Urban Transportation Planning
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Module No. #02
Lecture No. # 06
Conceptual Aspect Continued

This is lecture six on urban transportation planning. We will continue with conceptual aspects in this lecture after recollecting the essence of the previous lecture. You may recall that we started our discussion in the previous lecture with the clear understanding that the process of urban transportation planning is part art and part science. Then we try to understand the overall planning process in such a way that we take an over view of the different steps involved in the planning. We, now, know the first important step in the planning process is prediction of the horizon year land use pattern in an urban area.

Based on that prediction of the total travel demand, next important step is creating alternative solutions, alternative transport systems to meet the horizon year travel demand. Next, analysis of each of the alternatives, by studying their characteristic carefully while they are the operation. And finally, choice of the optimal alternative based on economic consideration. We will just check for the difference between the benefits and cost in each of this alternatives and choice the one which has got a maximum difference between benefit and cost.

Then we understood that systems engineering process can be applied for transportation system planning also. In that context, we will try to list the difference steps in the system engineering process starting from socio economic environment and so on. In connection with system engineering process, we define a set of important terms. First you define the term system, then environment, then we define the term in general goal. With understanding of the basic conceptual aspects related to these aspects we concluded the previous lecture, just check our self whether we have accurately recapitulated some of the points of the previous lecture.

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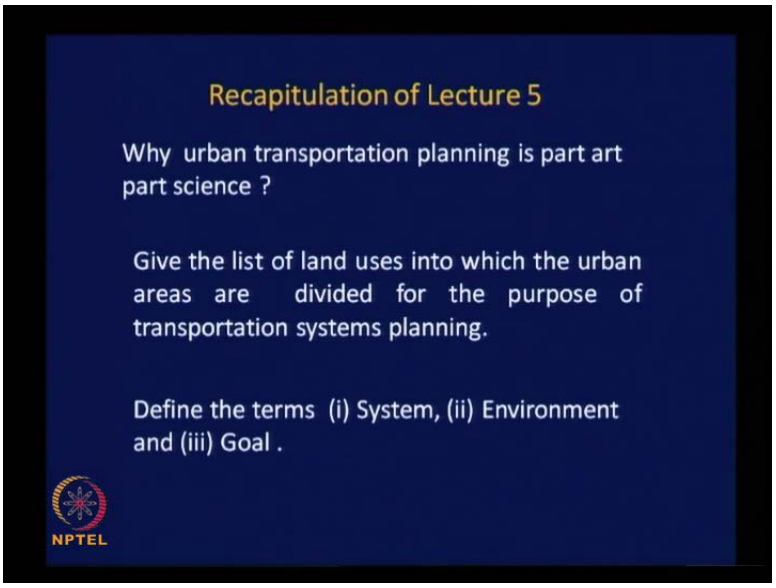

Let me just pose a few question to you. The first question is this, why urban transportation planning is part art and part science? Anybody? Why urban transportation planning is part art and part science? I think you clearly know the definition of art and science. Let me answer this question. Urban transportation planning cannot be done only based on scientific principles. The planner cannot just estimate the total travel demand and provide for the basic components of the transportation system namely the way, the vehicle, the terminal and the control.

The planner should give due consideration to the sensitivities of the urban dwellers on various issue; there emotional aspects, their intellectual likes and dislikes. All this aspects should go into the planning process. When these aspects are taken into account in the planning process, you cannot explain every decision taken in the planning process based on rational aspects, based on scientific principles. That is why it is going to be mix of consideration to the various likes and dislikes of the urban dwellers as well as application of scientific principles.

That is how we must understand urban transportation systems planning process to be part art and part science. The second question is Give the list of land uses into which the urban areas are divided for the purpose of transportation system planning?

Residential, recreational, industrial, agricultural, forest land then

Yes, institutional and so on. So, that is how we divided the urban land uses into different categories at a macro level to facilitate categorization of the urban land use based on the use to which they are predominately put to in urban areas.

The third question is very specific. Define the terms system, environment and goal. Anybody who can define the term system?

A system may be defined as set of components that is organized in a manner so as to direct the action of system in which they input towards specific goals in objectives.

Good. May be you have noted down the definition and reading out, nothing wrong. At least, others get the point and how do we define environment? because I will repeat the definition of system that give you some clue for the definition of environment. System is nothing, but, a set of components arranged or organized in such a manner given inputs it directs the output towards the set goals and objectives. That is how we understand the definition of a system. How do you define environment? Now, please.

Environment is a set of components which are outside the system, which influent the system and which in turn get in influenced by the system.

