Introduction to Multimodal Urban Transportation System
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Module No # 08
Lecture No # 36
Non-Motorized Transportation (NMT) Planning: NMT Design Principles

Welcome back everybody! We are now going to continue our lecture in the non-motorized transport series. We have looked at how to measure bicycle level of service as well as pedestrian level of service. Now we will get into the design aspect of NMT facilities. So, from this lecture onwards we will look at the different design principles and how to design a different NMT facilities.

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In today's lecture we will be taking you through the 10 guiding principles as well as 6 supportive principles for designing non-motorized transport facilities. This entire lecture is taken from the NMT Guidance document that was developed by Ministry of Housing and Urban Affairs, Government of India.

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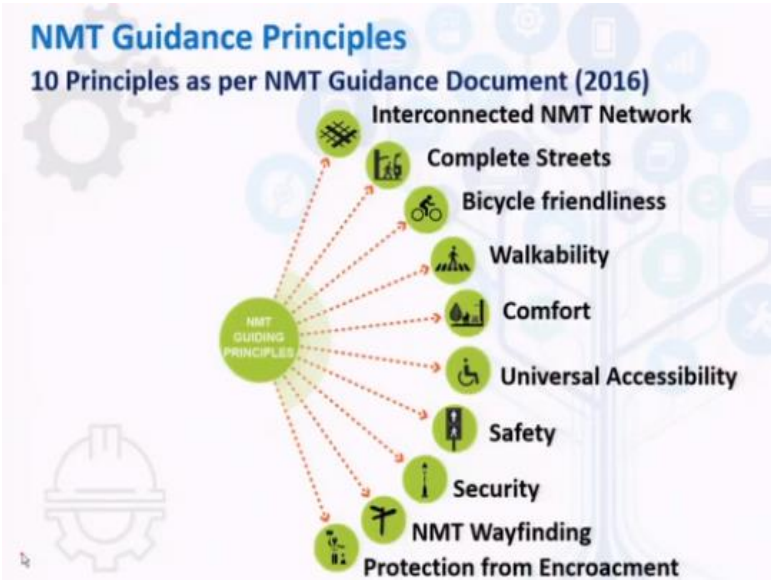

At the outset we will be looking at the 10 different principles that are listed in this document. So, this is a very well compiled document that takes into consideration the Indian NMT environment and develops design principles for different types of NMT infrastructure. They are divided into 10 basic principles or 10 guiding principles and we will look at them one by one. The first one is interconnected NMT network, next comes complete streets, then bicycle friendliness, walkability, comfort, universal accessibility, safety, security, NMT way-finding and finally, protection from encroachment. So, when you are designing any NMT infrastructure you have to keep in mind these 10 guiding principles. If you keep in mind all of these 10, then you are essentially designing a good NMT facility.

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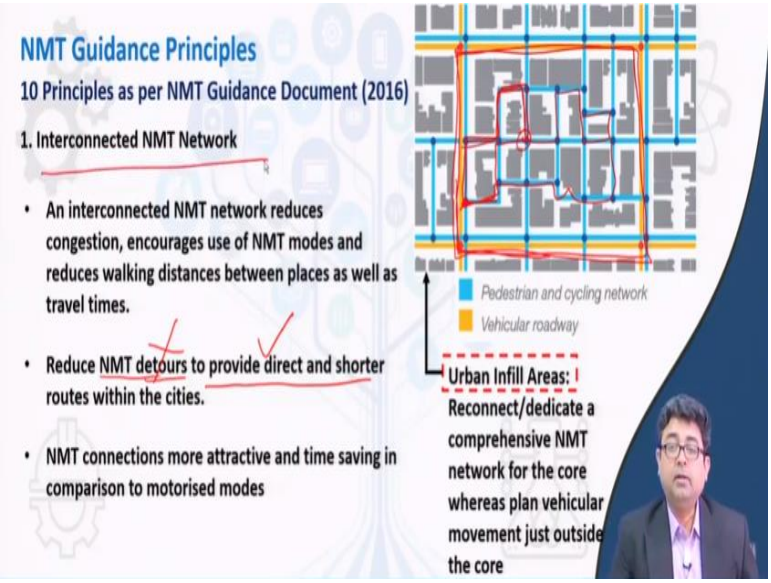

Getting into the first design principle which is the interconnected NMT network. If you often ask a pedestrian or a bicyclist why we do not often walk or bicycle, one of the reasons they will tell you is that there is interrupted facilities everywhere, that is not a continuous. For example, not a continuous sidewalk available from here to where I am trying to go or the roads that are connected from my origin to my destination are not suitable for bicycling. So what they are meaning to say is that if you provide them a continuous interconnected network then they would be more likely to walk or bicycle or use other forms of non-motorized transport. So this is logical because when we are otherwise travelling using vehicular modes we always have a continuous good pavement, but whenever there are lots of pot holes in the pavement or if you have Kutchha (unpaved) road coming in between and the road is not paved then you feel uncomfortable. Even while driving you feel uncomfortable you feel that, well I should not take this route again I should take some other route. So same is the case for NMT infrastructure as well, so when you are trying to walk from your home to the nearest bank. And you see that there is a footpath near your house, but as soon as you reach closer to bank the footpath disappears. That is discontinuous infrastructure and is not an inter-connected network. So if you have such kind of discontinuous networks then people will not walk, or bicycle, or use any other forms of non-motorized transport. So what the guidance document tells us is that, when you are designing for vehicular traffic that should be more at the periphery of your block, whereas inside the blocks you should have well connected NMT infrastructure. So preference should be given to NMT

