Introduction To Multimodal Urban Transportation System
Prof. Arkopal Kishore Goswami
Department of RCG School of Infrastructure Design And Management
Indian Institute of Technology-Kharagpur

Lecture - 45
Urban Transport & Sustainability: Transit Oriented Development (TOD)

Welcome back friends. Now that we have looked at what is travel demand management, what are the push and pull measures and we have also looked in a little bit of detail in one class about parking and how it can be utilized as a travel demand measure.

Today in this class, we are going to introduce you to another such topic which is called the transit oriented development or TOD, which is one form of strategy or development that allows you to incorporate various TDM measures into one single measure.

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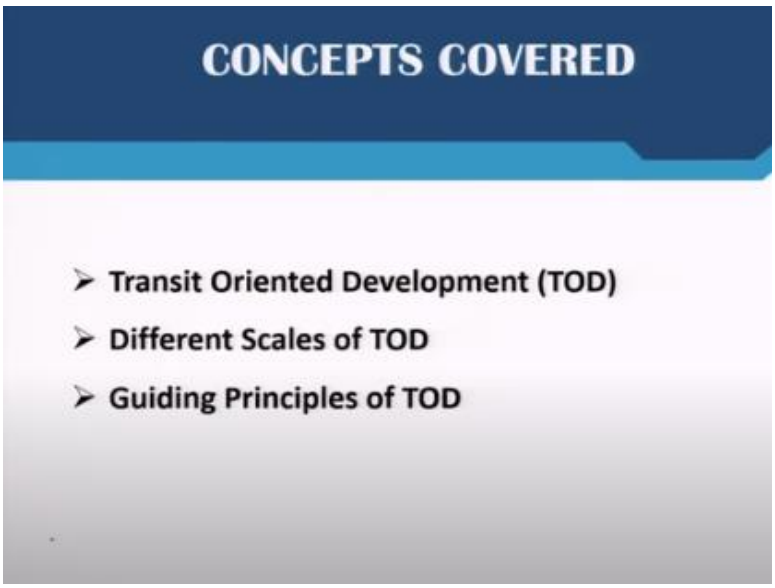

So in today's class, what we are going to tell you is we are going to introduce this topic of TOD or transit oriented development, show you the different scales of which TOD can be designed and also familiarize you with the guiding principles of TOD.

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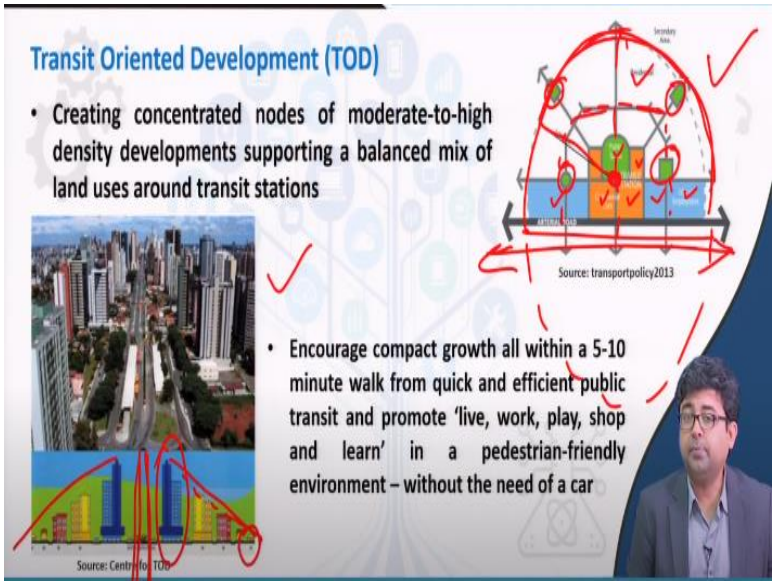

So transit oriented development, what is it? I mean, this is a term that is being used a lot in other countries, other developing countries as well. But it has recently gained some importance and traction in India as well. We do have a national to TOD policy in place. And so many of the developments, especially around the mass rapid transit corridors is being planned to be designed in this fashion.

So what is a TOD? Now TOD is a classic example of how transportation and land use should be integrated, how it should be integrated, that is one aspect of TOD. The other aspect of TOD when you purely look at it from the point of view of transportation is that it encourages the use of sustainable transportation modes. And it integrates them also in a good fashion.

So the two main things if you have to remember about TOD is the integration or the interaction between land use and transportation. And then furthermore, in the transportation side, it is the integration of different sustainable transportation modes. If you also want the third aspect, which is more related to land use itself, we are looking at in TODs we look at land uses that are mixed in nature, that are dense, that are compact in nature as well.

So that is the land use side of it. Then you have the transportation side of it, and then you have the integration between the land use and transportation. So conceptually when it was first developed, it was developed in this fashion, which is if you have a

major arterial on which your mass transport line or your mass transit line runs, then a semicircle around it, it could be a full circle as well.

But it is this the two circles, the two semi circles could be identical or different in nature, but whatever is the case, it is developed in this fashion. So maximum radius from the transit station. So if this is the arterial road and your transit station is right here. So you want to develop it in such a fashion that there are multiple land uses. So different land uses are shown in different colors, and residential is in white.

And also you have enough green spaces around these. And also what is not shown very well in that is that your different transportation lines are or different transportation modes along different networks are well coordinated. So it is a compact land use, it is a mixed land use and it integrates different types of sustainable transportation modes with it. Now this is a realistic sketch or a realistic example of how transport how TOD is developed.

Again, if you look at it from this way, where this is your main transportation or mass transit line, and you have such kind of development along both sides of the line, right. So it will be high dense, highly dense, high rise buildings first, then slowly tapering off to being more and more spread out. Whereas your transit line will be right at the center.

So you can have it either in a semicircular fashion. You can have it on both sides. It could be either around just one node. It could be along the corridor as well. Along the corridor development is usually called transit adjacent development rather than transit oriented development. But the principles are pretty much similar. So why was there a need to develop this kind of a scenario?