Good prefect. So, the definition of environment is this. It is again a set of components but outside the system which influences the behavior of the system and in turn gets influenced by the behavior of the system. For a transportation system what is the environment? In general you must understand the socio economic characteristic of the urban dwellers provide the environment for the transportation system. Trying the Input to the system comes out of the socio economic environments of the urban dwellers.

If there are more rich people there is going to be more input to the private vehicles or luxuries public transit vehicles. If there are considerable proportion of middle class people there is going to be more input towards the transits system right. So, the environment is nothing, but, the socio economic characteristic of the urban dwellers, the people right. Finally, goal. Anybody who can define goal?

The goal is the end towards which any plan tends.

Good.

It gives a sense of direction to the plans.

It is not exactly the end point. Do you agree with this statement? Yeah, goal is just a point towards which the plan tends. It is not exactly reaching the point and goal gives an expression of a desire in abstract terms towards which we continuously work to reach, but, very rarely we reach the end point of the set goal. That is how we need to understand goal and with this understanding let us proceed further and try to define the term objective.

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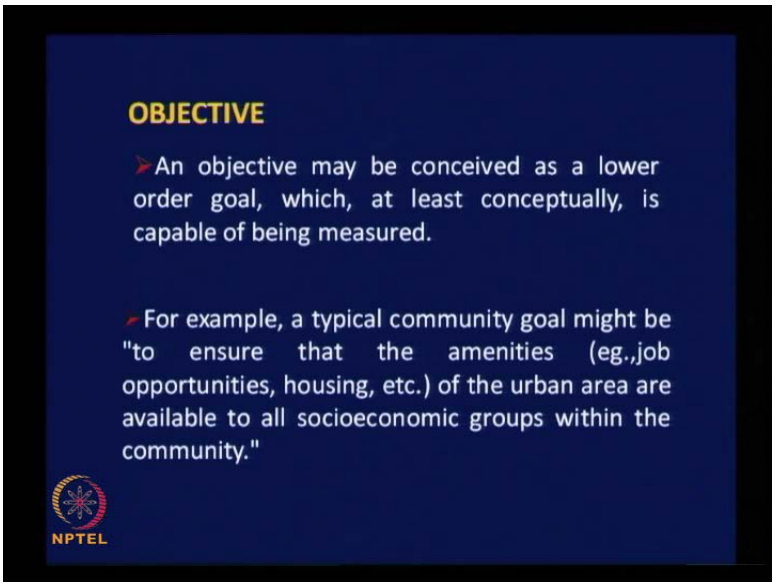

You may recall that as per as this course is concerned we decided to have different definitions for goals and objectives. In that context you must understand the definition given here. An objective may be conceived for understood as a lower order goal which at least conceptually yes capable of being measured. You will not be able to quantify and accurately measure but you will be able to conceptually have a feel of measurement of attainment of an objective. We will just start with example that we took yesterday.

In the previous class I said Sharmila telling that I would like to be a rich person could be a goal. Suppose Karthika wants to know little more precisely from her what exactly mean by I want to become rich? She might respond they saying that I would like to own a big bungalow, luxuries cars. Some additional input is there, but, still it is only conceptual. There is no quantification, but, there some clarity is added to the goal.

Suppose let say Rajashekar he says I would like to be a social worker or I would like to do social service. It is just a goal. Can you think of an objective for this goal?

Maybe he might say I would like to run an orphanage. Just an orphanage it is again correlated but gives little additional clarity to the goal. So, that is how you need to understand the definition of an objective. For example, a typical community goal might be to ensured that the entire amenities. Example, job opportunities, housing may be health facilities and so on. Of the urban area or available to all socio economic groups within the community, what is given here is the example of the community goal and we need to derive the objective. Is in it? That is what is given here the example given is.

Example, for goal can you think of some objective for this goal, related to transportation system planning process? This goal is common for any developmental work in the urban area it is a very common community goal, but, we must pick the relevant portion which is applicable for our planning process. Any suggestion? Yes please.

Widening of roads or may be increasing the number of density of road per square kilo meter.

Yeah, that is fine. These are very specific points related to infrastructure development.

At the planning stage we do not talk about the specific aspect related to the components of a transportation system. We just think of policy statements I will give you the relevant objective then probably you will be able to connect it much better.

