Introduction To Multimodal Urban Transportation System
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Lecture - 43
Urban Transport & Sustainability: Pull Measure Cases

Welcome back friends. In the last lecture, we looked at some of the push measures, which are once one form of the TDM measures that can be applied. In today's lecture what we are going to look at are the pull measures or the other half of the TDM measures as we call it.

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So in the in the pull measures, the different types of measures that we will be introducing you to include bus rapid transit system, bus lanes or bus priority. Pedestrian infrastructure improvement, pedestrian zones, crosswalks, and sidewalks. And bicycle improvements lanes and bicycle sharing. So you already have been introduced and you know very well how many of these systems work or many parts of these systems work, because we have looked at them individually now.

Now you will be able to grasp how these can act as pull measures, right. How these can help improve the efficiency of the existing system without creating new capacity or without creating new supply, but at the same time, it will attract people to these sort of these sustainable modes rather than you continuing the use of your personal transit, which is not very sustainable.

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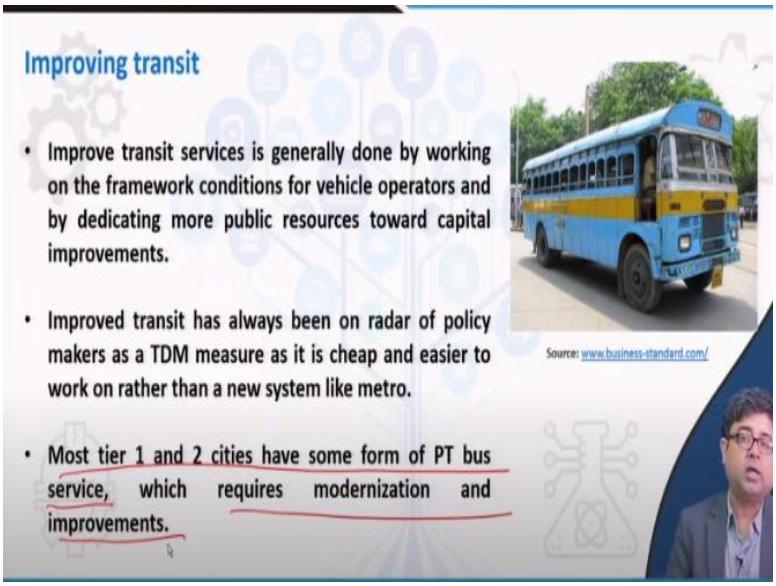

So improving transit, right. You have we have already looked at how can you improve the quality of your public transportation system in your city, right. Quality of service, we have looked at what are the different measures that quality of service depends upon. So what the pull measures or the pull TDM strategy looks at is to compare how ridership changes when you make a certain improvement in your transit service.

So in other words, ridership change meaning are people now going to use your public transit more as compared to their personal private transit, if you make certain improvements in your existing public transportation network, right. And these improvements cannot be capacity related improvements. They could be how to improve the existing efficiency, right how to increase the existing efficiency.

In extreme cases, in worst cases, like I said, capacity improvement is also one of the tools of improving efficiency, but it has to be the last tool that we resort to. We have to first exhaust all of the TDM mechanisms or all of the mechanisms by which we can improve the efficiency of the current system itself. Most tier 1 and tier 2 cities have some form of public transport service, which requires modernization and improvements, right.

It is not just enough to say that I have a bus route, I have some bus stops. And I run this service every one hour or every half an hour. And just lay back and say that well, I have a public transport for my city. That is not enough. That will not act as a pull

measure. That will not attract people to the bus transit or to the public transportation system. Remember, we are now talking about choice users, right?

We are now talking about choice users. There are one set of users who are captive users. Captive users meaning they will use public transportation, no matter what because of their economic condition, maybe for example. So their economic condition just would not allow them to purchase a private vehicle for themselves, own a car or own a two wheeler that kind of thing.

So they have to depend upon public transportation. So those, that category of users are called captive. So they are captive to that mode. Whereas we not only want to improve the system for the captive users, but we also want to improve the system so that choice users, now choice users meaning users who have a choice to use their private modes or public transportation.

So if you make your public transportation attractive, then maybe these choice users would now shift from using their private modes to the public transportation mode. So that is what we are more interested in. That is how to TDM pull measures are applied or are implemented and then are measured how well they are working.

It is so it is not just good enough to have a skeleton public transportation system in your city and say that, well we do have a system. So we do not know why it is not working, why people are not using it, so on and so forth.

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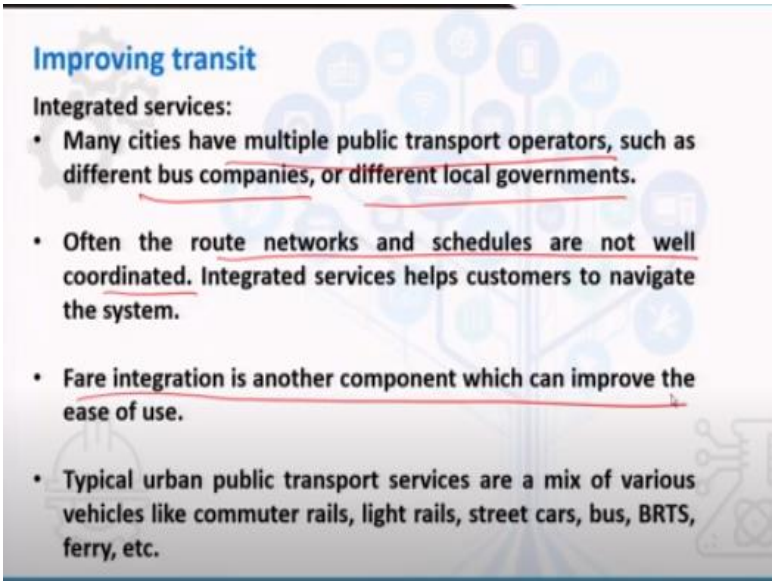

