Sustainable Transportation Systems
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Lecture No. 29
Introduction to Sustainable Transport Planning

Hello friends, today we will discuss about sustainable transportation planning. Means whatever aims and objectives of sustainable transportation systems are there we need to plan for certain modes of the transport or the systems of the transport, means various components and aspects of the sustainable transport we need to plan, you might have heard that plan the work and work the plan. So, planning is very very important in any activity and that way for transportation system also we need to do a lot of planning before execution of those plans or ideas or designs.

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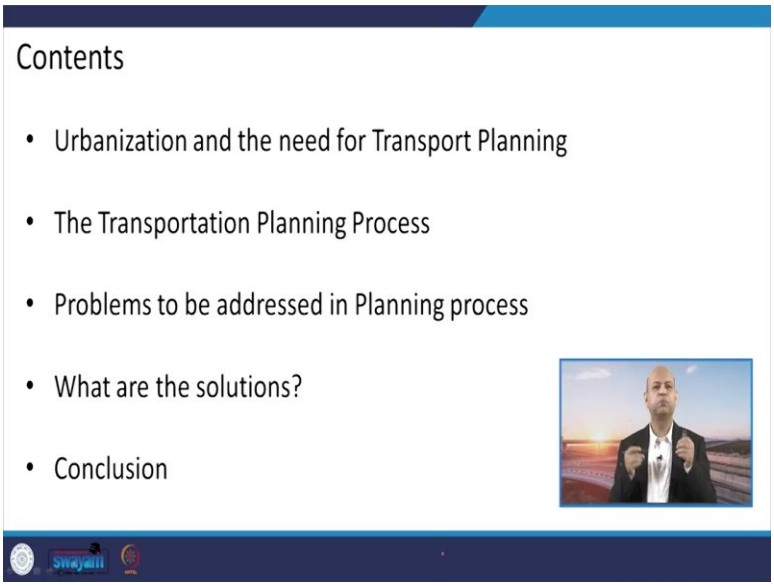

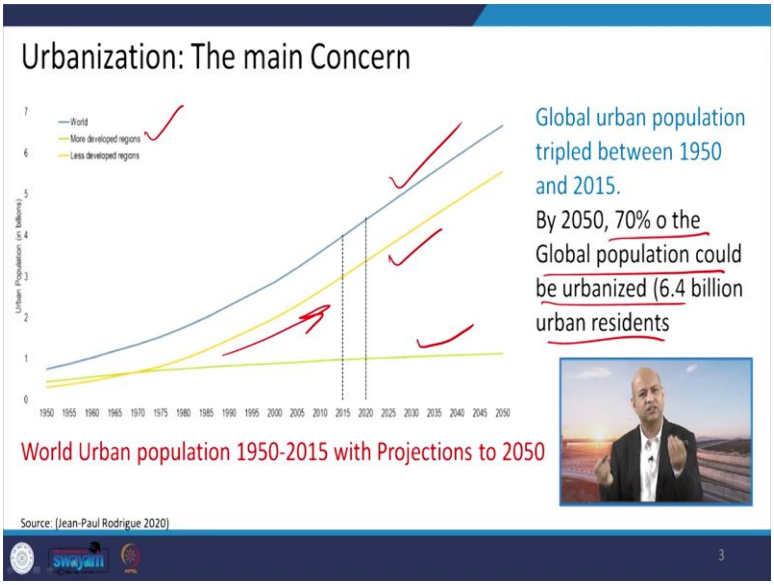

So, in this particular lecture we will cover like why urbanization happened and urbanization gave rise to the need of the transportation modes because we need mobility in life and then what are the important planning processes for the transportation and what are the main problems which we need to address during the planning process so that we can know what is good planning, what is bad planning and then what are those solutions which can be part of our good planning for the transport and that we will conclude at the last.

Well, if you see this trend world urban population from 1950 to 2015. So, these are the projections up to 2050 you can see, this is less developed world that means this one and this that is the average world population, urban population I mean and this is for more developed world this much. So, the urban population in more developed world is saturated that means, most of the countries have got totally urbanized, almost urbanized. Even their countryside which we can call rural area also having the same amenities as urban cities have, urban areas have.

So, basically from infrastructure point of view, from facilities point of view, from connectivity point of view all things are there which exists in the city that is why we call it urbanized but in less developed countries or developing countries, this urban population is increasing that means migration from countryside, from rural areas to cities is increasing day by day and this is this sign or indicator of so called development model of the present era.

But there are certain problems which we know and sometimes we discuss what are the problems related to this particular development era which is fueled by the fossil fuels or this is called as

carbon economy and that is why this carbon economy has forced us to a path which is no longer sustainable, if you consider the environmental damage, if you consider the climate change related threats and risks, then we conclude that this particular model is not sustainable for all the population, it really fragment us certain pockets are more developed, certain pockets are very less developed and at certain places people are not having even basic needs fulfilling infrastructure facilities.

So, that way this is no longer is the sustainable part of the development, but we have to study these trends and projections. So, the 70 % of the global population is estimated that it will be urbanized overall the globe. So, even this will have several implications from technological point of view to from political point of view because vote banks where it lies accordingly those agenda sets political parties.

If like in India, we have more rural population. So, our policies proposed by political parties are more inclined towards those population, if urbanized population is more than the issues will change. So, they have repercussions for example, mega city Mumbai, some people argue that mega city Mumbai should be a state like Delhi, but then the state politics say that no, this is not required, this is jewel of our state.

So, those are issues in fact, but there are, various concepts and ideas like people argue for city states like Singapore and there are other examples where in a lot of economic activities are concentrated and they are known as the economic engines of that particular region. So, this is the urbanized population and why it is growing as you know because most of the economic activities are concentrated within the city centers, means centers of the urban clusters or industrial clusters which are in and around the cities.

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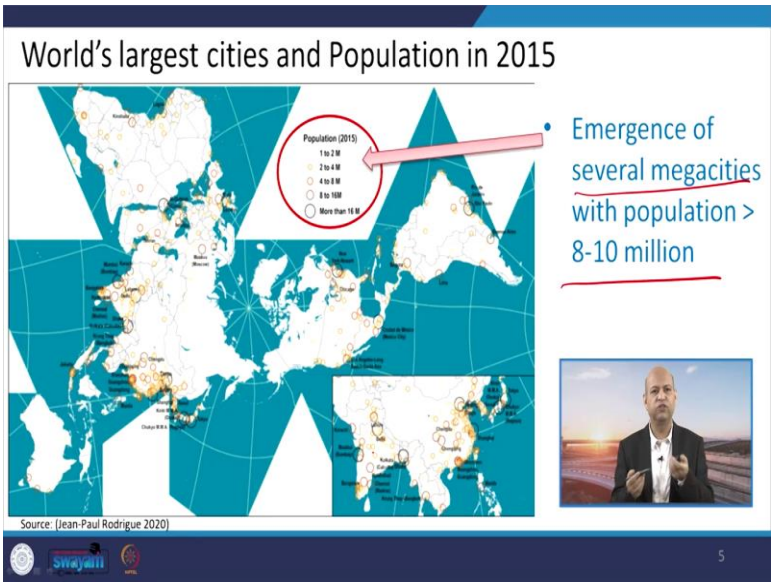

If you see this world's largest cities and population in 1850. So, this is the era when industrialization started. So, only three cities had population more than 1 million London, Beijing and Paris only these three cities, but nowadays forget about 1 million cities now, we have mega cities and mega cities are known as cities which have population equal to more than 10 million according to the United Nations definitions.

So, there are several cities which are larger cities nowadays, and in 2015 these emergence of several mega cities occurred and which are like 10 million or more. So, these are locations of cities and across the world like in India we have Mumbai, Kolkata, Delhi and in South Asia if we consider then Dhaka, Karachi all these are the mega cities.

