Urban Transportation Planning
Prof. Prof. Dr V Thamizh Arasan
Department of Civil Engineering
Indian Institute of Technology Madras

Module No.#06
Lecture No. #27
Route Assignment

This is lecture 27 on urban transportation planning; route assignment will be the topic of discussion in this lecture, and we have completed in the previous lecture; the topic of trip distribution analysis. You may recall in trip distribution, we discussed mainly about the gravity model of trip distribution, its calibration procedure as well as the application potential of gravity model. Then we discussed about 4 different types of models under growth factor method of trip distribution, starting from uniform factor method of distribution, average factor method, factors method and furnace method, and there are certain limitations or drawbacks of growth factor methods of trip distribution. The most important ones are as follows; these growth factor methods simply reflect the Bezier condition. If trip interchanges between a particular zonal pair is very less in the Bezier condition, same scenario will be reflected for the horizon situation also, even though there might be faster growth later.

In extreme case of these possibilities that during a Bezier data collection, you may find that trip interchanges between a particular a zonal pair is zero, there are no trips. And after 20 years for the horizon (()) condition also, as per the growth factor method you will be getting trip interchanges between those specified zonal pairs will be zero which may not be realistic. Other related issues are related to the fact that, the travel resistance is not taken into account at all in growth factor method of trip distribution, is it not? F I J effect is not considered which is very important, and third important aspect is related to data requirement. We need to have very elaborate data in the form of Bezier trip distribution matrix, as input for growth factor method of trip distribution, which is going to be more expensive and time consuming. In spite of all this disadvantages, there are advantages which are specific to certain situation while making use of growth factor methods.

One specific situation were growth factor method only can be applied, in practice is in relation to analysis of trip distribution of zones external to your study area, or

distribution of trips involving internal to external and external to internal trips. So, we need to go in for only growth factor methods. Other possible situations are like short term forecasting of distribution of trips over, say 5 years in urban area where there may not be much of variation in the growth of travel demand, in such a case nothing wrong in using growth factor methods and simply manipulate the available matrix to get the future scenario over a short term period, so that is how we need to understand trip distribution process. Please understand at this stage that, we have gone through three important analytical steps in the four step planning process; trip generation analysis, model split analysis and trip distribution analysis were completed, and at the end of trip generation analysis as I showed you earlier.

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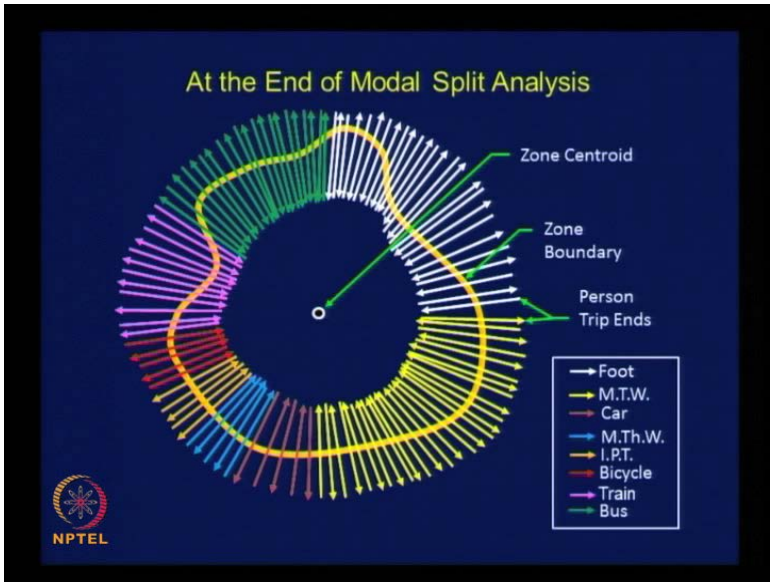

This is what we actually had, in respect of each of the traffic zones in an urban area. We just quantified the trip ends associated with each of the traffic zones. When we completed trip generation analysis, these trips are person trips not vehicular trips. Person trip ends associated or connected to each of the traffic zones were estimated on completion of trip generation analysis, which involves both trip production as well as trip attraction analysis, goes together. This is the result that we get at the end of step one. And at the end of step two, namely mode choice analysis, the same trip ends where further analyzed the associate modes for each of the trip ends, that is what we did in mode choice analysis phase, or we determine the proportion of trips associated with different alternative modes available for travel. The color coding is given here; the

modes available could be foot, motorized two wheeler car, motorized three wheeler, intermediate public transport, bicycle, train, bus and so on. This is what we did on completion of mode choice analysis, just assigning modes for the trip ends. Even at this stage we are only person trip ends, but with additional information of more used for each trip. So, that is what we have done on completing step two, and we have now completed step three.

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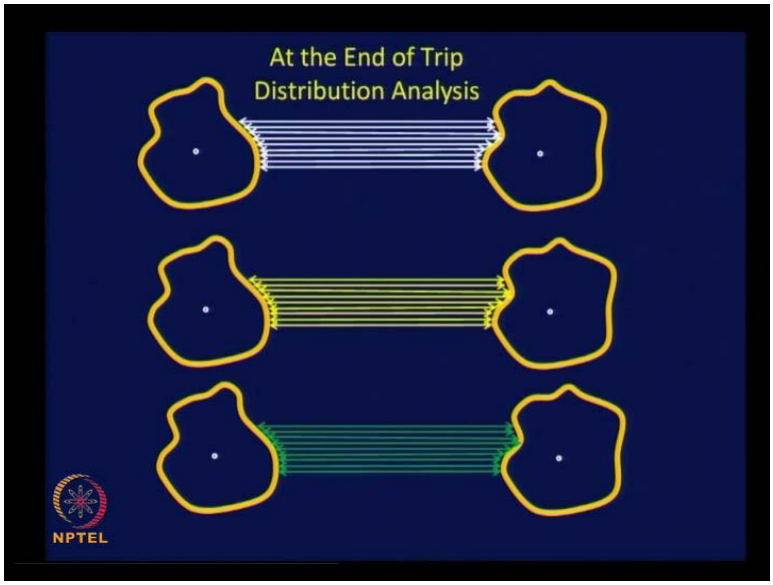

And on completion of step three, we have some information about trip interchanges between zonal pairs. When you take two traffic zones, we know how to get information about interchange of trips between zonal pairs, by a particular mode of transportation, and this could be for one mode and similarly, interchange trips for another mode and so on. Please understand we analyzed zones taking two zones at a time. Zonal pair analysis was done in trip distribution T I J; I at J will have unique values at a particular part of time, zonal pair trip interchange analysis. And we do this for all the traffic zones to get a complete trip interchange pattern for the whole urban area. Just to give you an idea about the complex city.

