Urban Transportation Planning
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Module No. # 02
Lecture No. # 05
Conceptual Aspects

This is lecture five on urban transportation planning. We will discuss about a set of important conceptual aspects related to the planning process in this lecture. Before we proceed further as we normally do, let us try to recollect what we did in the previous class. You may recall first we tried to understand that the effect of the growth in the travelling intensity which can be seen in the feel is in the form of traffic and transportation problems in the cities and towns. We also realized planning is a prerequisite to provide solution to these problems.

Then we tried to understand the definition of the term planning and then we went on to look at the contents of the course. Now you are clear that this course will be covered under ten different topics. Finally, I gave you a set of eight reference books and you also know now which are the chapters in each of these books are relevant to this particular course. Still, to make our self very clear, to make our self sure, that we have really recapitulated the important aspects of the previous lecture.

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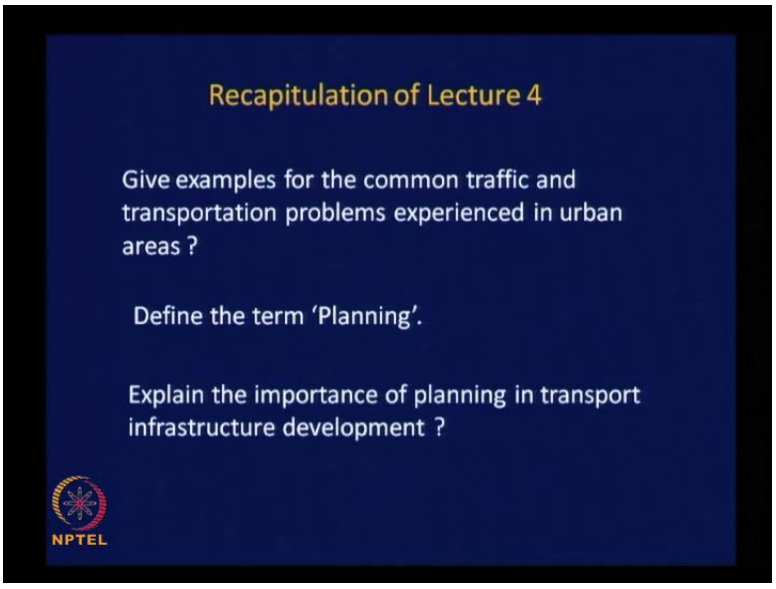

Let us post a set of questions as recapitulation of lecture four and try to answer these questions. The first question is this. Give examples for the common traffic and transportation problems experienced in urban areas?

The problems are traffic congestion, lack of mobility, accessibility, disconnection in transportation problems, crashers and injuries that is all, sir.

Good. These are the common problems that are experienced in urban areas. Traffic congestion, lack of mobility and accessibility, disconnected transportation modes operating in urban areas and the problem of traffic safety involving crashers, injuries and fatalities. And the solution to these problems as we realized is planning; appropriate planning before trying to solve these problems.

The second question is this, define the term planning? Planning is a scheme to accomplish a particular objective, to put in more precisely; planning is a process of preparing a scheme or program to accomplish an objective beforehand. That is what we mean by planning.

The third and last question is this, Explain the importance of planning in transport infrastructure development. Any response? May be I will answer this question. Any infrastructure developed in transportation system has to meet the demand for transportation over a long period of time, may be for about 20 to 30 years. To get the basic input for the design and construction of these infrastructural facilities, we have to have some idea about the total traffic that will be making use of such facilities in future. This information can be obtained only through comprehensive systematic transportation system planning process. That is how transport system planning is very important in the provision of transport infrastructure facilities, clear. With these questions, let us pass on to the conceptual aspects related to this course.

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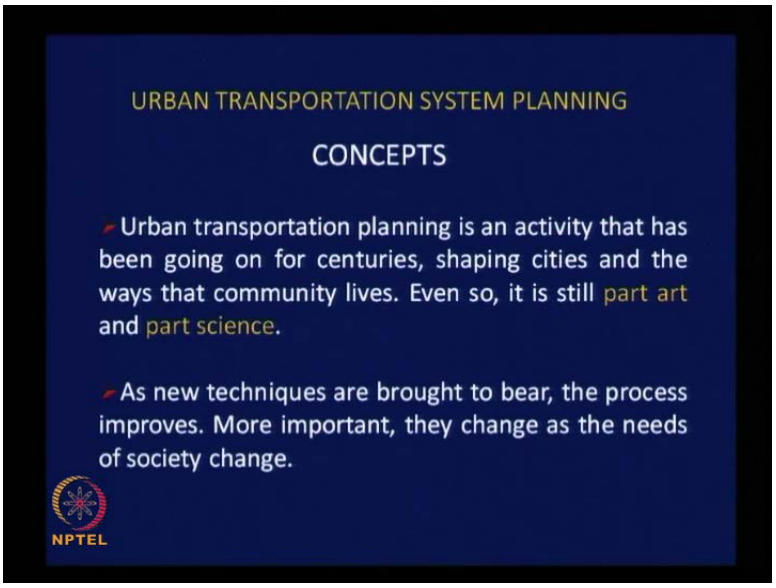

As, you might have perceived, urban transportation planning is an activity that has been going on for centuries, shaping cities and the ways that community lives. Even so, it is still part art and part science. You may also recall transportation as a process, is as old as the civilization of human being, but, here we are talking about transportation. Planning this has been going on in the civilized human society for centuries shaping cities and towns, but, still it is evolving. More important it is part art and part science. Why it is part art, part science?

Because transportation planning is for people who are living in the urban areas, the behavior of human being cannot be fully explained using scientific principles and we have to take into account human behavior also in meeting their travel demand. So, unless you treat this process partly as art and partly as science you will not be able to satisfy the need in terms of mobility of urban dwellers. Later, we will see little more detail about the terms art and science. Of course, as new techniques are brought to bear the process improves more important, they change as the needs of the society change. That is the most important aspect. It is a changing process because the needs of society changing on a continual basis.

