Sustainable Transportation Systems
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Lecture 50
Case Study-I_ Bus Rapid Transit System (BRTS)

Hi, friends. So, today we will discuss about Bus Rapid Transit System, BRTS. This is one of the most efficient transportation system which has been experienced, implemented, successfully implemented and experienced in certain cities. And also, we will discuss about certain cases where this system was not so effective or successful.

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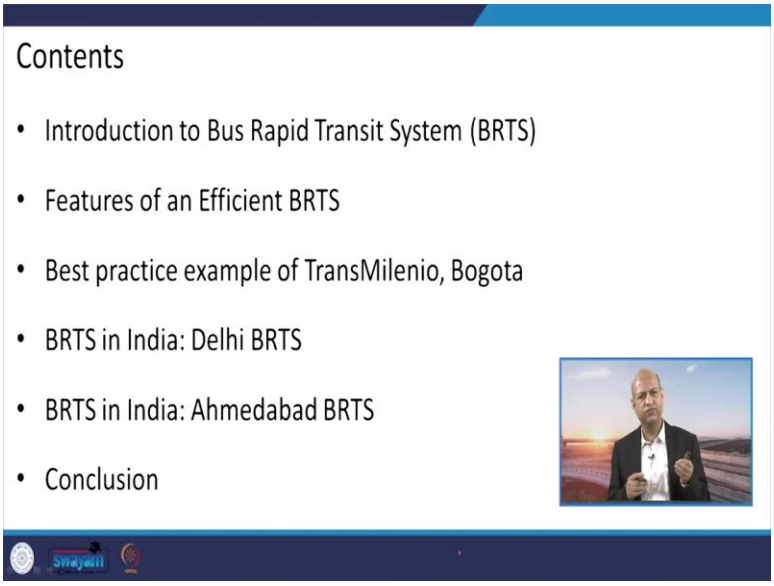

So, contents of this particular lecture are like we will give an introduction about bus rapid transition system or Bus Rapid Transit System, we call it BRTS. And then what are different important features which makes BRTS as an efficient transportation system and what are the best practices around the world. So, we will take one successful example of Bogota, TransMilenio is the name of that system, that company, and Bogota, in Colombia that is one successful example of BRTS. We will discuss about it.

And then we will see Delhi's BRTS system, what were the limitations, what were the challenges, so it could not pick up in the desired way. And the BRTS in Ahemdabad, means two Indian cases we will discuss, one Delhi and secondly is Ahemdabad. So, in Ahmedabad it is quite successful. So, we will see what are those features which makes Ahemdabad BRTS system very successful,

and why Delhi could not be so successful as Ahemdabad is. And then we will conclude our lecture.

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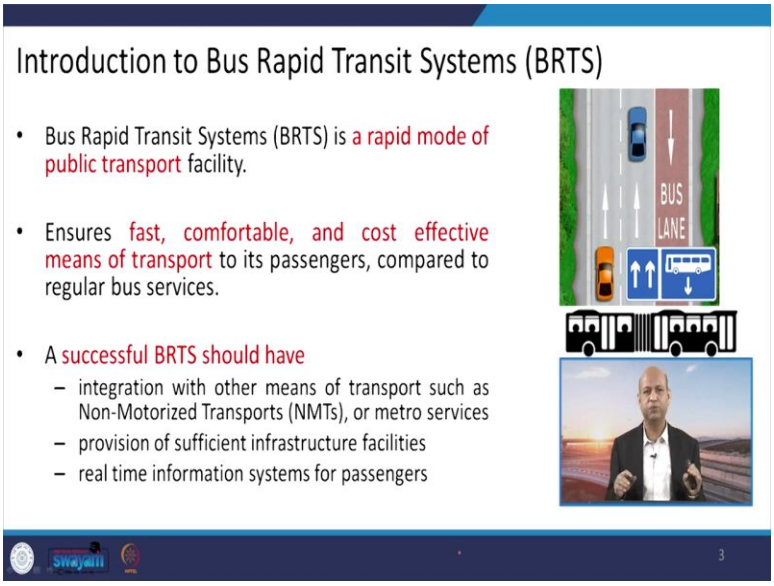

So, when we talk as an introduction of BRTS system, so we present it as a public transportation system because it, it uses buses. A lot of capacity is there for passengers, and these trips are quite frequent, so means it is, it is a kind of mass rapid transportation system, you can say. So, that is why its name also, like Bus Rapid Transit System. It is quite fast and it takes people to their destinations quickly.

Then what are those features, like why this is fast, what, what are infrastructure needs are there to make it fast, to ensure that it is fast plus comfortable because when we want people to shift from their private vehicles to the bus system or public transportation system, then of course, it should provide the journey comfortable.

And also cost effective, because when we are using the private vehicles, then we are paying a lot of money for fuel consumption and all other things, but in this case, when we are using the public transportation system, so the cost get divided into so many passengers and comfort level is also enhanced. And that way, means we have cheap system for transportation as well as the comfort levels also very good. So, and then what are those features which make successful BRTS like sufficient infrastructure facilities et cetera, dose are imperative things we will discuss during the presentation.

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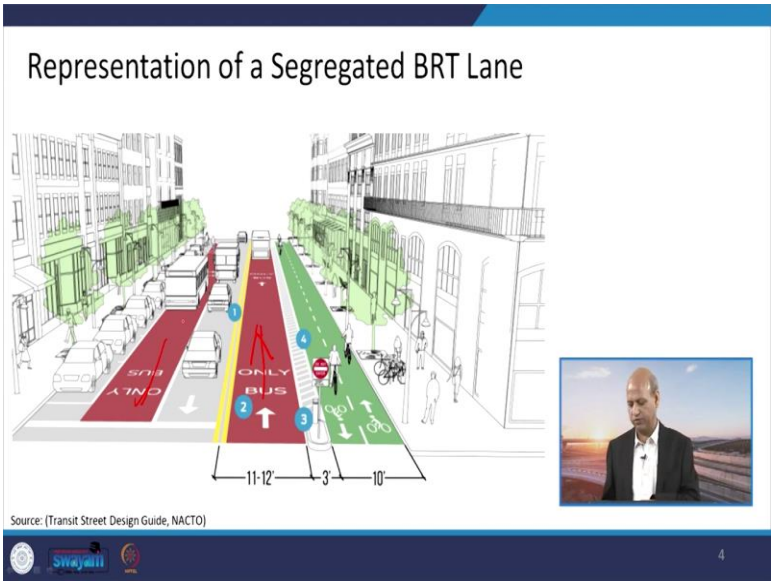

Now, see this one pictorial representation which gives this dedicated lane for the buses. So, this is like for going and this is one another lane. So, one for going and one for coming. So, these are the two ways, and they are dedicated, means no other traffic would apply on those particular dedicated lanes. Otherwise, speed will not be maintained for the buses. So, dedicated lane is one very important feature of the BRTS or Bus Rapid Transit System.

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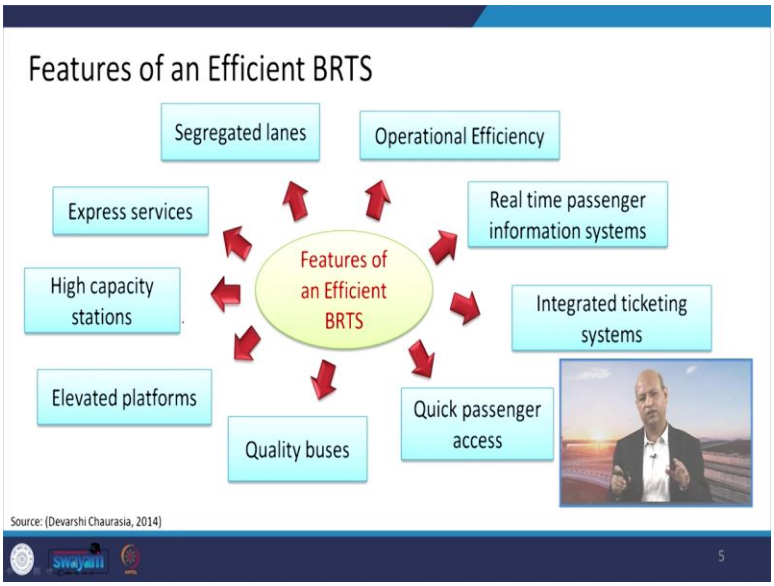

Then again, means that is only one part, segregated lanes or dedicated lanes, but there, there are other features like, means how to achieve operational efficiency. So, for that, we need to have

feeder system properly, and then real time passenger information system that means, we should have GPS and it should be connected with real time sharing of information like bus is about to reach to that particular station, and what is the time lag or those kind of things, so that is Just do not waste much time in waiting for the desired bus.

