1.1 INTRODUCTION

Transport demand in general is derived from the level of economic activity. To be precise, economic activity broadly involves production, distribution and exchange of goods and services of various types. As time passes, economic compulsions for generating income involve mobility of men and material for production and consumption activities. Demand for mobility is therefore directly proportional to the level of economic activity though this proportion varies from stages of development in a particular area and at a particular point of time in different areas depending upon the initial conditions of development in those areas. Demand for mobility may however be expressed as demand for transport services, as the movement of men and material often involves means and modes of transport as displacement or movement of men and material may not be possible without the aid of a means beyond a certain limit. In other words, human beings, to reach a destination, use a suitable mean if the distance to be covered is not possible on foot. Again, for shipment of material from one place to another manual services may not be possible or adequate enough making the use of means indispensable. Therefore, for mobility of men and material for various purposes transport services offered by different modes become indispensable. Transport services being an intermediate good (not final good, plays the role of an input, like a factor of production) is used for various purposes like production, consumption and exchange.

1.2 THE ROLE OF INFRASTRUCTURE IN TRANSPORT OPERATIONS

In addition to the modes to supply transport services another most essential factor that is necessary is the transport infrastructure like road, rail, airport, seaport, etc. without which the modes cannot operate. These infrastructures have their respective capacities to bear the load of the modes. If the load exceeds the capacities the diseconomies of scale set-in manifesting congestion, pollution and accidents warranting expansion of the capacities of the relevant infrastructure. It therefore follows that to meet transport service demand, modes of transport of various types depending upon the nature of needs of goods and passenger movements will necessitate the services of infrastructure which ultimately limits the supply of the services. Now, to plan for infrastructure to supply transport services the
knowledge about the demand for transport services present and potential is indispensable. This makes the problem of estimating transport service demand very urgent.

1.3 THE NATURE OF TRANSPORT DEMAND

The demand for transport services can be broadly divided into two types, one passenger transport service and the other goods transport service. These two types of services generally require two types of modes. This is true, particularly where the bulk movement of goods is necessary. In case of passenger movement, exclusive movement of persons is involved in commuter services or in local travel but in long-distances movement, be it on road, on rail or in air and ship, passenger movement is not exclusively movement of human beings, rather, some amount of load in terms of goods cannot be avoided. Therefore, exclusiveness of the modes depending upon the nature of men and material can be done in certain other cases. Even in cases where this exclusiveness is necessary, say in long distance bulk movements of cargoes, the difference in physical structure and design of the modes may also be necessary, depending upon the nature of the goods hauled. For instances, the structure and design of the carrier of coal and oil has to be different because of the difference of the nature of the cargo. Here the content determine the nature of the container.

However, whatever might have been the difference, in the nature of modes, of goods and passengers and of goods themselves for the difference of their nature, the common factor that is, infrastructure-- the lorries for goods and buses for passengers will hardly warrant any difference in infrastructure, similarly for rail, air and coastal shipping and riverine transport. As a result once the infrastructures say road infrastructure is built it can be jointly used by various surface modes mechanized and non-mechanized and by the pedestrians. This makes the transport infrastructure behave like a public good. This public good cannot however be called a pure public good in the sense that restrictions can be imposed on the users of these infrastructures and the “user-charge” can be imposed and hence the non-excludability criterion of a pure public good does not apply here.

1.4 DEMARCATING THE RESEARCH QUERY

Now the essential prerequisite for provision of transport service is the knowledge about the expected or future demand for transport service. As had been pointed earlier, transport service, being an intermediate good, is not the final good and as such a lot depends upon
the purpose for which the service is demanded, apart from the type of objects—men and material—to be transported. In the present study, passenger transport service has been taken up leaving out the goods transportation problem, which is, of course an important component of the total traffic and transportation scenario. The uniqueness of passenger transportation revealed in the variance of preference of each trip-maker for different trip characteristics makes their study an interesting one. With urban population soaring (by way of inward migration from rural areas as a consequence of strengthened secondary and tertiary sectors) as our economy flourish, the need for an efficient passenger transport service to effectuate the mobility of these people cannot be restrained. However, exclusive features of passenger transport e.g., ensuring safe and comfortable journey raises their importance over freight transport.