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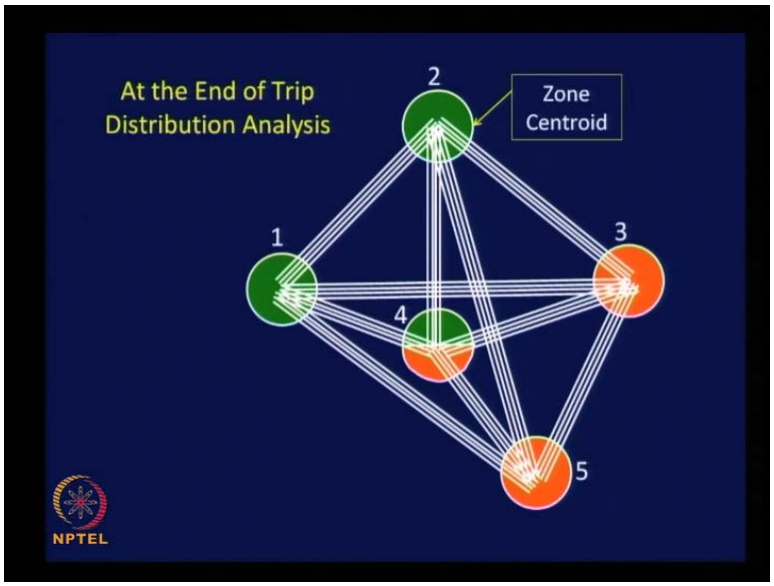

Let us consider five traffic zones, I have indicated zones centroids here, and at the end of trip distribution analysis, this is what we have done. The number of trips connecting the centroids of different zones, interzonal connectivity was analyzed. I have shown the methodology involving just fine zone centroids, you can extend this to any number. So this is what we have done at the end of step three namely trip distribution analysis, please remember these are also person trip movements, person trip interchanges with associated mode. In fact you will have this kind of picture for each of the modes, each of the alternative modes; one picture for distribution of trips using bicycle, another similar picture for distribution of trips using motorized two wheelers and so on. So you will have number of such interconnectivities involving each of these modes.

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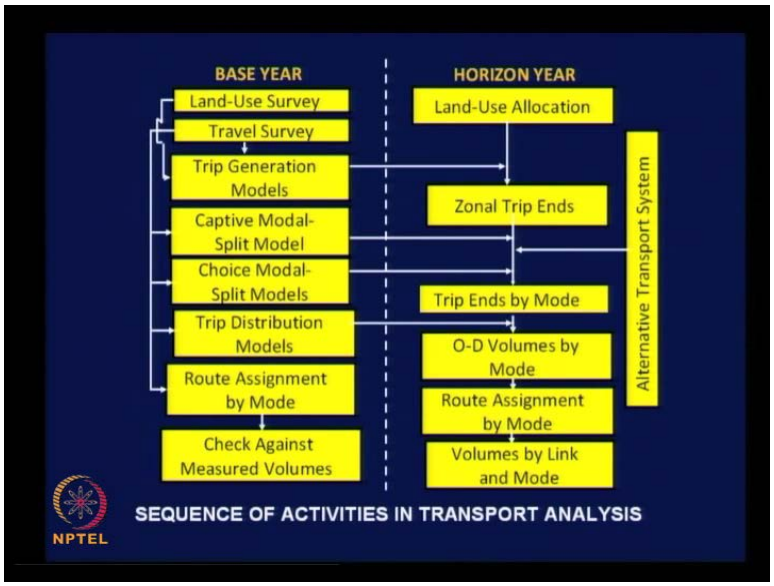

Now, let us go back to our original master flow chart, flow diagram deputing the different steps involved in transportation planning process, I hope all of you recollect this flow chart. Where are we now, we are now here route assignment by mode, after completing trip generation, model split and trip distribution we in this step which is the fourth and final step in the analytical phase of the transportation planning process. It is very clearly indicated that the step is related to route assignment by mode, that means we are going to assign routes for the trip interchanges, considering the mode of travel also.

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Let us see how we are going to do this exercise exactly, going through the steps involved, and incidentally route assignment is one terminology used by authors, another possible terminologies are trip assignment or sometimes traffic assignments, all are same; route assignment, trip assignment, traffic assignment and so on.

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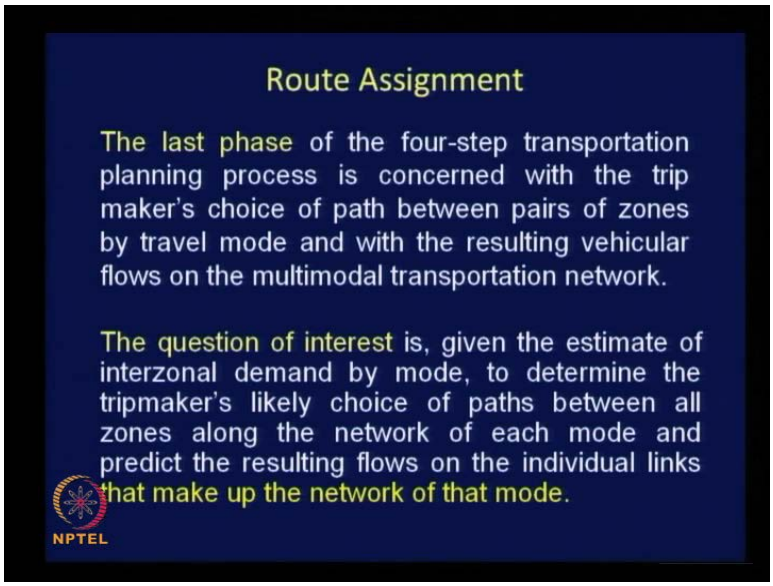

Now, the last phase of the four step transportation planning process is concerned with as we discussed trip maker's choice of path between pairs of zones by travel mode and with the resulting vehicular flows on the multi model transportation network. Are you able to understand the statement clearly. In the previous case we estimated the total trip interchanges between zonal pairs mode wise, but we did not know the route followed, there could be several alternative routes between a zonal pair. Zone one and two you may have two and three alternative routes, and people might use all the three alternatives are sometimes only two alternatives or worst case, may be only one route might be used. So we must understand how people are choosing the route for travel from one zone to another zone that is a question to be answered in this particular step.