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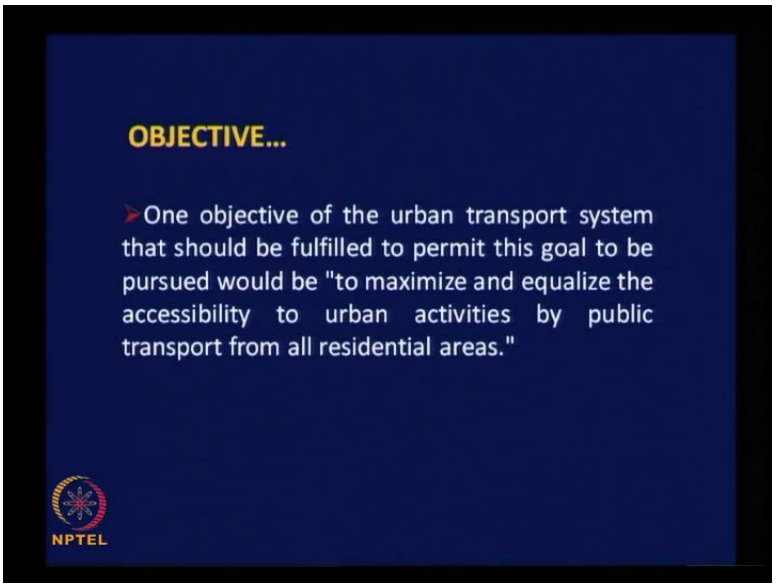

One objective for this goal is this, to maximize and equalize the accessibility to urban activities by public transport from all residential areas. So, highly loaded sometimes to maximize and equalize the accessibility to urban activities by public transport from all residential areas. Please go back and look at the statement of a goal where goal is to make what you ensure that the amenities of the urban area or available to all socio economic groups within the community.

That is a goal and the related objective is this to maximize and equalize the accessibility to urban activities by public transport. By Public transport is very important because we are concern with all socio economic groups including economically weaker section. That is why the words by public transport are here in the objective from all residential areas. Would you accept this as an objective related to the goal? It is just a policy statement similar to saying that I will own a bungalow and luxuries car or I will just run an orphanage, it gives an idea but still qualitative.

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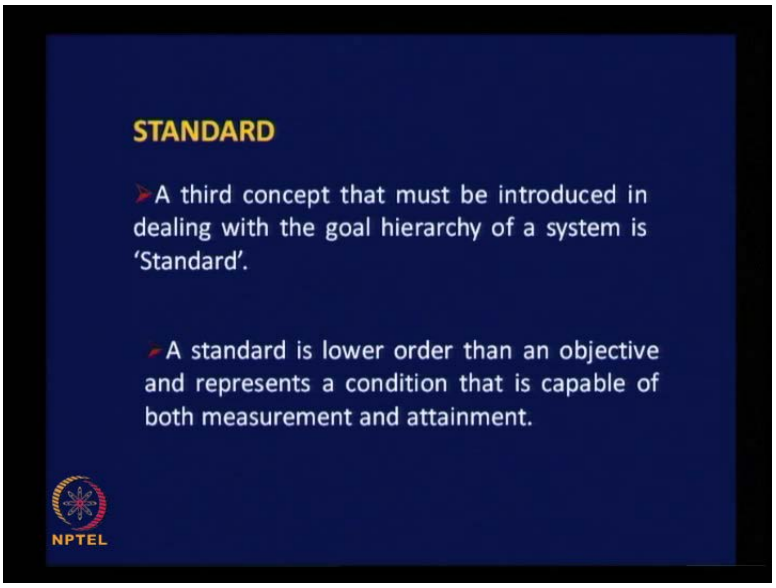

Your third concept that must be introduced in dealing with the goal hierarchy of a system is standard. Why third concept because planners will not able to work with only goals and objectives. They just give qualitative impression planners need to have some quantitative guidance otherwise they cannot find out whether there are tending towards a particular set point or not. That is why we need to go further and add more clarity to the set objectives. Let us go back to the two examples that we discuss.

General example, owning a big bungalow and luxuries car when she asked to add more clarity, Let say she says I would like to own a five bed room bungalow in a five ground plot and two Volkswagen cars. Now there are some numbers and clarity is almost 100 percent. What exactly she meant? Initially, that I would like to be rich is in it? You get all the information. Similarly, if other person says instead of just I would like to run an orphanage, if he says that I would like to run an orphanage at least having a strength of 30 mates, let say three zero, 30 mates.

Then, there is a perfect clarity and it is a complete statement. So, that kind of information has to be given. Finally, it should be quantitatively measurable.

