**Sustainable Transportation Systems**
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**Lecture No. 27**
**Case Study - II: TOD planning for Belgrade, Serbia**

Hello friends, you may recall last time we discussed a case study related to transit oriented development and that was focused on a particular stretch of Delhi Metro. So, today we want to extend one more case study, so, that you can compare between the existing one now, Delhi Metro is a big existing transit oriented system and another you can compare with the European city TOD project which is under pipeline and it may take place in future years with a lot of phases.

So, that will give you one perspective like highly densely populated city of mega city Delhi's TOD planning and, and then this Belgrade in Serbia that also one another case study we want to discuss today and that city is very thinly populated if you compare with mega city Delhi. So, two kind of extremes you will see to have a different kind of perspective, so, that you can have two particular contrast examples of TOD.

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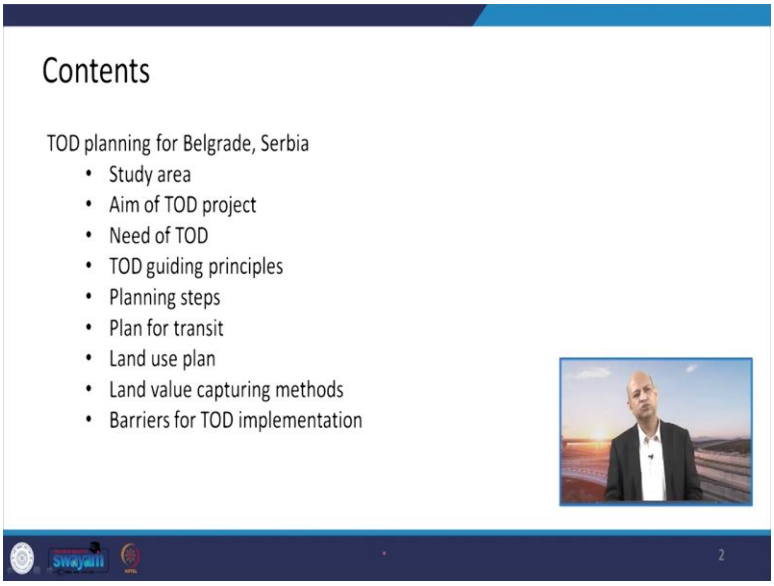


So, this particular lecture will include, for example, the characteristics or features of the study area, different features as we have seen in case of mega city Delhi, like which stretch was passing to what kind of population whether it was cultural center or another was for institutional

area those kind of things. So, this is a study area will also have certain features, then aim of the TOD project, what aims we want to achieve and need of the TOD. So, need means the present gap which we want to fulfill, and aim can be further means, more than the current need. So, those aims and needs will be discussed.

And then what are the guiding principles, which will direct this TOD project in this particular city of Belgrade in Serbia, and then different planning steps which will be followed for executing this project in full way in different phases and the plan for the transit, what kind of different parts of that planning is there related to this land development plan or a feeder bus service related systems or pedestrians, related systems, those kind of things.

So, land use plan will be there, then land value capturing methods means, how to get the return, because these TOD systems need lot of investment, huge amount of money is required to implement a TOD transit oriented development system. So, where this money will come from that is very important issue. So, we have to give some plans, so, that land value capture remains, you develop land in such a way that this land itself will have more price and in return we can meet the financial requirements of the project to sustain it and later on, some revenue will also be generated from different facilities.

And then we will discuss what are the barriers of this TOD implementation. So, how to address those barriers, so that it can be implemented very smoothly, all these aspects we will discuss in this lecture.

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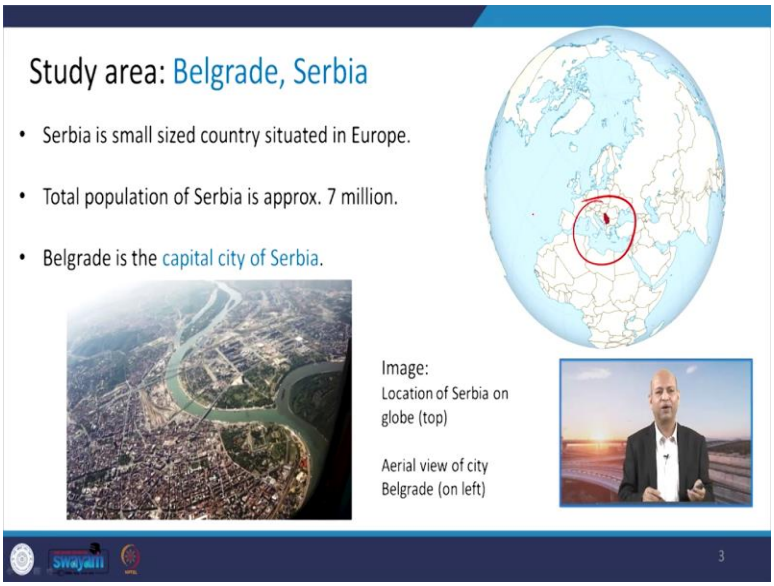


So, the study area is basically the Belgrade city of Serbia. And this is a small sized country in of Europe, Serbia is very small size country, population is only 7 million. We have several cities which are having population more than 7 million. In Delhi around 120 million people are living so, you can carve out three Serbia out of Delhi in that sense, if you compare the population, it is a very small country and within that a small country, the city Belgrade is of course capital city but still population wise, not very populated.

And it is, at the confluence of two rivers it is situated and this is the aerial view you can see and the location of this country in the Europe is also shown on the global map. So, you can visualize the country's location and geographical location and then the city plan or development kind of thing.

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Well, this report which was for this transit oriented development, this report was prepared by the World Bank and for the World Bank you can say because funding agency a lot of funds were required from the World Bank and the Tokyo development Learning Center developed this report basically, prepared this report and this discusses planning process for this whole TOD in Belgrade city. So, we have taken much more information from this particular report.

