Urban Transportation Systems Planning
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Lecture - 02
Travel Behaviour, Transportation Externalities And Present Scenario of Urban Transportation

Welcome my friends. So, today we go to module A lecture 2. Today will focus more on the travel behavior, transportation, externalities and the present scenario of urban transportation.

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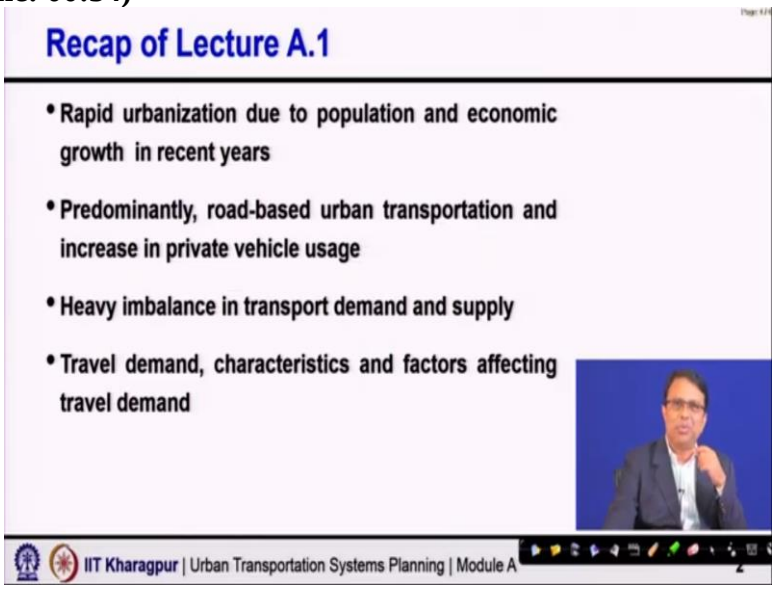

What we discussed in the previous lecture, we talked about the fact that the country is going through rapid urbanization due to increase in population, economic growth and other factors. We also highlighted our dependency on road based transportation in nearly all the urban areas in India and also the concerns related to the increased use of private vehicles. Then we talked about the resulting imbalance between demand and supply of transport in the road based transport sector.

One way is the urbanization and the growth of travel, then preference for private vehicle usage and the relatively or the diminishing trend of using public transport or the diminishing share of public transport in the overall trips and also in the vehicle. So the resulting externalities we say and then we try to relook at the travel demand aspect mainly again highlighting that transport demand is a derived demand.

There is a temporal characteristic, there is a special characteristic of demand all these are extremely important in the transport context. Also the transport is the derive demand and then said that it is amount of travel and also the characteristics of travel or trip all are equally important or both are equally important. Now, then we identified the factors which are affecting the transport demands. And the last factor was basically the travel behavior. This is something very interesting and important.

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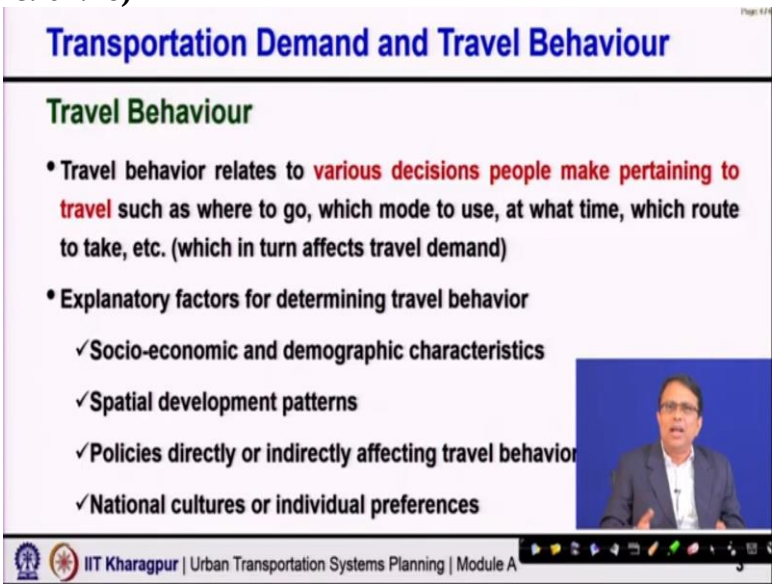

So our today's discussion start with this topic, that the travel behavior. What I mean by travel behavior? It relates to various decisions people make pertaining to travel, for example where to go, which mode to use, at what time to travel, which route to take in case of private vehicles all these decisions are important. Because what I said the key concern or the imbalance is happening so many vehicles are there at a given locations at a given time.