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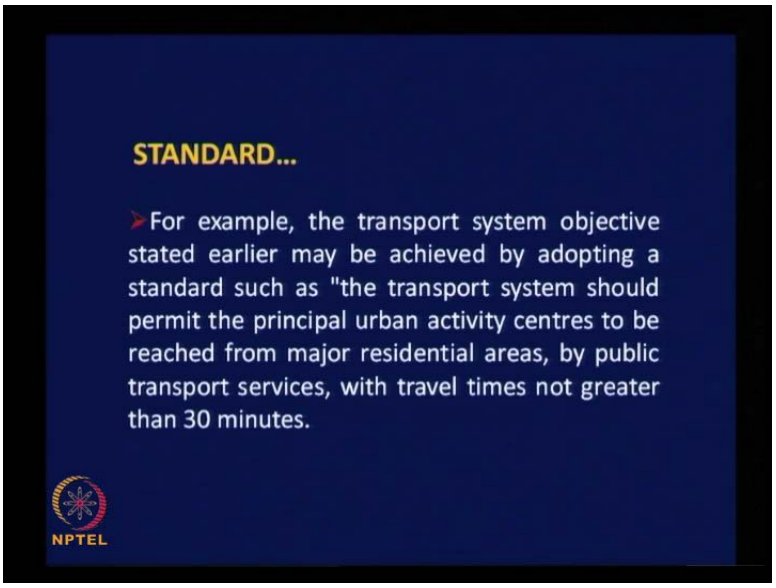

So, that is what we are meaning here by standard. Let us try to get some standard for the stated objective. A standard is lower order than objective and represents a condition that is capable of both measurement and attainment. Standard is measurable as well as attainable. That is tried to get a standard for the stated objective. For example, the transport system objective stated earlier. I hope all of you recollect this stated objective otherwise you will go back let us read the objective and get back this is the objective.

To maximize and equalize the accessibility to urban activities by public transport from all residential areas this is the objective. We are trying to get standard for this objective. Adopting a standard such as the transport system should permit the principle urban activity centers to the reach from major residential areas by public transport services with travel times not greater than 30 minutes. There is some quantitative aspect right. This is what we mean by accessibility to job opportunities and other activities to all sections of the society by providing good public transport service.

Now, introduce a quantitative term in regarding that it travel time should not be more than 30 minutes to reach out from home to any major activity center in a particular city or town. There is no sanity about the number 30 it depends upon the city or handling, it would forty or fifty or sometimes twenty two. One important aspect you understood is any standard should have some quantitative aspect. If the planner has got this kind of information then he or she will be very clear as to how to go about planning for the

whole system. There will be hundreds of standards given to the planner there is one example. So, planner can easily orient the planning process to meet all the set standards.

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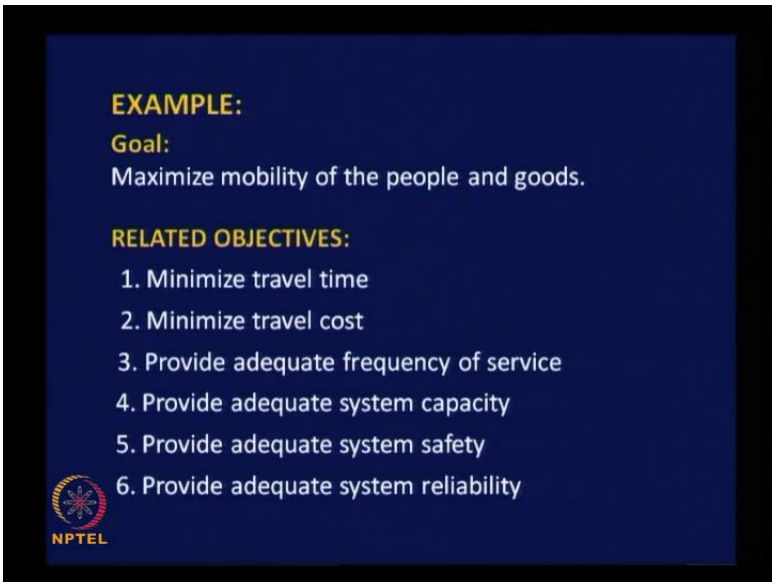

Now, let us consider one example with a community goal of this. Let us say the community goal is, maximize mobility of people and goods. This is urban community goal. Even though it is very specific to transportation still, in cities in urban areas where there is a major transportation problem of all kinds this could be one of the goals of the urban community itself. First, maximize mobility of people and goods. Let us do everything possible to maximize mobility of people and goods in a particular city or town.

So, it is a very general statement and it is just a statement which indicates the direction only. Shall we just try to develop a set of objectives for this goal? What are the possible objectives for this goal? Any suggestion? We just would like to maximize mobility of the people and goods. I will just give you one example then you will be able to get along the same line. So, we generally say minimize travel time make our modes faster. So, that mobility is made easier and people are encouraged to make more trips. It could be any mode any route.