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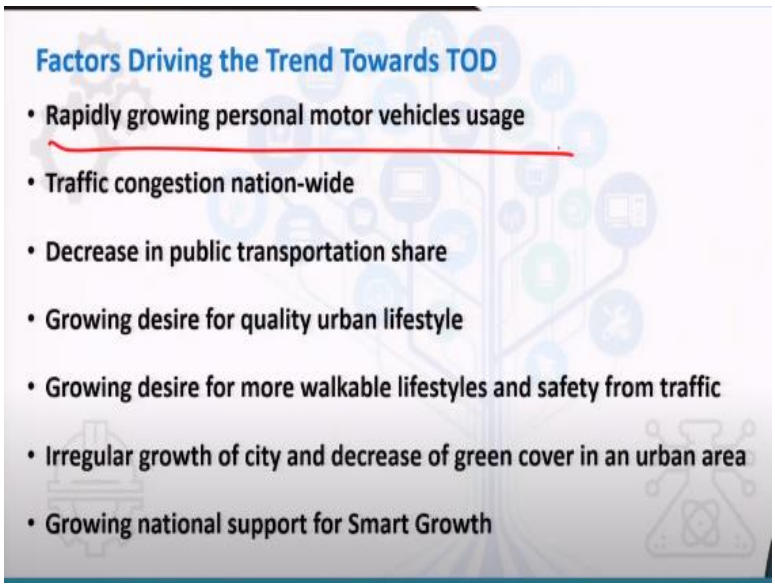

So what was happening was because there was the or there is still a rapid growth in the use of personalized vehicle and decline in the ridership of public transport vehicle, what urban transportation planners and urban planners started to think was how do we encourage people to use public transport? So that was their first aim, right? How do we attract people to public transportation?

So the immediate thought was, why do we not encourage or attract people to stay closer to the public transportation not very far away from the main line, but closer to it. Now, then they started to think well, no point only thinking about being closer to the public transportation line, but let us think that they are closer to the public transportation stations, right. Because eventually public transportation has to be accessed through the stations.

So although you are you may be close to the line, but the station may be still 400, 500 meters away. But that does not help. So let us then they started thinking was let us attract people to stay very close to the public transportation stations, okay. So that translated into this concept of transit oriented development.

Then came the thought that well okay now we are attracting people to stay near the public transportation stations, where they can now take the metro or the BRTS and go to their workplaces. But what about their other work purpose or other trip purposes? For example, now they want to go to the grocery store, they want to go to a movie theater, they want to go to a restaurant, do they still use their private modes?

So in response to that question, what they then started thinking was let us not only develop this TOD as a residential zone, let us develop it as a mixed zone. So then came the mixed land use concept. So mixed land use concept now said that okay, everything is pretty close by to each other. So you do not have to use your car or two wheeler all the time, you can now walk or bicycle or use some intermediate public transportation modes or bicycle sharing, so on and so forth.

So that was the intent of mixing up the land users. Then they thought okay, it is good to encourage these people to use other forms of transportation, but we have to also provide good quality of them. So then what started happening was, they started to look at the infrastructure, the infrastructure of sustainable transportation modes around these nodes. So they made footpaths pretty wide around there.

They started introducing bicycle sharing around the stations. They started discouraging the use of private transportation modes by increasing parking. So in yesterday's class, we looked at how parking can play a role in driving you out of your car, right. It can be used as a push measure.

So what they started doing was they started increasing the parking prices in the TOD, so that people would not now use their private modes more often or for every purpose, they would not use their private mode, they would rather walk or bicycle. So these are all these guiding principles around of a public transportation, of a TOD node. And this is how evolution of TOD started to happen, right.

So now if you are talking about a full-fledged TOD, you have to have all of these components designed in such a fashion that compactness is encouraged, mixed land use is encouraged, use of sustainable transportation modes is encouraged and use of private transportation modes is discouraged, to a large extent. So these are how this is how the chronology or the sequence of TODs evolved.

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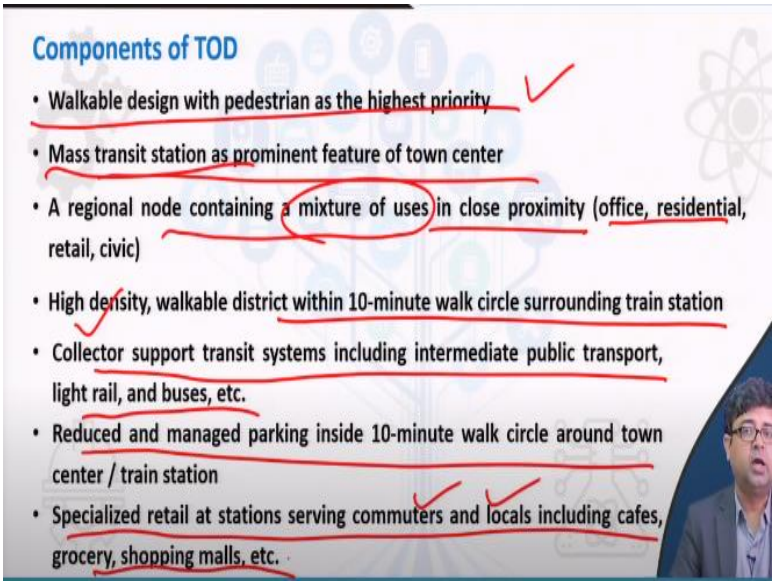

Then when we start individually looking at different components of a TOD, you would see that walkability or walkable design is a very important part of it and we have already told you how to design good walkable streets. Mass transit station is a prominent feature of that town center. So now if you think of, conceptually if you start to think of this as the center of your town, or your town is your TOD, right.

So it is a small it is not a large town, but it is a small area. But now you can call it, you can call this transit node as the town center. So if you think of that as the center, then you can develop around it in a very planned fashion. A regional node containing of a mix of uses, so land use mix, in close proximity. So now you started to see that there are office residential retail everything close to that node, that transit node.

It has to be high density. Now high density is something that is mostly something that is encouraged mostly in cities that are not very dense. Usually cities worldwide are very dense, but you would still find some Western cities that are sprawled, and they are not seeing the benefits of public transportation, or not seeing the benefits of integrating different modes of transportation.

So what they do is then, they densify the areas around the transit nodes, densify is not a word, but I am using it as a word. So they increase the density of the land uses around the metro stations also. They do that by increasing FAR or FSI or however they use it. But in our cases, you could argue that Indian cities are already dense. So how much more dense do you want to make it.

Because we usually are we are fed up with people living so close to each other. So maybe density is not one of our focuses, but definitely land use mix is one of our focus, right. We have to have the proper mix. We often see our neighborhoods being purely residential, sometimes. Sometimes they have residences on top and the ground floor is sometimes let out to retail stores.