infrastructure within a block area. Whereas in the periphery you can have preference to the vehicular traffic. If you design your streets in this fashion this will encourage a lot of NMT movement. Especially, we should avoid detours for NMT infrastructure, since you have to walk or bicycle that takes a lot of physical energy out of people trying to use them, thus, we should always try to provide them a direct connection rather than a detour. For a vehicle you can easily provide a detour which only will take will consume a little bit extra fuel. But in case of an NMT infrastructure, if the person has to go from point A to point B and you do not provide infrastructure rather you provide one that takes a detour, he or she may not end up taking NMT infrastructure or may not take a non-motorized form of transport. And then would rather just take up motorized 2 wheeler and reach their destination. So it is always good to avoid any detours and provide direct connect. So that is the first principle, you must have interconnected NMT network.

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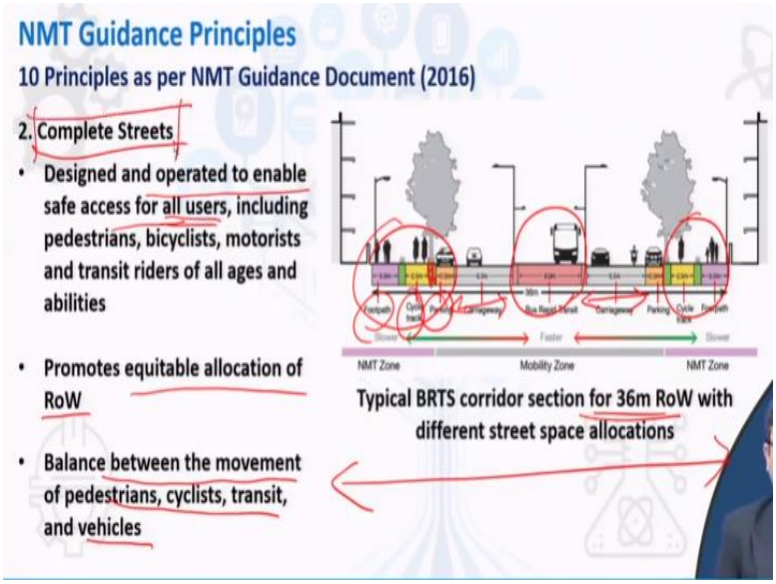

Next is the principle of complete streets. So whenever you are designing a street you have to keep in mind that the street should be designed for all modes of transport including NMT. So even when you are designing a main street, for example, this is an example of main street. It is a cross section of a main street which has 36 meter right of way. So even when you are designing a main street like this, you have to keep in mind that on both ends of this street there should be provision given to bicycles. There should be provision given to footpath, parking, green infrastructure. So all this should be included along with your carriage-way on both sides. And

most probably a rapid transit of some sort in the median of the road, right. So whenever you are designing the arterial in your urban area you should keep in mind that you should design it for all modes. That is what is called “complete streets”, designed and operated to enable safe access of all users. You can no longer provide or develop urban arterials or even local streets without keeping in mind that NMT users. This promotes equitable allocation of right of way and there is a balance between movement of pedestrians, cyclist, transit and motorized vehicles. If you do not provide interconnected infrastructure for NMT the likelihood of people travelling by NMT modes will reduced. And then again we will have the same issues that we have with vehicular transport of emissions and congestions and so on. So remember the second guiding principle is complete streets.

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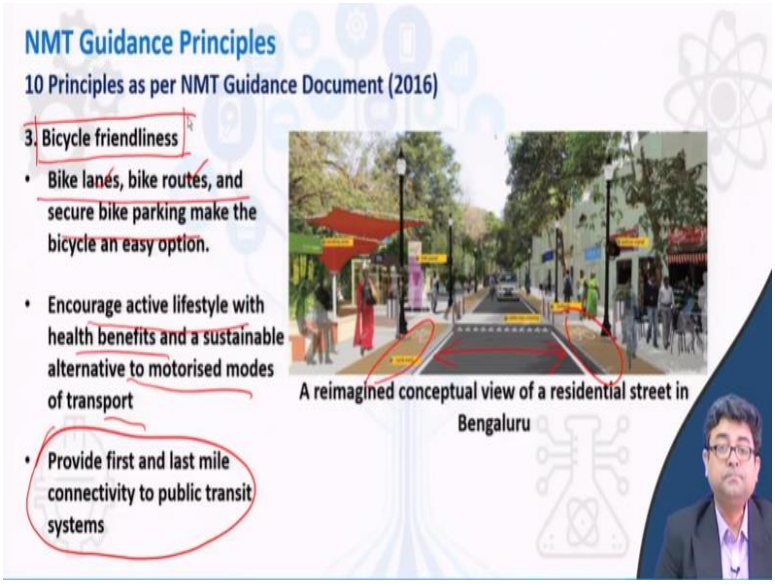