The subject of study has been further delimited to the urban transport component of passenger transportation leaving out long distance or inter-state passenger transportation problems. Even in this specified area of passenger transportation focus should be concentrated on the urban road passenger transport problems of small and medium-sized cities. In small and medium-sized cities, the total transport service is offered by a number of modes within the broad categories of private and public in terms of ownership, and slow and fast moving modes in terms of manual and mechanical operations. In short, in these areas, a mixed traffic is observed to have been bridled with a number of problems which are not always different from those of big metropolitan cities in nature and intensity.

1.5 FORECASTING / ESTIMATING THE TRAVEL DEMAND:
THE NECESSITY OF MODEL(S)

For forecasting or estimating future mode-wise travel demand of commuters in an urban area, broadly two types of determinants have got to be identified. One, the group of determinants which are basic explanations for travel say, purpose of journey like journey to work, journey to visit friends and relatives, journey to places of entertainment, journey to hospitals, etc. and the other relevant factors to determine the choice of mode which would help perform the journey are income, age, sex, speed of the mode, safety and comfort, etc. These determinants are the explanatory variables for the demand for travel. This identification and categorization is necessary so as to view the relationship between movement of passengers and the explanatory variables in the form of equations where the
demand for urban travel would be treated as a dependent variable and the rest as independent variables constituting the right-hand side component of the equality sign. In order to have these equation in its explicit form, the statistical relationship between these variables have got to be worked out on the basis of data collected from the specified geographical area of interest. The empirical relationship thus obtained is called a model, which can be used for predictive purposes. In other words, if the values of the independent variables are given independently the value of the dependent variable that is travel demand will come out uniquely. This process is easier said than done. The difficulty mainly comes from the availability of the data that identify the explanatory variables as they are often not quantifiable and even quantifiable are not easily available.

However, whatever might have been the difficulties associated with this process of model building, this stage cannot be avoided in an effort of meaningful transport planning and policy formulation. The other aspect of it is that there is no mathematical or statistical model, which can be universally applied, the reason behind this is quite obvious. One reason, is that a statistical model worked out in a particular situation with all the local peculiarities incorporated in it will obviously not be applicable to a situation where the local factors are different. Again, in the same area a model worked out at a particular point of time may become inapplicable after a lapse of time because the situation might have significantly changed in the meantime. However, in the process of model building several approaches can be made and as a matter of fact various attempt had already been made with difference in degrees of success offering a wide range of choice of theoretical models, which may be, tried in a particular situation to choose the one that best serves the purpose. It is interesting to make a brief references to those types of models already available. It is none-the-less true, however rich the inventory of the models already developed, they are surely not exhaustive enough to cater to all types of needs that may be felt in the area of transportation planning. It is surely not possible to offer a solution by way of estimating mode-wise travel demand so as to fit exactly into the requirement of future demand. What in actual situation is faced is a variation in the requirement though that variation remains within a range. If a prediction or forecast remains within a range it is considered to be a good enough result. In reality travel demand behaviour cannot be captured by a single value for instance one can hardly assert that at a particular point in an urban area a specific demand for a particular mode will be generated everyday in a week. Therefore, one can easily say that travel demand is a stochastic variable and hence this
stochastic element should also be incorporated in the model for forecasting the travel demand to be realistic. The present study has made an attempt to develop a similar type of model to capture certain aspect of choice of mode in small and medium-sized cities. More precisely, what has been tried in this exercise is to test such a model in some specified urban areas which could be categorized under small and medium-sized cities in West Bengal state of India so as to provide a podium for applying the exercise to be conducted in similar urban areas elsewhere.

1.6 **TRAVEL DEMAND MODELS - THE MODEL APPLIED IN THIS STUDY**

Now specifying this type of models which are stochastic models for passenger demand for modes also leaves a wide range of models from which the model required for the problem in question has to be chosen before applying them in given urban areas. The stochastic models can be easily handled if the stochastic variables could be defined by the nature of their parameters like mean, variances and standard deviation. Quite often it is not possible to define the stochastic variables in terms of the standard distributions we know. In this situation even if we know the nature of the variables handled, here it is the stochastic variables we may have to face the challenge empirically to make them fit into the actual situations so that they can be reliably applied for predictive purposes. There exists a host of models in these group that can be broadly divided into aggregate and disaggregate models according to present parlance in literature. The model that has been tried in the present dissertation belongs to the group of disaggregate models for two reasons, one, convenience and two, compatibility. The disaggregate models are convenient from the standpoint of calculation and policy sensitivity. The second point will be clear if we specify the question, which we want to answer in the present study, which of course is a problem of choice.