But they are not done in a very systematic fashion. Maybe the land use does not support it, but it is going on illegally or something like that. What that usually tends to happen after that is that people, the shops that open up are all of either similar nature, or they are not disorganized in a proper fashion.

So if you have a proper land use mix, if you have a land use code, which says this is the mix of land use, if you have 20%, residential, 30% retail, 25% entertainment or so whatever it is, and that is categorized maybe as a land use mixed type A. Whereas then there will be a different proportions of land use mixed type B.

So if you actually have such land use mixes coded in your zoning or in your land use maps that would really help in designing the TODs properly and we do need good land use mix so that we can encourage the use of sustainable transportation modes. And they have to be all within 10 minute walking distance, right. As the distance increases, probability of walking goes down.

People do not want to walk for longer distances. People do not want to bicycle for longer distances. So all of this design or everything has to be within a 10 to 15 minute walking radius so that everybody is encouraged to go to different places by walk or bicycle. Collectors support transit systems including IPT, light rail and buses should be provided. Now there has to be a good if your TOD now it is not just a small area around the transit station.

Now if you think that there are multiple transit stations and then you have multiple such TODs, which are now overlapping. So what tends to happen is only one mass transit line may not be sufficient for people to move from one node to the other. You

should have some supportive IPT or some supportive bus networks that are feeding into these, feeding into the main transit line.

So a TOD also has to have a good network of such feeder services, okay. Reduced and managed parking like we said. Parking has to be discouraged by either having fewer parking spaces or by having higher price of parking or both. So that is has to be done and specialized retail at service stations commuting, serving commuters and locals including cafes, grocery, shopping mall.

So again, when we are looking at mixed land users, you should be also looking at mixed sub land use categories also, right. So mixed land use may include 20%, retail, but if the retail is of all one kind, it is of no help. So even within retail, it has to be of different types. So all that mix or variety has to be ensured in a TOD.

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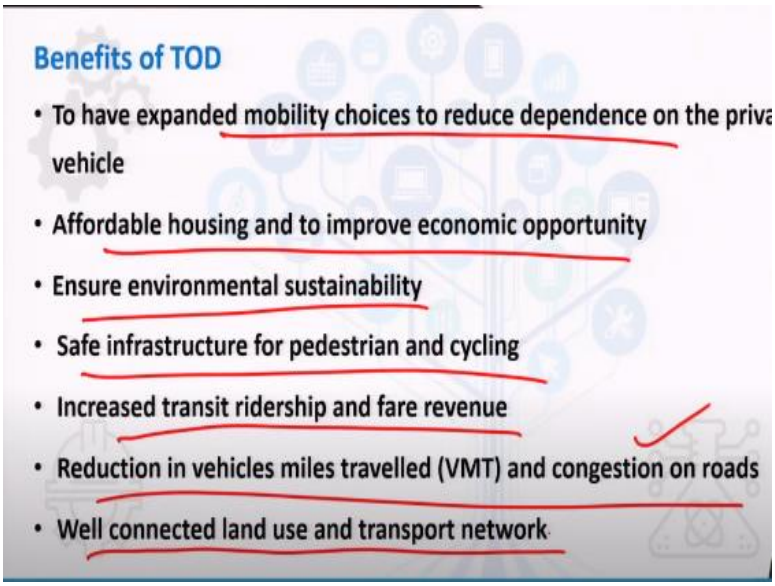

Benefits of TOD. Obviously, the benefits of TOD are the benefits of any sustainable transportation development. It will provide you choices for mode use, makes housing affordable. So now if you have mixed land use, and if you also have mixed income category housing in there. So what usually happens is public transportation was usually a captive mode for people with lower within lower income groups, right.

So now if you attract all those lower income group people, or not all maybe a proportion of those lower income people to be living around the metro stations, suddenly the entire TOD becomes very affordable, right. Now you have to have

affordable retail, you have to have affordable rental units. So everything comes up. So not only has to be not only there has to be a mix of land uses, not only it has to be dense, but also it has to be of mixed income groups.

Otherwise, if you just have start providing these fancy, high rise residential buildings with glass facades, then they are going to increase the land value, but they are going to only attract one category of the society and not a mix of people. So that also has to be ensured. This will ensure environmental sustainability because now you are using your private modes less.

It increases the safety of pedestrian and bicyclist because you are now designing those streets keeping in mind these modes of transportation rather than only designing streets with automobiles in mind. Increased transit ridership and fare revenue obviously, because everything is now centered around the transit station. So ridership should increase would increase and also the fare revenue increases.

The other thing that may also benefit the public transportation lines or the public transportation system by TOD is that not fare revenues, but now they can sell their land, because the certain portion of the land around the stations now belong to the belong to the metro authority or the BRTS or whatever it may be.

And then it is open to, the land is then so a first circle, or the first say 100 metres of the land usually belongs to the metro authority and then afterwards outside it belongs to the municipality or the corporation. So people what they start doing is the Metro authorities or the Transit Authority start doing is they start selling air rights. So vertically they start selling rights on top of their metro station.

So you will see that metro station is at the bottom or the underground and then you have parking on top of it or you have you have office buildings on top of it. So what they start getting is rental revenue by selling air rights. So that is called air rights, sometimes they even sell air rights on top of the metro lines. So Metro is going on one level and you can sell rights, they are called air rights, they have different mechanisms to do that.

But they, in some instances they have done that also. So this is additional fare or not fare, but additional revenues. These are non-fare box revenues to the metro line. So that also can be done. So TOD also allows them to get revenues in that fashion. Reduction in VMT because now you are not using your private vehicles much. So congestion would go down and well-connected land use and transportation network.

That we originally said that this is a prime example of how land use and transportation should be integrated.