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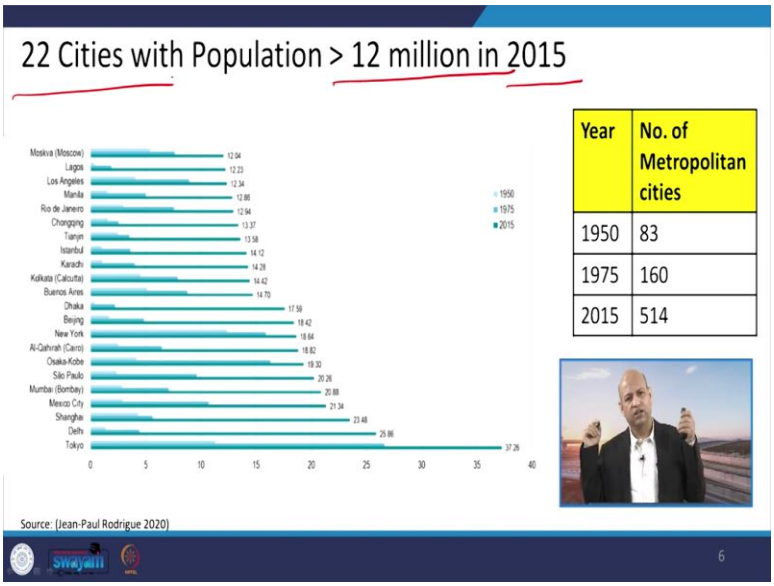

So, at present these cities which are having population more than 12 million means, this is the data of 2015. So, 22 cities across the world were having population more than the 12 million, you can imagine means, there are certain countries which have very less population, but these are only the cities which are having so, many people, so, that densely packed the reason is very simple, because the present economy is fueled by fossil fuels, and when we live together, then we need to spend less energy on transportation, if we live apart from one place to another, then we have to travel a lot. So, we have to burn fuel in great amount.

So, that does not make much sense. So, that is why this fossil fuel based economy really propels us to be pegged into cities or mega cities you can say.

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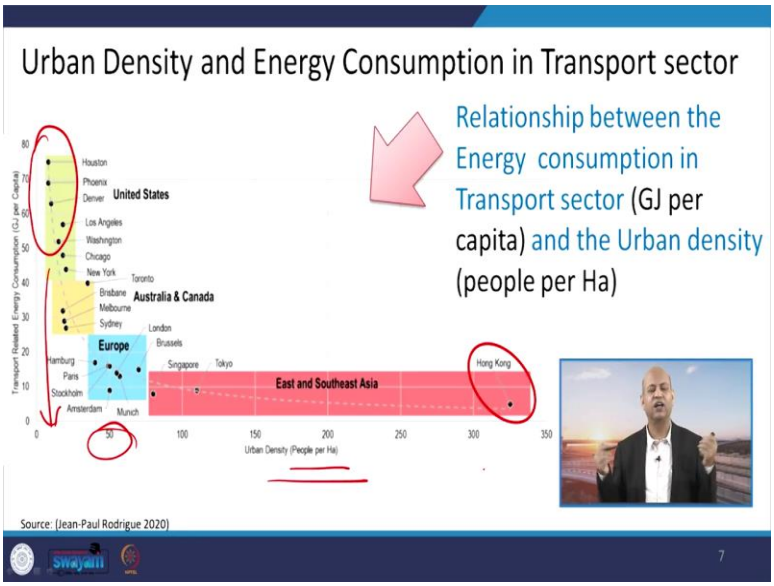

Well, if you see this urban density and energy consumption trend, which also gives this kind of insight that in East or South East Asia where cities are highly densely populated for example, Hong Kong or even Mumbai, Delhi etc. So, their density is much more per square kilometer or per hectare here this data is per hectare here and this is the transport related energy consumption Giga Joule per capita.

So, you can see like United States having very high per capita usage of the energy and their density of the population is very less, people are living quite faraway places. So, they travel a lot, they drive a lot. So, they need a lot of fuel to burn. In Europe, little situation is better than in comparison to the USA, because their public transportation is better and that way even some density related parameters also but, I mean more, but the energy consumption per capita is much lower than the USA.

If you see in less developed countries of Asia and other cities, where per capita usage of energy is very, very less, because the cities are highly packed, highly dense and the population is living together in multi storey buildings and even slums and very densely populated areas.

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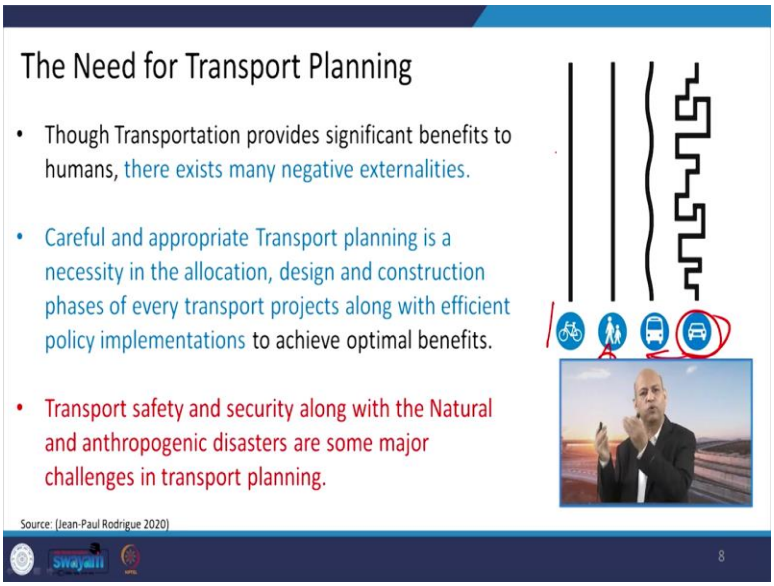

So, the need for transportation planning why it is there, why do we need to plan the transportation at all. So, the present transportation system which is based on fossil fuel burning, so, that way you can travel a lot of distances if you have a lot of per capita income, but if you want to shift towards like public transportation system from the private cars or taxis etc., or if you want to promote non motorized transportation system like walking or bicycling then these roads and paths must be shortest one that must be straight whereas in car you can go from one place to another in zigzag way or lower.

So, that way we need proper planning, so, that the distances we can reduce and these are walking distances, nowadays, concepts are emerging that the cities should be meeting the demands of the people in walking distances, their commercial centers, their job related, the issues or whatever activities or schools or hospitals, they should not be far away, that way some, small pockets must be developed.

It is not that at a particular city center, you have developed very high infrastructure and people are running towards those city centers to meet their demands. No, nowadays, population is being planned in communities and communities are being provided with certain facilities.

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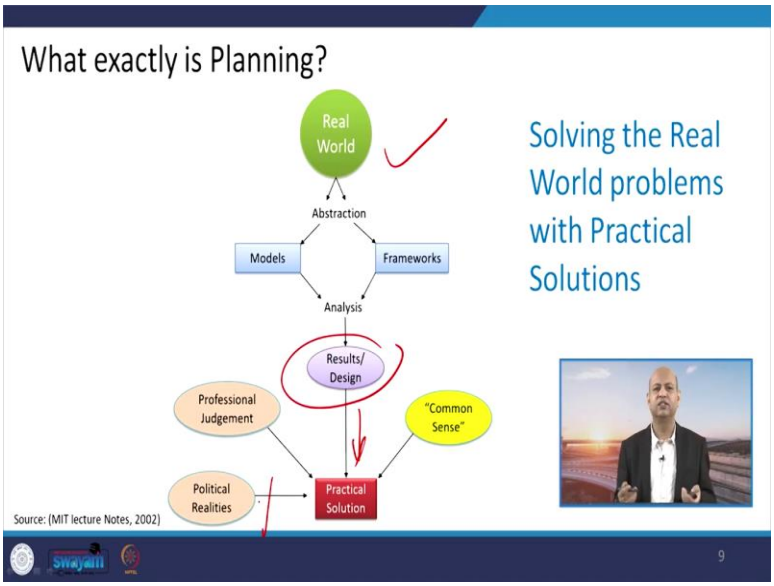

Well, if you see this, flowchart of planning ideas, so, the real world related whatever needs are existing. So, we abstract, we think about that, and then we develop some sort of models or frameworks in the sense conceptual kind of thing you can say and we analyze them and then we see what are the results or design and then we provide the practical solutions, which are again given some feedback through common sense or through professional judgment, because experts are there with some subject experts or field knowledge related specialized experts, which we need, so, their contributions are there and then there are political realities, because suppose you need some highway or some railway.

So, sometimes political reasons are there for having some particular track or some particular infrastructure. So, all these issues, when they club together, then the resultant planning occurs. So, all these factors are to be considered.

