Sustainable Transportation Systems
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Lecture No. 26
TOD Case Study: Section of Delhi Metro

Hello friends. In the series of transit oriented development, today we will discuss one case study and that will be focused on a particular section of Delhi Metro that will give you an insight, a real feeling how this transit oriented development is planned and executed in a particular city.

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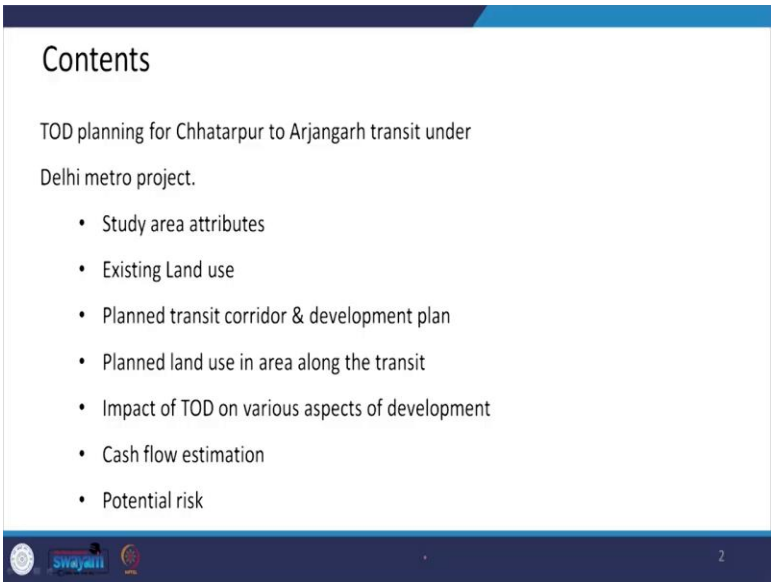

So, this particular section which is in between Chhatarpur and Arjangarh area. So, that is the basis of the case study so, that you can get feeling how transit oriented development is planned and executed. So, this will include the attributes or the features of that study area and then existing land use, how patterns were there what kind of uses of the land were existing and how it is planned in terms of transit oriented development and then the corridor which was planned on the basis of TOD and then the plan land use in the area along the transit particular that stretch.

And what is the impact of TOD on various aspects of the development. So, all those attributes and features we will discuss and how it influences the cash flow estimation within that particular locality or location or area and what are the potential risks or benefits, those kinds of things we will study in today's lecture.

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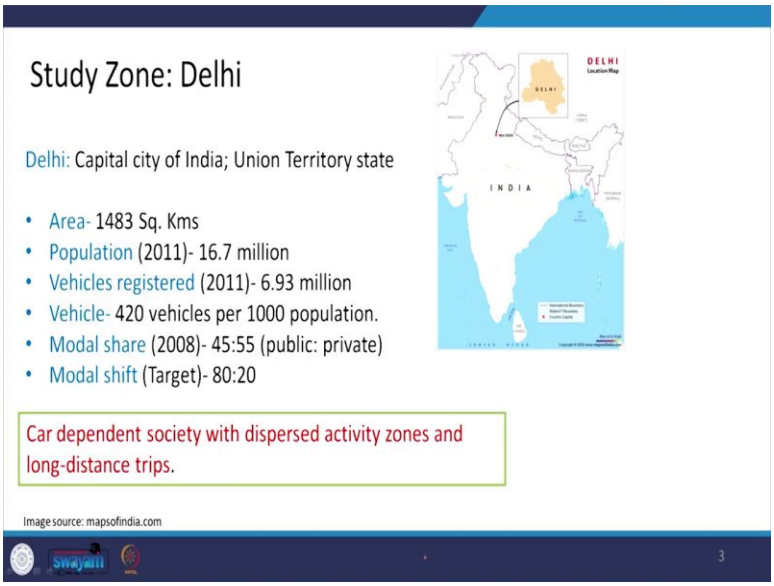

So, the study zone where this particular case study is focused on is in Delhi basically, in Delhi as you know, this is kind of combination of union territory as well as the state functioning in this National Capital Region of Delhi, and this is area like around 1500 a square kilometer and the population in 2011 was at that time when it was planned this TOD was planned, it was more than 16 million, now it is around 20 million.

Vehicles registered in 2011 it was just 6.93 or 7 million kind of thing. And you might surprise to know that basically privately owned vehicle is dominating for meeting the demands of the transportation for most of the population in Delhi, and it is said that the total registered vehicle in Delhi is more than the combined registered vehicle of Mumbai, Chennai and Kolkata.

So, that can give you one this perspective that how much dependency on privately owned vehicle is there in city of Delhi and why it is needed, much needed that we should promote the transit oriented development or the public transportation system so that we can help people to shift from privately owned vehicle to the public transportation system.

So, the car dependency or the two wheelers or means in privately owned vehicle dependency is dispersed in different zones, and it took a lot of planning and a lot of thinking and brainstorming to execute this TOD to meet the gap.

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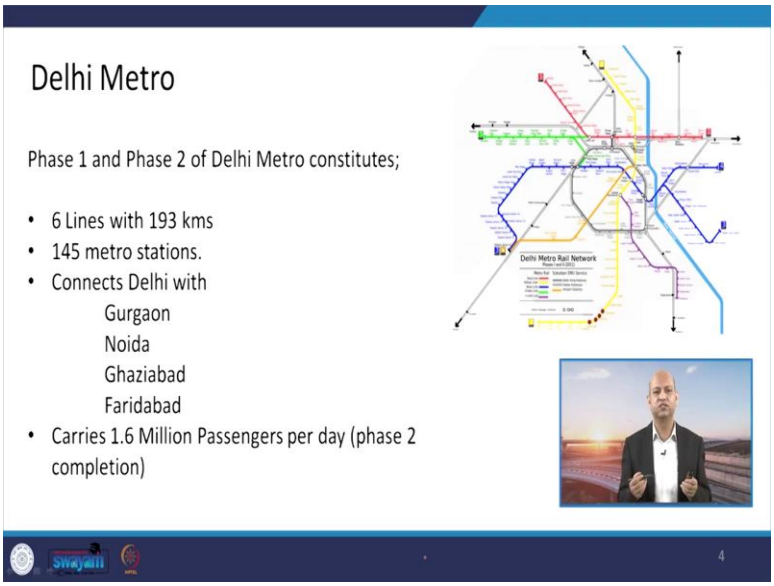

So, the particular section, which we are discussing today is basically related to phase one and phase two of Delhi Metro and this was constituted of 6 lines with around are 200 kilometers, 193 kilometers and then 145 metric stations were planned and it also connects Delhi with Gurgaon, Noida, Ghaziabad, Faridabad, those nearby cities and it carries around 1.6 million passengers and when phase two was to be completed, so, this is initial planning kind of calculations you can see.