Then integrated ticketing system, means if one ticket or one card one has purchased that should be applicable to not only the BRTS but also for other related transportation system because after dropping or leaving the bus one would like to go to the home or some office.

So, what is that integration system means, there are auto or there are some other small buses. So, can that ticket work in that particular bus? Otherwise people have to waste time for buying tickets et cetera. So, a lot of time gap is there. So, if integration is there then we can save a lot of time.

Quick passenger access means the system should be in that way that it is comfortably accessible, plus quickly. The level of entering and exiting and the platform level they should be quite same. Quality buses means, they should provide a good comfort level in terms of thermal comfort, as well as cushioning of the seats and, and air conditioning, those kinds of things. Elevated platforms, because if buses are having entry system or exit system the, higher than the ground, then at that level that elevated platform must be of the same level.

Plus, high capacity stations, means there may be a lot of people, so the platform or the station where people try to ride the bus or get down of the bus, the sufficient capacity must be there for movement, for waiting and those kinds of things. Then Express services means those lanes are dedicated, segregated lanes plus dedicated means good speed should be maintained for those particular buses.

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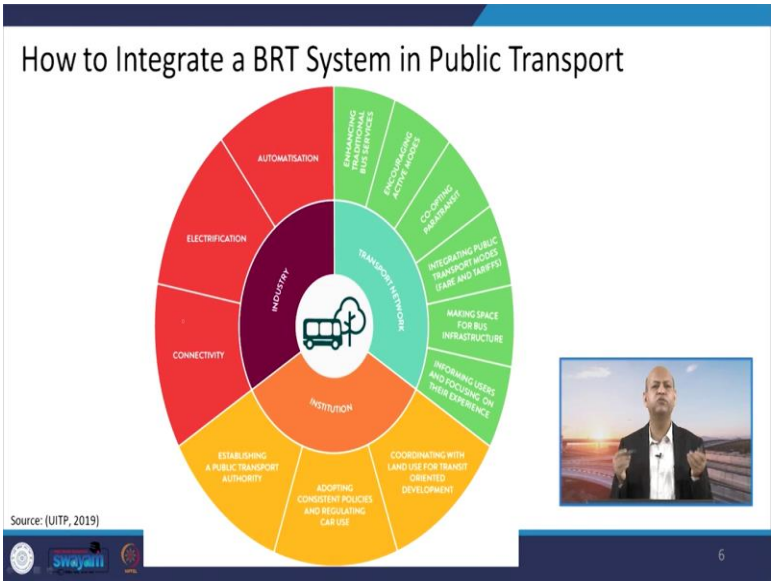

Well, in that sense means how to integrate the BRTS system with the other public transport systems, so this is one pictorial flow diagram, you can see. Like automatization and then electrification so that pollution is, less and connectivity must be fast, all those dimensions or aspects have been integrated with, where people are coming, like, it is, in the industrial zone also it should be having access. And then institutions or transportation networks, all those entities should have good integration, otherwise, efficiency and effectiveness will not be able to achieved.

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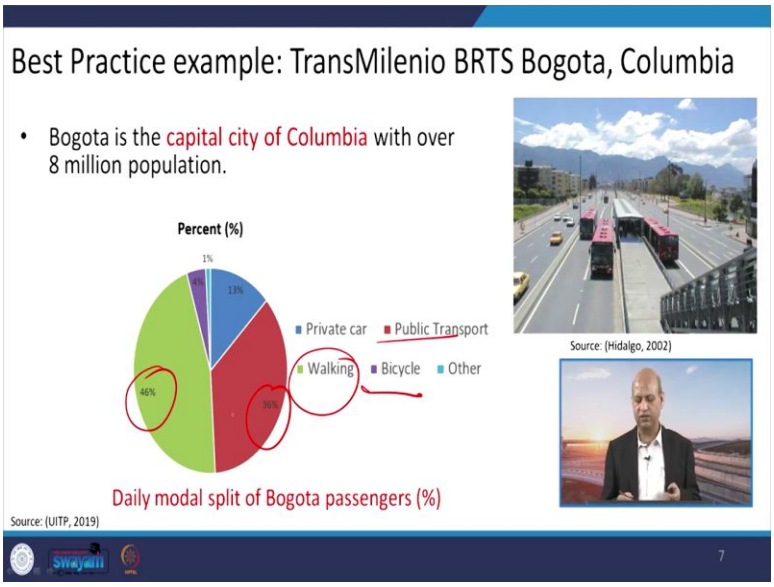

Well, so when we talk about this very successful BRTS system of Bogota of Colombia, so that is TransMilenio that BRTS system is known for. So, this is the capital city of Colombia and means luckily, I have personally visited that city and I have seen this BRTS system and that is wonderfully managed.

You can see like daily modal split of Bogota passengers. These 46 % working, means they are very health conscious in South American cities, whether Bogota or Sao Paulo in Brazil and in these Colombian cities. People like to work, to go from one place to another cycle, etc. And then bus system or public transportation system, they also use.

So, you can see the percentage of these passengers using different modes. So, private cars are only like 13 % or so, and bicycles 4 percent, around, and the public transportation system around 36 %. So, good, portion of the public or passengers ride to this BRTS system or other public transportation system. And road network is wonderful, and the dedicated lanes are there, and you will learn in subsequent slides that how the infrastructure facilities are good to run this system very nicely.

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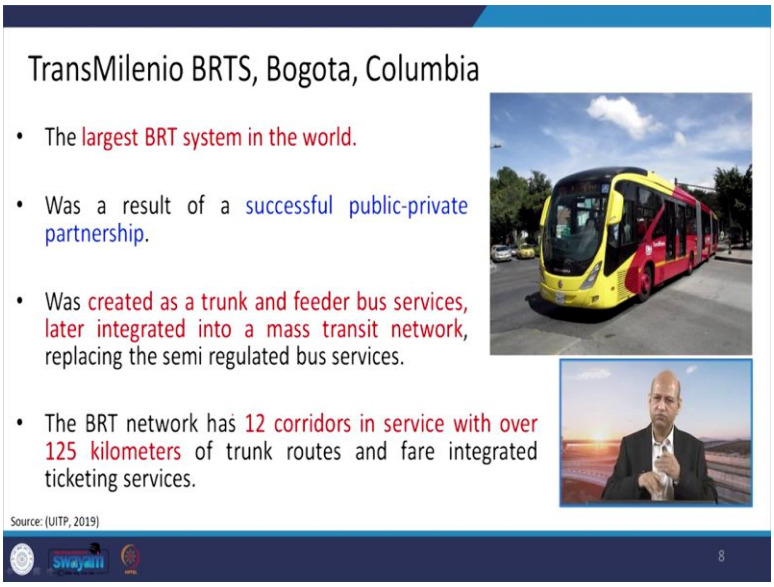

So, this is one of the largest system in the world, this BRTS system of Bogota, TransMilenio, and this is run by successful partnership for public and private collaboration, you can say. So, public money is also there, then private owners are also there. So, profit sharing, you can say, good advantage win-win situation.

And then there is very good feeder system, means last mile connectivity is also very good. It is not that you get down and then you are roaming around to wait for another passenger mode or some other transportation mode. You will find something to travel to your destination. And then there is very good integration of 12 dedicated corridors and it is running around 125 kilometers. So, that, that is a wonderful network of roads.