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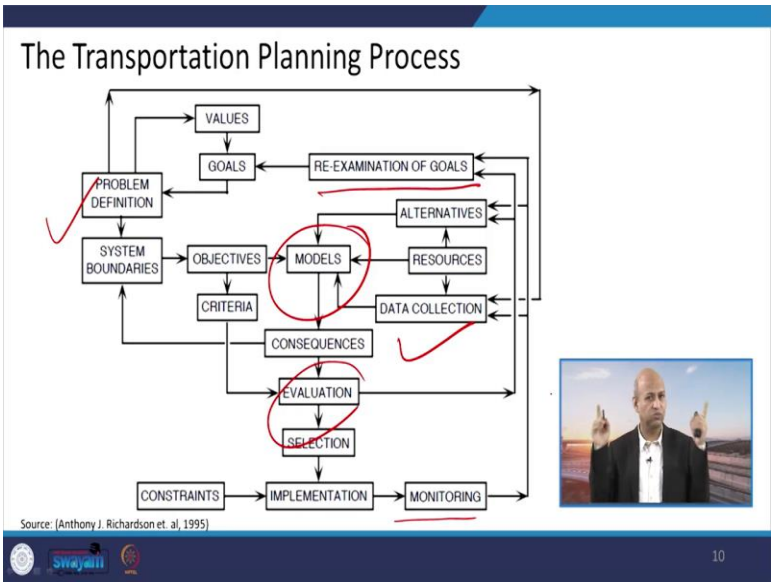

When we provide this more integrated planning process, then we define the problem and then the system boundaries means, what are the limitations in terms of finances available in terms of land use, land planning, those kinds of things, all those limitations, we work together then values and goals, what do we want to achieve by that particular infrastructure we want to develop, whether we want to promote education hub, we want to promote it as a medical tourism or we want to promote it as a tourist destination those kinds of things we need to keep in our mind.

Then we reexamine goals because of certain feedbacks because we collect data, we do field survey all those, then we do some modeling, and then consequence analysis, cause consequential analysis, then evaluate, select, then implement, we get some feedback through monitoring and then some feedback is going, some changes are there.

So, this is a continuous process, this is evolving process, it is not that you have provided one thing and it is all together for ever, no it changes, like one road after 10 years, you need to increase its width, two lanes, roads maybe you need required to change it to four lanes, that way, sometimes these infrastructure need to be changed according to the demand of the time.

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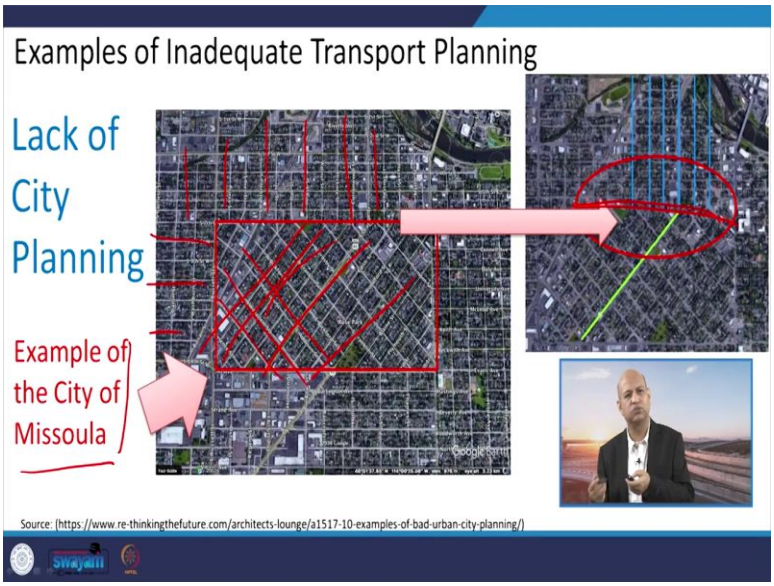

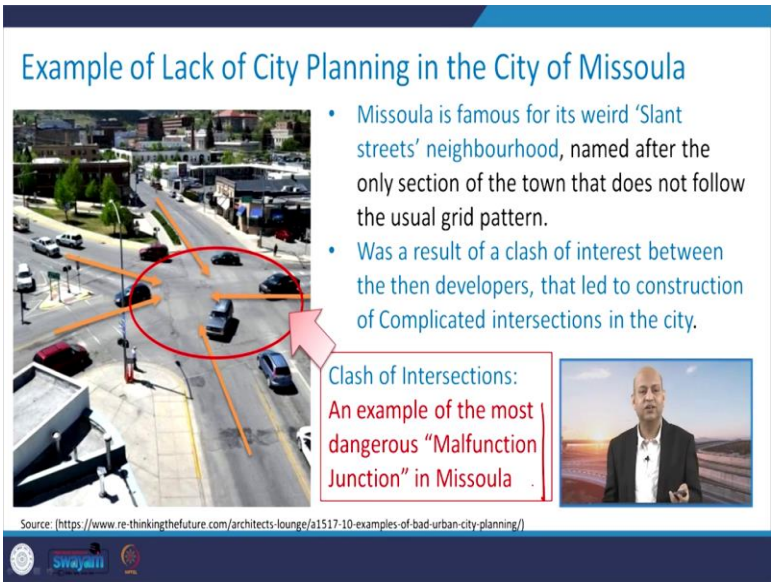

So, now, we want to see means what kind of negative aspects are there if there is no adequate planning or planning is lacking or there is a bad planning. So, these things will notice through the examples or pictorial representations. This is one example of the city of Missoula, which is kind of an example of lack of city planning or you can say a bad planning or unintegrated kind of planning like the city center, these grids you can see these kind of grids are there that way.

And then later on, some planners give these grids, these kinds of grids in in that way. So, these are not articulated in a harmonious way. So, these kinds of things, then create at the junctions, wherever these kinds of grids come across and they create junctions, there happens these traffic

jams or traffic related issues, some safety related issues of those kinds of. These are the examples of those kind of where planning lacks or it does not have the vision or it does not have the, it does not have the integration from the previous planning to the future planning.

So, these kind of intersections happen, where several kinds of sub roads are coming and they are intersecting with each other. So, people may get confused where they are going to turn and there is not even proper, these circle or traffic lights. So, these are the examples of bad planning or not adequate planning or un-adequate planning, inadequate planning or where planning is required proper planning is necessity there.

So, these are malfunction junctions, where accident stances may occur, accidents may occur, safety issues may arise. So, these kinds of things we need to avoid, that is why we need planning means these are the things, these are the real situations, which gives us a need of the planning that planning is needed for avoiding ill consequences of these kinds of situations.

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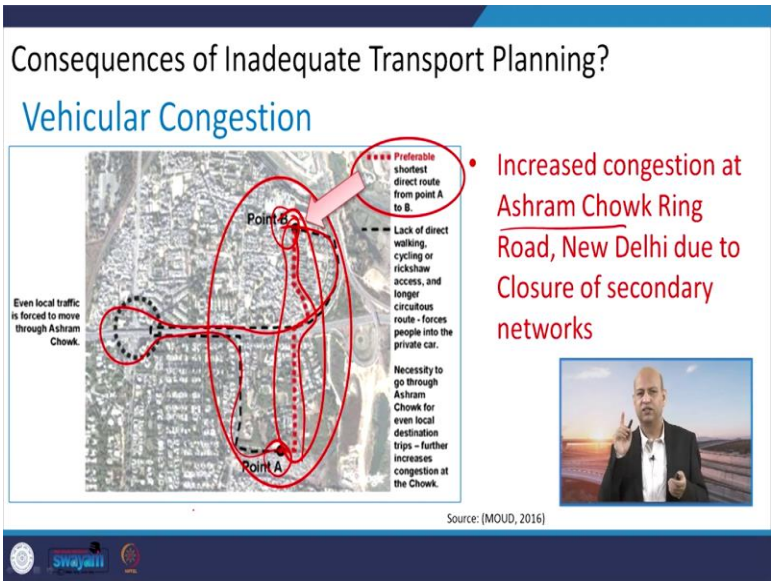

Now, one real example of Delhi at Ashram Chowk, this particular you can see this road this is not functioning this is closed due to certain regions. So, what happens the local population from point A to point B they could go from this short path and within like having bicycle or having a scooter those kinds of things and without wasting much time, but because this connectivity is not there what happens the person goes from this like that and this way and from B to A like this, this very long path.

