A STUDY OF TRAFFIC IN OLD DACCA

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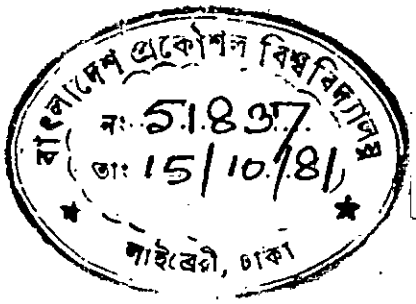

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may be accepted in partial fulfilment of the requirements for the Degree of MASTER OF URBAN AND REGIONAL PLANNING

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PREFACE

(52)

With the rapid growth of Urban Centres in Bangladesh, especially big cities like Dacca and Chittagong, the traffic situation is deteriorating every day. In Dacca City, the problem is worse than any other Urban Centre in Bangladesh. The rising importance of Dacca as the Capital City tends to make it greater and greater in its size and density. With the growth in population and landuse, the traffic situation has deteriorated. The situation in New Dacca is not yet too bad. But in the Old part of Dacca City, the old layout of road network is unable to carry the traffic demand which is put on it. The increased number of vehicles and new modes of transport are creating severe traffic congestion. This study aimed to examine the nature and causes of the traffic problem and to find alternative solutions. The identified solution might be helpful for tackling the developing traffic problems of other contemporary towns and cities in Bangladesh. The study concluded that the traffic problem in the study area arises mainly because of the high volume of traffic on the road particularly at peak periods. The increased volume of traffic developed because of the increasing use of new transport modes, increased number of vehicles, changed landuse and the establishment of new landuses in the area. Very recently the landuse of the area has changed dramatically. Landuses like godown and wholesale shops are generating more heavy vehicular goods traffic. Congestion occurs most frequently in the evening and a large part of the affected vehicles is goods traffic. To minimize the traffic problem in Old Dacca, several alternative approaches have been made in the past (for example, adapting the traffic to the town and adapting the town to the traffic) but with very limited success. Yet today the existing

traffic controlling rules and measures are not in use but rather being broken by every body. Traffic controls are needed to solve the problem, but the application to traffic controlling rules and regulations will not work unless the rules are apptopriate to the needs of the road users.

CHAPTER 1

THE URBAN TRAFFIC PROBLEM

The need for transport is an integral fact of everyday life. It plays a dominant role in determining the scale, nature and form of our towns and cities. Its efficiency contributes largely to the level of productivity, economic growth and thus the standard of living. With the development, growth and specialisation of urban society, the range of urban activities increases greatly, and the extent of movement between activities also increases.

With increasing urban population, rising vehicle ownership and greater demand for space from every type of transport, the volume of traffic grows steadily and the competition for space intensifies. Vehicles and people move within a town in connection with activities which they are engaged in. Traffic is therefore a function of activities. This explains why there is so much traffic in towns - because activities are concentrated there. At the same time the transport system itself can influence the shape of the town. Stone urges that "Transport acts as the most effective single form - determining element in the man-made environment."[1]

People need to move from place to place to get from homes to work, schools, shops, friends and other destinations. Goods must often be moved many times during production and then to the place of consumption. The means for transporting people and goods are varied. But the main forms of transport in our urban society are both the foot and the road vehicle. In general, although other forms of transport such as rail

[1] M.J.Bruton, "Transport Planning" ed. M.J.Bruton, The Spirit and Purpose of Planning, London: Hutchinson and Co. Ltd. p.169

transport sometimes make a contribution to the transport system of a town, the road system continues to be the most important and the most problematical facility. Yet today, the majority of towns and the cities in the world have been neither designed nor equipped to cope with the new forms of road transport, nor their increasing number.[1])

The Nature of the Traffic Problem:

The urban traffic problem, like most problems, arises out of the contradiction of trying to reconcile a number of partly incompatible goals. "Urban dwellers would like to move about their area (1) Quickly, (2) Comfortably, and (3) Cheaply but also (4) mostly to nor from the same places."[2] Urban movement thus is something to be done as quickly as possible. Speed and efficiency of movement is a prime objective, and traffic congestion, which slows movement, becomes one of the main problems.

The main urban traffic problems are discussed below;

Delay: To discuss the problem of delay it is worthy to quote,

> "Perhaps the most visible and therefore most irritating dimension of the transport problem is the loss of time and money resulting from inefficiencies imposed on the normal movement of people and goods through congestion and poor accessibility."[3]

Traffic congestion or delay is the problem, and it becomes most acute at peak hours, when large volumes of traffic are on the road. All road users, both pedestrian and vehicle users, suffer from the consequences of congestion.

Delay or congestion is not only the loss of time, to the road user, but also can involve monetary loss. For example if a Rickshaw puller loses one hour in a traffic jam, he will

1. Bruton, ibid. p.172
2. Bruton, ibid. p.169
3. Bruton, ibid. p.172

suffer a reduction in his daily income. Trucks stuck in a traffic jam may miss a ferry which will add more hours of delay to catch the next ferry, with a respective monetary loss of business.

The cost of delay may not result in the actual payment of money; the cost may not be felt immediately at the point of congestion; but the costs are nonetheless real and can be very substantial. "For example, it was estimated that in 1970 the cost of road traffic congestion in Great Britain was the equivalent of 35 per family per annum."[1]

In parts of old Dacca, it can take up to two hours to travel three miles (instead of only thirty minutes if the road is free) if there is traffic congestion.

Accessibility in urban areas gives people considerable freedom in deciding locations for work, to live, shop or play and to chose the optimal location for production and distribution activities. Conversely, poor accessibility can result in loss of comfort, frustration, inconvenience and more expensive journeys. Traffic congestion thus costs money and it diminishes the quality of life. But sometimes traffic can take away life altogether.

Accidents: The increasing use of faster motorised vehicles has resulted in a substantial increase in the number of road accidents.

Competition for road space, and conflict between different types of vehicles moving at different speeds, has made traffic accidents a serious part of the urban traffic problem.The cost

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[1] Bruton, ibid., p.172

of traffic accidents is high, in human terms and in monetary terms. In Dacca Metropolitan City in 1978, for example, 94 people lost their lives in traffic accidents and 131 people were injured (source: Dacca Metropolitan Police Office).[1] And the numbers have been increasing significantly in recent years.

The financial cost can also be high in terms of lost earnings, the cost of medical facilities, and damage to property. For example: "It was estimated that in Great Britain in 1971 the cost of total accidents was 375 million."[2]

Pollution and Damage to the Environment: In addition to delay, danger and anxiety, the vehicle, and especially the motor vehicle, is responsible for a great deal of noise. Traffic noise is now the predominant noise nuisance in towns.

> "There has never been a survey of the level of noise pollution in the city, but the bleats of motor horns and incessant cacophony from the microphones could make Dacca one of the noisiest metropolis in the world. Here there are no injunction on the use of horns and motorists, truckers and bus drivers are seemingly in a daily competition to find out who are the noisiest of all. In the noise race, the bus drivers inflict more decibels than our unfortunate earndrums can bear. They not only keep their horns working overtime but also keep a couple of assistants on the door to shout, and drum on the body of the bus adding a few combination notes to the blare that is coming out. These are no exceptions to the rule, not even in front of hospitals,educational establishments,offices,libraries and the like where people crave silence."[3]

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[1] These were the officially recorded accidents; it is believed that the actual number of traffic accidents is very much higher.

[2] Basic Road Statistics 1972 (British Road Federation,1972), quoted in M.J.Bruton, ibid., p.173

[3] Editorial,The Bangladesh Times, October 15, 1979

The motor vehicle has been responsible for much that adversely affects our physical surroundings. In city centres, where space is limited, and traffic at its most dense, the cumulative effect of encroachment by vehicles disturbs not only movement but can result in the destruction of the fabric of the town.

Traffic congestion at old Dacca not only affects the vehicles caught in the jam but the environment as a whole. Pedestrians cannot walk in peace; dust thrown up by the vehicles settles in food restaurants and shops. And people have to walk looking over their shoulder to guard against the danger of a passing vehicle. Thus the urban traffic problem has been identified as having three major components: delay (due to congestion); accidents; pollution and damage to the urban environment. One of the main reasons why these problems arise is because of the failure of the market mechanism properly to regulate these activities. In other words, for each of these problems people usually do not pay the full costs of their actions. Hence, there is a divergence between the "social cost" to society as a whole and the "private cost" of the individual road user. This divergence between social and private costs of the traffic problem is now examined below:

The Economics Of Traffic Congestion:

Traffic congestion occurs when a large volume of vehicles are on the road, which is not capable to carry that amount. Each road user slows down other traffic and so imposes a cost on other road users. Every single vehicle joining the road takes up a certain amount of road space. Road vehicles interact with each other, so each extra vehicle slows down the other traffic to a certain extent. In a situation of congestion, long queues exist and the traffic moves slowly. In other words, as

traffic concentration increases, the speed of the traffic is reduced and the flow is also reduced.[1]

The following graph illustrates the relationship between traffic speed and concentration very clearly:

The Relationship between Traffic Speed and Concentration[2]

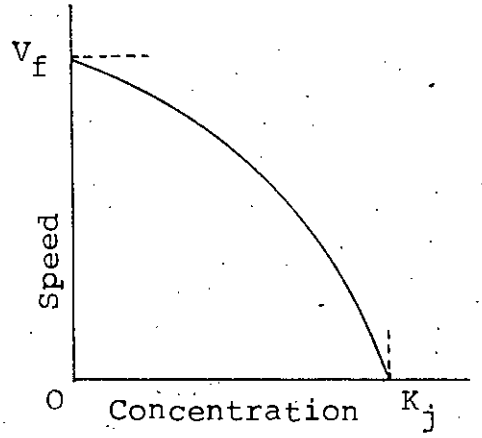

Fig: 1

Here, Kj is the point of maximum concentration or "jam concentration" where the traffic is so congested that vehicles are packed "bumper-to-bumper" and cannot move. The traffic is stationary and so the speed is zero. The point Vf represents the condition of free speed. In other words, when the road is completely empty or free, the concentration is zero and then the speed is at desired level of the drivers (Vf point). The only limitation to the speed of the driver at the point Vf or "free speed" is the design quality of the road itself. When a road is relatively empty of traffic, the impact of one extra vehicle on the road is very small, and traffic speeds are only

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1. Here traffic concentration means the number of vehicle on the road at a given time; speed means the average speed at which the traffic is moving; and flow means the number of vehicles passing a fixed point during a given time.

2. See Ernest Davies(ed) "Traffic Engineering Practice", London, 1968, p.83

marginally reduced. But when the road is very busy, the addition of one extra vehicle can have a very severe impact on traffic flow, even bringing the traffic flow to a standstill. This is clearly illustrated by examining the concept of "level of service" of a road. The "level of operation or service" of a road is related to the capacity of the road space, and the speed flow of vehicles. It tells us about the maximum flow of vehicles (in terms of vehicles per hour) that a road is able to carry at a given speed, and illustrates the severe impact which a few vehicles can have on the traffic flow, when the road is operating at very congested levels of service.

Alternative Levels of Service of a Road Related to Speed of the Traffic

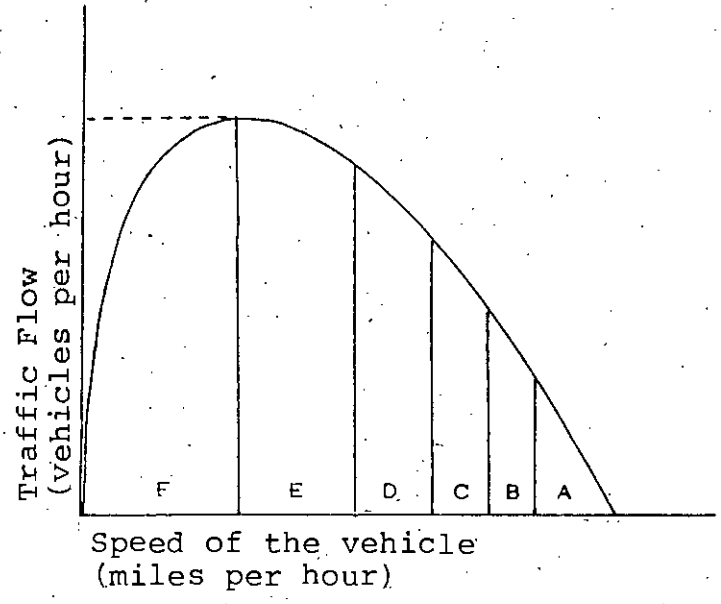

Fig: 2 Source: E. Davies, op.cit., p.70

Level of Service "A": At this level, the traffic concentration and hence flow is low and the traffic speed is correspondingly high. So drivers face little or no delay.

Level of Service "B": Here a zone of stable flow exists, where the speed is beginning to be restricted by the increased level of traffic. However, the drivers have freedom

to select the required speed, and little or no delay results.

Level of Service "C": Here traffic is still in the zone of stable flow. A relatively satisfactory operating level is obtained even though the freedom of speed has been slightly restricted.

Level of Service "D": This level is approaching unstable flow conditions, although the speed is still tolerable. But temporary restrictions to the traffic flow may cause substantial drops in operating speed.

Level of Service "E": Vehicles are moving at significantly lower speeds than that of level "D". However, the volume or concentration of the traffic is very high,so traffic flow is very high and the road is at or near capacity of the highway. The flow is unstable, however, and there may be stoppages of mometary duration.

Level of Service "F": At this level the speed is slow and flow is significantly below the maximum capacity.

> "These conditions usually result from queues of vehicles backing up from a restriction downstream. Speeds are reduced substantially and stoppages may occur for short or long periods of time because of downstream congestion. In the extreme both speed and flow can drop to zero."[1]

Thus when roads are operating at the level of service "F" the roads are highly congested, and the addition of even one extra vehicle can have a dramatic effect on the traffic flow bringing it to a complete stand still or zero. Therefore, traffic speed is reduced with the increasing concentration of vehicles on the road. Each extra vehicle reduces the speed of the traffic. The individual road user, however, does not pay the full economic cost. Individually a person might lose his time, but he is also delaying all other people on the road to

[1] E. Davies, op.cit., p.70

some extent, and this he does not pay for. The cost imposed by individuals to society has been ignored. The costs that an individual road user normally pays include;

1. Only his own time (if traffic delay occurs)
2. The cost of the extra fuel which might be incurred due to the delay
3. Road tax and vehicle licence
4. The capital cost of the vehicle when first purchased

Now, these costs which the road users pay, bear no relation to the cost of the traffic congestion, to which he is contributing. The capital cost of the vehicle is paid regardless of whether the vehicle is used in congested traffic conditions or not. Similarly, the road user has to pay the road taxes and vehicle licence cost any way. Frequently these taxes are low and certainly bear no relation to the level of traffic congestion or the amount of use of the vehicle.

> "Fuel costs rise during traffic congestion, but again , this extra cost tends to be very small in relation to the overall costs of congestion."[1]

Delay is a cost to the people who are using the road. But the individual road user, who may actually cause the delay, pays only a fraction of this total cost. For example, one man enters a traffic flow and causes delay of 5 minutes to the other traffic. So he is paying only for 5 minutes but delaying other traffic in the flow. Five minutes is not very much for the individual to pay but cumulatively, 120 people each being delayed by 5 minutes are paying 10 hours of time (120 X 5 min.= 600 minutes or 10 hours). Everyday people are losing substantial amount of man-hours only in traffic congestions.

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[1] E. Davies, op.cit., p.85

The Different Requirements for Road Space:

Not only does the individual road user not pay the full cost for the use of the road, but further more different vehicles consume different amount of road space.

> "Vehicles of different types require different amounts of road space because of variation in size and performance. In order to allow for this in capacity measurements for roads and functions, traffic volumes are expressed in passenger car units (PCU's)."[1]

The different consumption of road space by different vehicles can be expressed by a common standard. It is called P.C.U.; Passenger Car Unit. P.C.U. is a measure of road space taken up by a vehicle. The P.C.U. depends on vehicle speed and road design.

> "There are basic differences between standards for urban areas and those for rural areas. This is due to differences in acceptable levels of speed, though intermediate conditions apply in the urban-rural fringes. The necessity for this dual approach arises from the critical capacity of road junctions and the urban roads are more flexible in capacity."[2]

There is an international standard of P.C.U. where the motor car has been considered as one unit. Other vehicles are then expressed in relation to the standard car unit. P.C.U.'s for urban areas in Western Countries are typically:[3]

Car	1.00
Trucks/Lorries	3.00
Buses	3.00
Motor Cycle	0.75
Bi-Cycle	0.33

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1 Report on "Roads in Urban Areas," Ministry of Transport Scottish Development Department, The Welsh Office, London, 1966, p.6

2 E. Davies, op. cit., p.88

3 E. Davies, op. cit., p.89

Thus certain types of vehicle (e.g. Trucks) take up much more road space that others (e.g. Bi-cycle). Yet they all pay roughly the same amount for the use of the road space. When we consider the occupancy rate of different vehicles, the amount of road space taken up by different road users becomes even more marked.[1] The typical occupancy rate per vehicle differs greatly. for example;

	Car	Bus
P. C. U.	1.00	3.000
Occupancy Rate*	3.00	100.000
Road space taken per person	0.33	0.033

*The above table shows the typical occupancy rate in Bangladesh.

So it is clear that car passengers are consuming much more road space per person than for example, bus passengers. In this example the space consumed by a car passenger is 10 times the space consumed by a bus passenger. Yet both are paying approximately the same for the use of the road. When people do not pay the full cost of a certain commodities, their demand for that commodity is likely to become substantially higher than it would if they had to pay the full economic cost. Thus demand is artificially inflated, and may exceed the available supply.

Thus the failure of the market mechanism means that more and more road users will use road space until congestion occurs. In a similar way, road users are not paying the social cost of pollution. For example, the smoke discharged from trucks in a congested road can be quite substantial, and pollutes the air of the surrounding area. The cost(of breathing foul air) is paid by everyone, but the private cost to the owner of the truck is zero.

[1] "Occupancy Rate" means the number of passengers carried by a vehicle.

CHAPTER 2

CAUSES OF TRAFFICE CONGESTION

The fact that road users do not pay the full economic cost of their use of road space is one reason why traffic congestion occurs. But even if it were possible to charge road users the full cost, it is likely that congestion would still commonly occur. Why? Simply, because demand (the volume of traffic) far exceeds the available supply (of road space).

The main causes of traffic congestion are therefore due to;

1. Restricted supply and limited road space which can be caused by;
   a. Old and narrow road layout
   b. Poor road quality
2. Increased volume of demand, due to;
   a. Changed Landuse
   b. Vehicle ownership changing
   c. Increasing concentration of road users at peak periods

The supply of road space may be limited due to a number of factors.

1. a) Old Narrow Road Layout: The road system in urban areas has frequently been inherited from the pre-motor era, and is now unsatisfactory for motor traffic. Often the roads were designed for only pedestrians, or in some cases for horse drawn carts. The Traffic in Towns, the report put this aspect emphatically:[1]

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[1] C.D.Buchanan, "Traffic in Towns," London: HMSO, 1963, p.83

> "The manner in which the buildings and streets are put together is basically unsuitable for motor traffic. This soon become apparent after the invention of the motor vehicle because it soon exerted a strong influence towards changing the form of towns by encouraging the outward spread and sprawl of development."

The Report continues;

> "A motor vehicle requires a reasonably clear, uninterrupted run, but in the close criss-cross layout of our urban streets there are intersections at very frequnt intervals and each of these is a potential obstruction to the flow. Another great difficulty of the inherited road system of towns arises from the unfortunate fact that access to the great majority of buildings is gained direct from the street into which they front and thus obstruct the flow. A further difficulty, only too well known, is the shortage of parking places."[1]

Thus the road network may be quite restricted, and certainly not designed for the new demands which are made on it. But although the road network may be restricted, a further factor can serve to restrict the supply even more. That factor is;

1. b) Poor Road Quality: This factor can also limit the supply of road space on the road. Bad quality of road surface can substantially hamper the speed and flow of traffic. And the presence of obstacles in the roads, such as unauthorised constructions, holes, garbage, etc. can reduce the road space very significantly.

While the supply of road space in an urban area is restricted, and may be very difficult to increase once the layout of the town has been determined, the demand for the road space tends to increase substantially over time. The causes of increased traffic demand are now discussed below.

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[1] C.D.Buchanan, ibid., p.38

2. a) Changing Landuse in the Town: Traffic is a function of urban activities, thus a function of landuse. Landuse and transportation are so closely inter-related that it is difficult to separate the ways that each interacts with the other. Both of them are interdependent. As landuse and transportation change, these induce changes in each other, so that a changing landuse will change the pattern of transport movements while changes in the transportation network will cause changes in urban landuses. Some examples to illustrate how changing urban landuse can change the nature of the traffic demand are presented below.

Firstly, traffic demand may increase because the town or city is growing in size. As the city grows, more people come to live and work there. For the increased population, new landuses develop around the city. So the increased demand for movement by those landuses creates new volumes and types of transport. More people commute from the suburban areas to the centre of the city every day, which tends to increase both the traffic volume and the complexity of the cross-town movements.

Secondly, within the city area itself, in the course of time, the population density and landuse intensity will frequently increase in order to make maximum use of limited space. So, as a result , the traffic volume generated by this more intense use of space will increase substantially.

Thirdly, if new landuses come into an urban area, replacing older uses, the new landuse may generate more traffic than the original use. For example, if factories, warehouses, and offices replace older residential uses, they are likely to generate a substantially higher amount of traffic, and traffic of a different type, especially heavy vehicles. So the new landuses not only generate more traffic but of a different type from the original landuse.

It is worth illustrating briefly how changes in the transportation system can also induce changes in landuse. For example, if traffic congestion in an area is particularly bad and a frequent occurence eventually some landuses will decide for various reasons, that they cannot endure the congestion any larger, and will move to a new location. Again the provision of new transport infrastructure (such as a new road or a new rail link) will open up new areas, and new landuses may settle there. A second major cause of increased traffic demand arises through changes in vehicle ownership.

2.b) Vehicle Ownership Changes and Increases: More people are owning and using vehicles in the urban areas now than before. This is a trend in most of the towns and cities of the world. The level of vehicle ownership is increasing mainly because of increases in the level of income. In many developing countries, the income level of people in the urban areas is substantially higher than that of the rural areas and as income rises, the demand for transport increases. Some people use transport where previously they would have walked, while others use their increased income to purchase a vehicle, whether bicycle, motor-cycle or car. Not only does the level of vehicle ownership tend to rise, but the type or mode of vehicle owned also tends to change over time.

New modes of traffic are appearing in urban areas. This is happening because of changes in technology, the emergence of new roads and improvement to the transportation system. In western countries, lorries are getting bigger and bigger in size which occupy more road space in the urban areas.

In Bangladesh, the numbers of trucks are increasing and taking the place of other modes (for example: replacing train, river or push cart).

The emergence of new needs also serves to change the mode of transport. For example, many businessmen in Bangladesh prefer the truck to the train because it is quicker, is more secure and provides access direct to the doorway. The development of the transportation sector also invites new types of traffic which ultimately increases the volume. For example, interdistrict road transport in Bangladesh has been improved quite significantly in recent years which generates a large volume of road traffic both for passengers and goods movement . But the emergence of new modes of transport in the urban areas can create problems of conflict. For example, a motor car operating in congested traffic can only run as fast as the push cart moving (at walking speed) in front of it. Because of the narrow road layout, there may be nor room for overtaking.

2. c) Increasing Concentration of Road uses at peak periods:

A third factor which lies at the heart of the urban transportation problem is the fact that traffic demand is conventrated at peak periods of the day which puts a heavy load on the road system, in fact, often overloading it.

Most of the cities of the world face problems of congestion during certain peak periods of the day. The typical journeys made by urban dwellers tend to be concentrated at specific times, and at specific locations of the city. For example;

> " Central London is, of course, unique. In its ten square miles it employes 13,32, 000 workers."[1]

The work bound commuter wishes to travel to work at a specific time in the morning and before and after the office hours, waves of people and vehicles crowd into the city centre.

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[1] J.B. Cullingworth, Problems of an Urban Society; Urban and Regional Studies No.4, London: George Allen and Unwin Ltd. 1972, p.135

As the economic structure of a city changes, the pattern of transport also changes. Increasing office employment starting and finishing at regular times, and other changes, such as the increased participation of women in work, all serve to increase the concentration of traffic demand at certain peak periods. The demand which occurs at certain times is often more then the road system can carry. The traffic problem is primarily one of solving the problem of traffic congestion at peak periods. Planners, therefore, focus their attention on the problem of the peak traffic period. And they try to tackle the problem of traffic congestion both by increasing supply (of the roads) and by rationing or controlling the demand (for road space). The following chapter examines the responses to the urban traffic problem.

CHAPTER 3

APPROACHES TO SOLVING THE TRAFFIC PROBLEM

Traffic congestion arises because traffic for road space is higher that the road is able to carry. This is the basic problem. An over-loaded road system leads to congestion, delay and other traffic problems. Thus, when the traffic is too high for the existing road system, something has to be changed to improve the situation. There are many alternative strategies which Government can adopt to deal with the problems of traffic congestion. In the most simple terms, these strategies can be conveniently summarised into three categories;

1. adapting the town to the traffic;
2. adapting the traffic to the town; and
3. doing nothing, and hoping that the problem will solve itself.

Each one of these strategies will sometimes be the most appropriate response to a particular traffic situation, but in general, we tend to use a combination of all three strategies to deal with the traffic problem.