The aim of project is to basically assess the opportunities to better integrating the land use and the public transit planning in the city because the public transportation system is not as per the requirement because a lot of percentage of the total travel demands is met by cars. Of course,

there are public transport system based on buses, we will see their share, but still there is a requirement because the city is sprawled and horizontally it has been expanded. So, to connect the people of different locations or different pockets, we need some system which can encourage them to come together and access this public transit system.

Then also like this TOD is also required for development of the land use planning in such a way that more job opportunities are there and people feel incentive to leave in particular locations where economic activities can grow. So, all those kinds of things have to be integrated also to reduce the demand of privately owned cars.

So, that always I discussed that whenever we shift from privately owned car to public transportation system then we reap several benefits in terms of economic because we spend less money, then in terms of environmental gains, because less amount of pollution emissions are there, all those benefits are there you can list them like very win-win situation.

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Well, the need, need is because the very low density land use planning is going on at present. So, the transit oriented development can squeeze people they can gather at high rise buildings, they can fill incentive otherwise, they are having own cars and they travel, then they can locate their houses at other places even if they need to travel because they feel empowered that I can go anywhere, but if you want to use the public transportation system, then you need to think about

the availability and accessibility of the public transit system and accordingly you can relocate yourself.

So, the stations which are at present located and they are not accessible properly, you will see the pictures we will show you and then there is no high density dwellings near the stations and it is barren land or empty space lot of and the lack of synergy between the land use planning and public transportation planning, because people are living sparsely and then they come to take the train at the station by car and they move and that is why the sear of the train is very less you will see those figures.

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This example of low intensity development you can see, these are stations and there is no development nearby stations. So, otherwise, if you compare like our metro stations or railway stations in our big cities, a lot of development is there around the station. So, that is not the situation at present here. And that is why this railway, this train related journey is taken by very few people you will see their data I will show you the table soon after the slides.

So, the people need to access these stations mostly using cars because there are no other feeder bus services or people are living far distances. So, they have to have some way to these stations otherwise they will go using their own cars for various purposes. Well, this is the sprawl, this picture shows how this populated city in terms of like only 1.7 billion in 2011. And it grew around 5.3 percent from 1.58 million, which was the population of Belgrade in 2002. It was around 1.58 million and now 2011 it has around 1.66 million. So, around 5 % or 5.3 % population grew.

Then this is three of the fast growing municipalities if you compare within the Serbia those cities which is located east of the downtown, so, this kind of urban sprawl is developing in that sense and there is a strong trend of population moving out of the city center and they are spreading horizontally they are going to countryside to have better living, better environment, but this is also demanding or putting more stress on having their own automobile related travel modes.

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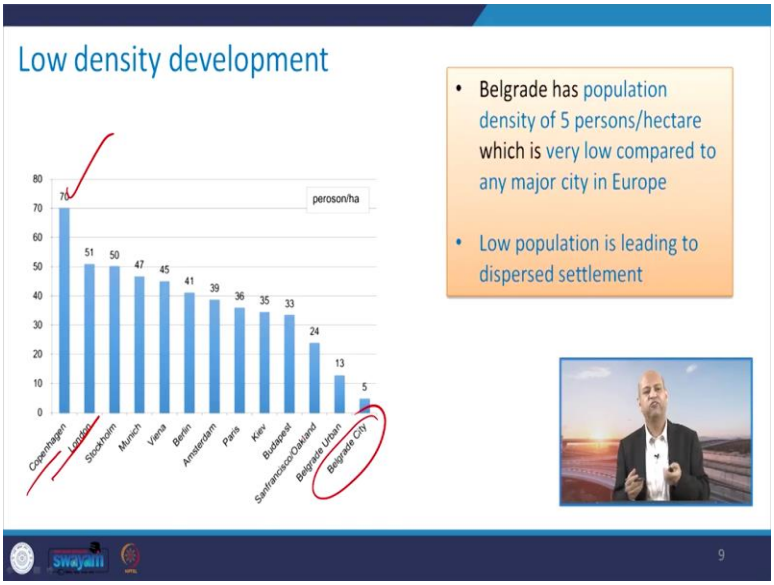

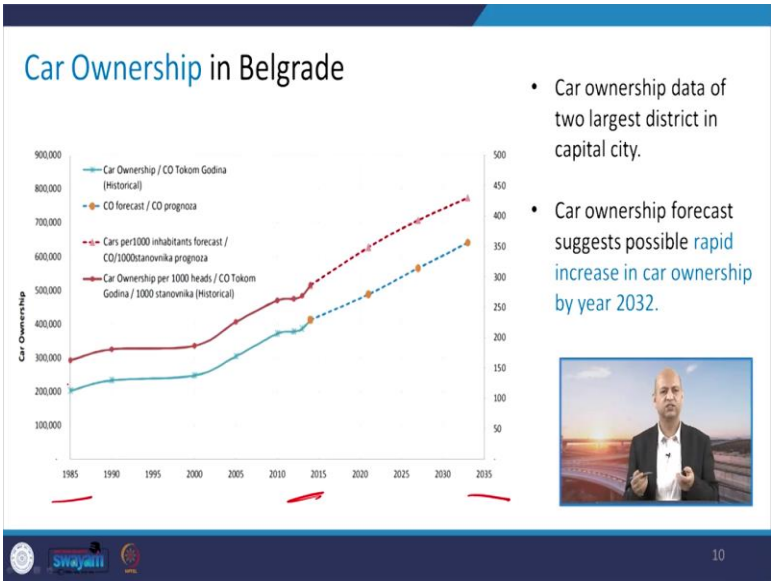


So, the low density if you want to compare this is the city which is having only 5 persons per hectare such thin population is and horizontally expanded population is there you can imagine how so, much empty space must be available there if you compare other cities density like in Copenhagen it is 70 people per hectare, if you compare Delhi, Delhi having 110 or more than that population, London is having around 51. So, that way this is, Belgrade city is having kind of minimum if you compare with Berlin or Munich or Amsterdam, in Netherlands, Paris or France those cities if you want to compare them.