So how many vehicles are there or how many vehicles will be there at a given time at a given location will depend on how individuals are making decision. So somebody takes a decision to use a different mode of transport probably will have less number of or high number of vehicle than what it is today if there is a change in the choice of mode. If there is a change in the choice of the departure time, then probably instead of 10'o clock so many vehicles.

We will, if some people decide to travel early, we will get less number of vehicles which will mean less congestion and less problems. So if somebody decides to change the route that I will use a different route and many people are making decisions like that, that will mean an

entirely different spatial distribution of demands. And therefore the congestions on all these roads are also going to be very different.

So this is very important the travel behavior or the decision of end user, that is very important in overall urban transport context. Because the problem does not happen all of a sudden what we are saying it is hundreds and thousands of people making so many decisions individually, but the collective effort brings so many collective results are so many vehicles at a given time at a given location, creating congestion.

So the travel behavior is very important. Now there are certain factors which influence the travel behavior for example, socio economic and demographic characteristics, income of people, the gender, and the household structured. So many other things they how the whole area is getting developed what are the other demographic characteristics. Then what is the spatial development pattern. I mean the decision also depends on the pattern.

I would probably like to walk if I find there is the walk or the pedestrian infrastructure is really excellent around that place and the destination where I go is within a reasonable distance and I can safely probably walk. So otherwise even for a short trip which happened most of them in most of the urban areas, people would still take a vehicle. They will either get into a bus or get into a taxi or it get into a shared vehicle to travel even one kilometer.

Simply because there is no safe infrastructure or safe sidewalk for people to walk safely. Then it depends on the policies which are directly or indirectly affecting travel behavior. You may decide that I will not allow parking I will not allow parking or I will not allow long term parking in a given area or I will not allow on street parking in this area, you have to go to an off street place and park your vehicle.

You can think the charges may be different, you can impose toll, you can increase the fear of public transport, you can reduce the fare of public transport there are several factors which are related to the policies. We can control, we can take the proper policies and that eventually may influence that decision. Because if the cost is changing the decision also depends on apart from other parameters, the decision is also based on the cost of travel.

So we are trying to impact the cost to impact the decision. Similarly what is the national culture or what is the individual preference, maybe it is a festive season, Christmas time everybody wants to go out everybody wants to travel, on New Year eve everybody will go. So there are certain very specific different regions in India have got different festival time different celebrations happen. So the national culture, the regional culture, also the individual preference, all these actually influence the travel behavior.

So these are very important because we cannot really solve problem but just by building infrastructure or building roads. We have to build roads, but we also need to think how we need to understand how the choice decisions or the how the, what is the behavior of people, and then what are the instruments available for us to influence the behavior of individuals. That is why it is important for us. And this is an introductory lecture. We are only in module A, we will come back to this part later. And especially, in the context of choice of mode at a later date, and we will have much more detailed discussion.

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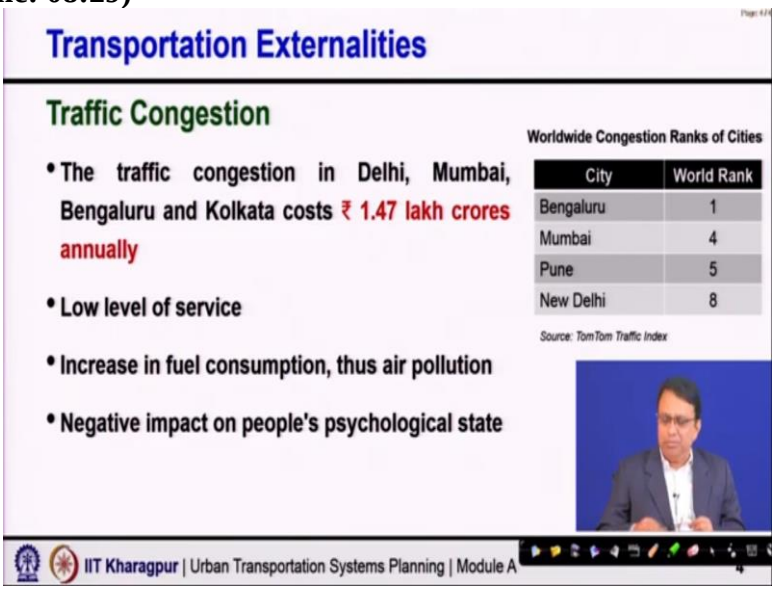