Many cities have multiple public transportation operators, such as different bus companies, different local governments. If you have a large metropolitan area, then you may have different agencies running different bus services. Often these route networks and schedules are not well coordinated. We have already looked at these examples. So these are low hanging fruits, what they call as low hanging fruits, right?

If you address these, without increasing the capacity, without adding new buses to the system, without buying new, bigger buses, you can itself improve the efficiency of the system, you can attract more users, right. So you have two different jurisdictions. From a municipal corporation, you are going to a municipality area, right? In a large metropolitan area, that may be the case.

You are no longer you are traveling from the city core to the suburban area, or you are traveling from the suburban area to the city core, there may be two administrative jurisdictions. And now these buses, if the bus operator in one jurisdiction is not in sync with the bus operator in the other jurisdiction, then if the person has to transfer at the boundary of the administrative jurisdiction, then the user will face a problem, right?

If these transfers are not coordinated, if the schedules are not synced with each other, then nobody is going to use the public transportation system much. They are going to maybe just use it very rarely, only when there is their vehicle breaks down, for

example, or their vehicle is in the shop for some mechanical reason. So that is the only time then people start using public transportation.

Otherwise, they do not do it. So you have to these are low hanging strategies, low hanging fruits that if you improve on them or work on them, then your public transportation system can improve. And that can act as a pull measure. The other is fare integration is another component that can ease the use. This is a little bit difficult to do. But again, two jurisdictional two jurisdictional agencies have to work in sync.

Not only two jurisdictions, maybe two different mode operators have to now work in sync. So for example, if you have government buses and private buses, these two bus operating agencies has to work in sync saying that well, if one person has to go from point A to point B he or she has to transfer at point C in between from a private to a public bus.

But once he or she has paid a fee on either of the buses, he or she need not pay another fee of the other bus. And in the background the fee sharing and everything can happen between the two agencies, right. The two agencies should get their share of money. But the user should pay it only once. And in the background, you can have system set up and algorithm set up in such a manner that the fee sharing is happening automatically, right.

So for a user it is benefit, right. He or she is only paying once and the transactional costs also go down. If you have two different types of systems in two different buses, then one transaction cost and one bus may be different from the transaction cost in the other bus, and these two may cause in the may cause the increase in fare slightly, whatever percent it might be. These transactional cost everything add up to the fair of the system.

So if you avoid that, if you eliminate that and have only fair integration between two modes or between multiple modes in multiple jurisdictions, then you improve the efficiency and ridership is likely to increase, right. We have already kind of touched upon that, various modes you may have.

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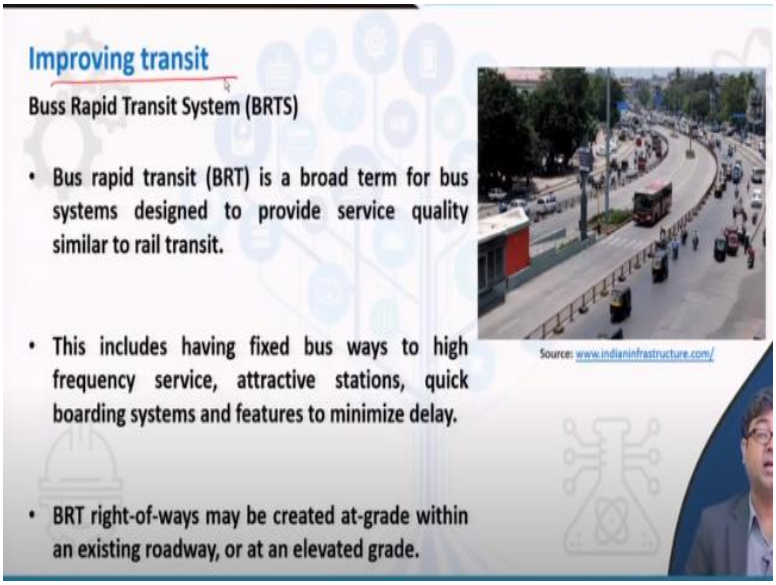

So when improving transit also means improving the type of transit maybe. So now we are talking about actually doing some capacity improvements, right. So when you shift or when you make the improvement from your regular city bus transport and upgraded it to a BRTS or a bus rapid transit system, what you are actually doing is you are not only improving the functionalities of bus, the system, but also are creating some additional capacity now.

So now this increase in capacity is better in terms of urban transport sustainability versus the pure increase in capacity in terms of widening a road. So what it has been seen is that in cases when urban transport officials actually do want to widen a road, if that extra capacity is used for any public transportation mode, then that kind of widening or increasing capacity or increase in supply is welcome.

Is it acts as a pull measure, it acts as a not as a deterrent to sustainability. It acts as a actually an attractive force towards sustainability. So this kind of improvement from a from a skeleton bus network or from an existing bus network that runs on a mixed right of way to creating a bus rapid transit system that has its own right of way also increases the attractiveness of bus rapid transit or public transportation and people get attracted to it.