Huge scope is there to bring population a little closer so that they can have a better interaction and first economic activities. The car ownership is increasing, if you see this car ownership, it is increasing historically from, not historically but 1985 to if you want to project also some growth up to 2035. So, up to 2015 data are there and it is showing how it is growing. So, the forecast is also there with this car ownership and this is the cars per 1000 inhabitants means the density of the car you can say. So, naturally it is also increasing, population is also increasing. So, that way the need of the transportation is also increasing.

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Well there are around 15 % of the road junctions they experience one or other kind of extreme condition or traffic jams in means it is estimated that they will experience these traffic jams in 2033 these are the projection, even now, at certain points traffic jams situation is there, but if you want to be very proactive, and you want to take measures to implement certain policies, so that these kinds of negative externalities you want to reduce or avoid, then we have to be proactive.

So, the projections if they are giving us this scenario that a lot of car ownership will increase if you do not provide the people better public transit system, then these kinds of situations may occur. So, the average value for of this volume to capacity ratio is 0.43 in 2015 it can increase 0.61 in 2033.

So, whenever this volume to capacity ratio of automobiles and the infrastructure or roads available of the roads increases beyond 0.5, then this is this sign of having like traffic jams or situations of congestion etc. So, the 0.5 is the kind of optimum value and it is in 2015 it was 0.43. So, within few years maybe now in 2021, it might have reached 0.5 there are no interventions to reduce those kind of congestions away from the roads.

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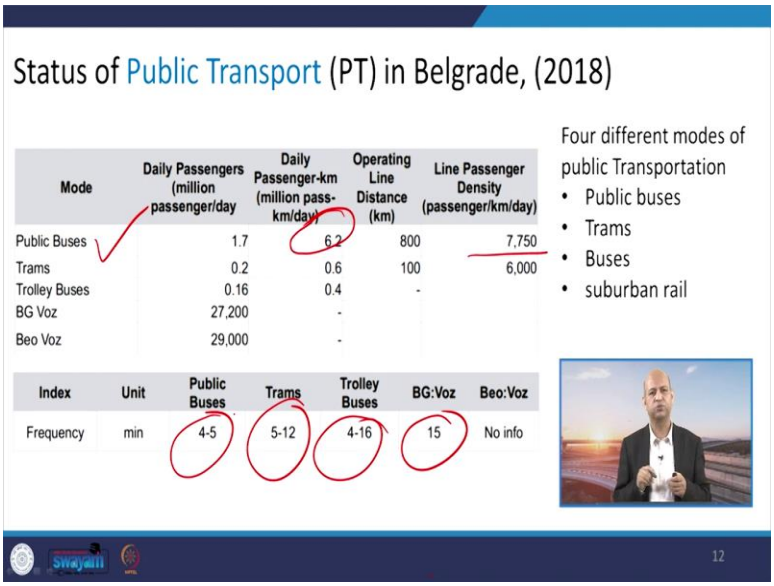


The status of public transportation, if we look at the figures of 2018 then buses are serving a lot population of Belgrade, you can see around 6.2 million passenger kilometers per day services provided by buses, the line passenger density, passenger per kilometer per day is around 7700, and the public buses, the frequency per minute is 4 to 5, and these trolley buses 4 to 16. And then railways, around 15 minutes, and trams 5 to 10 minutes. Those kinds of things are there.

Mixed public transportation system is existing like public buses, trams then simple buses and suburban rails, but the public buses are giving a lot of service, lot of population is using the public buses, that is why this data is giving such a huge mass of the passengers being served by the public buses.

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One very important feature of the population of Belgrade is similar to European population or the developed countries find that aged population is growing. So, this demographic change is to be noticed and when we develop some public transportation system or public transit system, we have to keep this in mind because, when we are having more old people, then the system should be designed in such a way that they can have easy access very comfortably, because, when you are youth you have full, you are full of energy you can even jump, you can have the high rise buses also, easily you can ride but the aged population requires patients and their accessibility must be very smooth.

So, in that way around like 22 % population in 2002 like 18 years before was over 60 years old. So, now situation must be further increasing this particular ratio and 24 % in 2011. So, if population of old people is more than we have to take care in terms of design of infrastructure for those catering the demands of this aged population so that they can move around in independently with the help of the public transit because they cannot drive cars they cannot drive their two wheelers, they have to have the public transportation system.

So, and in developed countries, most of the people are independently living. So, much need of this kind of system is there so, that their independence, their autonomy is respected and in dignified way they can do their daily course of activities. So, the designing of the infrastructure

for aged population is one mandatory thing, one mandatory aspect to give them a smooth accessibility to different amenities.

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When we see the share or the ratio of different modes in this Belgrade city. So, as I said, the situation of bus is very nice, buses are getting around 40 % share of total mobility you can see right, the total modes here, cars are having 26 % of the second largest demand is being met by cars, the next is walking, that is very good sign means that means people love to walk and they can have their things done by walking and that also is a sign that there may be certain, many of the facilities very nearby. So, that is a good sign of the that urban planning.

But if you see these cycling is only 1 kilometer, 1 % of the share and these trains here is very less around 0.4 %, motorcycle is also very less. So, if we want to promote this rapid transit system, then we have to expect that the shifting will be from the cars, from the cars and maybe increasing the cycling so that people can access those metro stations by bicycling if we have better this parking facility.

So, right now, maybe, people use very less share of the cycling. And the reason could be their most of the demands is being met by walking very nearby distances and the distances which are like more than 2 kilometers, 5 kilometers or so, then they are using their cars or buses.

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Well, the guiding principles for this particular city are the common one which are like we have to give higher population density. So that public transport system is accessed by most of the people otherwise, economically it will not be viable, plus we have to provide incentive to the public so that they can go for public transportation system and also penalty towards automobile ride, penalty in the sense means the policies like high parking charges or some taxes if they are taking it into city center, etc.