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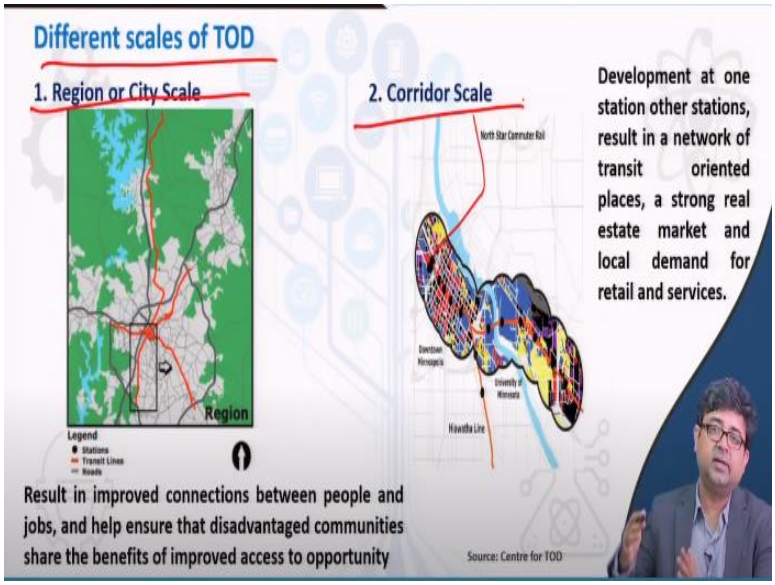

So now, this could be at different scales. If you start looking at the scale of a TOD, we started looking at a scale of a TOD from the point of view of one node or one station, right. Now, it could be one station or it could be for your entire city scale as well, right. If you are looking at entire city scale, then you have developed your city as a transit oriented development.

So your entire city development, land use and transportation are integrated around your transit nodes. So this could be at a city scale, this could be at only one corridor scale. So maybe you have picked only one. There may be multiple corridors of mass transit line in your city. But you have found out that this one corridor is the most beneficial if I convert this into multiple TOD zones and join them.

So it becomes transit adjacent called a transit adjacent development and TOD mixed together for the entire corridor.

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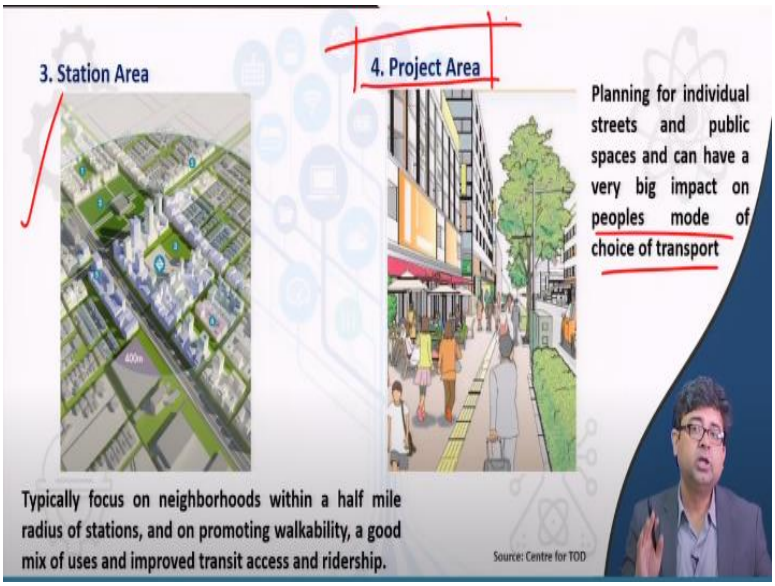

We looked at station area. So just around one station node, you are developing it as TOD or it can be a project area as well. Now the project area converted into a TOD is essentially a zone where people have choices of transport. But the mass transit corridor may not be available as well. So what happens is not many cities will have mass transit lines, right. But they want to encourage people to bicycle and walk.

So the principles of TOD which is improving, which is mixed land use, dense land use, integration of sustainable transportation modes, all those principles minus the mass transport node as such. So it may not be a mass transport node. Now think of it as maybe you have just suburban railway station or your intercity railway station. You do not have a good Metro network or a BRTS network in the city.

But you have a definitely every city or town in India has a station or a bus stop or a bus station right. So now think of it that as a node and just develop around it with those simple principles of TOD. So although it will not be around the mass transit node, but it is still it can be thought of as a project area, where the entire area now has these principles of TOD.

So you can build it at any scale you wanted to build it, as long as you are implementing those principles of TOD that we talked about.

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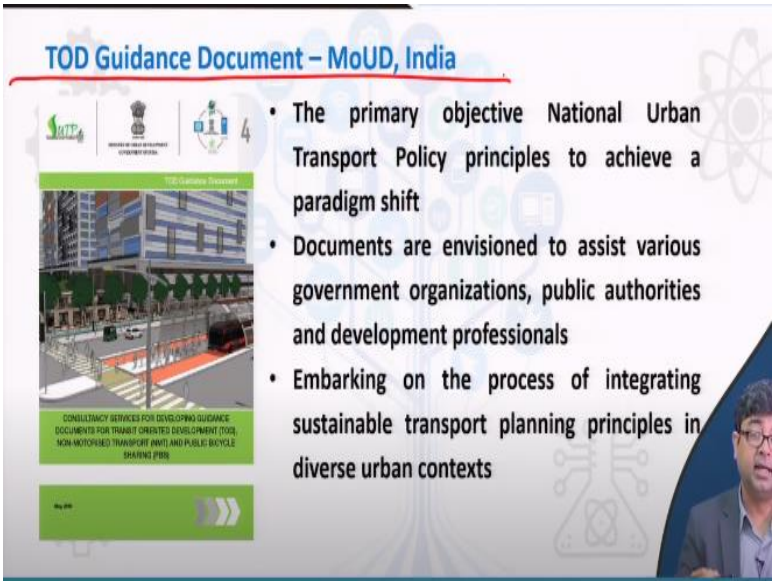

Now there is a guidance document that the Ministry of Urban Development of India has developed. Now, it is the Ministry of Housing and Urban Development. But at that time, it was MoUD. So most of the points are taken from that document to make you familiar, to make you familiar with that document and so that you can use it in the future.

This is based on true real life examples in Indian context, that this document has been developed.