The question of interest, is given the estimate of interzonal demand by mode, that is what we have done in the previous step, to determine the trip makers likely choice of parts between all zones along the network of each mode, and predict the resulting flows on the individual links that make up the network of that mode. They talk about network for a particular mode. Normally you may perceived that a road network is common for all

modes of transportation, but still there may be parts which are specified for a particular model transportation, you take for example bus transit system. Bus service is not going to make use of all the routes or links in the road networks, busses will follow specified routes. So, the number of links used by bus transit will be different, from the number of or the pattern of movement by private transit or private transport modes. So, that is how we need to understand the links related to a specified mode of transportation. Ultimately, when you try to assign trips made by all the modes, you will get the total link loading or the total loading on the whole of the network.

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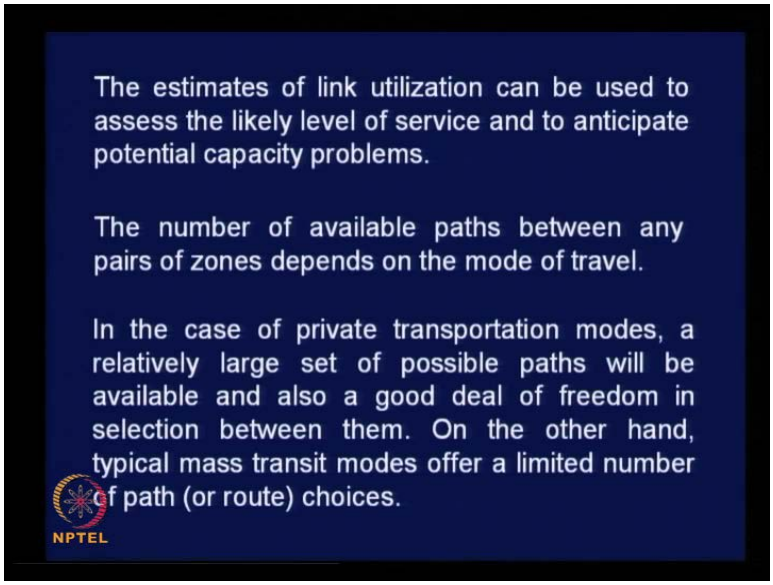

And the estimates of link utilization, obviously once we complete the assignment process you will find to what extend each link is utilized or loaded. Can be used to access the likely level of service and to anticipate potential capacity problems, after assigning you will come to know the actual traffic volume on each stretch of road. Some stretches may be relatively less loaded, that means level of service is better you can move little faster. In certain stretches may be heavily loaded, resulting in poor level of service and indicating problem of congestion. All this information you can get after completing the assignment process. The number of available paths between any pairs of zones depends on the mode of travel that is what he told you.

Number of available paths depends specifically on the mode that you choose for your transportation. In the case of private transportation modes, a relatively large set of

possible paths will be available as you said, and also a good deal of freedom in selection between them, because it is own vehicle, you can go this way that way and so on, lot of freedom and relatively large number of alternative roads. On the other hand typical mass transit modes, example bus or for a limited number of path or route choices, it could be bus or even train. The routes are fixed, so you can take may be to go from here to T Nagar, either 5 b or 47 series busses, you cannot take all the busses, any bus you want to go to that destination, because that mode gives you only few choices.

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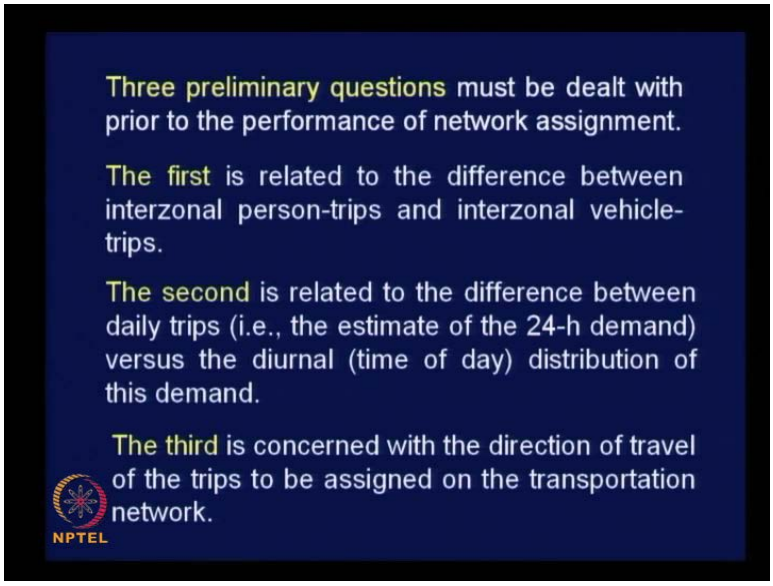

And, three preliminary questions must be dealt with prior to the performance of network assignment, before you start your assignment process you have to deal with three important questions. Then, only you can assume that you are ready for getting into the assignment process. The first aspect is this, related to the difference between interzonal person trips and interzonal vehicle trips. So for in all the three trips, in all the three steps, we were dealing with person trips, now we are going to deal with vehicular trips. We are not going to assign person trips on the roads or on the real system. So, it is concerned with vehicular movement traffic assignment or route assignment is concerned with movement of vehicles, not movement of persons. So, this distinction has to be understood very clearly, this is a first point.

The second is related to the difference between daily trips, that is the estimate of the twenty four hour demand, versus the diurnal time of day distribution of this demand.

Again please note, when we talk about trips in trip generation, mode choice and trip distribution, those trips are related to daily trip, total of all the trip made for twenty four hour period on a typical working day, that when you assign trips in the form of vehicular flow, you know it is not going to be same throughout the day. So, there is a need for understanding the hourly variation, in the case of route assignment, whereas that is not necessary in the previous three steps, we were just dealing with aggregate, total number of trips made in twenty four hours period.

Third point to be remembered is, concerned with the direction of travel of the trips to be assigned on the transportation network, because at the end of the traffic assignment step, you are going to visualize the traffic flow, for the entire network, transportation network. To visualize a flow you need to know the directional flow also, what percentage of movements are in one direction, what percentage is another direction, so direction of movement is also very important in this particular step. So, we should add little more information on each of these aspects. First, related to difference between person trips and vehicular trips, then related to variation of trips over time period, and third related to direction of movement. We will discuss detail about each of these aspects.