Now let us talk about the, again go back and relook at the externalities. In my first lecture, I talked about externalities, but here we will again spend a few more minutes to talk about each of these externalities. The first is traffic congestion. This is something what I believe it does not require any introduction. Am I correct? Because all of us whenever we travel to any urban area, the first problem we face is the congestion.

We are not able to reach to the destination on time, sometimes we are getting late, there is a loss, there is huge embarrassment because of the trouble you face in terms of congestion, in

terms of delay and all though. So it probably does not require any introduction. Every Indian city is really we have a problem of congestion. But understand what the implication of this congestion is. Some of our cities are right in the top or rank wise very high in terms of congestion.

Of course this ranking and other thing, keep on changing, maybe I have taken it from some reference and if see before two years or after two years you go the ranking may change, but let us only consider that, there are genuine problems of congestion in almost all Indian cities, irrespective of whether the rank little bit go up or come down. Still the problem is very severe.

The other party is, look at the impact of the congestion, as per one of the studies, what I came across, the traffic congestion because of the traffic congestion in Delhi, Mumbai, Bangalore and Kolkata we are losing almost rupees 1.47 lakh crores. That is the equivalent loss annually. Just think the amount. If you could save and you follow fast we are put our efforts and can save a part of it also, it is going to make something really wonderful.

Apart from this, what we find the level of service is degraded because of the congestion, longer travel time delays for the overall quality of service or the level of service go down. The more the congestion, we are spending more fuel, we are consuming more fuel apart from spending more time and since we are spending more fuel, travelling for longer time engine is on for the longer time.

So naturally we are emitting more for the same travel because it is congestion, the contribution or the detrimental, contribution to the air quality is even higher. There is also overall negative impacts on peoples psychological state, you want to go, you never sure you are never sure where you will get stuck off, you want to go to hospital for emergency purpose you are stuck off, you want to go to office you have meeting.

So there is some kind of also psychological pressure on population or on people who are living in the city. So congestion is really a big problem in Indian cities and those who want to work or who are working in the area of urban transportation, our one of the challenges how to really bring down this congestion level.

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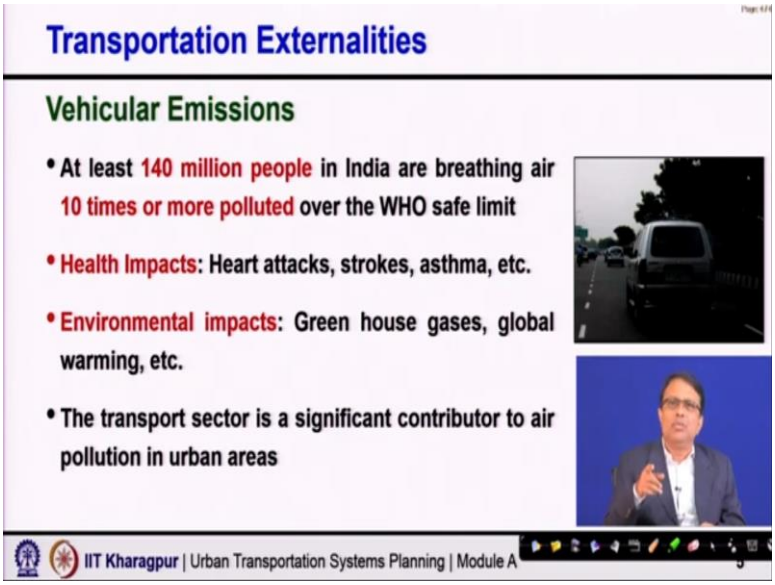

The second, vehicular emissions: Air pollution is a major issue in almost all the Indian cities. And air pollution is almost like you can call it a silent killer. Road accidents happen, other kinds of problems happen at least to some extent people are talking about that media is reporting that. But here it is something which is almost like a silent killer. At least 140 million people in India are breathing air, what is the quality of air, 10 times or more polluted than what is said by safe limit by World Health Organization.