1. Doing Nothing:

At times this can be the best approach, because to a certain extent people are able to adapt to the problem. When traffic congestion occurrence becomes a regular occurrence, road users will learn to adapt to the situation, and find ways to avoid the problem. The strategy of "doing nothing" can have both short term and long term effects. In the short term, the effect of "doing nothing: is that people find alternative routes, thus avoiding the areas of congestion, and they will also tend to choose off-peak hours for travelling, especially if their journey is not essential. Those people who have to travel in the peak hours frequently look for alternative routes,

such as secondary roads, to avoid the congestion of the main roads.

In the long run, the effect of "doing nothing" is that landuses will gradually relocate in areas where there is greater accessibility and where traffic congestion is less of a problem. Further more, in the long term people will change to alternative nodes of transport which are less liable to suffer from delay. For example, more people may walk or travel by rail.

Certain landuses may relocate because good accessibility is important to their activity or business. If traffic congestion is a regular occurrence, eventually some activities may decide that they can no longer tolerate it, and despite the costs of moving, will relocate in new areas. Relocation of landuses frequently take place to some remoter places on the periphery of the town. The relocating landuses usually include industries, business activities and also residential housing. Thus there are some clear benefits in the strategy of "doing nothing", traffic demand will rearrange itself to a certain extent, and in any case it is usually not possible for Government to take action at each and every point of traffic congestion - there are simply too many points.

But by itself a strategy of "doing nothing" is generally unacceptable. Usually, traffic demand will not rearrange itself sufficiently to overcome the problem of congestion. Road users frequently are unaware of traffic delays until it is too late and they are caught in the jam. It may be many years before certain landuses finally relocate. Furthermore, the divergence between the social costs and the private costs of traffic congestion means that congestion will tend to occur at higher levels than road users would otherwise be prepared to accept,

that is, if they were able to pay the full economic costs of congestion.

As Reynolds argues:

> ".... there is a very large gap between the prices paid and the full costs of vehicle operation under congested condition."[1]

and later;

> ".... urban congestion seems to have the following elements,
>
> i) a noticeable cost or loss borne willingly (in a broad sense) by the individual and presumably taken full account of in his actions, choices and valuations.
>
> ii) a similar or larger additional cost or loss imposed by the individual on other people, taking the form of a small cost or loss imposed on many other people who cannot usually be easily identified or compensated."[2]

Thus the strategy of "doing nothing" can impose significant costs on the community, and furthermore, this burden may not be equally shared by all;

> "The present"free for all" on congested urban roads means that the private motorist, who is in general wealther than the average, raises the cost of all other road transport; the resulting chaos imposes extra costs on people who are more often than not poorer than himself."[3]

The second strategy is to adapt the town to the vehicle.

2. Adapting the Town to the Traffic:

This is the process of adapting the town to the growing

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[1] D.J.Reynolds, "Economics, Town Planning and Traffic," Institute of Economic Affairs, 1966, p.40

[2] Reynolds, ibid., p.32

[3] Reynolds, ibid., p.36

volume of traffic as well as to the increased size of vehicles. Because landuse and transportation are closely related, when one changes, the other will automatically change. Accordingly one way of coping with the increased volume of traffic is to reorganise the design of the town. This can be done by;

- building new roads (or other transport facilities)
- controlling and changing the landuse of the town.

Building New Roads and Other Transport Facilities: To cope with the increased volume of traffic, the building of new roads or the introduction of other forms of transport can provide some solution to the problem, at least in the short term. Inside the existing urban area, old roads can be widened and straightened, or new roads constructed. Alternatively, new transportation systems, such as urban railways, underground railways and so on, can be built.

> ".... there are (transport) systems which are modern, efficient and economical. Electric bus is one and it seems to be suitable for Dacca and installation of this system is possibly economically feasible for us. A circular train around Dacca appears to be another good and viable idea. The Government is thinking in this line. The proposals for electric bus and circular train is part of a lasting solution to the traffic problem of the city...."[1]

But once a town has been built and adapted to one particular form of transport and landuse layout, it is very hard and expensive to change the design to accomodate new transport systems, whether road or rail. The changes include demolishing buildings on the way, widening the roads, and so on. Often the land value of urban areas is so high that it is very complicated, disruptive and expensive to acquire land for the new transport system. As an example of how costly the solution of

[1] Raquib Siddiqui, "Lets Find a Modern Lasting Solution," The Bangladesh Times, October 22, 1979

building of new roads can be considered the case of London in the early 1970's.

> "The London Motorway* proposals as a whole are estimated to displace some 90000 people. Can the displacement of such a number of people be justified for the benefit of the minority."[1]

The cost of building approximately five miles of motorway in London in 1970* was estimated to be £33 million (which would be approximately Tk. 109 crore simply for 5 miles of urban road!)[2] To quote Cullingworth again; "To accommodate large number of cars in urban areas in a civilised manner involves a very high level of expenditure."[3]

The high level of expenditure or new roads in old urban areas may be expensive in a Western City like London; it may be a luxury which cannot be afforded in a developing coutry. Furthermore, experience gained in Western countries in the past indicates that building new roads does not, in fact, solve the traffic problem. This is because new roads will attract new volumes of traffic, which will again create a problem.

> "Building new roads as a solution to urban congestion and degradation is rather like printing more money as a cure to rising inflation."[4]

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[1] J.B.Cullingworth, Problems of an Urban Society, London: George Allen and Unwin Ltd., 1972. p.139

[2] J.B.Cullingworth, ibid., p.140

[3] J.B.Cullingworth, ibid., p.140

[4] J.Ratcliffe, An Introduction to Towm and Country Planning, London: Hutchinson & Co. Ltd., 1977, p.226

*This London road is known as the "Westway" leading to the airport.

It can be predicted that if roads are widened and become less congested, more people would like to use the vehicles on the road. Before the road is widened, the potential demand is dormant and this potential demand may be relased after new roads are constructed or existing roads widened. More roads tend to generate more traffic and thus exacerbate the situation. For example, in 1970 a traffic census carried out in London gave the following figures at the peak hour;

> "3,900 buses carried 15,09,000 passengers while 73,600 cars brought in 1,03,000 passengers only."[1]

This is a very good illustration of latent demand for road space which new roads merely release. From the above example, it appeared that the majority of people in London used public transport as a mode of transport. In addition, trains in Central London play a significant role in carrying large numbers of people. Many people in London travel by bus or train because the roads are too congested to accommodate greater numbers of cars and other private vehicles. But if road improvements are carried out, many people are likely to change from public transport to car, and congestion will reappear, albeit to a higher level.

The American experience would seem to confirm this conclusion:

> "Nevertheless, American experience provides good grounds for arguing that road improvements are self defeating: The greater the expenditures have been, the greater has become the need. With it all, no city can say, regardless how much it has poured into providing conveniences for its motorists that it does not have far more congestion and far greater inconvenience than when it embarked on its costly venture."[2]

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[1] J.B.Cullingworth, op.cit., p.150

[2] J.B.Cullingworth, op.cit., p.138

In short, building new roads is expensive, takes a long time to implement, and finally does not meet the objective of eliminating the traffic congestion. There are, however, other ways that the town can be adapted to the traffic.

Changing and Controlling Landuse: Under this heading two sub-heading can be discussed: namely, Control of Landuse, and Relocation of Landuse. Introduction of new landuses into an urban area, or the intensification of existing landuses, will result in the generation of more traffic. Thus if landuse can be controlled, traffic can be controlled, The control of land-use is carried out by controlling building construction (e.g. height, density, and location) and controlling landuse. Restriction of these buildings and landuses is intended to keep the volume of traffic within acceptable limits. However,this approach of adapting the town to the traffic suffers from a number of limitations. Firstly, it is a "negative" response to the traffic problem, trying to prevent future problems rather than dealing with the existing problems of today. Secondly, in order effectively to carry out this kind of controlling system, a strong administration and planning system is required.

If too many buildings or landuses are allowed as "exceptions", building control will have little effect on traffic congestion. The relocation of key landuses (market centres, factories, offices, etc.) may be another solution to adapt the town to the traffic. Usually the relocation takes place to the periphery of towns, or even to the other cities, reducing the traffic from the central area. The relocation of the old and famous Covent Garden Market in London in the 1970's, moving from the central area to a new location several miles away, is one notable example. Sometimes incentives are offered by the Government (for example:a tax reduction or a tax free period for several years) to encourage industries, factories and offices to relocate.

> "The Council of Ministers (of Bangladesh) also decided in principle to transfer a number of government and semi-government offices from the capital to different places of the country to reduce the continuous pressure of increasing population in the city..... "[1]

But the relocation of landuses is also an expensive solution and unless there is an efficient planning mechanism and controlling system to prevent new landuses, which also generate large volumes of traffic, from simply replacing the old landuses, this approach is unlikely to work.

3. Adapting the Traffic to the Town: Where demand is too great for the capacity of the transport system, we have to ration the demand by some method. To adapt the traffic to the town there are a number of methods by which the use of the roads can be rationed or controlled to a certain extent. We can categorise these methods into two broad groups;

1. Pricing Techniques, which seek to ration use by the pricing mechanism.
2. Road Management Techniques.

Rationing Road Use by forms of Pricing : Since road users are "consuming" a scarce and limited resource (i.e.roads), it would seem reasonable that they should pay for the use of that resource. Pricing techniques represent one approach for controlling the use of the roads: the higher the price the road-user has to pay, the less will be the demand.[2]

There are a number of ways that road users can be charged for their use of roads. They include;

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[1] "A Number of Offices to be shifted from the Capital," The Bangladesh Times, October 20, 1979.

[2] Reynolds, op.cit., p.81

1. Import quotas and taxes for imports of vehicles,
2. Purchase Tax for vehicles,
3. Annual Road Taxes and vehicle licences,
4. Petrol Taxes, and
5. Direct Road Pricing.

Import quotas and taxes on imported vehicles can limit the number of certain types of vehicles that are introduced to a country. Higher purchase taxes and road taxes and a higher cost of vehicle licences also have the effect of making certain types of vehicle more expensive and hence limiting their numbers. But the taxes, from the vehicle owners point of view, are a rathercrude form of charging for the use of the vehicle on the roads. Once the tax has been paid, the owner is free to use the vehicle as he pleases. This method: "....fails to cope with the modern traffic problem in a number respects;

a) It fails to discriminate between those situations in which congestion costs of road use are high and those in which they are low.

b) Different vehicles have different fuel consumption where fuel tax is useless.

c) The comprehensive employment of a fixed annual charge appears to have even less effect than the fuel tax in restricting congestion."[1]

An alternative, therefore, is to charge road users directly for the use of individual roads. This techniques is known as "road pricing". The demand for roads can be compare with telephone users which provide a theoretical justification for road pricing. Like roads, telephones are a public service Again, like roads, demand for the use of telephones tend to be concentrated at certain peak periods. If telephone equipment is installed to cater for the peak level of demand, then for

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1. J.Ratcliffe, Introduction to Town and Country Planning, London: Hutchinson & Co. Ltd., 1974, p.277

most of the "off-peak" period the equipment will be under-utilised, which is expensive and wasteful.

Some countries (e.g.UK., Sweden) have introduced increased telephone rates at peak periods. This has the effect (or at least the objective) of restraining demand at these periods. Those who judge that they must make a phone call in the peak period, pay the increased rate. Other less essential demand is directed to off-peak periods. The peak is thus reduced to managable proportions, the demand for the equipment is thus "smoothed", and less equipment has to be supplied to meet demand.

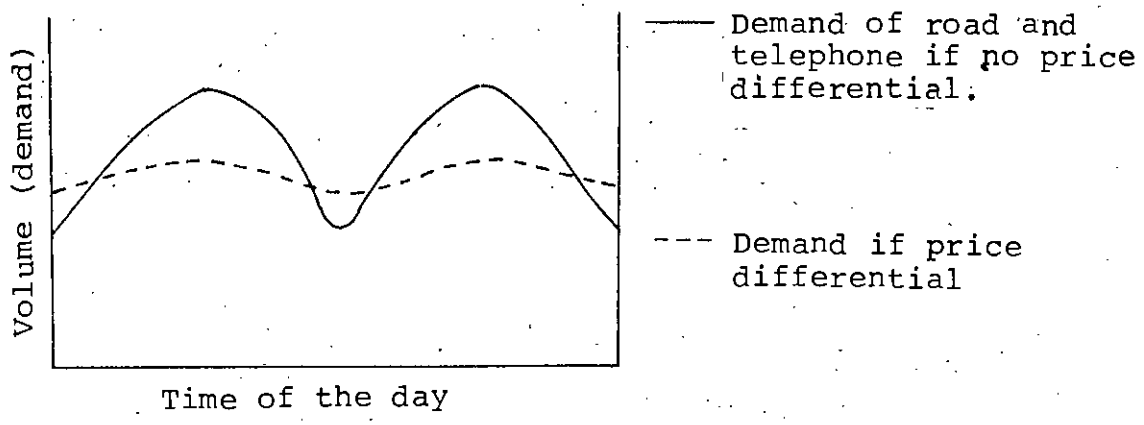

Fig: 3

Usually the demand for roads and telephones follows a very similar daily pattern. But the road users on the other hand do not pay different prices at different times of the day. Some big cities have responded to this problem indirectly by popularizing "flexi-time" working. For example, "Another interesting innovation, this time from Germany, is the voluntary flexible staggering of working hours under a system known as Gleitzeit or "Sliding time"....[1]

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[1] J. Ratcliff, op.cit., p.269

But a more direct response is through direct pricing. These direct methods are briefly discussed below.

Toll taxes, and toll gates have long been used in different parts of the world and are of cours, still employed on bridges, tunnels and on major highways. This method is widely used in Bangladesh, and provides a method whereby the road user pays directly for his use of the road. But this technique requires a lot of organisation; the establishment of toll gates and collection points, for example, and thus it is only practicable where entry and exit to the road is limited (as in the case of bridges). It is therefore rarely suitable for the diversity of urban roads.

A second form of direct pricing is through parking charges, where the road user has to pay for parking his vehicle. Again, this technique relies on both the provision and public control of all parking spaces, and the creation of a complicated administrative machinery to collect the charges. This pricing technique is now widely used in Western countries,[1] although it is a rather recent development of the 1960's and 1970's.

A third technique is a vehicle pricing meter on the vehicle itself.[2] But although this technique might be the most effective technique of all, it is sufficient to say that no country has yet fully overcome the technical problems and succeeded in introducing such a system.

In conclusion, of the different forms of direct road pricing in urban areas, a few techniques have been successfully implemented. Among these techniques, parking charges have proved the most successful, but it has required both effective control over parking space, and effective administrative machinery to collect the charges.

[1] See Brierly, "Parking" in E.Davies, op.cit., p.188

[2] [illegible] op.cit., p.279

The alternative to rationing road use by pricing techniques, therefore, is to control the use of the road itself.

TRAFFIC MANAGEMENT

Traffic Management is the device of getting most efficient use out of the existing transportation network.

> "Traffic Management simply expressed is the exercise of controls on the use of roads so as to obtain their best use in the general interest..... The "best use" is usually thought of interms of increasing the capacity of the streets and junctions so as to provide for more vehicles to use the streets more smoothly and with less delay. But"best use" should also mean making the streets as safe as possible both for vehicles and pedestrains. Fortunately these two aspects are not in much conflict and experience shows that it is possible to design schemes which at the same time increase the capacity of the road network and reduce accidents."[1]

In short, Traffic Management deals with minor changes to the transport network. So Traffic Management Techniques tends to offer cheaper solutions to the aim of increasing road capacity. Traffic Management is concerned with activities such as:

a) Minor alteration to roads (for example, kerbs, islands, and road junctions);
b) The control of moving vehicles; and
c) The control of standing vehicles (for example, by imposing restriction on waiting, loading and unloading, and parking).

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[1] E.Davies, Traffic Engineering Practice, London: E & F N Spon Ltd., 1968, pp.102 - 103

There are many different traffic management techniques which can be applied to urban roads in order to increase the capacity of the streets. Some of the most common and effective techniques are discussed below.

The introduction of the one way street is a popular technique of traffic management.

> "The reason for making streets one-way is to improve the flow of traffic, increase capacity and reduce delays. Experience in London shows that one-way systems also reduce accidents. In modern traffic management, one-way streets are generally the more important measure in a comprehensive scheme for an area....."[1]

The improvements to traffic flow are generally brought about because the number of points of conflict between vehicles at intersections is reduced, the flow of traffic is made smooth by removing opposing (on-coming) traffic, and street parking and stationary vehicles are generally less troublesome.[2]

Another technique is the restriction of certain types of vehicles to certain areas. These restrictions may be imposed both for certain times of the day and for certain types of vehicles. For example, in Central London, the entry of large lorries above a certain size is completely prohibited, while the entry of smaller lorries is restricted to certain roads. The aim of these restrictions is to limit the numbers of certain types of vehicles which could have a disproportionately adverse impact on the traffic flow. The best example of this is Singapore where cars are totally restricted in the city from 7.30 am to 10.30 pm. The system was introduced in 1965 for 3.5 square miles area and became a popular example. The central area has 22 entry points where one has to pay 4 dollars daily (60 dollars monthly) if he gets in.

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[1] J.T.Duff, "Traffic Management" in E.Davies, op.cit., p.105

[2] J.T.Duff, op.cit., p.106

Another traffic management technique is the control of Right Hand Turns. In a two - way road, the speed of vehicles is substantially restricted by the vehicles coming from the left to make a right hand turn. This can also be responsible for causing a large number of accidents. To avoid delay and accident, the restriction of the number of right hand turns can be a very effective technique. The construction of round-abouts is another technique which can help to reduce congestion at road junctions.

Bus lanes and Pedestrian ways: For reducing the conflict between different modes of transport, different traffic lane can be provided: for example, a foot path for pedestrians and separate lanes for slow moving vehicles such as in bi-cycle. In Holland and in some new towns in Britain, different lanes for cyclists have been provided. In Dacca city, different lanes have also been provided for Rickshaw and bi-cycles. The provision of separate lanes for different types of vehicle requires a lot of road space, however and while this may be possible in the planning of new roads, it is much less possible in older urban areas.

Control of Parking: Congestion, accidents, and inconvenience all these problems are very common without proper parking controls or policies. To use the urban road space to its maxmum capacity, Parking Control is a very important part of Traffic Management. There can be two types of parking control:

1) On-street Parking
2) Off-street Parking

On-street parking is now controlled in many cities. On-street parking is convenient for vehicle users but is also an expensive use of road space which reduces the width and hence the capacity of the road. When controls are introduced, parking is allowed only at specific times and in specific places.

Off-street parking involves the provision of parking spaces for vehicles. Parking space is a scarce resource in the urban areas, and if off-street parking space is provided, the user normally has to pay a charge for it. The level of parking charge differs according to the intensity of demand for parking space. It is usually more expensive in the central areas and lower around the periphery of the central areas.

These are some of the techniques employed in traffic management. There are many others. But they indicate that there is a tremendous scope to reduce the problems of urban traffic congestions by adapting the traffic to the town.

One example illustrates how better management of traffic can increase the capacity of existing urban roads and reduce the problems of congestions.[1]

EXAMPLE OF THE BENEFITS OF TRAFFIC MANAGEMENT

Consider a typical urban road with an effective width of 20 feet (excluding refuge or central reserves). Two alternative approaches have been studied on this road: (1) a one way traffic flow, and (2) a two way traffic flow.

In this example, three different degrees of traffic control have been considered. They are:

i) An all-purpose street with road capacity restricted by waiting vehicles and the existence of several road junctions.

ii) An all-purpose street with high-capacity junctions and "No Waiting" restrictions imposed.

iii) An all-purpose road with no frontage access, no standing vehicles and negligible cross-traffic.

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[1] This example is quoted from: "Roads in Urban Areas," Report from the Ministry of Transport, Scottish Development Department, The Welsh Office, (1966), p.7

These three cases correspond to different levels of traffic control. The first case involves almost no control at all: vehicles are free to park on the road, and there is considerable cross-traffic. This situation prevails on most of the streets of Dacca today. In the second case, a number of controls have been introduced, and in the third case, traffic control is very rigorous: no parking is allowed, vehicles cannot enter or leave buildings directly from the street, and cross-traffic has been eliminated.

With the introduction of a greater degree of control, the capacity of the road is increased dramatically..

TABLE 1

PRACTICAL CAPACITIES OF URBAN ROADS

Effective width of road is 20 feet	Capacity in PCU's per hr.	
Description of road situation	Two way Traffic	One way Traffic
1)All purpose street with capacity restricted by waiting vehicles and junctions	300 to 500	800
2)All purpose street with high capacity junctions and 'NoWaiting' restrictions	800	1300
3)All purpose road with no frontage access, no standing vehicles permitted and negligible cross-traffic	1200	2000

Source: "Roads in Urban Areas" op.cit., p.7

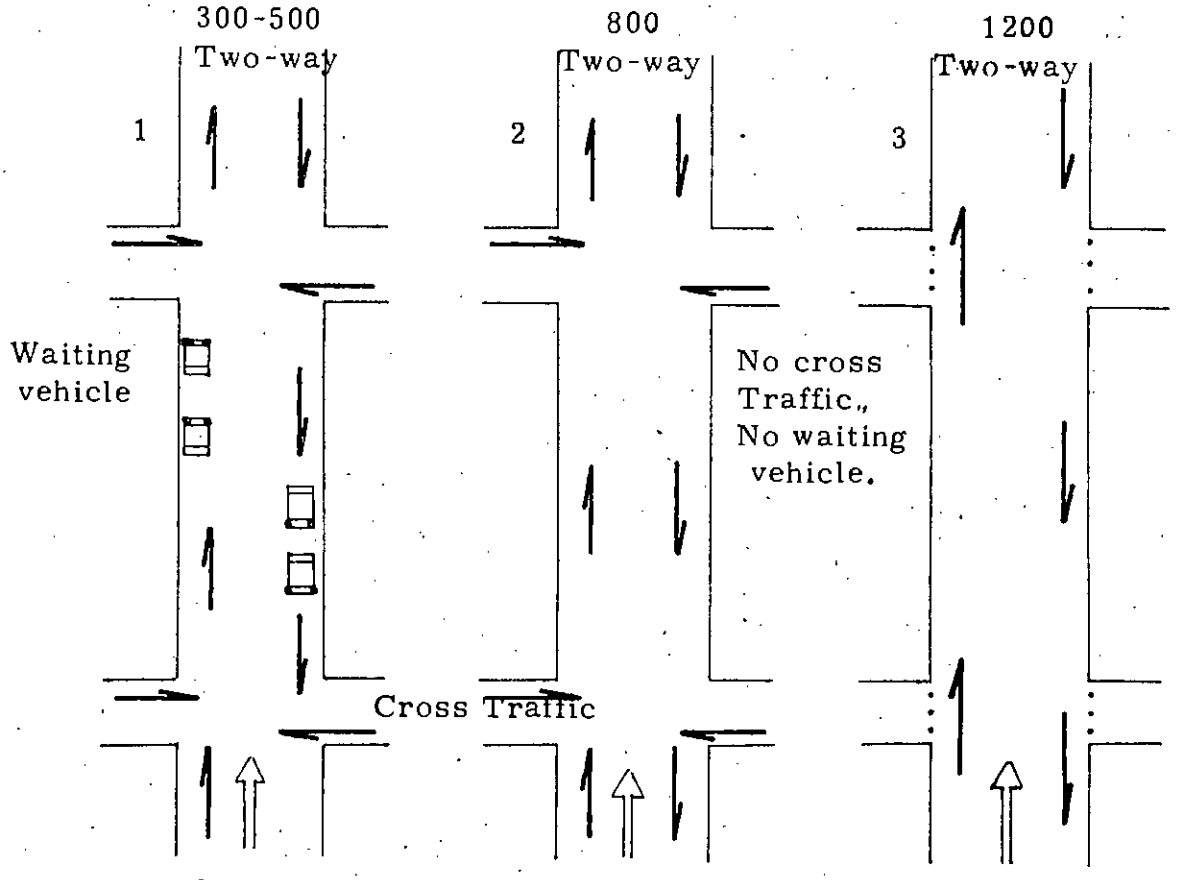


Fig: 4

Thus if an urban road 20 feet wide is converted from two-way, traffic to one-way traffic (with no other controls imposed), the road capacity will increase by approximately 60% to 100%.

If parking restrictions are imposed and road junctions controlled, the capacity may increase by a further 60% to 100% approximately. And if a two-way road with no restrictions (300 to 500 p.c.u's per hour) can be converted to a one-way road with very stringent restrictions (2000 p.c.u's per hour), the potential increase in road capacity is of the order of 400%.

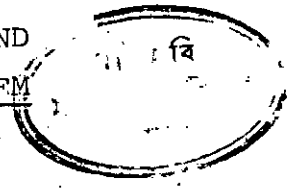
Clearly traffic management techniques can significantly raise the capacity of urban roads. And 'adapting the traffic to the town' can be a much cheaper solution to the traffic problem than "adapting the town to the traffic". Traffic management techniques are relatively inexpensive to introduce, unlike the building of new roads.