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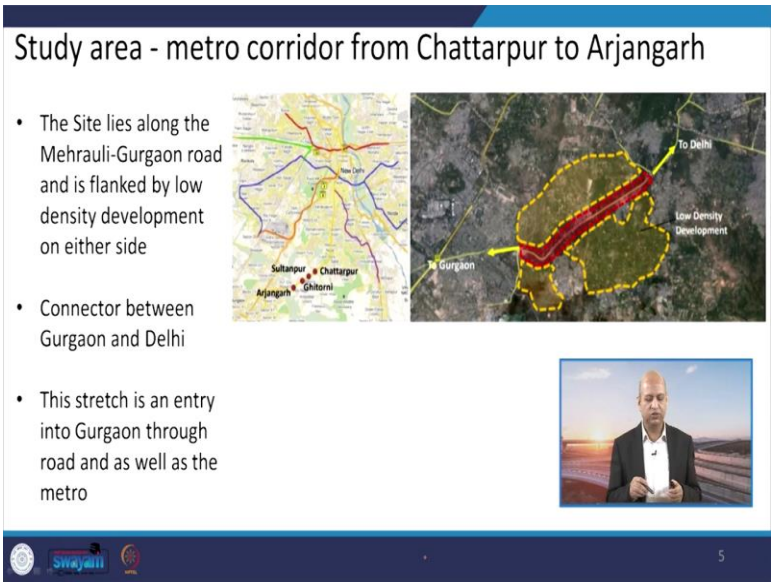

Now, this is study area corridor from Chattarpur to Arjangarh you can see there are these locations, this goes towards Gurgaon and this is towards Delhi. So, this is the stretch we are considering and the area surrounding it. So, what kind of characteristics of that area is and what kind of population density is there, is the scope to make some developments or not all those things we will discuss.

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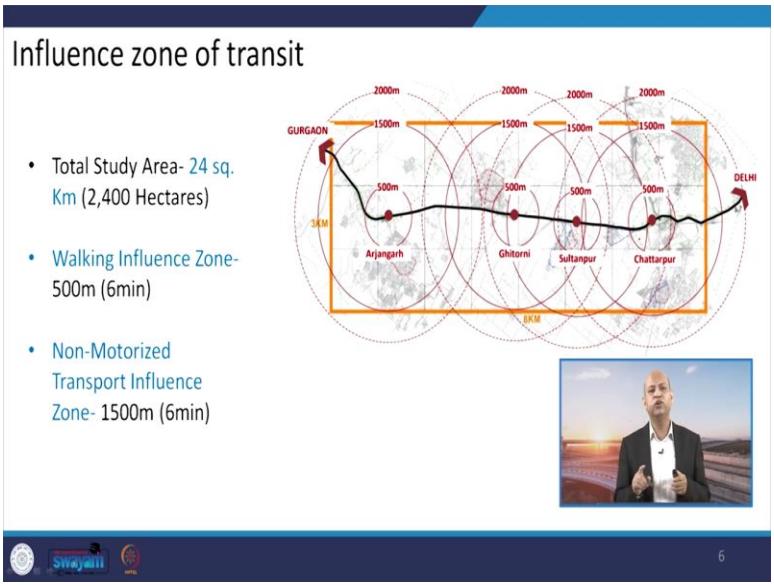

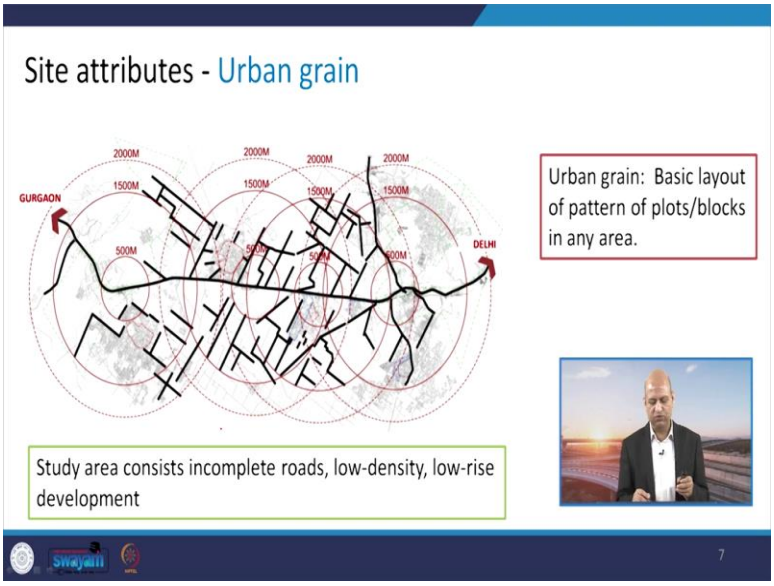

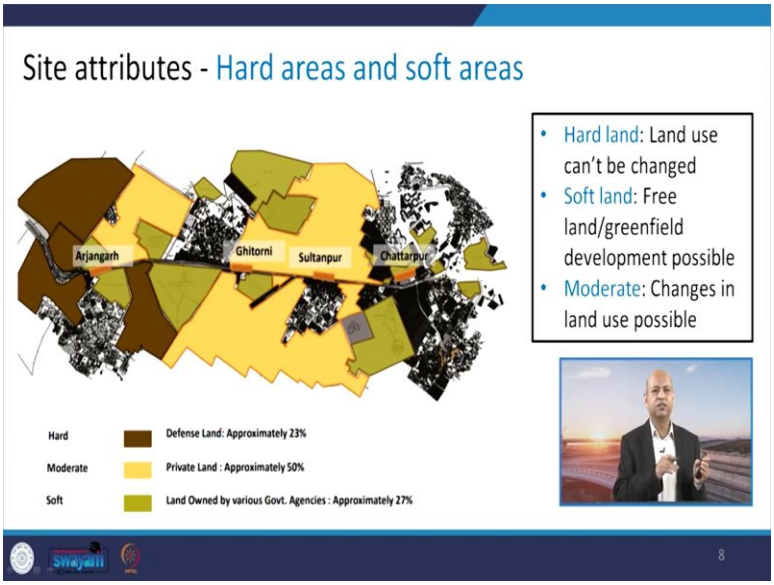

This total area of this study is around 24 square kilometer around 2400 hectares. And on the basis of the study we found that around 500 meter that is approximately 6 minutes walk was under this walking influence zone and the non-motorized transport in place zone was around 1.5 kilometers. So, that way things were planned accordingly and you can see the existing roads and the streets were not very much connected.