And we have already told you what are the reasons why are BRTS better than the bus, regular city bus network. It is because they have their own right of way. They may have what is called priority at signalized intersections, right. They are called bus

priority signals. So once the BRTS is at the signal, and other traffic is also stopped on the signal, the BRTS gets priority green time.

So they will leave or they would exit the intersection first. And then the green time would be given to the rest of the rest of the traffic so that the bus is not obstructed within the other modes of the traffic at the intersection and they can leave first. So that is again a measure that can improve transit performance and can act as a pull measure to attract people to use public transportation system.

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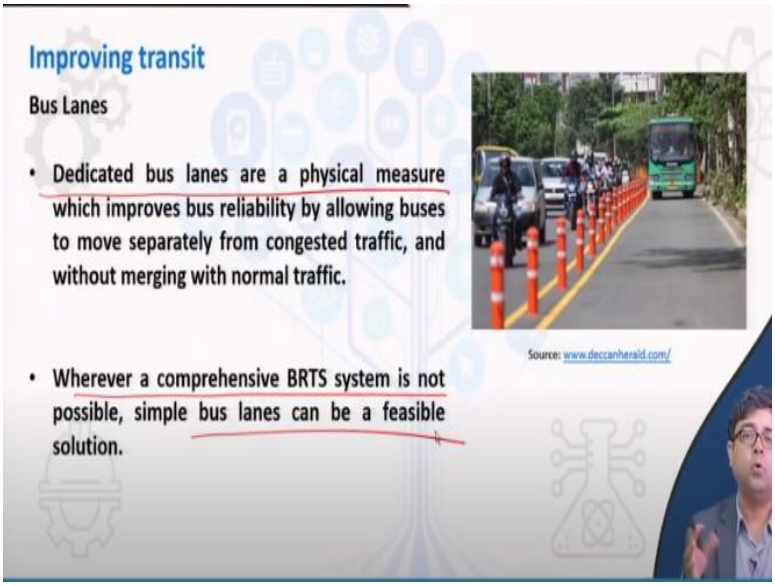

You could you could just you could also have dedicated bus lanes. Sometimes you would not have a full-fledged BRTS system. But you would see that at certain CBD areas in certain central business district areas what you would the regular bus transit the regular bus transit system or city bus transport system would also be given dedicated bus lanes.

So this may be very close to a depot when they are entering very close to the terminal stop at the CBD or so on and so forth, you will see that really where the congestion is in the CBD, they would try to carve out a lane only for the buses, so that the buses can then exit and enter and exit the CBD very quickly, right. So these are also certain means of reducing the travel time on the bus on the bus system.

If you reduce the travel time on the public transportation system, then again people are attracted to this system. So that is also sometimes possible. See this is where the

case, wherever the comprehensive BRTS system is not possible simple bus lanes can act as a feasible solution, right. These are not comprehensive BRTS. A BRTS has dedicated right of way throughout the network.

Whereas bus lanes may be only provided at certain areas in the city, for example, the central business district and so on and so forth.

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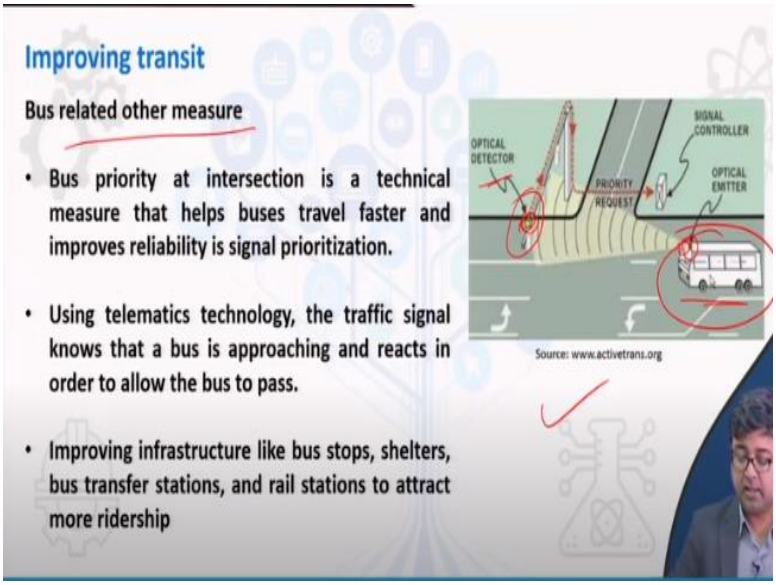

Any other we have already looked at one such other related measure, which is called bus priority. So you would see that this diagram kind of explains to you how bus priority works. There are transponders in the bus, which act which are in sync with the signals at the intersection and whenever this detector detects a bus coming, what it does is it allows you to if the bus comes during the red time, it allows the bus to get green first.

Alternatively, if it if it detects that the bus is arriving at the green time, but it can sense that by the time it arrives at the intersection, this is it the signal would turn red. So what it would do is it would extend the green so in order for the bus to cross the intersection. So it acts in two different ways.

A, when it when this detector detects that the bus has arrived at the junction when the signal is red, then what it would do is it will turn on the signal to green first for the bus and then it would turn on the signal green for the other traffic. That means there are two different green signals, one for the bus and one for the general traffic.