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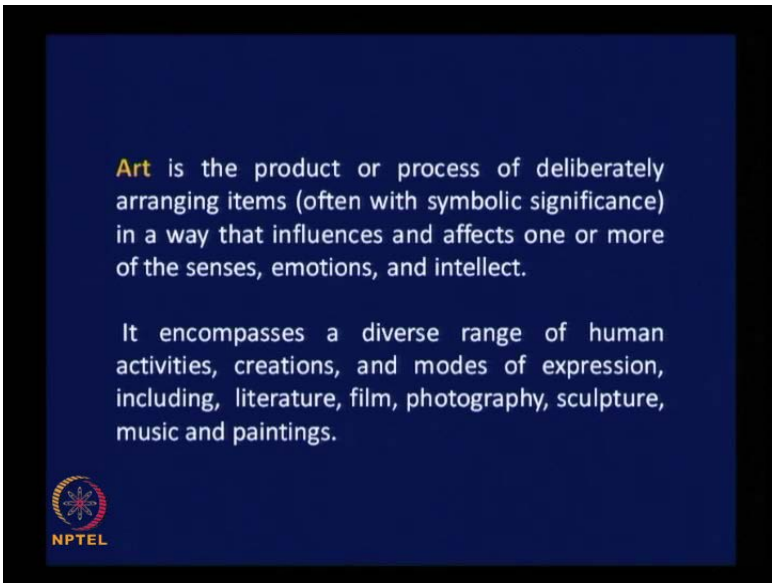

Let us try to define the term art now. Art is a product or process of deliberately arranging items often with symbolic significance in a way that influences and affects one or more of the senses like hearing vision and so on emotions and intellect. That is the definition of the term art. It encompasses a diverse range of human activities creations and modes of expression including literature film, photography, sculpture, music and paintings.

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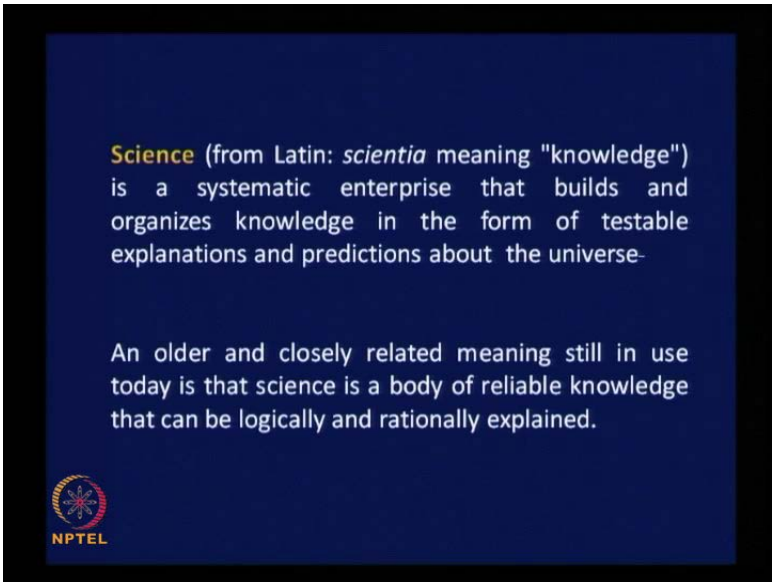

Have this definition in mind. We will define the term science and then try to understand, why planning has to be part art and part science? Let us try to define the term science.

Science is a word which has originated from Latin word scientia, meaning knowledge, is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe and of course, a refined definition for the same term is this. Even though it is older still it is applicable. An older enclose related meaning still in news today is that science is a body of reliable knowledge that can be logically and rationally explained.

Now, you know the definitions of the two terms namely, art and science. Now, can we just try to understand little better why transportation system planning process is treated part art and part science? Let us say as per the planning principle based on the predicted transportation demand in the horizon year. Your fly over needs to be constructed or a great separation facility needs to be constructed particular locality in a city. This is based on scientific principles. Any project has to get the approval of the society and the stake holders. When the project is put forth the reaction from the society is different. They feel that this great separation facility if provided in this location will spoil the landscape of that locality. That takes off the town or the city in that particular place will be lost.

We have to accept the emotions, intellect of the users of the facility and the planner should think of an alternative, there is no other way. And as per your planning, your Trans it station may come very close to a structure which is historically important. And there may be objection to have a station with artificial construction very close to the historic building. So, that has to be accepted by the planners. These are all artistic views which should go into the planning process and there could be a locality where you take your you take your public transit service quite close to your religious place, which will disturb the peace and other solemn activities of that area. And people might feel that it is not desirable to bring everybody very close to that particular place.

So, that is how we need to give provision to accommodate emotions, cultural aspects and intellect of the urban dwellers in the planning process. That is why we need to understand that it is part science and part art. Yes, you apply scientific principles designed on the travel demand designed on the possible infrastructure facilities to be developed, but, still it should be acceptable by the users based on artistic aspects.

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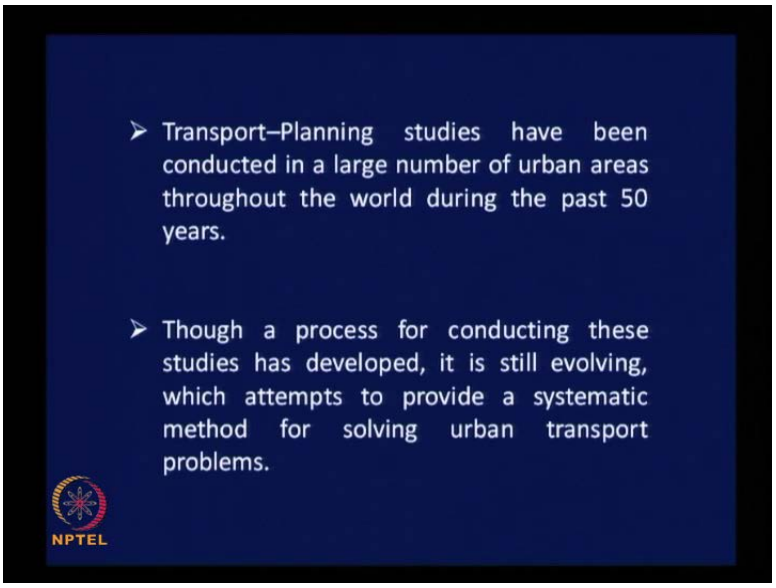

Then transport planning studies have been conducted in a large number of urban areas throughout the world. During the past 50 years number of studies have been done all over the world in different cities. Though a process for conducting these studies has been developed based on the past experience of half a century, it is still evolving which attempts to provide a systematic method for solving urban transport problems.