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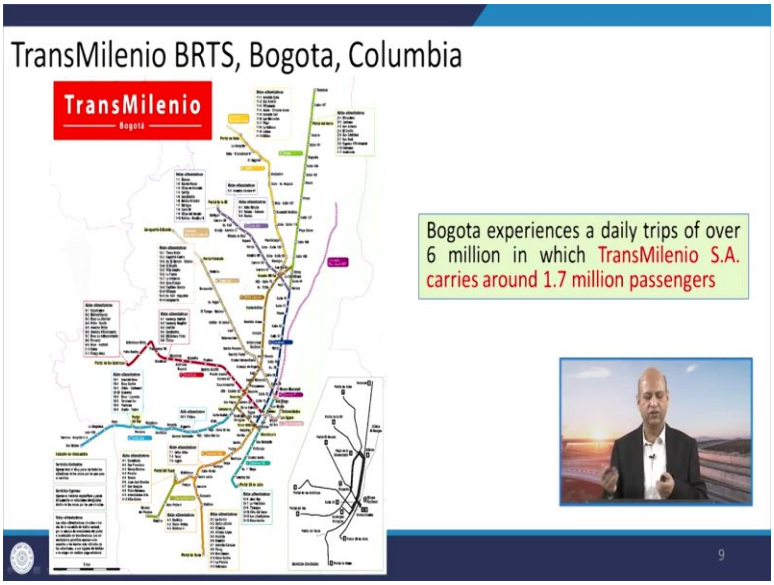

And that is shown in this picture, how they have been catering for different zones, whether it is industrial or residential and commercial, all these road network are catering for those particular accessibility points.

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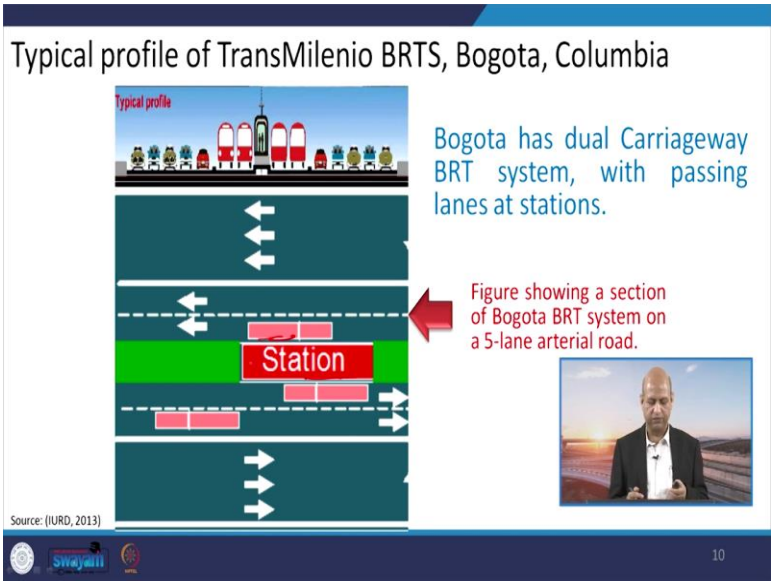

This shows how this dual carriageway system is run, like a station is there. So, both, both sides means, whether it is coming or going. So, on this side this is a platform where bus will come and passengers will ride here and on this side this is again one platform. So, in between this platform system is there.

And there may be like parallel platforms, maybe 3, 4, 5 so that a lot of, frequency bus, this frequently busses come, so they can conveniently take passengers or passengers can get down. And these are the 5-lane arterial roads, you can see. So, those are separate ones. And this dedicated lane for BRTS is separate one.

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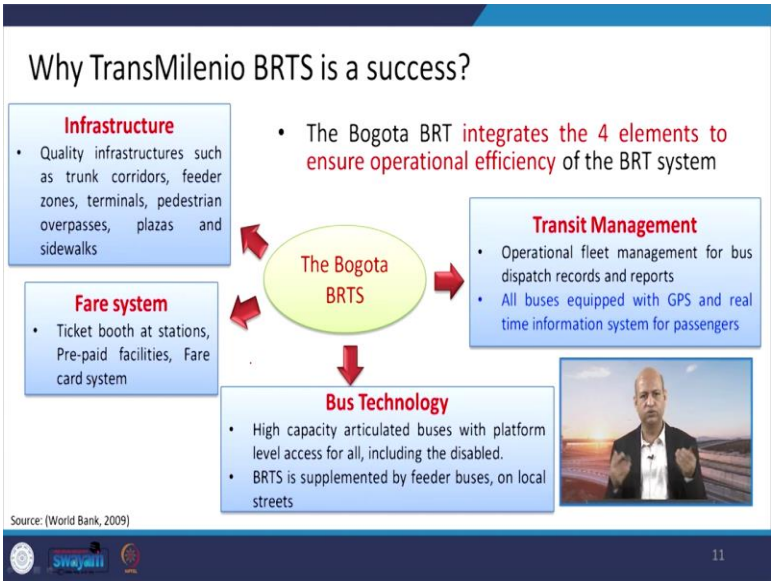

Now, we will see how this success story was built. So, there are multiple reasons of this, like infrastructure. So, quality infrastructure is there, road is very good, and feeder system as I said, it is very nice. Then for pedestrians, there is nothing problematic things, means if you want to reach to the station, so you have elevated pedestrian system or walkways, so that you can go comfortably to the station and you can get down and go towards other side.

Fare system. So, there are booths, and prepaid facilities are there, card system is always there. So, you can just have one card and you can recharge it periodically whenever this money is less in that card. And then this transit management, means this is equipped with GPS system. So, the centralized system knows where a particular bus is there. So, communication, constant communication is there. And also, people get SMS and that which bus for the, which station, what is the time gap, so that one can reach timely to the station. And then bus technology, means high capacity articulated buses are there. And all those last mile connectivity. So, these four very important elements are behind the successes story, building the success story of BRTS.

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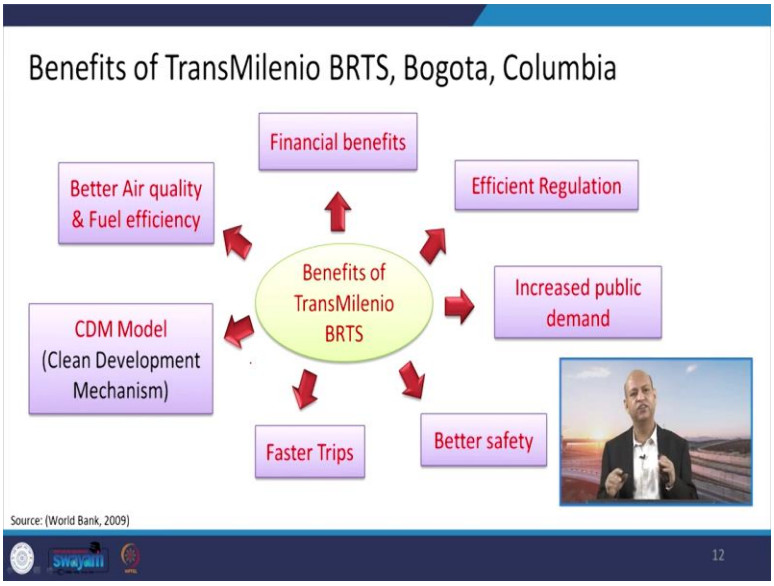

Then there are a lot of benefits which have been lived by these people, like financial benefits because everyone is benefited when you are having comfortable transportation system with investing less amount or spending less amount. So, it is financial benefits. Then efficient regulations, because, it is not like one regulation is there and implementation takes a lot of time. For example, if we say, like for CNG also, in Delhi so many times dates were extended, means ultimately the Supreme Court had to give the instructions that now we have to implement CNG buses in Delhi. So, such condition is not there.

Then increased bus public demand, means public demand, I mean public is demanding. It is not that public is not opting for this public transportation system. Because of the those very good reasons they also opt for this particular transportation system, better safety because technology is very good, faster trips, good speed is maintained, road network is very nice, and dedicated lanes there, there is no mixed traffic on that particular bus lane.

And then clean development mechanism, those CDM related fuel efficiency, all those engine related technologies they are using. So, better air quality and fuel efficiency are related to each other. That is also achieved. So, so many benefits, multiple benefits have been outcome of this BRTS in Bogota.