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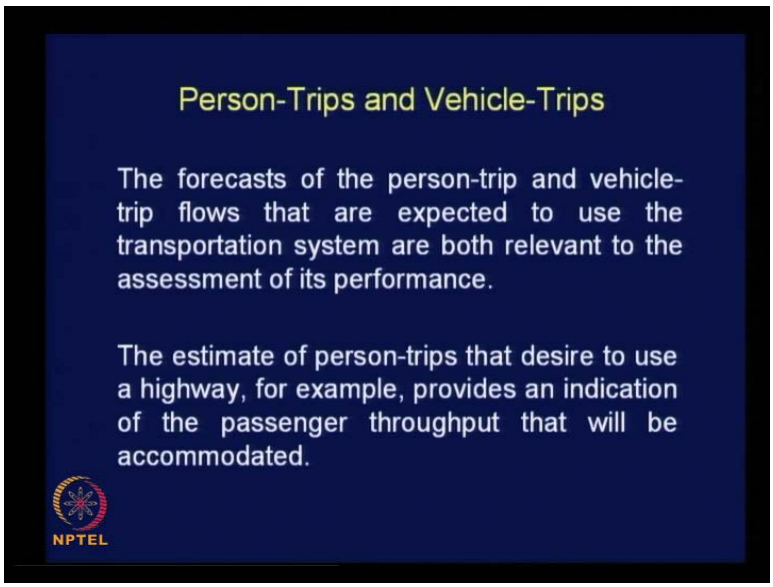

Peson trips and vehicle trips; the forecast of the person trip and vehicle trip flows, that are expected to use the transportation system are both relevant to the assessment of its performance. If we talk about system in general, we need to have information both about

person trips as well as vehicular trips, is acceptable, but still we need to come down to the specifics related to the particular process of route assignment. The estimate of person trips that desired to use a highway for example, provides an indication of the passenger throughput that will be accommodated, even though on the highways or any road network, we visualize only vehicular movement. If you have information, with regard to number of people making use of that particular stretch of road, that gives you an additional information of the extend of passenger throughput, through that particular roadway. So, that is how when you analyze system nothing wrong in having both the information, regard to total person trips as well as vehicular trips.

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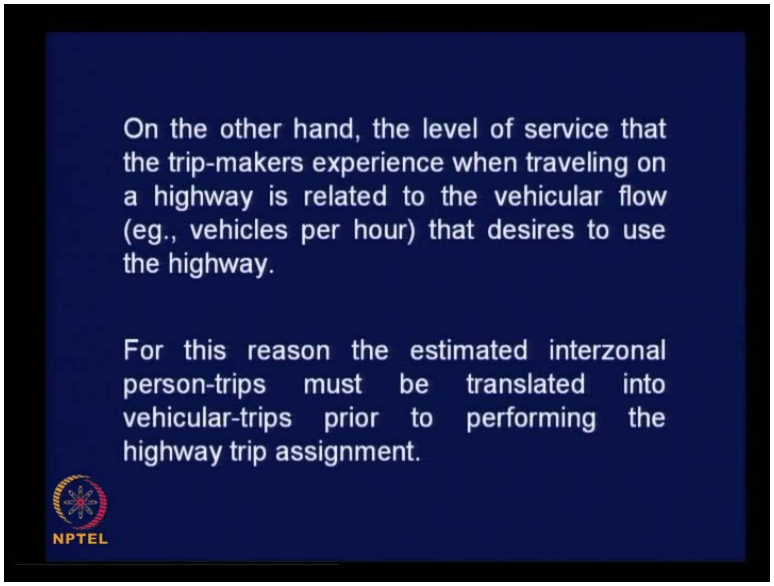

On, the other hand the level of service that the trip makers experience when travelling on the same highway, is related to the vehicle of flow that desires to use the highway. How, level of service related to vehicular flow, what do you understand by level of service of road, how do you define level of service of road. A level of service to some extend is qualitative in nature, it is the level of comfort enjoyed by the travelers when they are making use of a stretch of road. Comfort is related to various aspects, the freedom which with which they are able to move, or the extent to which they are able to maintain the desired speed, and the extent to which they are able to move in an uninterrupted condition and the level of comfort they enjoy while moving on the particular stretch of road. All these things are together, is what we call here as level of service, so level of service can be understood only, when a traffic moves on a particular stretch of road that

is what is indicated here. So, for this reason they estimated interzonal person trips must be translated into vehicular trips, prior to performing the highway trip assignment or in general route assignment.

Now, the question is how to convert person trips into vehicular trips, any response how you will convert person trips into equivalent vehicular trips. First you should know the proportion of people making use of different type of vehicles. Then we know that, because we have done mode choice analysis we know proportional travelers making use of different types of vehicles, knowing that how will you convert person trips into equivalent vehicular trips. It is a basic question to be clearly understood by any transportation engineering or planner, unless you answer this question you will not be able to proceeds which route assignment, because we are going to deal with vehicular trips in route assignment not person trips.

Let us say there are thousand person trips, estimated to make use of motorize two wheelers, form one zone to another zone, thousand person trips. How will you convert the thousand person trips into equivalent motor cycles, thousand mode cycles. In certain cases two people may ride a motor cycle, in some cases three, in certain cases whole family, we find all kinds of situations. So, how do you convert the person trips into vehicular trips, conduct survey take measurement regard to actual occupancy of a particular vehicle time. Go to the road side count the number of people making use of motorized two wheeler, how many have only single rider, how many have two people, how many three and so on, do it for a day and come back get the average value, you may end up with one point four, as the average occupancy of motorized two wheelers or one point eight. Now, you can clearly say when the total number of person trips making use of motorize two wheelers is thousand, the number of motorized two wheelers that will be really moving on the road will be thousand by one point eight, it’s as simple as that, but getting this one point eight is not that easy you have to conduct detailed survey at appropriate locations to get this number.