So, there was a huge scope to really connect it with the transit, which was planned for this development. Also, now, there are differences in between different kinds of uses of the area available. So, which area is available for the development and which area we cannot touch because of certain regions. So, the hard area and soft area and moderate area those kind of area were categorized.

So, hard area is like defense land in between. So, there we cannot do any kind of development, this is out of scope, and then moderate area which is privately owned property, some developments can occur with the participation of the private parties, we can talk to them that these kinds of developments you can carry out so, that you can get benefited by some related activities.

And there are a lot of soft areas also land owned by various government agencies, which was available for the kind of green field development where you could plan any kind of activity as per your region as per the requirement of the TOD.

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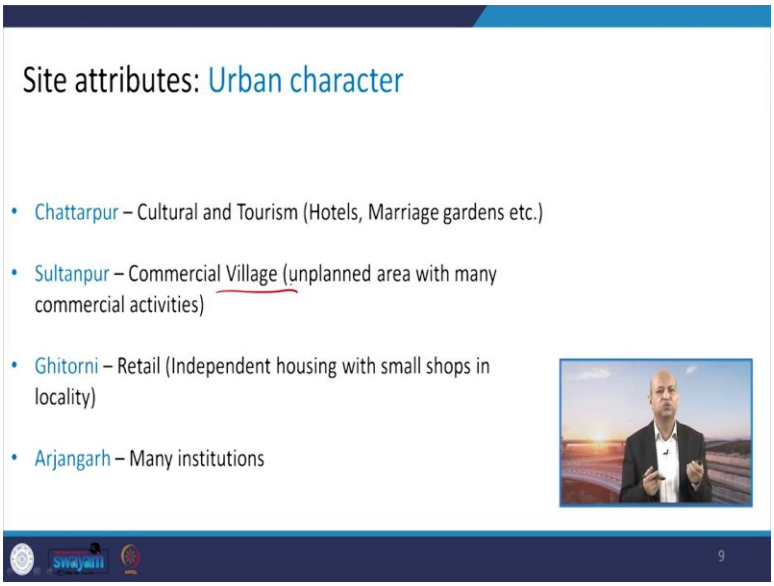

So, the attributes of the site you can see like Chattarpur area is more towards cultural and tourism related characteristics like there are so, many hotels, marriage gardens and then it is also nearer to the Mehrauli where Qutub Minar and those places are there where tourists come and visit those places. So, the characteristic of the area around central pool is more of cultural and tourism related character.

Sultanpur which was commercial village and unplanned area with many commercial outlets and activities. So, that is particular character of that area of the Sultanpur. Then there is another area like Ghitorni and that is known for retail related activities, independent housing, small shops, those kinds of activities were there, Arjangarh, many institutions, so institutional area is surrounded this Arjangarh area.

So, you can see different characteristics of those areas. So, we have to integrate them in a proper way. So, that was the feedback issue for better planning of the TOD.

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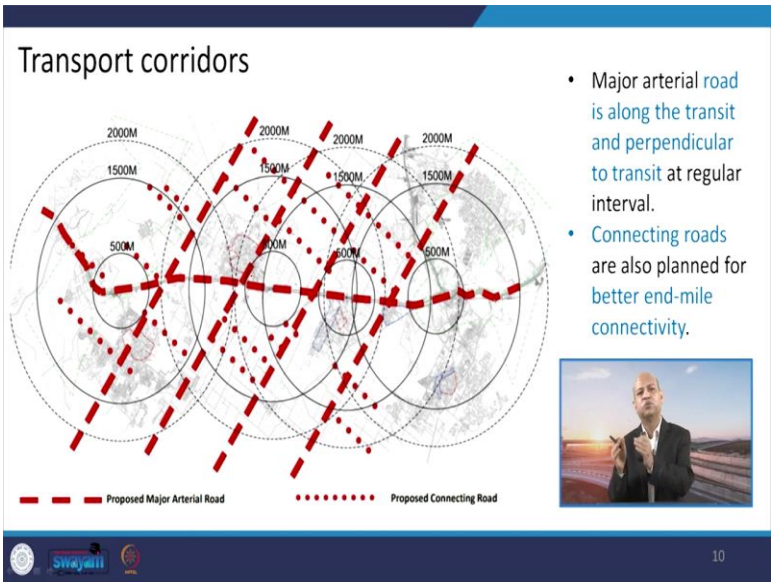

Now, you can see this we have seen that 500 meter area is walkable zone and then 1.5 kilometer for non-motorized transport systems etc. So, a lot of roads were provided then planned I mean, so, intersection, this is the transit route and these are the roads which were planned around 90 degree intersection and then other interconnected roads or streets were planned accordingly so smooth transportation is there, smooth mobility achieved and minimum time is required to reach to the metro stations along the transit.

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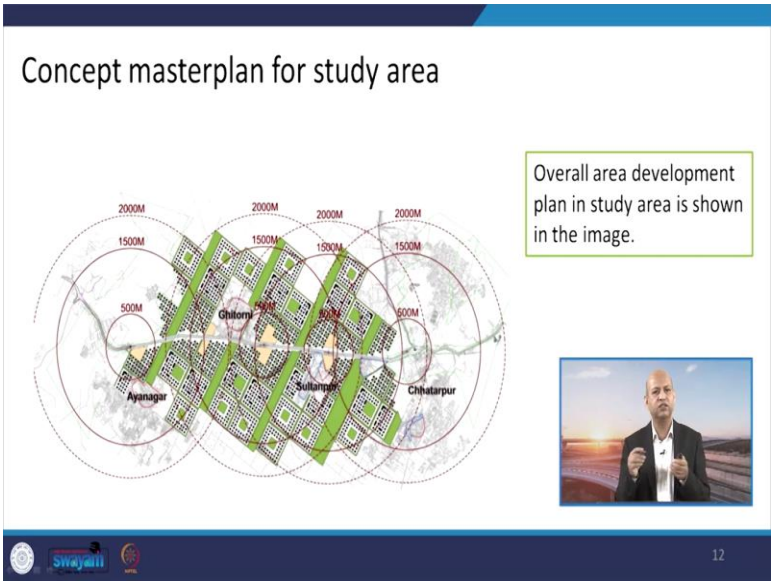

So, for example, now, we will give you some visibility or visualization, how these areas were developed. So, let us say this is one existing metro station and nearby area is there for the development. So, these kind of green corridors were planned. And then it was divided into different blocks. So, nearby blocks were developed for like shopping malls or plaza and high rise buildings around 8 to 12 storey buildings, beyond that, like buildings were less like floors like 5 to 6 or so, we will see these attributes later on.