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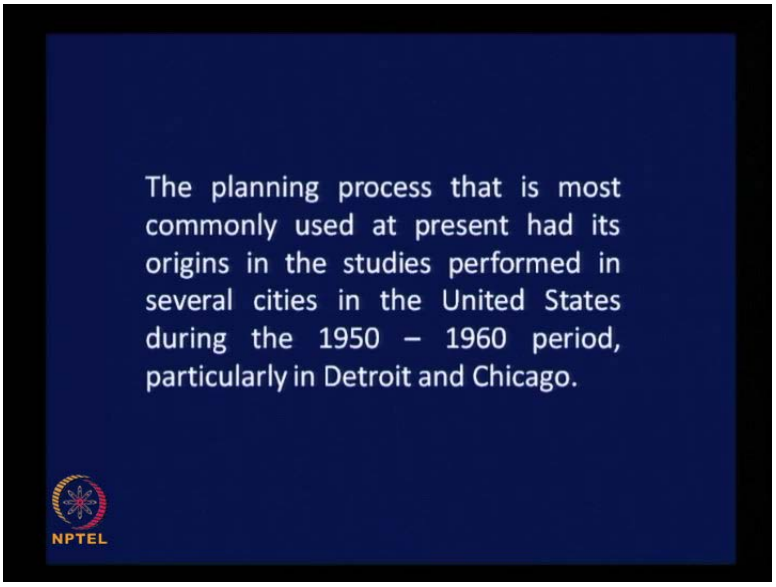

It is very dynamic still evolving and it is going to continue in the future. That is how the planning process has to be understood. The planning process that is most commonly used

at present had its origins in the studies performed in several cities in the United States. They were the pioneers in urban transportation systems planning. During the 1950 s and 60 s, particularly the studies of the cities of Detroit and Chicago are work mentioning. Even today planners refer to the planning record pertaining to these two cities to get some clue to solve the problems that they encounter.

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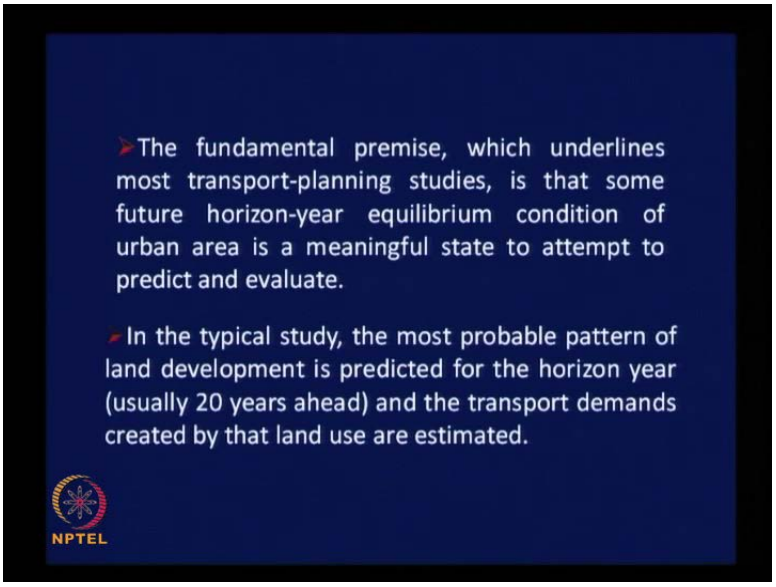

What is the fundamental assumption in the planning process? The fundamental premise or assumption which underlines more transportation studies is that, some future horizon year equilibrium condition of urban area is a meaningful state to attempt to predict and evaluate. Or in other words you must have confidence in the accuracy of prediction of the future condition of an urban area. If you strongly feel that it is not possible, there is no point in proceeding with the entire planning process. So, we must believe that with the available information, available data it should be possible for us to predict a future urban land use and transport system condition reasonably accurately based on this assumption only we proceed further.

In the typical study, what do we do? The most probable pattern of land development is predicted for the horizon year usually twenty years a head from the base year and the transport demands created by that land use are estimated. Or in essence we predict the horizon year land use what you understand by land use. The use to which the land is put to is land use. Urban land space is used for a number of purposes numerous purposes and

if you attempt to classify urban land use based on all the purposes that you come across you will end up with hundred different types of land uses, but, that is not our intention. We should be clear about what we really need in the form of land use as input to your planning process. It is enough if we just aggregate all this different types of land uses and classify the land uses on broad basis.

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Accordingly, the urban land use is classified as follows. First and most important; residential land use, urban areas with predominantly residential use. Then commercial land use urban land space with predominantly commercial activities. Then industrial land use land space with predominant industrial activity. Institutional land uses like government offices, educational institutions and so on, recreational land use, agricultural land use. You may have some additional type of land uses depending upon the conditions. For example; you may have land uses like just baron land or water bodies.

So, these categories can be included based on the requirement. So, this is how we classify the different types of land users in an urban area. Yes please (( )) also urban land uses agricultural. Yes, when we say urban area normally our planning area for any town and city will be much larger compare to them area bounded by municipal boundary, the peripheral areas may have agricultural part even forest land may be part of an urban area. Later on, I will tell you how we delineate the planning area for cities and towns. It will encompass areas around a city keeping in mind the possible future development.

That is how this kind of category may be necessary. It may not be there in all the cases. You may have pieces of agricultural land pieces of even forest land in hilly terrain and the huge water bodies, just barren land so on. Now, while we try to predict the urban land use for the horizon year condition, what is our interest. Are we interested to predict the total number of houses that will be accommodated in a particular residential land use or total number of industries that will be coming up in a particular area? That is not our interest; our interest is at the macro level. How the land use scenario overall will change in the horizon year is our aim or is our requirement.