The third one is looking at how streets can be bicycle friendly. Now it is very important to understand that to promote NMT or different form of non-motorized transport near urban areas, you have to design the facilities in such a way that they are friendly to those users. If you do not have bicycle tracks on each side of the roads then you should ensure that the carriage-way itself is designed in such a manner that it makes the bicycle users feels safe. And if they feel safe then they would ride it a whole lot, so provide bike lanes, bike routes and secure bike parking to make bicycling an easy option. The other thing in our urban areas is parking, which is a big issue right now. We do not have good parking facilities wherever we want to park either our motorized vehicle, 2 wheelers or bicycles. So we have to provide good parking spaces along with bicycle

lanes and routes, which encourage people to bicycle. You would also see that now in order to bicycle there are many corporate offices that provide locker and shower facilities. So if they have employees that are bicycling to office from a long way away then they provide them a good locker facility and shower facilities. So that if they sweat along their way they can come and take a shower in the office and change into proper office clothing. So that also is bicycle friendliness that encourages people to bicycle to work. So that will also encourage active lifestyle, health benefits and sustainable alternative to motorized transport. Bicycling has several health benefits, as you may imagine, it increases the physical activity levels or physical activity and helps in reducing a lot of diseases, be it high cholesterol, blood pressure or so on and so forth. And lastly it also provides the vital first mile and last mile connectivity to public transit systems. So, when you are trying to encourage people to use public transit systems, bicycle access to public transport stations is also very important. Because now if you have good bicycle parking, say for example at a metro stop, then people will just use their bicycle, come there, park and then use the metro. Some of the metro systems around the world also allow certain types of bicycles to be taken along with them on the metro during certain hours of the day. So that can be called multimodal transport. Now you can allow different modes to coexist with each other so that at non-peak hour the traveler can take the bicycle on the metro rail, go to destination, again take it out, and then bicycle on it. So you can have that sort of facility as well. For at least, a bare minimum, have good connectivity from the catchment area of a metro station or a bus station or a BRT station to access the metro rails or the BRTS. And then have at least good parking there so that they can come and avail the mass rapid transit or a public transportation in your city. So bicycle friendliness is the third principle that has to be kept in mind when you are designing for NMT infrastructure.

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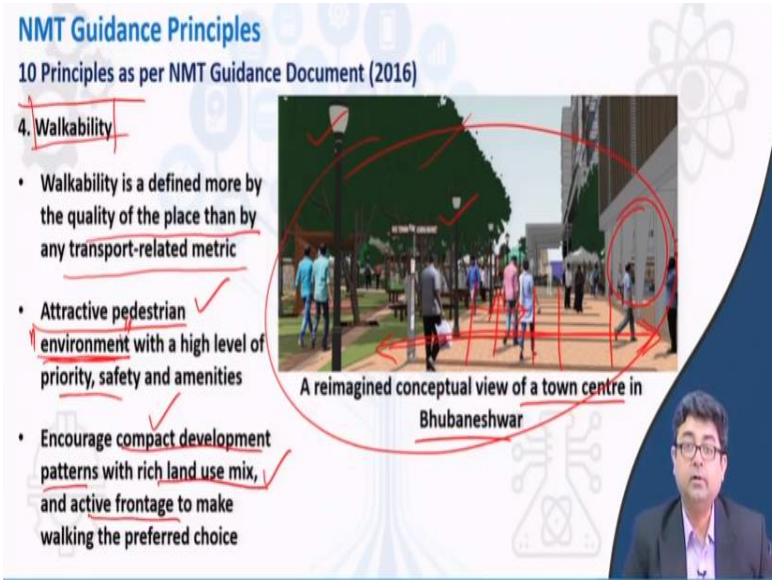

The fourth principle is walkability, it is defined more by the quality of the place than by any transport related metric. So although we although used the phrase pedestrian transport, but when we are talking about people or walkability of a space we are looking at more than just the transportation aspect. We are looking at the environment that is around the pedestrians. A good safe environment encourages people to walk and helps increases the NMT usage. So attractive pedestrian environment with high level of priority, safety and amenities will be conducive to pedestrians. You have to have a lot of tree shade, for night, you have to have lot of illumination. Space given for people to walk has to be comfortable and are not rubbing the shoulder against each other. So all of these things put together is known as the walking environment. You have to make sure that the environment given to the pedestrians is such that it encourages people to walk. This is a rendering of a town center in Bhubaneswar. As Bhubaneswar is one of the smart cities, they are planning to have the town center remodeled or redesign in such a way that it encourages a lot of pedestrian activity. Another aspect of improving walkability is to have compact development patterns with a good mix of land uses and active frontage. So what we mean by active frontage? If you convert the front entrance of the building, commercial adjacent to the pedestrians, then they are encouraged to walk, their safety levels also goes up. Instead of that if you have, for example, vehicle parking in front of a building and then people are unable to see what is in the building. So what people like especially in commercial areas is to kind of feel that there is somebody right next to them while you are walking. This frontage of the buildings