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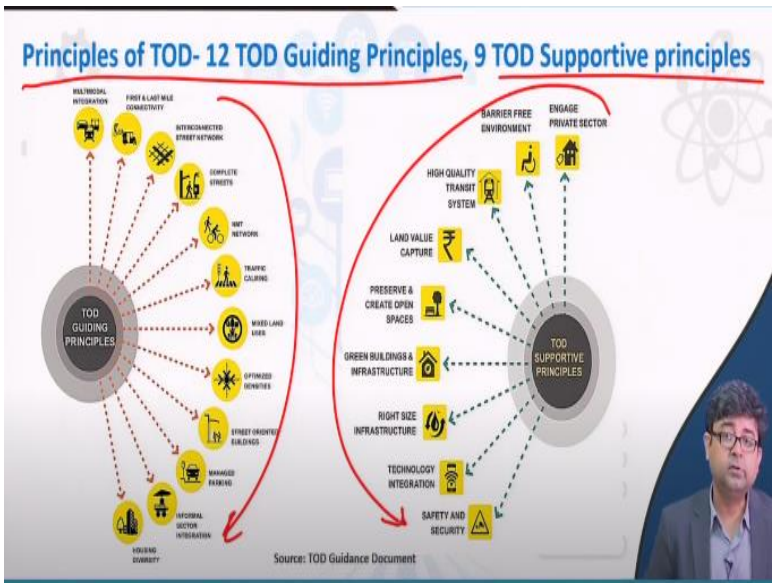

So you can follow that. And if your city is planning for a metro network or a BRTS network, then you can talk to your authorities and say that, hey, if you are planning for a metro network, then our nodes should be designed in a TOD fashion. So that

recommendation should come from you as a transportation engineer or a transportation planner.

So what this document, guidance document says that there are 12 TOD guiding principles and nine TOD supportive principles based on which you should design your development around at whatever scale you are thinking of developing it. So we will look at each of these 12 guiding principles, and I will leave it up to you to read about the supportive principles which can be, you can pick and choose which supportive principle you want to use for your design.

But when it comes to the guiding principles, you make sure that you have used all of them, or at least the maximum of them.

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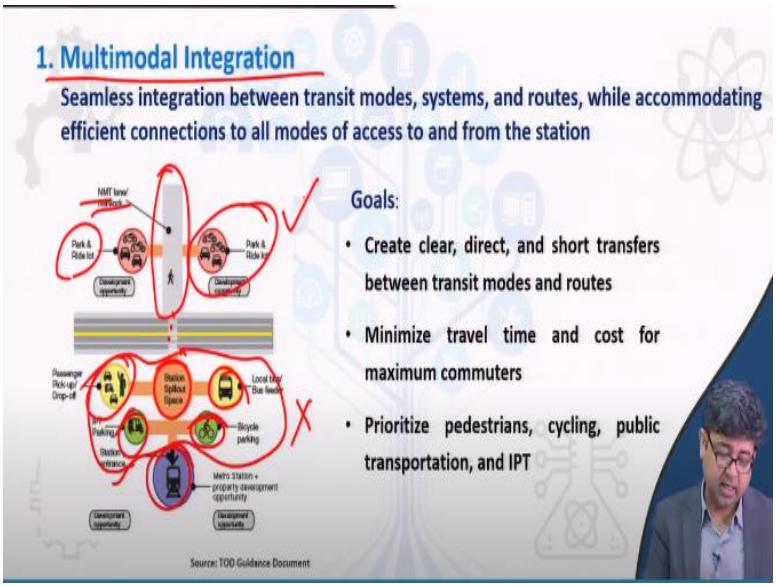

So the first principle is it has to have multimodal integration. We have already talked about it. So if this is your station space or if this is your basically station entrance, and this is your metro line or a BRTS line, what you have to make sure is that there is enough space around the metro that allows you, allows the integration of modes so that you are not only accessing the metro station using private transportation.

You are using IPT you are using bicycle. Maybe your local feeder bus is dropping it to you or you are being dropped off and picked up by other your friends or family. So that is how it should be designed, multiple modes. Then if you are crossing the main

road it has to have proper crossing principles and your other street network, existing street network should have good, an empty network maybe.

It should have a park and ride development, right park and ride lots on both sides, where some people would want to park and then use the metro station can do that. But it has to be, see the park and ride lot is not right here but it is right here, right. So it is a little bit farther away. So discouraging people to park right at the metro stations that is the entire principle. So it has to have such multimodal integration around the nodes.

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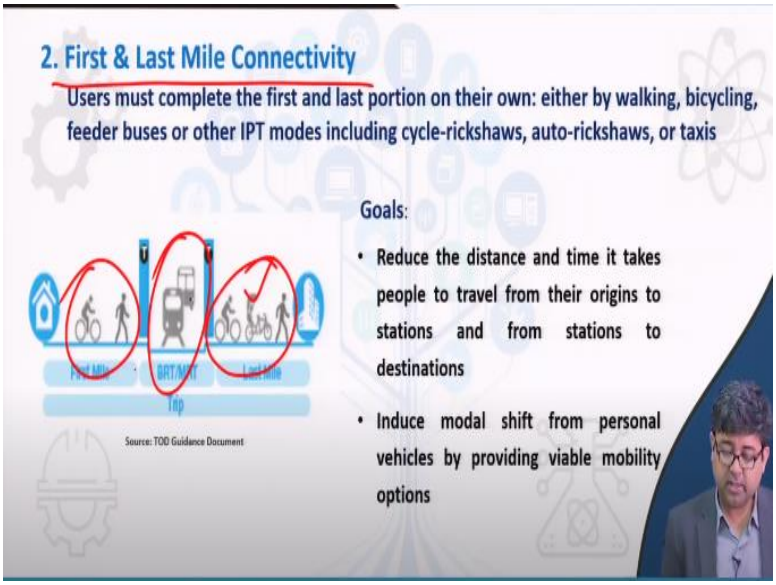

The first mile and last mile connectivity should be that people are either bicycling or walking or in the, even in the last mile they may be using some other modes of sustainable transport such as cycle-rickshaw in our case. So it has to be encouraged that the first and the last mile of access to the main trip, to the main line or a main public transport line has to be some form of sustainable transportation.

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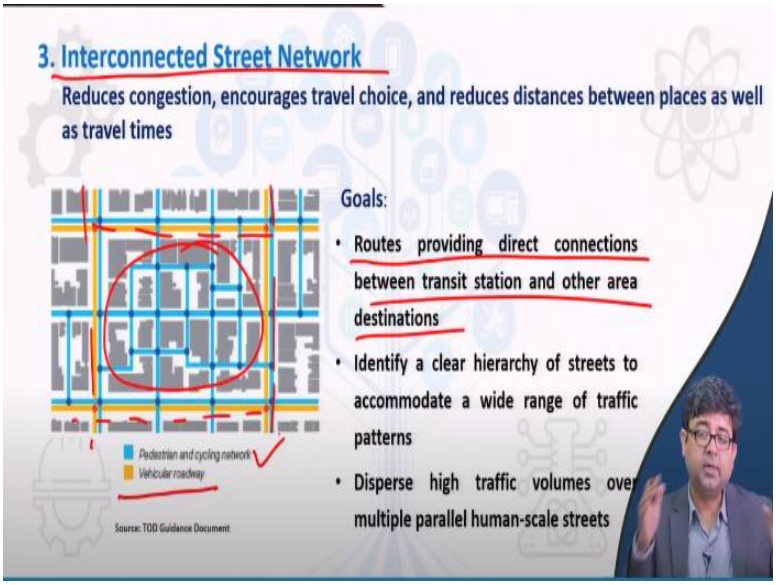

Interconnected street network. The other thing that is encouraged in a TOD is to have multiple, the best option is to have a grid type street network that minimizes travel time between or minimizes walking time between two different nodes. Encourages people to walk. If you have grid network, with smaller block sizes than that is very helpful or it encourages people to walk a lot.