Just imagine, multiple times higher than what is the prescribed limit we are inhaling that air and as many as 140 million people in India every day we are inhaling. What is the concern? Is it something good to inhale? No certainly. It is really having a lot of detrimental effects. One major concern is the health impact. If you look at the urban areas now, the number of heart attacks, the number of strokes, number of chest related issues asthma, these are very common.

And one major contributor and the one major reason is basically the air quality, poor air quality. The other is basically the much bigger thing, health is also much bigger. Another bigger thing is basically the environmental impact; all of you know our concerns related to the greenhouse gases, globally people are talking about global warming. So the more we are emitting, we are actually creating environmental hazards.

And in terms of creating or retrofitting our concerns related to greenhouse gases related to global warming. So two major aspects, one is we have to save the environment. So that is one part, which is getting impacted very adversely because of the poor air quality or the emission.

The second is there is a huge health impact and silently lakhs and lakhs of people or millions of people are actually getting affected and they are also dying.

Lots of people are dying because of this indirect impact. So why are we in transportation planning or in urban transportation course it is of interest to us, because that is the last point what I indicated here the transport sector is a significant contributed to your pollution in urban areas. Because there are many sources of air pollution I will not really go in details of that because that is not really important for this course.

Emission may come from industry there are many sources, but if you look at this areas, urban areas already in how many urban areas we have core polluting industry, they are already removed. Probably government already they have shifted these industries to outskirts of the city, that are in little rural base or where relatively less development that there. So we are in urban area where are industries.

So the major contributor I would say, the major or single largest contributor is basically transport and look at our cities, say for example, Calcutta. Calcutta is a diesel hub. So many other systems look at the most of our commercial vehicles, even the public transport buses, like vehicle, they are all running using diesel. So the diesel cars, petrol also create pollution, so all these are actually the majority of the problem which are coming to related to air pollution, the major contributor is the transport.

So if you want to address the issues for the air pollution, want people to live and breathe clean air, we have to care for the transport, and we will see how we can mitigate and bring down the emission which is coming out of transport.

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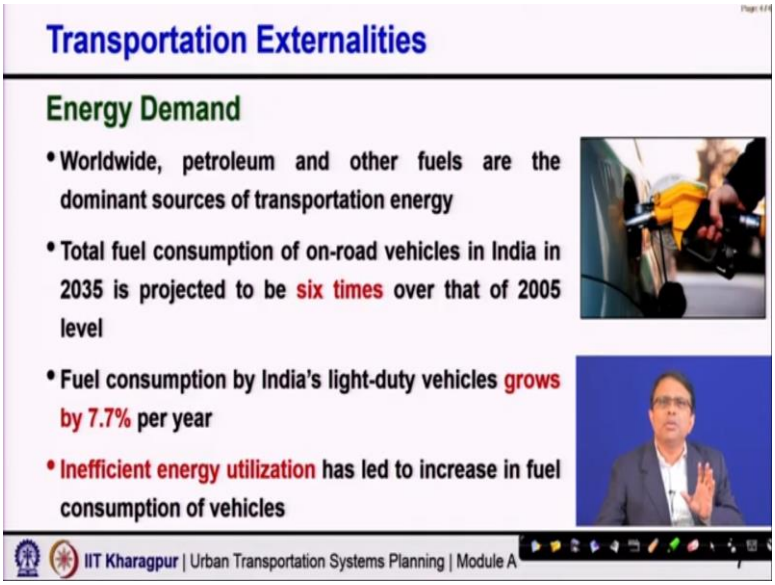

The third is the road accidents, again, a major and very serious concern. I am not sure how many of you are aware of this, that almost 400 plus people are being killed on Indian roads every day, just due to road accident. And we call it is almost like a Boeing crash on Indian roads. And India, as per the statistics as per the data, we rank first, in terms of number of persons being killed due to road accidents.