It is very general statement minimize travel time and it is a minimize travel cost. See possible to minimize travel cost. In a private transport system it may be difficult because it depends upon the cost of operation, but, in the operation of public transit it is possible

to minimize cost to encourage people to make more trips by providing required subsidy by the government it is possible. So, by some means if you are minimizing travel cost then the level of mobility will increase. Is not it? There are other possible objectives provide adequate frequency of service.

You should not just run a bus once in two hours people will be waxed and then many may not make trips provide adequate frequency of service. Provide adequate system capacity. How to ensure that you are providing adequate system capacity? By knowing what is the strength of or the people how much people travel to that system. You can find the adequate capacity of the system. By knowing, or may be survey or through some other means we can find out the strength or the maximum number people traveling in that system which can give you average capacity of the system people traveling in system.

So, what you mean is, we should know the total travel demand on a particular route as well as the temporal spread of the demand or spread of the demand over the time. So, that we know the quantum of demand spread over time. Accordingly we can provide the adequate service adequate means what? Yeah, there should not be any passenger left out for non availability of this service. So, everybody should be able to get the service at the desire point of time on a particular route or on a desire route. Provide adequate system safety that is very important.

If your system is unsafe, some people who are concerned about safety may avoid traveling frequently. Why should I take risk? Let me stay at home. So, system safety is very important. So, if you want to encourage or enhanced mobility you must ensure we required level of safety the transport system of ration. Provide adequate system reliability. What you understand by the system reliability? It should be functional. We are talking about transport system reliability. How do we understand system reliability?

The system what we are using, the vehicle and all should be functional and should not break down frequently, should not break down, there should be proper maintenance on workshop, to cover up the and there should be some system to cover up in suppose some there is a some break down and additional should be kept in hand. So, that the immediately the demand can be meet. Spar fit should be available to make a phone. They

unexpectedly break downs. That is one aspect of reliability. Even maintaining the schedule correctly makes the system reliable.

If the schedule is not maintain, if a bus is a excepted to be at 5 PM at a particular bus stop, if the bus arrives at that time then the bus service is reliable. Instead of 5 PM, if the bus arrives by 5.30 one day and 5.10 another day 5.20, 30 day then, the services are not reliable. It unnecessarily puts the travels into discomfort. So, that is also very important aspect related to reliable. Maintaining schedule providing break downs as we point it out and so on.

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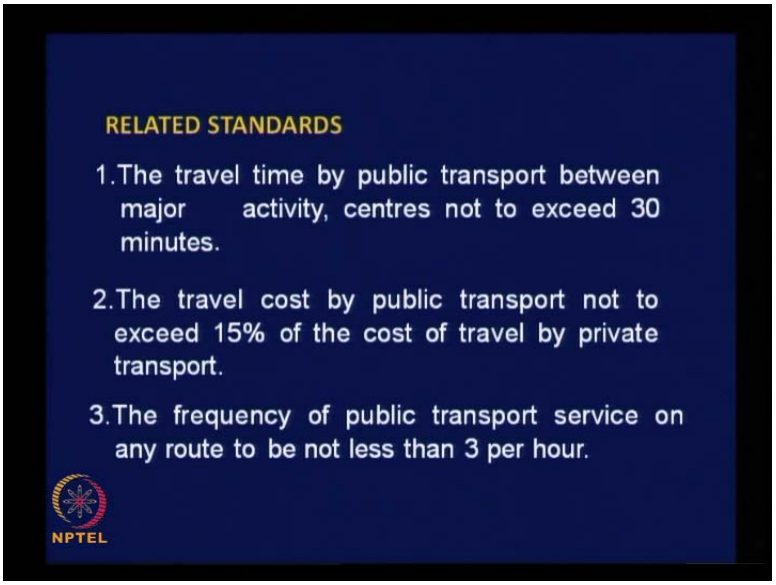

Let us try to list the related standards, for at least one standard for each of these stated objectives. The first objective you can go back and look. First objective is to minimize travel time. Anybody who can give a standard for this objective? Minimize travel time. There are several possible days only clue is you must introduce some number into it and still it should be policy statement. It should not be partnered to specific aspect I will give this as an example.

The travel time, by public transport between major activities centers not exceed 30 minutes. It is a general policy statement still contains some number as a specific guideline for the planners. So, this is how you must derive standards for a stated objective. Can we think of standard for this second objective? What is the second

objective? Minimize travel cost. You may recollect minimize travel cost was objective number two.

For kilometer for traveling in a bus should be less than two rupees over.