Conclusion

Truly speaking, most of the big cities of the world, practice all three approaches to solving the traffic problem. First of all they sometimes do nothing; secondly, they try to adapt the town to the traffic although frequently the traffic problem re-emerges at a higher degree. And thirdly, they adapt the traffic to the town by trying to ration demand. Traffic management plays an important role. Traffic management is a technique for improving road capacity which is cheap and flexible. The most interesting comment about traffic management is that the planners can try this approach first before building new roads or relocating landuses. It can be tried as an experiment. If the first attempt or technique fails, we can go back to the original situation and try the next technique. But to fulfil the experiment of traffic management, it requires discipline and effective implementation and organisation, and furthermore it imposes costs on certain user groups.

CHAPTER 4

THE TRAFFIC PROBLEM IN DACCA, AND APPROACHES TO SOLVING THE PROBLEM



Because Bangladesh is still a rural based economy and only 10% of its population live in towns and cities, the problems of transportation in the urban areas are not yet that severe, except perhaps in the two main cities of Dacca and Chittagong.

But the urban transportation problem is worsening with the rapid growth of these cities. Bangladesh towns and cities are beginning to share these problems with other towns and cities of the world. The nature of the problem may vary a little according to local characteristics, but the overall situation of an alarming future is the same.

> "Urban Transportation is in a 'mess' which is steadily worsening qualitatively. The type of urban transportation available is a very important factor in shaping the character or form of a city. Urban Transport for a complex set of reasons has become a major concern of our life."[1]

Transportation problems of Dacca and Chittagong now existing, therefore, are the incoming problem of the other towns of Bangladesh, which were established in the same pattern of road layout design and in a generally unplanned and haphazard way.

As the towns of Bangladesh grow in size, the traffic demands of an ever-increasing urban population are likely to put a progressively heavier strain on the existing road layouts.

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[1] Meyor, Kein, Wohl, The Urban Transportation Problem

And these problems will probably be greatest in the larger towns, which are growing fastest.

> "The Urban Population of Bangladesh was only 4.3% in 1961. In the 1974 census the figure was 8.8% or 137% increase over 1961. 54% of this urban population live in the 6 cities of 100,000 or more inhabitants, namely Dacca, Chittagong, Khulna, Narayanganj, Mymensingh and Rajshahi."[1]

THE TRAFFIC PROBLEM IN DACCA

As the city grows, the traffic problems increase. As the city spreads in all directions, the distance between different landuses increases. Journeys which once could be made on foot now demand the use of a vehicle. The more intensive use of land, and the growing ownership of vehicles, all add to the total traffic demand placed on the roads. New types of vehicles areintroduced, which conflict with the older, slower, traditional forms of transport. Thus the strain on the old road network grows steadily.

THE RAPID GROWTH OF DACCA CITY

Dacca is an Old Town and its history is known to date back to the 3rd century A.D. "Dacca city was first officially established in 1608 as the capital of Bengal by Islam Khan, the Mughal viceroy of the time."[2] In 1947 Dacca became the main focus for East Pakistan as the provincal capital, and later it became the capital of sovereign Bangladesh in 1971.

> "There are two distinctive historical parts of Dacca, namely Old Town, lying south of the Old Railway Line, and the New Town. The Old Town was

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1 G.M.Jamil, "The Origin of City, Rise of Urbanism and the Historical Development of Urbanization," N.Islam (ed.), Students' Readings in Urban Planning, Department of Geography, University of Dacca, p. III-7

2 N. Islam, "Dacca: The Capital of Bangladesh, A Geographical Introduction," CUS Bulletin, 1974, p. 2

mostly built between 1600 and 1900 while the new town was developed since the beginning of the 20th century, particularly rapidly since 1947. The major population increase in the city since 1961 took place in the newer parts which is now over 30 square miles."[1]

The dramatic rate at which Dacca City has grown in recent years is illustrated by the following table:

TABLE 2

GROWTH OF POPULATION IN DACCA CITY
(Municipality and adjoiningareas)

1881	1891	1901	1911	1921	1931	1941	1951	1961	1974	1979
80358	83358	104385	125733	137908	161922	239928	338762	556712	1600000	2000000*

Source: Weekly Bichitra, May 4, 1979, p.19
*Un-official

Nobody knows the true size of Dacca today. The table above suggests a population of 20 lakhs. Other sources suggest Dacca's population is 30 lakhs.[2] Whatever the true figure, Dacca has grown rapidly in recent years. While much of this growth took place in the new town, the population has also increased substantially in Old Dacca.

With the population growth and increased activities in Dacca city, the landuse has changed significantly. The number and type of activities has increased, intensifying the demand for urban space. New activities created new landuses. In old Dacca for example, the landuse changed: with old buildings being replaced by new ones, and the addition of new activities. Some residential building have now become commercial and industrial buildings.

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[1] N. Islam, ibid., p. 3

[2] Raquib Siddiqui, "Battle for Bus Ride, The Bangladesh Times, October 15, 1979

Dacca for example, the landuse changed: with old buildings being replaced by new ones, and the addition of new activities. Some residential building have now become commercial and industrial buildings.

TABLE 3
URBAN POPULATION INCREASE IN DACCA AND BANGLADESH
(in million)

Year	Bangladesh	Dacca Area	Dacca Average Annual Rate
1960	2.8	0.8	6.5%
1965	3.9	1.1	6.5%
1970	5.5	1.5	7.0%
1975	7.9	2.1	7.5%
1980	12.7	3.0	6.0%
1985	18.2	4.0	5.0%

Source: Amman and Whitney, p. 34

While spacious new roads were laid out in the new town of Dacca, on the other hand the road network of Old Dacca remained in its original state, unsuitable for modern traffic, with the resulting problems of acute traffic congestion.

Furthermore, the population of Dacca City is expected to grow even faster in the future, in all directions and in all areas. The trend of population growth in Dacca was estimated by Amman and Whitney Consultants, in 1964.

To date, Amman and Whitney's forecast has proved to be very accurate. Dacca is growing very rapidly, and other forecasts agree that future growth is going to be enormous.

> "Metropolitan Dacca currently with over 2 million people could swell to the present size (8-11 millions) of such major metropoli as Buenos Aires, Sao Paulo, Calcutta, Peking, London and Paris. If this were to occur, Dacca's population would have increased four to five times in a little more than 20 years."[1]

This population growth is expected to take place in all parts of Dacca. For example, the population of Old Dacca was estimated by Amman and Whitney Consultants to grow at less than 1% annually from 1967 to 1990, and the new city to grow by 4.6% and the environs by 8.8%. Dacca, therefore, is growing at a rapid rate. But while the population has increased rapidly, the volume of traffic has increased even faster.

The Growth of Traffic in Dacca:

Upto even the early "fifties the main transports in Dacca were horse bogies and cycle rickshaws. Today horse bogies have almost vanished, while the cycle rickshaw has become the most important and conspicuous form of public transport, and other modern types of vehicles have arrived, such as the car, the bus, the baby taxi, and the truck.

In 1947 there were only 4,410 motor vehicles on the road in Bangladesh (excluding military vehicles).[2] This was approximately one motor vehicle for every 9,000 people in the country. Of these motor vehicles, 1,700 were cars and jeeps, 1,400 buses, and 700 were private trucks.

---

1 UDD/UNDP "Iformation Paper," (Urban Housing Policy and Programme Project), August 1978, p.1

2 Bangladesh Transport Survey, Part-3, Volume 2, "Roads and Road Transport," 1974, p.83 Appendix B1

Today (1979) there are not less than 50,000 motor vehicles on the streets of Dacca alone.[1] As a whole, the number of vehicles has increased in Bangladesh significantly, especially after liberation in 1971 (See Table 4).

TABLE 4

NUMBER OF VEHICLES ON ROAD 1965-77 IN BANGLADESH[2]

Year	Private Car	Bus	Truck	Motor Cycle	Others*	Total**
1965	9953	2969	6965	10824	15027	45738
1966	10512	3739	7053	11001	15170	48475
1967	10710	3640	7170	12112	15468	49800
1968	12538	4339	7878	14281	15967	55059
1969	15725	5522	8864	18305	17799	64629
1970	17097	5879	9608	20525	16977	70086
1971	9198	3812	6344	11226	10220	40800
1972	9847	4497	7278	12996	11127	45715
1973	10413	6030	8440	15264	14392	54539
1974	11160	6207	9380	17026	15846	59919
1975	11882	5223	9457	20194	15311	62067
1976	12409	5264	9369	22605	16332	65979
1977	14301	7359	9956	25508	15793	72917
% from 1965-77	40%	133%	43%	127%		60%

*"Others" includes Autorickshaws, Taxis, Jeeps, and Station Wagons, Tractors and Special Purpose Vehicles.

** These figures do not include Military vehicles, which if included, would considerably increase the total number of vehicles.

[1] Raquib Siddique, Roads Extremely Hazardous, " The Bangladesh Times, October 17, 1979

[2] 1979 Statistical Year Book of Bangladesh, Bangladesh Bureau of Statistics, Ministry of Planning, Dacca, p.421

Motor vehicle ownership grew rapidly during the 1960's, but many vehicles were damaged or destroyed during the War of Liberation. Thereafter, the numbers have again begun to rapidly increase. The increase have occurred with all types of motor vehicle.

What is more, the majority of motor vehicles are concentrated in the two main cities of Bangladesh: Dacca and Chittagong.

TABLE 5

CONCENTRATION OF TRAFFIC IN DACCA
Number of Vehicles Classified by District[1]
as on June 30, 1977

Selected Districts	Buses Petrol + Diesel	Trucks Petrol + Diesel	Private Car	Motor Cycle	Auto Rick-shaw
Dacca	2212	2302	7546	8062	1500
Chittagong	2304	3667	4835	4227	4062
Sylhet	340	447	563	1080	729
Mymensingh	120	128	62	1209	25
Khulna	273	314	236	718	243
Comilla	194	152	21	582	582
Jessore	594	179	170	1283	192
Bangladesh TOTAL	7359	9956	14299	25508	8017

* Note : These figures exclude military vehicles.

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1 1979 Statistical Year Book, pp 423, 424.

30% of all buses are registered in Dacca.[1] 53% of all private cars are registered in Dacca, as are 23% of all private trucks.

Chittagong in 1977 contained the highest numbers of buses and trucks of any District in the country. But a large proportion of these vehicles serve to connect the first port of the country (Chittagong) to the first city (Dacca).

The growth of industrial commercial and administrative establishments has made possible the creation of a very wide urban base in Dacca. The City performs a wide range of services for its hinterland, and has become the hub of the transportation system of the country. It is favourably connected with other important areas by road, rail, water and air. The busiest highways in Bangladesh converge on Dacca (See Table 6).

TABLE 6

AVERAGE ONE WAY DAILY TRAFFIC OF SELECTED MODES ON MAJOR ROADS & HIGHWAYS IN 1976-77.[2]

5 busiest roads for Trucks		5 busiest roads for Cars		5 busiest roads for Buses	
Ctg - Feni*	603	Ctg - Kln	603	Ctg - Kln	664
Dac - Aricha	591	Dac - Tang	438	Dac - Tang	589
Ctg - Kght	507	Ctg - Feni	385	Dacca-Aricha	498
Dac - Tang	473	Ctg - Cox's	302	Ctg - Feni	385
Jes - Kln	361	Dac - Aricha	273	Syl - Mv.Bzr	344

* The Chittagong - Dacca Road

Note : Kght = Kalurghat, Kln = Khulna, Jes= Jessore, Mv.Bzr = Moulavi Bazar, Syl = Sylhet, Tang= Tangail.

[1] Many of the buses are registered in Dacca but in fact ply on District roads and inter-district roads. The same is true of trucks.

[2] Statistical Year Book, (1979), p.428

Thus there has been a rapid growth in the number of motor vehicles in Bangladesh, and the majority of this increase has been concentrated in Dacca and Chittagong. A tremendous increase in the number of vehicles has also occurred with non-motorised forms of transport too.

Official statistics on vehicle ownership are notoriously unreliable. One estimate puts the number of rickshaws in Dacca City today at 80,000.[1] Another estimate puts the number of rickshaws at 60,000.[2] What is beyond doubt is the fact that number of rickshaws has increased enormously in recent years. In 1974 the Bangladesh Transport Survey estimated the total numbers in Dacca to be 19,000.

Similarly, push cart ownership has increased, but the numbers are not known. The Bangladesh Transport Survey estimated that there were approximately, 1,300 licenced push carts in Dacca in 1973, but conceded "the number in operation in Dacca is probably much higher than the 1300 officially licenced there."[3] A recent estimate suggested that in 1979 there were 1,500 push carts in Dacca[4]. The estimate based on official registrations, clearly is too low.

A more realistic picture of the growth in traffic volumes in Dacca, was presented in the journal "Weekly Bichitra".

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1 Raquib Siddiqi, "Roads Extremely Hazardous"- Bangladesh Times 17 October, 1979.

2 Weekly Bichitra, 4th May, 1979, p.22

3 Bangladesh Transport Survey, Part 3, Vol.2, p.207

4 Weekly Bichitra, op. cit., p.22

TABLE 7

REGISTERED VEHICLES IN DACCA CITY
(Selected modes)[1]

Mode of Transport	1969	1974	1978-79
Car	4942	12700	18400
Taxi	235	468	429
Bus	933	1605	2820
Truck	2034	3629	5770
Auto-Rickshaw	2512	4592	5600
Rickshaw	4024	16000	60000
Pickup/Microbus	562	1434	2343
Motor Cycle	4149	11216	20410

The total number of vehicles has increased in Dacca substantially but it has not noticably improved the transport problems of the city dwellers. A substantial increase is found in private vehicles (See Table 7) of which the occupancy rate is very low. Although the number of buses has increased, most of them are used for inter-district routes, which cannot solve the problem of Dacca city. Conversely, it has allowed the problem of congestion and insecurity to the inhabitants to continue. Rickshaws are the most important mode of public transport, specially in Old Dacca where the bus is almost absent. The volume of rickshaws has increased dramatically in the last few years.

Different Models of Traffic:

The type of traffic to be found in Dacca city include Bus, Truck, Car, Pickup, Bicycle, Motor cycle, Baby Taxi, Rickshaw, Bullock cart, Push cart, Hand Trolley and an insignificant number of Horse drawn carts. The function of these

[1] Weekly Bichitra, op.cit., p.22

different modes are either carrying passenger or carrying goods. But the function varies according to their size, capacity and speed[1]. So also do the problems associated with the potential conflict between these different modes:

> "Together the fast motorised vehicles and slow non-motorised transports are creating a traffic problem known possibly only to a few other cities in the world. Apart from incompatability of these two very different classes of vehicles almost total disregard conciously and unconciously - to traffic rules and regulations by their drivers has made the city roads unsafe."[2]

Past Approaches to Solving the Traffic Problems in Dacca:

In the quote above, it was suggested that Dacca is developing a traffic problem "known possibly only to a few other cities in the world". What were the approaches adopted in the past to solving these traffic problems ?

In fact, very few attempts have been made in the past to grapple with these problems. These attempts have included each of the three approaches discussed above: that is, adapting the town to the traffic; adapting the traffic to the town; and doing nothing!

Adapting the Town to the Traffic:

In the past priority seems to have been given to adapting the town to the traffic. The Dacca Master Plan prepared in 1959 gave heavy emphasis on the construction of new main roads.

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[1] A brief description of the function of different modes of transport is given in Appendix 2.

[2] Raquib Siddiqi, Bangladesh Times, 17 October,1979

> "The aim of the town plan should be to develop a simple pattern of main roads which will form direct routes for the speedy movement of motor traffic. Even though improvements and new construction may only be carried out piecemeal they should form part of a comprehensive road pattern.
>
> In the Old Town our proposals are based on the principle of interfering as little as possible with the existing intensely developed shopping streets by planning new parallel routes, thus tending to convert these old streets into service road and pedestrian ways.
>
> In the new town we propose to make use of many of the existing roads; these are wide and well suited to motor traffic and were developed as part of a previous plan for the new town area."[1]

In the new town, therefore, few changes to the road network were proposed, because the roads were already wide. In the Old Town, however, the emphasis was on building new main roads, both to connect Old Dacca to the new parts, and to build new roads within Old Dacca. The proposals included, for example:

- the continuation southward of Mymensingh Road into old town near Chawk Bazar.
- a new east - west road parallel to the river, bypassing Chawk Bazar and Islampur Road.
- an inner-ring road in the old town following the line of the old Dholai Khal (chanal).
- some widening of existing roads in the Old Town.

The results, 20 years later, are extremely disappointing.

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[1] Dacca Improvement Trust (1959) " Master Plan for Dacca" Sections 50, 51, 52.

Most of the proposals were not implemented. Some of the proposed roads were never started, and some were started but never completed (North-South Road and the Inner Ring Road, for example, of which English Road is a part). The main reason why the roads were never completed is because land acquisition was very difficult. Even today, 20 years later, some of the buildings in the proposed road line have not been acquired, and long legal battles are still going on.

A further comment can be made about the proposals of the Master Plan. Very little consideration was given to non-motorised forms of transport, which accounted for and still account for the majority of Dacca's road traffic. Furthermore, virtually no consideration was given to the application of traffic management to Dacca.

Building and Landuse Control by the Dacca Improvement Trust:

Dacca Improvement Trust has the power of controlling unauthorised building construction, regulating building, heights, and controlling the use of buildings (to a limited extent). In short, DIT has powers to control the landuse, which is the main factor of traffic generation. But in practice, none of these powers is being implemented effectively. The result of this is unauthorized building construction all over Dacca City. Very few people ask for the planning permission and of those who do, nearly 90% are given permission.[1]

In practice, therefore, this approach to "adapting the town to the traffic" is not yet being tried in Dacca.

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[1] Q.Nuruzzaman (1979), "Physical Planning Legislation in Bangladesh: A Study of Proper Legislative Needs." Unpublished Thesis, submitted to the Department of Urban and Regional Planning, BUET, Dacca.

Road Maintenance:

This is one of the most popular topics in the news paper about the roads of Dacca City. To quote:

> "There is a saying that a stitch in time saves nine. But frequently this timely stitch is missing which means that more that the originally estimated sum of money is required to complete work on simple projects, Had there been better co-ordination of activities between different civic bodies, then this financial drain and needless public miseries could be avoided.... The heads of DIT, PDB, WASA and of the Public Health Engineering and the Roads and Highways Department are scheduled to meet at regular intervals with the DMC Chief for harmonising their respective plans and programme, taken up from time to time."[1]

The order of this coordination for road maintenance among different bodies was given in the Gazette. To quote the Bangladesh Gazette of Thursday, May 27, 1976, the Ministry of Home Affairs, Police Section (III) announced:

> "Government have been pleased to constitute a Traffic Hazards Control Committee with the following Members :-
>
> 1. Additional Inspector General of Police (Adm) - Convenor Members
> 2. Director General, Telegraph and Telephone
> 3. Chief Engineer, Roads and Highways
> 4. Chief Engineer, Power Board
> 5. Chairman, WASA

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[1] Bangladesh Times, 10th August, 1979

6. Chief Engineer, Dacca Improvement Trust
7. Chief Engineer, Dacca Municipality
8. Police Commissioner - Member Secretary

Terms of Reference:

The committee will take appropriate measure for elimination of traffic hazards in the city of Dacca through-

a) Prevention of indiscriminate digging of roads by Government Organisations like Electric Supply, Telegraphs and Telephones, WASA, Gas Corporation and other connected agencies.

b) Co-ordination of the development schemes of the concerned agencies so far as they relate to digging of cable line, sewerage, pipelines for water supply, etc.

c) Any other measure considered necessary."[1]

But simply legislating a new committee into existence doesn't necessarily solve the problems. In practice, a high rate of abstentian in these meetings has been noticed. Actually, the proposal of meeting every fortnight is really unrealistic.

Meanwhile, road maintenance is lacking very significantly in many parts of Dacca while good quality roads in other parts of Dacca may have been "over-maintained". That is, their standard is much higher that the present volume of traffic would justify. The roads around the University are a good example.

In conclusion, past attempts to "adapt the town to the traffic" have not met with much success. The new parts of Dacca have been fortunate to start with wide roads. But the attempt to build new roads in Old Dacca has met with little success.

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[1] The Bangladesh Gazette, Government of Bangladesh, 1976

It has certainly not solved the problems. Other approaches, such as building and landuse controls and road maintenance, are conspicuous by their absence.

Adapting the Traffic to the Town:

One very important approach of "adapting the traffic to the town" in Dacca City is through the application of import controls and vehicle licencing. These controls are applied to try to limit the numbers of unwanted vehicles in the city.

The main trust of this policy has been to restrict the numbers of rickshaws (and also push-carts), and instead encourage the use of baby taxies.

> "In 1976 the Dacca Pourashava Authority launched a rickshaw eliminating project to remove all rickshaws from the City. But the project was bogged down in midway."[1]

To implement this policy, the authorities have ceased since 1971 to issue new vehicle licenses in Dacca Pourashava, both for rickshaws[2] and for push carts.[3] In addition, the import of rickshaw spare parts has been made more expensive, while loan sanction has been given to encourage the import of baby taxies.

> "Very recently the government has sanctioned a loan of Taka 2,36,00,000 to import 48 auto-tempos for 12 tempo associations."[4]

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[1] New Nation, 19th November, 1978- "Rickshaws Choke Traffic."

[2] New Nation, op.cit.

[3] Bangladesh Transport Survey, op.cit., p.207

[4] New Nation, op.cit.

But these controls have not stopped the numbers of rickshaws and push carts increasing. In 1971, the number of rickshaw licences in Dacca Pourashava were fixed at 14,700. But in the same year more than 15,000 licences were issued in five adjacent areas: Mirpur, Gulshan, Uttarkhan, Dakhsinkhan and Tetulchhara union parishad. These latter licences were given "on the condition that the rickshaws of a particular pourashava or union parishad will ply only within its respective areas."[1]

Today the rickshaws in Dacca number between 60,000 and 90,000. The controls have not worked, but have simply bred corruption.

> "It is said that certain intriguing moves by individuals and organisations are permitting this intrusion (of rickshaws into Dacca) about which pourashava seems to be blissfully unconcerned. It is alleged that very recently an association which is named Dacca Mahanagari Rickshaw Malik Federation has mushroomed illegally which is not at all a registered organisation.They have anyhow manipulated the traffic police authorities to instal a number of check points in the different corners of the city. They invite the outsider rickshaws in the city and collects 10 Taka as an entrance fee in the city from each rickshaw. Against the money received they issue a token to each rickshaw. Wheneven an intruder is challenged by the traffic police, they show their token - symbol, and get exemption. It is also alleged that the traffic police receive a lions' - share of the money collected against the illegal token."[2]

Similarly, the Pourashava has, within a period of seven months(up till November 1978), issued 1,000 duplicate licences as replacements for 'lost' licences.

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[1] New Nation, op.cit. p.3

[2] New Nation, op.cit. p.3

Trying to control the numbers of vehicles has not worked in the past, and the alternative is to control the traffic through better traffic management. The Bangladesh Transport Survey is worth mentioning in this respect.

> "...it is by no means clear that the optimum solution to the problem of interaction of slow and faster moving vehicles is to restrict the slower vehicles .... Rather than merely restrict them, policy should be to control rickshaws and ensure a higher standard of road discipline from the rickshaw pullers. It may well be appropriate to try to separate slow and fast moving vehicles by providing special facilities in certain cases for the slow moving vehicles. In other cases it may be best to achieve this by restricting the motorised vehicles. Many of the narrow streets of old Dacca, for instance, might with advantage be closed to motor traffic."[1]

Traffic Management:

Traffic Management is not widely practised in Bangladesh nor in Dacca City, although general power to control traffic is given to the authorities in black and white. For example, according to the Dacca Metropolitan Police Ordinance, 1976 (Ordinance No.III of 1976 from Section 17, No. a) the police has power:

"a) To regulate and control the traffic in the streets"; and from section 25, (c), the Police Commissioner has the power to make regulations for:

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[1] Bangladesh Transport Survey, op. cit., p.212

"c) Regulating the conditons under which vehicles may remain standing in streets and public places, and the use of streets as halting places for vehicles orcattle".[1]

Powers have been given not only to the Police Commissioner, but also to the Municipal Authorities to control and regulate traffic. For example, powers of controlling parking, overloading, road encroachment have been given to them. Some examples are quoted below. In Chuadanga, Kushtia[2] Traffic Control Bylaw 4 framed under Section 86 of the Municipal Administration Ordinance 1960 states:

"4.No person shall keep standing on any public street any vehicles in such a way as to cause inconvenience to the public except for a time which is reasonably required for loading or unloading or for taking up or getting down passengers. Fine - Rs.5.00 on second or every subsequent contravention, fine Rs.10.00."

An example of overloading control from Jhenaidaha Municipal Regulation (No.10), Jessore:

"No cart shall, without the general or special permission of the town committee carry on any public road load in excess of twenty maunds. Fine-Rs.10.00"[3]

The traffic controls are very extensive. Quoting again from Chuadanga[4]:

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[1] The Bangladesh Gazette, Tuesday, Jan.20,1976,Ord.No.II of 1976.

[2] Some examples of Municipal Traffic Rules from outside Dacca are quoted here. On enquiry, Dacca Municipality were unable to locate any copies of any rules. But it is believed that the traffic rules in Dacca are very similar to those elsewhere.

[3] Dacca Gazette, 1st June, 1967 p.583.

[4] Dacca Gazette, 25th August, 1966 p.909.

> "9. No person shall without the general or special permission of the Town Committee take any elephant or camel along any publis street."

There are other traffic controls, permitting only one person on a bi-cycle, requiring all vehicles to carry lights, even requiring that the ironwork of rickshaws be painted black.[1]

But almost none of the traffic laws is implemented or obeyed. One reason in Dacca City, among many, is the shortage of traffic control police.