are in such a manner that they make the pedestrians, walking alongside them, feel safe. That is something that encourages more pedestrian activities. So you always try to avoid parking in front of the building and can have parking behind the building. We are not discouraging parking altogether but have parking behind the building, such that you have pedestrian footpath or your pedestrian sidewalk right up to the frontage of the building. Compact development allows different types of land uses to be close to each other, so if the distances are close to each other, then people are more and more encouraged to walk. Similarly in a good mix of land uses people can go from one place to the other in short walking distances. So in order to encourage walkability you have to have the environment which is conducive to walking. So we have to provide the environment and what are the elements involved in providing the environment.

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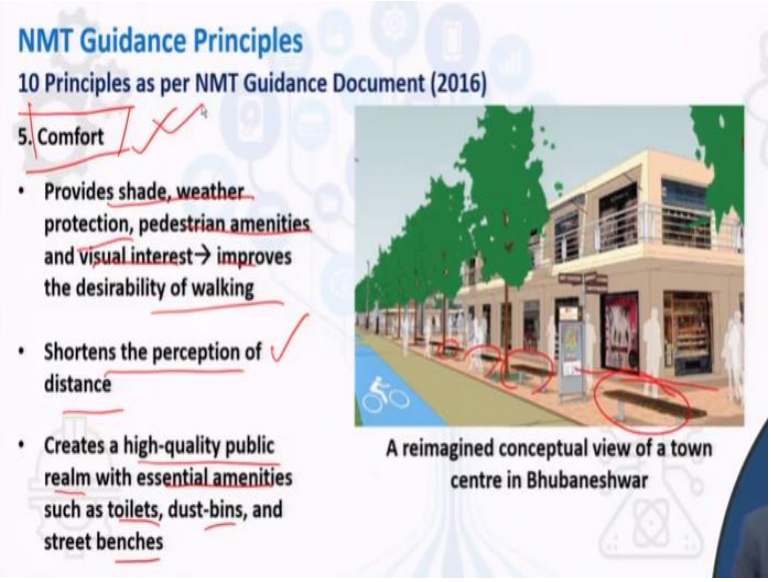

The next designing principle is comfort. Whenever it comes to the design of NMT facilities comfort is one of the most important things that users always want. So whenever you ask somebody why do not you walk to your bank which is only 200 meters away? They would say it is too hot to walk, or it is raining so we cannot walk, or the footpath is broken so we cannot walk. All these are pointing towards the level of comfort of the users. So if you want to encourage more pedestrian activity or more NMT activity you have to somehow quantify this level of comfort. Comfort is a feeling which is very qualitative, my comfort level is different from your comfort level. But there has to be a way, if you try to quantify it in some manner, and then set a threshold for that measure of comfort and make sure that you provide shade, weather protection,

pedestrian amenities, visual interest all of these improves the disadvantages of walking and also bicycling activity. So, if you are providing some benches alongside, say a commercial area, where people can just walk alongside window, shop or do whatever they want to do. Or maybe there is a cafeteria where they want to sit and have a cup of coffee. All of these provides comfort to the pedestrian and then he or she would like to walk or use bicycle and it shortens the perception of the distance. So if you make something very comfortable people will not think that it is arduous to walk or it is too far away. Suddenly they have too many things to do or see along the way. The perception of distance then shortens, it feels like it is just a small distance away or it is just a 5 minute walk away. So if you providing them comfort it is always shortening the perception of distance. Thirdly, it creates a high quality public realm with essential amenities such a toilets, dustbins and street benches. All of this put together not only provides the environment for walking and bicycling but it also enhances comfort levels. So, just as we have to ensure the comfort level of a motorist, while he or she is driving his personal vehicle or 2 wheelers, in a same manner, we have to cater to the comfort levels of the pedestrians or the bicyclist when he or she is using their bicycle or walking along a sidewalk or a footpath. It is no point encouraging everybody to walk but not providing them with comfortable infrastructure or facilities. You to take that into account, for example, when you are driving your 2 wheelers nobody likes too many pot holes, it is very uncomfortable or nobody likes too many speed humps that is also very comfortable. Similarly, when you are taking care of the comfort of the people riding your vehicles, you also have to take into account the comfort levels of the NMT users.