You would have seen two different greens in cases of pedestrian crossings in some intersections, right where you have the green Walkman that has a different cycle than A or that has different timing than the green for the other for the regular traffic. So similarly that could be for the bus and in the second case, when it detects the bus is arriving and the green and it is still green, but it can sense that by the time it comes to the intersection the signal would turn red.

So what it would do is it would extend the green. So give two, three more seconds of green, so that the bus can now cross through the intersection. So these are all ITS or intelligent transportation systems. That also we have given you an idea of how to develop or at least a brief understanding of what are the technologies involved and how communication works, what type of data flows are involved, we have already given you an idea about that.

So you can build your own transit signal priority at your intersection, at your city at a particular intersection, where you may think that bus traffic is very high for example, and they are stuck in other kinds of traffic. So if you want to provide a signal, these bus priority signals usually if they are not coordinated with at all the intersections then they do not work very well.

So you may want to coordinate it. If there are such coordinated signals in your CBD areas or if there is one isolated intersection where you really see that the bus volumes are very high so in those cases at such isolated intersections, you can definitely have these bus priority systems or bus priority signaling.

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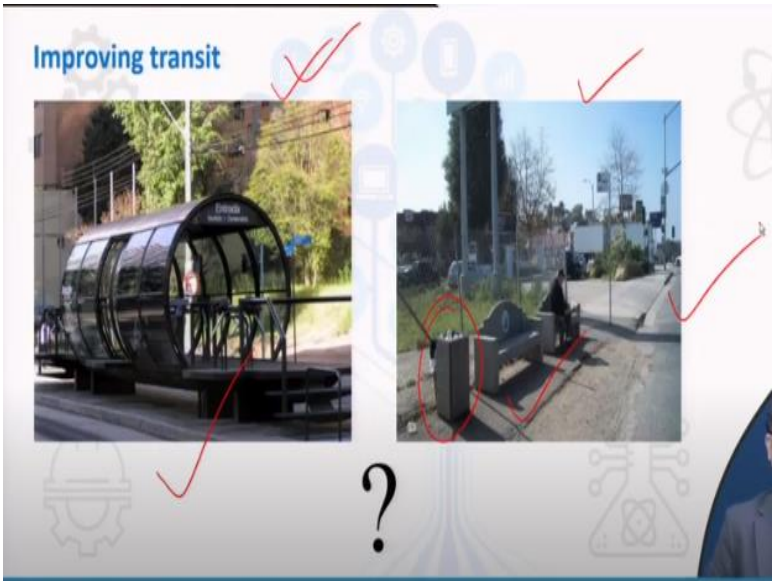

Okay, now if you were to be given these two pictures and you would you would be asked which type of by looking at these two pictures, can you guess where would, which type of system would attract more choice riders. A system transport system that has bus stops designed in this fashion or a transport system where the bus stops are designed in this fashion, right?

So you would be able to at least have a educated, I would not call it guess but an educated answer saying that this type of a bus stop which is on your left has a shelter associated with it. So it should be able to give more protection to people during harsh weather times. It has good seating capacity also at the bus stop.

So people might be more attracted to take a bus from this bus stop rather than a very skeletal bus stop infrastructure where it just has a bench and no shelter and the trash can is kind of leaking here and there is no lid on the trash and so on and so forth. So you are, a bus network or a public transportation network that has bus stops designed in this fashion is more likely to attract more choice users.

Whereas this type of network, a bus network with bus stations, which are shown in the picture on the right, are less likely to have attract more choice users. So this is the difference in different elements of a public transportation system from which you can also gather, how to design different pull strategies in order to attract people to public transportation.

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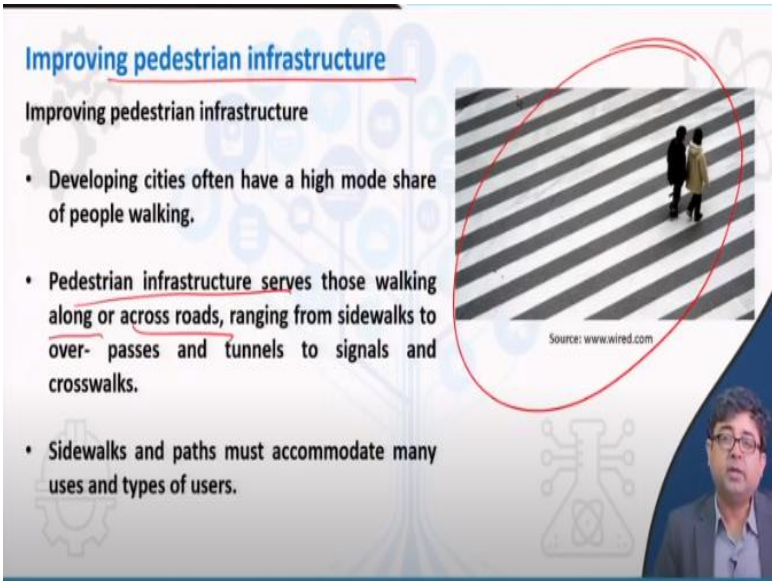

Similarly, when we now talk about pedestrian infrastructure, what are the different design elements that would attract people to walk, right? Now, you already understand that people do not walk for longer distances, right. People of a certain age would not walk a longer distance because of a physical inability or any other measure. So the most, the most choice users who would want to walk are somewhere between a certain age group.