> "Five hundred men and fourteen automatic traffic signals are what Dacca has to cope with the complex problems of its traffic.... The traffic authority says, one of its main handicap is lack of manpower. The number of traffic policemen, according to the traffic authority, has risen from pre-independence 500 to 550 only. And all are not available at a time due to illness, leave, etc."[2]

The organizational hierarchy of the traffic wing of the D M C is as follows:[3]

1	D P C - Deputy Police Commissioner.
3	A C - Assistant Commissioner
6	Inspectors
30	Sergents
8	Assistant Sergents
58	Habildars
500	Constables
606	

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[1] Gulshan Traffic By-laws: Dacca Gazette, 15th July, 1976, sec.4, p.799

[2] Raquib Siddiqui,"Inadequate Manpower for a Complex Problem", Bangladesh Times,20 October, 1979.

[3] Interview with Deputy Commissioner of Traffic, Dacca Metropolitan Police.

Of these, usually 400 constables are fit for duty. They work in two shifts. So, 200 force can work at a time. Besides these, every day some reserved forces are set aside for special functions. They cover 140 points in Dacca Metropolitan area which covers 116 square miles within 12 metropolitan thanas. They have 40 police out-posts and nine police boxes. Some specific points can be made. At the minimum, 300 points should be covered (according to DC of Traffic, D M C).

They have submitted a proposal to the government to expand the traffic police force immediately. The proposed staff demand is as follows:

	1	DC
	4	AC
	9	Inspectors
	17	Sub-Inspectors
	55	Sergents
	250	Habildars
	1570	Constables
Total:	1906	

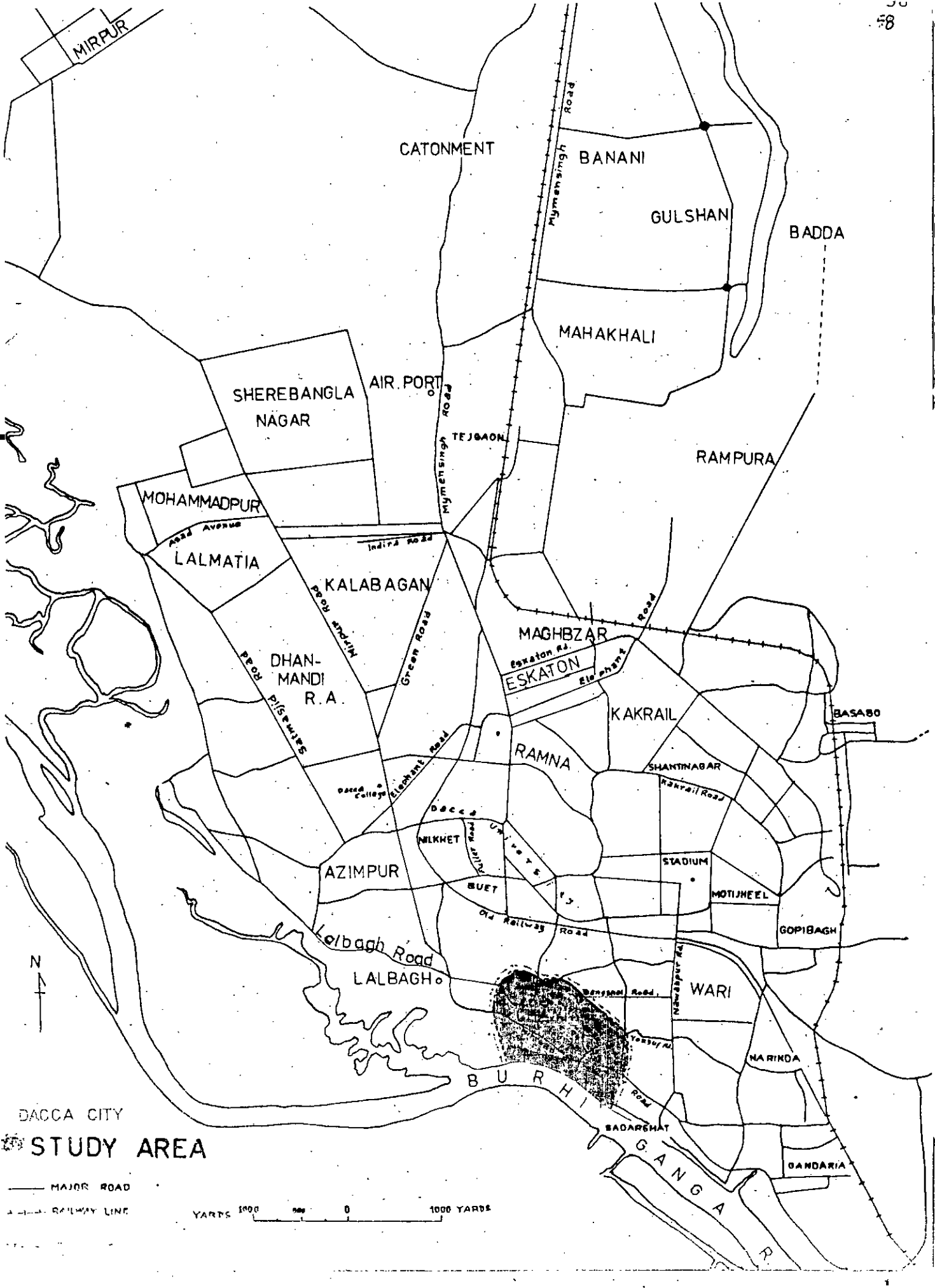
Conclusion:

In practice none of the three approaches is perfectly practiced in Bangladesh as well as in Dacca City. Some proposals were made to adapt the town to the traffic, some techniques were introduced to adapt the traffic to the town (traffic management). But in practice very little has been done to improve the traffic situation especially in Old Dacca. In Old Dacca, the possibility of adapting the town to the traffic is quite difficult as the landuse is very compact and dense which does not permit drastic change. In general, doing nothing is practised commonly. The traffic problem in Old Dacca is the worst in Bangladesh more than any other urban area.

Within the rapid growth of urban areas, the traffic problem is very likely to be getting worse in the near future in all urban areas, particularly in big cities. The problem of Old Dacca today is the incoming problem for other towns and cities in Bangladesh too. The traffic problem in Old Dacca is an alarming problem which should be taken into consideration to improve. The importance of Old Dacca as a functional economic region to the Metropolitan Dacca City as well as to whole of Bangladesh should not be underestimated. Old Dacca is serving as a potential area to the business economy traditionally. The demand for that area is quite substantial. A step is needed to do something about traffic problems in that areas to understand the problem properly. Almost no attempt has been made to study the traffic problem there. It is hoped that studying in traffic problem in Old Dacca will give a clear picture which can be a guide to tackle the incoming problems of other towns in time. Old Dacca covers a large area which is impossible to study in a limited time. So the study area has been chosen as one of the main problem areas. The area in-and-around Chawk Bazar is a wholesale-retail business area and still the Central Business District (CBD) of Dacca City. Chawk Bazar area has been suffering from traffic congestion for a long time and it is almost inevitable in every working day of the week.

Methodology:

The methodology used in the study is discussed at different stages throughout the analysis. For detailed information, please see appendices of the thesis.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Eskaton Rd.
ESKATON
Elephant Road
DHAN-MANDI R.A.
Satmasjid Road
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AZIMPUR
SUET
MOTIJHEEL
Old Railway Road
GOPIBAGH
Lalbagh Road
LALBAGH
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A N A L Y S I S

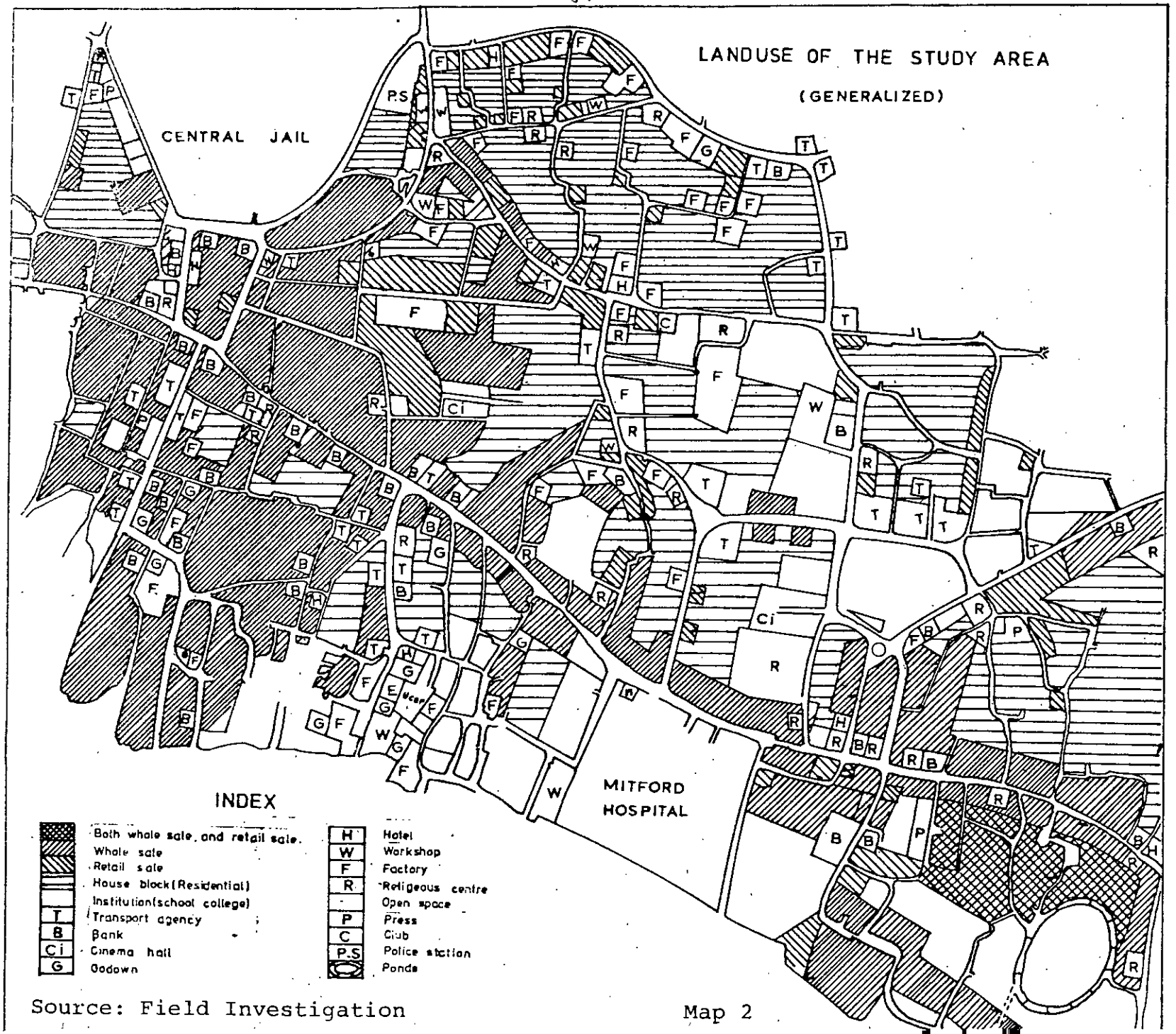
CHAPTER 5

THE MAIN LANDUSES AND ROAD NETWORK IN THE STUDY AREA

This section examines the existing landuse of the study area. The existing landuse has evolved considerably since the 18th Century, and the intensity of land use, (both horizontally and vertically) has increased very much. For example, nearly all possible horizontal development has taken place in the study area and now this area has a very compact, intensive landuse.

The study area contains a complete cross section of all types of all urban activities. In particular, a number of key landuses can be identified which dominate the character of the area. The key landuses include several wholesale markets or bazars which are of city wide and even national importance, such as Chawkbazar and Moulovibazar. In addition, there are several smaller markets and wholesale centres which serve local and city needs, such as Mitford Medicine market and a local fish market (Swarighat).

Another important landuse in the area are the godowns mostly located along the Buriganga river bank. Badamtalighat is a key location for godowns (see map 2). In addition to major commercial landuses, there are a number of important public non-commercial landuses in the study area. These include the Mitford Hospital and Dacca Central Jail, which are both of regional and national importance. Besides these there are 5 schools in the study area, and a number of mosques, cinemas, and banks.



Source: Field Investigation

Map 2

To complete the picture, the entire area contains residential accomodation, many small shops factories and workshops. The nature of the landuse is of major importance to the study, because landuse determines the nature of the traffic; that is, the volume, type, destination and hours of movement of the traffic. For these reasons, the landuse and the type of traffic that it generates is now discussed in more detail below.

Commercial Land Uses:

The most dominant characteristic of the study area is wholesale business which involves large scale transactions of goods, both finished and raw goods.

Chawkbazar: Chawkbazar comes from the Bengali word Chaokobazar, which means a market or bazar of rectangular shape. The Chawkbazar has an ancient pedigree. To quote D'oyly who wrote in 1809 about Dacca:

> "The Chawk or market place of Dacca is very ancient and it is situated in that quarter of the city which is known by the name of old Nekaus. It was founded by Morshed Aly Khan, and forms a square of about two hundred yards where fruits, vegetables, trinkets, toys, sweetmeats, etc. are daily exposed for sale. At sunset the inhabitants assemble here in crowds."[1]

Chawkbazar is located at the western end of the study area(see map 2). The area is dominated by wholesale business. Chawkbazar commercial area serves not only Dacca city but all of Bangladesh. The wholesale enterprises deal

[1] Ahmed Hasan Dani, Dacca: A Record of its Changing Fortunes, Dacca: Mrs. Safiya S.Dani, 1962, p.189

mainly with the following goods and services; plastic and rubber products, textiles (rayon, cotton yarn), trunks and suitcases, aluminium, paint, stationery, paper cutting and printing and many other commodities. All these activities attract many businessmen. Because businessmen from outside Dacca district come here regularly, some service facilities have grown gradually; hotels, restaurants and boarding houses, are good examples. Chawkbazar is also crowded by bawkers and street vendors. One thing is very interesting about the Chawkbazar area; that is, more than 70% of the wholesale shops have under ground godowns. The shops in this area have so limited space that they store their goods in the basement floor. This method of storing is uncommon to any other area of Dacca.

Moulovibazar: Moulovibazar is adjacent to Chawkbazar. This market is well known as a food market, and has operated since the 19th century. Both perishable and non-perishable goods are offered for wholesale here. The main food stuffs of Moulovibazar include all types of food grains, vegetables, fish, meat and other food and cooking stuffs. All these items are sold both in wholesale and retail, but the major part of the transactions are made in wholesale. Businessmen usually purchase from here and than sell to other local markets at higher margins. In fact, Moulovibazar is the hub of the food market in Dacca city and surrounding areas, especially for daily commodities.

Wholesale Shops Along The Main Roads: In addition to Chawk bazar and Moulovibazar, a large volume of wholesale business is carried out along the main roads (Water Wroks Road, Mugultuly Road, Mitford Road, Islampur Road, see map 3) of the study area. These main roads stretch east-west through the study area. Along the road frontage various commercial activities are carried out, including the sale of

glass products, crockery, ceramic products,,alluminium goods, perfumery and many other household products.

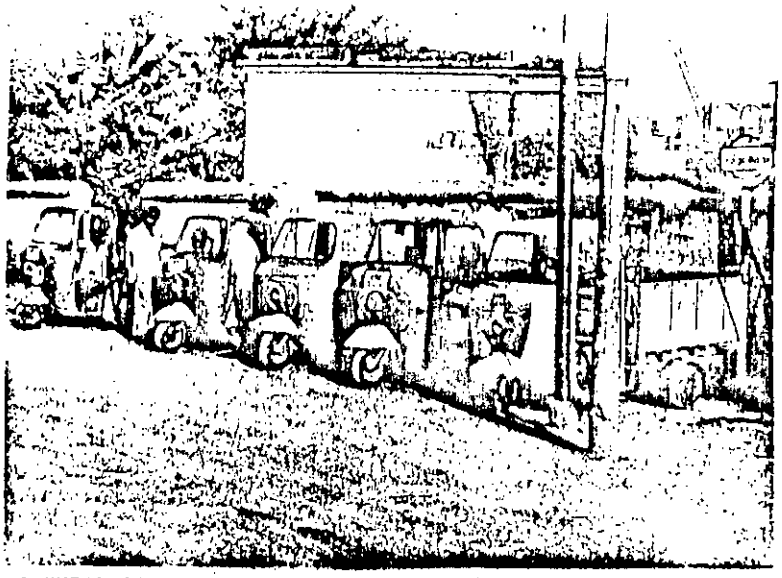
Medicine Market: This is situated along the Mitford Road and appears to be the leading wholesale market of medicine in Bangladesh.It owes its origin to the adjacent Mitford Hospital but serves all over Bangladesh.

Fish Market: Since the study area stands by the river, perishable goods come up by river easily, especially fish. It is believed that more than half of the fish consumed in Dacca city comes through Swarighat (located in the study area), because it is the principle wholesale fish market. Every night fish is brought in by launch and in the early morning it is sold to the petty businessmen and wholesalers. Recently the fish market at Swarighat has expanded considerably. The traffic it generates is firstly river traffic , but then the goods are transferred on to the roads (e.g.head loading, rickshaw, etc.).

Badamtali Ghat: This is a special centre for the rice business. Rice is stored here in godowns from which wholeselers can purchase. More than 50 godowns are situated here. Much of the rice which comes from Southern Bengal is received here.

Most of the godowns in the study area were historically located next to the river to receive goods from the river and then to distribute them by road transport. Nowadays the godowns also store other factory products which come in by road transport. These products include manufactured goods like electric batteries, biscuits, cigarettes, textiles, baby food, and so on. The mode of transport the godowns

Wholesale Business at Chawk Bazar (sponge and plastic shoes).



Authorized Parking Space for Auto-Trucks at the Junction of Jail Road and Chawk Circular Road.

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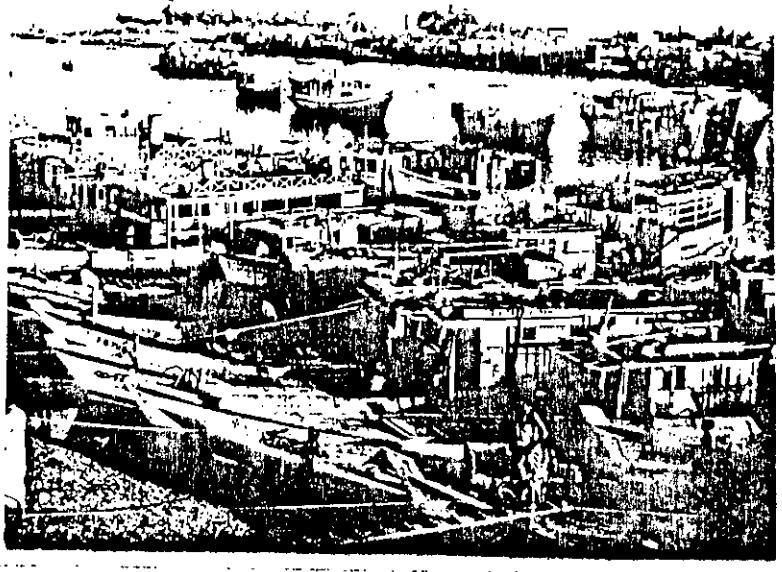

Boats at Swarighat Fish Market (5 P.M.).

are now using includes heavy vehicles. Therefore, the godowns generate a large volume of traffic especially heavy vehicles.

Transport Agency: Connected with the commercial wholesale activities, the area has a large number of transport agencies, Within one square mile area of the study area, there are 80 transport agencies. Most of them were established in the last 15 years. The main modes of transport which the agencies use are the push cart, hand trolley, truck and a large number of head loaders. There is a major problem of parking for the loading and unloading operations.

Non-Commercial Landuses:

The main public institutions in the study area are;

a) Mitford Hospital
b) Dacca Central Jail
c) Schools and Madrashas

Mitford Hospital: Situated next to the river, Mitford Hospital occupies about 7% of the study area. It is a very old hospital with a medical college (including two student hostels) and hospital facility. The hospital serves both Dacca City as well as the nation. The hospital and college generate a large volume of traffic, particularly in the evening at visiting hours. Its importance is increased because there are only 3 hospitals serving Dacca City and its surrounding regions.

Dacca Central Jail: This is the central Jail of Bangladesh. It is situated at the northern part of the study area. It occupies about 10% of the study area.

Schools and Madrashas: By itself, a single school is perhaps not a key landuse, but there are 5 schools and 1 madrasha* within the sutdy area which generate a significant amount of traffic. The schools generate traffic in the moring and afternoon and compound the traffic problem of the area. Among the schools, Armanitola High School, Ahmed Bawani High School, Hammadia School and Ananda Moyee Girls School are particularly important.

OTHER LANDUSES:

Other than the key landuses the study area contains many other forms of land use. Those are also very important to the area. In general the land uses are:

- Retail Shops
- Residential Uses
- Banks
- Factory and Workshop
- Cinema Hall
- Clubs
- Hotel (both residential and non-residential)
- Religious Centres
- Open Space

Retail Shops : Along with wholesale business, retail shops are also found in the study area. Most of the main roads, and secondary roads and even the lanes and by-lanes contain many shops.

Residential Uses: Residential Housing is scattered through out the whole area. The residential density has increased very much in recent years. Extensions have been built to the houses, and many of the houses are now in multiple - occupation where once they have contained only one or two families. The density therefore has increased many times

* See "Glossary of Terms"

in the study area in recent years.[1]

Banks: As a consequence of tremendous commerce and whole saling activity of the study area, there are 32 banks within one square mile of the study area. It was found that 23 of them are concentrated around Chawkbazar, Swarighat, and Imamgonj area.

Factory and Workshop : The study area is comprised of many small scale manufacturing factories and workshops. Old Dacca in general is a place where small scale manufacturing is carried out. The distribution of the factories is interesting. Out of 30, 16 factories are located on the southern part of the study area (i.e.Swarighat, Choto Katra Imamgonj). The other 14 are located dispersed across the northern part. The 16 factories concentrated next to the river are mainly saw mills.[2] This activity is, therefore, dependent on the river facility by which timber is brought in. These factories use mainly head loaders and hand trolleys for the movement of their goods within the area. Many factories now occupy old buildings which were mainly residential before the factories came to the area.

Hotels and Restaurents: As the study area is mainly a whole sale business area, people from other districts come here for business and stay for some days. The residential hotels are mostly occupied by those businessmen. 10 residential and

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1 The existing land use map is based on the use of ground floor. The use of 1st and 2nd floor have been omitted in some cases. The land use has been surveyed by the author.

2 The other factories are; Silk Factory (at Begumbazar node), Sponge Sandle(Swarighat and Choto Katra), Plastic Toys,pen, etc.(Swarighat), Glass Factory, Chimni Glass (Becharamdewri), Pulse Husking Factory (Water Wroks Road), Shoe Brush Factory (Imamgonj),Aluminium Factory(Begumbazar), Packaging Factory (Babubazar).

6 non-residential hotels are situated here. In addition, some residential boarding houses are found in the first floor of some buildings, while the ground floor is occupied by shops or markets. Numerous restaurents and tea stalls are also found all over the study area.

Other Important Landuses:

In addition, the study area contains only one significant open space (Armanitola playing field), one Community Centre (Moulovibazar Community Centre), two Cinemas (Tajmahal and Shabistan), twenty Mosques and one old Christian Church (Armenian Church, built in 1981).

CONCLUSION:

While the nature of the traffic problem of the study area may not be unique to Bangladesh (except for its intensity and frequency), the land use of the area is most certainly unique.

In addition to a full range of typical urban activities such as residential housing, shops and workshops the area contains a number of commercial and public centres which are of national importance. The volume of local traffic generated by these centres is therefore exceptionally high. Moreover, the importance of these centres has been growing in recent years, as Dacca itself has grown in size and importance. The intensity of land use in the study area has increased significantly,and the nature of the land use has also changed with a spread of commercial and wholesaling activities into former residential areas.

These commercial and wholesaling activities owed their origin to the proximity of the Buriganga river. Typically most goods were brought in by river and then distributed locally by road transport. The land-uses generated all types and modes of road traffic. But in recent years, both the mode of transport and the nature of the goods carried has been changing: more motor vehicles are being used (especially trucks), and more manufactured goods are being brought to the area from new industrial estates such as at Tongi and Tejgaon (on the outskirts of Dacca).

Thus, the demands placed on the local road network have been changing and increasing at a significant rate. The next Chapter examines the nature of the road network, but first the main generators of through-traffic in the study area are examined. Through traffic although less important to the study area than local traffic, is also significant.

Major Landuses Surrounding the Study Area:

There are a number of significant landuses around the study which also generate a significant quantity of traffic. These are discussed according to direction.

Eastern Side

Sadarghat Terminal: It is the most important point of entrance to the Dacca city. This river terminal (I W T A), which is of national importance, is beside the river Buriganga. The main road of the study area connects to Sadarghat Terminal Road. A large amount of traffic originating from Sadarghat terminal has its business in the study area.

Fire Brigade: The former Head Office of Fire Brigade is situated next to the river and near Sadarghat. The head office has been transferred recently to Siddique Bazar, but the office is working and the Central Workshop is still there.

A complex of retail shopping centre has also developed around Sadarghat. The Hotel business is very flourishing there. Clothing and Stationery shops are also important.