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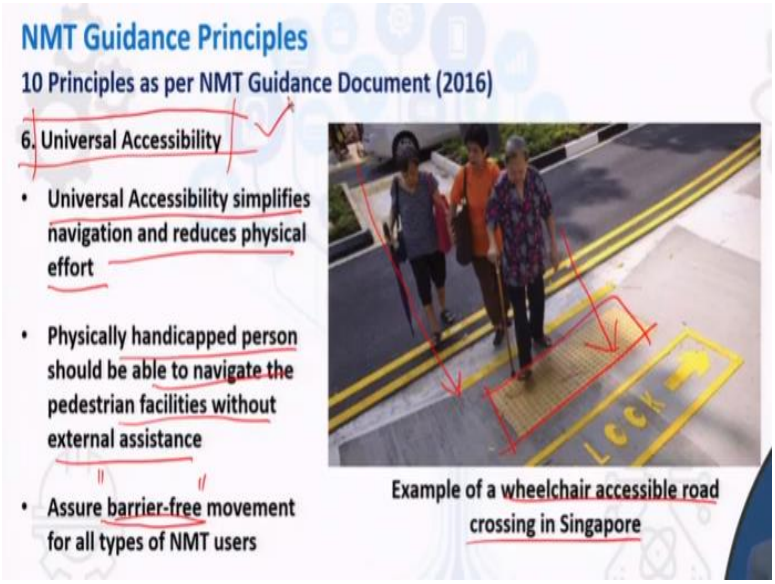

Moving ahead with the sixth principle which is a very essential principle—universal accessibility. When we were designing for NMT infrastructure we have to keep in mind that we are trying to design for all types of users who come under the ambit of non-motorized transport users. That includes people with disabilities, specially-abled people, small children, elderly people. So, all of them combined are categorized as non-motorized transport users. Here is an example of a wheel chair accessible road crossing in Singapore. So somebody is trying to cross from here to here. There are ramps made in such a manner that he or she may be able to use the wheel chair to cross. Even this sort of tactile flooring ensures that a visually impaired person understands, where he or she is walking. So universal accessibility simplifies navigation and reduces physical effort. When we are talking about NMT users we have to always realize that there is a level effort that goes into walking or bicycling, i.e., physical effort. So, we have to always try to minimize that physical effort. Physically handicapped person should be able to navigate pedestrian facilities without external assistance. Our goal should not be that specially-abled person will always have somebody helping him or her. He or she should be able to navigate through these facilities by themselves, so that should be our aim while you are designing these NMT facilities. That is why you would see a lot of design currently are barrier free designs, meaning that it has no barriers to all, it provides no barriers to any type of NMT users. Any user can use this, so you would see entrance of a building used to have only steps in the past, but now you have to have a ramp access to the building as well. So that is an example of

a barrier free design. So similarly, when you are on a sidewalk, you have to have the ramps at the intersections so that people can easily go up and down the sidewalk at the intersections and not have to jump off of it. Usually people can easily go down the ramps or slopes. So, universal accessibility is something that is essential in case of non-motorized transport infrastructure design.

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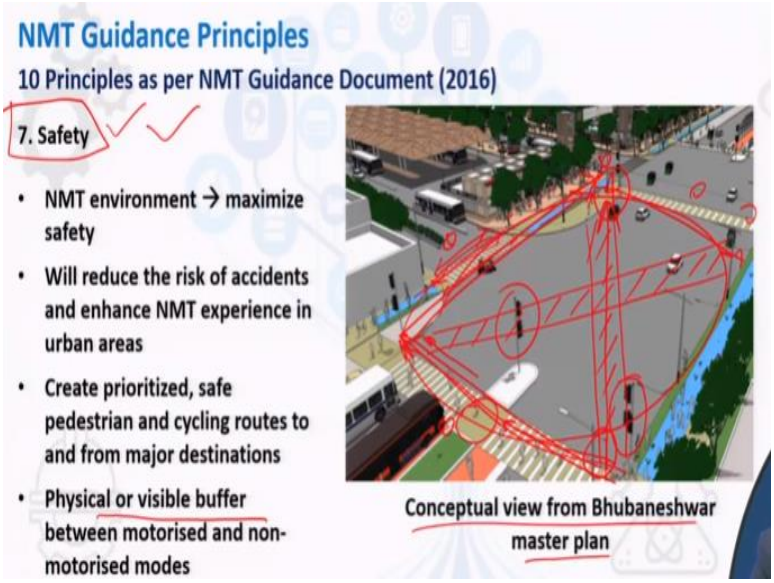

The next one and crucial one is safety you have to have your facilities designed in such a way that they the users feels safe while using such a facility. Say for example, you have such a large intersection with a conceptual view from Bhubaneswar master plan. If you have a very large intersection where you expect people to cross from here to there and there to there, you have to have proper safe infrastructure that would allow them to do so. You have to have a median refuge island because there are 2 lanes here and other 2 lanes here, so you cannot expect a bicyclist or a pedestrian to cross at one go and have to have a refuge island. You have to provide curb extensions so that this distance that they are crossing reduces such that the right of way carriage may reduce at the intersection and this distance is shorter for the pedestrian or bicyclist to cross. So all of this includes the aspects of safety. When you are providing for signals at the intersection, you have to make sure that there is a NMT phase. In many such large and modern intersections, you would see that there is all-red phase. The all-red phase allows people to crisscross in any direction that they want to. So if somebody is crossing from 1 and wants to go to 4, he or she need not take this route. He can or she can take the direct route here, so what the

signals are designed in such a way that it provides an all-red phase. So red for this approach and this approach, so, that the pedestrians can cross in a crisscross manner as well and all the vehicles at all the legs of the intersection are seeing red and are stopped. So you will see such kind of pedestrian signalization also especially in case of large intersections where there is a lot of pedestrian movement happening. So all of this comes under the realm of safety so all this aspect should be taken into account when you are trying to design for any kind of NMT infrastructure. Physical or visible buffer between motorized and non-motorized vehicles—any kind of buffer, it may be a tree buffer or it may on street parking that provides a buffer, such buffers also help the movement of non-motorized users okay.

