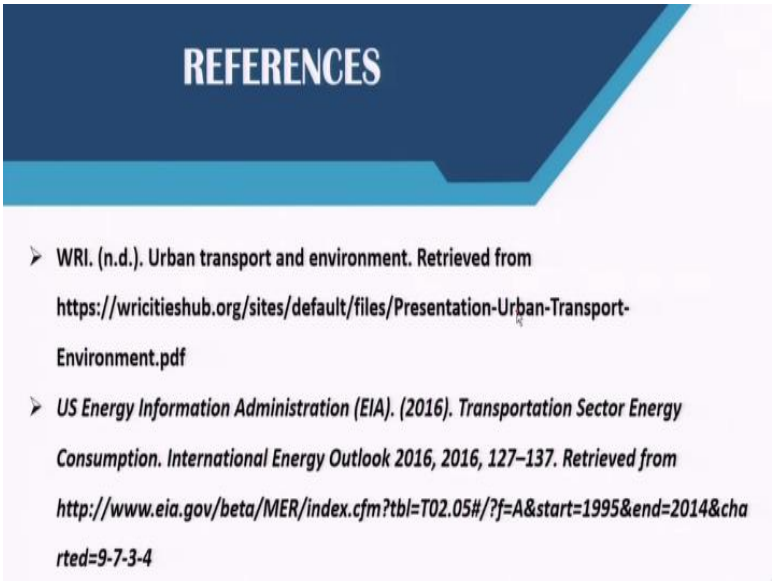

So that brings us to the end of our course, not only the lecture but also the course. These are the last slide of references that you can use.

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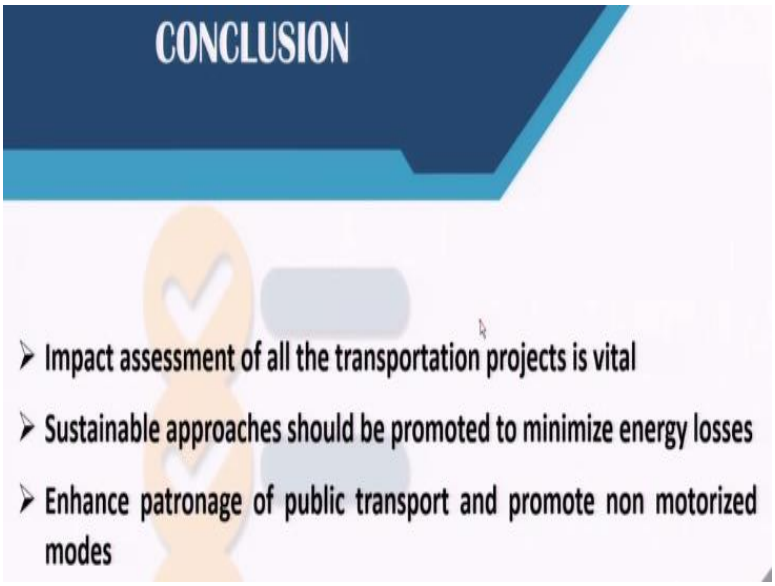

I hope you have had an overview of what multimodal transportation is during the entire course. In this lecture of course, we have exposed you to different types of environmental impact assessment, health impact assessment. How do you develop multiple strategies to avoid shift and improve the existing scenarios to minimize the impact of transportation on the environment? So, I hope you have enjoyed this lecture and the entire course. Thank you very much for your attention.