So you have to make them walk as much as possible during an urban trip, or during multiple urban trips that are shorter in, relatively shorter in distance. You would notice that in many of our cities, our trips are usually not very long, because our cities are pretty dense, pretty compact. At least the city course are. So land users are very close to each other. So all these makes walkable makes walking very possible.

But if you do not have proper infrastructure in place, what happens is even the short trips, which should be ideal for walking gets replaced by trips on motorized two wheelers for example, or even motorized three wheelers, which is really not the sustainable way of moving forward. So you have to understand about the infrastructure that is needed along and across roads that would encourage people from or encourage people to walk as opposed to as opposed to using unsustainable modes.

This is a picture that shows an intersection that has um a traffic box for example, all marked like a zebra crossing. So what that tells you is the signals, they have a all red phase at the signalized intersection, where all the signals are red for a given amount of

time, maybe 30 seconds, 45 seconds. And it allows people from all the directions to cross during that time.

Otherwise, usually, you would see that the at the junctions at the intersections it is only red, red or green at particular times for particular legs of the intersection, right that allows you the pedestrians only to cross one way from the traffic and not cross in a diagonal fashion because the traffic may be still moving.

However, at junctions that have heavy pedestrian volume, what they do is they the signals are such that they are designed in such a fashion that it gives a red phase to all the legs of the intersection for the motorized vehicles and during that all red phase, it is green for the pedestrians and the pedestrians could cross diagonally, crisscross parallel or perpendicular to any direction.

So that is another means of improving or enhancing existing pedestrian facilities and making it more attractive to walk, right? All you have to do is paint zebra crossing and change the signal timing and it does not take a lot of capital infrastructure or money to implement this kind of a pull measure for example.

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Similarly, we have we have told you what are the different factors that are involved in improving the pedestrian level of service for example, and these improved by improving the pedestrian level of service, what you are actually doing is making the

making the walker or the pedestrian more comfortable during their walk or during their journey and this attracts people to take carry out the journey by walk.

So some of the measures includes having good seating infrastructure for example, along the footpaths. Definitely having good, not having littered sidewalks for example, right? Sidewalks, usually you would see are sometimes that are present but are littered with various things because there is no proper garbage cans at proper locations, right.

So you have to you have to now pay attention to the entire right of way, for example, that is the that is the meaning of a pull measure. You cannot just pay attention to the pavement section of the right of way and work on that pavement section. But if the right of way includes two sidewalks on both sides of the road, you have to pay attention to the sidewalks as well.

Because it is no good only providing a sidewalk which is one meter wide and check a tick, provide a tick in any of the reviews saying that yes, we have provided a sidewalk and we are happy. But a one meter sidewalk may be equivalent to no sidewalk at all. Because that does not provide a level of service that pedestrians need. And hence nobody would walk on it. And then you would you are left with unsustainable modes on the road, right.

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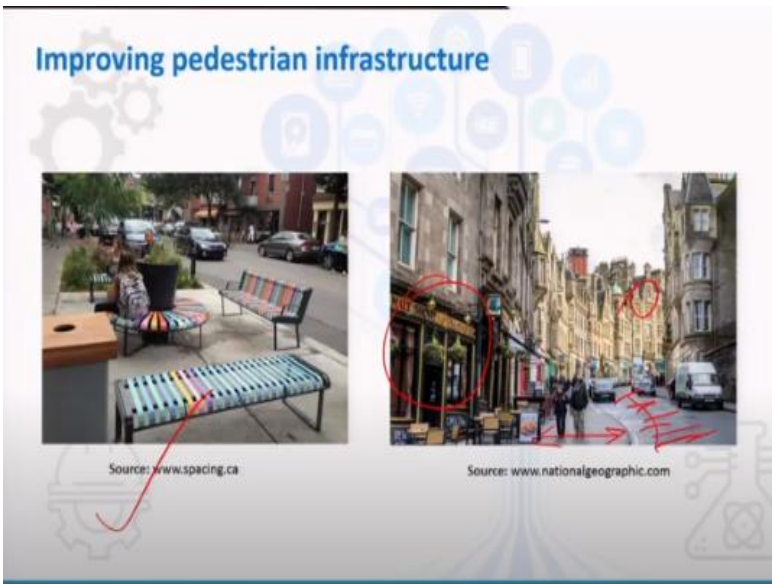

So all of these points essentially demonstrate the same feature. Again, you would see various infrastructure along the sidewalks that attract people to walk. You would even see during along certain neighborhoods or along certain central business district to calm the traffic down right, traffic calming. We learned about traffic calming in couple of lectures before.

What they would do is they would narrow the streets, they would actually narrow the streets for motorized vehicles. Or they would have a different texture of pavement that would disallow vehicles to go very fast. So these are different techniques. And then they would actually widen the sidewalk. So these are different techniques that makes walking more attractive in these areas.

And hence people would now who would have previously taken their two wheeler or four wheeler to come to this restaurant, for example, would now actually want to walk from their home here for example. And because they have good sidewalks or good footpaths and vehicular speed has calmed down. There is speed calming that has happened. So these all are actually pull measures that can help improve pedestrian transportation.