So if you want to, if you want to achieve less congestion, less number of cars on the roads, so we have to make that journey more expensive, and this public transportation system, less expensive, more comfortable. And more reliable so that people feel incentive to use the public transportation system. Similarly, we have also to improve the non-automobile multimodal alliances, so, that like bicycling or walking or some feeder buses etc., so that people can reach to the institutions very comfortably and efficiently.

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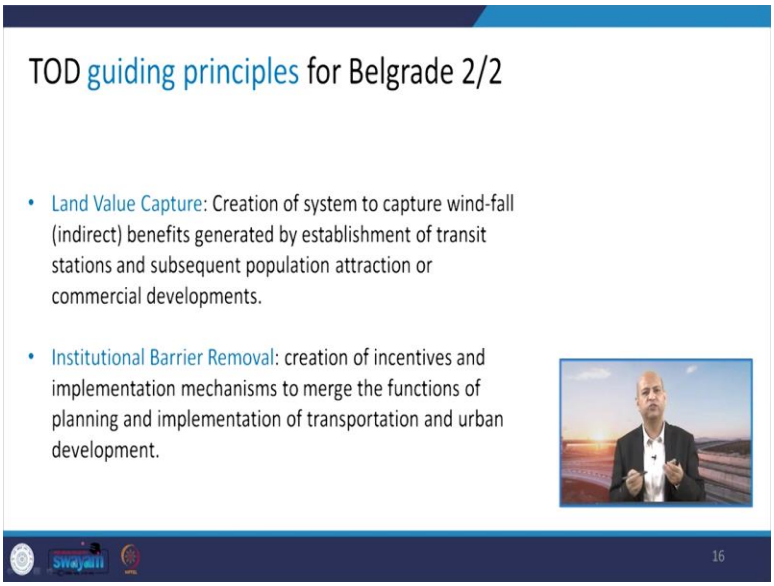


The land value capture as I earlier also said that if you create a system which can capture this benefits, which are generated by commercial activities in and around the transit stations, then it give rise in the price of the land. So, people will have more money, those who are having private lands there, otherwise, they will go for high rise buildings and accessible by the common people also, flats will be less expensive, then institutional barriers maybe there which have to be reduced.

For example, if there are multiple agencies, which are looking after urban development related activities or transportation related activities, and if we can have some one corporation or something, which can take care of all the development when land use related development as well as transit related development, if one corporation can have responsibility, then it becomes very efficient to get sanctions or like allowing for particular use otherwise a lot of time is taken when so many agencies are included or involved.

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The different steps are there. As that like, we have to first assess the existing public transportation system, what is its weaknesses, what are bottlenecks and what are the strengths also, so, that they strengths can be clubbed together with the planned transit system and the bottlenecks must be addressed in a planning phase of the public transit system right. So, that those bottlenecks and limitations can be overcome, and the strengths can be reinforced or enhanced.

Real estate market assessment means, if you are planning this TOD transit oriented development project in a particular landmass, where there is no scope for real estate market or economic activities then it will not be viable. So, those kinds of things also to be assessed, whether there other activities will also multiply over the period of time. The legal and regulatory assessments are also to be taken maybe, some lands are there which are highly disputable and if you cannot take those areas for the development of the project, then it will delay the project.

So, those regulatory framework has to be seen plus clearance must be fast so those kinds of frameworks, we have to see the legal compliance, land development plan must be proper, so, that and in phase manner, so, that you can go a step by step and there is no delay in the project, new transit plans means different new transit plans can be proposed, they can be compared with each other.

So, alternate routes, alternate modes, and then you come with some optimization way of doing things, and institutional setup of implementation so, those things should be there, pilot project and the phased implementation. So, that has to be seen, because pilot project is needed, because you cannot go for the complete project in one go, because, it is very expensive, these kinds of transit oriented developments requires huge investment. And if you do not do the pilot project, if you do not get the feedback, if you invest a lot of money, then if it fails, then huge losses may incur.

So, to avoid that, we have to first see that the pilot project, some stretch has to be developed. As you may recall, like in Delhi, the BRTS system was implemented in a stretch as a pilot project it did not succeed. So, it was not implemented. Otherwise, suppose in whole Delhi, if BRTS system was implemented, if it got failed then how much big losses must have been there. So, to avoid those situations, pilot projects are needed and the phased implementation is also again important thing because you do not have much money at a time.

So in phased manner, one phase is developed, then you start getting some revenue, which can also support the operation of this the first phase, for second phase also, some feedback is also received by the experience of the first phase. So the second phase will be similar. Then the third phase like there are different phases can be taken for development of the project.

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Well when we assess this TOD in the planning process, then we assess current operations of public transportation system as I said that you have to see which kind of public transportation systems are giving good services. So, for example, buses are giving good services then how to keep those services running plus route this new system of TOD in such a way that the integration happens very nicely.

So, the buses services are there then in areas where buses are not meeting the demands, there you can go for this kind of public transit system which is being planned newly. Then the customers perspective, like comfort level, accessibility, what are their concerns, so, based on the surveys, you have to get those information, all those information will give you better perspective to plan the this TOD.

And the assessment of the willingness to pay means, how much it will cost when it will be operational, and how much people can give for such comfortable journey into TOD and so, those kinds of things should also be there otherwise, suppose you fix a price which is not affordable to the public, people would not go there with they would not use this TOD. So, those things must be first collected, and then the recommendations for the improvement strategies with the help of feedback system must be there.

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Then real estate market assessment is very important like, if there are already some land masses which are very expensive, then it will be difficult to implement that project on the ground. So,

that maybe better that you go for other services like the elevated ones or something like that. So, in that framework, the land use control or planning, although the scopes are taken care, so that you implement the project with the least cost.