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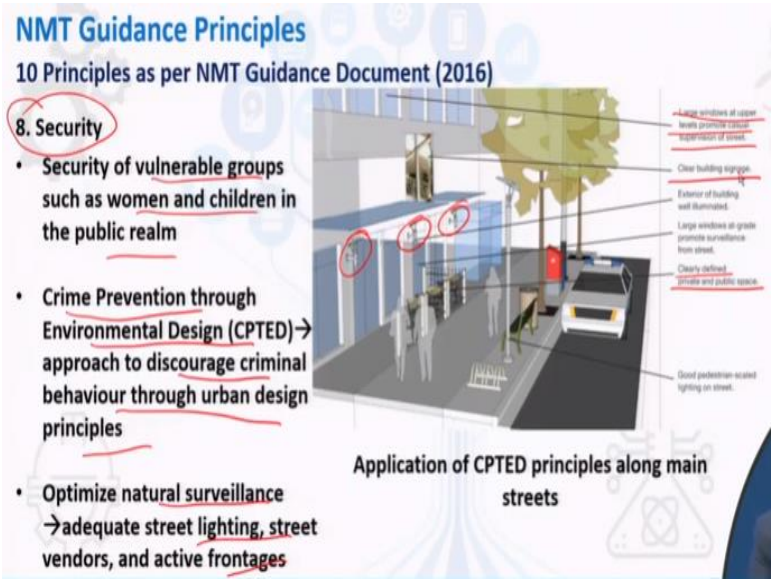

Moving ahead, closely with safety, the other aspect is security of vulnerable groups, such as women and children, in the public realm should be ensured. Nowadays you would see there is the large presence of public CCTV cameras along streets. Also the provision of proper lighting during evening and nights is very essential in order to help people feel secure while they are walking. Especially women, elderly people and children, security has to be paramount while you are designing for them. There is also, crime prevention through environmental design which discourages criminal behavior through urban design principle. You can do so, by having small lights alongside the walls, as well as, alongside your façade of buildings. So there are urban design principles that integrates security into them and natural surveillance, obviously, which we talked about. So, all of these principles ensure that people feel secured while they are using non-

motorized transport as well. Large windows at upper levels promote casual supervision of the street. Anybody sitting on the second floor can just have a look on the street that gives sense of security. So all of these, gives them a sense of security and while you are designing, again safety is one thing, security is another thing. Both of them have to be taken into consideration while developing NMT infrastructure.

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The ninth one is way-finding. So often we have street signs which again are geared towards motorized users. So for a non-motorized pedestrian it is no use for him or her to see a sign that says the destination is 10 kilometers away. That is not useful for him or her because they are not going to walk for 10 kilometers. So when people are walking for shorter distances you have to have way-finding at a very local level. Maybe at the street level for example you have to have such boards telling them if you go this side, the post office will be this side. If you go this side the school will be on this side which is a 5 minute walk away. So if you give way-finding in terms of time that helps a pedestrian or bicyclist, rather than giving it in the form of a distance. Perception of distance reduces if you give it a time metric. So, wayfinding has to be easy and legible, and they should be in multiple languages. Maybe people who are walking both are local as well as or may be from out of the region. For both of them it should be easy to understand. I may know where the local temple is because I stay there, but somebody who is coming from out of town or from another neighborhood may not know where the local temple is. So we may help him or her in giving them better navigation, so that they can walk. This definitely promotes

tourism whenever you go to a tourist spot. You may have seen many of them offer a walking tour, so, you should keep an eye and see how during the walking tour there are good legible NMT way-finding signs. It will tell you exactly how to get from point A to point B which encourages people to walk and that is very essential as well.

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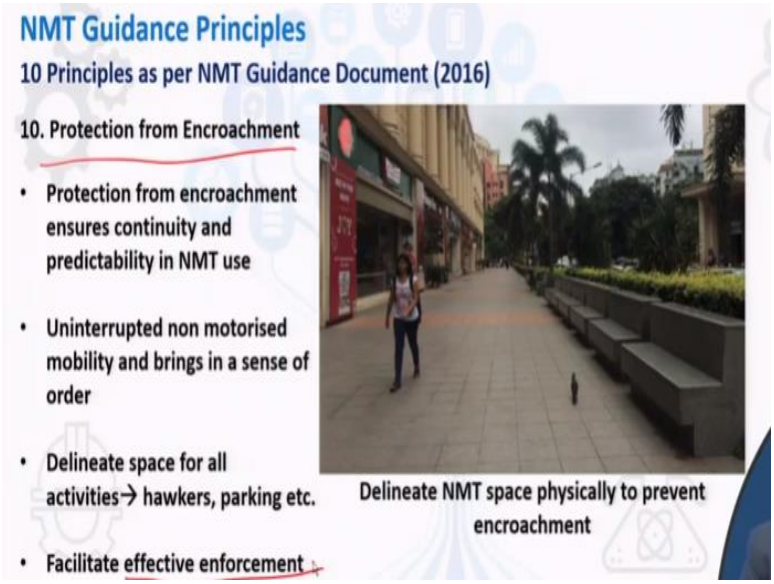

