Introduction to Multimodal Urban Transportation Systems (MUTS)
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Module No # 01
Lecture No # 01
Overview of Urban Transportation: Urbanization and Transport

Hello, welcome everyone to this first inaugural lecture on the course titled introduction to multi modal urban transportation systems. Here in this course you will be exposed to various types of urban transportation modes, how do you plan for them, and how do you integrate them? So during this first week we would give you an introduction of the overall urban transportation system and in this first lecture let us see what we have lined up for you.

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So, in the first lecture we will look at urbanization and its relationship to transportation. We will cover the urbanization rates and how urbanization is impacting the economy and as a result of that how are the travel demands of the citizens living in these urban areas are increasing. How are urban areas dealing with poverty and in turn how is transportation helping in alleviating poverty or reducing poverty and then we will start looking at the rate at which motorization is increasing in India. As a result of urbanization, there is also an increase in purchase power etc.

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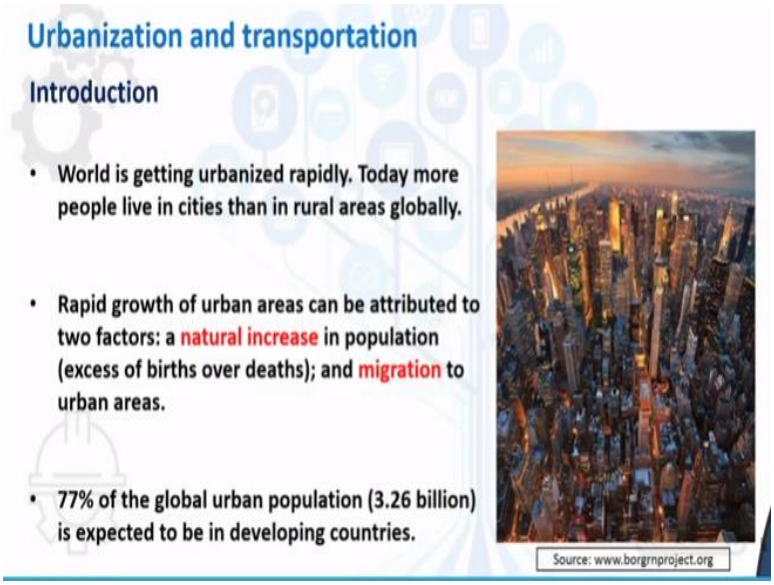

So, when you start looking at transportation, invariably you are thinking about all the transportation modes in the cities and urban areas. They may be small cities, mega cities, metropolises, but urbanization and transportation go very much hand in hand. You may know that India, at the time of independence, was called nation of villages, lots of small villages that used to constitute a majority of the Indian geography and most the people used to be living in rural areas.

The people used to live in rural areas, but that has not been the case for the last 2 or 3 decades, where a lot of people have now either shifted to the urban areas, contributing to the rise in the urban population. So the rise in population coupled with migration from the rural areas to the urban areas has led to a lot of people now living in the urban areas. Statistics show that 77% of global urban population is expected to be in the developing countries. So India being one of the developing nation in the world, it is in such nations that you see a higher percentage of people living in urban areas.

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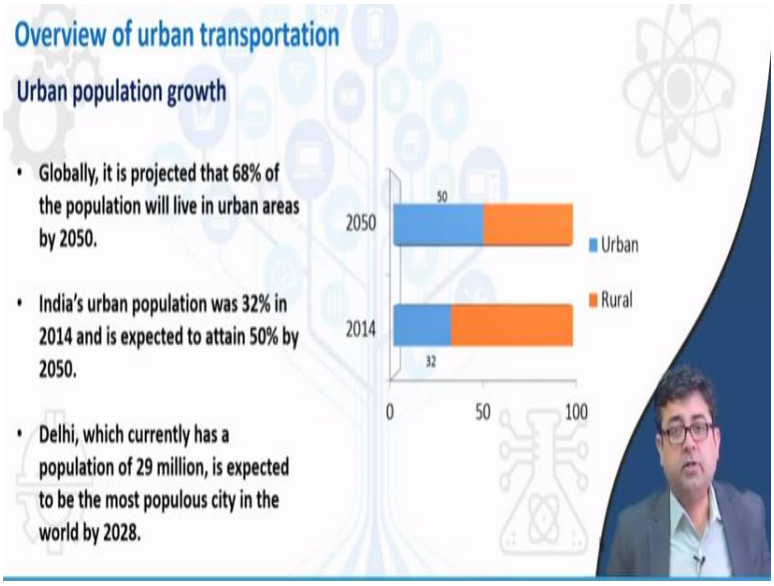

As a result of this population growth what we are also seeing is sprawl in the urban areas. So what is happening is that the people that have moved or the people that are newly born in these urban areas are now looking to move away from the urban core areas, but not too far away, so sub-urban areas are being formed. So this entire area of the urban agglomeration is increasing day by day.