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Now, see the pictorial representation because visuals give, as there is a saying that one picture is better than the 1000 words of the story. So, you can see before implementing this BRTS system, how chaotic situation was there, lot of pollution was also there. See, the visibility is not so good. But after implementing BRTS system, see the buses and these lanes are clean and clear. And even, there is no air pollution kind of thing, no suspended dust, et cetera. So, very nice picture. This gives the idea about the implementation of this BRTS system.

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One section is shown, like how these cars et cetera they go on one particular side and they do not breach into the lane of the bus. And these buses are going on that side and this side. These are the platforms. So, both sides, people can get down or they ride the bus depending upon where they want to go. So, this is the dedicated lane. In between, these other platforms. And as I said, some platforms can be there like 1, 2, 3 in between, because some important stations are there we are a lot of people come or a lot of people go from that particular place. So, we need a number of platforms otherwise, otherwise congestion will be there. So, to avoid congestion we have to have more than one platform depending upon how many passengers are available there.

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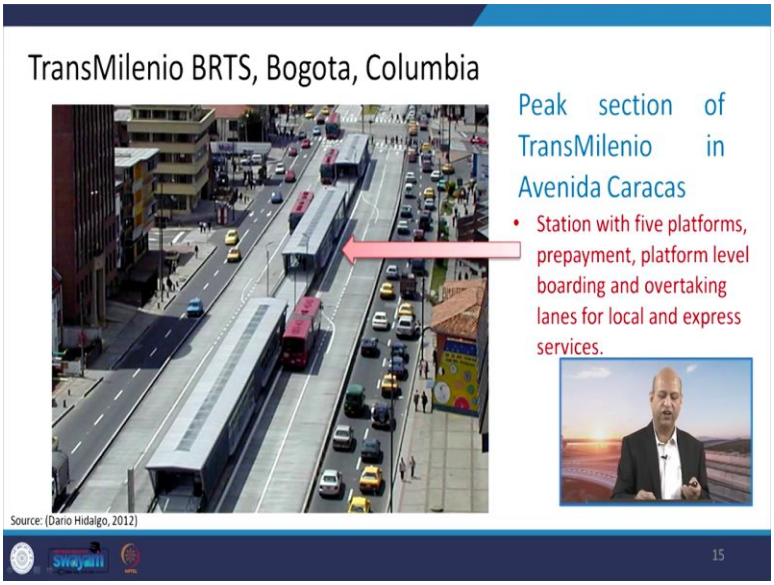

Now, see, the peak section means these five platforms are there here 1, 2, 3 4, 5. So, when a lot of traffic is there, or I mean lot of passengers are there, demand is there so GPS system is connected and this information goes, and then buses start to take care of those passengers.

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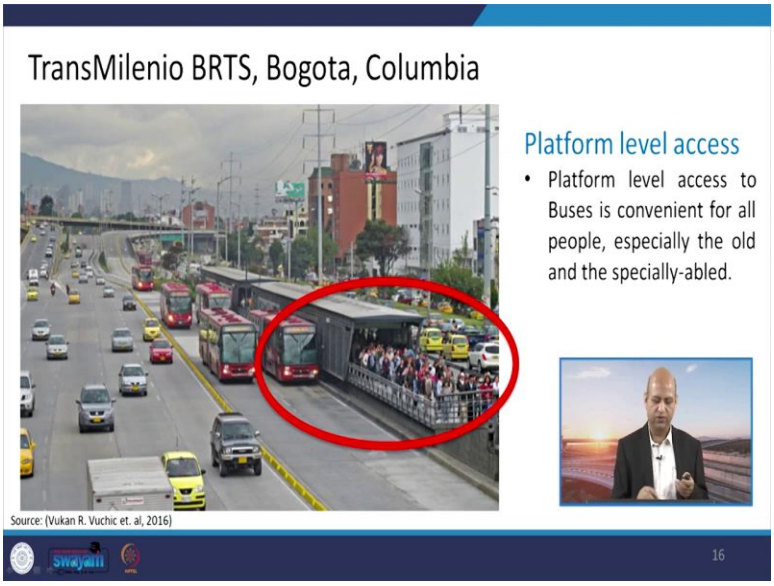

Like see here, if there is a crowd, you can have this GPS system and the information is there, more buses will come. At the same time if there are so many people, so they need the space, so that space must be comfortable and it should be adequate. Plus, even these especially abled people, they should be able to ride the bus. So, the level of platform at the exit or entry of the bus are the same. So, those kinds of things are there which can be seen.

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Then these are like one very good example because the two buses they can accommodate around 300 passengers. So, that means, 75 cars, means if we assume that one car is taking around two

passengers also, so one bus can replace 75 cars. So, so many cars, if one bus can replace, a lot of advantages in terms of like, less fuel is burnt, less emissions are there, air quality will be improved, and if people can travel by using that bus.

But again, there are other features like when you are having private vehicle, then you have a lot of freedom to travel from one place to another, and these buses have limitations because they will not go to every place where you want to go. Then you have to take another kind of mode of transport. So, there are issues but still, I mean for longer distances buses can be a very good option, provided they are very safe and comfortable and timely efficient, and also affordable in terms of ticketing.

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Now, you can see the city center, means pedestrian areas are there and only these buses are allowed, no other private vehicles are allowed. So, that is again one incentive for the people to ride the, this BRTS system. Otherwise, you can walk you can, there is no traffic condition, et cetera, except few cars, maybe some a special permit or so.

One is story is there, like in London also, some condition ticket or peak hours ticket was implemented otherwise lot of privately-owned vehicles were there and congestion, lot of pollution was there. And when this was implemented, a big ticket or large amount of fee then this discouraged lot of people to take their private vehicles. And so emissions were less and then air quality got improved.

So, similarly you can see this is quite clean site, and very few privately owned vehicles, only this public transportation system. Otherwise a lot of people are walking around.

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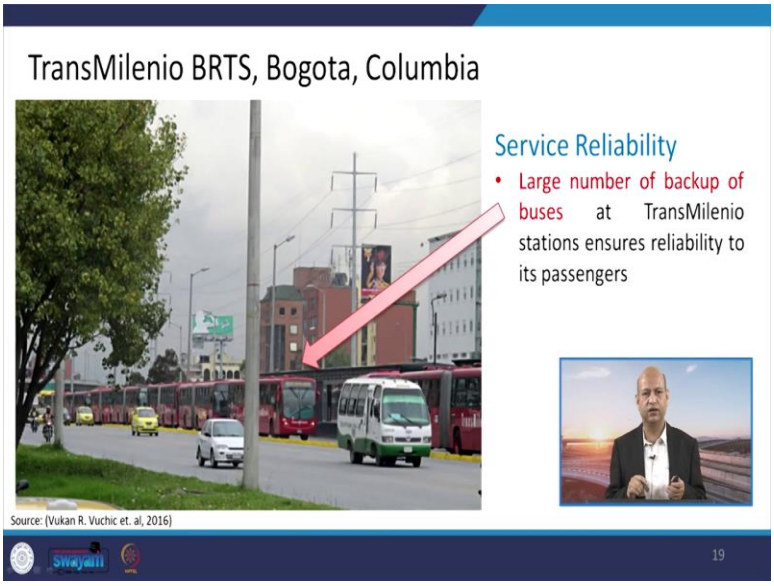

Then, a lot of buses are there, large number of buses backup system, means again, if you want to promote public transportation system, the demand must be fulfilled on time, means if people have to wait lot of, for so many minutes or hours, then it is not good thing, and next time maybe they do not opt for public transportation system.

So, if peak hours are there and lot of public is there at a particular place you should be able to provide adequate number of buses to cater those large number of crowd. So, those kinds of things are there. So, in, they have done very good planning, means how many passengers are there on the peak hour so how many buses we need. So, backup is there, means, of course, cost will be total but good, very good planning, means it is not that only some limited number of buses will be there and in peak hours crowd has to wait lot of time, that, that is not the case.