Similarly, the legal and regulatory assessments, as we discussed that the institutional plans and the frameworks of the finances because you need a lot of money, then these limitations of the potential and limitations in terms of legal and regulatory assessment has to be taken care of, so that there is no bottleneck afterwards, there are no issues, otherwise people will shoe and then project will be delayed. So, those things must be completely clear before launching the project.

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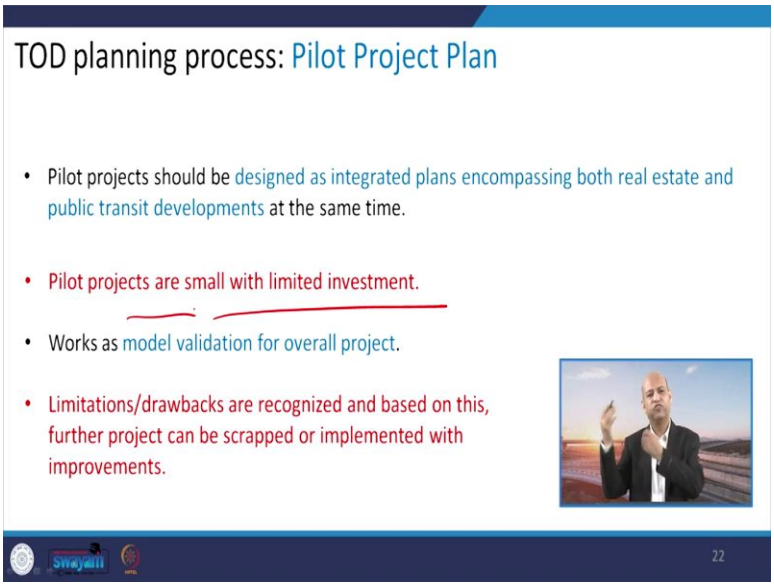


Institutional setup means like integration of urban transit development and the land use planning. So, one particular agency like omni-powered agency model, which is being suggested for this particular project, so that it can combine all land development related issues and transit operation related issues and the integrated transit conglomeration model can be promoted, which is has been successful in Hong Kong, in MTR and this Japanese private suburban railway companies, they also use this particular model to get good profitability, so the tested models which are already giving some benefits those kinds of models can be proposed.

Pilot project plan as I just said that, you have to have some limited investment in the smallest stretch. So, that even if this fails, the losses are not very huge, and the limitations and drawbacks are recognized some feedbacks are received, which can be addressed when we go for phased manner development. Similarly, like phase one development we go, high financial and other resources involved.

So, you cannot go at a stretch as I said, and the initial development is done in the areas where success chances are more. So, when we get positive feedback, and people start to use that TOD in that particular phase one, this will give the boost or moral high to other population, they will see the better aspects or the positive aspects of that phase one development and the phase two will be very smooth and very welcoming kind of step.

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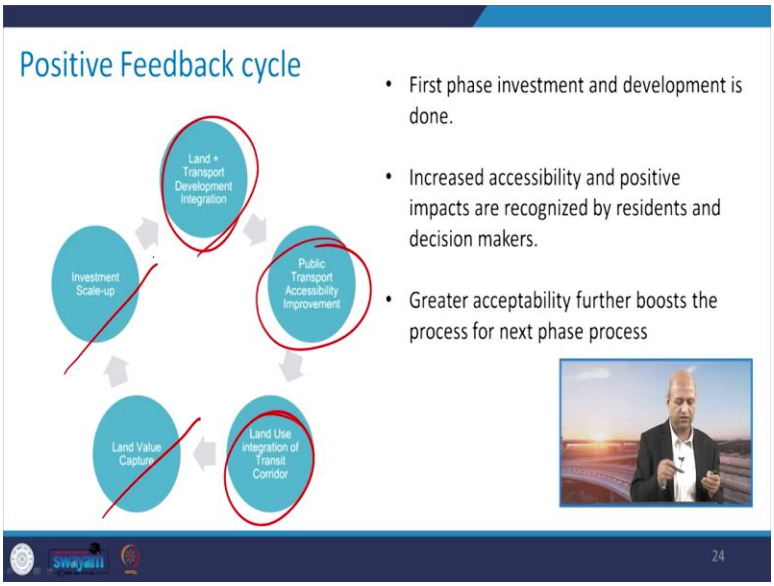


Then feedback cycle must be there, so, that you are always open to learn and to implement based on the learning. So, the land plus transport development integration is one thing which has been kind of feedback from the success stories of Hong Kong or Japan, those kind of things, public transport accessibility improvement, because it is a need, as you have seen only buses are catering the demands, the trains and those trams are not being accessed by people very much rather they rely on their privately own car. Land use integration in transit corridors, so has to be there otherwise if you do not integrate the commercial activities, institutional activities, residential colonies with the transit system, then it will not be viable, it will not be sustainable.

Then the land value capture which I again and again repeat because these projects are very costly and you need to get money out of it. So, because of this project, when land prices becomes high commercial activities increase, then you get the revenue out of it through taxes, through many ways, investment I scale up that goes in phased manner.