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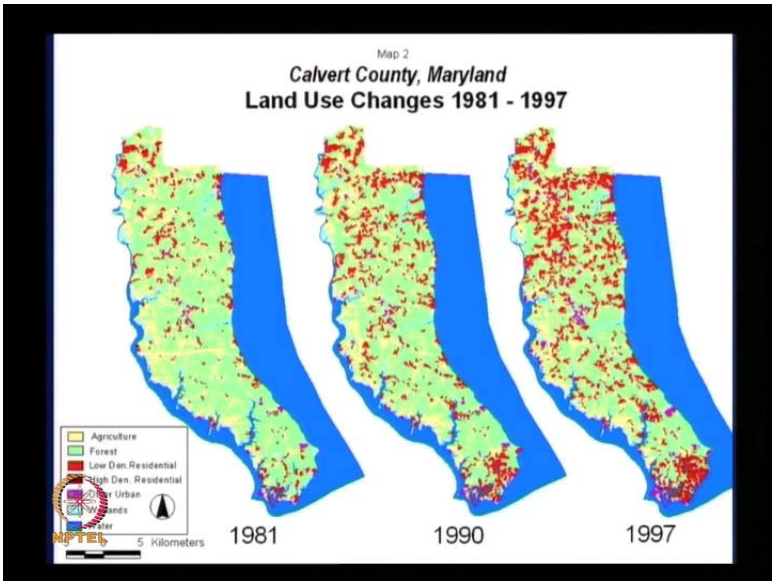

Keeping this on mind I will show you an example of land use change in a particular city and give you some information about the macro level land use prediction. As, you could see this slide show, the land use change from the year 1981 to 1997 of Calvert County, Maryland, USA. They have categorized the different types of land uses starting from agriculture, forest, low density residential development, high density residential development other urban land uses wet land and water bodies. You just compare the development or changes in the land use based on the color coding from the year 1981 to 1990.

You can see there is increase in the area covered by low density residential as well as high density residential uses, land uses. If you go beyond up to 1997 you can see similar pattern still further increase of low density and high density residential land users. Some

increase in other land use activities too. This is our interest. Take an overview and try to understand how the land use pattern will change. You can see here the rate of increase in the residential activity had been very intense at the southern and northern tips of this urban area. The southern tip initially 1981, you can see with more of green patches.

Now, in 1997, it is almost full of residential development the similar situation in the other tip also. This is how as planners we need to take a overview of a land use pattern change which will help us to understand the possible trip production and trip attraction rates in an urban area and decide about provision of mass transit systems connecting this major activities centers.

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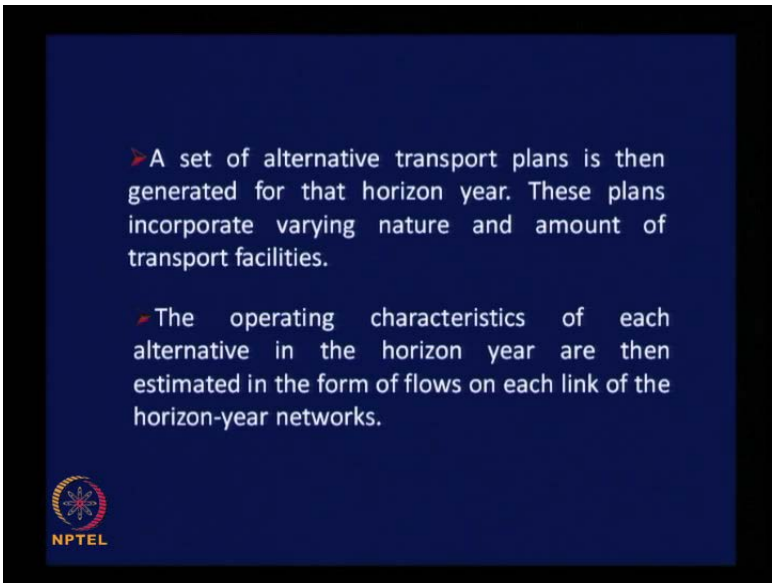

Now, after predicting the horizon year land use, Let us come back to the original step of predicting the future land use pattern. The next step is development of a set of alternative transport plans for that origin year. These plans incorporate varying nature an amount of transport facility. You just incorporate different alternative plans in the planning process and then you study in detail each of these alternatives. The operative characteristics of each alternative in the horizon year are then estimated in the form of floors on each link of horizon year networks.

For example, let us say you have identified two major activity centers in the urban area and you are plan to provide as alternative one as a mass transit service connecting the two activity centers, As a second alternative you are planning to just provide very good

bus service connecting a two activity centers. Each of these two alternatives will have its own implication in the form of traffic as well as other environmental impact.

So, look into these impacts carefully of each alternative and try to choose the optimal one. On what basis, what is the basis for choice of optimal alternative? It should be based on economic criteria.

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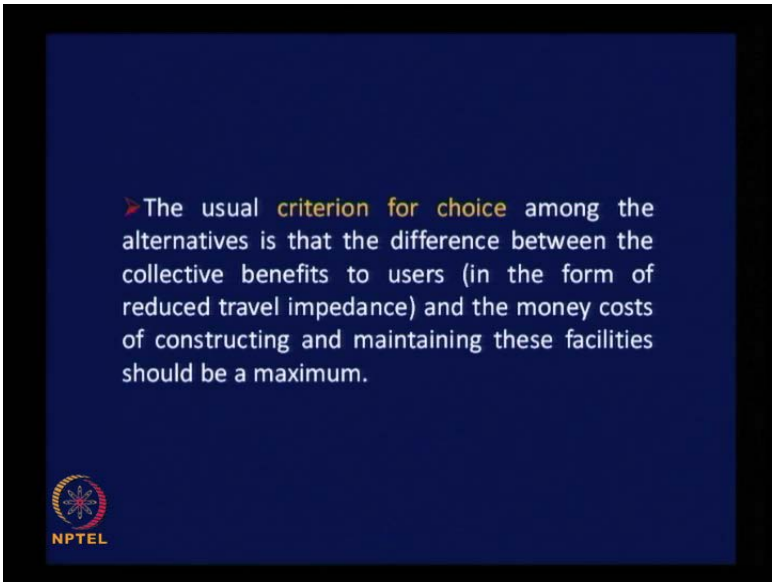

The usual criterion for choice among the alternatives is that the difference between the collective benefits to users in the form of reduced travel impedance and the money cause of constructing and maintaining this facility should be maximum. Difference between benefits and cause should be maximum. Get the difference for each of the alternatives and choose the one which gives you maximum difference between the benefit and cost assuming that the benefits are going to be more compared to the cost in all the alternatives.