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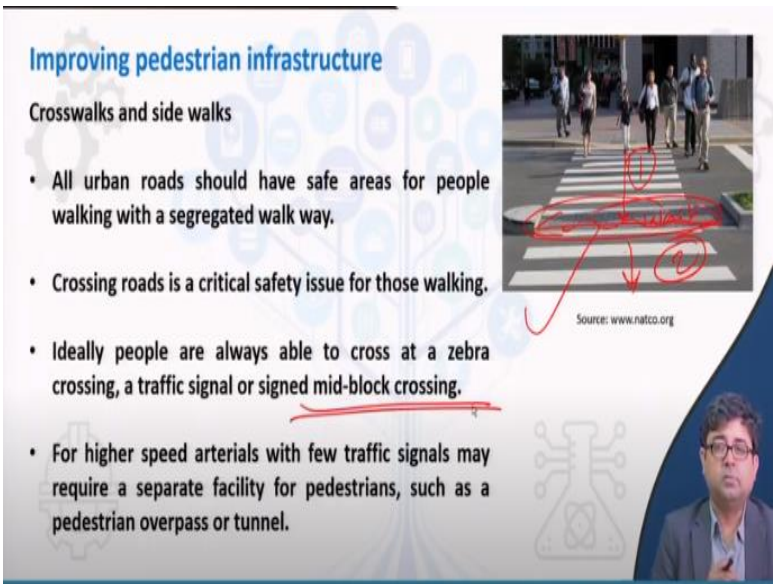

Of course crosswalks, you all know about crosswalks. They are very essential, especially because during your pedestrian journey between your origin and destination, you are bound to at least encounter one intersection, if not multiple, right.

So at this intersection, you are actually now going to interact with motorized vehicles, although you are temporarily separated from the motorized vehicles.

But if you do not have such designated crosswalks, then you often undertake what is called jaywalking, and that reduces safety. And suddenly, if you feel unsafe while walking, you would not undertake that trip on the as a pedestrian, and you would maybe shift to a different mode. So we do not want that to happen. That is why we would provide good crossing facilities.

Again, you are aware that if the width of the road that you are crossing is too large, it is a divided urban arterial, then it is best to provide a what is called an island in between which in between or on the median, so that the pedestrians who are crossing here can wait on this island and make a second crossing. So you can cross the entire width of the road in two phases.

This is the first phase, wait here and then maybe this is the second phase based on how the traffic signal is designed at that intersection right. So this is very important at signalized intersections. Sometimes you are also in need of a crosswalk at mid-block sections where there is no signal. Those are very, very tricky to design. You have to have certain traffic calming measures before you put in this kind of a crosswalk as well.

But these crosswalks also enhance your walking trip especially if the distance between two signalized intersections is very large or your block size or your city block size is large. Then you would not want to walk all the way to the signalized intersection then cross and then maybe come back because your destination is in the mid-block on the other side of the road.

So for such situations, sometimes many cities do provide mid-block crosswalks although they are provided with other facilities such as maybe there is a flashing light, flashing yellow light that shows to the motorists that there is a crosswalk coming up which is unsignalized or you may have raised pavement markers that are lit that lit up at the crosswalk.

So the whole point is that mid-block crosswalks also enhance the pedestrian journey and then attracts people to walk more or encourages people to walk more. So those are also very, very important.

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Again, just like we showed you picture for the transit stop, if I show you this two pictures and ask you which type of crosswalk would attract more people to walk. You should be able to say that this is the crosswalk which has a median refuge island. This crosswalks are nicely painted. And again, the ramps from the crosswalks are also provided so that people with special abilities or disabilities can actually use this crosswalk and get on the sidewalk safely.

So this type of a crosswalk is more or would attract more number of pedestrians whereas this is a crosswalk which almost leads to nowhere and the sidewalk is very high on the other side and somebody who is using this crosswalk has to now jump up to become or to access the sidewalk. Or if anybody has to come from here he or she has to jump down.

So this is kind of a crosswalk which does not make the trip very attractive and should not be provided. Anyhow these are safety issue anyways. So this is the type of crosswalk that would make your pedestrian trip more comfortable and more number of people would be attracted to such type of a trip. So these are again look at all of these in the context of being pull measures that you can provide for your pedestrian transport.

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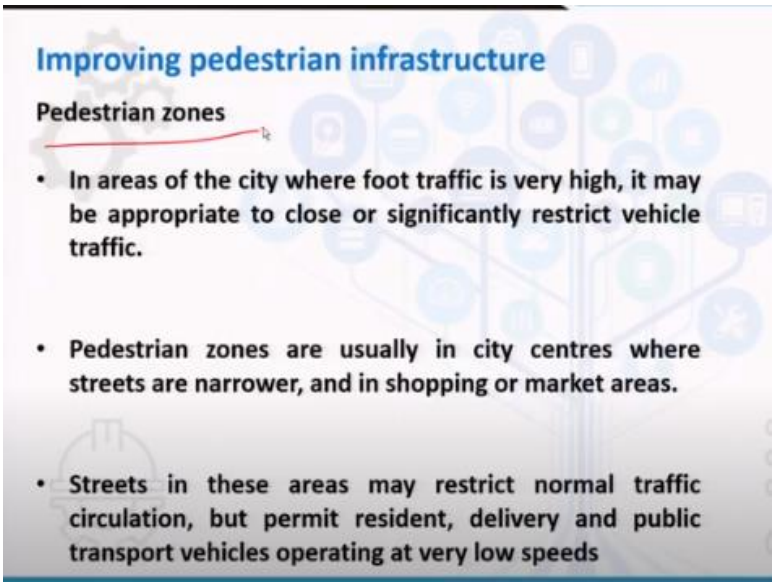

Similarly, we have talked earlier in the earlier classes when we were looking at pedestrian transport in depth, we are talking about pedestrian zones. Several CBDs can be converted into pedestrian zones during certain hours of the day or certain days of the week that makes a pedestrian activity prioritized and people would be more and more encouraged to use such zones, right.