So goals are to routes providing direct connections between transit stations in other areas. See, so if you may have a vehicular network which is yellow, at the periphery right, the periphery may have all the yellow but inside you have to have a good pedestrian and bicycling network. So bicycle and pedestrian network should be well integrated in the center. And the periphery can have a lot of vehicular movement. So it has to have interconnected streets.

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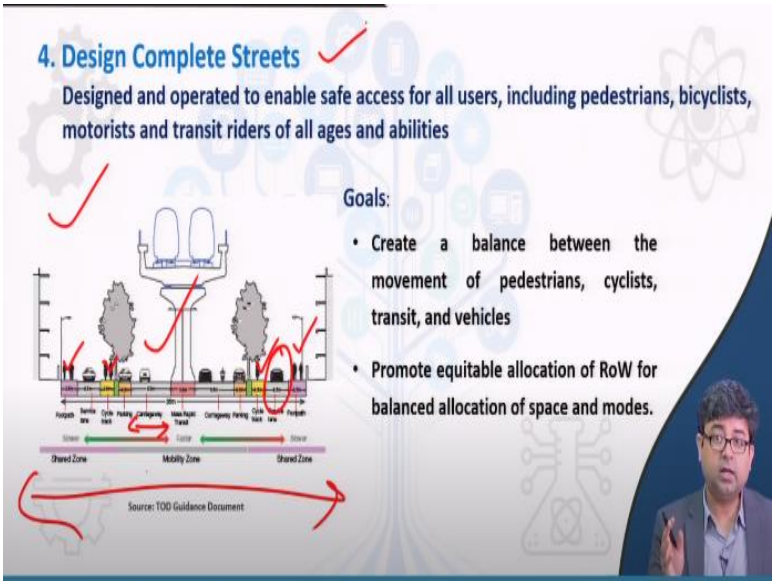

We have already given you an example of how to design complete streets. So all of the streets that are being designed should have space. So if this is the entire right of way, it should have space for everything, it should not only have space for your Metro, but it should have space for walking, maybe a service lane on both sides. So now, you can pick and choose based on the width of the right of way that you have.

Maybe both sides you do not have a service lane, one side you have. But bicycle lanes, walking, pedestrian sidewalks you have in both sides. Maybe traffic lanes are something that you can avoid having two lanes on each sides. Maybe you cut the width of the traffic lanes in order to encourage people to use sustainable modes of transport.

So that is complete streets, all modes get some space within the right of way. It is not only motorized vehicles that get the majority of the right of way.

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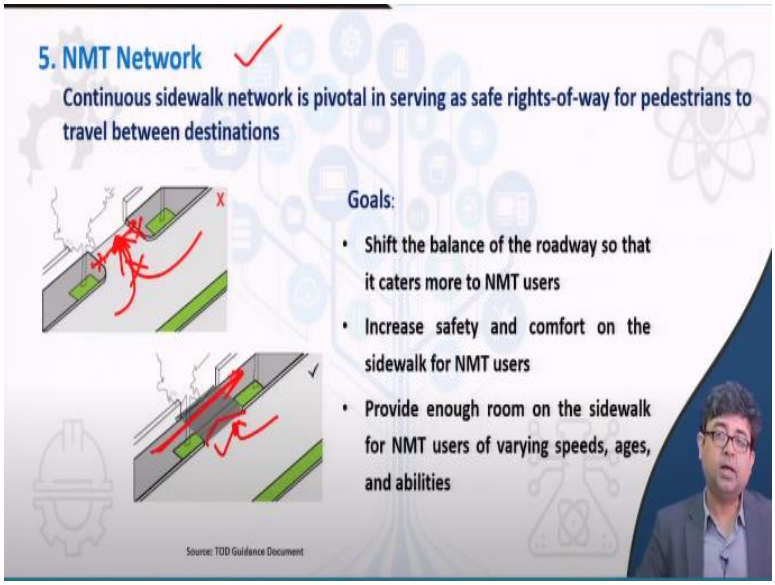

It has to have good NMT network. And we have told you in the NMT segment in the NMT module how to design good NMT network. For example, at property entrances, this is just an example of showing how property entrances should be designed. It should not be designed like this, where this is giving access only preference only to the motorized vehicle that are turning in.

And no preference is given to the pedestrians who now have to get down from the curb or the sidewalk, wait for these vehicles to go and then cross this. So such type of design should be avoided. Whereas if you provide a ramp and when you provide a continuous path for the pedestrian to walk, then that will allow integration of or integration of both. Now here you are getting you are still giving preference to or preference to the motorized vehicle.

But now you also have a clear path for the pedestrian. So a pedestrian's, NMT network is taken care of.

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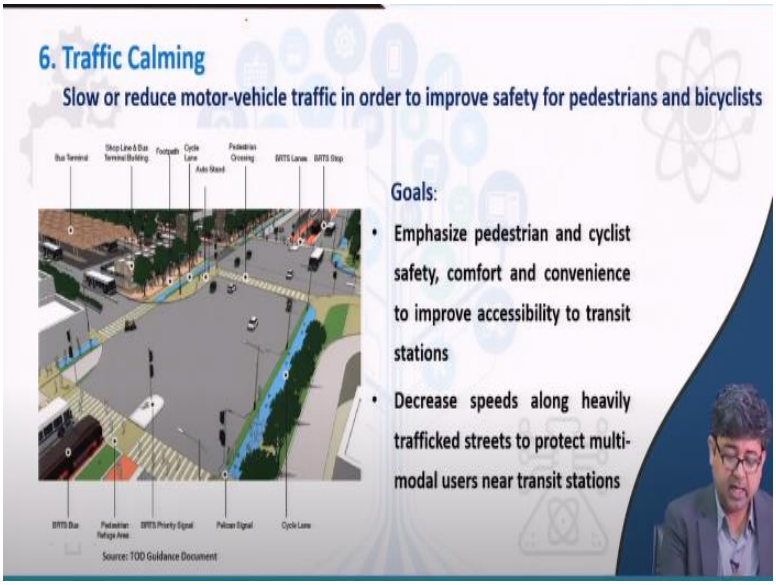

Traffic calming. We just told you in the previous classes about how to provide traffic calming devices, where to install chicanes. If you have straight roads make them a little bit windy so that traffic calms down. Essentially traffic calming is nothing but reducing the speed of motorized vehicles.