Lastly, protection from encroachment. This is one of the biggest things that we see at an Indian street, especially in busy commercial areas where there are vendors who are encroaching upon the footpath. Also, sometimes in our residential areas, people either park their 4 wheelers or 2 wheelers on the footpath. You hardly have any space to walk on that footpath. Rather than fighting with the vendors, for example, to move away from there, if we provide them a proper space for vending and incorporate that into our design, that will help in the walkability or even help to promote NMT usage. Also if you just have proper parking areas for vehicles to park they would not encroach upon the footpath. All of these have to be taken into account and of course there has to be effective enforcement. All of these regulations and rules should be known to everybody, where the parking spots are, where the vendor's area are, etc. So those were all the 10 guiding principles that should be used while you are designing a NMT facility.

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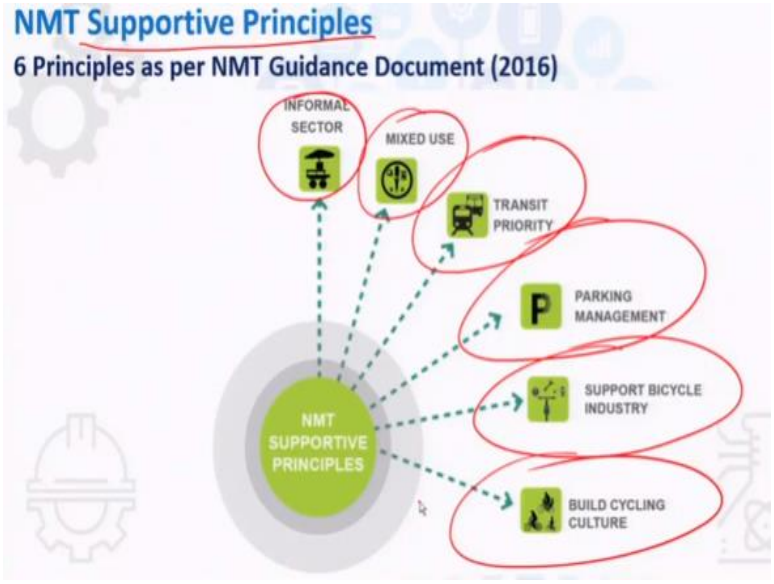

Now supporting of those guiding principles there are 6 things that one has to keep in mind. These are supportive principles. First thing you have to keep in mind is the informal sector. You have to make sure that you have mixed land use alongside to promote an NMT infrastructure. Make sure transit is given priority in those areas where you are providing NMT infrastructure. Effective parking management has to be there, this will ensure that there is support to the bicycle industry and also will give rise to the culture of bicycle. These are supportive principles in addition to the 10 guiding principles that you should keep in mind while you are developing NMT infrastructure.

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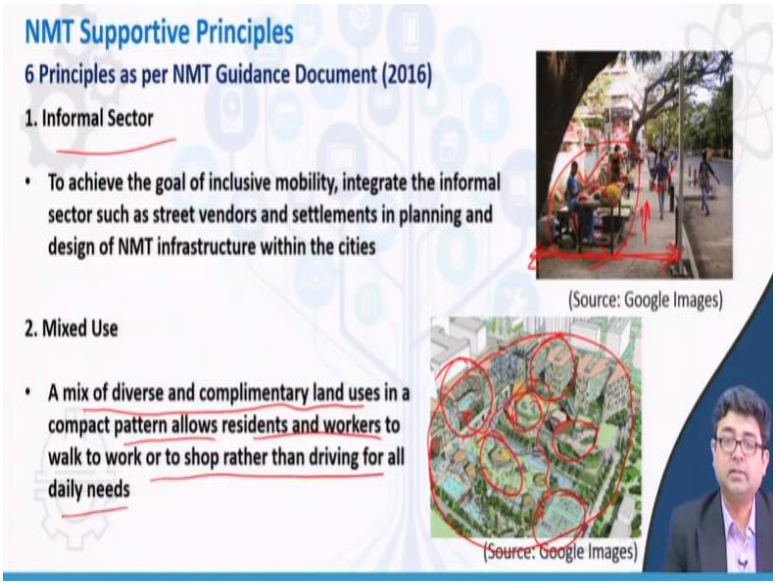

Okay quickly we will have a look at them. Informal sector will always be present alongside the footpath. But if you ensure that they will be present within a certain distance and still leaving a clear path for the pedestrian to walk, that will incorporate both the vendors as well as the pedestrians. Rather than making them encroach upon the entire foot path you should give them a designated space. Mixed use and complimentary landuse, in compact pattern allows residential workers to walk to work or shop, rather than drive for all of their needs. If you have a park here, your residences here, offices here, an open plaza with lots of restaurants here, a sporting tennis court here; so all of this is a completely mixed use area. If you have such areas whoever lives here will just walk to the restaurant here or walk to the tennis court here or just walk to work from home. So all of these will be within the walking distance this encourages NMT usage.