It is expected that by 2050, 50% of India population would be living in the urban areas, which currently is about 32%. So you can imagine the amount of rise in the number of people who want to live in the urban areas. As you all know India has 4 metropolitan cities, with Delhi-NCR being the one that has the highest population of 29 million and it is expected to be the most populous urban area in the world by 2028.

So with such large number of people living in the urban areas this definitely is putting a stress on the infrastructure that is available in these cities.

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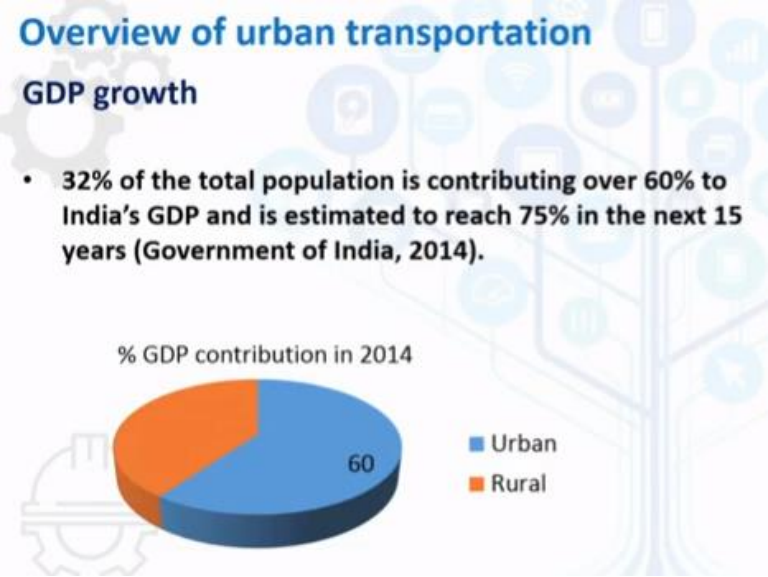

It is also being noticed that the urban areas are driving the economy. That means why are people migrating to these urban places or urban areas? Because there are jobs; because there is some form of employment which is otherwise not available in the rural areas. So, although the urban population currently is only 32% of the total population in India, but it contributed over 60% to India's GDP. So you see, the Indian GDP is very much dependent upon the urban areas and the jobs that are there in the urban areas.

So this is a catch 22 kind of situation, where because of the lack of jobs in the rural areas people are migrating to the urban areas; however the urban areas are getting too congested and then people are again sprawling out to the sub urban areas, which are almost the urban periphery. So there is kind of the 2 way dynamics going on here, and it might turn into a vicious cycle if we do not arrest this situation pretty quickly.

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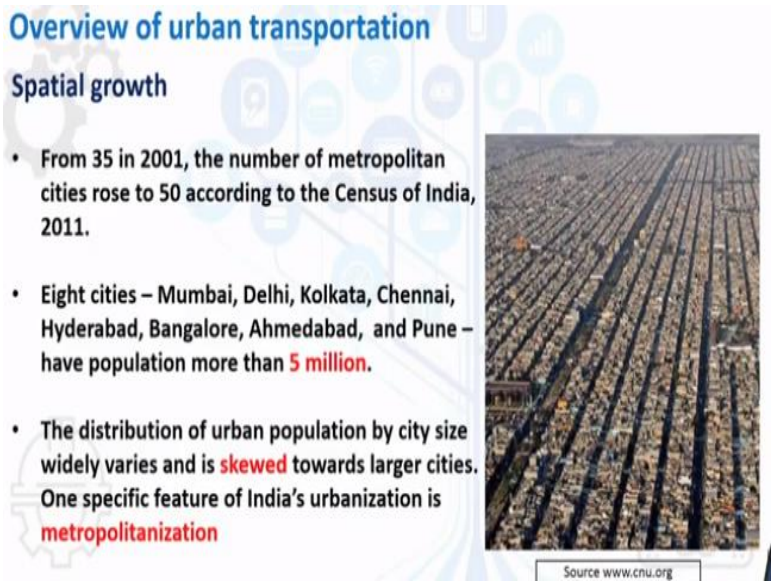

This is what I was talking about when I was talking about the sprawl in the sub urban areas from just 35% in 2001 the number of metropolitan areas has grown to more than 50% and what we are also seeing is that cities with population of more than 5 million are now 8 in number. So in addition to the 4 mega cities, or the metropolitan areas, we are also seeing the rise of the cities such as Hyderabad, Bangalore, Ahmedabad and Pune.

So all of these areas are attracting people because of the employment opportunities, and everybody seems to be moving into these cities.