Less than two rupees that is fine. When you give some numbers related to fair in absolute terms that may not be valued for a long period of time due to inflation and so on. We are talking about planning for two decades. So, our numbers should be reliable numbers which can be referring to as guidance for the entire planning period. So, in that context this may be a standard for this second objective. The travel cost by public transport not to exceed fifteen percent of the cost of travel by private transport. Whatever may be fluctuation in the transport cost, we are just giving a comparative value.

Travels will be traveling by private and public transport modes. See that, the cost of travel by public transport is not more than 15 percent of the cost of travel by private transport by car for motor cycle and so on. This will stand the time period that we consider. What is the third objective that we considered? Will go back provide adequate frequency of service will try to recollect the fourth one also provide adequate system capacity. What is the objective that we purpose for third objective? This is the one which will be more appropriate.

The frequency of public transport service on any route to be not less than 3 per hour. You can understand that we are giving some limiting values. That is what is required what is the minimum standard we except out of a public transport service, has to be made very clear to planner. So, planner will know that somehow there should be free services made available on any route per hour. That will guide us to work out the flit requirement and other operational details later while you implement the scheme.

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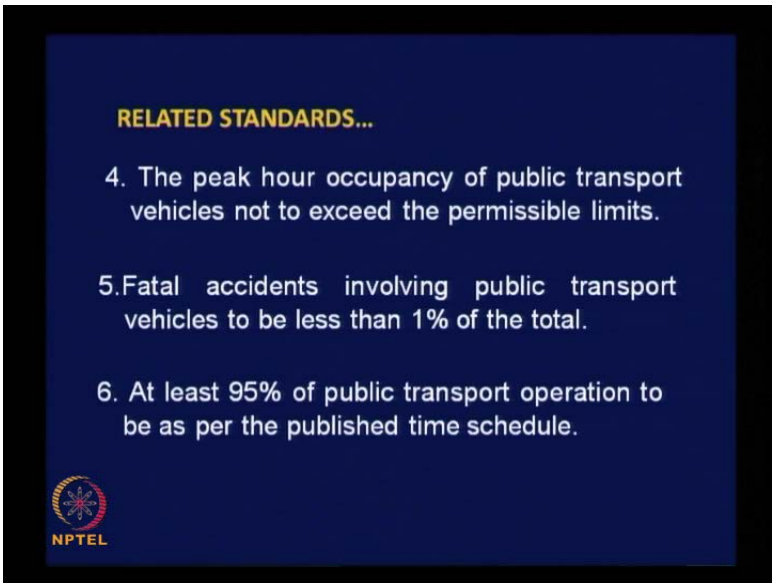

The standard for the next objective about capacity. It is very difficult to give exact numbers I given a statement, but, still it gives you indirectly a number. The peak hour occupies public transport vehicles not to exceed permissible limits. Why I have not given numbers? Because, for a period of time bus size may change, capacity of bus may vary, but, our concern is about the capacity of system. If you ensure that even during peak hour the capacity is not exceeding the permissible limit in any vehicle then you are providing adequate capacity.

Let say 25 percent seated and 20 standing totally 45 in a bus service. So, at a particular point of time for any bus it demands should not be more than 45 that is the meaning. So, this case care of the possible changes in system characteristics still provides you with some number and next, what is the next objective that you are listed? Safety and it is a difficult very difficult to give a standard for safety because safety itself is a qualitative or complex issue. Safety of course, related to accidents. Accidents involving properly damaged, minor injuries, major injuries or fertilities or combination of all and how to give a number related to level of safety?

Let us try out and see what can be done. This is one possible way of providing a standard regarding safety. Fatal accidents involving public transport vehicles to be less and one percent of the total. How do we get this number one percent it should be based on the past record? You may have accident record and you may have comparison of the

accidents involving public transport vehicles and total number of accidents. You just try to improve the system to the extent possible and fix up some number like 1 percent or 2 percent. This would be very clear standard for planning purpose.

Then, reliability this is how we can fix a standard for reliability. At least 95 percent of public transport operation to be as per the published time schedule. This is the most important aspect. What happens today to the public transit uses, particularly, bus transit uses in our citizen towns? When you go to bus stop do you have the schedule of operation of the buses displayed in the bus stop? No. You do not know which bus will come at what time. No information, no documentation available in the bus stops. In my opinion this is a very basic requirement for the travels to understand the operation of the transit system.

When this itself is not provided we can say that the level of service provided by the transit system is very poor. This implies that we are yes tolerating the very poor service provided by bus transit system and the whole of our country. I am not heard about this kind of schedule being displayed at bus stops in any city, so far. I will just give my experience in using bus service when I use to visit Germany. This kind of display used to be there at every bus stop. There will be dynamic message sign indicating even possible changes of times in major bus stops.