And then open spaces were also planned between these residential or commercial activities or community related activities were also planned. So, that way different kinds of uses were planned for development, you can see in this way and distance where like 500 meter walkability, and then these green belts and different blocks, so, over all area development was the concept related to the master plan of that study area.

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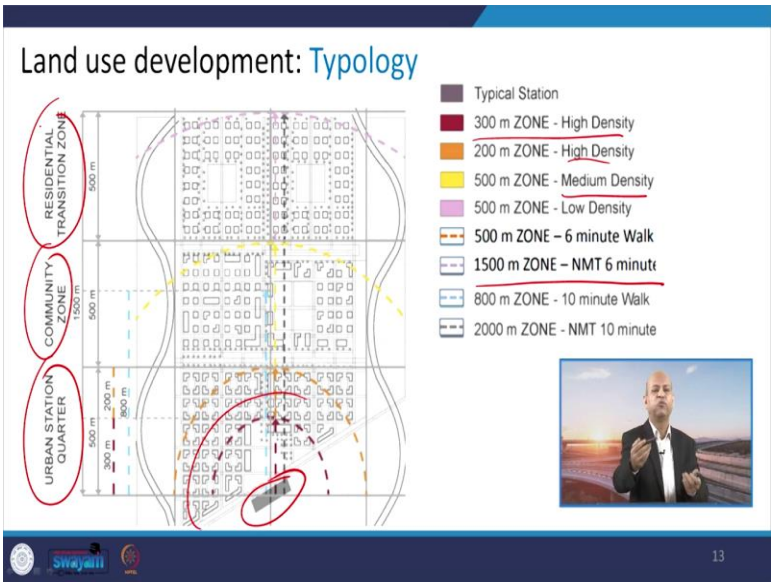

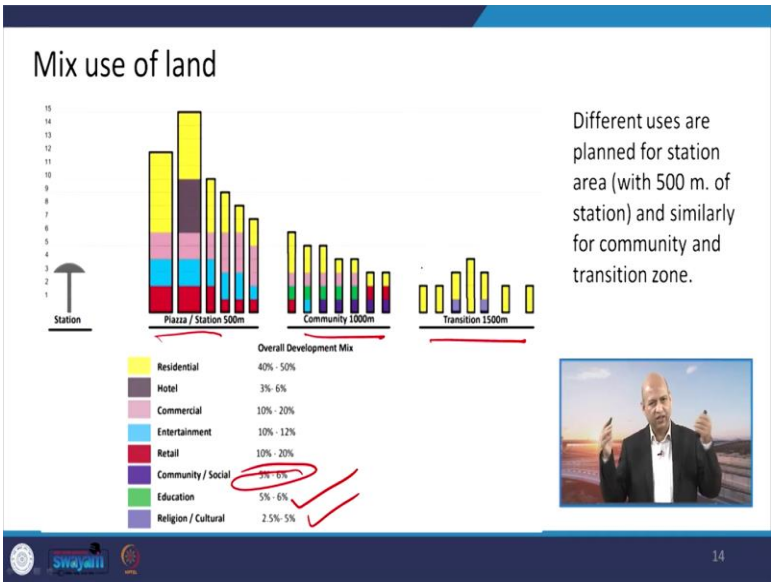

Now, you can see here see this is typical station of any metro station along the transit and 300 meter zone is high density area. So, a lot of high rise buildings and those commercial centers were planned and then 200 meters zone again high density, 500 meter medium density, where walkability is also easy and then a 1500 meter like NMT related issues. So accordingly different zones like urbanization, quarter then community zone, residential institutional zones, those kinds of distances from 500 meter to 1.5 kilometer those areas were planned.

And the mixed use of the land was promoted. So, the residential like 40 to 50 % land was given for residential active area and then hotels around 3 to 6 % commercial activities 10 to 20 % area

and entertainment again 10 to 12 %, retail 10 to 20 % commercial social activities community based, community based activities 3 to 6 %, education related like schools or those institutions 5 to 6 % and the religious or cultural related activities 2.5 to 5 %.

So, those kind of mixed uses were planned and distributed according to this distances and like this is plaza and then community related activities then this is transition 1.5 kilometer and you can see accordingly the usage of the land and the density or those kinds of things are there.

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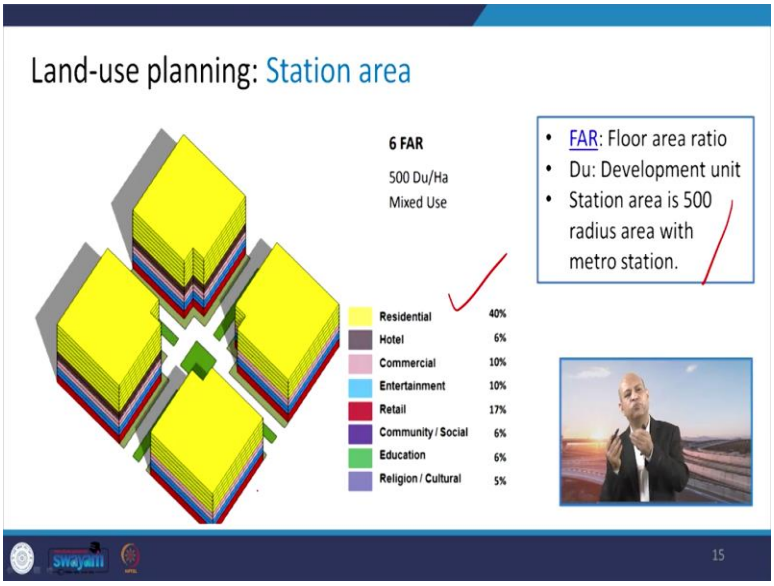