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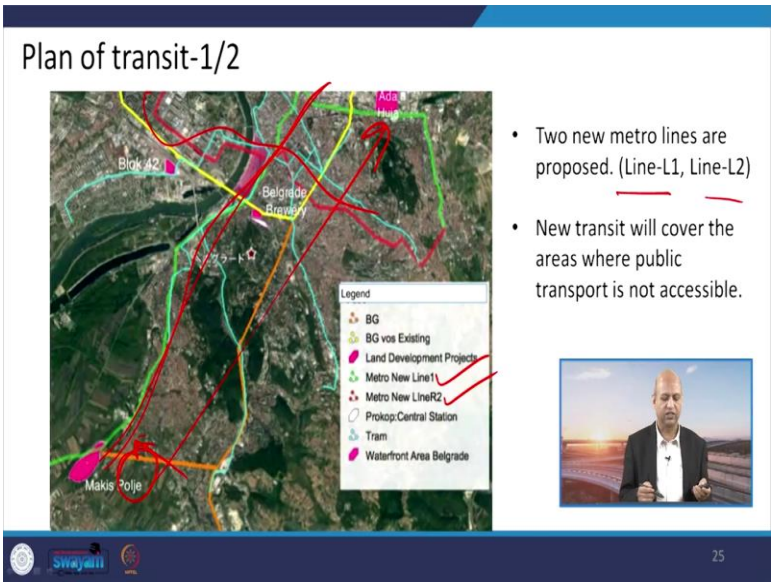


So, the plan transit in this particular city, Belgrade city has been two lines L1 and L2. So, one is this one, line one green one and this maroon two, so, this is the line 2, and this is line 1. So, again these has been planned or proposed, because it will cater the most of the needs, where people are waiting for some sort of, transit system, but they are not getting, so, these may be the areas where most of the people are using their cars.

So, maybe to shift them from the cars to, because this will give saving, if someone is using car to go from this point to this point, and investing a lot of money maintaining car and in the fuels have also so, if he can be provided a nice ride with the metro, he will certainly see from this car to this if it is timely available, reliable, frequency is more, comfortable journey nothing like that, most of the time he will try to park his car at the station if he is 10 kilometers away or 5 kilometers away from the car station, otherwise he will not or feeder system maybe there so nearby to the residential area, he can take out auto rickshaw or some bus, minibus, those kinds of things can also be integrated. So, that way these two lines have been planned.

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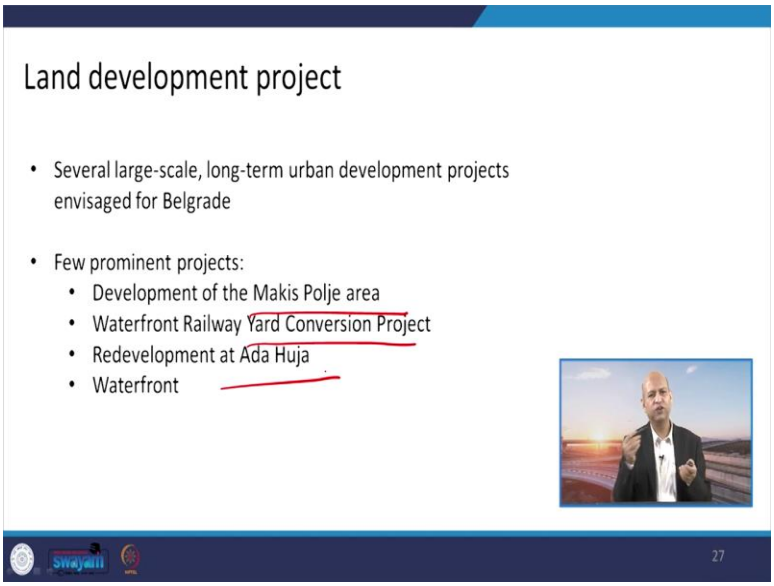


So, this is one plan for the transit you can see, these are the images for the urban railway, existing urban railways, which is the yellow one, and these are the metro planned one, this one. So, again, you can see, these are the areas which are not being catered by other kinds of transportation system. So, there are chances that that will be taken by the people and the land development because, there are certain areas which are important from local importance point of view.

So, those points will be connected like in case of Delhi, we discussed that Arjangarh to Gurgaon and different areas where they are like narrowly related, cultural centers, Chhatarpur okay. So, different those important places can be connected by this TOD.

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And then how to invest the money, what is the way, where to get the money. So, the public private partnership has been proposed, so, that private people who are having a lot of money, they can also invest in this corporation and they can reap the benefits, they can share the benefits, vis-à-vis this investing also into the service of the people. So, this venture which is joint venture that can develop residential areas, so, maybe private land developers can be there, builders can be there they can participate in this particular project, because they will be having good opportunity for making money when they are given certain areas to develop.

So, they will develop multi storey buildings and they will sell it. So, they will earn good profit as well as the profit will be shared with the government also because the public owned land will be sold to them and they will reap the profit. Similarly, other kinds of activities can also be shared in a PPP mode.

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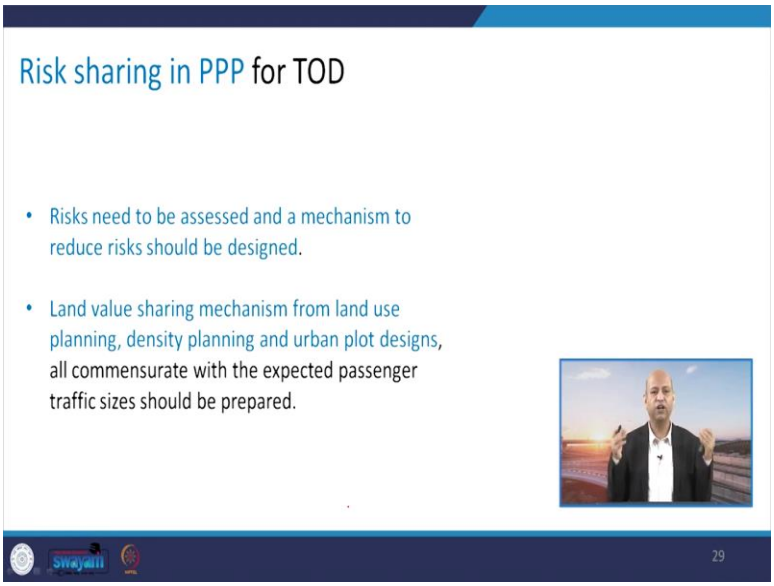