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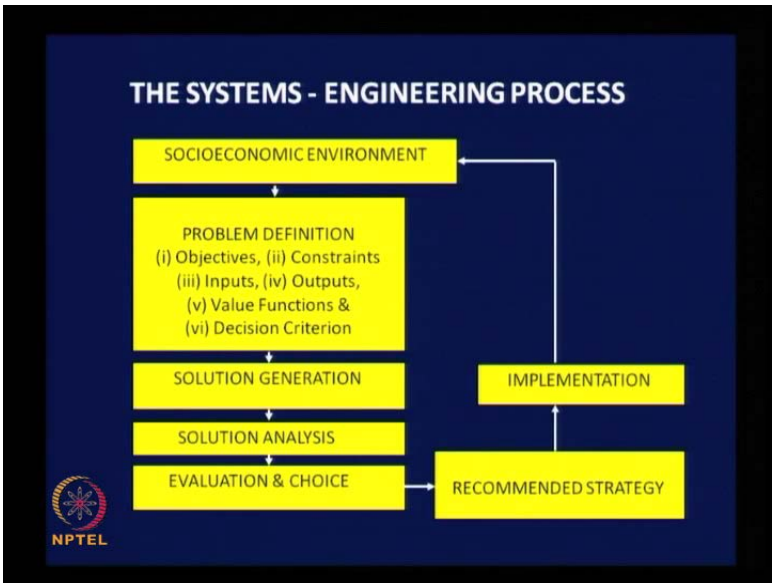

That is the basis on which we choose the optimal alternatives for implementation and to understand the planning process in detail, understanding of the basics of the systems engineering process will be helpful.

Then, what are systems engineering process? This is a process which explains a steps related to providing solution to the problems emanating from socioeconomic environment. You can realize that is what we need also try to provide solution to the transportation problems which emanate from socio economic environment. So, it is appropriate for us to understand first the systems engineering process and later see how these steps can be directly transferred to the transportation systems planning process.

Let us look at the steps involved in the systems engineering process. First as I mentioned, understanding of socioeconomic environment which generates problems have to be solved. To understand the problems clearly you must try to define the problems. Problem definition it is a very important step in the engineering process. Definition of the problem as you could see here involves a number of steps starting from understanding or defining objective then understanding the constraints then having some idea about the inputs outputs value function and decision criterion.

At this stage you need not have to bother about definition of each of the terms we will see in detail about each of the terms a bit later. Just have a overview of the process as we

go further. So, after defining the problem, we generate a set of solutions solution generation.

After generating solutions, you analyze each of the solutions for their merits and demerits, understanding of the merits and demerits associated with each of the alternative solution. Then evaluate each of the alternatives and choose the optimal one as I mention to you earlier. Evaluation and choice. After choice of the optimal solution strategy for implementation recommended strategy.

What you mean by strategy? Why should we have a strategy for implementing a solution? Once you identify an optimal solution you can go ahead implementing. What is meant here? By a strategy I will give an example.

If a solution is to provide an eight line divided road way on along a traffic order to meet the future travel demand. The related question is this. Should we have to provide the eight line divided highway right from the beginning or we can face the construction process? Do we need the eight line divided road to meet that demand today? This eight line divided roadway has been proposed to meet the travel demand that will be existing in the horizon year twenty years ahead.

If you wiser in your economic management or financial management you can just face the construction program. You first construct a four line divided roadway to meet the travel demand up to fifth year. Let us say then make it into a six line divided roadway which can take care of the demand up to tenth or fifteenth year and subsequently widen it to meet the horizon year demand to eight line divided roadway at the end.

So, that is what is meant by recommended strategy for implementing your optimal solution which will help us to manage our finance much better because there are different sectors competing for scarce resources. You cannot diver the entire money for single project. So, you must have some strategy for implementing any project.

Then implement it and the arrow gets connected to the step one. This implies it should be a continuous process. Go back and see the impact your proposal makes to the socio economic environment if necessary, make required adjustments and continue the process.

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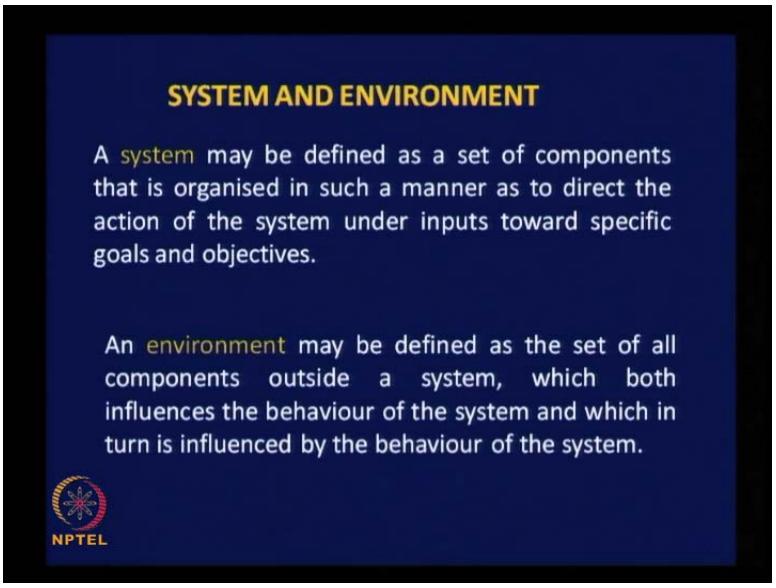

Now, let us try to define some of the term that we have seen in the flow chart. Let us define the term system itself. What do we understand by system? A system may be defined as a set of components that is in such a manner as to direct the action of the system under inputs towards specific goals and objectives.

We have to understand the definition very clearly. We have a set of components in a system. Arrange these components in such a way that when you give an input the output given by the system should satisfy the set objective. So, that is what is implied here. Specific goals and objectives. Then what is an environment? An environment may be defined as a set of all components outside a system, all components outside a system which both influences a behavior of the system and which in turn is influenced by the behavior of the system.