Jagannath College is to the north of Islampur Road. It is one of the University College where many students are studying.

Western Side

In the western part of the study area, Lalbagh is located. Lalbagh is a very densly populated residential area. It is the one of the old residential areas of Dacca.

Southern Side

The study area is bounded by the river Buriganga. But beyond the river the south Jinjira (the other side of the river in Keraniganj Thana) has grown rapidly in the last few years. There is a possibility of Dacca city expanding into Jinjira. Jinjirabazar is important for supplying construction materials (timber, tin, etc.) and hardware products. Some small scale manufacturing are also found there. Jinjira is a growing residential area for the people of Dacca city. Dockyard and boat making activities are also important here on the rever side.

Northern Side

The north-eastern part of the study area is important for a paper market and timber market in the Nayabazar area.

Both paper and timber shops are concentrated along the road in two blocks. Bangshal residential area is also important. Beyond these the Jagannath College campus occupies a large area. Beyond the campus, new Dacca begins, and now extends upto Gulshan and Mirpur.

Conclusion

It is clear that the study area and the surrounding area have so many activities and multiple uses that enormous volumes of traffic are generated. Within the study area not only local traffic but also a large amount of through-traffic is significant.

THE ROAD NET WORK AT THE STUDY AREA

The study area is situated on the Buriganga river frontage of Dacca city, but within the study area, the only form of transport facility is road transport. The road network of the study area is as old as Dacca city itself, which dates back more than 200 years. When the roads were built, these were designed only for pedestrian traffic and horse drawn carts. Today the road network remains almost the same, but the type and volume of traffic has changed dramatically. Old Dacca remains old without any change in its road network, whereas New Dacca has been developed with modern wide roads. It is interesting to compare the roads of New Dacca with those of Old Dacca, in terms of the road width.

The average width of roads in the study area (Old Dacca) for example is only 20 feet. Some of them are only 11 feet wide (e.g. Swarighat). On the other hand, the approximate width of some sample main roads in New Dacca can be quoted; Airport Road 80 feet, Mymensingh Road 70 feet. Main roads both in Old and New Dacca have to carry large volumes of traffic, but the latter were clearly designed for the motor age, while the roads in Old Dacca were designed for the pedestrians.

The Quality of the Roads in Old Dacca:

The roads in Old Dacca have long been notorious for their poor quality. To describe the road quality of Dacca city during 1905, S.N.H.Rizvi noted that;

> "The Islampur, Mitford, Mugultuli Road to Chawkbazar was mean and squalid in 1830." and
>
> "for Dacca suffers from manifold drawbacks of an old Eastern city. The streets and lanes are extra-ordinarily narrow; there are neigher sidewalks nor room for them and as the foot passengers wander at will all over the roadway, continual ringing of a bell is required to clear a passage for wheeled vehicle. In the absence of stone the roads have been metalled with burnt brick which is unable to stand the heavy traffic so that the surface is worn into holes and in all but the wettest weather is intolerables dusty. There is no system of drainage either for the removal of sewerage or of surface water and filth and garbage accumulate in all the lanes."[1]

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[1] S.N.H.Rizvi, (ed), Dacca District Gazeteer, Government Publication, Dacca, 1975, p.457

Old Dacca was mostly built between 1600 and 1900 A.D. During the first half of the 19th century most of the roads in Old Dacca were built by the prisoners of Nizamat Court.[2] The road network of Old Dacca, all of which was built before 20th century, is characterised by a narrow, twisted road pattern which is suitable only for smaller vehicles. Even upto early 1950's the main form of transport in Dacca was provided by horse-bogeys and cycle-rickshaws. Today the horse- bogeys have almost vanished and new forms of transport such as car, truck and baby taxi have replaced them. Yet the road network remains as it was when first built, and the condition of the roads is no different from its poor conditon of the 19th century. The study area almost completely lacks modern road facilities such as pedestrian sidewalks, traffic light, and traffic signs, pedestrian crossings and so on. With the exception of two roads (Armanitola Road and Naya Bazar Road), there is no pedestrian way. The conflict between pedestrian and vehicle is intense. There are very few roundabouts and very few traffic police are to be found in the area. Garbage cleaning along the roads is rather unsatisfactory, and frequently refuse is piled up at the side of the road. The absence of a good east-west main road or other main roads connecting New and Old Dacca is another important factor of the transport problems in Old Dacca. The improvement of English Road in the 1960's particularly eased this problem, but the quality of the roads in the study area is deplorable.

Road Classification

In order to identify the function and purpose of different roads in the study area, and also to serve as a frame work for the analysis of traffic movements in the area, the road network of the study area was classified into three categories. The categories are:

1. Primary Road
2. Secondary Roads
3. Tertiary Roads (Lanes and By-lanes)

The roads identified as primary roads are those which have the prime importance in the study area. They carry the highest volume of through traffic. Generally, they link the study area with other parts of Old and New Dacca. In other words they are the roads which have to bear the heaviest traffic demand. These primary roads are briefly listed below.

The road parallel to Buriganga river runs east-west through the study area. This is one of the very important roads which connects Sadarghat at the east and upto Lalbagh in the west. The road has different names in different localities, such as Mugultuli Road, Mitford Road, Islampur Road.

Chawk Circular Road is the main corridor of movement within the study area, because it is the only primary road connecting other primary roads in a north-south direction.

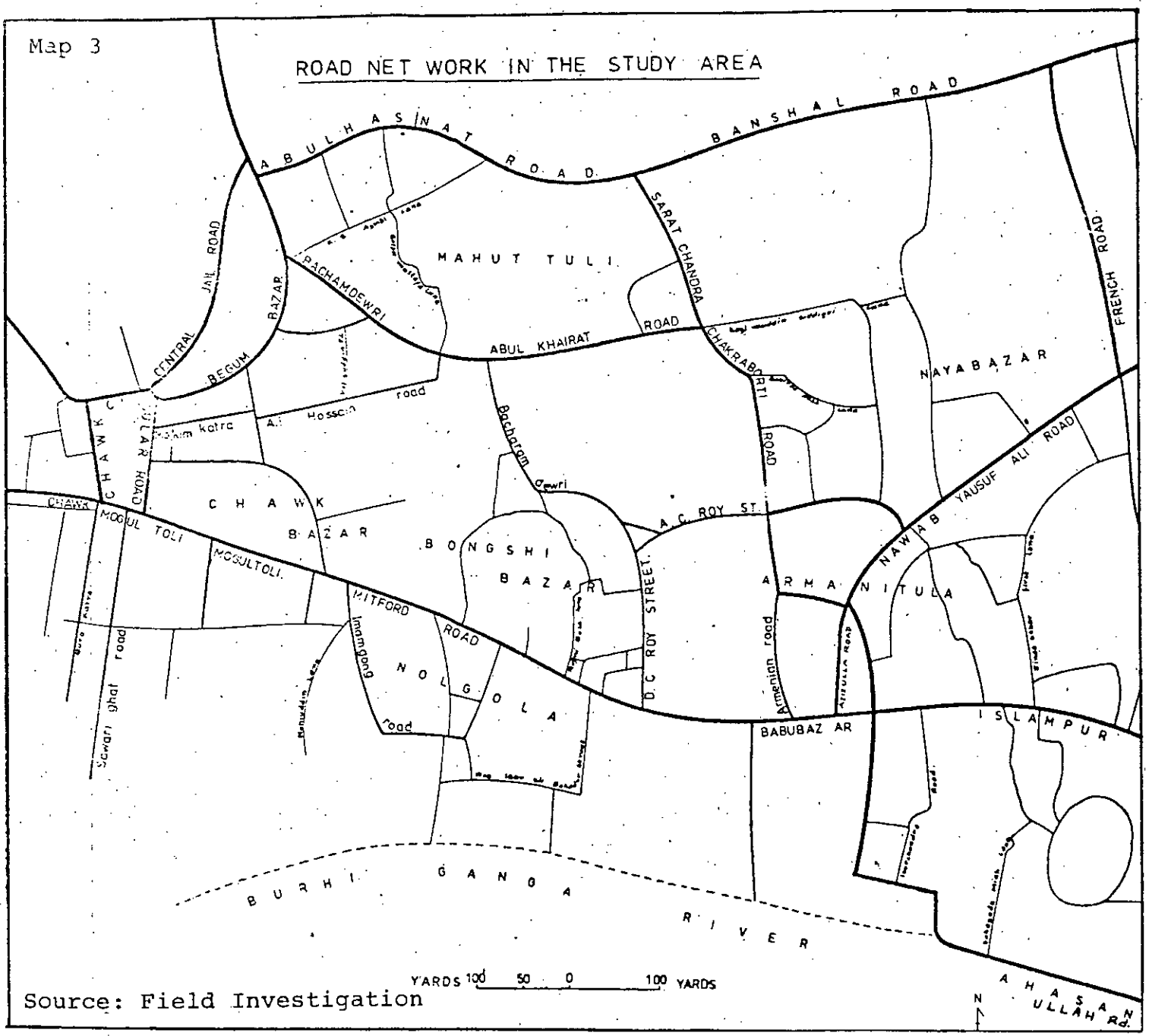
Jail Road connects to Nazimuddin Road and is an important primary road which connects the study area to New Dacca. This road is mainly used by trucks and other heavy vehicles to enter and get out of the study area.

Abul Hasnat Road is another east- west primary road connecting Jail Road and Bangshal area.

Nawab Yusuf Road is another outlet of the study area to new Dacca area through Kazi Alauddin Road. This is an alternative route of Nawabpur Road which is a one-way road towards south.

Map 3

ROAD NET WORK IN THE STUDY AREA



Source: Field Investigation

Other important primary roads of the study area are Becharam Dewri Road, Sarat Chandra Chakravorti Road, and Begum Bazar Road.

Secondary Roads:

Next to primary roads, but significant than lanes and by-lanes are considered as secondary roads.

Secondary roads connects the primary roads and important landuses within the study area.

Important secondary roads are: Swarighat Road, Boro Katra Road, Imamgonj Road, Moulovi Bazar Road, Mukim Katra Road, A.C. Roy Road, D.C. Roy Road, etc.

Tertiary Roads:

The lowest order of roads in the study area are included here. These roads are very narrow and congested. Some of them are used by only pedestrians and a few rick-shaw (Nanda Kumar Datta Lane).

Other tertiary roads are Banghi Bose Lane, Golam Mostafa Lane, Kazimuddin Siddique Lane

TABLE 8

ROAD CATEGORIES IN THE STUDY AREA

Primary Roads	Secondary Roads	Tertiary Roads
1. Mugul Tuli Road	1. Swarighat Road	1. Bangshi Bose Lane
2. Mitford Road	2. Imamganj Road	2. Nanda Kumar Datta
3. Babu Bazar Road	3. Moulovi Bazar Road	3. Golam Mostafa
4. Chawk Circular Road	4. Mukim Katra Road	4. Mohiuddin Lane
5. Abul Hasnat Road	5. Armenian Road	5. Boro Katra
6. Becharam Dewri Road	6. A. C. Roy Road	6. Rajoni Bose Lane
7. Jail Road	7. D. C. Roy Road	7. K. S. Azmal Lane
8. Urdu Road	8. Ali Hossain Road	8. Hafizuddin Road
9. Sarat C. C. Road	9. Nolgola Road	9. Kazimuddin S. Lane
10. Nawab Yusuf Road		
11. Begum Bazar Road		
12. Water Works Road		
13. Nazimuddin Road		
14. Kazi Alauddin Road		

Source: Field Investigation

CONCLUSION

The road network in the study area is very old and it is quite inadequate to cope with motor traffic. The road quality (both surface and width) is very poor. The narrow, twisted roads are sometimes inaccessible to certain larger type of vehicles. The access roads from the study area to New Dacca area are few in number and very constricted. The road network and quality have remained almost the same since the time when it was built, except for one or two small developments.

CHAPTER 6

THE NATURE AND COMPOSITION OF TRAFFIC IN THE STUDY AREA

The greatest traffic problems and congestion are likely to occur at the peak hour on the busiest day of the week. Any policies for improving the traffic situation must necessarily concentrate on these busiest times; at other times of the day, congestion is likely to be less, and remedial measures may not be so necessary.

The aim of this chapter is to identify the nature of the traffic demand placed on the road network of the study area. In particular, to determine how the demand varied over time (hourly variation, day to day variation) in different parts of the road network.

The first step, therefore, was to identify the extent of the maximum (or peak) traffic demand. Experience suggested that the level of traffic varied during the day. What was the busiest time of the day ?

Hourly Variation of the Traffic: Peak Hour of the Day

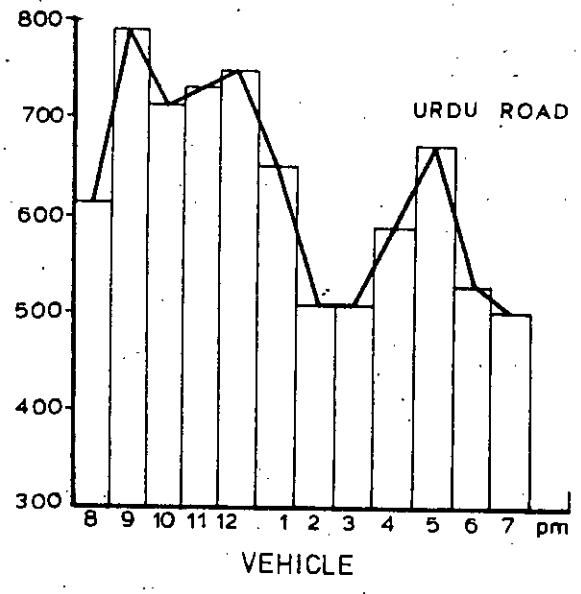
To identify the variation within a day, a 12 hour traffic count was carried out, by the researcher assist by other investigators from 8:00a.m. until 8:p.m. Two of the busiest (primary) roads (Mugultui Road and Urdu Road) were selected for study. The aim was to identify the peak hours of traffic demand on one road, and then check these results with a count on a second road, to test whether the findings (on the first road) gave a representative picture. A Thursday was selected for the count as this was believed to represent a typical day of the week, and a count was taken for 30 consecutive minutes in every hour from 8:00 a.m.to 8:00 P.m

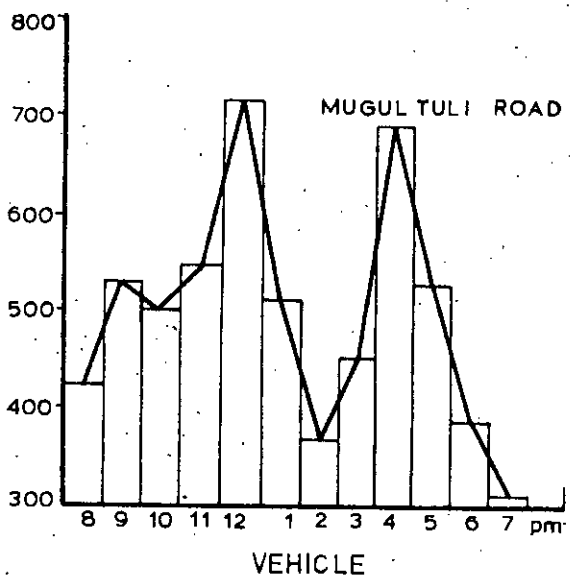
Fig. 5

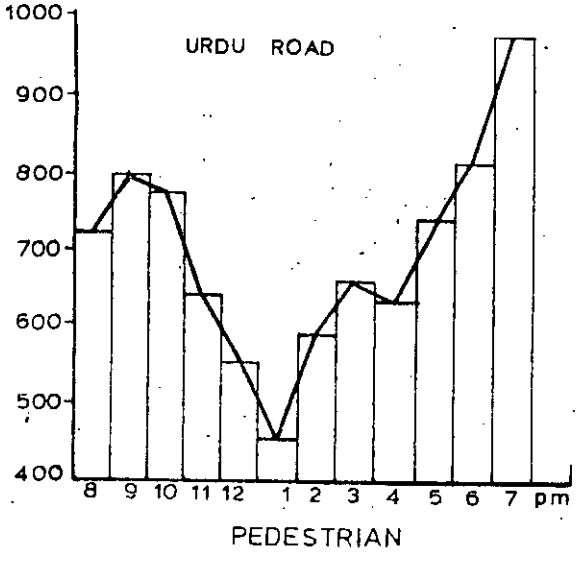
HOURLY VARIATION IN THE NUMBERS OF PEDESTRIAN AND VEHICLES ON TWO SELECTED ROADS

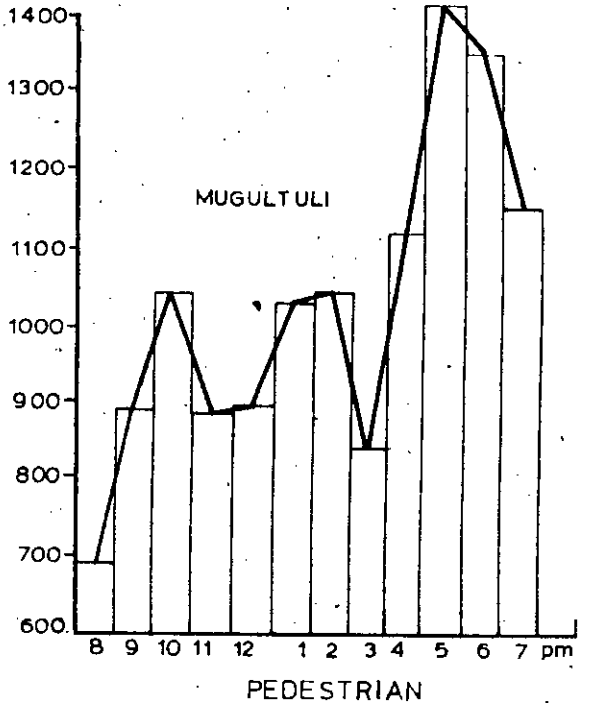
[Urdu Road and Mugultuli Road : Two way Traffic Counted in 30 minutes intervals from 8·00 a m to 8·00pm on Thursday the 3rd May 1979.]

Weather condition : Fine.









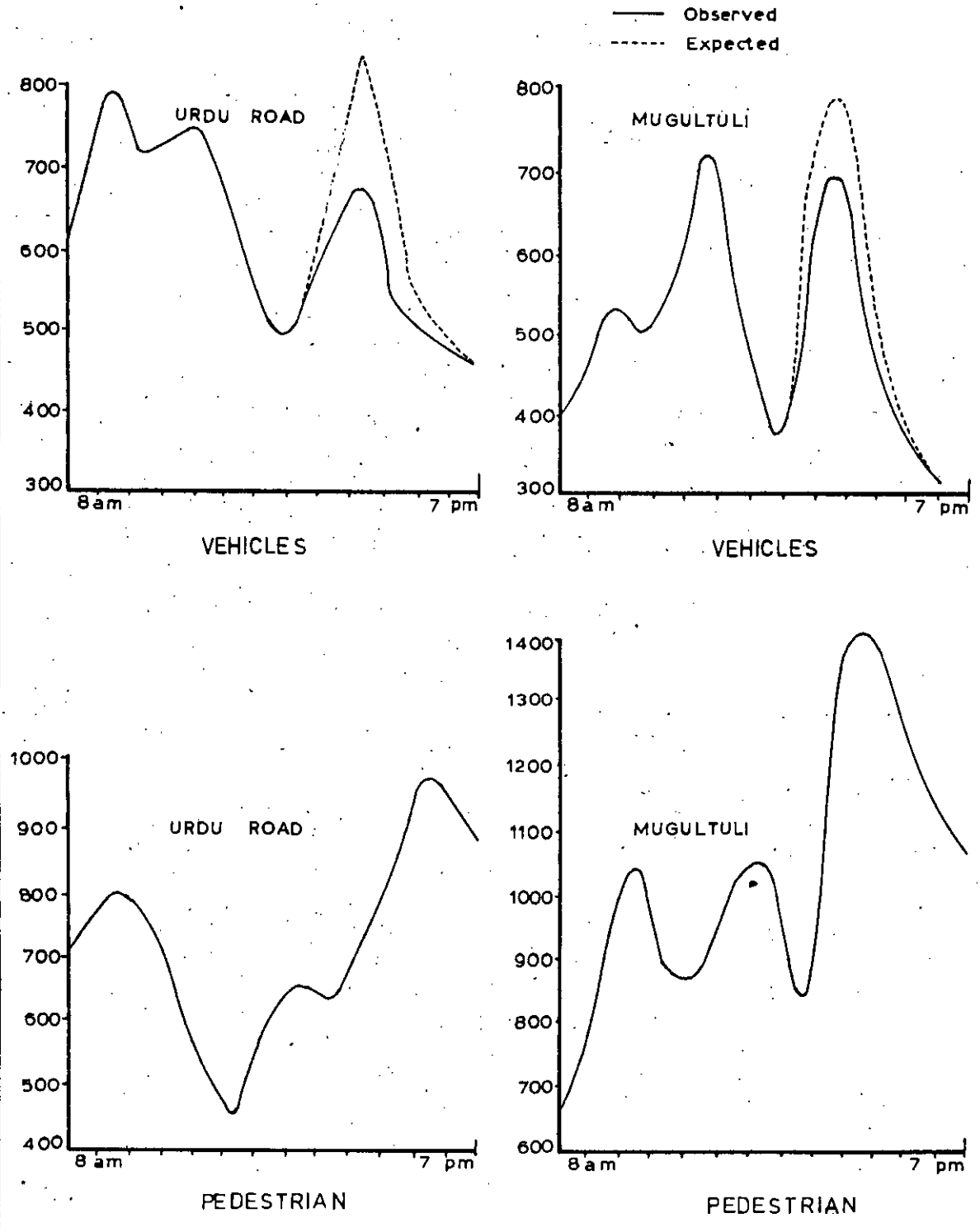
Source: Field Investigation

Fig. 6

HOURLY VARIATION IN THE NUMBERS OF PEDESTRIAN AND VEHICLES ON TWO SELECTED ROADS

[Urdu Road and Mugultuli Road : Two way Traffi Counted in 30 minutes intervals from 8-00 am to 8-00 pm on Thursday the 3rd May 1979]

Weather condition : Fine.



Source: Field Investigation

The hourly variation of the traffic within a day was found to be similar in the case of both roads. Although the volume differed between the roads, the type of variation was the same in both cases.

Two distinct peaks were found. They were:

a) A broad peak running from approximately 8:30 a.m. to 12:00 p.m. (noon).

b) An evening peak, running from 4:30 p.m. until 7:30 p.m., reaching its highest volume at around 5:00 - 6:00 p.m.

At most times of the day, the number of pedestrians moving along the roads was very high and constituted a substantial part of the traffic, both in terms of numbers and road space occupied.

The highest numbers of pedestrians occured during the evening peak period, though their numbers also "peaked" at around 9:00 a.m. in the morning and 12:00 noon.

The numbers of vehicles appeared to vary less throughout the day than the numbers of pedestrians, and from the traffic count it appeared that the morning peak for vehicles and higher than the evening.

The general trend of flow, in terms of vehicles moving down the roads was higher during the morning peak, though the variation between morning flow volume and evening flow volume was small (less than the variation in pedestrians)

In the evening, however, the flow contained significantly higher numbers of large vehicles (see later sections) So demand for road space may have been as great (or ever greater) in the evening as in the morning. At any rate,

congestion found to occur much more frequently in the evening peak periods.

A number of reasons can be suggested why the peak traffic periods, both for pedestrians and vehicles, occured at these times .

Morning Peak Hour:

Between the hours of 8:00 - 9:30 in the morning, a large number of people journey to work. As business and commerce are the key activities in the area, it is believed that a large number of the trips are connected with business purposes. However, the morning peak gradually decreased upto 12:00 p.m. and significantly fell around 1:30 to 2 o' clock. This lower level of traffic then continued upto 3:00 to 3:30 in the afternoon.

The reasons for the abrupt fall of traffic at 1:30 to 2 o'clock can be suggested as follows:

a) Lunch Break: Many businessmen of the study area especially owner of shops, take their lunch at the shop. So they do not contribute to the traffic at this hour. In addition, many of the people who live in the area return home for lunch around 1 o'clock, and by 1.30 p.m. the number of home-bound commuters begins to fall.

b) Change of Rickshaw: At 2 o'clock rickshaw pullers change shifts and thus there are fewer rickshaws on the streets at this time. It is customary for one rickshaw puller to operate in the morning shift and the second puller operates the afternoon/evening shift. At 2:00 p.m. they change over, reducing the number of available rickshaws and hence the road traffic.

c) A third cause is due to the weather. Mid day and early afternoon is normally the hottest time of the day, and many people avoid travelling and take rest at this time of the day.

Evening Peak Hour:

The main causes of the heavy demand at the peak period in the evening are suggested below:

a) People return home from work, school, college university and other places. Much of the flow of traffic is due to people returning from work.

b) Businessmen are very active in the area at this time of the day, both travelling to work and going back after finishing their business. Much business activity takes place during the evening.

c) A large number of shopping, recreational and social trips are made during the evening. Being the coolest time of the day and also "leisure time" for many people, the markets, retail shops restaurants and cinemas are busiest at this time of day.

Thus one of the busiest times of the day for traffic in the study area was found to be during the evening peak period running approximately from 4:p.m. At this time of the day, traffic is generated for a complete cross-section of purposes; including business, commercial, shopping, leisure and commuting (that is, returning home from work).