If you have a corner radii very sharp, increase the radius of the corners or increase the radius, turning radius at your intersections that will slow down the vehicles that are trying to turn. So if there are various traffic calming means that you have already read and that should be implemented at TOD zones.

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Mixed land uses. We already told you that mixing of land uses, jobs and residence justifies higher service frequencies and promotes higher ridership levels. So now if

you your mass transit line if it has to have continuous ridership throughout the day, then if your nodes have different types of land uses, for example, one node has lot of hospitals, the other node has lot of offices, then what it will ensure is that hospitals may have night shift.

So even the metro line working in the night has enough ridership. Whereas offices may be only in the morning. So they have ridership in the morning and in the nights. So that is the entire principle of having or need for having mixed land uses so that it can justify service frequency and promote higher ridership at the for the transit line, for the MRTS line.

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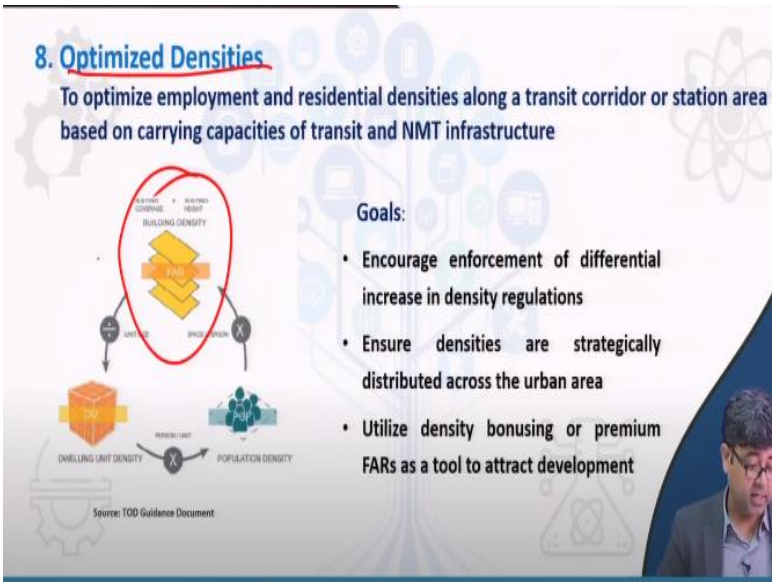

Density again, we have to optimize density. So in our case, we have to be very careful not to make already very dense areas even more dense. So if you have lot of density already, maybe we are only looking at improving the mix of land uses rather than density. But there are different guidance given in this document as to how to improve density by giving more FAR or giving less parking or so on and so forth.

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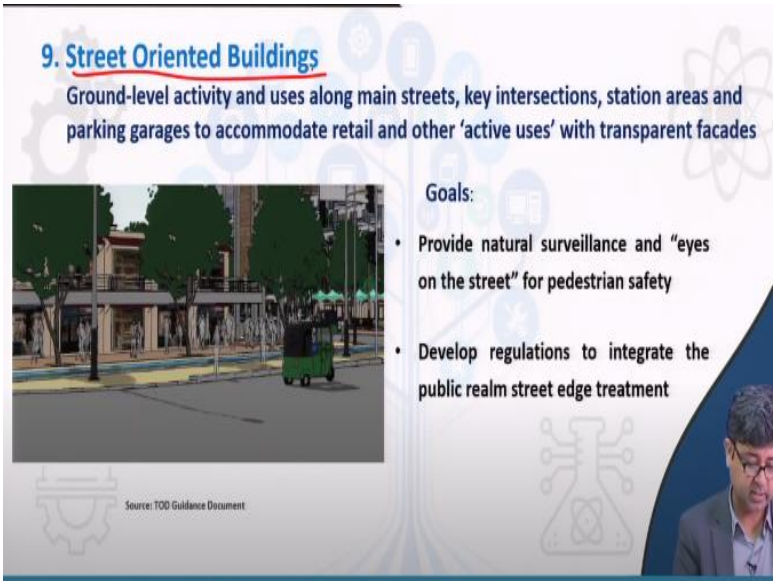

Street oriented design. Street oriented buildings are something which says that you are building frontage should be facing the main street rather than you provide parking in front of the building. Always it is said that you avoid parking in the front of the building because that makes it more motorized friendly design.

Whereas if you have a sidewalk in front of the building that encourages people to walk, and you can have parking behind the building or you can have parking underneath the building, so on and so forth, but never have parking in front of the building that discourages people from walking. So is something called street oriented buildings.

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Managed parking we have already looked at. Reduce parking or increase the parking fee or both.

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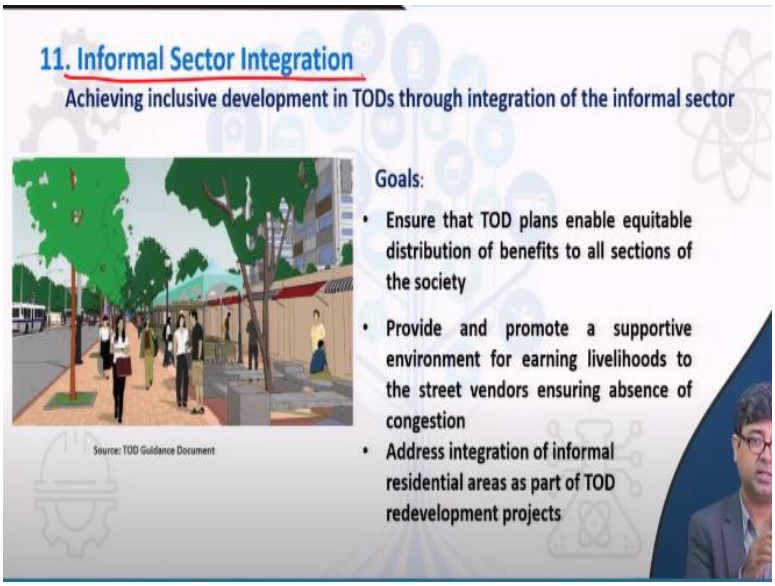

This is something that is very true to Indian situations where you have to integrate the informal sector while you are looking to design your streets. So essentially there you have to design for the street vendors. You have to provide them specific places where they can set up their stalls and they should not be setting it up haphazardly everywhere along the street.