So, they take their cars or taxis or three wheelers and that creates a lot of traffic jams situation on this particular part because, this is the ring road where local population also goes because ring roads are having mobility or transportation for other connectivity means larger distances, but these shorter distances population or traffic also gets added into that and that creates situation which is not required, which can be avoided. So, these kind of vehicular congestions are again the indication that we need proper planning.

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Again see this terminals and transport modes, how much crowd is there, that means, again, the need of the people is not being met properly, maybe they need more terminals, or they need more

frequency of the trains, something like that, so, that they can take the people at that particular time duration, now, people are traveling just, this is this bus is totally packed, and they are allowed, even at the doorsteps and this is very dangerous because something happens and people lose their balance, they can fall on the road and bad accidents may happen and these are the things which really happen, you might have read in newspapers that some traffic accident happened because of these kinds of negligence things.

So, these are avoidable and these are the situations which motivates us that we should go for better planning. This is another example even in developed countries also if you do not have proper signage, and if these cars, if they come on the cycle track, these kind of intersections are there and proper indicators are not there, then these kinds of accidents may happen even in developed countries.

So, those particular rules and regulations have to be followed and they should not violate their own lanes and they should carry like bicycle person should be on their bicycle lanes only, and the car should be on the road only. So, these kind of mixing should not be there this should be avoided. So, these are again the examples of accidents, which are again the indicators of bad planning or the requirement of better planning.

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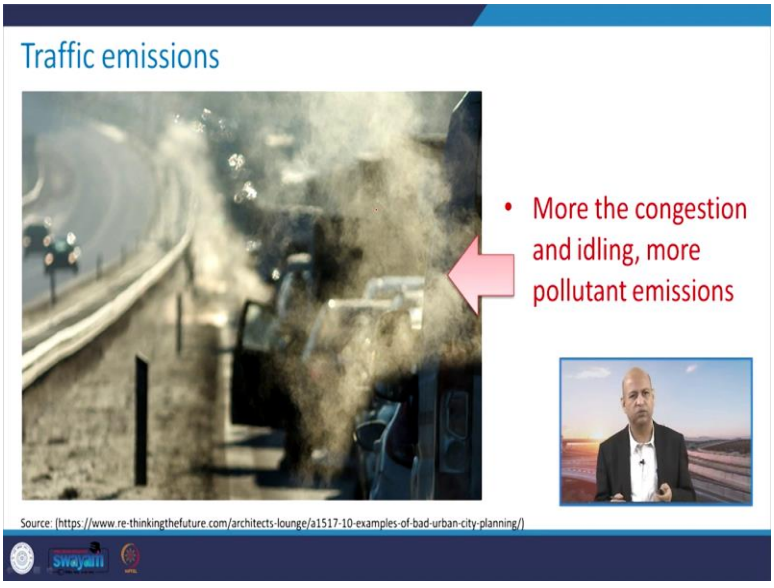

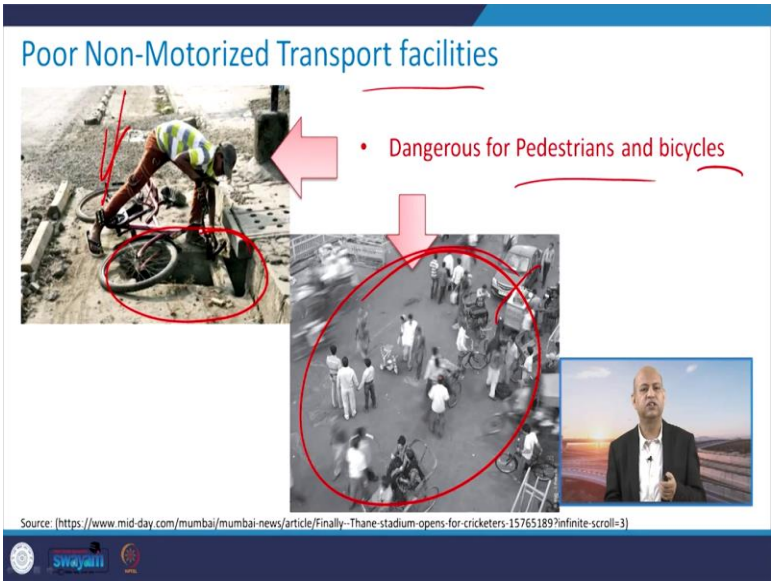

Well traffic emissions, so, more congestion, more slow speed, more idling means you are there you are waiting for move, these moments of the traffic and then sometimes people do not switch off their engines, and these kinds of emissions happen. So, a lot of fuel is burning as well as air quality's being deteriorated. So, these are also the results of inadequate planning or bad planning, where we need good planning so that traffic jams or congestion does not happen.

Well, poor parking facilities are also the things which are indicators of the negative aspects of the bad planning. So, you can see this the lane which is meant for bicycle, somebody has parked his or her car here. So, this is poor parking facilities result means they needed parking facility, but they do not have adequate parking facility and they use this particular path. So, both way are

they are means the wrong act is there but at the same time, if that person does not have the proper place of parking, then he or she may say that where should I park I have come to buy some medicine or something like that some emergency there, then what happens, those kinds of excuses may be there.

Then again, these are the bad parking means people are not parking their vehicles in a proper lane so that they can go from particular direction and people are going, he is moving this side, that fellow is moving this side. So, all kinds of mixed traffic is there. So, this is bad planning. Poor non-motorized transport facilities means again, this is the track for walking or bicycling. But these kinds of potholes are there or drains are there. So, these are dangerous.

If somebody does not properly watch it or they do not have alertness then they can fall and accidents may happen similarly, if pedestrians and bicycles and cars all those mixed traffic happens in particular junctions then also people will drive at very slow speed and that way a lot of fuel will be burnt and air pollution emissions will happen or there may be chances of accidents also. So, these kinds of things are the, indications or indicators of poor planning.

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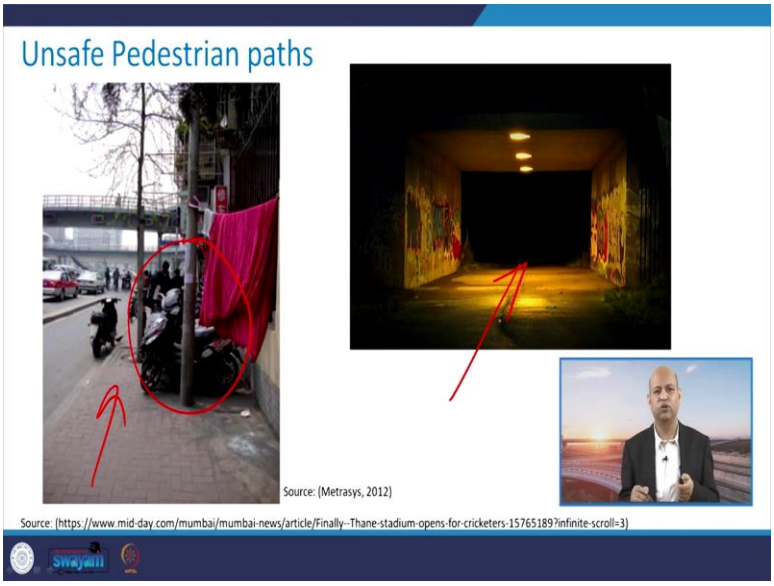

Well, unsafe pedestrian paths, which we have seen in other presentations also. So, again these are the footpaths but people are occupying them for other facilities, for other uses, inadequate lighting, so, it is unsafe people may not like to use these kinds of paths, which could be used

properly if it is properly lit. So, all these are the examples of the need for the better planning you can say.