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It is a very simple even though it looks little complicated it is not that complicated. You understand environment as again a set of components, but, outside a system. These components what do they do they influence the system as well as get influence by the system. That is what is indicated here as an environment. For example, when there is a dense residential corridor, that residential corridor is a system for a transit line for which is running through that particular corridor or that system or that environment acts a input to this system which is the transportation system. Obviously, the residential activity influences the characteristics of a system because when the demand is more we introduce more services when it is less you reduces services and so on.

But if you are introducing a very good metro service along the same corridor it will change the environment. There will be more and more of residential even commercial activities developing on both sides' environment changes. So, that is how you must understand and appreciate this particular definition. An environment may be defined as a set of all components outside a system which both influences a behavior of the system and which in turn is influenced by the behavior of the system.

Let us try to understand the term system in the context of urban transportation system with the help of a set of pictures. I am just projecting a set of pictures related to urban transport.

I want you to give a name for this set of pictures depicting different types of transport modes available in urban areas. Any suggestion? Simply you can name this as a urban transportation system. That is what we mean by urban transportation system putting all the available modes together. Is not it? I am going to pick some of these pictures and put them together and you have to give some name for that assuming that set as a system.

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These are the pictures I am trying to put them together. I would like you to give a name for this set of transport modes in an urban area. Yes please. Urban passenger transportation system, all passenger vehicles. I would like to emphasis here system is a highly flexible term in different context to mean different things.

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Let me show you this set of modes of transport and could you suggest some name for this. Set urban goods transport system except the bicycle. Bicycle is also used as a goods transport vehicle. We need not consider bicycle as only passenger transportation vehicle and people have large carrier for bicycles to carry certain things on a regular basis you would have seen in commercial areas any suggestion for this set of urban public transport system or you can say public transit system also?

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It is not really mass transit because we are putting as well as train together you can just name it as urban public transport system.

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And how about this set , Urban Para transit or intermediate public transport system the Indian terminology equaling to Para transit or I P T intermediate public transport? Indian transportation research is like this term I P T intermediate public transport modes. in this case all these modes together as a system.

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Suggest a name for this set of vehicles? Yes, urban personal transport system. Now you can understand for the flexible usage of the term system. It is context specific that is how we need to understand the definition of the system and as well as application of the term system in different context.

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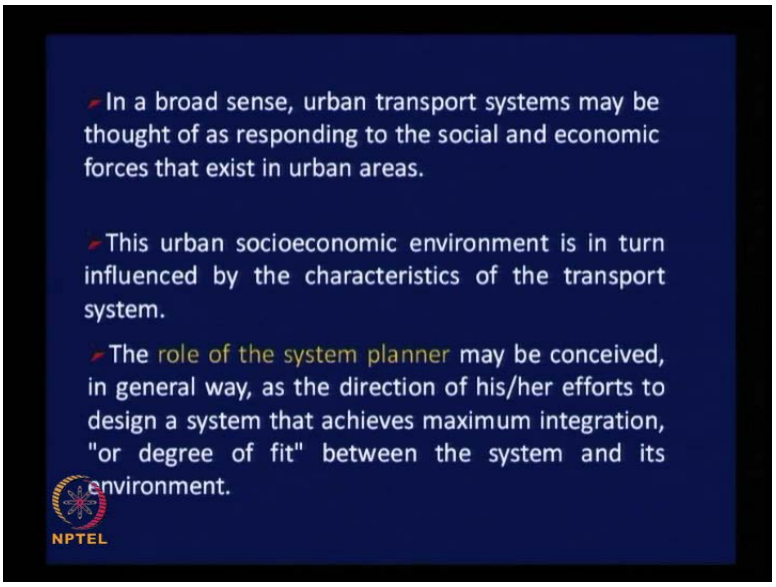

In a broad sense, urban transport systems may be thought of as a responding to the social and economic forces that exist in urban areas. I think all of us agree with this statement is responding to social and economic forces that exist in urban areas. And this urban socio economic environment in turn, is influenced by the characteristics of the transportation system. Now this is the role of the transportation systems planners. The role of the system planner may be conceived in general way as a direction of his or her efforts to design a system that achieves maximum integration or degree of fit between the system and its environment.

I think we have clear idea about the definition of the terms system and environment. We need to understand the terms system and environment in urban transportation system planning context. System here is the transportation system that we are planning and the environment is nothing, but, the socio economic environment of the urban area. The role of the transport system planner is to get a good fit of the planned system into the socio economic environment. That is the role of the transportation system. Let us say one

thought of urban area is predominantly inhabited by economically weaker section of the society.

If the planner is planning to introduce or take metro rail system through that residential area or if the planner is planning to have an elevated roadway through that area to facilitate cars and other vehicles to move fast, Will this proposal fit into the environment better? Metro rail is going to be relatively expensive compare to ordinary local bus or Tran's system and when you provide elevator roadways it is going to be used by personal vehicle owners. It is not going to serve the local community of that portion of the urban area. So, there will not be any fit of a system into the environment in that particular context.

That is what is meant by fitting of the plan system into the socio economic environment of the urban area you must understand the people, understand the socio economic environment and provide an appropriate system. That is where we are not paying enough attention we just carried away by the technologies and different types of modes being used in different cities of developed countries and try to transfer the system directly into our context our environment which may not work well on the long run. That is where the statement is very important the planners have a road to see that whatever system is proposed is really fitting into the socio economic environment of the urban area.

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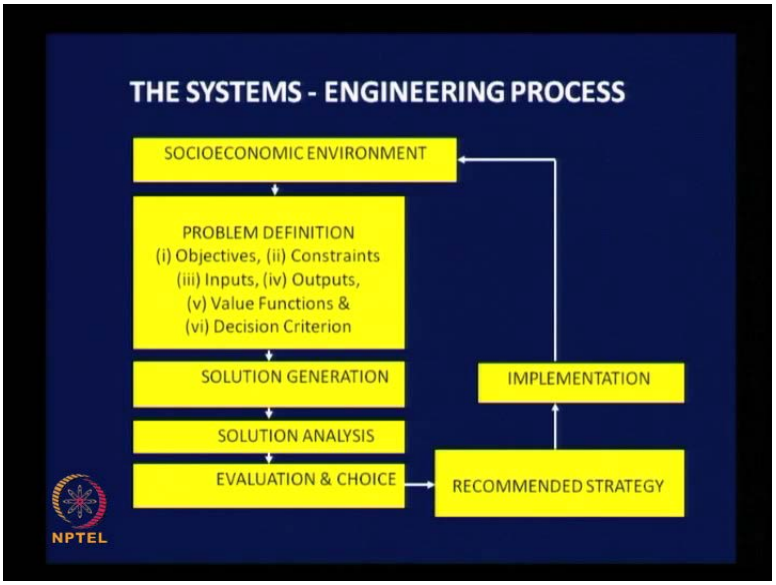

Just, let us recollect the various steps involved in systems engineering process. This is just a facilitate continuation of our discussion to defined the other terms involved in the process. So, this is our systems engineering process we have now understood clearly about the system and environment and how to fit the transportation system urban socio economic environment.