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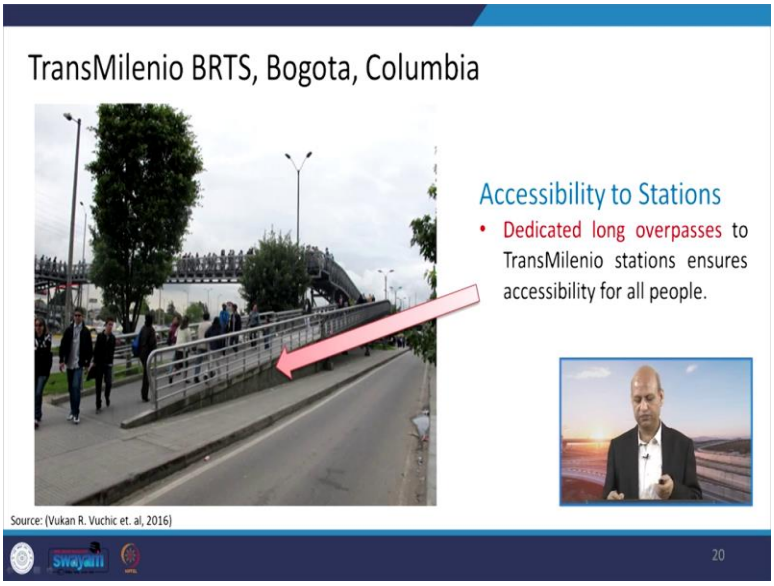

Well, dedicated long overpasses, you can see people can go and these are the overpasses. So, you not need to cross the roads which is busy lanes, or busy roads. And there are chances of accidents. So, safe movement is there, these pedestrian bridges are there and one can use easily for going from one side to another one.

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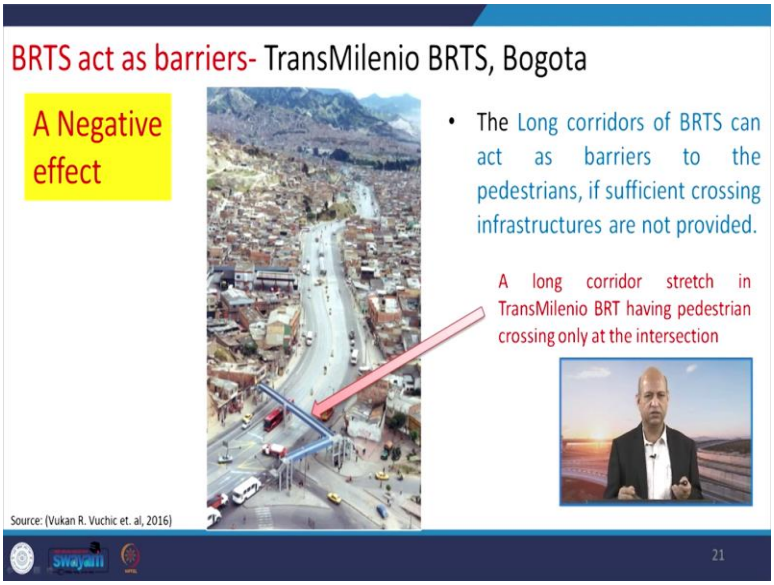

Of course, one negative impact is there of these kinds of facilities because for longer distances there are no crossing, and only at certain places where platforms are there, so those kinds of overpass are there. So, maybe, means these are the things which can be addressed on the demand

of the public on the basis of how many people are there for crossing at a particular place. So, some underpass or some other things can be added into the system and this is one limitation, you can say.

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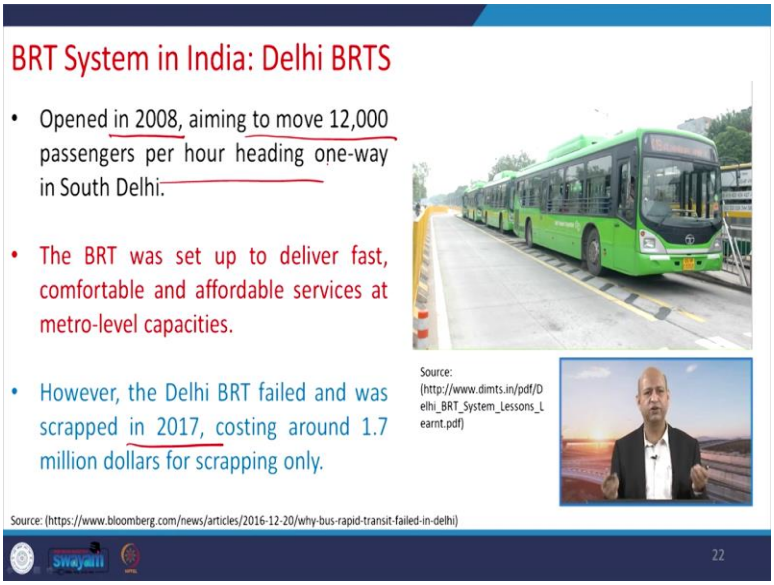

Now, we come to Delhi BRTS system, means it is not known a successful system, it is known as a kind of failure case, in a sense. So, why it happened so? So, that we need to know. What were those features which could not make the, this Delhi BRTS system a success story? We need to learn about this.

So, it was opened in 2008. And in 2017, it was tried for nine years, but there were a lot of issues, we will see in subsequent slides. And aiming to move 12,000 passengers per hour, this was the ambition. In South Delhi, this was one stretch, which was as an example or demonstration, it was tried.

But then, means ambitious goal was there but somehow after nine years it had to scrap, means a lot of resistance was there from many segments of the people. Some people say that it was also a kind of politics from different kinds of groups of the privately-owned vehicles or buses. I do not know much about that. But of course, the net result is that it could not pick up as it was aimed at.

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Well, you see, the when it was, means a, a stretch was dedicated for the BRTS system in Delhi, so all those privately-owned vehicles were packed in, in a remaining part of the road. This was a big issue. Public used to say that you have taken, means road width is not so much and out of that you have taken two lanes, and now we are left out with this very narrow lane, where every kind of vehicle has to move.

So, it was kind of crowding only, and a lot of emissions were there, time wastage and so. But I, I heard one seminar on this. So, one expert was arguing that the issue is that it is not the idea of BRTS to take care of other segments. They have to dedicate it so that people feel incentive to shift from other segment to the public transportation system.

But as you know, because privately owned vehicles in Delhi are in a big number. It is said that if you combine Chennai, Mumbai and Kolkata even then the total vehicle population in Delhi is more. So, I mean, that, that, that might be one issue that in that planning it was not taken into account or it was not taken as seriously as it had to be. That when you are taking one lane out of given roads then where this traffic will go? Do you provide the alternate routes, or what kind of planning is there? So, that might be maybe lacking or so.

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Anyway, so it led to the congestion, and sometimes then people, when they were frustrated, they even came to those lanes. And they went to BRTS lanes also, and it was a hospice kind of situation.

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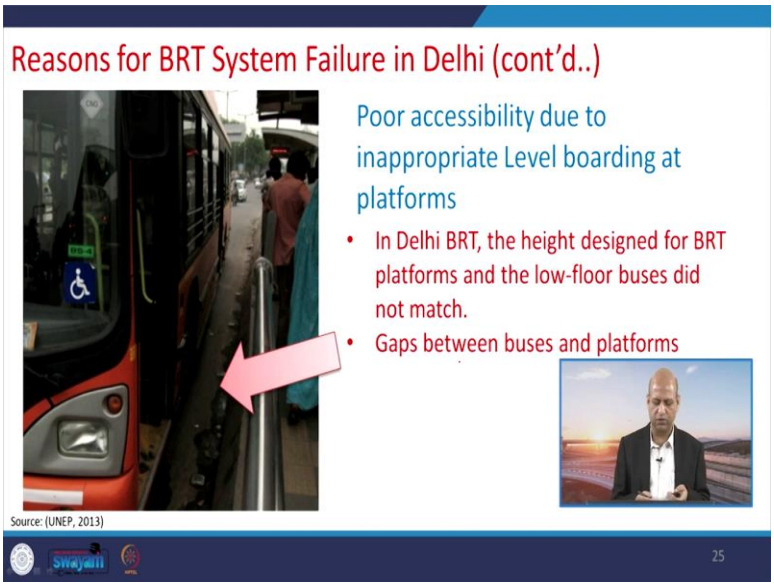

Also, there was not good planning of the platform. It is said that the low-level buses and the platform, there was a gap, and it was not so comfortable as it, it has to be. So, the accessibility was not so good as it was aimed for.