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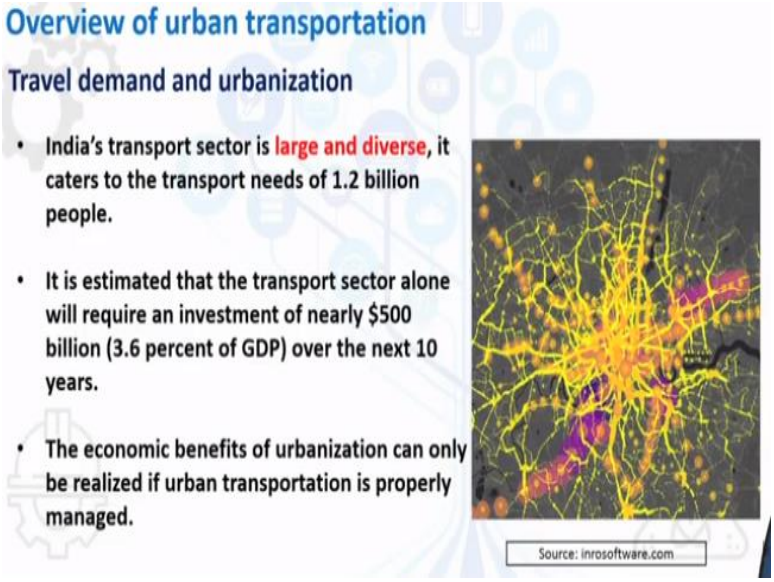

So as a result of this what is happening to the transportation network of this cities? So back in the day when the cities where small in size, the population was not that much, the planning of the city was done in such a way that catered to the population at that period. However with the great influx of people or the increase in the population and population density in the urban areas what is happening is that the existing transportation network is coming under great stress.

Stress meaning, it is not able to provide for the mobility or accessibility of the people residing there. So for example, you every day hear that all the roads in the nation's large cities are congested and the time it takes to travel 2 kilometers in the morning peak hour is often more than 30 minutes along such roads in certain cities and that adds to not only travel time delay but also leads to a lot of pollution in these urban areas.

So what is happening is, as people start living in these cities and the road network is not able to cater to their needs, there is an always increasing requirement of building new roads. However building new roads are also not solving the problem, they are only shifting the problem by 5 or 10 years may be, and after 5 or 10 years we are back to the situation where congestion returns. So people are then looking for alternative means of improving the mobility or accessibility in these urban areas.

So, we are noe look at different means such as metro rail, BRTS, now you have public bicycle sharing systems in India, the sidewalk or the pedestrian transport network is being looked at very carefully, so that not many people should be willing to take motorized trips when they can take non-motorized steps such as walking or bicycle. So, all of these new and different forms of urban transportation modes are being implemented in these urban areas.

However the other issue with that is, with all these modes coming up, the next step is to integrate them into the system. If you have a bus network that it is not integrated with the metro rail network, which is not integrated with the parking systems, so it becomes a chaos. So what we are currently experiencing in India is the evolution of the transporting system, or the transportation network in the urban areas, and what I just talked about is only by looking at the transportation system for the people.

Along with it, there is the transportation system for the freight, that is a very important part of the urban transportation system. If you do not get the goods in time, you may not be able to cater to every family's needs who require fresh vegetables, who require fresh milk, so all of this has to be transported on some vehicle or the other, and it has to reach to destinations on time.

So urban transportation plays a big role in the economy of the nation and if the transportation system is smooth and seamless, if it provides good quality of service, then the economy invariably improves. So that is how, on a very broad scale, if anybody asks you how transportation effects the economy or how urban transportation impacts the economy, you can explain it in that manner.

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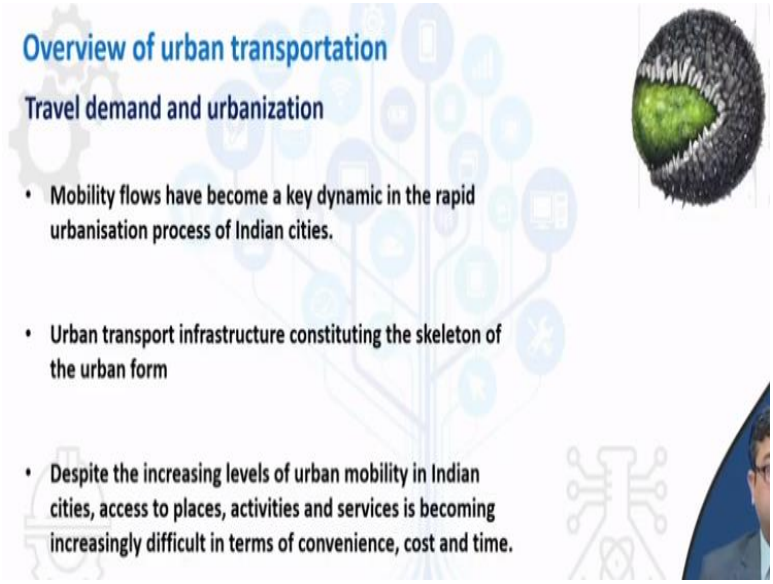

With this increase in the mobility needs of the people living in the urban areas, we are seeing different types of issues as well. Urban transportation infrastructure although is the skeleton of the urban form but what is happening is -- our cities are relatively old, i.e. atleast most of our large cities are old, and many of our even smaller cities are old. So the transportation infrastructure present there is also old. Now, once it is aging and due to the growth of the population you are unable to revive this old infrastructure, or it becomes very difficult to revive the old infrastructure.