Not a good thing to say that we are number one. But that is what is the reality? And if you look at it, the number of fatalities in million plus cities increasing increased registering a compound annual growth rate of about 1.9% as compared to 0.8% at the national level for the period 2015 to 2019. That means it shows that road safety is a problem all over India. And it is even a serious problem in urban areas. Road accidents not only have devastating impact on lives.

People who have lost someone near and dear in the family due to road accident only know what is the real impact? We cannot really teach that in that way. People who are the victims and the families they know, what is the real impact? But there is also a huge economic impact of that. If we look at this thing the age group, most important the young and just before that age group. They are the major actually victims.

So the loss is almost about 3% of the GDP. It is really enormous. So when we are talking about transport and urban transport it becomes so important and so important, because of congestion and economic impact, because of the emission and economic impacts and health

impact, global warming and all these issues, because of road accidents and safety issues and its impact. The last but not the least is basically the energy aspect.

Worldwide petroleum and other fuels are the dominant source for transport energy, India is no exception. The world is slowly now going towards electric mobility, people are talking about electric private vehicles, electric buses as slowly they are coming in India also in some of the urban areas, but till day we are, majority of the transport we are using conventional fuel like petroleum and other fuels. Now the fuel consumption on road vehicles in India, in 2035 is already projected to be six times over that of 2005 level.

Just think what it is now and what it would be then. Private vehicle ownership is increasing, usage is increasing maybe it is good to see that people are able to buy vehicle, but we have really other concerns, if all of them they come on road and this transport is so congested and then we keep on consuming conventional fuel like this, what is going to the energy sector, what is happening. Fuel consumption in India by light duty vehicle growth nearly 7.7% per year.

So overall I would say that inefficient energy utilization has led to increase in fuel consumption of vehicles in urban areas and all over the world people are now concerned about the energy they are focusing on the energy and we cannot ignore urban transport if we have to handle the energy aspect efficiently and judiciously in urban context. Again the transport comes back. So it is so much of externalities.

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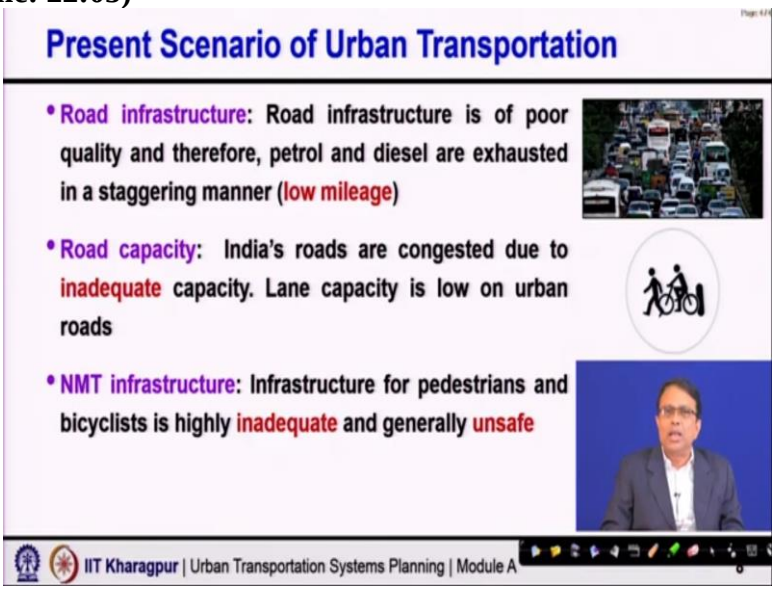

But then next is, look at this thing is it like all of a sudden that suddenly all of a sudden we got congestion, we got energy inefficiency, we got the safety issues right or we got the issues related to air quality. Let us look at the urban transport scenario in India. First our road has infrastructure is inadequate. And the condition of the road infrastructure in many cases is not good. We have roads but we call them road but may not be of good quality the riding quality is poor, there are potholes, there are maintenance issues.

So what is really happening in most cases because the road condition also the vehicles are giving low mileage and as I explained because of the disease aggravating condition it is aggravating emission and everything? Then the Indian roads are congested due to inadequate capacity. As I said the most of our towns and cities are not planned development. They do not we do not have planned development.