Day to Day Variation of the Traffic:

From the reconnaissance survey it was observed that the volume of traffic fluctuated from day to day during the week. This appears to be true not only in the study area but in almost all parts of Dacca. In general, it appeared that the traffic volume is quite high in the study area at all times of the week, but there were significant fluctuations of traffic from day to day.

Monday was believed to be the busiest day. This information was based on observation, experience and interviews with local people. Furthermore it was believed that as the days of the week go by , the daily volume of traffic decreased, to its lowest level on a Sunday.

To study the variation of traffic during the week, three different days were selected: Monday, Thursday and Sunday. Sunday was believed to be the day of least traffic as the closed day of the week. Thursday was selected arbitrarily as being a typical week day for traffic. The traffic counts were taken at 3 primary roads (Urdu Road, Mugultuli Road and Chawk Circular Road) at the morning peak hours (9:00 a.m. to 12:30 p.m.).[1] The morning hours were selected for study since traffic flow was less affected by congestion at this time of the day, so the figures obtained illustrate more clearly the level of demand for the roads. From the graph (Fig.7), it is clear that all three roads experience a gradual decrease of traffic both vehicular and pedestrain, during the week from Monday.

[1] All traffic counts throughout this analysis have been based on the first 30 minutes of each hour (for example, 9:00 - 9:30 a.m.etc.) To estimate the hourly volume of traffic, the figures should be multiplied by two.

TABLE 9

DAY TO DAY VARIATION OF TRAFFIC (Peak Hour Traffic count between 9:00 -12:30 p.m. on Monday, Thursday and Sunday)*

Roads	Mode	Monday		Thursday as a % of Monday		Sunday as a % of Monday	
		Nmbr.	%	Nmbr.	%	Nmbr.	%
Urdu Road	Vehicle	3070	100	2968	96	2525	82
	Pedestrian	2938	100	2754	93	1702	57
Mugultuli Road	Vehicle	2665	100	2294	85	1310	49
	Pedestrian	3707	100	3398	91	1288	35
Chawk Circu -lar Road	Vehicle	1487	100	1252	84	1009	67
	Pedestrian	3071	100	2801	91	2387	77
Average	Vehicle		100		88		66
	Pedestrian		100		91		54

Note: The numbers in the table represent total 2 way traffic observed for 4 consequtive half hour periods (9:00- 9:30, 10:00-10:30, 11:00-11:30 and 12:00-12:30 p.m.).

Source: Field Investigation

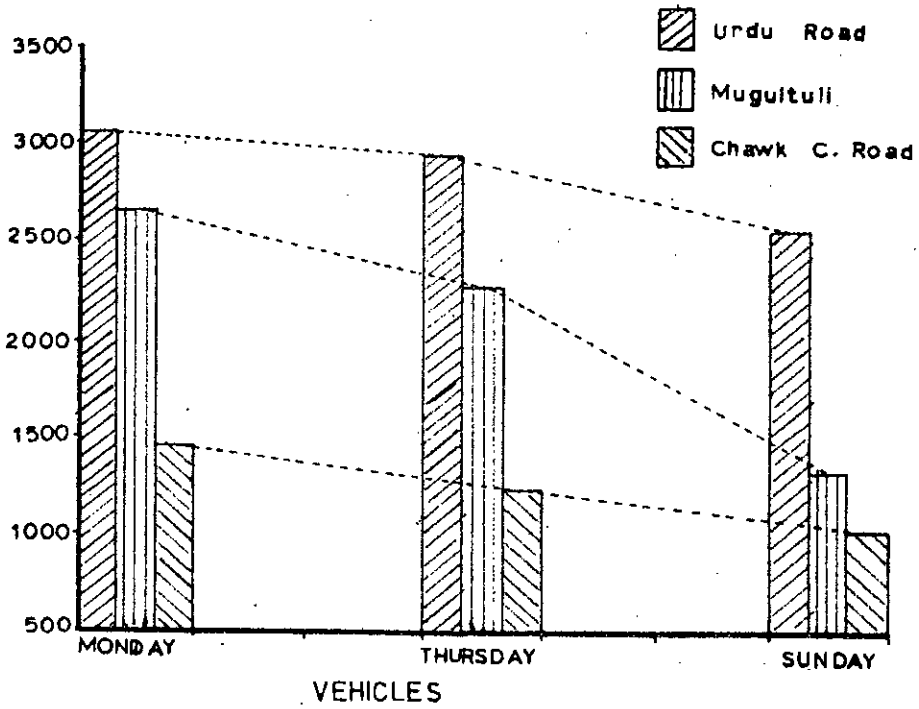
Taking the Monday volume of traffic as 100% the number of vehicles on a Thursday was found to be 88% of Monday's level while Sunday was about 66% of Monday's level. A similar pattern was observed in each of the roads studied. Only at Mugultuli Road the decrease was more significant on Sunday which is 49% - less than half of Monday's level.

The day to day variation in the number of pedestrians was quite different. Thursday was 91% of Monday's level (on average) which is more than the vehicles. Sunday was approximately half (54%). The figures suggests that, traffic varies more from working day to non-working day (Monday to Sunday). The reasons for the day to day variation in the traffic are suggested below.

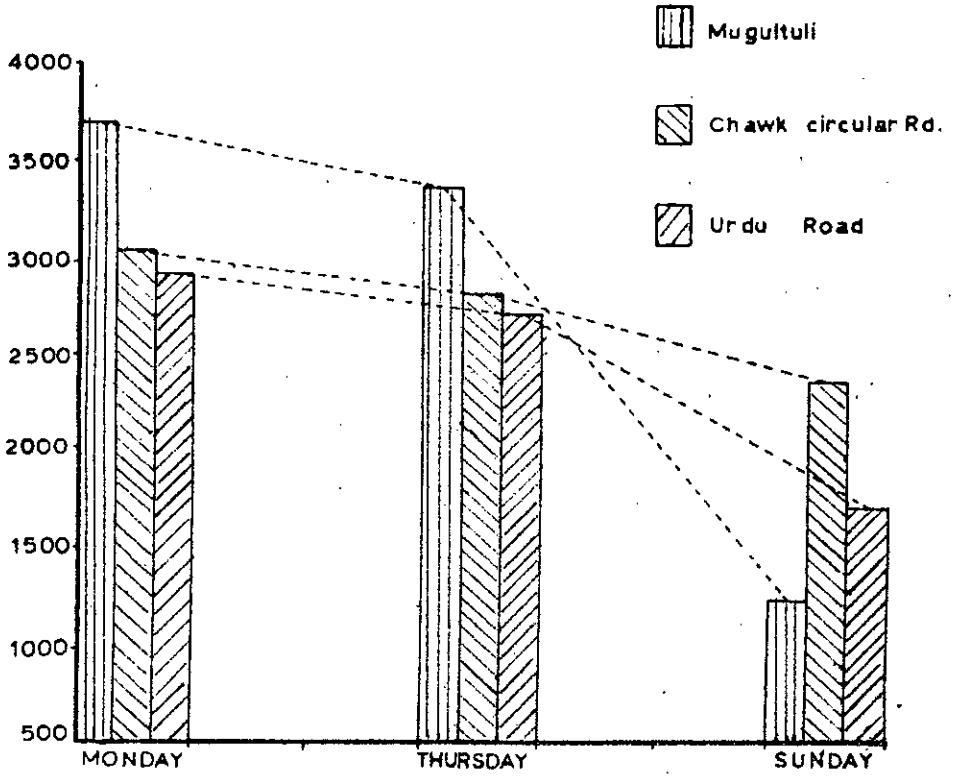
VARIATION IN TRAFFIC VOLUME BETWEEN MONDAY THURSDAY AND SUNDAY

(Total Two way Taffic of Venicles and Pedestrian; 900am to 12-30pm(30 minutes count in each hour)

Weather condition: Fine



VEHICLES



PEDESTRIAN

Source: Field Investigation

Fig. 7

Monday is considered as the busiest day. Business activities are likely to be heaviest on a Monday- work has "piled up" over the week end, and this significantly increases the level of activity at the start of the week.

Tuesday, Wednesday and Thursday are also business day generally less busy than a Monday and all with rather similar levels of traffic. In addition, during the week days (including Saturdays) schools are active and people travel to work (commuting).

Friday is the Jumma Day: people get ready for Jumma prayer and they are less involved in other business. Besides, some shops and business remain close for the prayer time. The study area contains 20 mosques.[1] And from general observation it was seen that the traffic volume is significantly influenced by Jumma Prayer and is therefore less on Friday.

In the study area, Saturday is considered as half-day business. So after 12 o'clock noon many business and other activities related to the area are closed.

Sunday is a totally closed day for the study area, and thus there is less traffic than any other day of the week. Most of the traffic generated on Sunday is from the residential parts from where people make trips for purposes like social meetings, shopping, recreation and so on.

Other Factors which Influence the Level of Traffic:

From general observations and discussions in the study area, it was found that there were other factors which influenced the level of traffic moving in the study area.These factors were;

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[1] Recorded during Field Survey.

1) Weather conditions,
2) Month to Month variation(that is seasonal variations).
3) Special occasions.

As we have seen, high temperatures at mid day (especially in the summer) are one factor which reduces the level of traffic.

Heavy rainfall has a similar effect. During a downpour the level of traffic (pedestrian and vehicular) is greatly reduced, sometimes almost to nil. As soon as the rain ceases, traffic returns at an abnormally high level. The traffic has been "bottled up" during the rain, and is released in greater number once the rain ceases. In fact, the non-motorized vehicles and pedestrians are particularly affected by heavy rainfall.

Secondly, traffic levels vary from season to season or month to month. No data was collected on this factor, but it was observed that the impact of changing hours of daylight (shorter days in winter and longer days in summer) has an effect on the level of traffic. Generally, there is less traffic in early morning and late evening during the winter months. The effect of this factor on the level of peak demand (and hence congestion) is believed to be insignificant, although it may have some influence on the hour at which peak demand occurs (bringing the evening peak hour forward in the winter, for example).

The third factors are the "special occasions", such as a religious festival (Eid, Durga Puja, Muharram, etc.) which may increase the level of business activity and shopping activity. Also football matches and political rallies can create abnormally high demands for traffic.

Conclusion:

On the basis of the above studies, it can be predicted that the busiest time for traffic in the study area is likely to occur:

- On a Monday
- during the evening peak (4.30 - 7:30 p.m.)
- immediately after a rainstorm
- during the week preceeding Eid Festival
- just after a football match or Cinema ended

Therefore, in the subsequent analysis of the traffic problems of Old Dacca, attention has been mainly focussed on the traffic situation prevailing during the Monday peak periods.

The Composition of the Traffic

Having identified the peak hour of the day and peak day of the week, we are familiar with the nature of traffic. But how does the traffic function according to composition over time.

The study area was first built some 200 years ago when the only modes of transport were horse-drawn carts and pedestrians. The road network was designed for those purposes. But in recent years the composition of the traffic appears to have changed substantially. In short, nearly every type of road transport to be found in Bangladesh (with the exception of buses) can be found moving in the study area. Ten different type of vehicles were found, in addition to pedestrian traffic. The types are categorised below:

Motorised transport	Non-Motorised transport
Truck	Rickshaw
Baby Taxi	Bi-cycle
Motor Cycle	Three Wheeler
Car/Pickup Van	Push Cart
	Bullock Cart
	Hand Trolley.

The other important forms of traffic include:

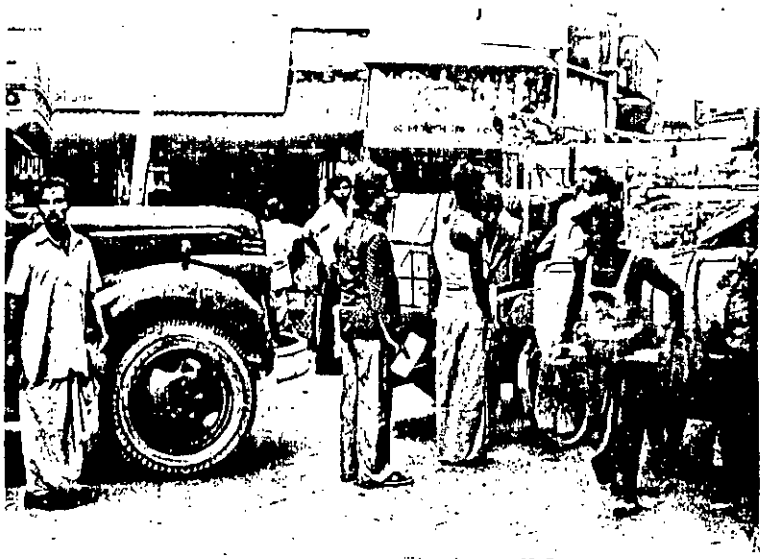
1. Pedestrians
2. Head Loaders and Shoulder Loaders

The traffic composition displayed a number of notable characteristics. Firstly, nearly all types of road vehicle were found to be present in the study area. Because the roads are generally very narrow, this suggested that there was a much greater potential for conflict between the modes, given the different speeds, sizes and functions of the different vehicles.

Secondly, pedestrians and rickshaws formed the overwhelming majority of the traffic. The total volume of pedestrian traffic (see table: 8) was very high and it represented the most important single form of transport in Old Dacca. The rickshaw accounted for the maximum number of vehicles.

Thirdly, motorised and non-motorised vehicles(excluding rickshaw) were very small in number (especially the car and truck).

The figures obtained from the traffic counts on two roads were believed to be representative of traffic composition throughout the study area. Subsequent traffic counts on other roads confirmed that this was the case. From the



Conflict between Motorised and Non-Motorised Traffic.

Traditional Mode of Transport: Bullock Cart.

table below (Table 10), it was found that more than 80% of the vehicles were rickshaws, and there were a very insignificant number of trucks (0.2%) and cars (1.2%). The Baby Taxi and motor cycle were the main forms of motorised transport, which accounted for 4.1% and 2% of vehicles respectively. A large number of the vehicles (especially of the non-motorised type) were involved in moving goods.

TABLE 10

COMPOSITION OF THE TRAFFIC

Number of Different modes of Traffic on 2 Selected Roads, 12 hours count (2 way traffic)* in half hourly intervals from 8:00 a.m. to 8:00 p.m. on a Thursday (3rd. May 1979)

Weather: Fine

Mode	Total Number of Vehicles & Pedestrians			
	Urdu Road		Mugultuli Road	
	Number	Percentage	Number	Percentage
Pedestrians	7520		10868	
Head Loaders	520		1589	
Non-Motorised Vehicles				
Rickshaw	6145	82.1	4922	85.4
Bi-cycle	538	7.2	170	3.0
Hand Trolly	101	1.3	302	5.2
Push Cart	101	1.3	118	2.0
Three Wheeler	50	0.7	25	0.9
Bullock Cart	2	0.02	21	0.4
Motorised Vehicles				
Baby Taxi	308	4.1	40	0.7
Motor Cycle	155	2.0	102	1.8
Car	87	1.2	39	0.7
Truck	2	0.02	29	0.4
Total Vehicles	7487	100.0%	5762	100.0%

* To estimate the total 2 way traffic during the period 8:00 a.m. to 8:00 p.m. the above figure should be multiplied by 2, since the figures represent a $\frac{1}{2}$ hour count only.

Source: Field Investigation

The most important mode of non-motorised transport (after the rickshaw) was found to be the bicycle (approximately 3% to 7% of all vehicles). The nature of the traffic composition suggested that the traffic had "adapted" itself to the study area to a great extent. While traffic figures for roads in other parts of new Dacca were not collected, general observation indicated that in New Dacca (for example, Mirpur Road, Airport Road, Motijheel Road, etc.) the numbers of cars, buses and other motorised forms of transport are substantially higher.

In the study area (Old Dacca) on the other hand, the narrow and crowded roads make bus movements almost impossible, and car (and truck) movements very difficult. The area thus gives a natural preference to lighter vehicles such as the rickshaw and bi-cycle.[1] Rickshaws are used not only for passenger carrying but a large number (20%) for movement of goods. It was observed that the composition of the traffic varied, to some extent, throughout the study area. These variations were observed to exist:

- from road to road
- at different times of the day
- on different days of the week

The following sections now examine the variation of the traffic composition, to try to establish whether there was any relationship between the traffic composition and the occurrence of traffic congestion.

Variation in Traffic Composition from Road to Road:

It was found that the numbers and proportion of different types of vehicle varied significantly from road to road.

[1] Although different levels of vehicle ownership in the study area may be another important factor influencing the traffic composition.

The following table illustrates how the proportion varied on 4 different primary (or main) roads: Urdu Road, Mugultuli Road, Jail Road and Water Works Road. A significantly higher proportion of motorised vehicles were found in Jail Road and Urdu Road, whereas in Mugultuli Road and Water Works Road they were less. Notably, there were many more Baby Taxis, cars, and Motor Cycles in Jail Road and Urdu Road.

TABLE 11

VARIATION IN TRAFFIC COMPOSITION (ROAD TO ROAD)

Two way Traffic on Monday at Evening Peak Hour (5:00-8:00pm)
Weather: Fine

Mode of Transport	Urdu Road		Mugultuli Road		Jail Road		Water Works Rd.	
	Nmbr	%	Nmbr	%	Nmbr	%	Nmbr	%
Pedestrian	2730		3009		1409		2850	
Head Loaders	124		205		79		236	
Non-Motorised Vehicles								
Rickshaw	1738	82.0	963	84.0	1707	85.0	812	83.0
Bi-cycle	143	6.7	32	2.8	68	3.4	65	6.6
Hand Trolly	28	1.3	56	4.9	11	0.5	54	5.5
Push Cart	27	1.3	43	3.8	36	1.8	10	1.0
Three Wheeler	3	0.1	9	0.8	6	0.3	4	0.4
Bullock Cart	7	0.3	-	-	10	0.5	7	0.7
(Total)	1946		1103		1838		952	
Motorised Vehicles								
Baby Taxi	104	4.9	8	0.7	64	3.2	4	0.4
Motor Cycle	35	1.6	17	1.5	54	2.7	11	1.1
Car	34	1.6	11	1.0	17	0.8	5	0.5
Truck	3	0.1	7	0.6	31	1.5	10	1.0
(Total)	176		43		166		30	
TOTAL Vehicles	2122	100%	1146	100%	2004	100%	982	100%

Source: Field Investigation

The proportion of rickshaws was roughly the same in each road, but it was also notable that the numbers of hand trolleys and head loaders were significantly higher in Mugultuli Road and Water Works Road. These latter two modes of transport are employed for moving goods, typically for short distances only. Thus the variation in traffic composition from road to road suggested that:

Firstly, the different roads held different functions. For example, Mugultuli Road and Water Works Road were widely used for business and goods movements as they are located within a major commercial area. On the otherhand, Urdu Road and Jail Road were more frequently used for passenger trips as people travel from the study area to other parts of Dacca. Both of these roads (Urdu and Jail Roads) connect other localities and longer distance journeys are made on these roads.

Secondly, a major reason why the different roads held different functions was because the landuse of the area influences the nature of the traffic on the road network. For example, godowns generate a large number of hand trolleys and push carts to carry their goods. And a large number of these vehicles was found in Muqultuli Road and Water Works Road, where a substantial number of godowns are located.

Thirdly, another important reason why different roads held different functions (and thus contained different types of traffic) was because some roads were not suitable for certain modes of traffic. For example, Urdu Road is quite narrow and is rather unusable for trucks, whereas it is quite suitable for lighter modes of traffic (such as hand trolleys and head loaders). This factor is examined in more detail in later sections.

Variation in Traffic Composition by time of day:

To analyse the composition over the day it was found that different modes occurred in different numbers at certain hours of the day. Notably, the numbers of larger vehicles (such as trucks, push carts, hand trolleys and cars) became a more important part of the traffic in the evening (see Table 12). It appeared that the percentage of heavy vehicles tended to increase as time went by during the day. Rickshaws on the other hand, accounted for a marginal proportion of the traffic in the evening.

TABLE 12

TRAFFIC COMPOSITION VARIATION (Hour to Hour)

Weather:- FINE

Count taken on 5 Primary Roads (Jail Road, Urdu Road, Mugultuli Road, Water Works Road & Mitford Road)

Time	Total Vechicles	Hand Trolly		Push Cart		Truck		Bullock Cart		Car		Rickshaw	
		N	%	N	%	N	%	N	%	N	%	N	%
AM													
9-09:30	3135	54	1.7	18	0.6	3	0.1	23	0.7	23	0.7	2741	87.0
10-10:30	3690	60	1.6	33	0.9	6	0.2	18	0.5	25	0.7	3299	89.0
11-11:30	3803	62	1.6	42	1.1	3	0.1	16	0.4	24	0.6	3386	89.0
12-12:30	3460	86	2.5	47	1.4	10	0.3	14	0.4	42	1.2	2974	86.0
PM													
5-05:30	2951	64	2.2	40	1.4	18	0.6	21	0.7	29	1.0	2535	86.0
6-06:30	2820	76	2.7	43	1.5	25	0.9	24	0.9	33	1.2	2397	85.0
7-07:30	2600	60	2.3	60	2.3	25	1.0	15	0.6	31	1.2	2137	82.0

Note: Involves some double counting as vehicles counted in one road may appear later in another road. The figures are the total for 5 roads.

Source: Field Investigation

The increase of heavy vehicles is illustrated in the following table. Relating these figures to the total traffic volumes observed on the roads, it can be noted that during

TABLE 13
PERCENTAGE OF HEAVY VEHICLES
HOUR TO HOUR ON 5 ROADS

Time of Day	Percentage to total number of vehicles
9-9:30 AM	3.8
10-10:30	3.9
11-11:30	3.8
12-12:30	5.8
5-5:30 PM	5.9
6-6:30	7.2
7-7:30	7.8

Note: Heavy vehicles include Hand Trolly, Push Cart, Truck, Bullock Cart and Car.

Source: Field Investigation

the morning peak hours, total traffic numbers on the roads was more than during the evening, but the numbers of heavy vehicles was significantly less. Hence, there was less congestion, and traffic was flowing faster.

During the evening peak hours, the total traffic volume was slightly less, but the demand by heavy vehicles was considerably increased. Thus traffic moved more slowly, and on a number of occasions, this resulted in an evening traffic count that was a significant understatement of the true demand. In other words, heavy vehicles (especially trucks) blocked the roads and greatly reduced the traffic flow in the evening. The number of heavy vehicles increased by almost double from the morning to evening. This was believed to be because:

In the early morning, business activities are less in comparison to the evening. The traffic is therefore closely related to the hours and methods of business operation.

A traffic rule imposed in the area states that no trucks may enter the study area before the hour of 5 o'clock in the evening.[1] Thus after 5:00 p.m., the number of trucks significantly increased.

The analysis of hour to hour variation in the traffic composition therefore suggested that large vehicles, although small in numbers, had an adverse impact on the traffic flow which was significantly greater than their (small) numbers would suggest.

Variation from Day to Day:

The traffic composition varied over the week as the days went by. The traffic composition was compared for a Monday, Thursday and Sunday. Examples were taken from three different roads: namely: Mugultuli Road, Urdu Road and Jail Road(there is no count of Thursday for Jail Road).

The following table on the variation from day to day suggested that (with the exception of Mugultuli Road on a Thursday) although the total traffic and number of rickshaws decreased in numbers through the week, the number of large vehicles dropped even more substantially. The drop was more significant from Monday to Sunday than Monday to Thursday. For example, in Urdu Road, rickshaws dropped by - 10% and -14%

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[1] This traffic rule is discussed in later section. It is worth noting here that there were many exceptions to this rule.

from Monday to Thursday and Monday to Sunday, while heavy vehicles dropped -19% and -61% respectively. The decrease in large vehicles was greater in business areas (Mugultuli Road -34%) than non-business areas (Urdu Road -18%).

The number of heavy vehicles is related to the business activities whereas passenger vehicles are are also widely used on a holiday (Sunday). The variation in traffic composition through the week again suggested that large vehicles had a very big impact on the traffic: when their numbers were less, (as on a Thursday and Sunday) that level of traffic congestion was also significantly reduced.

TABLE 14

DAY TO DAY VARIATION (TRAFFIC COMPOSITION)

Day	Reduction in % Vehicles			Distribution of Sub-Toatl of Heavy Vehicles: HV				
	Total	Rick-shaw	Sub Total of HV	H.Tro-lley	P. Cart	Tru-ck	B. Cart	Car
URDU ROAD								
Monday	5183	4213	233	80	53	3	15	82
Thursday	4642	3783	189	64	60	1	2	62
(% of Monday's)	-10	-10	-19					
Sunday	4270	3603	90	22	23	1	11	23
(% of Monday's)	-18	-14	-16					
MUGULTULI ROAD								
Monday	4058	3669	236	120	75	9	10	22
Thursday	3539	3076	274	169	53	16	11	25
(% of Monday's)	-13%	-16%	+16%					
Sunday	2689	2489	72	34	17	5	10	6
(% of Monday's)	-34%	-32%	-69%					
JAIL ROAD*								
Monday	5159	4476	196	28	72	35	17	44
Sunday	3497	2946	109	7	30	8	17	47
(% of Monday's)	-32%	-34%	-44%					

* Jail Road has no Thursday count

These figures represent total 2 way traffic observed for morning peak period (9:00 a.m.-12:30 p.m.)on Sunday, Monday and Thursday.

Source: Field Investigation

The Impact of Different Types of Vehicles:

The "Passenger Car Unit" is a unit of measurement to calculate the space taken up by different vehicles. PCU depends on different factors and so a suggested PCU has been given for Old Dacca by the author.