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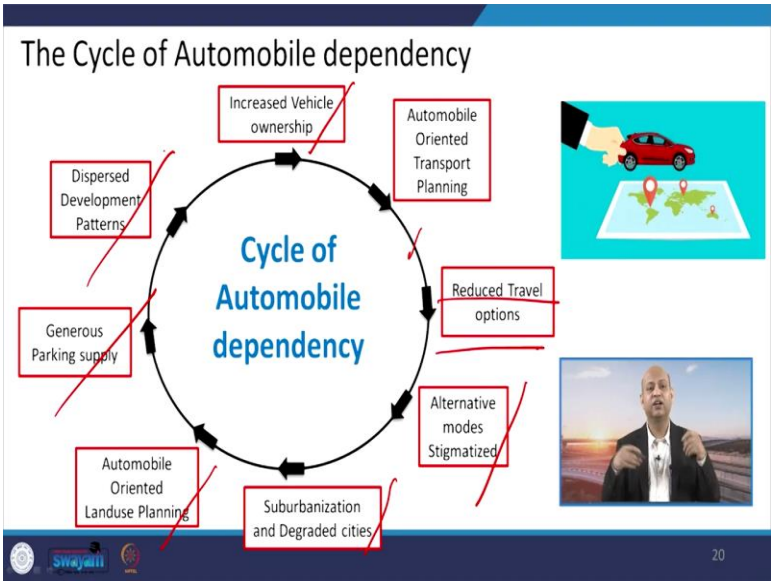

Well, the cycle of automobile dependency. This is again result of bad planning we would say because, when like increased vehicle ownership, they will demand for more roads and you have more roads and those kind of facilities people tend to buy more these automobiles or vehicles, privately owned cars etc. And that way those spaces or land uses which could be planned for pedestrians or for a cycling purpose that will be taken by these cars or these other automobiles.

So, that is a vicious cycle means more automobiles they need more infrastructure, more infrastructure, less space for the pedestrians or cyclists etcetera. So, that way, because they will need like reduced travel options will be there people when there is a lot of safety issues for pedestrians and cyclists Why will they go for cycling or having a walk alternative models are stigmatized sometimes people give kind of false ego kind of I have this car or if that particular model and people one family buy two or three cars these kind of superficial ego related issues or those kinds of things.

If somebody is walking or using bicycle people say oh this poor fellow, what standard is there means those kind of standards or these visions which we are tagging with the authority or the reputation of the person, these are the false issues, but they are the part of the society and they really give a boost to some certain kinds of behavior, then suburbanization and degraded cities,

because when they are far away, then they have to travel, automobiles oriented land use planning, as we have discussed, generous parking supply.

So, again, if you need more parking than less space will be available for let us say, parking is, these children parks or those kind of forest areas or greenery, green spaces, etc., then disperse development patterns, those kinds of patterns, which are, dispersed here and there, they again need more kind of automobiles to travel. So, these are the signs of, unsustainable kind of development path.

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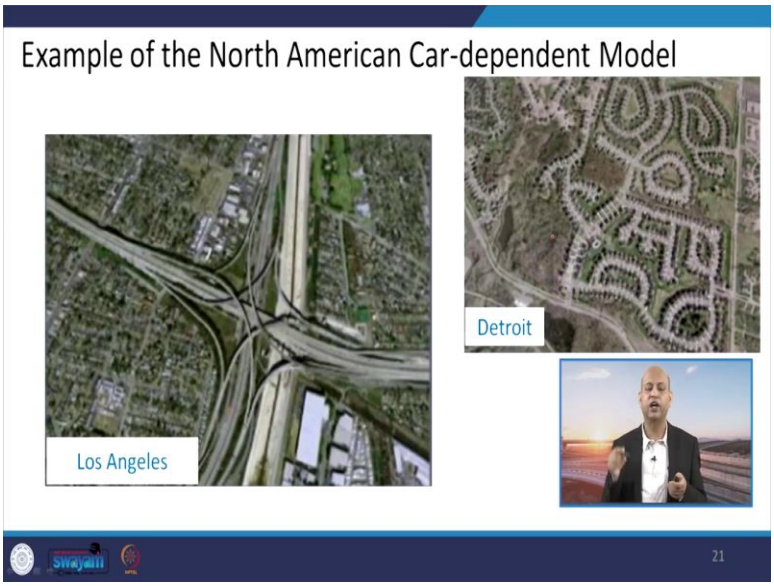

Well, this is one example of North American car dependent model, because they boosted their economy with the help of automobile industry highways, and that is why they, needed so much infrastructure and they pump so much money for developing these kind of infrastructure, but this is very, very energy intensive lifestyle, which is not sustainable. Some people argue that if everybody has to, rise to the standard, this living estimate of the USA or those kind of developed countries, then we need, 5 or 6 Earths which is not possible, only one planet we have.

So, we are the common citizens of this planet Earth, and we have the shared responsibilities, it is not good that some population claim more resources and others are deprived of them that is not a good idea. That is not sustainable. So, these kinds of you can see bridges and highways and then lanes or roads have been designed in Detroit and Los Angeles, because these are the cities which is highly dependent on automobiles, or cars.

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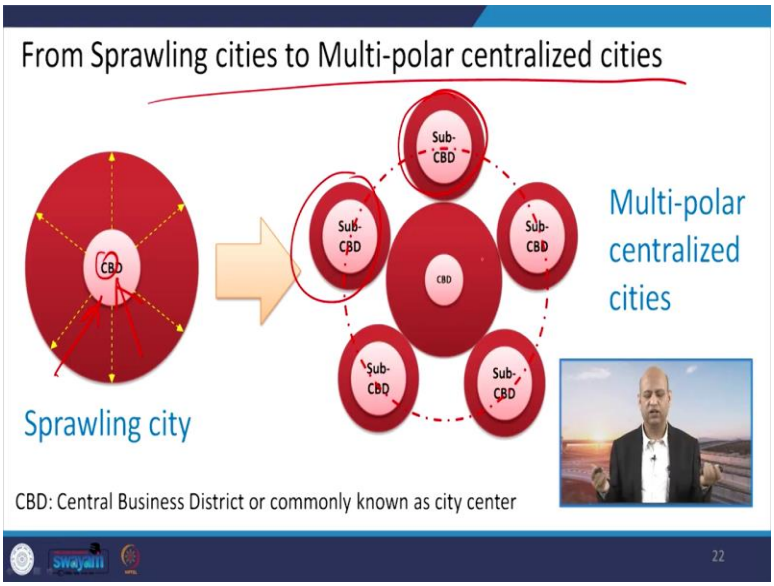

Well, these sprawling cities to multipolar centralized cities competition is there because if the central business district or commonly known as city center if they are at the center, and all population is, running towards that to meet their commercial demands, etc. then lot of traffic will be there. So that way now designs are there that is small businesses areas, commercial areas can be developed across the city or some cities are clubbed together like sometimes we talk about twin cities or even when bigger cities are there, city expansions are there then cities get integrated with each other.

And like for example, Chandigarh, Mohali, Panchkula where it is ending where it is starting it is difficult now, it is similarly Gurgaon, Delhi, Faridabad, Ghaziabad, Noida, Delhi and those cities are its expansion is so much that they are a big, big one city in in a sense, you can say.

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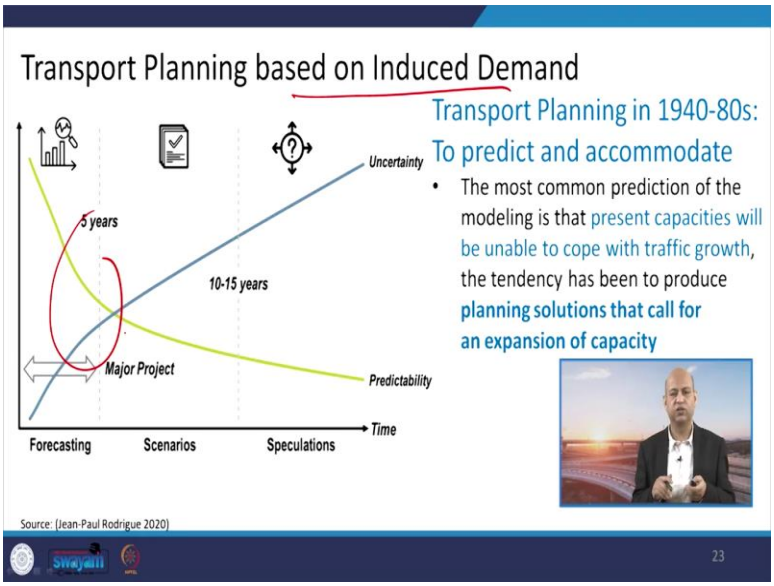

Well, when we talk about these in transportation planning based on the induced demand, which is the example of USA means, you are pumping a lot of resources for building certain infrastructure to support the automobiles industry and your urban centers or your big malls are located certain miles away from the cities, then people need automobiles. And then other, financial products are also available to give you loan, you can buy car, then you can pay those kinds of economic systems may be there.