So they are not planned cities, as simple as that and the road space is limited. So there are the capacity overall road is less, then the second problem over and above is whatever we have, we do not get the full or adequate capacity from those roads, why, because there are other issues there are encroachment, roadside activities, people are working, there are shops around, some are encroachment, temporary vendors are there all sorts of the sides friction is huge.

So in normal road, whatever capacity it should offer, most cases are urban roads the capacity is much lesser than that, because of all this issue. The one way we have less percentage of road so less road. The second whatever roads we have still we are not able to use the full capacity. Our NMT infrastructure is very poor. We have only cared or bothered about motor vehicle users, neglecting the pedestrians and bicyclists.

So in how many cities people are using bicycle or how many cities people can walk safely there is no footpath, no crossing facility, and no separate bicycle facilities. Now after this post COVID still we are in the COVID situation but I can still say that during this period and post COVID naturally the usage of bicycle is increasing which is good, but we cannot allow this bicycle to go without an infrastructure.

Because then it will fire back because you will find tomorrow a lot of accidents will keep happening because the fast moving vehicle and the bicycles are all going to use the same road that cannot happen. So we have serious deficiencies of NMT infrastructure.

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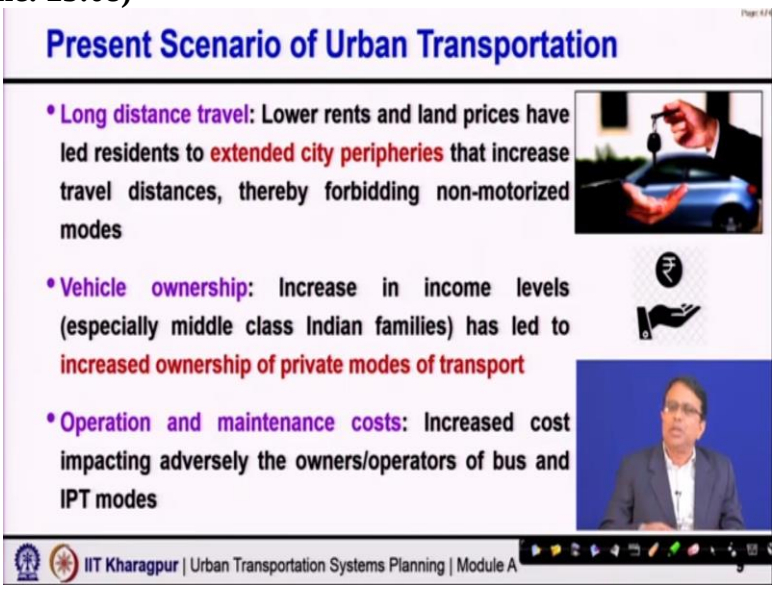

Many cases people are making long distance travel, because the work offices in the civil area, they cannot afford to stay there, because the rent or the value, cost of living is high, so they would like to stay in the suburb and also beyond probably. And if they are staying such a long distance, they cannot use bicycle or walk to come to the office. So they have to only use the motorized modes. So the transport sector is getting loaded and loaded with vehicles, and vehicles are bringing congestion, vehicles are emitting all those issues are getting linked.

Private vehicle ownership is really growing. And it is good that if country is doing good in the, in terms of economy, income levels are growing, and people are experienced, there is nothing wrong, but really I say that, I am afraid as a transportation person that we really, I really may not preferred my economy to grow just by selling more vehicle, because our cities are not developed to accommodate so many vehicles.

So this is a concern, it is growing, it may even grow further. And even if they take everybody if they start using vehicle for day to day work within urban area for going to office and going to work, then that is a much bigger problem because we simply do not have road capacity. Operation and maintenance cost is increasing, insurance to fuel costs to all other things are increasing, which in any way creating more pressure on the public transports, a bus and IPT operators.

In our country in India, buses are also operated by private operators. So they need the operational viability is really important for them. And this operational maintenance cost is an issue.