Passenger Car Unit for Old Dacca

Mode:		PCU's
	Car	1
	Truck	6
	Baby Taxi	0.5
	Bi-cycle	0.2
	Motor Cycle	0.5
	Rickshaw	0.4
	Bullock Cart	5
	Push Cart	2
	Hand Trolley	2
	Three Wheeler	0.4

The PCU's has been derived taking into account the following factors:

i) Surface quality and width of road
ii) Speed and congestion of traffic
iii) Loading of vehicles (empty or fully loaded/over-loaded)

If the road surface is poor and the width of roads is narrow, large vehicles have difficulty to move whereas slow small vehicles can manouvre far more easily. For example, Rickshaws have more chance to turn or overtake or run than a car or Truck in the Old Dacca. Furthermore, the slower the traffic and the heavier the congestion, the more difficult it is for large vehicles to manouvre and adjust to the other vehicles. Because the road network in Old Dacca is operating at a maximum point where congestion and slow speed is common, the PCU should therefore be considered in relation to this and rickshaws and bi-cycles, for example, given a lower weighting.

It is also observed that loaded vehicles, expecially hand-propelled types, have more difficulties in moving than unloaded vehicles. Overloading is very common on Old Dacca which substantially reduces the speed of hand-propelled vehicles and slows down other traffic. All of the above factors are interrelated to each other.

The suggested PCU's for Old Dacca were based on the above factors. For example, if a car is 1 PCU, the estimated influence of it is the same as between 2-3 rickshaws in Old Dacca and hence the PCU of a rickshaw is taken as 0.4. Again, a Hand Trolley usually takes about the space of a car but it carries so much load and moves so slowly (walking speed) that it should be given a higher PCU. Here the suggested PCU is 2.

The demand of different types of traffic for road space was then estimated using these PCU's. The result suggested that the small number of large vehicles moving on the roads during the evening peak hours grossly understated their actual demand for road space. In other words, a small number of large vehicles had a heavy demand for road space, and had a major impact on the prevailing road congestion. The following Table gives a clear idea about it.

TABLE 15
IMPACT OF DIFFERENT MODES ON TRAFFIC
2 way Traffic on Monday at Jail Road

Time Period	Rick-shaw	Baby Taxi	Tr-uck	Push Cart	B. Cart	Car	Hand Trolley	Bi-cycle	3 Wh-eeler	Motor cycle	Total
AM											
9-9:30	651	37	2	2	4	6	5	25	1	9	742
in PCUs	260	19	12	4	20	6	10	5	-	5	341
PM											
6-6:30	595	21	13	17	7	6	4	13	1	15	692
in PCUs	238	11	78	34	35	6	8	3	-	8	421

Note: PCU's has been calculated as the suggested PCU's for Old Dacc
Source: Field Investigation

The above table suggests that even though the total numbers of all types of vehicles was less in the evening peak, the total load (in terms of PCU's) which the road was carrying was greater. Furthermore, during the morning hour(9:00-9:30 a.m.) large vehicles (Truck, Push Cart, Hand Trolley, Bullock Cart, Car) accounted for only 2.6% of vehicles, but 15% of the total PCU's. In the evening peak hour(6:00 - 6:30 p.m.) the large vehicles still made up only a small part of traffic by numbers (i.e.7% of all vehicles), yet in terms of PCU's they made up a great part of the traffic:38% of the total PCU's.

TABLE 16
IMPACT OF DIFFERENT MODES ON TRAFFIC
2 way Traffic on Monday at Mitford Road

Time Period	Rick-shaw	Baby Taxi	Tr-uck	Push Cart	B. Cart	Car	Hand Trolley	Bi-cycle	3 Wh-eeler	Motor cycle	Total
AM											
11-11:30	1026	6	0	9	6	5	16	17	0	17	1102
PCU's	410	3	0	18	30	5	32	3	0	9	510
PM											
7-7:30	567	6	3	21	9	12	12	33	0	36	699
PCU's	227	3	18	42	45	12	24	7	0	18	396

Source: Field Investigation

Taking a second road for comparison (Mitford Road) it was again found that although traffic volume in the morning is much higher in number, the load in the evening was rather similar (even though the evening traffic was near stationary and the number of vehicles much less). In the morning, heavy vehicles (Truck, Push Cart, Bullock Cart, Car, Hand Trolley) represented only 3% of the total vehicles, but 16% of total PCU's.

In the evening, heavy vehicles represented only 8% of all vehicles, but 38% of total PCU's. And in the evening, the space occupied by large vehicles (114 PCU's) was 34% higher than the morning level of PCU's (85 PCU's at 11:00 - 11:30 a.m.). The numbers (and the space taken by rickshaws, on the other hand, had fallen in the evening to half of the morning's level.

Conclusion:

The composition of traffic in Old Dacca includes almost all modes of road transport to be found in Bangladesh. Different modes are used for different purposes. In Old Dacca most of the modes are non-motorised and many are used for carrying goods. The composition of the traffic varies from hour to hour, road to road and from day to day over the week. This variation of composition is related to the landuse, the function and width of roads, and the methods and hours of business operation in the area. Although large heavy vehicles accounted for only small number, they had a big impact on the road space, which was quite out of all proportion to their numbers. And because different modes are plying on the same road, so the possibility of conflict between modes was greater.

CHAPTER 7

THE DISTRIBUTION OF THE TRAFFIC LOAD ON THE ROAD NETWORK

The total traffic of the study area was divided into two categories; (1) Vehicles (this included all types of motorized and non-motorized vehicles); and (2) Pedestrians (which also included head loaders). The latter accounted for a large volume of traffic in the study area. The distribution of traffic volume is shown in map 4 and 5, where vehicles and pedestrians have been shown separately. It was found that in highest volume of vehicles occurred on the main roads connecting the study area to other parts: for example, Urdu Road, Nazimuddin Road and Nawab Yusuf Road are three main thoroughfares from the study area, and most of the heavy vehicles ply on these roads in order to enter and leave the area. Urdu road connects the area to the western part of Dacca. These roads carry traffic coming to and from the study area. The numbers of vehicles here are more than the pedestrians (Table 17).

The next highest volume of vehicles occurs on main roads running through the study area. They are Mitford Road, Mugultuli Road, Jail Road, S.C.Chakravarti Road, Becharam Dewri, Begum Bazar Road, Abul Hasnat Road and Chawk Circular Road. On these roads, the number of vehicles is high but in number of pedestrians is also very high or even higher (compare two maps). These are the primary and secondary roads inside the study area as shown as category B in Table 17.

TABLE 17

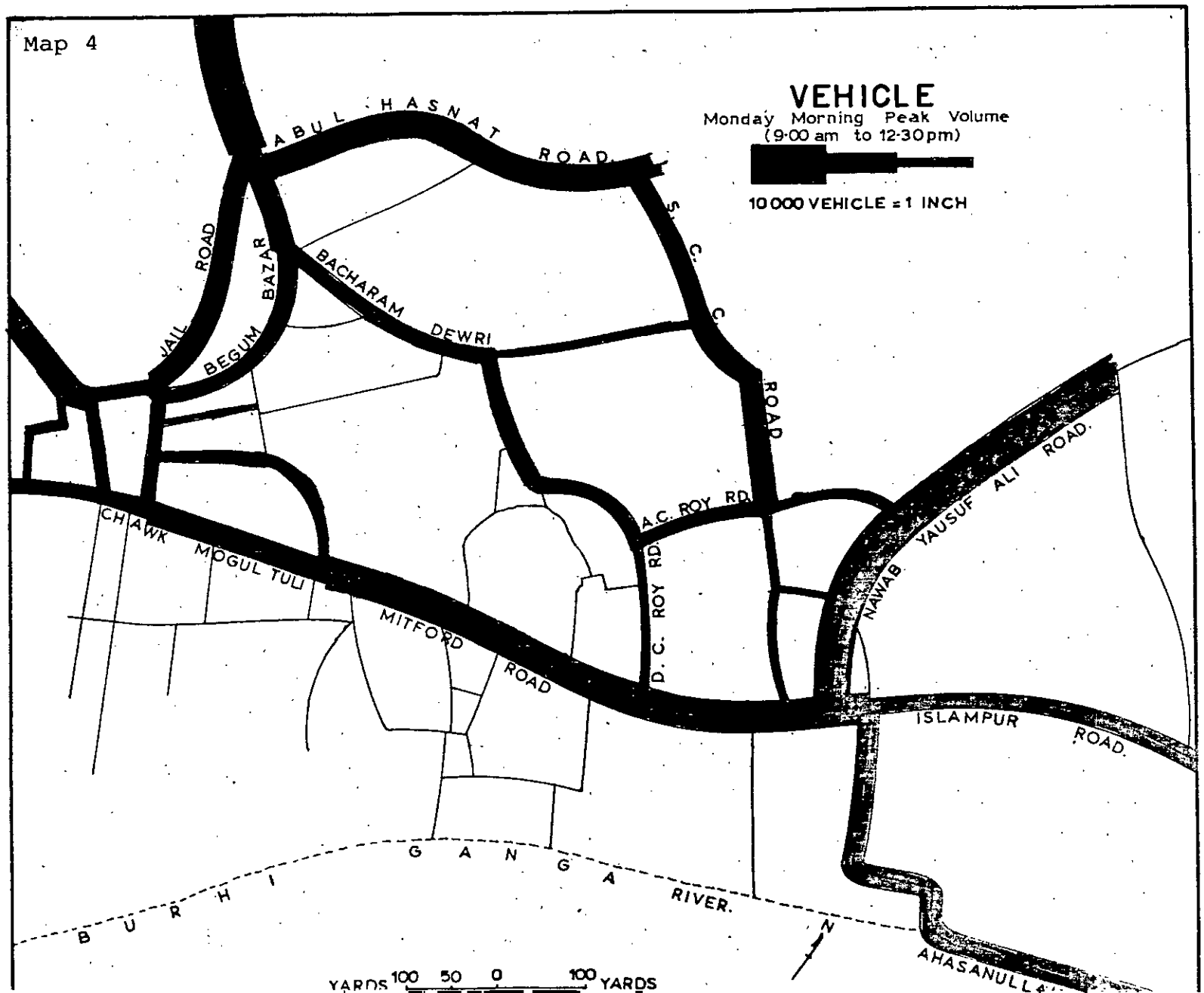
TOTAL VOLUME OF TRAFFIC ON DIFFERENT ROADS

Monday Morning Peak Count (9:00 to 12:30 pm.)

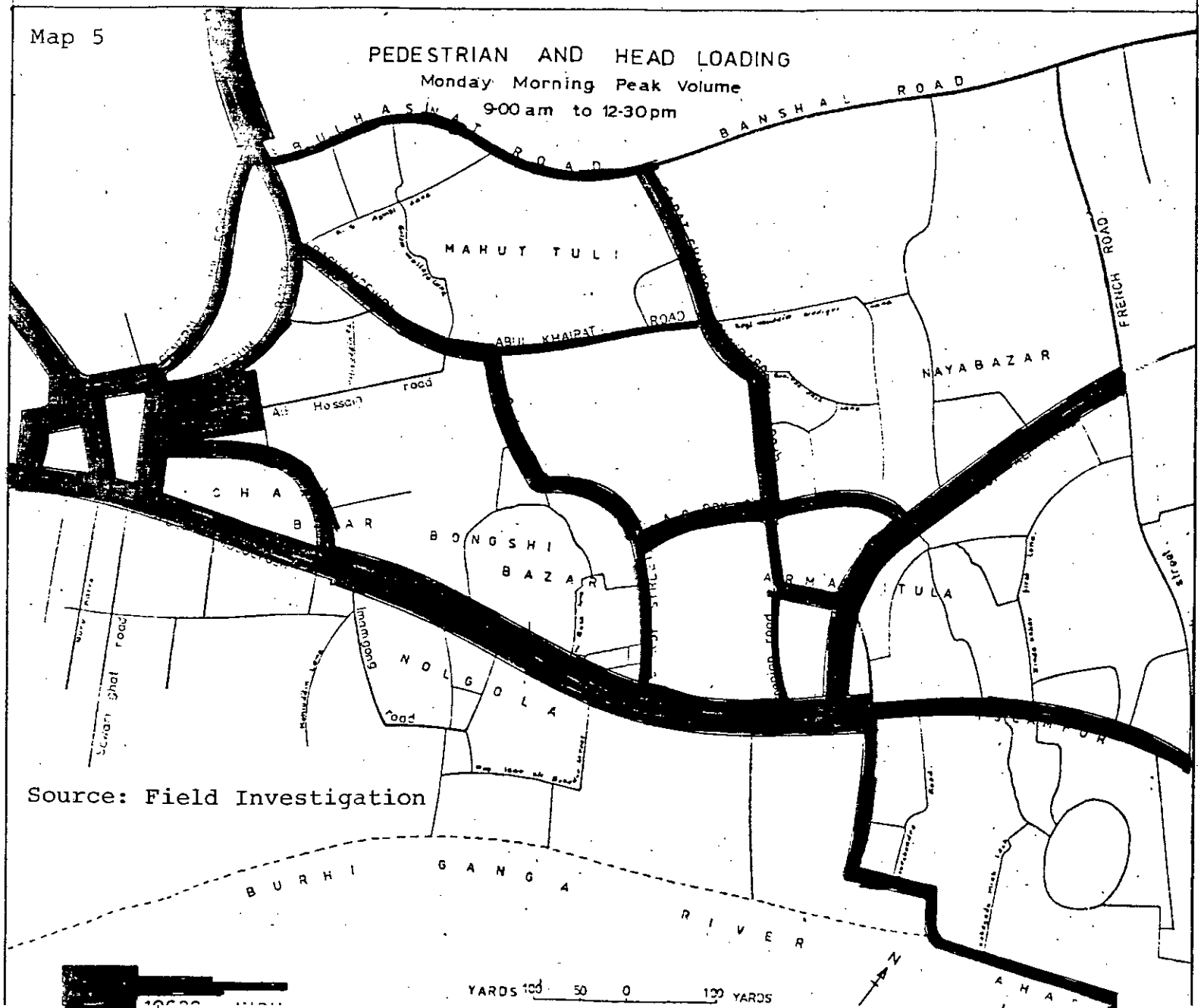
Roads	Average width in feet.	Total vehicles	Total Pedestrian & Head Loaders
(A)			
Nazimuddin Road	28	5268	4837
Nawab Yusuf Road	29	5002	3351
Urdu Road	24	3070	2938
(B)			
Mugul Tuli Road	16	2929	3398
Mitford Road	26	3838	4841
Jail Road	25	2755	1582
S.C.C.Road	26	2524	1850
Abul Hasnat Road	25	1837	1910
Begum Bazar	15	1907	1757
Becharam Dewri	16	1186	1894
Chawk Circular Road	23	1487	3071
Babu Bazar	24	2490	1857
(C)			
A.C.Roy Road	22	1896	1952
Water Works Road	16	1329	2949
Moulovi Bazar	19	1132	2051
D.C.Roy Road	20	918	1166
Armanitola	22	830	1062
(D)			
Nanda K.Datta Lane	8	438	4028
Mukim Katra	13	331	6674

Source: Field Investigation.

On some internal roads the volume of vehicles is very low where as the volume of pedestrians and head loaders is very high (Map 5). For example, Mukim Katra (6674) and Nanda Kumer Datta Lane (4027) accounts for the highest volume of pedestrians and head loaders whereas they have the lowest volume of vehicles-331 and 438 respectively. This happens because these roads are very narrow and are internal roads serving the surrounding market. Only small vehicles can ply


Map 4
VEHICLE
Monday Morning Peak Volume
(9-00 am to 12-30 pm)
10000 VEHICLE = 1 INCH
ABUL HASNAT ROAD
JAIL ROAD
BEGUM BAZAR
BACHARAM DEWRI
S. C. C. ROAD
A.C. ROY RD.
D.C. ROY RD.
NAWAB YUSUF ALI ROAD.
CHAWK MOGUL TULI
MITFORD ROAD
ISLAMPUR ROAD.
BURHI GANGA RIVER.
AHASANULLA
N
YARDS 100 50 0 100 YARDS

Map 5



Source: Field Investigation

easily (like rickshaws, hand trolley etc.). As a substitute for heavy goods vehicles, large numbers of head loaders and hand trollies serve the market.

On the main roads, (A category), a large number of longer distance vehicles were found (Table 18), compared with other roads. These longer distance vehicles included Baby Taxis, Motor Cycles, Cars,Trucks and Rickshaws, whereas shorts distance vehicles such as bi-cycles and hand trolley and also pedestrians were comparatively less.

TABLE 18

COMPOSITION OF ROAD TRAFFIC ON SELECTED ROADS

Monday Morning Peak (9:00 to 12:30 noon) Weather : Fine

Roads	Rd. width ()	MC	3W	Bi C	HT 0	Car	BC	PC	Truck 0	Baby	Rick	Total PD & HL	Total vehicle
(A)													
Nb. Yusuf	38'	113	42	213	134	88	21	38	20	79	3954	3351	5002
Urdu Rd.	30'	77	22	201	52	48	8	26	3	150	2475	2938	3070
(B)													
Mugul													
Tuli	17'	28	11	42	64	21	32	6	15	15	2431	6612	2665
Mitford	32'	47	5	66	42	23	17	36	3	22	3348	4841	3609
(D)													
Mukim													
Katra	17'	9	7	41	42	0	3	3	0	3	233	7501	331
Nanda K.													
D. Lane	10'	23	10	54	20	1	7	1	0	4	429	4020	438

Source : Field Investigation

Mugultuli and Mitford Roads have similar volumes of vehicular and pedestrian traffic. These roads function as distributors of the traffic load from the main connecting roads (such as Nazimuddin and Nawab Yusuf Roads) throughout the area as well as carrying purely local traffic. Table 17 suggests that the composition of traffic varies from road to road according to the function and capacity of the road.

Conclusion:

Studying the composition and volume of traffic it appeared that, in the study area, a "natural hierarchy" of roads existed. That is, a process of natural selection is taking place. For example, main roads carry all sorts of vehicles while some internal roads are too narrow and unsuitable for large vehicles, thus here pedestrian movement accounts for the maximum number. The highest demand is placed on the main roads. But it was also found that road width was not related to the demand placed on the roads. For example, some roads (Mugultuli, Water Works) were very narrow, yet carried heavy loads (Table 19).

The average width of Mugultuli road is only 16 feet whereas it carries large amount of vehicles (783). On the other hand Urdu road is comparatively wide (24') but carrying only 801 number of vehicles. Mukim Katra and Nanda Kumar Datta Lane do not allow vehicles as they are too narrow.

The reason why road width does not relate closely to the total demand is because the roads were not originally planned for such volumes of traffic (unlike the new roads of Dacca city) - but simply evolved. Secondly, as the area has developed, new landuses have grown up, and the road function has changed significantly.

Mode of Transport: Head Loading

Mode of Transport: Trucks and
Hand Trollies(Mugultuli at 5:40 pm).

Table 19 shows the demand for different roads in comparison to width.

TABLE 19

TOTAL VEHICLES (2 WAY) ON MONDAY (11:00-11:30)

Roads	Average width	Total vehicles
A.(PRIMARY)		
Nazimuddin Road	28	1278
Urdu Road	24	801
Nawab Yusuf Road	29	1096
B. (SECONDARY)		
Mitfor Road	26	1102
S.C.Chakravarty Road	26	717
Mugul Tuli Road	16	783
Jail Road	25	795
Abul Hasnat Road	25	458
Begum Bazar	15	452
Becharam Dewri	16	417
Chawk Circular	23	394
Babu Bazar	24	421
C.(TERTIARY)		
A.C.roy Road	21	469
D.C.Roy Road	17	274
Water Works Road	16	324
Armanitola Road	22	266
D. (LANES)		
Mukim Katra	13	82
Nanda K. Datta Lane	10	87

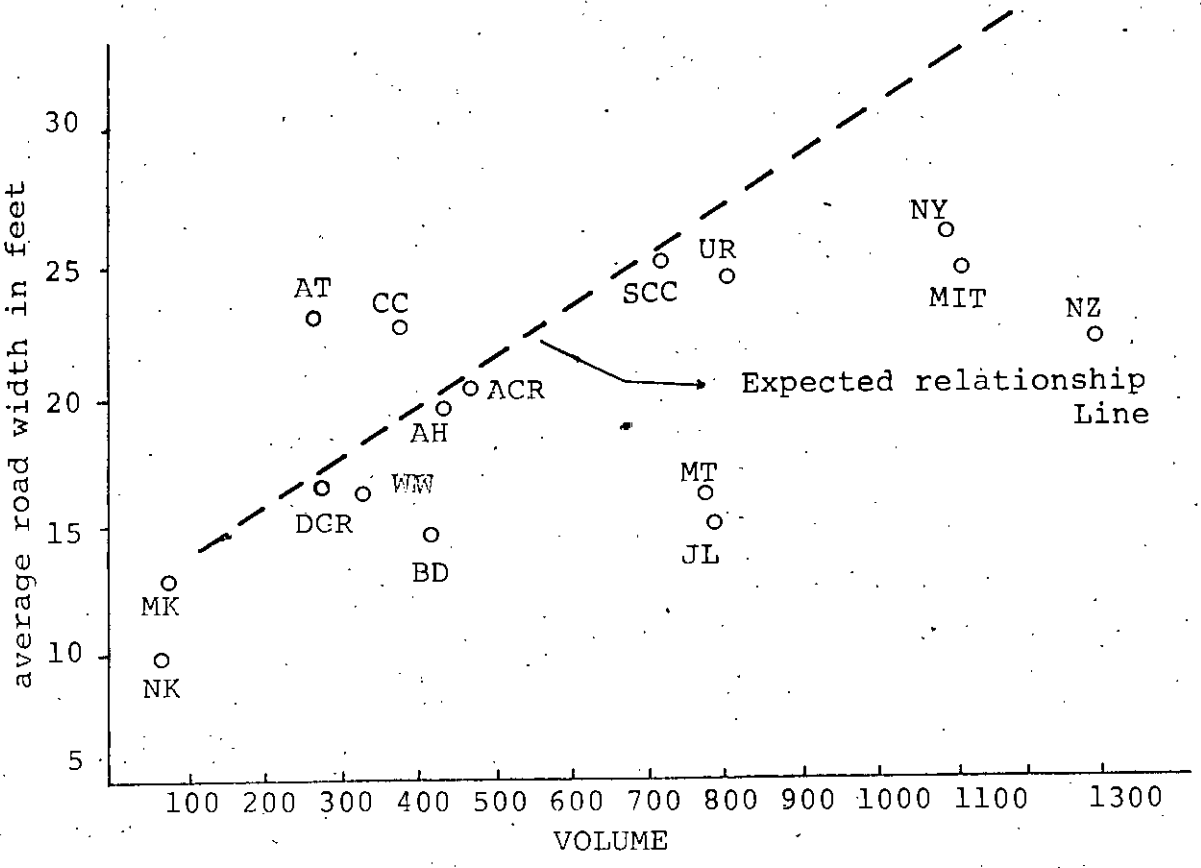
Source: Field Investigation

Sharing of Road Space by Vehicular and Pedestrian Traffic at Choto-Katra.

The following graph shows the relationship of road width to the volume of traffic. The graph illustrates the fact that although there is a natural hierarchy of road function, the width of the road often bears no relationship to this hierarchy. Some major roads are in fact very narrow.

ROAD WIDTH COMPARED WITH TRAFFIC VOLUME (VEHICLES)

Total vehicles, Monday (11:00 - 11:30 am.)2way.
(Illustration of Table 19)



NZ: Nazimuddin Road, UR: Urdu Road, NY: Nawab Yusuf Road MIT: Mitford Road, SCC: Sarat C Chakravarty Road, MT: Mugultuli Road, JL: Jail Road, AH: Abul Hasnat Road, BD: Becharam Dewri Road, CC: Chawk Circular, ACR: A.C.Roy Road, DCR: D.C.Roy Road, WW: Water Works Road, AT: Armanitola Road, MK: Mukim Katra, NK: Nanda K.Datta Lane.

A further conclusion was reached that some unsuitable larger vehicles enter the narrower local roads in contradiction to the "natural hierarchy." This creates problems. For example, lorries occasionally go up Moulovibazar Road, which is narrow and not suitable, in order to avoid congestion on main roads. This conclusion suggests that on some streets, entry restrictions for certain classes of (large) vehicles might be appropriate, and would make sense. It was observed that a minority of unsuitable vehicles entering very narrow streets sometimes caused major problems of congestion. The natural hierarchy could be enforced on some selected roads, so that all obey the process of natural hierarchy. Moreover, the restrictions would affect only a small number of "offending" vehicles, and would thus have a greater chance of success.

The Occurrence of Congestion Throughout the Study Area:

This analysis was based on (1) general observations, (2) discussions with local people and (3) analysis of the traffic volumes. It was found that most of the roads were operating beyond their maximum capacity for much of the day especially during the evening peak hour.