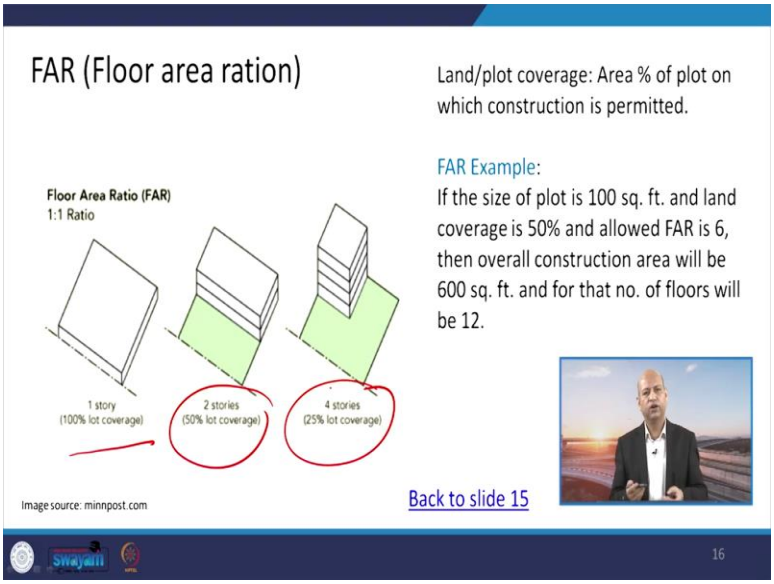

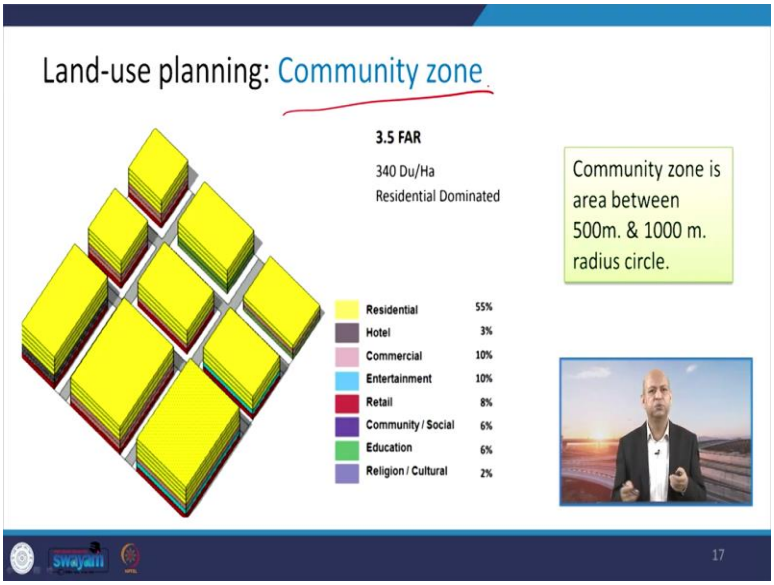

Land use planning also in the station area, you can see like floor area ratio, high floor area ratio is there in nearby localities or areas of the station. So, it is around 6 FAR that is a floor area ratio and 500 development unit. So, the station area is around 500 radius area which is near to the metro station and again like residential area 40 %. So, these different color schemes are giving an idea or visual inspection kind of thing that which kind of activity was given how much area or weightage right.

Similarly, like floor area ratio is decreasing when we go away from stations. So, like one story 100 % plot area and then two stories mean some when you are vacating some area or keeping it vacant then you can have multiple storeys, 4 storeys 25 % this plot coverage, you can go up to like 4 storeys, so, those kinds of things have to be kept in mind.

And then there may be like community zones around 3.5 FAR, so, as per the usage or utilization of the area, different floor area ratio was also allotted so that activities can be properly planned and executed.

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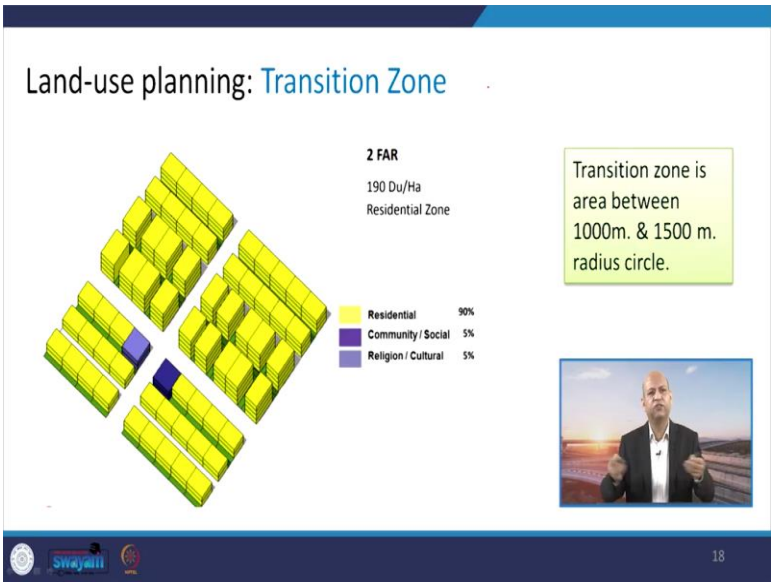

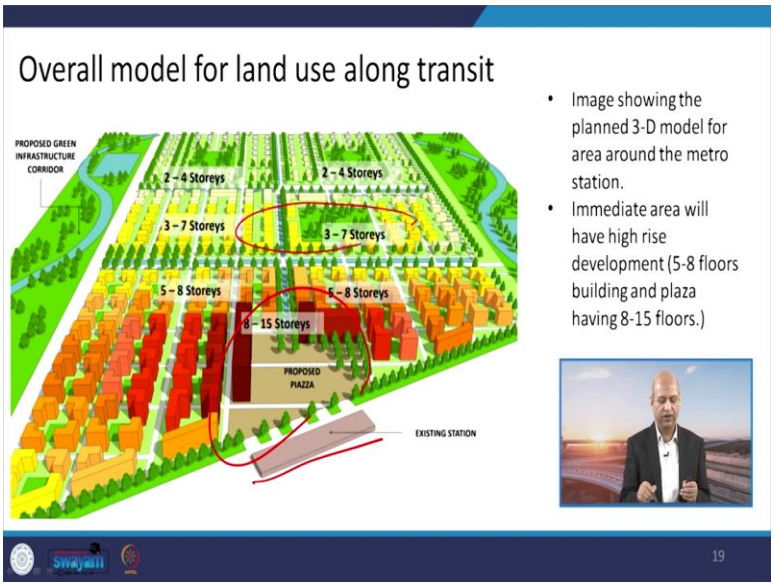

You can see like land use planning in transition zone, which is around 1.5 kilometer away from the metro station, the floor area ratio is less because you can have horizontal growth also. So, that way you can see here, this 3 dimensional kind of map shows you this is the station and now near to the station like plaza and activities, 8 to 15 storeys were allowed, so, highly dense in a populated kind of thing, then 5 to 8 storeys in this particular zone, 3 to 7 storeys in community related and this transition zone 2 to 4 storeys.