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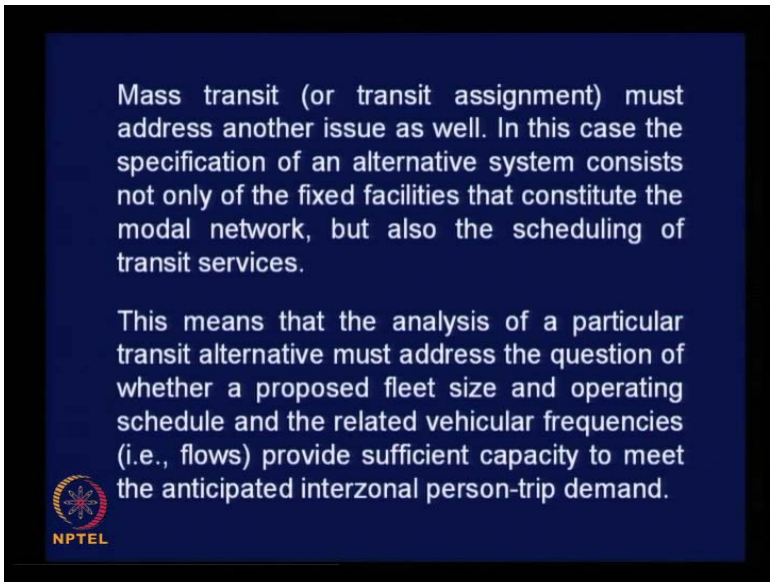

Now mass transit, what is mass transit mode, transit mode which can move more number of people at a time, must address another issue as well. In this case the specification of an alternative system, consist not only of the fixed facilities that constitute the model network, but also scheduling of transit services, what do you understand by this. So, we finally work out the number of vehicles based on more choice analysis, and more choice is then based on number of alternatives available for travel. Let us say we have train and bus services in mass transit modes, available as two choices. From one zone when you try to estimate the number of people making use of bus and train, you may end up with some proportion, may be 70 percent making use of bus and 30 percent making use of train. This proportion pertains to your 24 hour observation, this is an average proportion, but here in route assignment you are going to consider the hourly variation of travel demand also.

Let us say certain number of people want to make use of bus in the morning peak, and certain number train in the same period of time. So, you should be very careful to check, whether the frequency of service and capacity of two alternative systems are sufficient to take this proportion. Are you able to appreciate this point morning peak hour, may spread over say one or two hours or maximum three hours, within that three hours unless the frequency service is sufficient by the mass transit modes, to really provide for the model share that we are predicting, then we have to rethink and do some adjustment in route assignment. This means that the analysis of a particular transit alternative must

address the question of whether a proposed fleet size, number of vehicles fleet size and operating schedule and the related vehicular frequencies provide sufficient capacity to meet the anticipator interzonal person trip demand. There is another important issue associated with transit trips or mass transit trips.

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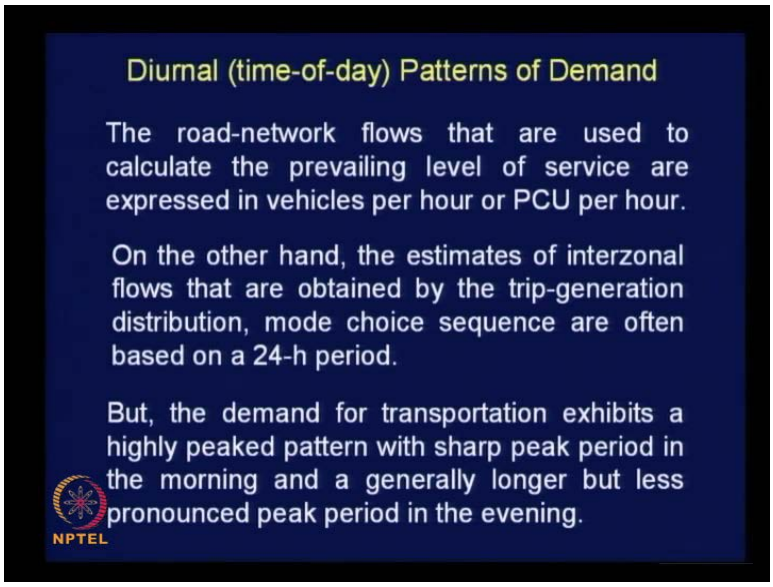

I think we have discussed a sufficient enough to understand the complexities of converting person trips into vehicular trips. Now, second aspect is diurnal time of day patterns of demand, variation of travel demand over period of time or temporal variation of travel demand that is what we are going to discuss now. The road network flows that are used to calculate the prevailing level of service or expressed in vehicles per hour or P C U per hour, all of you know about it. The traffic flow in a road network is expressed normally in number of vehicles per hour or P C U passenger car units per hour, I think all of you are clear about P C U; passenger car unit any question, motorized P C U all of you are familiar with the term.

On the other hand the estimation of interzonal flows, that are obtained by the trip generation, distribution, more choice sequence are often based on 24 hour period, that is what we are dealing with, when we say number of trips or trip ends it is 24 hours travel, but we are going to deal with now hourly traffic flow. But, the demand for transportation exhibits the highly peaked pattern, with sharp peak period in the morning and generally longer that less pronounced peak period in the evening, is it true, very sharp peak in the

morning, little flatted peak in the evening, do you accept the statement. Why it is flatter in the evening and sharper in the morning. Time for attending the work or work to the office, is normally is fixed time while turning back from the office to the residence it may vary from office to office or some person to person, that is why it is distributed.

Exactly, see normally when you start the work you have to go for work in time, report for work in time, everybody would like to go in time, and at the end of the day no boss questions his colleagues or her colleagues when they stay back later in the evening in work. They will be happy if they are working staying back in the office and working for a long period and depending up on the working capability and work load and things like that. The dispersal time will be spread over, a longer period normally in the end of the day that is how normally, typical cases, it is very sharp from the morning a little flatter in the evening, and of course if there is a different attitude of workers. If they want to work to rule, leave the office at the stroke of 5 o clock or 5: 30 then you will get sharper peak in the evenings, also it might happen in certain cases. It all depends up on the attitude.

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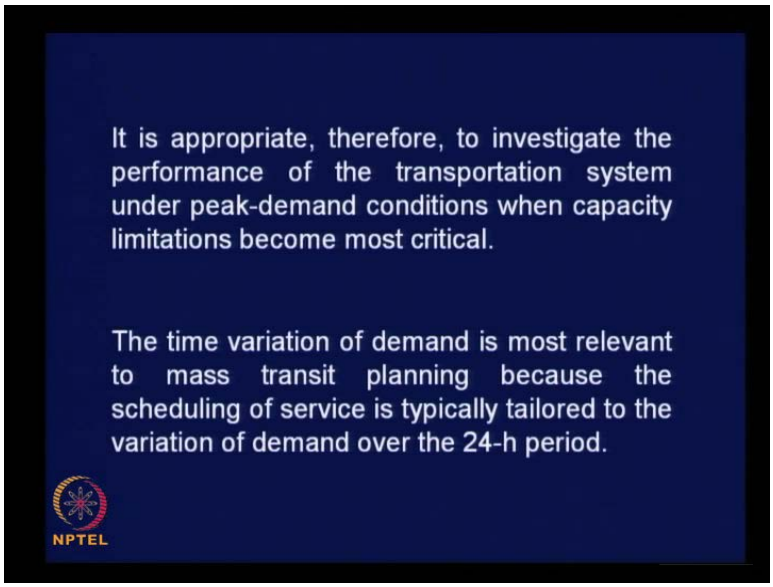

It is appropriated therefore, to investigate the performance of the transportation system under peak demand conditions, when capacity limitations become most critical. This is the most important point to be remembered. There is no point to taking daily average in doing work route assignment, so you just check for the capacity the system and the demand is high during peak period. The time variation of demand is most relevant to

mass transit planning, because the scheduling of service is typically tailored to the variation of demand over the 24 hour period, there is the most important point.