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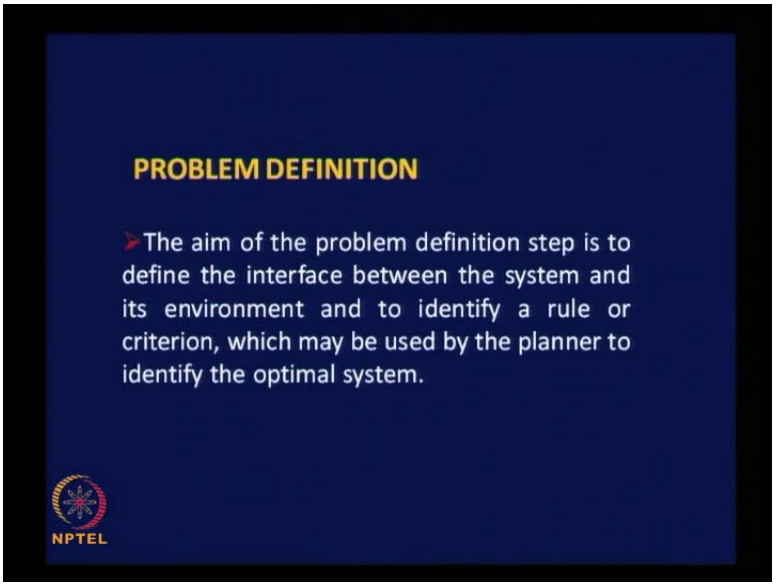

Let us now pass on to the important step of defining the problem using different steps shown in this particular flow chart. We get into problem definite phase of the systems engineering process. The aim of the problem definition step as we know is to defined the inter phase between the system and its environment and to identify a rule or criterion which may be used by the planner to identify the optimal system. It is simple continuation of our discussion.

I said earlier the planners role is to get a good fit to develop a good inter phase between the system and the environment. Understanding of the inter phase can be done better by defining the problem that is what is stated here. The aim of the problem definition step is to define the inter phase to define the inter phase between the system and its environment and to identify a rule or criterion which may be used by the planner to identify the optimal system.

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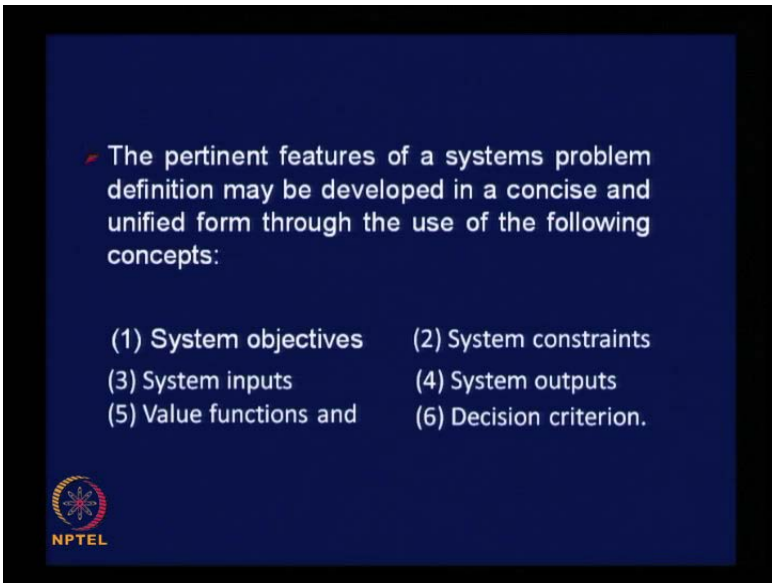

We are concerned about the inter phase. That is the role of a planner. The pertinent features of a system problem definition may be developed in a concise a unified form through the use of the following concepts. As we have shown in the flow chart, 1st important is system objectives, 2nd system constraints, 3rd system inputs, 4th system outputs, 5th value functions and 6th and last decision criterion. Let us try to understand each of these aspects or define each of these terms clearly so that at the end of understanding all the six terms you will have a clear understanding of the problem definition phase itself.

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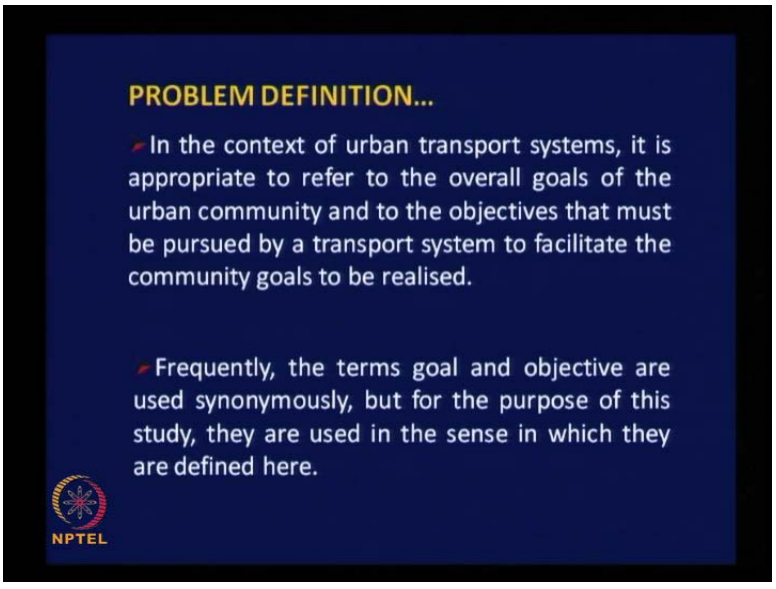

In the context of urban transport system, it is appropriate to refer to the overall goals of the urban community and to the objectives that must be perceived by a transport system to facilitate the community goals to be realized. Our interest is just overall the goals of the urban community. And of course, frequently the terms goal and objective are used synonymously, but, for the purpose of this study they are used in the sense in which they are defined here. We are going to have different definitions for goal and objective. We will define goals and objectives differently in this particular case.