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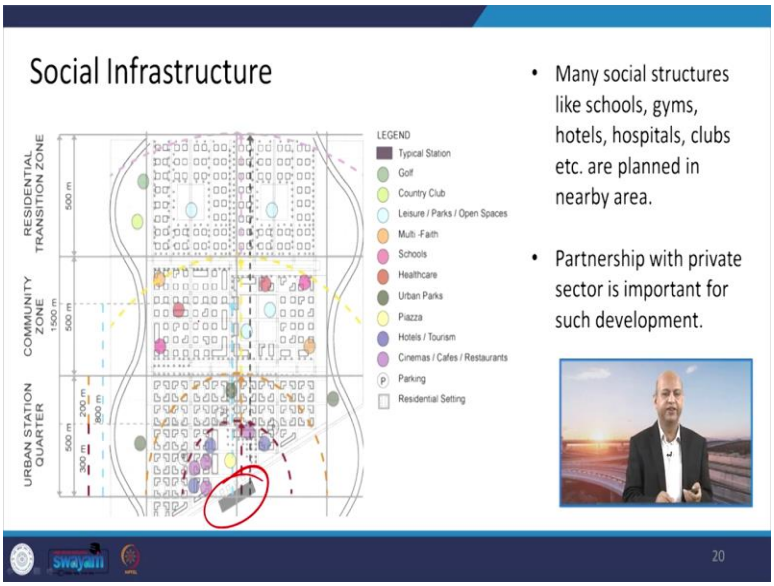

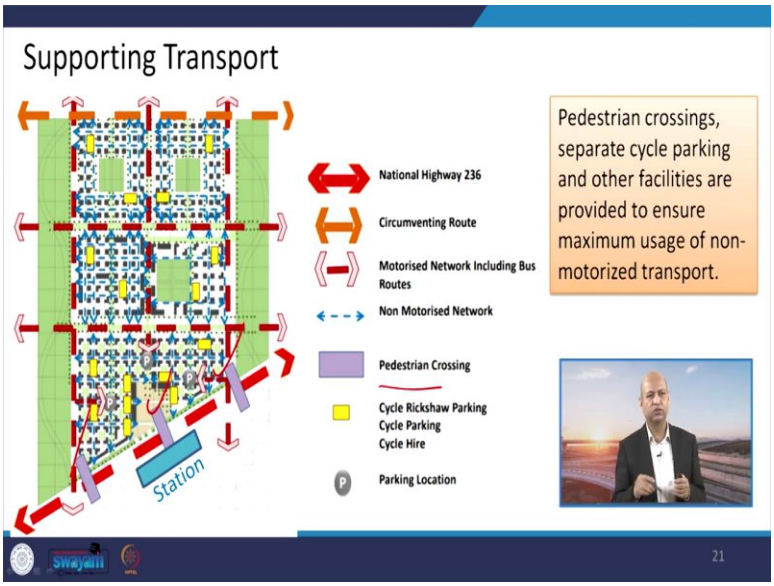

So, that way, this thing you can see for different kind of activities like social infrastructure also you can see these different legends are there. So, this is typical, railway station. So, how much area is given for like gyms, community activities or schools, hospitals, clubs or community centers, those kind of things are you can easily identify according to their color scheme.

And then the supporting transport again, this is like national highways is there so, it is also well connected with the station and then the pedestrian crossings were planned here you can see these 1, 2, 3 so that easily people can cross from one side to another. And then these motorized networks you can see in different color schemes at perpendicular roads were planned properly,

so that connectivity is smooth to go to the station as well from a station to the home or some other commercial activities or community based activities.

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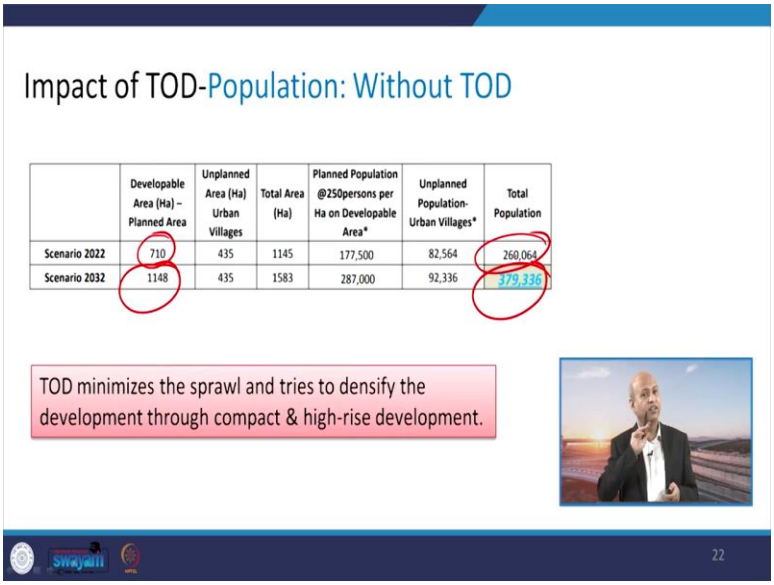

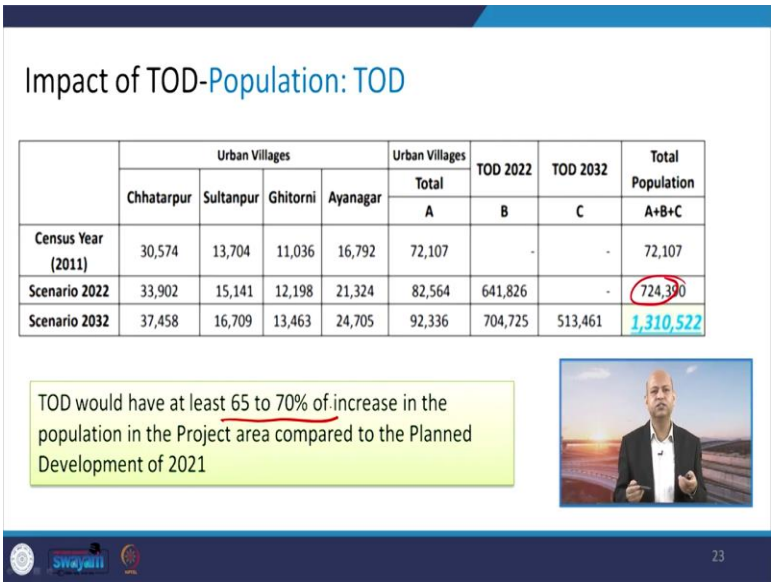

Now if you want to see the impact of the TOD, so without TOD, if there was no TOD this transit oriented development, then we can see the scenario 2022 around this much development area is estimated, in 2032 to around 1148 in total from 260 to 379000 kind of population was estimated when there is no TOD scenario. When TOD is there, then you can see as per census data and this population has grown from, 724000 to this is around 1.3 million rather, so it is basically the 65 to 70 % increase in the population of the projected area.