Minor bus stops will have clear display of the schedule of operation of busses and all the routes. There will be one schedule for the period from Monday to Friday, Saturday another schedule, Sunday different schedule. I was regular a bus user to go from my place of the state to the university. I have never found bus service to be deviating the schedule time by not more than or more than just a minute. There could be variation of a minute between the schedule time and the actual of arrival of departure of a bus. I used to get astonished as to how this people are able to maintain such prefect schedule of operation.

Whereas, in our case we are unable to of course, there are reasons the bus operator say that our roads are not reliable. They get suddenly congested due to various reasons processions or passing of v I p as through a particular road. All this things caused delay to traffic, but, in spite of that taking all this various in the account still, if you look at the reliability of bus operation in our country is very poor. The services are very poor right.

So, that is what is meant here, the planner should aim for such a reliability level. At least 95 percent of public transport operation to be as per published time schedule. Let us take another example to rain force our idea of goals objectives and standards.

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Let us take quite common community goal of reducing air pollution. Major metropolitan city is experienced today in our country suffocating air pollution level; injurious to health so; obviously, this will be a very important community goal reduce air pollution. You have to come out and tell me what are the possible objectives for this goal are in transportation system planning process? We need to reduce air pollution. Please understand urban transportation is about moving people from origin to designation and not about moving vehicles.

It is about moving people and not about moving vehicles. That is how your planner has to understand the transportation process or urban travel. This is clue for your answer. That is now; fix an objective for this goal.

They use of non motorized transport.

Encourage use of non motorized transport, good. That is very important objective very relevant for this goal. Any other objective?

Could be to increase the percentage of people by a certain laid down percentage who are using public transportation. For let say daily communicating to work.

Good. Encouraging people to make use of public transport vehicles providing par ten age for public transport. I think, a two objectives are made very clear by you and. So, let me list them formally, Maximize usage of public transport modes. Using public transport, you can carry more people with less number of vehicles which will result in relatively less air pollution. That is how; this is related to the goal of reducing air pollution and then, Encourage use of non-motorized modes of transport which is totally pollution free. Now, we need to identify a set of standards need not be only one standard, there could be a number of standards for a single objective.

Let us try to derive as many standards as possible for the first objective namely, Maximize usage of public transport modes. Can you come out with some ideas? Maximizing usage of public transport modes, some standards?

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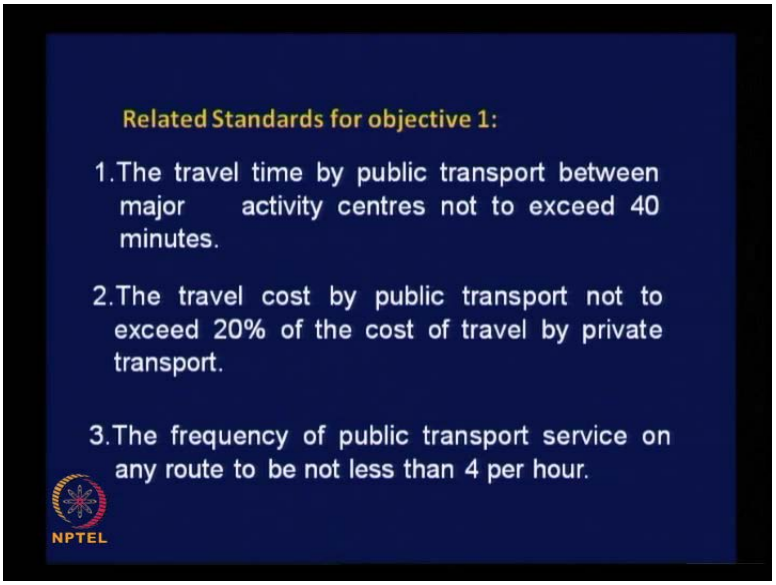

Yes, it is already known to you the travel time by public transport between major activity centers not to exceed 40 minutes. Let say this enhances the level of service of public transport this implies that we are encouraging use of public transport is in it and I will just follow the same sequence as we did in the previous case. Then about travel cost, the travel cost by public transport not to exceed 20 percent of the cost of the travel by private transport. I given you different numbers here to make the point that it is not necessary to just add scientifically any number.

It depends upon the situation. Third, the frequency of public transport service on any route to be not less than let say 4 per hour right and fourth, all this standards are related to the stated objective of encouraging public transport.