So, this is the induced demand, which is not the real demand, but you can infuse and you can motivate artificially the population to buy or to put a lot of efforts in a particular sector. So, that way this transportation induced demand needs some sort of predictions or kind of scenario creation. So, predictability and uncertainty are always there, because people have volition, when people will change their choice, nobody knows, but certain behavior can be predicted for shorter periods of time.

So, for example, like within 5 years or so, there are kind of good relationship between prediction and the uncertainty means, a lot of uncertainty is not there, but if you want to predict or speculate for let us say 50 years or so, a lot of uncertainty may be there, and predictions are the scenario creations may be false. So, according to those kinds of long term scenario creations, it is difficult to plan whatever planning you want to have.

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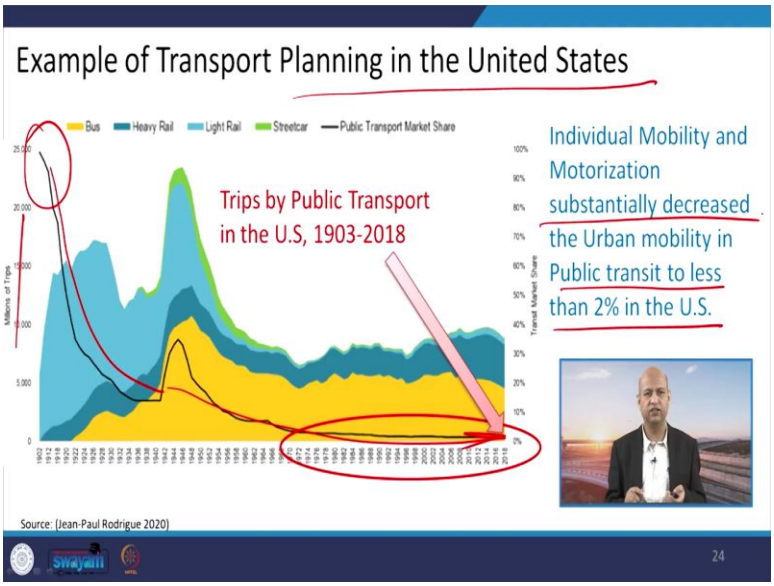

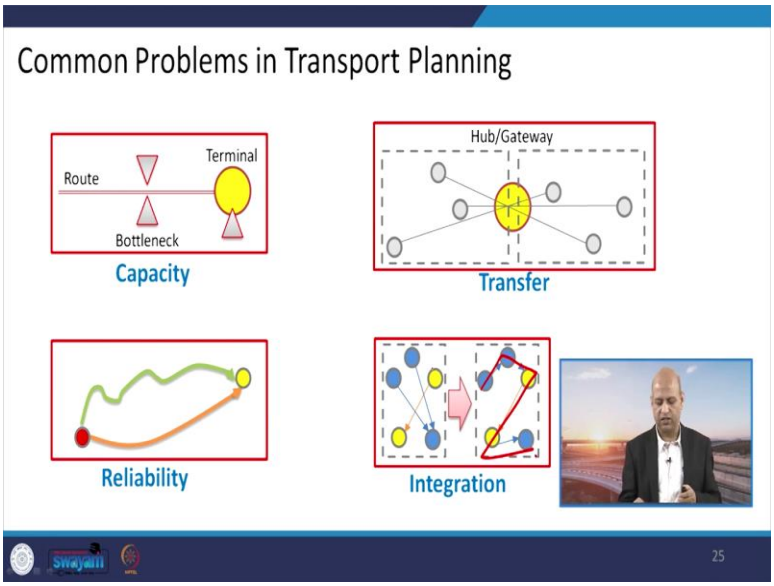

Well, this example of transport planning in the United States the result you can see the trips by public transport in like initial of 1910-12 means lot of population used to be there. The trips, million trips of the public transportation system was there, but it got reduced because this privately owned automobiles increased and slowly you can see very less in these years, very less people travel through public transportation system, most of the people are having just their own automobiles, their cars.

So, you can see this only public transit to less than 2% in the US, so, it has substantially decreased over the years. So, that is not a good sign, if you think from sustainable perspective,

well, these are the common problems in transportation, planning, when we talk about terminals or hubs or gateways, then reliability depending upon the path and the integration. So, if you need to integrate, certain destinations and locations, then you need to do proper planning, so, that like, you go there and you reach the destination properly. Otherwise, if there are certain intersections then there are problems of congestion etc.

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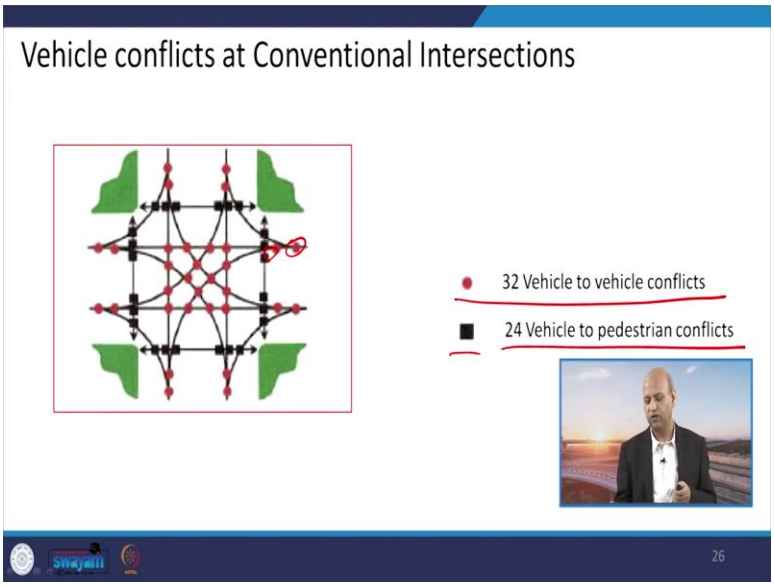

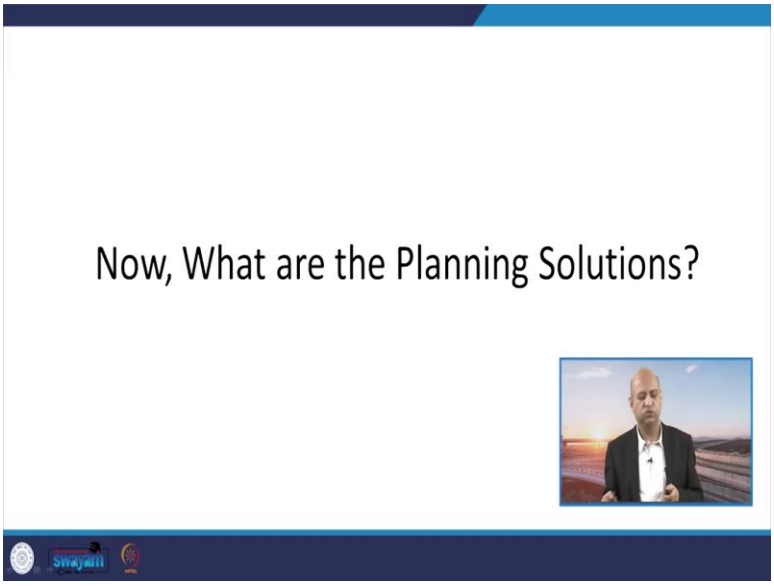

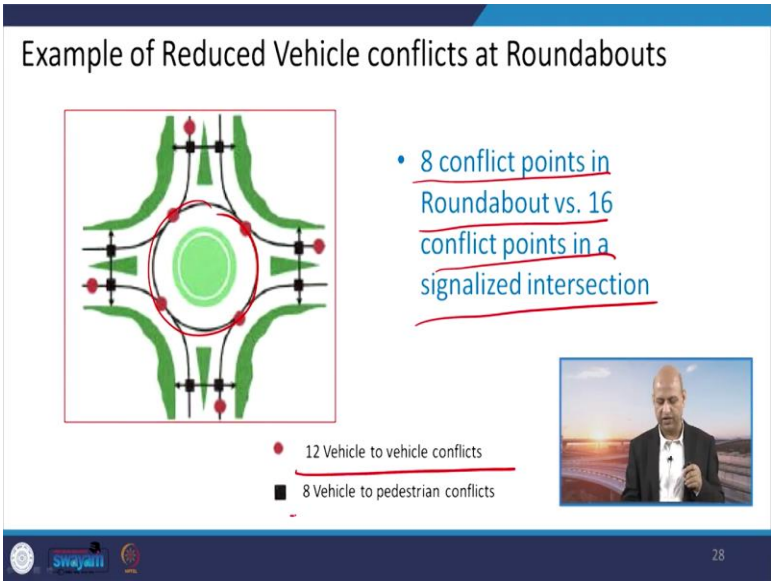

This is one example of that, for example, if this is the issue, when people are moving or traveling or riding their automobiles from one direction to another, and these kinds of free flows are there at the intersection. So, the 32 vehicle conflicts are estimated, these are the red signs and the black 24 vehicles to pedestrians if we estimate or we imaging there will be people who are walking also. So, they are the possible intersections that means, chances of accidents also may happen. So, this is conventional intersections which are not good and better planning can reduce these kind of vehicle conflicts or pedestrian complex in a big way.