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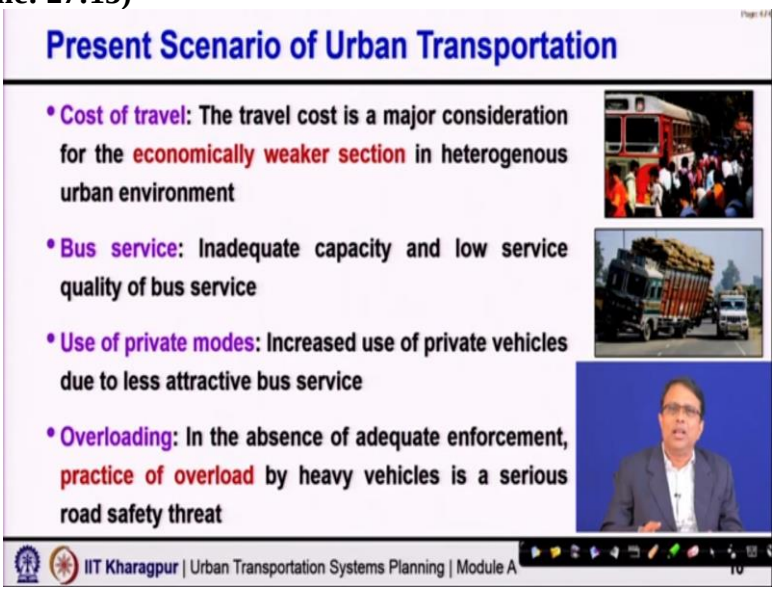

Why I am saying it is an issue? Because there is other and there is another cost. Cost of travel. You cannot really make them, say for example, you cannot make the public transport fare very high, because in our urban areas it is highly heterogeneous. We have very high income people, we also have very poor people or economically weaker section of the community, they are also living. And in many cases they are 15, 20% population or even from that income group.

So you cannot make this one way the cost is going up, but you cannot increase the cost of travel for public transport, because then it creates a deterrence for them. So the cost in most cases in although there are ways and means to solve these problems, which we cannot discuss right now, because we are just only identifying some of the areas. So this is certainly the cost is a bottleneck because you cannot improve the service.

So what is happening, the bus service is getting degraded, because the same kinds of buses are going and you cannot really increase the fare, the cost of fuel, cost of everything is going up. So what is kind of happening most cases it is a compromised service, which do not satisfy or which are not able to, this kind of services are not able to satisfy the requirements of little high income group people.

So they are more and more living buses and going to private vehicles, which is again a problem for us. Then as I said the next because of bus is poor, so people are using more and more private vehicle those who can afford. Then overloading of vehicle is also another issues. In our case as you will see even whether it is passenger vehicle whether it is goods vehicle, vehicle are being overloaded.

Our enforcement is not that strong or maybe not adequate, I should say. So what really happens that goods vehicle overload goods, passenger vehicle even you will find that a three wheeler what we call auto popular, very popular mode in urban India, which ideally should carry maybe driver plus three passengers, most cases they are carrying more number of passengers.

So if you are overloading a vehicle, whether by putting more people or by putting more goods in the goods vehicle, actually, we are compromising in terms of safety and the vehicle is loading getting loaded more so it may emit more also, all sorts of problems we are inviting.

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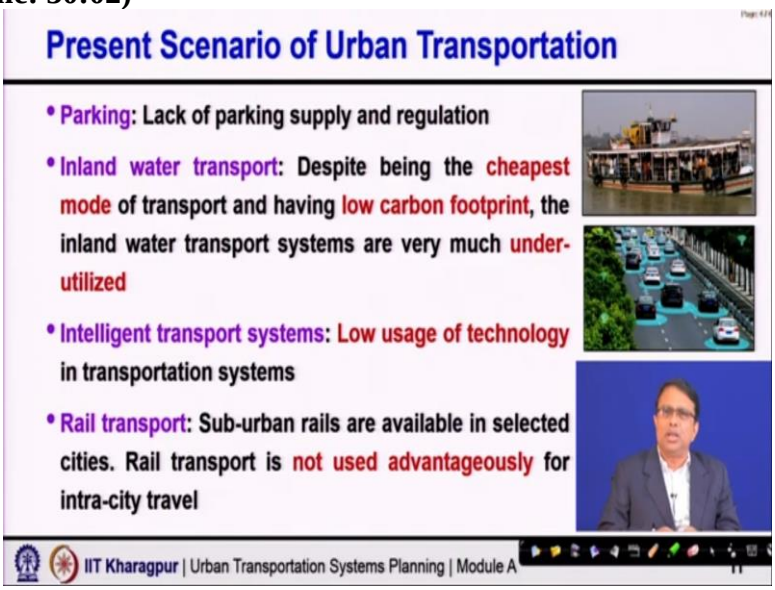