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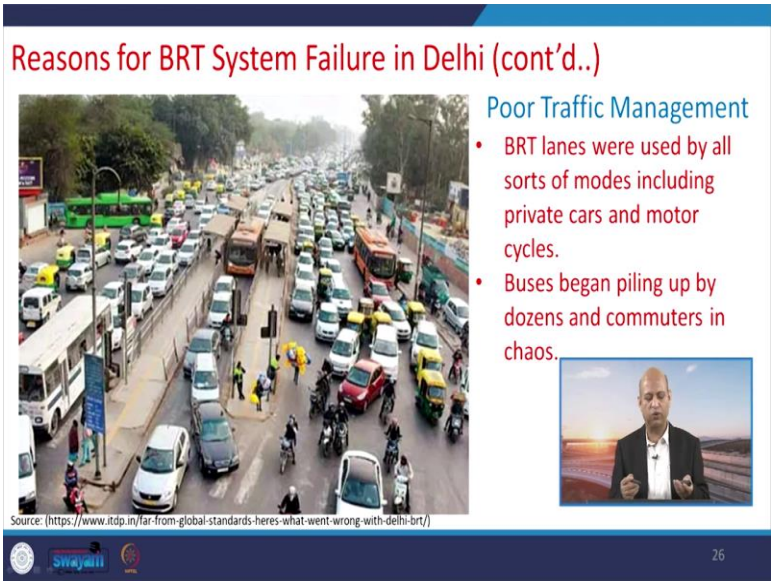

Now, you can see like privately owned cars and even auto rickshaws or other buses. So, they, when they did not find proper path, so they crossed from one lane to another and again these congestion related issues were there.

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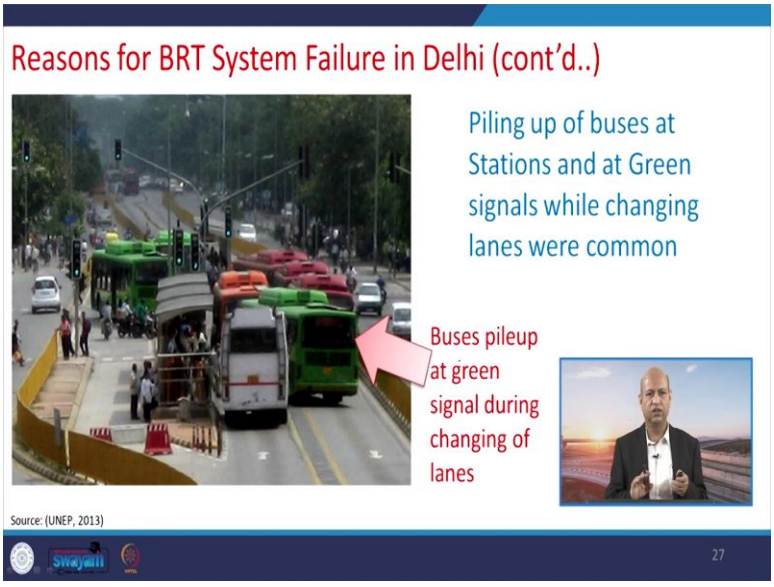

And buses got piled up at the green signal when they had to cross the lanes. So, it was not the properly planned dedicated lane. Otherwise, if there is a dedicated lane then the signaling also has to be synchronized in that way, that those buses need not to get into other lanes for crossing one lane to another one.

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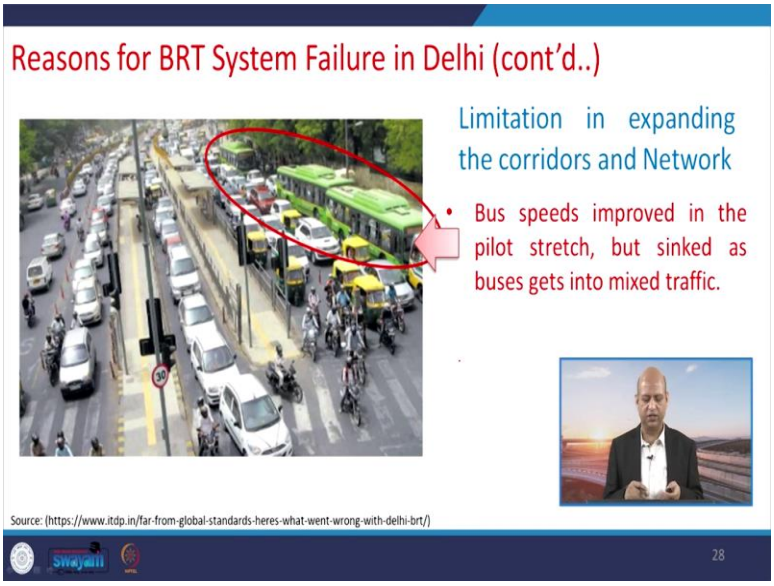

Well, so these are the limitations with got into like, congestion, as well as the reduced speed, and then mixed traffic. So, ultimately, means there was a lot of issues and it was dropped down that it was an idea that it will be for whole Delhi but it could not pick, but there is a search, success, success story of the metro. That is another story. Metro system is very successful there. So, but if there were, like if we could use BRTS as an even feeder system or so, that could be a good story, but somehow it could not pick up.

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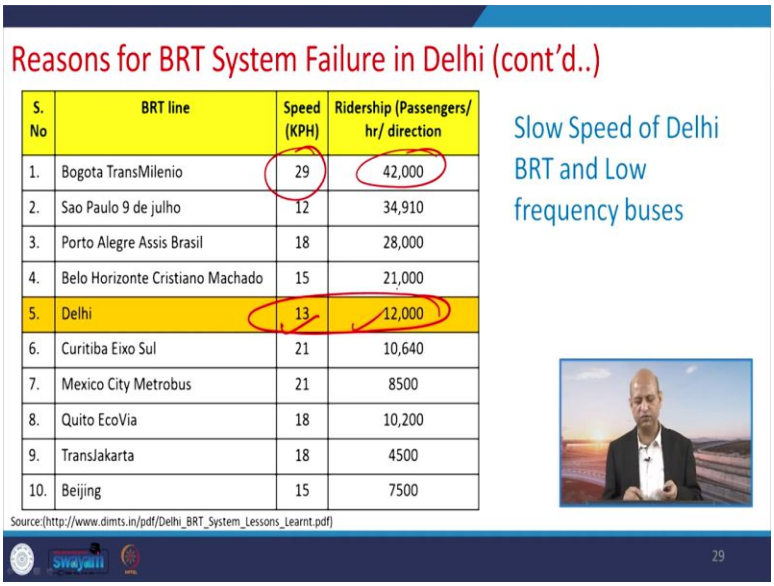

And also, one reason like, the speed. In Bogota 29 kilometer per hour, average speed and the ridership passengers per hour per direction around 42,000. In case of Delhi It was not more than 13 kilometer per hour and 12,000. So, means it was not so good and, you can say, it was poorly implemented and ultimately, ultimately even it results to a lot of accidents.