So, now, we come to that what kind of solutions we can provide through planning means, what are the advantages through planning we can achieve, why do we need planning or what good points are there of the planning. So, this is the same kind of example which we just saw. So, if we do like a circle kind of thing there and proper roots of these people or vehicles as well as there are like certain parts where people can work.

So, the 8 conflicts points in round about versus 16 conflict points in a signalized intersection. So, that intersection had more 24 basically and then it has been reduced to 12 vehicle conflicts and 8 vehicle pedestrian conflicts earlier it was how much 32 and 24. So, great reduction is there possible work by this kind of better planning right and then when you provide signal then again, you can reduce those conflicting points.

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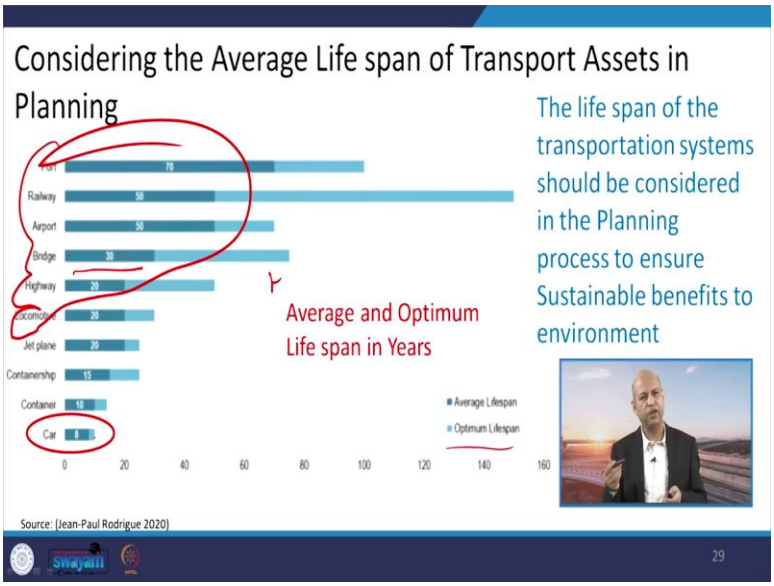

If we consider planning when we are estimating things for future scenarios, we need to learn about life span of each infrastructure or transport mode you can say like cars nowadays in certain cities, they are not allowed after certain years, 8 years, 10 years or 12 years according to the policy, well then bridges, their average ages or life span is 30 or an optimum is more than like even up to 75 years they can survive those kinds of things.

So, these are given ports, railways, airports, so, you can see wherever public transportation systems are their ports, railways, airports, bridges, highways or locomotives, all these are having very good life span. So, if you promote the public transportation system, they will have more lifespan they will serve us for several decades whereas whatever these kind of cars, etcetera their lifespan is less and more investment is needed to use those kinds of things.

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Well, efficient street design if you want to talk, so, like one way road can be there or there will be two way roads, then four way lanes can be there four way lanes with median like these greeneries and those kinds of things and this is without medium but certain rules and regulations traffic lights, they can provide us and proper signage, proper these kind of dividers all these things must be there so that the safe street design can be ensured.

Then if we talk about parking facilities so at for example, airports or railway stations, we need multistorey parkings. So, that people can park properly and they are not wasting so much time to look for the place where they can park their vehicles, so multistorey parking, properly laid and or

even at the ground level, if they have in a sequential way then people can park quickly and they can also take their vehicle when they need.

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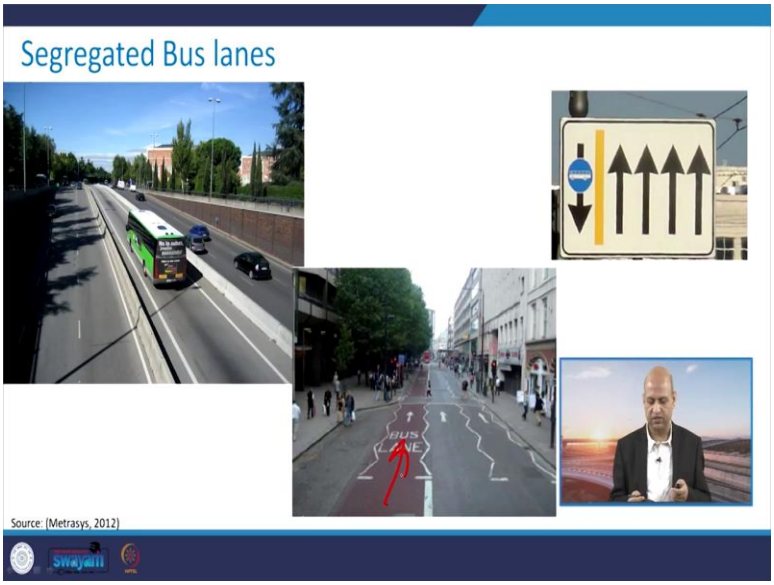

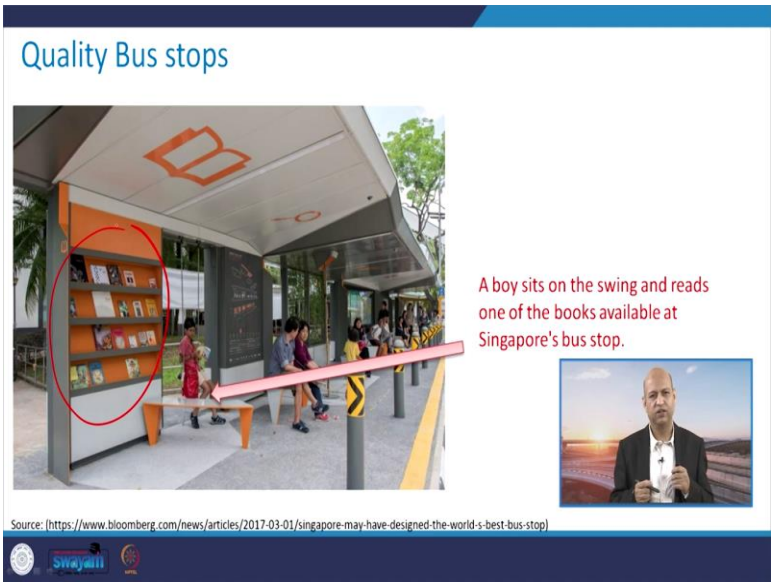

Segregated bus lanes, which we have studied, if you remember BRTS system, bus rapid transit system. So, dedicated lanes can be there for buses, these are like bus lanes, and then proper signage so you do not need to go for that particular lane and that will be dedicated for the public transportation system through the bus. So, these are the good planning options which we can have, see the beautiful bus stop in Singapore, this is one example.

One child is you know he is using swing as well as reading the books and there are certain magazines and books are available there. So, these kind of good facilities if provided for the public, for the masses, they will feel incentive to use the public transportation system rather than their own and see the community live because as it is said that human being is the social being, we should have those kind of transportation modes, which allows us to intermingle with each other rather than isolating if we are using our own vehicle we are isolating ourselves, we are meeting people very less if we meet people then socialization happens and it is healthy for the our mental behavior.

In so called developed economies people are more depressed, they are more stressed up and they are talking to themselves and these kinds of issues are there, but in societies where people happen to talk to each other, they are more friendly. And if these are kind of locations where people meet, then certain positive things happen into the society. So there are several aspects, positive aspects of the good planning.