So, with the TOD you can serve so much population. So, that is growth this can digest or this can assimilate. So, this is a tremendous growth because when population is also growing and other facilities are there to cater their demands then economic activities automatically grow. So, when economic activities grow people get jobs, they can get other services and that way cash flow is tremendous, and the populations income groups also grow.

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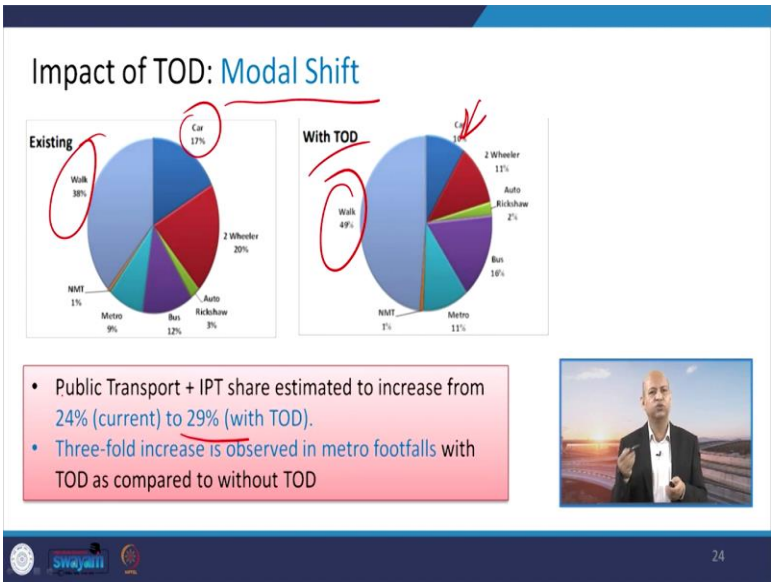

Well the Modal Shift, in terms of model shift there is also impact like existing workability is only 38 %, with TOD it was estimated around 49 %. So, again healthy way of doing things like because at the walking distance when facilities are available, people have incentive to go and take something or go and work those kinds of things.

Similarly, this car uses 17 % without TOD and with TOD it reduced to 10 % so, the car dependency got reduced. So, that kind of win-win situation you can always see so, that 24 % to 29 % this share of the public transport and pedestrian kind of facilities that was estimated to grow so, that is a great benefit, beneficial impact.

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And not only from the mobility perspective, but also other aspects of the total socio economic development were also integrated with this TOD development like Solid Waste Management Plan, because when so, many people are living lot of solid waste will also be produced, how to manage it. So, that was planned properly and organic waste was planned for biogas generation.

So, that can be used for cooking, as a cooking gas or producing electricity by producing steam and running the turbine and the inert material was planned for the landfill kind of sites. So, under TOD means these activities were also planned its not only the transportation or mobility related issue, it is complete integration that complete package which comes in terms of socio economic benefits also.

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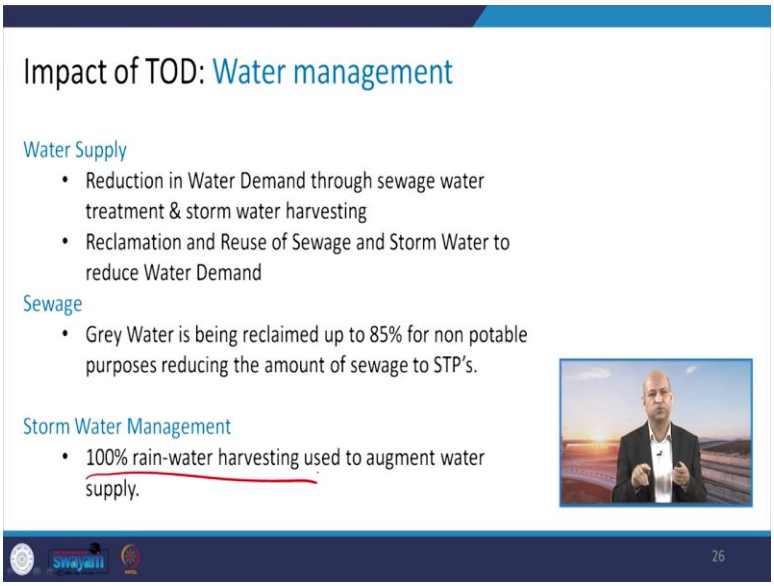

Similarly, water management, so water supply related issue and then it was planned that around grey water, 85 % of the grey water will be reclaimed for a non-potable purpose. So, that way it is a great utilization of that grey water and 100 % rain water harvesting was also planned, so that we you can see the water demand issues were also addressed and properly addressed means optimization of resources that is the central idea basically when we do for transit oriented development, we go for optimization of resources, how to maximize the benefits out of given landmass or given area.

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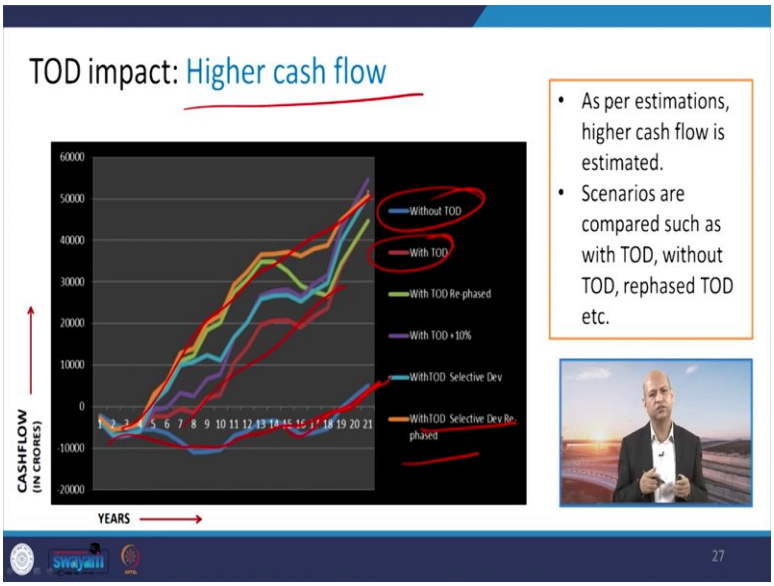

Now you can see the higher cash flow as I was discussing or talking about, so without this selective development this was the kind of without this TOD this was the growth, and then with TOD you can see this much. And this with TOD selective development rephased means in other way so that was more than this one. So, there were different scenarios were estimated and accordingly the cash flow was estimated that it will increase tremendously. So great benefits were related to this TOD related development.