Then parking space, we may not have adequate parking supply in urban area because as I said, we have less number of roads, less percentage of land allocated for road. So we are not able to even if you want to take more on street if you allow more on street parking, then you have less capacity left for the moving vehicles. So many cases we have lack of parking supply, the off street and other facilities are not planned properly.

And the proper regulation is missing, I mean, which road where I should allow on street, where I should allow off street. On street mean where the, just by the side of the road, you are parking your vehicle, off street means not on the road, you are going to separate place maybe multi storied building or maybe a little small open area where the parking is allowed. So there are supply issues and there are also issues related to regulation of parking.

Then the inland water transport is hardly used only recently now, the Government of India is really focusing more on the development of inland water transport, but if you see traditionally the whole development has taken place based on water, all that if you take river Ganga, you know all the developments along the side of the river Ganga. So water transport was really a key consideration.

But over a period of time we have focused so much on road transport and we have not really done justice to water transport and in many cases which were earlier existing, we are not even continuing with those service. So that is, what is the situation, despite the fact that they are the cheapest mode of transport and having low carbon footprint? Similarly the ITS is missing huge technology application which is a lot of potential these days.

Apply of technology for traffic management for bringing the, matching the expedition of the road users, in so many ways application of, effective application of technology that is missing. The rail transport again I would say if you consider only maybe Calcutta, Bombay and in very few limited to some extent Chennai very few Indian cities are actually using suburban rural service otherwise, suburban rail service is not there.

And how much we have tried really to use rail transport advantageously for intra cities travel. Within the city you want to travel, let transport let the rail transport be the predominant transport, we have not used advantageously. So, so much focus on there.

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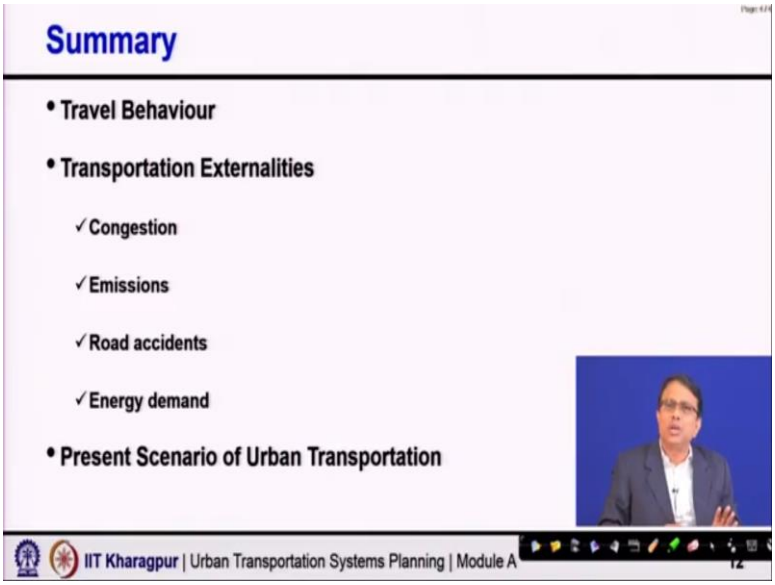

So with all these obviously, the scenario cannot be improved. So altogether I said in this lecture, we discussed about the importance of the travel behavior and certain important factors which influenced the decision making of the users. Then we talked about the transport externalities, congestion, emission, safety or road accidents and the energy demand. Then we discussed a number of factors which describes the present scenario of urban transport.

And all these say that it is not a surprise, why our cities are congested, why we are emitting more in urban area, why so many accidents are happening and why we are doing an inefficient energy management in the transport sector. So with this we close here, we will continue in the next lecture. Thank you.