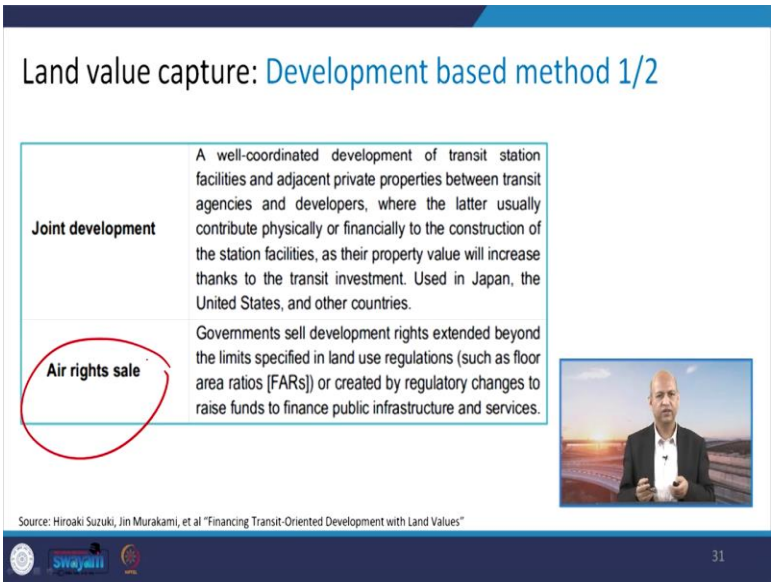

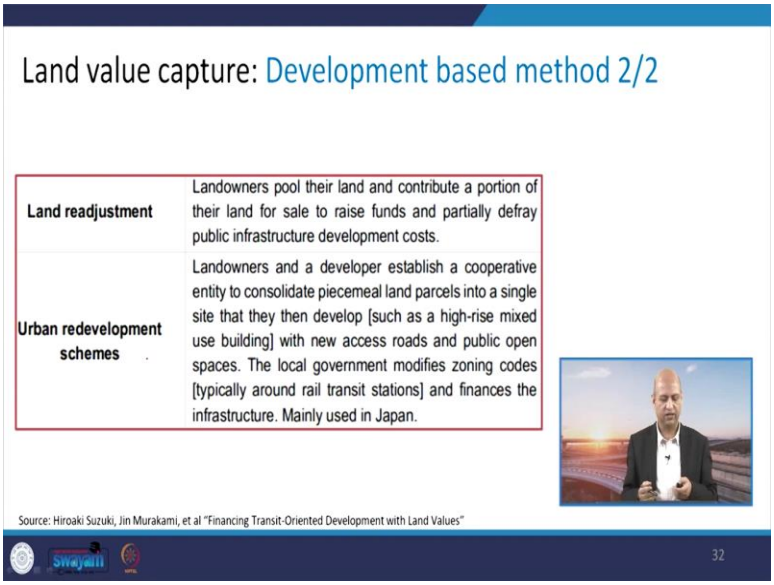


There are risk sharing also because, it is not only the profit sharing but the risk sharing. So, when this project can be distributed and many parties in terms of number of developers they join hands, then the risk is also be distributed and it can be affordable. So, that kind of project planning is going on. And then how to get the revenue means land value capture how to make the land valuable and to get the money out of it.

So, you can see the property and land taxes and then betterment charges you can get when, development is going on. So, the government will get some money out of it then tax increment and the land sale and the on the lease. So, that way there are opportunities for making money for the private builders as well as for the government agencies also, similarly the joint development will give opportunity for better development of those particular areas. And then air rights means the multi stories floor areas, like if you want to have 8 storey or 10 storey, then those rights are also given and the profit is shared.

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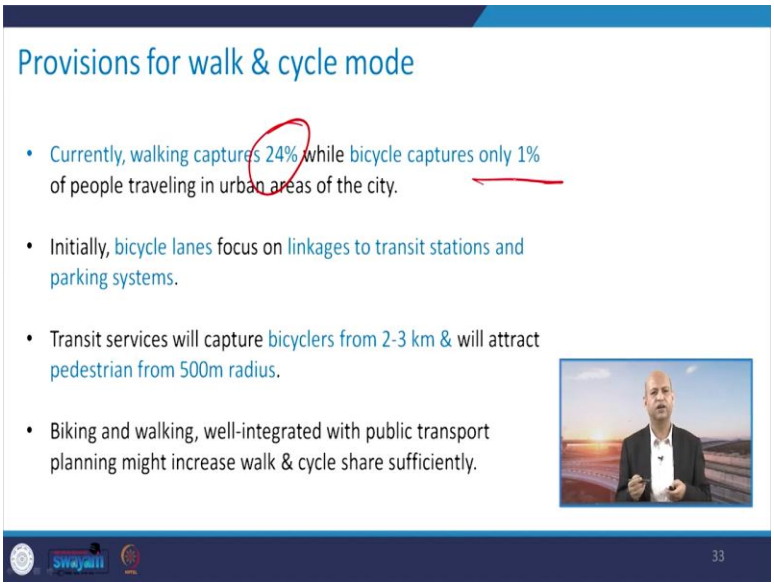


Well, then the provisions for walking or cycling modes and integrating them with the stations which are being planned have to be increased, because walking already 24 % but the cycling is only 1 %. If you increase the parking facility, and maybe some privately owned cycling agencies can also cater the demand so that people can hire and rent those bicycle and deposit on the other station, those kinds of things in nearby areas if they want to take the services.

So, those kinds of things can be explored and accordingly some multimodal, this last mile connectivity related issues can also be addressed by some kind of facilities through minibuses etc.