For example if you have a narrow road or a bridge which you do not monitor for many years, what happens is because of the ever increasing loads that the bridges are carrying, for example,

the trucks are getting larger and larger; the car sizes are increasing; and all this is putting stress on that bridge or the road, and they are deteriorating. Once deteriorating, it is very difficult to repair them because of the issues in the urban areas such as narrow streets, you may be are not able to get access to those streets.

So what is happening is that people are now moving out to the sub urban areas, like I said. So when in sub urban areas you have green fields, you can develop new infrastructure and you can have better quality of infrastructure. So in search of better quality infrastructure people are moving out to the sub urban areas however that is eating up on some of the farm lands that are in the periphery of the area.

So that is also not desirable, i.e. what is happening with this sub urban sprawl is that it is primarily the residential areas that are moving out to the sub urban areas and not the offices. So now people are living far away from their offices which is in turn is resulting in a situation where they have to travel a longer distances. If you live very close to your school or very close to your office or very close to the market, then you have to travel only short distances.

But now if you live in these sub urban areas and your office is still in the central business district, your travel time or your travel distance increases. And so with this increase again the same thing starts happening -- you emit a lot of noxious gases into the atmosphere which causes severe air quality issues in many of the cities. Also we have now noticed that there is an increase, or there is a correlation between the numbers of kilometers that you travel and the probability of an accident that you might get into. The more you travel, it seems like there are more number of accidents. So all of this is some of the characteristics of the urban transportation system in India. Currently we are not only looking at mobility as such, but along with mobility we are also look at accessibility, and we will get into what those terminologies means during the course of this entire lecture series and you would be able to distinguish between all the terminologies.

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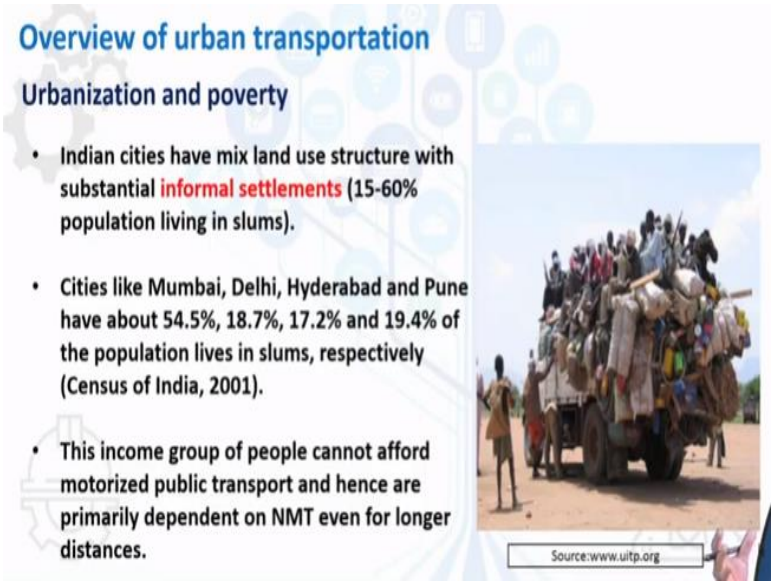

The other issue with urban transport is -- how it can help facilitate the livelihood of people. Transportation, as you start reading more and more about transportation, one thing to keep in mind is the transportation is derived demand. Meaning you travel from one place to the other for some purpose, you are not just travelling without any purpose, there are some leisure trips that you take, but that is also for a purpose.

So when you are going on a vacation, that is the purpose of your travel. You hardly are on the road because of nothing; so even if you are exercising that is the purpose. A very few trips that you just want to relax and you are walking on the road along the side, or park, or something like that, but those types of trips are very few in nature. So transportation being a derived demand you are always travelling for a purpose and the overwhelming majority of the reasons for which you are travelling is essential for livelihood.

Everybody almost travels at least twice a day -- once from home to work, and then back from work to home, it is all for livelihood. The other purpose is maybe for education, or for health, or for leisure, like I said, but the overwhelming majority people actually travel on the road because of livelihood. Now, if the transportation network that is provided in an urban area, enables people to access their work place from their home in a safe manner, in timely fashion, provide quality infrastructure, then we could say that the infrastructure is sufficient, or the transport infrastructure is sufficient in helping the economy or livelihood of the people.

But more and more projects that are coming up are skewed towards one section of the society, and are not accounting for other sections of the society. So I could give you an example --for example if you widen a road, roads are predominantly for motorized travel. So suddenly if you widen a 2 way road to a 4 lane road, which goes from the middle of your city, what happens is the pavement is taken up by vehicles.

And vehicles can be owned by people who have enough money to buy those vehicles and now suddenly there are no sidewalks, or there are no footpaths alongside these roads, or there are no buses, or bus comes only once in 1 hour. So what happens to the people who cannot afford vehicles -- they are now at a disadvantage. Now, you had a 2 lane road where they could may be cross safely.