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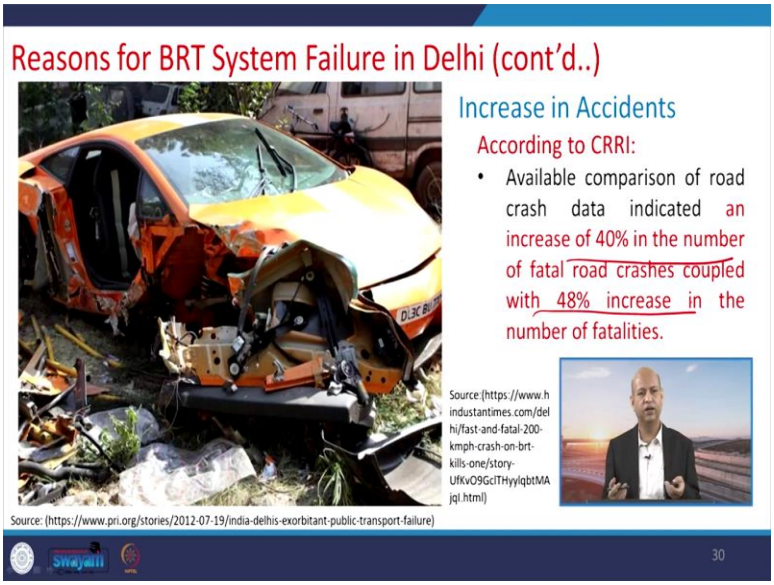

So, there were cases that around 40 percent increase in the number of fatal road accidents and 48 percent increase in the fatalities. So, that is again a negative part if, we are, we are going to provide the safe system and in place of it if we are getting unsafe system then it is not good for the society. So, all those issues were there, which ultimately gave idea that we should not go for this BRTS system in Delhi.

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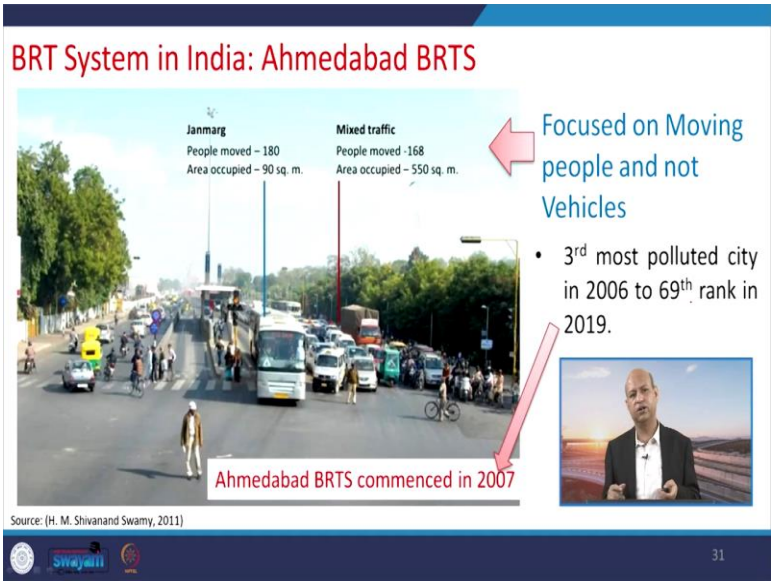

But success story is there, like for Ahmedabad. Now, we will see the difference between the Delhi's infrastructure system in terms of the roads, in terms of the platforms, or stations and other things. So, it will clearly give that what were the reasons of the failure of the Delhi case of the BRTS, and how other, means in the same country we are having the success story of the Ahmedabad.

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You see, the before this, the condition of the road and now you see nicely planned laid out payments and the lighting system, everything is very, very good. So, the better planning. It shows, means the pictorial representation gives a good feeling of the better planning.

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Then before this there was not proper, this circle, et cetera, and it was chaotic situation, people are going here and there. But here it is properly, this round is there and lighting system, signals everything is nicely planned.

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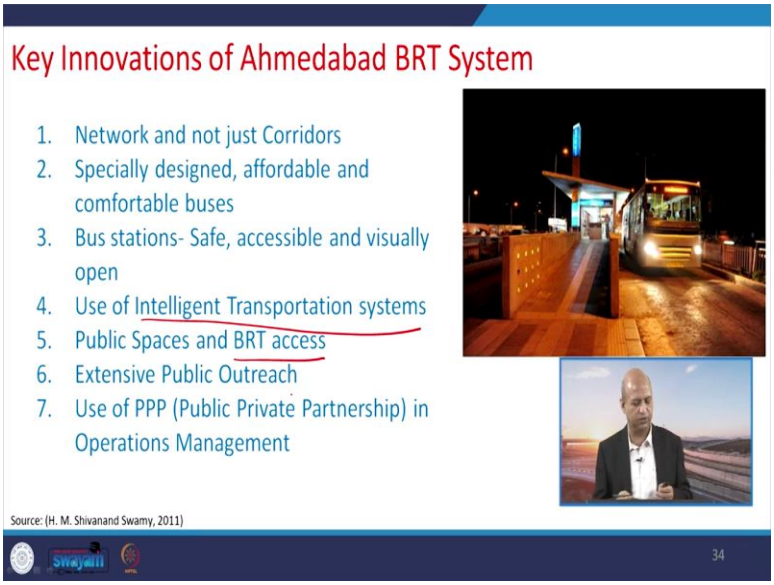

Then, network like network and the corridors, means, it is not only the corridors, one corridor you have given as a dedicated but, network is very important. So, in that sense, this Ahmedabad BRTS system is very good because it is connecting from one milestone to another, and one feeder system to another one in a good, integrated network way. Then, especially designed affordable and comfortable buses. In case of Delhi, means those usual low flooring buses were given to this BRTS system. That were not properly for design for BRTS system in terms of like platforms et cetera.

But in this case, it was taken into account that at which height platform will be there. So, is it the same height as the entry and exit doors of the buses or not. So, those were the specially designed and affordable buses which were given to the system. Then those stations were safe and accessibly visually open, the glass doors et cetera, means you feel secure in public place, nobody can do eve teasing or something like that. And then intelligent transportation system, this was also implemented. Again, the same like, GPS. So, you get real time information exchange.

And then public spaces, and BRTS access, they are also integrated in a nice way. And the outreach and awareness, lot of work done, we will see the pictorial representation of that. And public private partnership, again, here also like, Bogota. In Delhi case perhaps it was not so, but in this case again, public private partnership was tried and it was a success story. It is a successes story, rather than.

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Like regions, so when we are talking about these, so all kind of flat floor buses or semi-low floor buses, low floor buses they are shown. So, choice is there and properly designed buses were they are in this particular BRTS system.

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So, you can see it is completely transparent with glasses are used. Also, like both side ticket windows are there, and you do not need to wait when you are trying to board the bus. You do not need to buy the ticket. Like metros, you go, you get down and when you have to pass through that particular station, which is completely closed, so you have to pay the price for your journey. So, that ticket or that ticketing system is there. So, that is a quite efficient system in that way, you can see.

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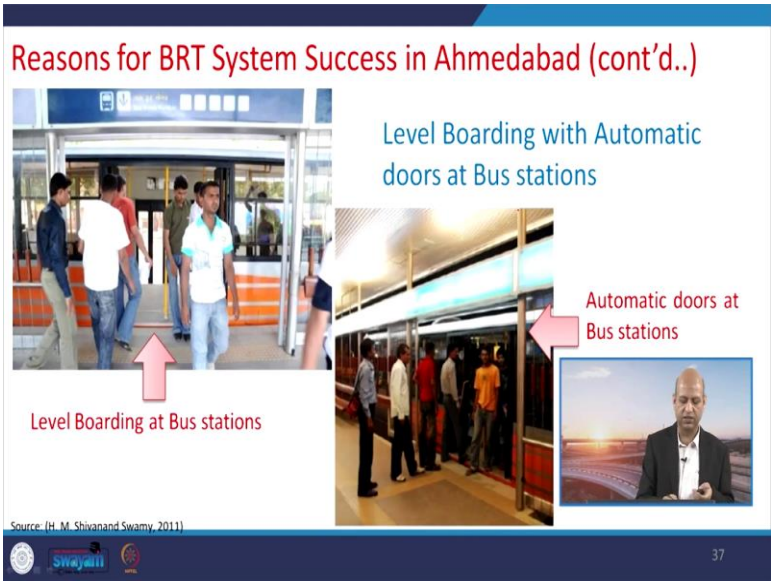

And then level of boarding is the same. So, it is quite comfortable for, and automatic doors are there at the bus stations. So, no hospice, and you have to be in queue and properly you can ride the bus.