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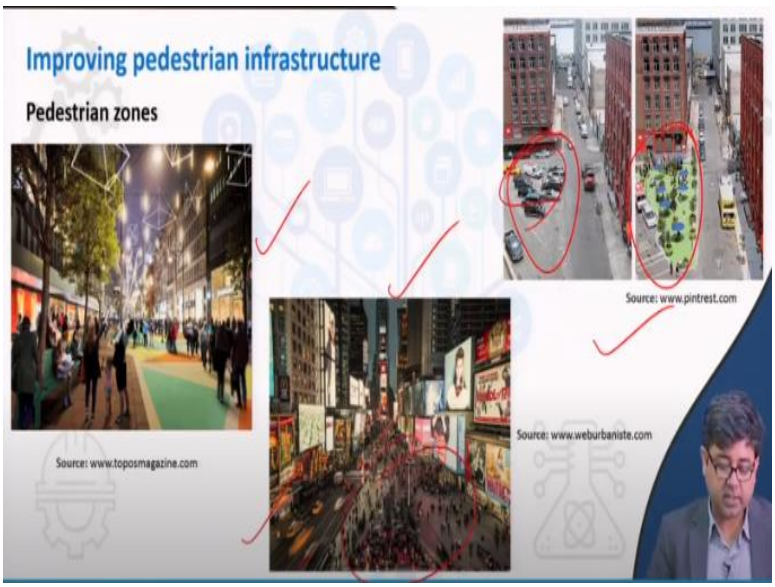

These are three different pictures from three different cities. You would see that an area at the intersection prior to some pedestrian improvements and this is post the pedestrian improvements where the median could be utilized for a open air cafe for example and make it more pedestrian friendly now. Whereas this was being used as a informal parking lot which was not very pedestrian friendly.

This is of course Time Square, which has experimented with having reduced lanes for motorized vehicles and more area for pedestrians now for example.

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Finally looking at bicycle infrastructure, we many of the cities in India have lot of bicyclists but have allowed these bicyclists to use the roadway, use the pavement and mingle with motorized traffic while during the journey which sometimes **is,** is okay is beneficial when the speeds of the motorized vehicles are low.

But when the speeds start getting higher, there are some safety issues that creep up and makes the bicycle journey not so comfortable and hence people stop using bicycle modes. The other issue with bicycles is that there is a stigma against it saying that it is a it is a mode for not the rich and the happening people. It is a mode for more economically weaker sections.

However that has changed over the last two decades especially after the turn of the millennium where now more and more people do want to bicycle longer distances even. And these are again choice bicyclists, right. People who have the choice of using their motorized vehicles are now actually choosing bicycle during for certain types of trips of course, for certain types of trips, maybe it is a weekend trip to the grocery store.

Maybe it is a weekday trip once a week to your office, or once a week to your college. Well college most certainly should be all five days a week, five or six days a week. But there are different types of dedicated bicycle facilities that can also be provided. Not just facilities that are common along with the motorized vehicles but dedicated facilities.

For example, this is a bicycle facility that allows bicyclists to cross an intersection without mingling with the motorized vehicles at all. There is a great separated crossing for bicycles which is very safe for them. However, you would again argue that there might be some capital costs involved in it. And so should TDM measures provide or go for such costly bicycle infrastructure?

So the answer there would be that would be the last measure that you do. But again, like I said, for pedestrian and public transportation, you can resort to this last measure of increasing the capacity as long as that is being used for some type of a sustainable mode right. As long as the widening is not for motorized traffic, it is for a sustainable mode of transport such as bicycle pedestrian or public transport. It is still justified however, that should be the last resort that you adopt.

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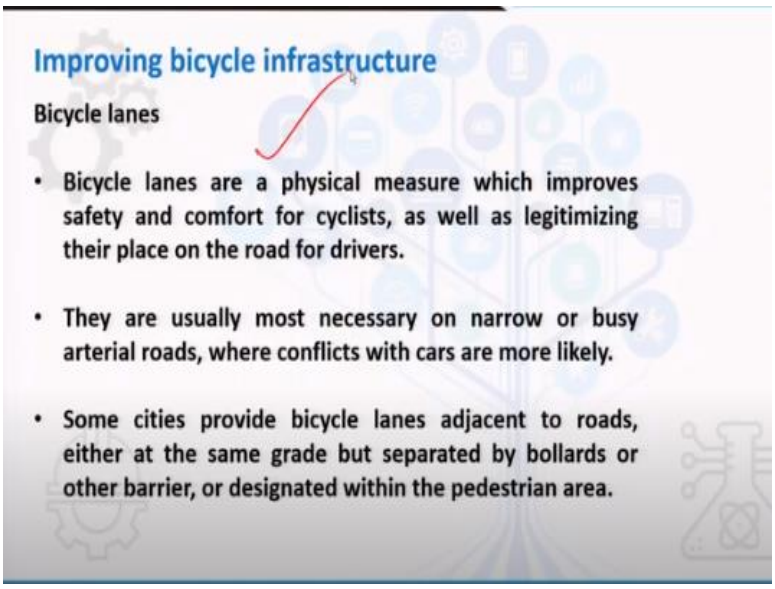

Of course bicycle lanes are getting more and more popular now. In India, some of the Smart Cities are getting these lanes. However how to operate them is the challenge yet. How to avoid I mean, how to not have motorized two wheelers use these lanes.