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Fourth, the peak hour occupancy of public transport vehicles not to exceed the permissible limits. Occupancy means, number of persons sitting in a vehicle is occupancy that should not exceed the permissibility limit. Then fatal accidents, to make these public transport safe fatal accidents involved in public transport vehicles to be less than two percent of the total. Why we are concerned about only fatal accidents? Because, it is fatal concerned with life.

So, that is how we need to understand the important of relating safety with fatal accidents. At least 90 percent of public transport operation to be as per the published time schedule. That is about reliability of operation.

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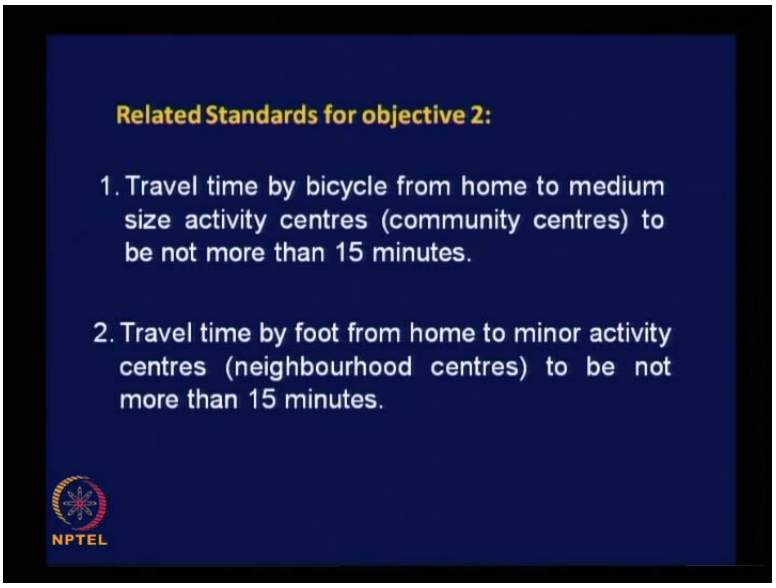

You can realize now that these standards are equally applicable the previously stated objective right. So, if you look at carefully all this standards and objectives are oriented towards encouraging public transport modes. If you want to provide equal opportunity for urban community of all economic groups and if you want to reduce the air pollution as we have stated here, the only way out is encouraging public transport service by fixing standards as we have listed now.

Now, let us try to identify a set of standard for the second objective, encouraging non-motorized modes of transport in the urban context. You can understand bicycle and foot as the popular non motorized modes of transport. How do we encourage bicycle? Encouraging non motorized mode transport, we must give a policy statement, we cannot say just provide five meter wire bicycle track along major traffic. That becomes a detail implementation guide line; it should be a policy statement. I understand it is not that easy we must first understand typically or ideally land use planning and transport planning should be done simultaneously.

Some standards may have linkages with land use planning also. Even though they standards for transport system planner that may have some linkage with land use planning process. This is a typical example; the possible standard for the stated objective is this. Travel time by bicycle from home to medium size activity centers medium size commercial area. For example, middle schools, elementary schools, some day to day

service centers. That is what we need to understand by medium size activity centers to be not more than fifteen minutes. One should be able to ride a bicycle for fifteen minutes and reach out to most of the medium size activities to satisfy their day to day need.

So, it is related to the location of activity centers as well as profession of one component of the transport system namely the right path way connectivity between home and the nearby activity centers. So, this is the simple policy statement still provides a clear cut number for the planner to understand clearly what is mean by this particular statement. Then, Travel time by foot from home to minor activity centers, neighborhood centers whichever at walk able distance to be not more than fifteen minutes. Any, minor activity should be able to access with not more than fifteen minutes of walking.

So, this is again a guide line provided simultaneously both to the transport system planner as well as land use planner. That is how you need to understand the standards for this particular objective of encouraging non-motorized modes of transport. Now, let us try to summarize what we have discussed in this class. We extended the previous class discussion to understand and define the term objective and then, we define the term standard. Then, we took an example of urban community goal and try to list a set of objectives first and then try to list set of standards.

Now, we are clear that unless the planning process gets the guidance from the urban community goal, the planning process will not be successful exercise. You must look at the document giving the urban community goals. There could set of goals pick the goals that are relevant to transport system planning, list those goals. Then list the objectives related to each of this goals respect of transport system planning. Then try to derive standards in cooperating quantifiable numbers. So, that ultimately you have a set of standards for each of the objectives which are co related to each of the goal of the urban community.

That is how we need to understand the guidance that we need to provide to the transportation system planner. With this we will conclude our discussion for today. We will continue our discussion the next lecture.