Now, as the 4 lane road comes up, the crossing of pedestrians become unsafe and so the people who are accessing job location from one side of the road to the other side of the road now feel unsafe. So what starts happening is that -- vulnerable road users or the section of the society that cannot afford to buy a vehicle suddenly feels disadvantaged. They feel that this infrastructure, transport infrastructure, that is put in place is not for me.

And as a result of this, they begin to feel “my livelihood chances, or my livelihood opportunities are not improving”, so they resist any kind of change. So you see when land is required to widen such roads many people do not feel that they should give up the land and one of the reason behind the thinking is -- if I give up my land, which is was using for cultivation now, I will lose my land, and by widening of the road I am not going to get sufficient remuneration which will allow me to continue my livelihood for at least my age or at least the generation after me.

So what starts happening is these modes starts favoring only the people who can afford motorized vehicles and the poverty does not reduce. However if you invest in public transportation modes, mass rapid transportation modes, you would see that it is even the people who cannot afford will be simply using such modes, and then there will be enough opportunities for them to commute between their homes and office and then they have a chance to come out of poverty .

So you should never be in a situation that is shown in this picture where you have one bus and bus is so overcrowded because none of the people who are on the bus can afford vehicles, so everybody should take on their bus or the truck. But this kind of situation should not arise when we are talking about urban transportation modes so the transportation modes should cater to all parts of the urban areas or the sections of society living in the urban area and not skew towards only one group.

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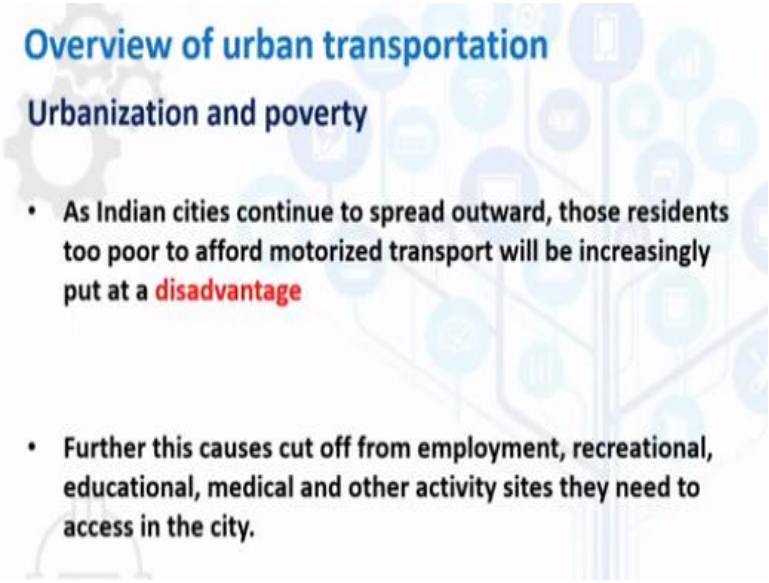

As the Indian cities, and we have already talked about this, grow outwards, it spread outwards, this phenomenon is called urban sprawl. So you see transportation is very interesting subject, it is almost blend of civil engineering, urban planning, and economics; all of these things come together in transportation. Many people call it transportation engineering but this form of multi model urban transportation is just not engineering, it is much more than engineering.

It as economics, associated with it is urban planning, associated with it so this phenomenon of urban sprawl, which is a very important phenomenon that transportation agencies guard against. Although these agencies are currently not directly involved in developing the master plans for cities, which they should be involved, and when the urban plans are developed, i.e. the master plan, they also keep in mind that there are strong growth boundaries.

So a city is planned in such a way that for the next 20 years all the growth would happen within a boundary, and nothing beyond it. Because the minute you start sprawling beyond those

boundaries you are at a disadvantage both in terms of transportation and in terms of environment, because, like we already discussed, travel increases from sub urban to the urban city core, you emit more gases, vehicle emission increases and effects the environment.

So you have to be very careful when you are trying to look at how sprawl impacts the transportation or vice versa how transportation impacts sprawl.

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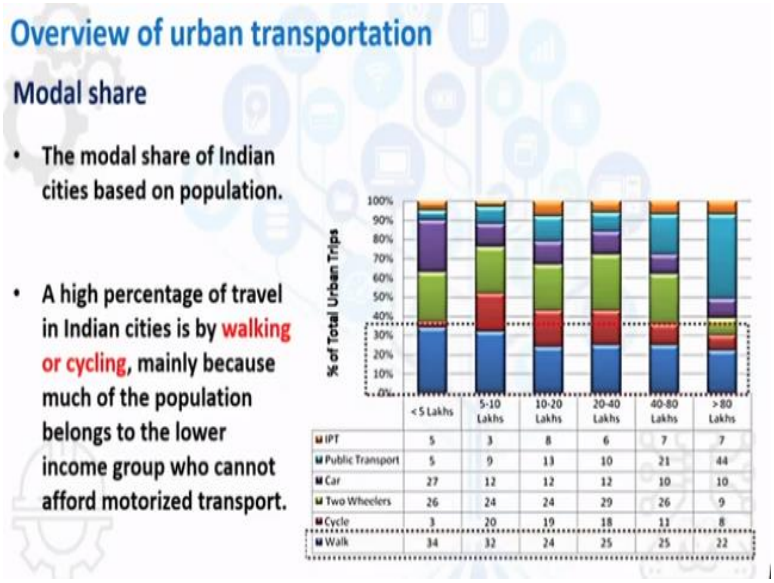

Now when you start looking at the various modes of transport or urban transport, you would find that predominantly in the cities and towns in India a lot of people used to walk for various purposes. Because you know when the city was small and very compact, your grocery store used to be very close to your home; your bank used to be very close; your markets used to be very close.