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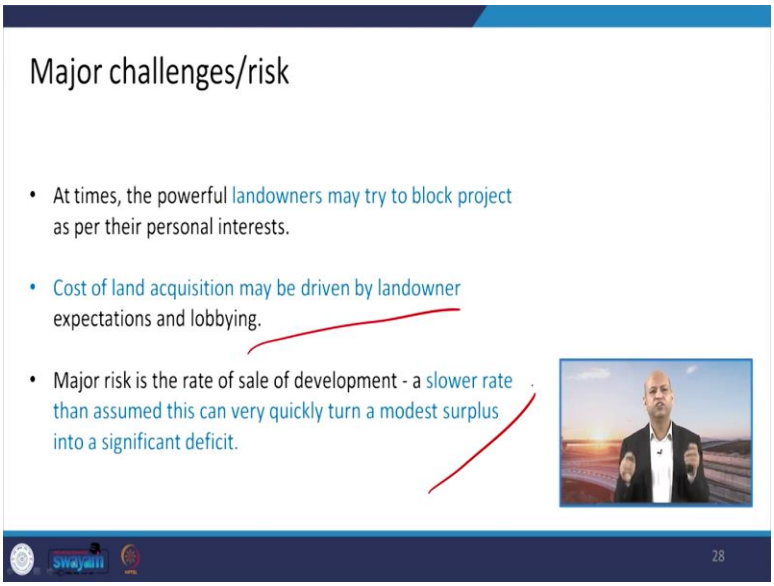

Then nothing comes without challenge, without risk, what are those risks like there are in between privately owned lands. So, there are issues because privately owned lands, then land owners have their own way of thinking. So, if they are not convinced with our idea, they can delay the project. So, its again public private participation. And we have to convince them this is the beneficial activity your land value will also increase, you can have other commercial activities, you can have better utilization of your land resources, so that we they need to be convinced and sometimes people feel if we do some sort of arm twisting, we can get more money.

So those are human nature, but all these issues have to be dealt properly. Similarly, the cost of land acquisition may be driven by landowners as I said, expectation, some lobby may be made. So, all these issues have to be really dealt smartly and with open heart and transparency so that

there is no kind of unreasonable benefit accrued to some group of the stakeholders like then there are some major risk related to the time.

If you do not succeed to negotiate properly, then try and get delayed and when these kind of big infrastructure projects get delayed a lot of cost, implies, loss is there, because cost will increase day by day. So, that way, we have to be very much smart in planning and executions before, execution of planning should be very smart, so, that there is no hurdle and all those issues are addressed timely and in a judicial way.

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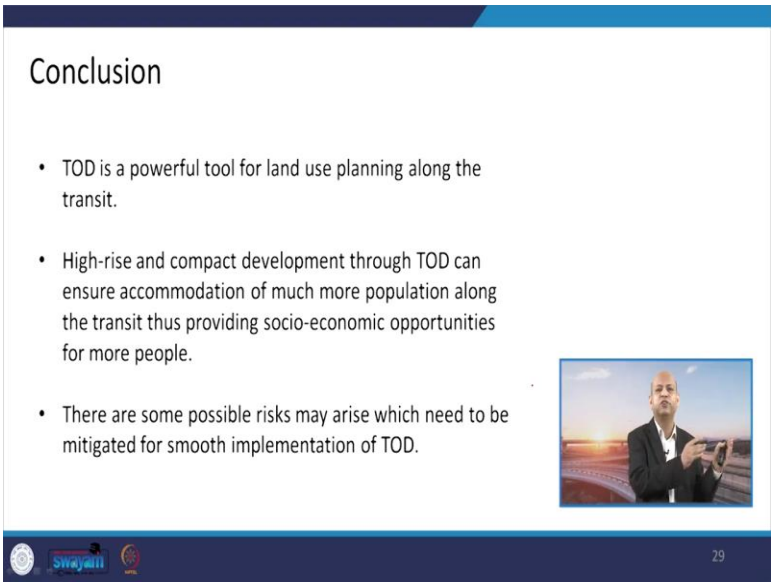

So, we can say that this TOD or transit oriented development is a very powerful tool to make the land utilization in a very optimum way, where you can pet lot of people and you can promote their activities without harming the environment, rather boosting the economic activities, and high rise, compact development, those kind of things can easily be accommodated near to the this transit route or corridor, because it can easily cater to the demands of the mobility or transportation of those people.

And also there is a lot of shifting from privately owned vehicle to this public transportation system. So, it is a kind of win-win situation, but there may be some risks and as we have discussed just a while ago, so, those risks should be properly dealt with and timely should be dealt with, so that there is no escalation of the cost, there is no delay in time in execution of this project.

So, this is all for giving you a visual kind of idea about how TOD is planned and executed basically planning purpose, how these different characteristics of different areas they play a role and how we go for land utilization, optimization and also serving the people in the best possible way.

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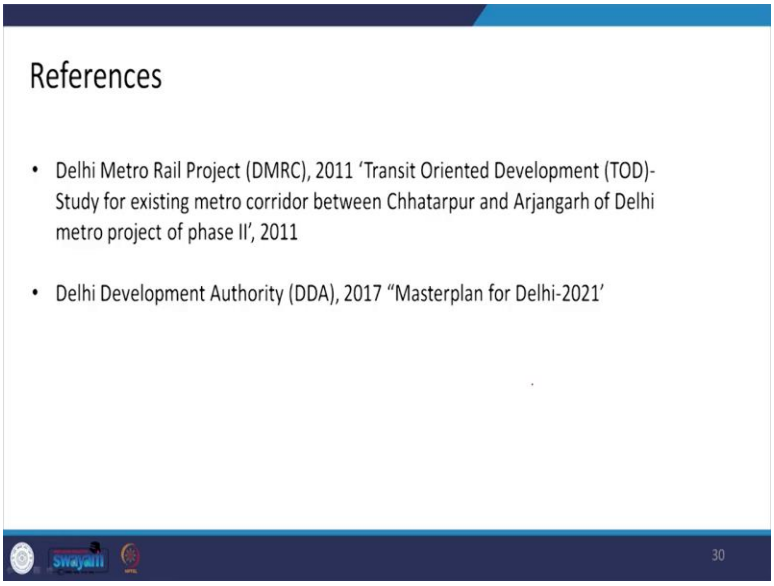

So, this is all for today's lecture, this is the reference which was the source of all this information, it is a detailed document, you can be interested to go through it to have more information. So, this is all for today. Thank you very much. We will continue these kind of planning related issues in future also. Thanks a lot.