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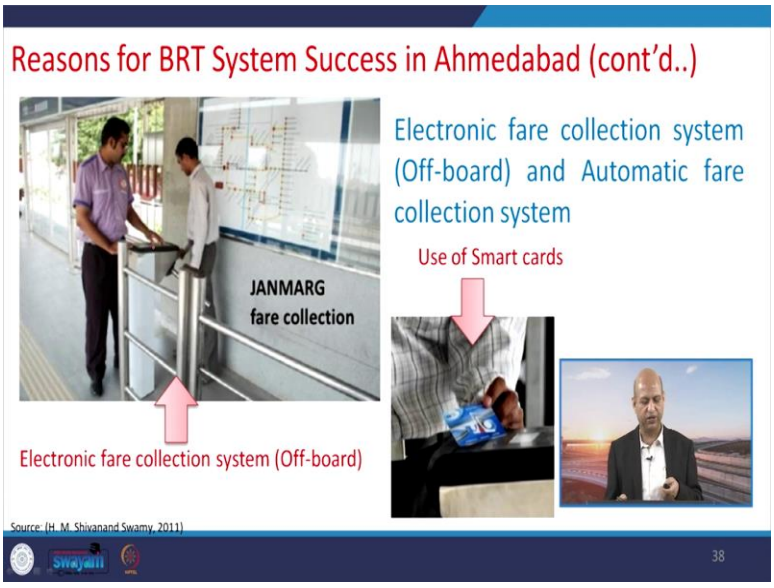

So, as I said, means once you get down then you have to pay. That means you do not need to wait for buying a ticket and then riding the bus, whether, when you are getting down then you have time to pay. So, electronic system is there, card system is there and other systems are also

in place. And people feel incentive when they are riding frequently. So, they buy these cards et cetera, prepaid cards.

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Also, like LED system is there at the station as well as in the bus. So, you, you know when you were station is coming. You do not need to ask anybody. And also audio system is there. That way, means again, it is very good connectivity of passengers and the, this bus system.

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Plus, this location system because of the GPS system where vehicle is there. So, centralized information is flowing.

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Pedestrians zones are there, and they are integrated with the, these BRTS stations. So, access is quite nicely done.

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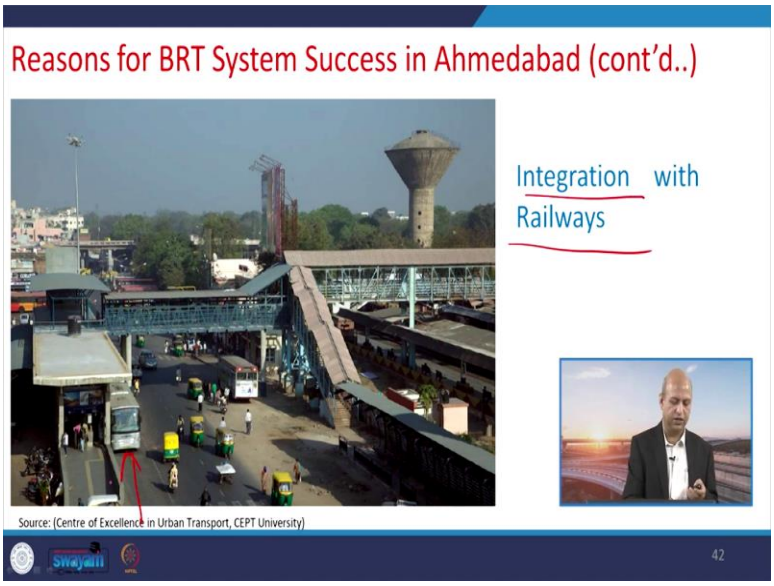

And you can see this railway stations integration, means buses are coming, this BRTS system is also there. You just get down, and you ride and you can go to the railway station. So, integration or interconnectivity is very nicely managed.

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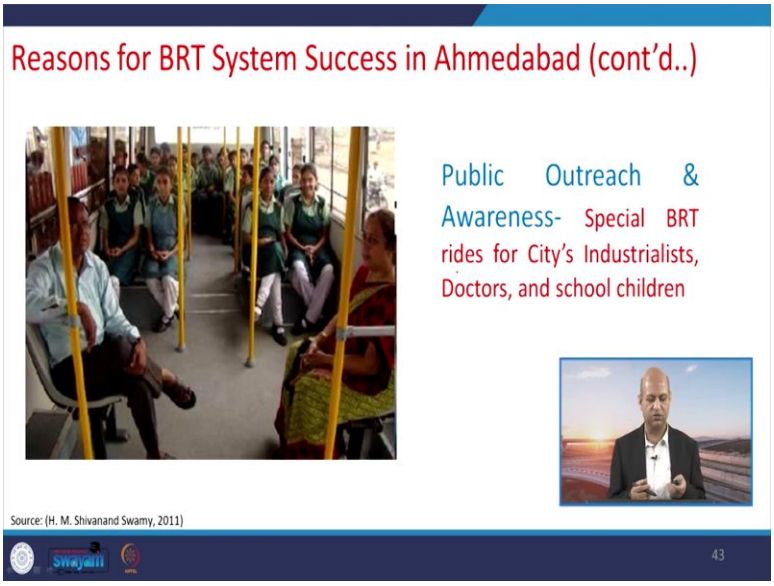

Lot of outreach and awareness, public awareness campaigns were done. So, many industrialists and top class people were invited, a, school kids were also invited to give them free ride and getting aware about the system. So, those activities were also planned. So, that contributed.

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Plus, like when you have something opportunity, means constraints, means there are constraints but you can use it as the opportunity. So, this is wonderful example. There is an existing canal, so both ways you can see BRTS system was built and the pedestrian system was built, lightning. So, it, it is a kind of win-win situation. When you are having this kind of land mass there. So, if

you build as an opportunity, so this is a one creative or innovation you can see integrated into BRTS system.

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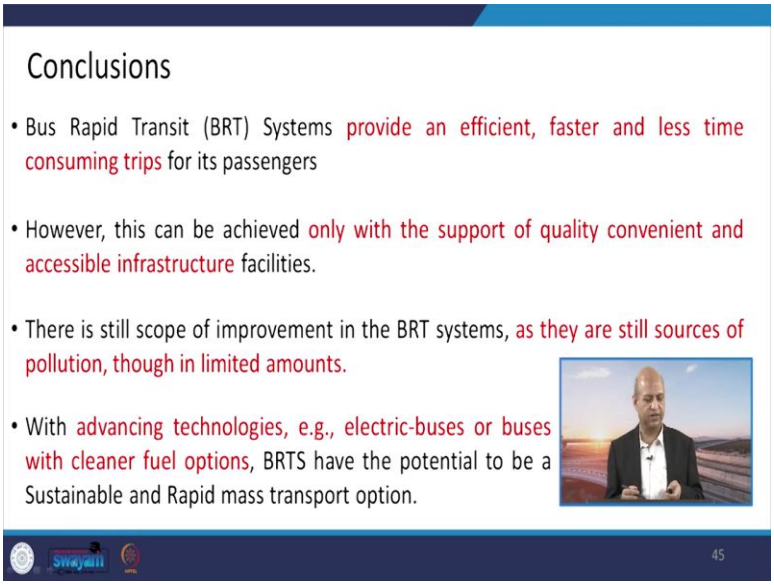

So, in conclusion, we can say that when we want to have an efficient, faster and less time consuming BRTS system, then we need to have good infrastructure quality infrastructure, and also integration of different feeder systems, plus that bus system, means the, that should be at par with the world class amenities, which passengers want to have in an economic way.

So, advancing technologies may be tried in future, like electric buses, so that even pollutions, which is still there from the buses, even if they are efficient, some pollution is there, exhaust emissions are there, so reduce it further, we can have electric buses or new, clean fuels are coming. So, those hybrid verses may also be tried. And that way in future we can have better BRTS system.

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And this is the references. If somebody wants to have more knowledge about those case studies and other issues related to BRTS, they can read these exclusive references. So, thank you again for your kind attention. And we will have more case studies so that you can learn about success stories of different kinds of sustainable transportation systems. That is all for today. Thank you very much.