So you could easily walk or access these different types of land uses. However as the city starts to grow what happens is now you have specialty retail stores which may be 1 or 2 in the city and invariably they are never close to your home. So you have to depend on motorized modes. Then you have the introduction of metro rail in multiple cities in India; now most of the major cities have some form of bus transportation and then there is a another form of transport in the urban areas, which we call intermediate public transportation system.

So that is IPT, so these are the auto rickshaw or the cycle rickshaws that provide you the last mile connectivity from your bus station to your home or from metro station to your home and so these are those modes; collectively they are called intermediate public transportation system. Taxis are also a form of IPT. And now the most recent one's that have been introduced into the urban transportation networks are the transportation network companies, i.e. the Olas and Ubers.

Now you have these on-demand public transportation systems, so they are called as on-demand transportation system because whenever you need one you use your mobile device to hail one of these rides and they arrive and then you take it. So there are different forms of urban transportation modes that are available in your cities. However if you look at the figure that is shown here, the trend is that there is a decrease in the number of people who want to use non-motorized transport or public transportation.

And there is an increase in number of people who want to use motorized transportation such as either the 2 wheeler or the cars, so on and so forth. So there are multiple reasons for such things -- one of the primary reasons is aspiration. You hear that India is an aspirational country. As our GDP increases our income rises, and as our income rises we always want to have better modes of transport, which provide us much more comfort which are available to us at any point in time.

So we can take it and move from one part of the city to other. There are externalities to it, but it is a fact that as income increases the tendencies to use motorized modes also increases.

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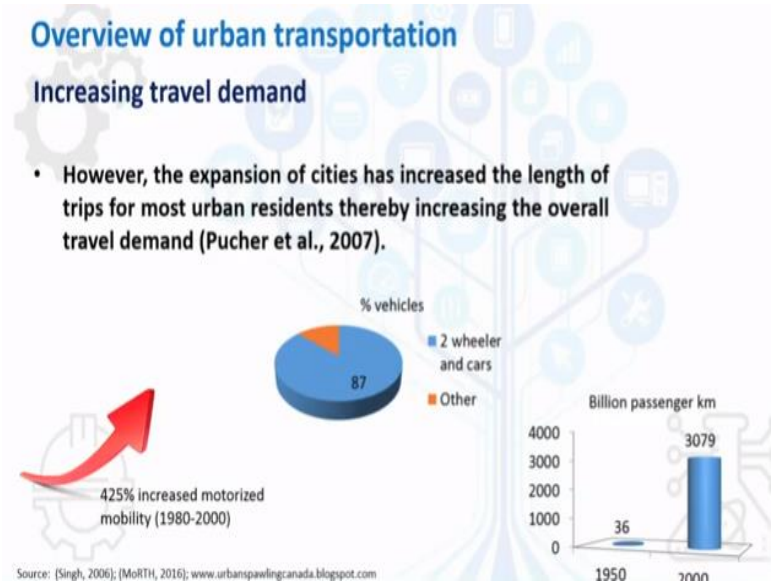

So when we were talking about travel demand that is what we were essentially meaning. So you can see in this chart that in 2007 the percentage of 2 wheelers and cars are overwhelming or overwhelmingly high in most of the cities in India, and so is the increase in the length of trips. And it has increased the length of the trips because now you are living further and further away from the place where you work, or the place where your school is, or the place where you go to shop and that is increasing the number of kilometers that you travel.

So when I say vehicle kilometers of travel, what I mean to say is not only is there ownership of vehicle increasing, not only are more and more people owning motorized vehicles but the number of kilometers that they are using those vehicles is also increasing .

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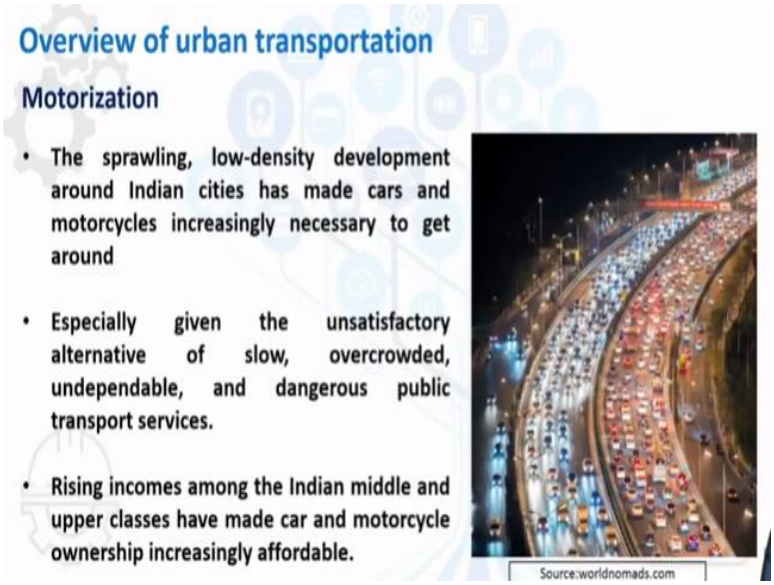