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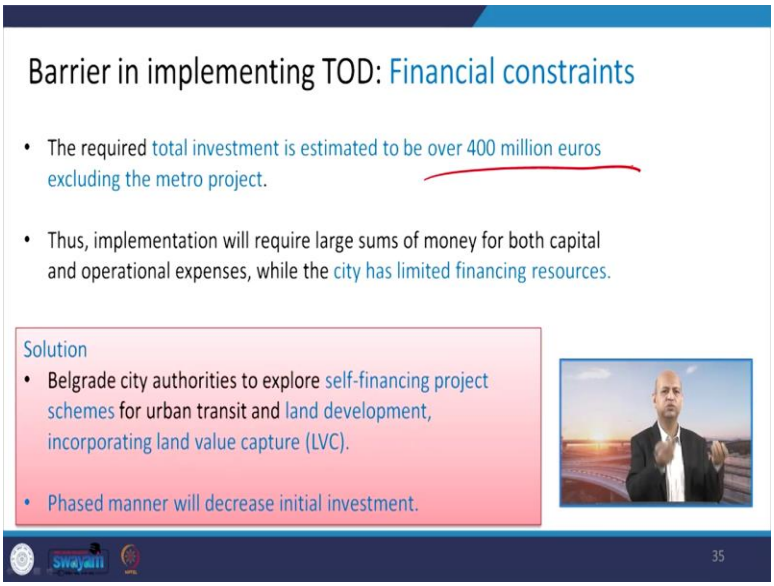


Well, if we talk about barriers in implementing, and so, one is like poor perception for the public transport because people feel that it is slow and it is not meeting the demands of the people and it is not giving the frequently operating kind of opportunity. So, that way we have to give them the frequency of let us say less than 5 minutes then people may appreciate if I miss one time then after 4 minute I will get another chance okay.

So, those kinds of things, and then the interconnectivity of different corners with the multimodal those feeder systems are required, and then the financial constraints as are those we have discussed. So, it is used money around 400 million euro is the cost. So, if you get even loan from the World Bank, you need to repay it. So, those PPP mode really can help because, you will get a lot of money from private parties also that we will need less loan and by in phased manner if you develop, then you start getting revenues and start supporting the project.

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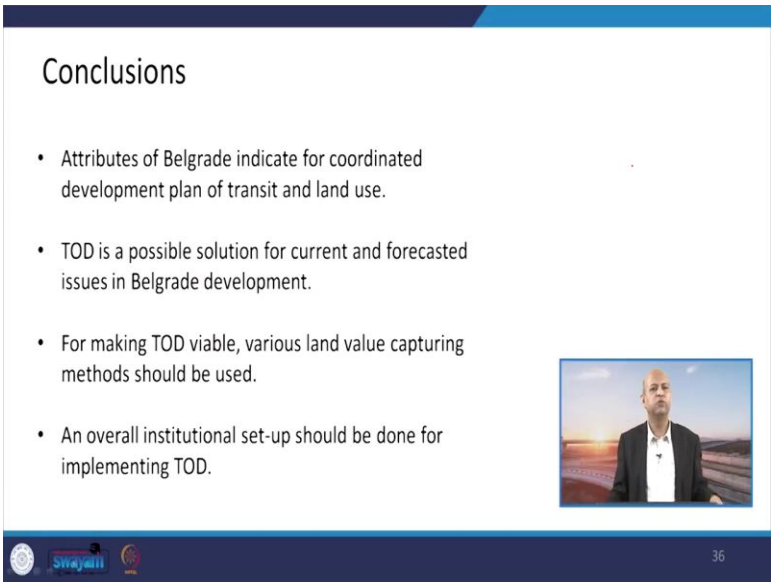


So, that way wisely, you have to plan different stages, and those stages have to be implemented. So, in conclusion, we can say that, this Belgrade city has certain characteristics and attributes, which have to be addressed before developing a transit oriented system. And, there are like buses are good, but trains are not giving good services. So, there is a lot of demand at certain pockets. And if you can fill up this demand with the newly planned TOD, then people can feel, motivated to join hands in the investment as well as to run this project to operate this project plus to take the services of the project, so it can be viable.

And if you can integrate the usage of different landmasses areas, into commercial centers, or recreational centers, and that way land value capture, you can achieve, then lot of money can inflow and it can support the project. So, overall institutional setup like one agency which can govern these, so some maybe those kind of venture has to be started from government and private entities. And those kinds of vehicles can really help to support this project. So, we hope that this project will be implemented, and the Belgrade people will have a good transit oriented development.

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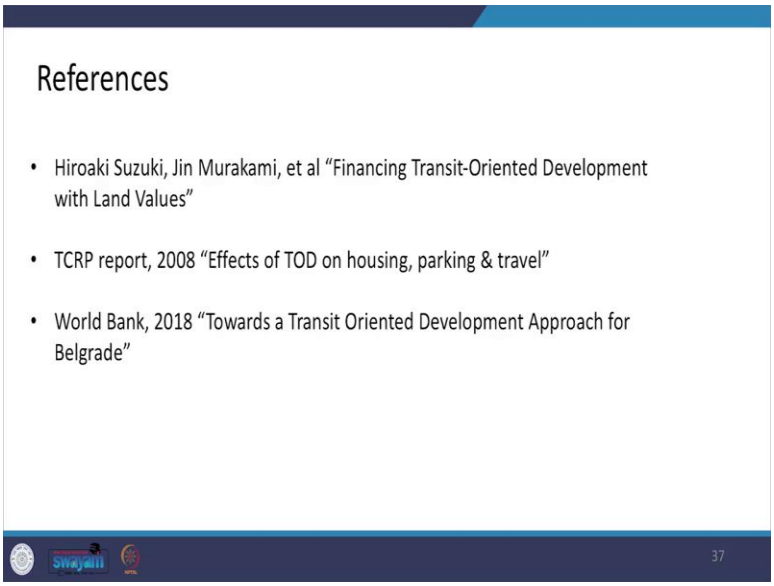


So that is all, these is the reference list where you can go through for having more information about this particular project, which is interesting because it is under the development and you can go through it. So, thank you for your kind attention. So, that way we have covered two case studies. I hope you must be enjoying these because case studies always help us to have better picturization or visualization in the mind, and we can appreciate the concepts on the practical side, the real world application side. So, that is all for today. Thanks again.