In the morning hours everybody will knowing from home to the activity centers, which are most likely to be located around one center path of the urban area. So, the whole of the traffic converging towards one point, and transit system operators should be able to operate the fleet to meet this demand, think of bus operators. Let us say they are operating bus service from different production zones to the activity centers near C B D, drop the people there in the morning. When the bus is returning it is going to be almost empty, how do they ensure economic vibrative operation, these are all the questions to be answered, that is why it is very critical for mass transit service operations.

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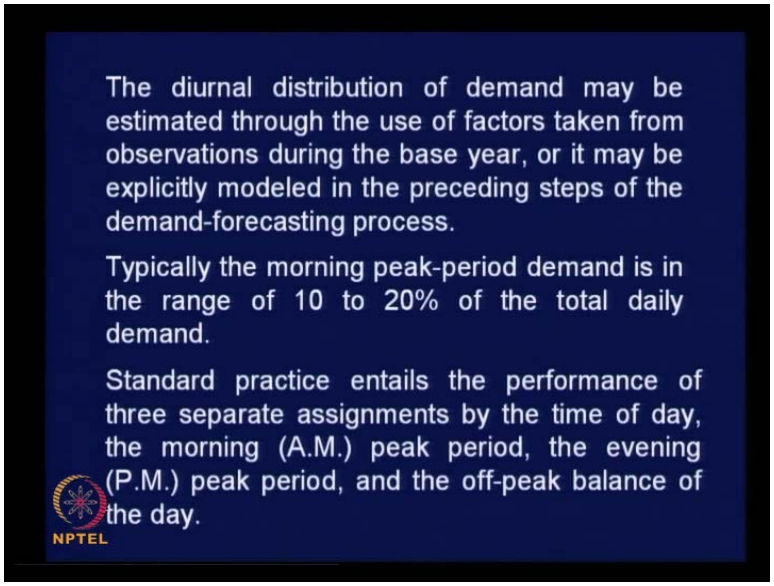

The diurnal distribution of demand may be estimated through the use of factors taken from observations during the Bezier, or it may be explicitly model in the preceding steps of the demand for casting process, it is nothing, but determining or quantifying the peak demand, how to quantify the peak demand. One way is you observe the demand and its variation in the Bezier, but you will be assigning traffic for Bezier condition, later for horizon air condition also. After Bezier process is over you are going to use this four models to do the same exercise for the horizon air condition, and your interest is to know the horizon air peak situations also. The simple question is what percentage of the 24 hour traffic, will constitute morning peak. It is a reasonable question, unless you

understand the answer to this particular question, you will not be able to really quantify the peak demand and assign your traffic.

So, this can be done based on our Bezier information or there are empirical models available using which will be able to quantify the horizon here peak demand, both for the morning as well as evening. Typically, the morning peak period demand is in the range of 10 to 20 percent of the total daily demand. The range itself is very wide 10 to 20 percent of the total demand is occurring in the morning peak, which might be spread over normally two to two and a half hours, maximum three hours. It is only information; you need not have to worry about these numbers. We have to take the value from the field observed data and you can also think of similar situations, which already experienced the horizon air condition for your city. Standard practice entails the performance of three separate assignments, by the time of day, the morning am peak, the evening p m peak, and off peak balance of the day.

You have to do assignment for three traffic demand situations. You just quantify the demand for am peak doing the traffic assignment, when p m peak assign the traffic and visualize the traffic scenario, then non peak period, just quantify the demand and then assign visualize the traffic flow, which is similar to the desired setting for traffic signals. As a traffic engineers you might know that, you cannot have a single signal cycle for the whole of the day, to manage traffic at intersections, even though in our country in many cases they just fix only one cycle time and manage to regulate the traffic. You should have different cycle times and different phase split; one for morning peak, one for evening peak, one for non peak hours. If necessary you can go in for more cycles also, and the traffic signal should be really dynamic, because truly dynamic traffic signals are vehicle actuated traffic signals. You can install senses on all the approaches, depending upon the number of vehicle is waiting, to take a particular route the signal will change its phase red to green and so on, it’s very important. And for planning purpose desirably we can do three different assignments; one for morning peak, one for evening peak and other one for non peak hours, because it is for the purpose of planning at the macro level, this is good enough.

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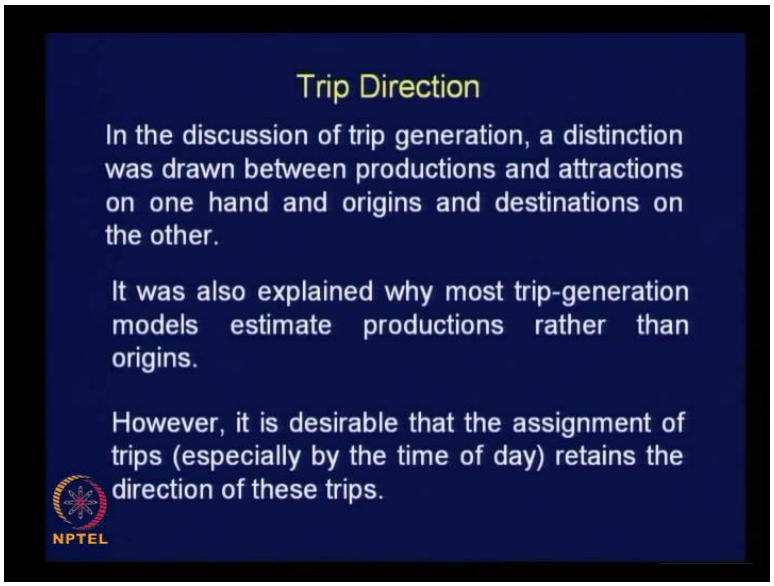

Then, about the third aspect that we listed initially; the direction of movement, trip direction, in the discussion of trip generation, a distinction was drawn between productions and attractions. We differentiate it between productions and attractions and we did not bother about the direction of movement, while going trip generation analysis. We never assign direction of movement in trip generation analysis. It is also explained why most trip generation models estimate productions rather than origins. It is convenient, because we designate zones as production zones attraction zones and so on, there is no need to worry about trip origins, trip destination at that stage. The point made here is the direction of movement was not considered, while you quantify the total trip hence associated with traffic zones, that a point. However, it is desirable that assignment of trips, especially by the time of day retains the direction of these trips. It is obvious that is what we discussed about, while you assign traffic the direction of movements has to be retained, which is possible by converting your P A matrix into O D matrix, that is why we discussed about conversion of P A matrix into O D matrix, only for this particular purpose.