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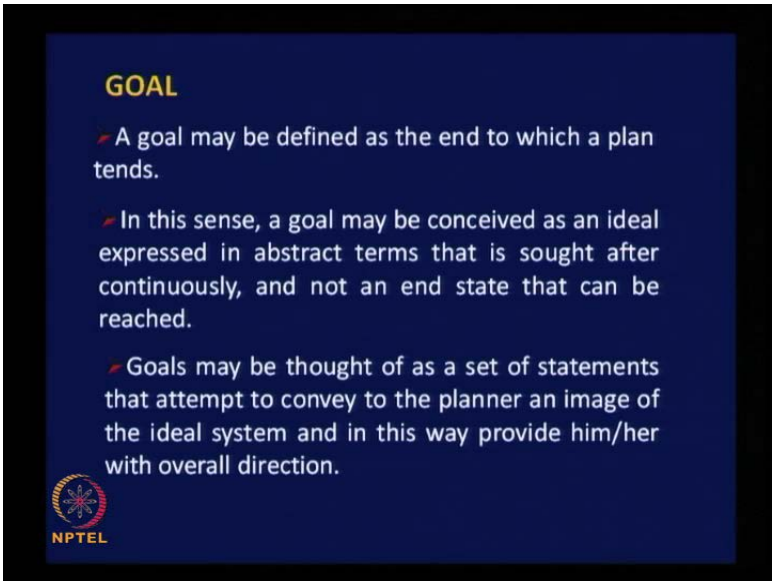

Let use try to define the term goal. A goal may be defined as a end to which a plan tends. Please note the word tends. It is not reaching the goal plan tends towards the particular goal. In this sense, a goal may be conceived as an ideal expressed in abstract terms that is sort after continuously and not an end state that can be reached. Are you able to appreciate the statement? It is just an abstract statement. Or an ideal expressed which will be sorted after continuously. Let us say a person says, let us say, Sharmila says that I want to be rich lady in the future. It is just a goal. How much rich what is the exact amount of money she is going to accumulate is not known.

It is just an expression of desire. That is how we need to understand the term goal. Goals maybe thought of as a set of statements that attempt to convey to the planner and the image of the ideal system and in this way provide him or her with overall direction. Just an image of the ideal system is perceived by understanding the goal in the planning

process. There is no completion or it is not possible at all to reach the goal you can just over end the planning process towards the goal.

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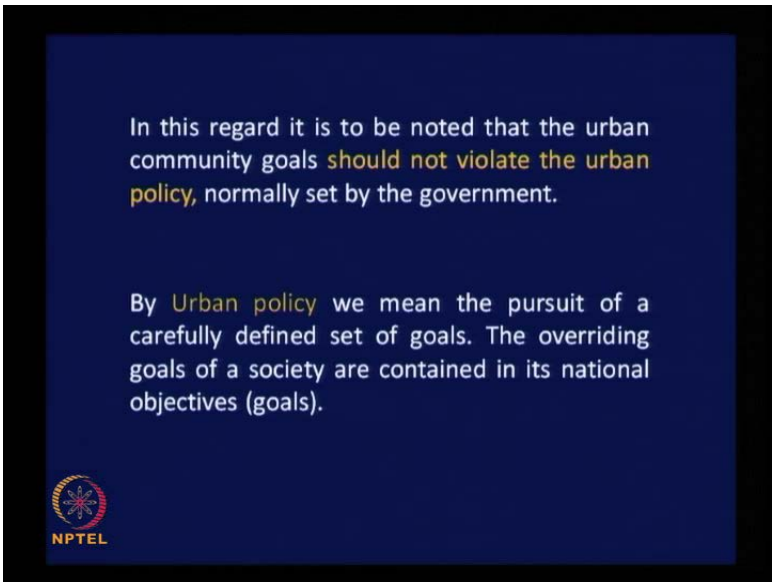

In this regard, it is to be noted that the urban community goals should not violate to the urban policy normally said by the government. The goal that we discussed is nothing, but, the urban community goal. Each city and town will have its own goal for the purpose of developmental process. It is available here for most cities in developed countries. If you go and talk to the urban planner he or she will be able to talk to us talk to us about the urban community goal. This goal is evolved through the process of consultation with all the stake holders in the urban area.

Business community, other stake holders, government department and nongovernmental organizations all these agencies are consulted before formulating urban community goals. These goals need not be same for all the urban areas. It will be different for different urban areas because there will be specific local issues to be solved. So, these goals should not be violated by any developmental work that is happening in a particular urban area. These are just broad guide lines, but, these community goals which are locally developed should not violate the national goals or community goals evolved at the national level. That is very important. That is what is stated here in this record.

It is to be noted that the urban community goals should not violate the urban policy which is evolved at the government level. By urban policy, we mean the pursuit of a

carefully defined set of goals. A gain goal in the form of policy, the overriding goals of a society are contained in its national objectives or goals. The terms are interchanged here you can understand in this particular context as the national goals.

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For example, traditionally these national goals include at least these aspects like freedom, social justice, progress and national unity. These are all the broader goals or objectives set at the national level and this will be wetted by political system. These are ranked in the order of importance in different societies according to the desires of their respective members as filtered through the political system. Unless, a policy filtered through the political system, you will not be able to implement the policy. That should be understood by the planners as well as local urban communities. You should not just be extreme and peruse some goal, which is not accommodated by the overall goal evolved by the government at the national level.

And to summarize in this class, we started our discussion with the understanding of what planning process and we have defined a number of terms in connection with transportation systems. Planning the most important terms that we have defined or the system the environment and the goal and goal is an abstract statement evolved by the local communities to express their desire in respect of developmental work that will be carried out in any urban area. And these local community goals should not be violate the

national urban policy like national unity social justice and so on. We will conclude this lecture with this and we will continue the rest of it in the next class.