For example bicycle, scooters and bikes from using this lanes how do you disallow them or how do you maybe find them.

All those fine tuning has not yet happened. Bicycle lanes also need a good network. They should not be isolated in certain parts of the cities that does not again encourage the choice bicyclists to use bicycle more for their daily trips. So network has to be developed sufficient provisions have to be made at the intersections again for these bicyclists so that they can be separated from other traffic and across the intersection in a safe manner.

So many operational issues are still there. But at least at the planning level at a thought level, these bicycle lanes are being developed.

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So you would see such lanes coming up even in the some of the Indian cities of course. This is these are pictures from abroad from cities mostly in Europe.

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Bicycle parking is one of the pull measure that is becoming more and more important. Although you provide these bicycle lanes at the end of the day, if you do not have a safe parking structure or a safe parking facility, then people would not use bicycles to go to the destinations, to access the destination. So safe bicycle parking is being provided, safe and dedicated, right?

It is not just tie your bicycle to an electric pole and leave it there and go, right? It has to be a safe facility. Dedicated facility would encourage people to use more bicycles.

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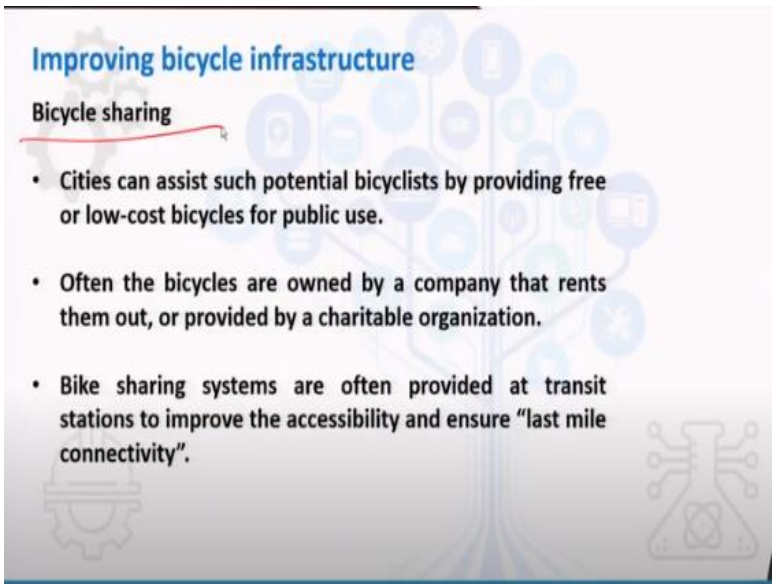

Bicycle sharing is becoming popular. Many of the metro stations in India also have public bicycle sharing systems that enable people to access the metro stations using bicycle paying a minimal fee for these shared cycles.

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You would see such systems in many cities in India as well and abroad.

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So those are three different types of pull measures that we have looked at or pull measures for three different modes that we have looked at, but you should have gotten an idea now what type of strategies that you can adopt, which are very easy to implement strategies, right. These are not high capital cost strategies, most of them are not high capital cost strategies.

This will help in attracting the choice users to the sustainable modes of transport and help in improving the sustainability of your overall public transportation network in your city.

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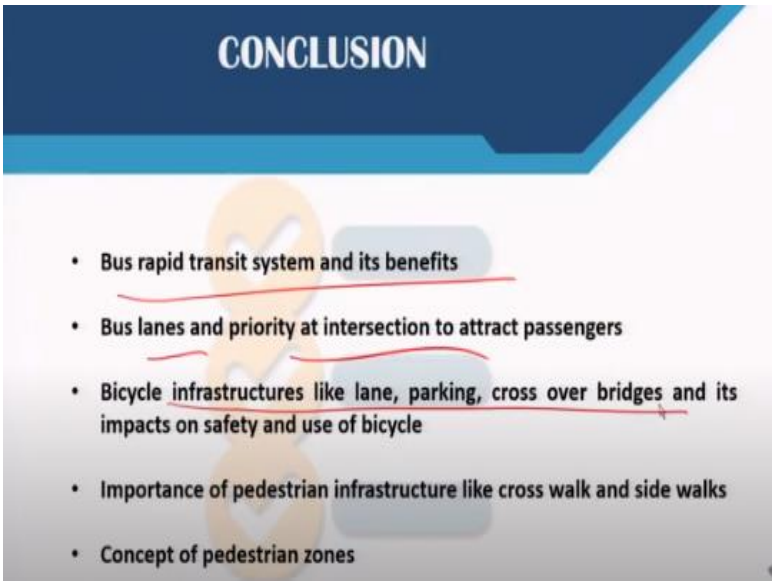

So just in conclusion, what we looked at in this session are the bus rapid transit improvements and benefits that would attract the choice users. How bus lane and priority at signalized intersections would attract the users. We looked at bicycle infrastructure, different elements of a bicycle infrastructure in the city that would make it more attractive for certain types of trips, certain types of at certain types of destinations.

And also looked at pedestrian infrastructure and concepts of pedestrian zones that makes walking a more comfortable means of travel. Thank you for your attention.