1.7 **THE AREA OF APPLICATION AND THE LOGIC BEHIND**

The problem can be broadly described as the problem of urban travel modes in a medium-sized city of West Bengal, typical of a developing country. To be somewhat more clear the model is to be used for predicting, which of the two alternative modes—fast-moving or slow-moving is chosen by a commuter in a city of the said type. To answer this question apart from the suitable model to be applied one has to know whether the commuter is ready to pay faster and more comfortable mode leaving out the slower ones in a given income-distribution. Apart from income-distributions one of the important determinants of the choice of mode, as has been pointed out, is the purpose of journey, for example, a trip
for the purpose of going to the place of work is obviously more important than for going to visit friends, relatives or places of entertainment because the former trip is income-generating trips and the latter are consumption oriented. Therefore, urgency and punctuality of the former type of trips are obviously more important to the commuter than in case of the latter. In a given income circumstances a commuter may be willing to pay more for a journey for the former purpose than the latter. If so then, we can perhaps develop a hypothesis that during peak hours when journeys to work place assumes the modal value in statistical sense, the faster modes will be chosen by the commuters if the ability to pay permits. If the hypothesis is valid, then it may well happen that in a given income situation, a significant proportion of demand for faster mode during peak hours may remain unsatisfied to inflate the demand for modes of lesser choice. In other words, there may be difference between the desired or perceived demand and the actual demand made effective by the modes available. To put it differently the structure of the modes of urban transport in terms of proportion of different modes in the total modal supply in an urban area may be unsuitable for making the choice of the commuters effective warranting a revision of this proportion suitably. In so doing, what is necessary is to know what is perceived demand and actual demand of the commuters of a particular locality. To know that for a plan horizon one should identify a suitable form of the model and estimate the parameters before applying it. Precisely this has been attempted in this thesis.

1.8 THE SEQUENCE OF THE DISCUSSION

It is therefore clear from the above discussion that the entire work to be somewhat reasonably systematic has to be approached following a number of stages which may be divided into a number of chapters. At the outset, the typicality of transport operation including its impact on the society needs to be discussed so as to validate the need for a transport plan. Thereafter, a brief historical perspective followed by the objective of a transport plan is taken up to relate the importance of estimating travel demand in it. The nature of travel demand in the hierarchy of cities in terms of intensity and choice of modes in developed and developing countries is then highlighted before coming to the specific urban area in geographical sense on which the empirical study should be made. Next, or in the next chapter a discussion on the role of model building in estimating or predicting future travel demand should be described on the basis of the existing literature available on it. In this context, the typical models which have already been applied in developed and developing countries should be described with a view to give an idea about the inventory
of models available which will include two types of models—aggregate and dis-aggregate
types mentioned earlier. Following this, the justification behind taking up the urban
transport problems of the small and medium sized cities should be given along with the
justification of choosing the specific cities for trying the model. In the same chapter, some
salient socio-economic feature of the cities should be enumerated which will ultimately
converge to the problem identified for specific model building purposes. After doing that,
 chapter should be devoted to the discussion on the justification of the specific theoretical
model, its data requirement and the availability of data with their limitation should be
discussed in detail. Following this, a chapter should be devoted on the presentation of the
empirical result in brief and their interpretations should be clearly presented pointing out
the future applicability and the caution to be exercised before prescribing policy on the
basis of these results. At last, some suggestions, if any may be made in connection with
the theoretical aspects of the model, improvement of the data base necessary for fruitful
applications of this type of models and further work to be attempted for further
improvement of this type of model building process to cater to the nature of the problem in
future. In the following chapter, which constitute chapter 2 of this dissertation, will take up
the nature of travel demand.