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You already looked at Transit priority. NMT provides the very crucial first mile and last mile connectivity. So whenever you are prioritizing transit you have to make sure that you provide for NMT infrastructure or vice versa. When you see that there is lot of NMT usage around in a certain area you might as well give priority to transit usage. Because, these people who are using NMT they may end up using public transport for the longer haul. Parking management, we have also briefly looked at that. If you provide on-street parking that provides natural buffer to the pedestrians from the traffic, it is always encouraged. But the main point is you have to have proper designated spots for parking and there has to be enforcement when people are not parking at the right spots. So you have to take that into consideration as well.

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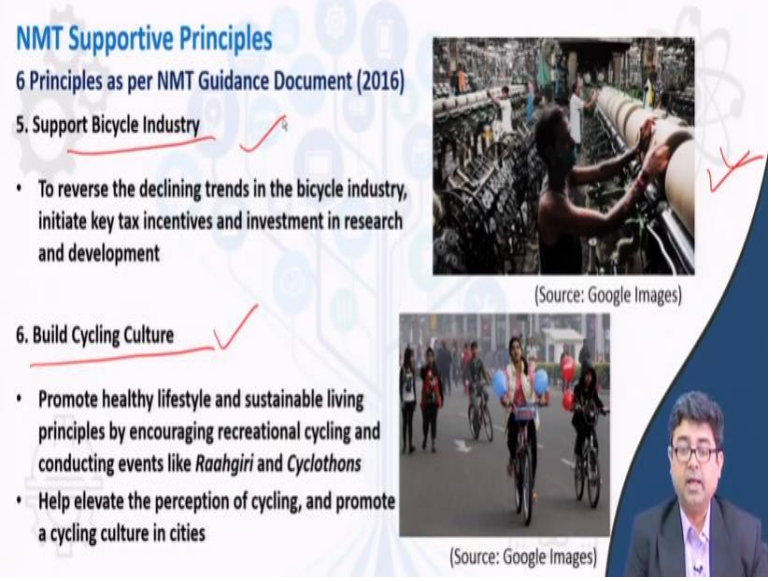

It has been noticed that bicycle industry gets benefited a whole lot when you design for good bicycle facilities, good NMT facilities on the roads. Bicycle industry can be supported just by encouraging and providing these facilities and finally building a cycling culture. We already have lot of people who use bicycle for their daily needs but most of them are captive users, i.e. most of them are users who cannot afford other means of transportation. So that should not be the case, they should be choice users, i.e. they should be choosing bicycle out of their own will. And that will only happen when you have good NMT infrastructure in place. So building a bicycle culture will support the bicycle industry which in turn will then help the NMT users grow in your urban areas.

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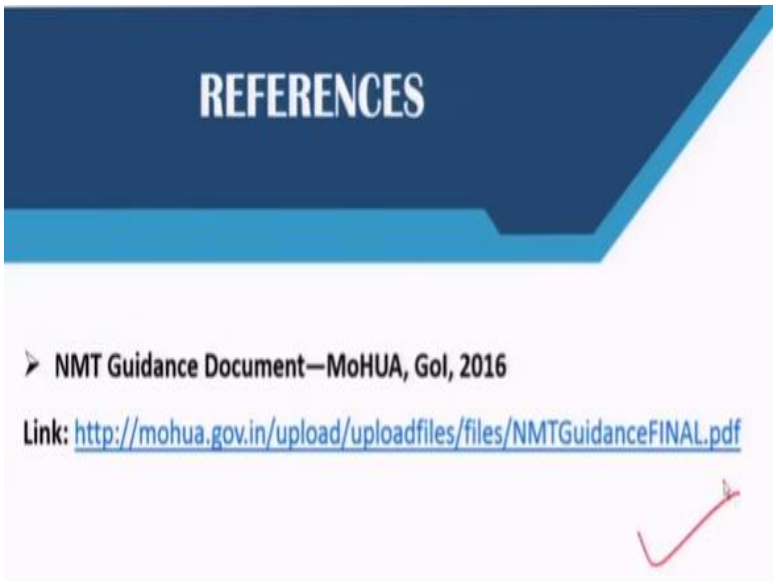

So that brings us to the end of this lectures again this is the reference that we have used and it is free for download at this website.

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What we have informed you today are about the 10 guiding principles in NMT design and along with that we have also told you about the 6 supporting principles. All the guiding and the supporting principles are listed here. In a nutshell, you have to design the environment in such a manner so that it encourages the NMT users to come out and use the NMT modes rather than using their motorized vehicle for all different types of purposes. Thank you for your attention!