But at the same time, if you disallow them, then you will cut their, you will cut the large portion of the informal economy that we have, which is not very desirable in our case. So integrate them well, when you are developing your TOD plants. Give them proper places where they can also put up their shops, but at the same time, it does not impede the flow of pedestrians or bicyclists or motor vehicles. So that is very important.

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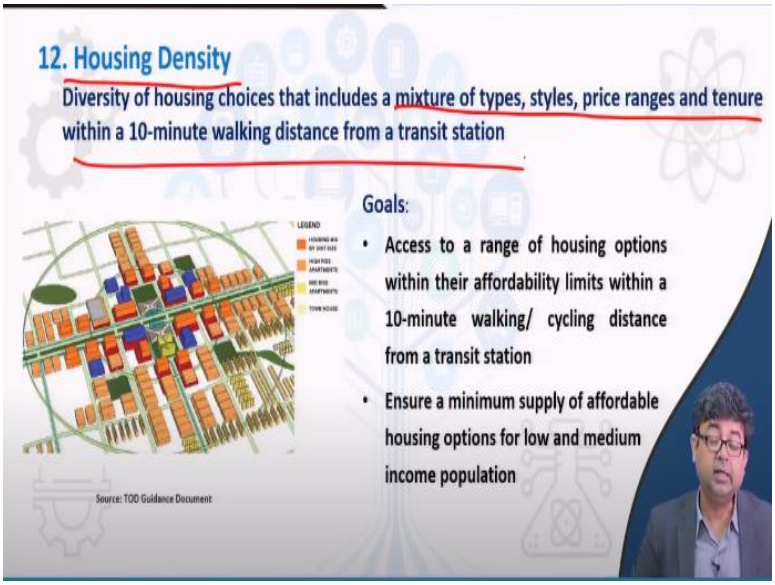

And finally, housing density. We have looked at that. There should be a mixture of type, styles, price ranges and tenure within the 10 minute walking distance of a transit station. So have different mixes of housing. Do not only have high rise buildings like you saw you can have high rise buildings right next to the metro station, but then you can taper off.

So that different types of tastes of different types of people are catered for and then you will have a good mix of people that are living around in your TOD and that will make it more vibrant and even helps in the economy of that TOD as well.

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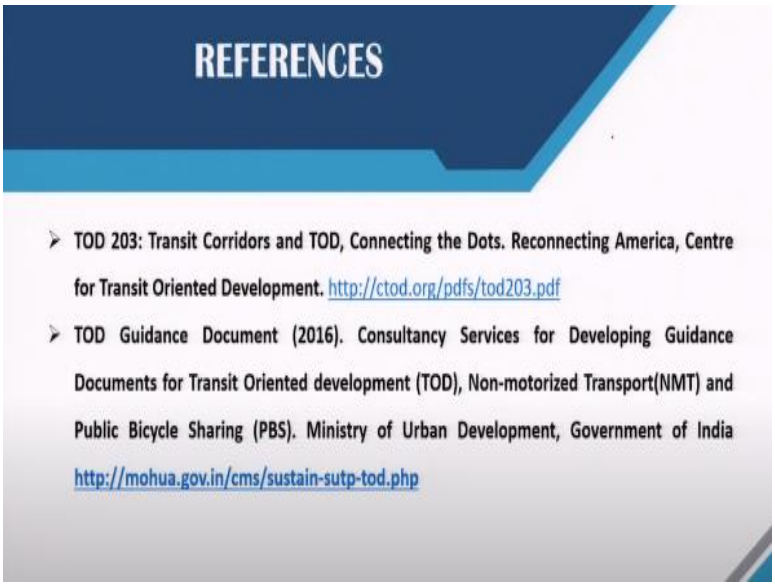

So that brings us to the end of this week's series of lectures, where we have looked at how to integrate different modes and we have introduced you to this concept of travel

demand management. So that now, once you have studied each of these modes individually, you have to be able to integrate them together as well. The documents or the references are given here. Please go through them. They are free for download.

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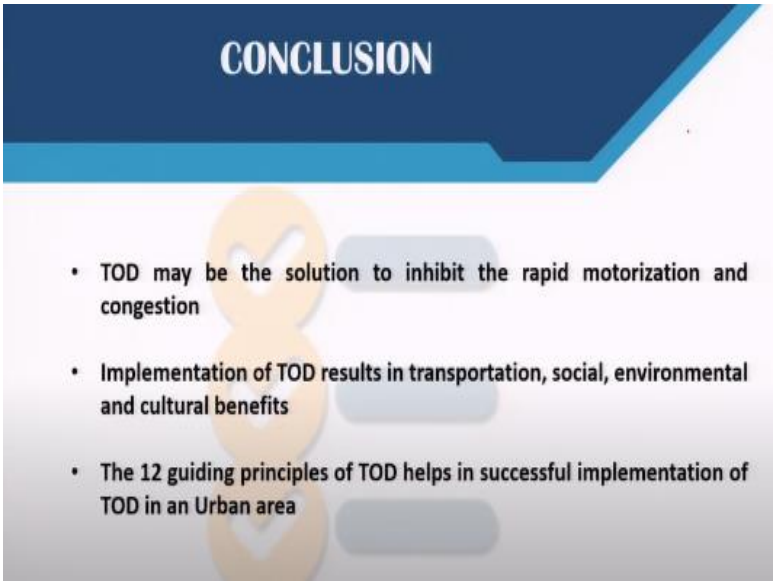

So in conclusion, what we can say is, in today's lecture we have learnt about what is TOD? how TOD can be implemented in different scales? And then also we looked at the different guiding principles that is the 12 guiding principles that helps in successful implementation of TOD in your urban area. Thank you very much for your attention.