And that is giving rise to this entire phenomenon of congestion. So as I said, I mean, transportation again is a very closed related to economics. So if the supply of the road is constant, meaning that the number of lanes that you provide remains constant. However the demand for travel is increasing; the demand for travel meaning the number of vehicles on the road is increasing, and the number of kilometers driven on those vehicles is also increasing.

So what happens is this there is a mismatch between the supply and the demand. Supply cannot keep up or keep pace with the increasing demand. You cannot widen a road every day, however every day you are adding to the number of vehicles that are actually using this road. So as there is an imbalance between the supply and the demand, this is what gives rise to congestion.

So when you see a congested road in your city or in urban areas you have to keep in mind that why this is happening? This is happening due to the phenomenon of supply not keeping up or not keeping pace with the demand, i.e. with the travel demand.

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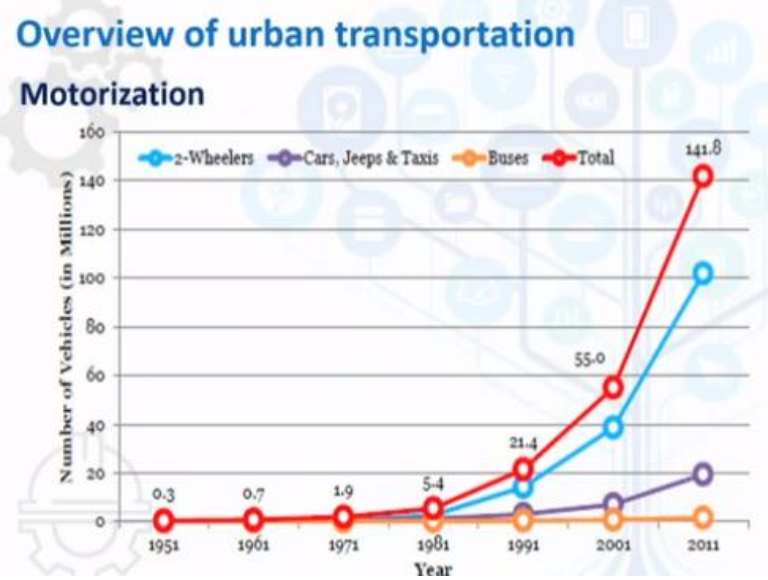

Here is an example, or the data that shows that how the total number of vehicles registered have been increased over years. So if the red line is the total, so what you can see is that the number of 2 wheelers, this the blue line, is very similar to the pattern shown in the total number of vehicles. So that means, in India we are not buying too many cars or jeeps or 4 wheelers, but the number of 2 wheelers are very high.

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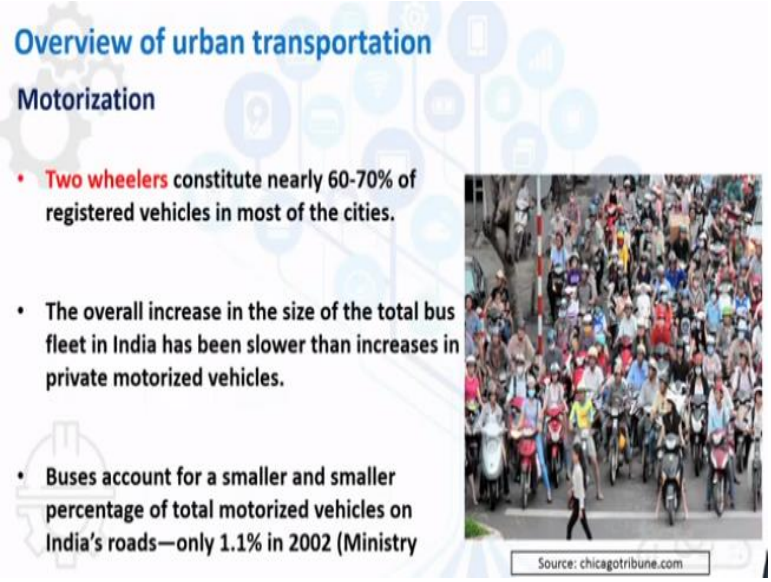

That is what even this slide is telling; along with the increase in the number of 2 wheelers what is also happening is that there is decrease in the number of buses that are being actually put out on the urban transportation network. So you would see many of the governments always pushing for buying new buses because you know what, bus can transport 40 people whereas one 2 wheeler

can transport at the maximum legally 2 people. So investing in a bus is much more thoughtful from transportation point of view than saying that 40 people buy 40 individual motorcycles.