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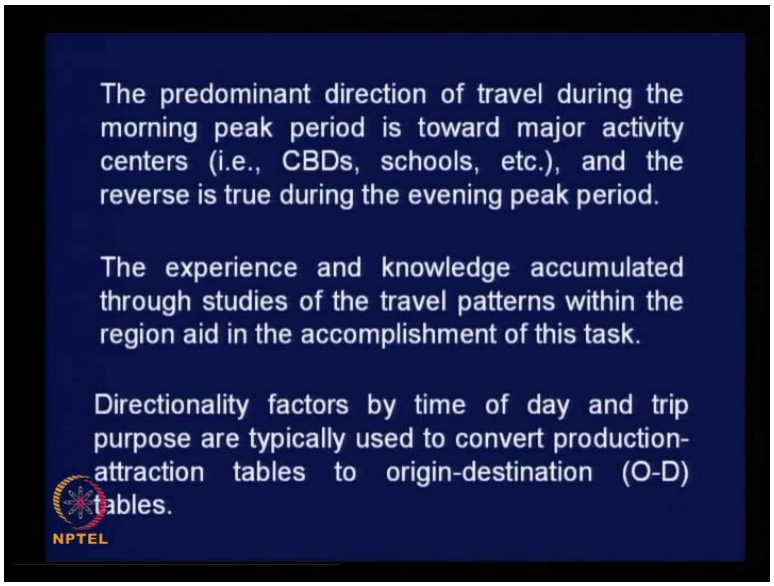

The predominant direction of travel during the morning peak as we discussed, could be towards major activity centers like C B D's, educational institutions etcetera, and the reverse is true during evening peak obviously. And the experience in knowledge accumulated through studies of travel patterns, within the region aid in the accomplishment of this task. So, lot of experience about the travel pattern of the urban area that you study, helps you to analyze the peak and non peak demands much better. And of course if the C B D movement towards C B D etcetera applies to cities of certain size, when the city is become mega cities, like Chennai, Mumbai, Delhi, Kolkata and so on. These cities developed a number of nuclei, they become multi nuclei cities, you have several C B D's you take Chennai city, the Paris corner is one C B D, Anna nagar another C B D, T Nagar third C B D, Maylaporer another C B D, now Velachery is developing as one more C B D, Tambaram different C B D. So, there are several nuclei being developed in mega cities. So, you cannot apply the concept of everybody converging towards one active location in urban area, when the city size is beyond certain limit.

That is why this statement is very important, they experience in knowledge accumulated through studies, of the travel patterns within the region aid the accomplishment of this task. Directionality factors by time of day and trip purpose are typically used to convert, production attraction tables to origin destination tables, about which we have discussed in detail, what do you understand by this proportionality factor. The value of alpha that

we used for converting P A matrix into O D matrix. The percentage proportion of trips that are origination from a particular traffic zone, that is what is indicated here as proportionality in this particular context.

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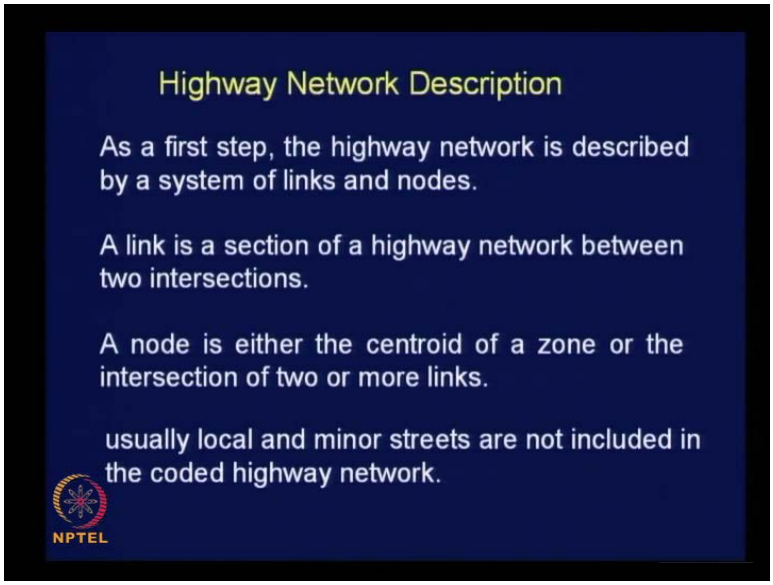

So, having discussed in detail about the three aspects, what are the three aspects; first one was related to conversion of person trips into vehicular trips, second one was related to temporal variation of travel demand, and third one was related to direction of movement. So, all these three aspects are to be given required attention, while you start assigning traffic on various roads, and to assign traffic first we need to represent the network properly, pertaining to urban area. How are we going to represent the road network, because this is an analytical process. The entire road network will be going as input for your route assignment analysis into a computer program. You cannot give the city map as city road map as input your computer program. So the network of road should be understandable for the analytical purpose, so you must by someway represent the road network analytically, in such a way that this information goes as input for your route assignment analysis.

Let us see how to go about doing this; first step the highway network is described by a system of links and nodes, system of simply links and nodes. A link is a section of highway or simply road network between two intersections; in a road network you may have intersections, crossing roads. The stretch of road between consecutive intersections

is termed as link. You have Madhya Kailash's intersection then there is a Koturpuram road junction in front of I I T, is it not?. The stretch of road between Madhya Kailash and I I T is one link, stretch of Sardar Patel road over this particular portion is one link. A node is either the centroid of a zone, namely traffic zone, you know what is traffic zone now, centroid of zone or intersection of two or more links.