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Then the accessibility for a specially-abled people. So, those elevations and those slopes and the low lying, low floor buses, those kinds of things must be there so that especially abled people can also use them properly. So these are the plus points of the good planning. Then Park and Ride means if you want to go, let us say 20 kilometers away, and you do not want to use your car, so you can park here, you can take the bus, you go, you do your shopping etcetera come back use your car and go to, if there is no last mile connectivity, if you have rickshaw, three wheelers etc. then you do not need to bring your car even.

So, that way you can park, you can ride, you can come back and again sometimes people travel 50-80 kilometers for their let us say job, etcetera even then it makes sense that you use the public transportation system because it is fuel efficient, it charges less amount, it will cost less to your pocket, if you use your own car every day you will burn a lot of fuel it is not good for the environment, it is not good for your personal family economy. So, that way there is good parking facility then you can take these public transportation systems and use it properly and efficiently.

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Well, safe pedestrian zones you can see the people, if there are no buses or these automobile free zones, then it is quite easy and comfortable to enjoy the walking and shopping etc. So, those zones must be free you can see here only bicycles and pedestrians are allowed. So, those kinds of things can be by law, municipality can by law those kinds of spaces can be made free, then somewhere some shared spaces may also be there, because sometimes people want to go very near to the shopping center or something.

So, some lanes may be there and these are shared but then proper signage must be there, proper lights must be there, traffic lights, so that people do not get scared when something comes across

or they do not meet any accident something like that. So, those shared places or spaces should be properly planned.

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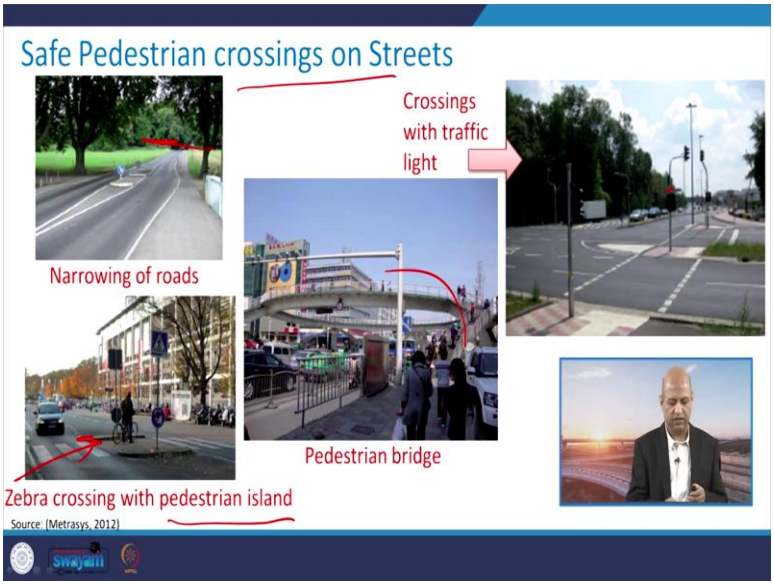

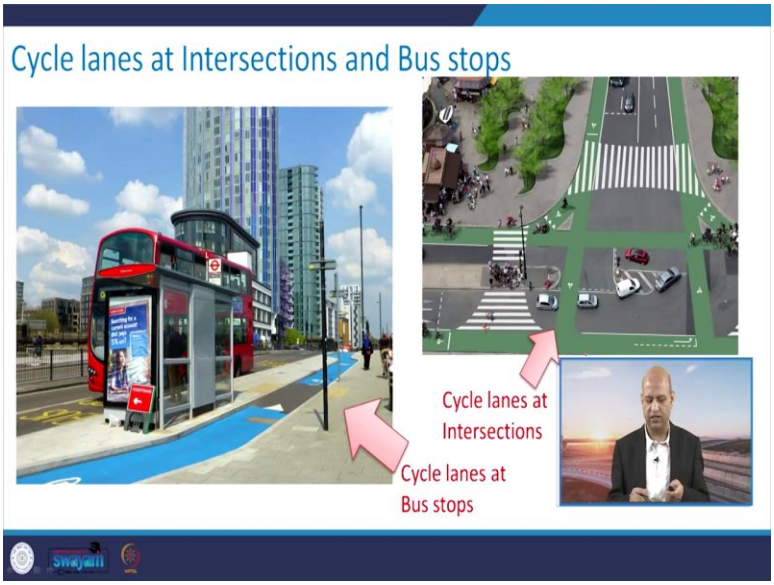

Similarly, like when safe pedestrian crossings on the streets are to be ensured then many things has to be there like these traffic lights must be there, pedestrian bridge maybe there if lot of traffic is there, then it is not advisable that roads should be crossed. And narrowing roads when some place is there to cross by pedestrians then narrowing down the speed is reduced, zebra crossing with pedestrian islands means one person can cross one particular lane then he or she can wait here then again they can see whether light, green light is there and then they can pass through this particular location.

Uninterrupted bicycle path, see the beautiful bicycle paths one example of Turkey, 25 kilometer long uninterrupted bike path. So, this provides a lot of motivation to those who love to bicycle or do exercise. So, and these kind of things are there so that nobody can go to this particular lane, this is dedicated for the bikes or bicycles they can use for those.

So, bikes can be there here and the four wheelers can go through this road. So that way they are not sharing path because some you might be reading many times two wheelers accidents happens because of car, because of bus or trucks etcetera. So, if you provide the bikes lane path or small road separately, then it makes sense and it is much safer for the bike riders.

Cycle lanes maybe they are similarly you can see the cycle lanes here properly. So, you can use cycles, you can take cycle in the bus also and at the bus stop then there are other cycle lanes which you can see here at the bus stops and those crossing areas. So, there are proper signage and proper way of planning so that there is no intersection of different facilities.

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Well, bicycle parking facility at the Amsterdam you can see, Nederland most people bicycle, they use a lot of bicycle they are health conscious and it is very healthy to use the bicycle, it is also environment friendly, there are no air pollution emissions. So, these are the ways they have provided lot of facilities for bicycle riders. So, these kind of facilities if you provide people will feel to use if they are not having a parking facility, why people will take their bicycle otherwise, they are always worried somebody will pick it up if I leave here.

So, there must be proper facilities. So, these are the real time information available at the public places like related to bus, related to train. If those information are available, then people can plan their journey and they can use their own vehicle also accordingly.

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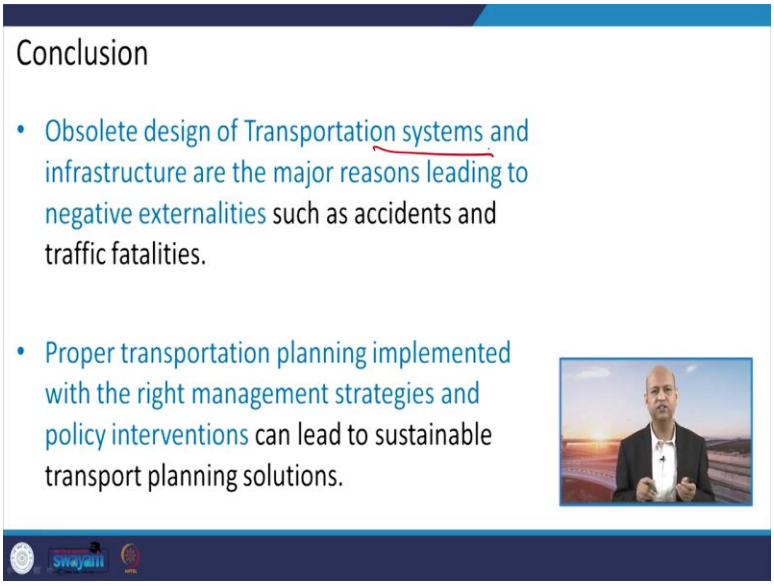

So in conclusion, we can say that the obsolete design of the transportation systems which were much old age systems or infrastructures, they are no more usable in these times when lot of demand is there of multimodal systems and we are more health conscious. We want to use like separate lanes for walking and cycling etcetera. So, the proper transportation planning is needed to be done for implementing. And we have also seen that what are the negative or externalities of the bad planning and what are the good points which can be addressed through better planning.

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This is the reference list which you can go through for additional information. Thank you for your attention to this planning related introduction. And planning is very important in transportation to achieve sustainable transportation system. Thank you again.