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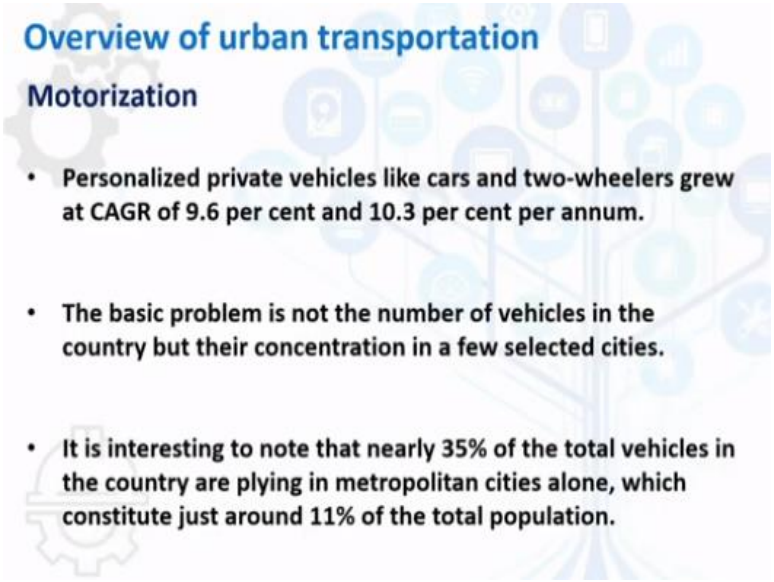

This chart further provides figures, such as personalized vehicles like cars and 2 wheelers grew at a rate of 9.6% or 10.3% per annum. The basic problem is not the number of vehicles in the country; it's with the concentration of these vehicles in a very few select cities. This is a very concentrated phenomenon it does not happen in smaller cities, where they have different transportation issues, but the congestion issueis concentrated to just these larger cities.

It is interesting to note nearly 35% of the total vehicles in the country are plying in the metropolitans cities alone, which constitute only around 11% of the total vehicle population. So 35%, so one third, of all the vehicles are in the metropolitan areas. So non metropolitan areas everything put together as the rest of the 67%.

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5 metro cities are the ones that are looking at higher motorization rates and what is happening is now one household has more than one motorized vehicle. You may see, or it is very common to see, in any urban areas or in any urban metropolitan areas especially, the household has either two 2 wheelers, or has one 2 wheelers and one 4 wheeler. So you see what is happening is, 10 years or 20 years earlier a family used to have 1 vehicle.

So what it would do is, it would add, i.e. every household would add, only one vehicle to the transportation system. Now suddenly within span of 10 to 20 years every household is adding at least 2 vehicles to the transportation system. So the number of vehicles added per household as doubled so you can imagine what stress, or what impact, it is having on the congestion along the streets. Definitely the number of lanes has not doubled.

So this is the impact that motorization is having in our large cities as well as in the cities that are increasingly seeing more population living in them such as Hyderabad, Bangalore and so on and so forth.

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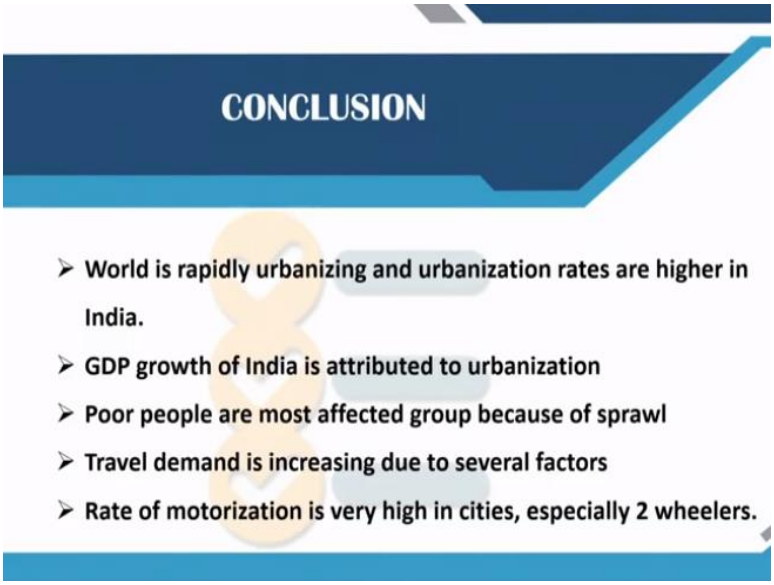

So that concludes our first lecture in this course. We looked at urbanization and the urbanization rates, which contributes to not only GDP increase but also contributes to sprawl and it is also in turn contributing to the transportation networks' failures, and sometimes its inability to cope. So how are we looking at urbanization and transport we gave you some examples of some cities and in the following lecture we will now look at transportation system in-depth. Thank you very much.