Road intersections are nothing, but intersection of links is it not?. So, each road intersection is considered as nodal point nodes and your zone centroids are also considered as nodal points. Zone centroids are not fixed at road intersections. They are fixed based on set of different criteria about with will discuss later. As of now understand that all road intersections are considered to be nodal points, all the zones centroids are also consider to be nodal points. Usually, local and minor streets are not included in the coded highway network, that is very important, do not include every minus street, lanes and by lanes in your network, they are not relevant at all. You must think of the roads which constitute the main network reflecting or taking the major flow of traffic in the urban area, choice of roads into formulated network is very important.

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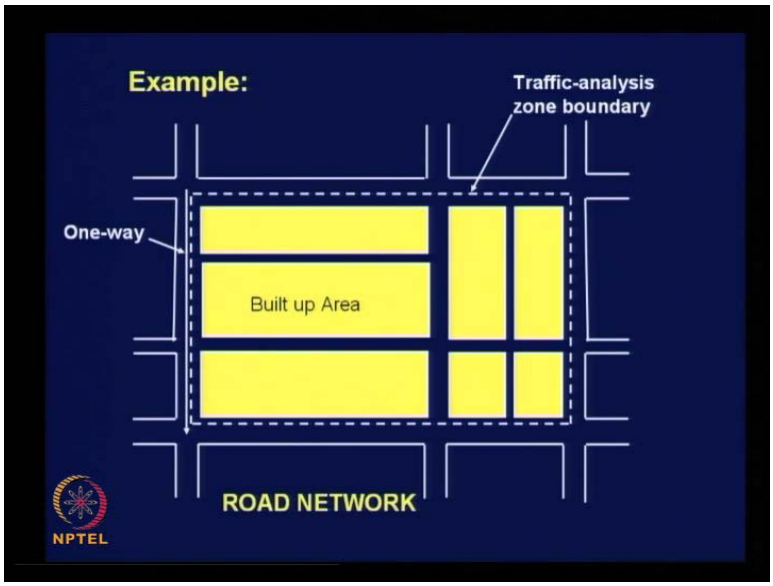

Let us consider a small example to understand the concept much better. This is a small portion of an urban area, heavily built up urban area, and we are trying to convert the roads involve in this area, in the form of coded network. Let us say this is the traffic analysis zone boundary. The dot line indicates the zone boundary is it not? that is how

you can fix a boundary obviously. You cannot just make the boundary line to cross the yellow colored portion, boundaries can be only obviously along the roads, and later on we will see how to really make this dotted lines, how to fix the boundaries for zones, we will discuss later in transportation survey about fixing boundaries for zones, as if now understand that this is the way a boundary line if fixed for traffic zones.

Now, our interest is, what are the roads or links and nodes relevant to this particular traffic zone that is our question. Please note there are several roads that are relevant to this zone, if you take on the horizontal direction, one road on top, there is more road here and one more road here. There are three parallel roads in east west direction that are relevant to this particular traffic zone. In addition you have one minor road in east west direction, one more minor road, this alone is the additional road in the east west direction. In the north south direction we have one major road here, another major road here, third road here and there is one more minor road in the north south direction in this area. Now, the question is should we have to consider all the roads for making the network or we can afford to ignore some of the roads.

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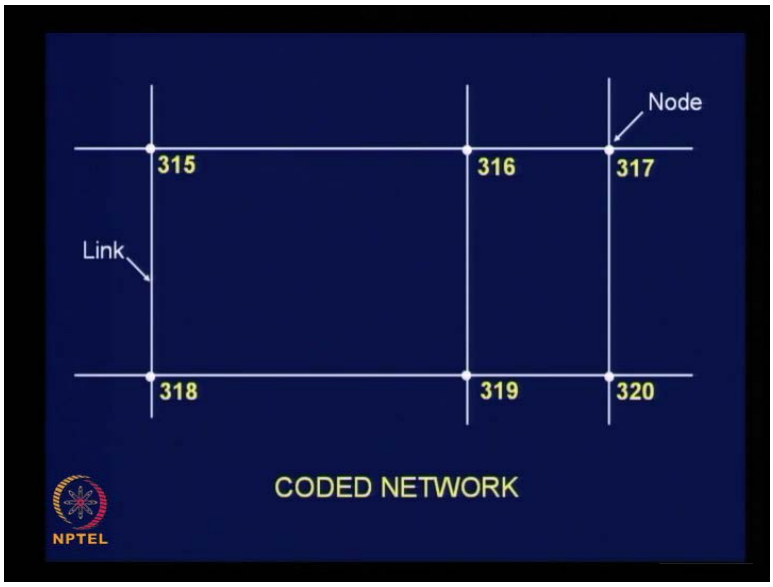

And one suggested network for this zone is this, we have given known numbers for the road intersections. How many roads we counted earlier, more than the number that is shown here, you may recall we observed three roads in east west direction, major roads and one more minor road, totally four and we have considered only two roads in east

west direction, and there were number of roads in the north south direction, we have considered three roads. Other roads are not considered, because they are minor roads and major minor distinction should be based on the actual traffic flow, on the roads. So, this is the network; nodes and links pertaining to this traffic zone. I will go back to the picture, please look at it and we have ignored this minor road, we have also ignored this road, this is also not taken in the account, this is also ignored, this road is also not taken into account, because these roads are minor roads and later on we will see how to account for the vehicles making use of these roads, as traffic generated from this particular traffic zone.

So, this is how we convert the rod network into nodes and links, and what is the designation of this link, how to name this link. Name this link simply as link 315, 316 links are named using node number, use the node numbers to name the links that is how we manage. Now there are some numbers which can be used, to designate a road intersection, to designate a stretch of road. Can you not perceive at this stage that these numbers can be used as input, to give information about to nodes and links in a city road network, it is possible. So, you can convert your entire road network into some set of numbers and give that as an input for your analysis. When you say 315 give 315 as input that represents the particular node in a particular location in a city. We are not going to give 315 or any other intersection, and when you say link 315, 316 that is going to indicate only that particular stretch of road no other road.

So, that is how conversion of the road network into links and nodes helps you to analyze the whole network easily, or give the information as input for the analysis. So, we will stop here and continue the rest of it in the next class, and to summarize what we have seen today. We started our discussion with a clear understanding that the previous three major analytical steps; namely trip generation, mode choice and trip distribution. We handled only person trips person trips, whereas in route assignment analysis we will be handling vehicle trip, in that context only we discussed about three important points related to route assignment; the first one was converting person trips into vehicular trips, second important aspect was converting the daily traffic demand into hourly traffic demand realizing the temporal variation in the demand for transportation, and third aspect was related to direction of movement, because we are going to deal with traffic

flow, and finally we have understood the method of representing the road network in the form of links and nodes, we will continue with the rest of it in the next class.