In the following Table (20) all of the traffic has been converted to PCU (passenger car unit), to understand the actual traffic flow on roads in the study area. Pedestrians and head loaders are also included in total PCU. As we have seen earlier, pedestrians and head loaders account for a large number of traffic. So this should be considered. And because both vehicles and pedestrians are sharing the same road space (as there is no pedestrian way) so the demand for road space is coming from both of them. The PCU of pedestrian and head loaders has been suggested as .1 and .2 PCU.Considering one moving person takes about one tenth of a car space

TABLE 20

TRAFFIC LOAD ON SELECTED ROAD

Monday Peak Hour Count (9:00 - 12:30 and 5:00 - 7:30 pm)

Mitford Road				Urdu Road		
Total HL PD	Total vehi-cles	Total HL & PD & Vehi-cle in PCU	Time	Total HL & PD	Total Vehi-cles	Total PD & HL & Vehi-cle in PCU.
718	462	276	9 - 9:30	1098	840	490
1196	1050	617	10 -10:30	790	710	423
1469	1102	670	11 -11:30	514	801	417
1458	996	643	12 -12:30	536	704	402
864	828	480	5 - 5:30	843	656	384
671	584	396	6 - 6:30	778	775	460
681	139	468	7 - 7:30	1223	691	449
Mugultuli Road				Water Works Road		
939	735	470	9 - 9:30	807	355	277
916	781	450	10 -10:30	809	336	297
762	783	460	11 -11:30	672	322	238
1375	633	387	12 -12:30	661	316	304
1375	380	373	5 - 5:30	987	358	343
1090	429	358	6 - 6:30	987	334	274
749	337	279	7 - 7:30	1102	290	280

Note: PCU of Pedestrian is.1 and Head Loaders .2 PCU.

Source: Field Investigation.

whereas head loaders and shoulder loaders takes about one fifth of a car space.

To analyse the table, it was found that the roads were frequently operating beyond their maximum capacity during the evening peak. When the roads are so busy, the impact of the addition of even one more large or slow-moving vehicle

can make the total traffic stand still. It was true that more vehicles were moving in the morning (i.e. higher traffic flow) than in the evening. For example, in Mitford Road, the highest capacity was 670 PCU at 1100 - 1130 am but during the peak at 5 - 5:30 pm it was operating at only 480 PCU's, although the total traffic demand was higher than in the morning period.

A similar pattern was found on Urdu Road, where the peak flow was achieved at 9.00 to 9.30 a.m (490 PCU's),but during the evening peak, again when the total demand was equal or greater to that of the morning, the flow was only 384 PCU's (5.00 to 5.30 pm.)

The same was true on Mugultuli Road. Peak traffic flow on this road occurred at 9.00 to 9.30 am. (470 PCU's). During the evening peak hour (5.00 to 5.30 pm.) the traffic flow was only 373 PCU's, which was a reduction of about 20% compared to the morning flow, although demand was higher.

Water Works Road was the exception. Here the evening traffic demand did not overload the road, and maximum traffic flow was reached during the evening peak period (5.00 to 5.30 pm., which was 343 PCU's).

From studying the composition of traffic it was found that more heavy vehicles were plying in the evening peak (Table 21). Heavy vehicles were thus taking more space at this time and conflicting with other vehicles to increase the traffic congestion.

On Mugultuli Road, for example, large vehicles (trucks, push carts, bullock carts and hand trolleys) took up 69 PCU's of road space between 11:00 and 11:30 in the morning, and 88 PCU's between 12:00 and 12:30 pm.In the evening, however,

TABLE 21

COMPOSITION OF TRAFFIC ON TWO SELECTED ROADS

Monday Peak (9:00 - 12:30 and 5:00 - 7:30 pm.)

Time	Truck		Push Cart		B. Cart		H. Trolley		Rickshaw	
	MT	MF	MT	MF	MT	MF	MT	MF	MT	MF
9 - 9:30	-	12	18	4	42	5	32	6	270	173
10 -10:30	-	6	18	6	-	30	26	22	289	401
11 -11:30	12	-	16	18	15	30	26	32	292	410
12 -12:30	12	6	12	44	-	20	44	24	231	355
5 - 5:30	-	18	38	6	-	-	38	36	124	296
6 - 6:30	6	36	28	6	-	15	38	42	147	204
7 - 7:30	24	18	20	42	-	45	36	24	114	227

Note : Expressed in PCU Source: Field Investigation

MT: Mugultuli Road
MF: Mitford Road

these large vehicles took up 76 PCU's (5 - 5:30 pm.) 72 PCU's (6 - 6:30 pm.) and 80 PCU's (7 - 7:30 pm.). Rickshaws, on the other hand, took up far less road space during the evening peak period.

These figures confirm the finding, made earlier, that the greater numbers of large vehicles during the evening peak period have a very major impact on reducing the traffic flow and increasing congestion.

The Main Location of Congestion:

It was observed that, congestion occurred most frequently where the traffic volume (in other words, demand) was greatest. This is

On main connecting roads (Map 6)

On internal main roads

At junctions, particularly where main roads converge.

Thus junctions were critical places where the possibility of convestion was at a maximum. For example, Dacca Central Jail gate, Chawk Bazar junction, Mugultuli- Imamganj junction and so on. From the Table below, it can be understood that the high volume of traffic on the roads is one of the main causes of congestion. At Jail Road junction where four roads converge, there were 1410 vehicles and 1127 pedestrians within half an hour of time on a Monday morning. So it is easily imagined how critically the roads are operating.

TABLE 22

NUMBER OF TRAFFIC IN HALF AN HOUR AT JAIL ROAD JUNCTION

Monday Morning 12.00 - 12:30 pm.

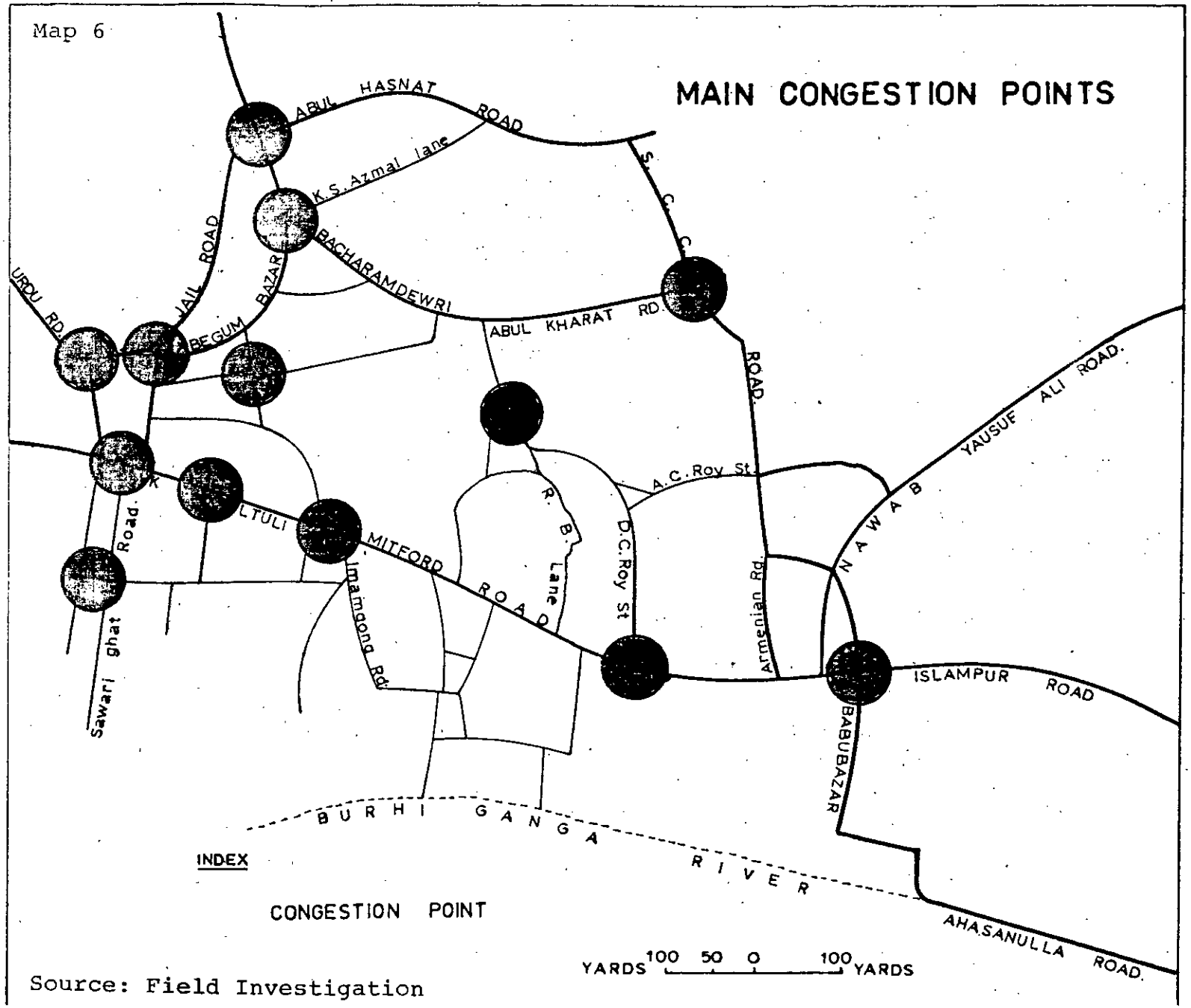
Roads (Junction of 4 roads)	Ped	HL	MC	Tr	BC	HT	Car	BC	PC	TW	Baby	Rick
Jail Road (S-N Direction)	150	37	3	-	8	1	1	-	7	-	19	376
Nazimuddin Road (N-S Direction)	377	19	22	3	42	3	12	-	17	1	40	424
Begum Bazar Road (S-N Direction)	245	62	7	1	8	3	1	-	2	-	3	156
Abul Hasnat Road (E-W Direction)	221	16	6	-	12	3	4	-	3	1	6	214
Total	993	134	38	4	70	10	18	1	29	2	68	1170

Source: Field Investigation

Total Number of vehicles converge 1410
Total Number of pedestrian and Head loaders 1127

But congestion occurs at many other places too. Because many roads are operating beyond their maximum capacity, congestion occurs most frequently where roads are narrow and volume is highest, which means especially at road junction. But many other factors cause congestion such as:

Map 6



Source: Field Investigation

-When large vehicles ply on narrow roads and try to pass one another facing on coming large vehicle:
-When loading and unloading goes on the street, taking up a large part of the scarce road space (Fig.)
-Bad or poor road surface also causes congestion, especially when overloaded vehicles (mainly non-motorized types i.e. push cart, hand trolley) try to move.

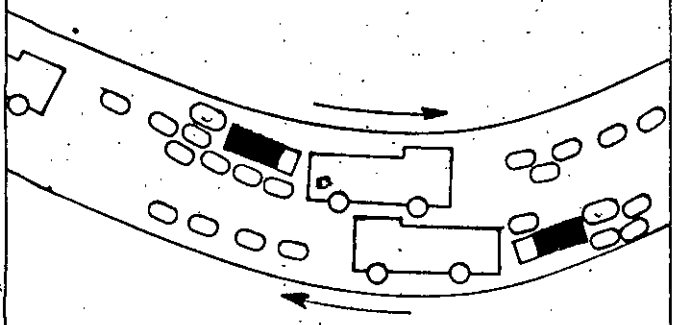
The Scale and Extent of Traffic Congestion:-

Traffic condition in Old Dacca is quite peculiar in character and thus the scale and extent is also different. The study of traffic congestion has been carried out to illustrate it and to try to evaluate the social cost to the public. As has already been discussed, the roads are very narrow and characterized by poor surface quality. Also the road width is reduced by many private side uses of the road. Both traditional vehicles and modern motorized vehicles use the road and are surprisingly different to each other in their speed and movement. Traffic congestion has become a regular part of everyday life in Old Dacca. Many of the rickshaw pullers avoid the area in the evening to carry a passenger there even if higher prices are offered. Sometimes the congestion continues for several hours, the main roads are blocked and the area becomes isolated from the rest of the town. It is not unusual to be in a traffic jam for two hours. Sometimes truck drivers leave their vehicles for a cup of tea nearby, and street hawkers sell their goods in the middle of the congestion as they are confident that the delay will last for hours. Sometimes the congestion causes a more traffic delay. Mitford Hospital is the only hospital which serves almost the whole of Old Dacca, especially in emergency cases. Sometimes, injured patients caught in a

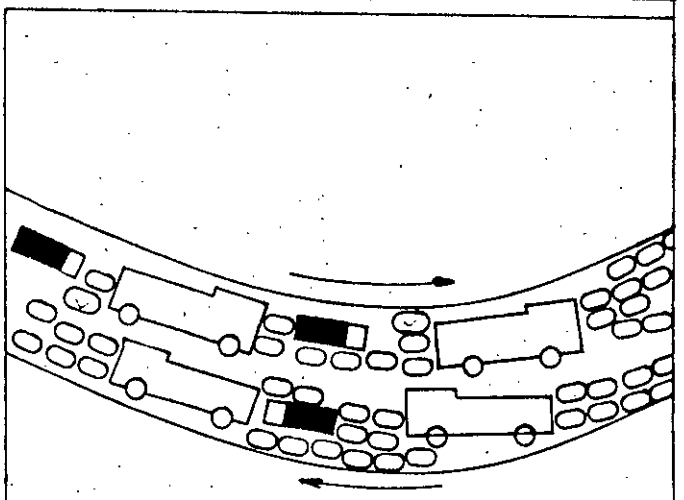
Fig. 8

CAUSES OF TRAFFIC CONGESTION

Conflict between large oncoming vehicles.

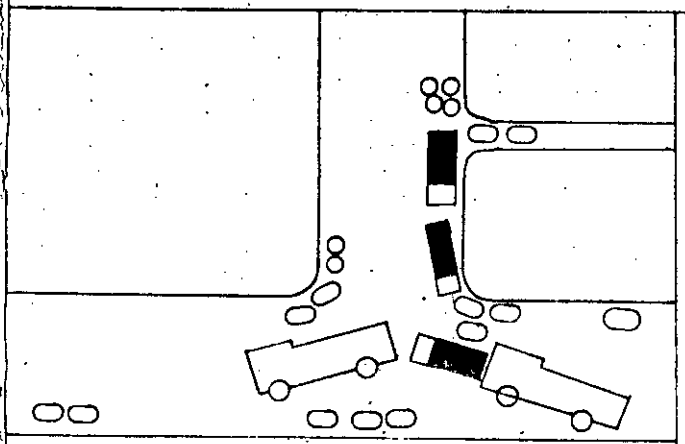


Stage -1

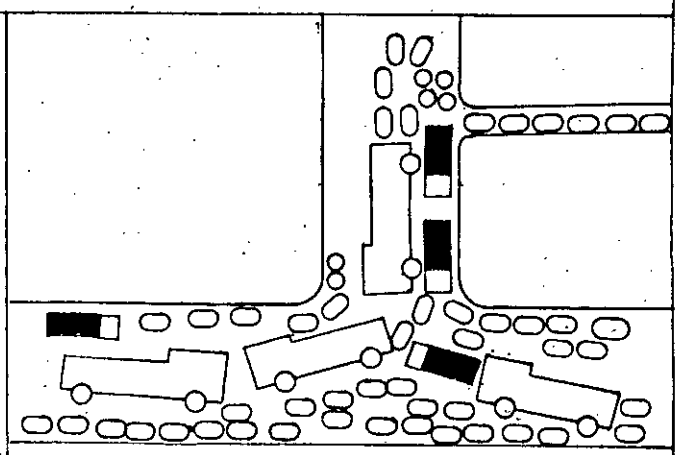


Stage -2

EXAMPLE - 1



Stage -1



Stage - 2

EXAMPLE - 2

INDEX

- Rickshaw
- Baby taxi
- Push cart
- Truck

Conflict at Junctions.

Source: Field Investigation

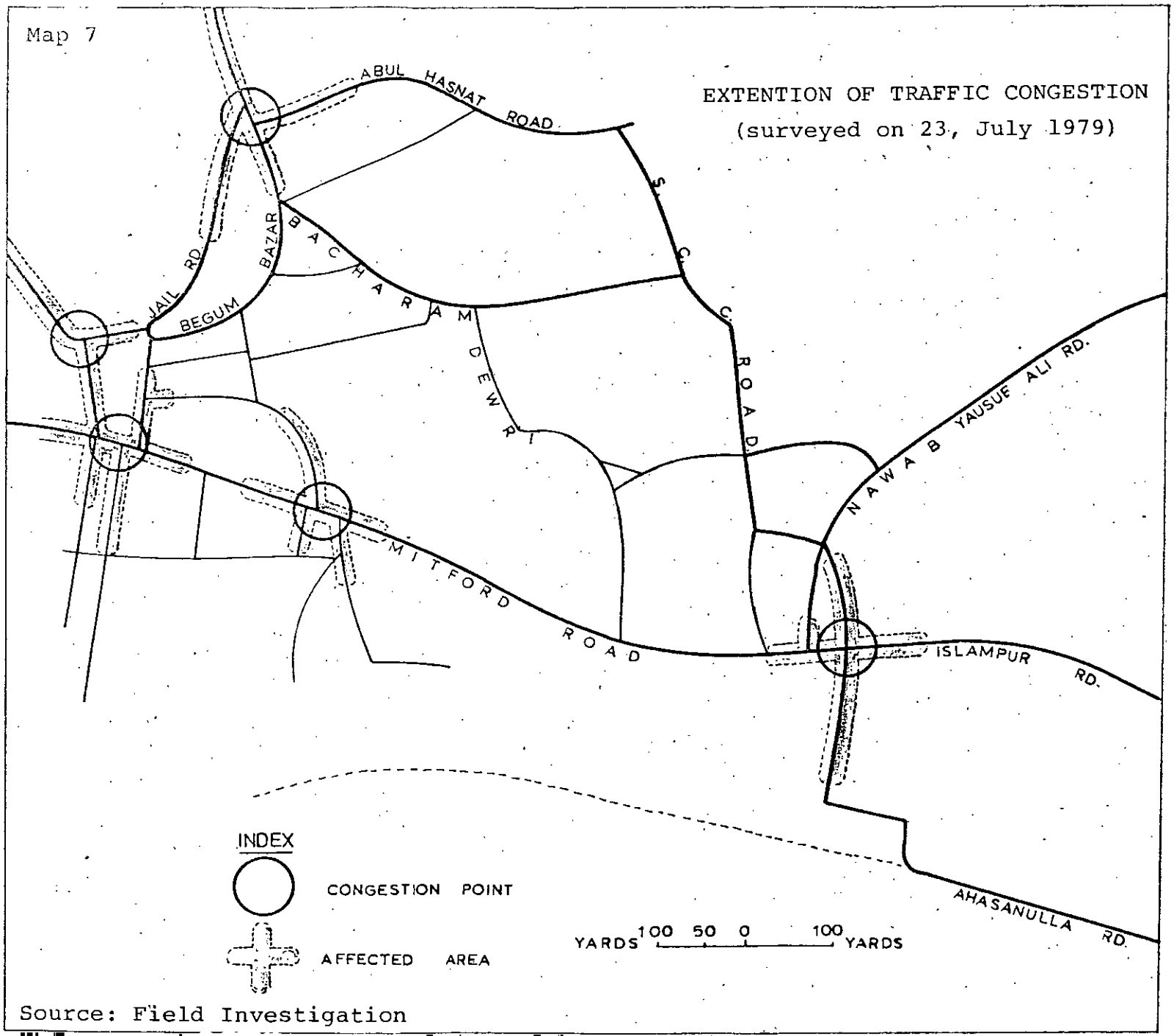
congestion have to wait for a longer time in the middle of the journey where there remains no possibility to enter an ambulance. Sometimes an ambulance carrying a serious patient has to wait until the congestion has cleared. In the summer season, congestion occurring at about 12 - 1pm. of the day, can create great chaos in that area. People get angry, children start crying, drivers shout at each other all these make the situation intolerable.

To illustrate the full extent of traffic congestion in Old Dacca, two different case studies have been analysed below:

CASE STUDY 1: IMAMGANJ - MUGULTULI JUNCTION:

The location of this case study was the junction of Mugultuli Road and Imamganj forming a "T" junction (see sketch). Moulavibazar Road and Ruihatta Road are situated very near to this "T" junction. Mugultuli Road is characterized by wholesale and retail commercial shopping. There are some godowns at the back of the shops. The average width of Mugultuli Road is only about 16 feet and that of Imamganj Road about 19 feet. Both the road width are reduced by poor quality and a number of obstacles. So the road is operating at a reduced capacity. In Mugultuli Road, it is very difficult for two trucks to pass each other. On the survey day (23rd. July, 1979), congestion started at this "T" junction. Just opposite this "T" junction, there is a godown for glass-ware. At about 4.00 pm. one truck was badly parked at this junction at an oblique angle (stage 1 in the sketch), which took almost 50% of the road space. Head loaders were unloading the glass wares from the truck to the godown. Unloading was going on for a long time. Three push carts were already parked on the other side of the parked truck. Some empty drumps were on the corner of Imamganj Road. After 4pm. in contravention of the truck

Map 7



Source: Field Investigation

time restriction (5 pm.) trucks began to enter the road from two direction - Mitford road and Mugultuli Road. The first truck was parked facing towards Chawk Bazar. In the meantime another truck came from Mugultuli direction and parked almost alongside the previous one. So together both the trucks occupied about 90% of the road space. Two more trucks coming up the road from the Mitford Road stopped behind the first parked truck (with the second parked truck on the right) and there was no room to get past. These heavy vehicles immediately halted all of the other vehicles. Some bullock carts, push carts, hand trolleys and a private car queued behind the trucks on both sides. Rickshaw pullers squeezed in between those vehicles haphazardly. But some of them tried to be cleverer than others and jumped the queue. So the road space was completely occupied by vehicles. In the congestion rickshaws, baby taxi and other smaller vehicles worked as the glue or cement to the traffic queue and within 15 minutes the congestion was completely held up. Space occupied by these vehicles prevented the trucks from moving backwards or forwards. With the large volume of traffic of the evening peak, very quickly the queue became larger and larger. At about 4 - 45 pm. there were 159 rickshaws, 9 trucks, 34 hand trollies, 17 push cart, 8 baby taxi (Table 23) and some other vehicles. That is in total 252 vehicles were caught in that congestion.

Around 5 pm. rickshaws lined up at the back of the queue started to turn back and went to go up another substitute road. Some of the passengers of the local area, who were trapped in the middle, got off from the rickshaws and baby taxis and started walking to their destination. Those people who had a chance with motor cycle and rickshaw went through alternative roads such as Moulovi Bazar Road, Armanian Street and Rajonibose Lane. The business men were, however, generally trapped in the congestion with their goods in the rickshaw

TABLE 23

NUMBER OF AFFECTED VEHICLE AT MUGULTULI-IMAMGANJ JUNCTION (MAJOR VEHICULAR TRAFFIC)

Time	Truck	Rick	H.Trolley	P.Cart B.Cart	Baby Taxi	Others
4:15 pm.	8	45	16	10	7	16
4:25 "	8	76	21	13	8	18
4:35 "	9	103	27	15	8	22
4:45 "	9	159	34	17	8	25
4:55 "	3	87	18	11	5	3
4:58 "	0	29	3	3	1	0
5:05 "	1	21	8	3	0	3
5:10 "	3	27	15	5	1	11
5:15 "	0	18	12	2	0	1
5:35 "	5	50	15	6	2	6
5:45 "	8	97	21	10	2	10
5:55 "	2	33	14	8	0	3
6:05 "	1	23	8	3	0	1
6:15 "	2	15	2	3	0	3
6:25 "	0	6	1	0	0	0
6:35 "	1	23	12	3	0	1
6:45 "	3	42	15	3	3	4
6:55 "	0	12	2	4	0	4
6:05 pm.	0	3	0	0	0	0

Note: Others includes bicycle, motorcycle and car (maximum number was accounted by bicycles).

Source: Field Investigation

and in baby taxi. One truck, which was at the opening of Moulovibazar Road (which is not suitable for truck) and again made the situation more complicated which delayed the jam for another 45 minutes. Shopkeepers were watching the situation and finally two of them tried to direct the traffic with the help of a truck driver and a push cart puller. They cleared the space at the back of the trucks on both sides and managed to help two facing trucks get past. Two trucks turned back to Imamganj Road, to give way, and then they passed. Finally the congestion cleared up at 7.05 pm., three hours later.

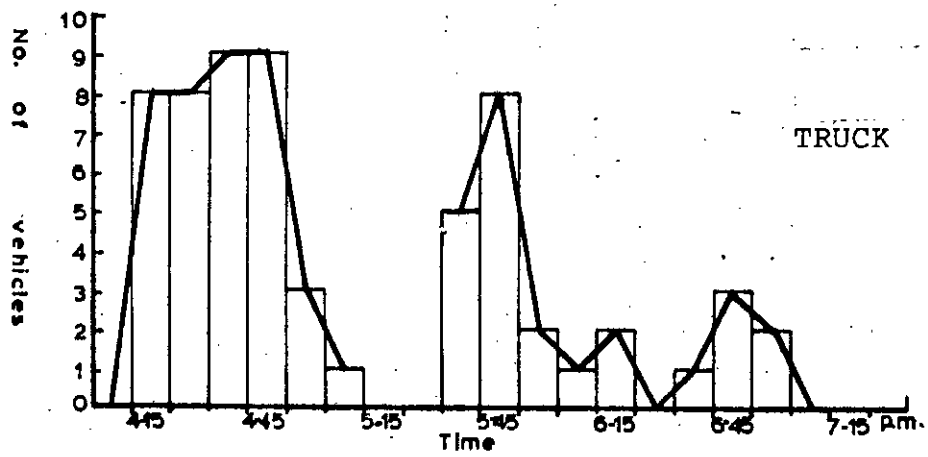
Fig. 10

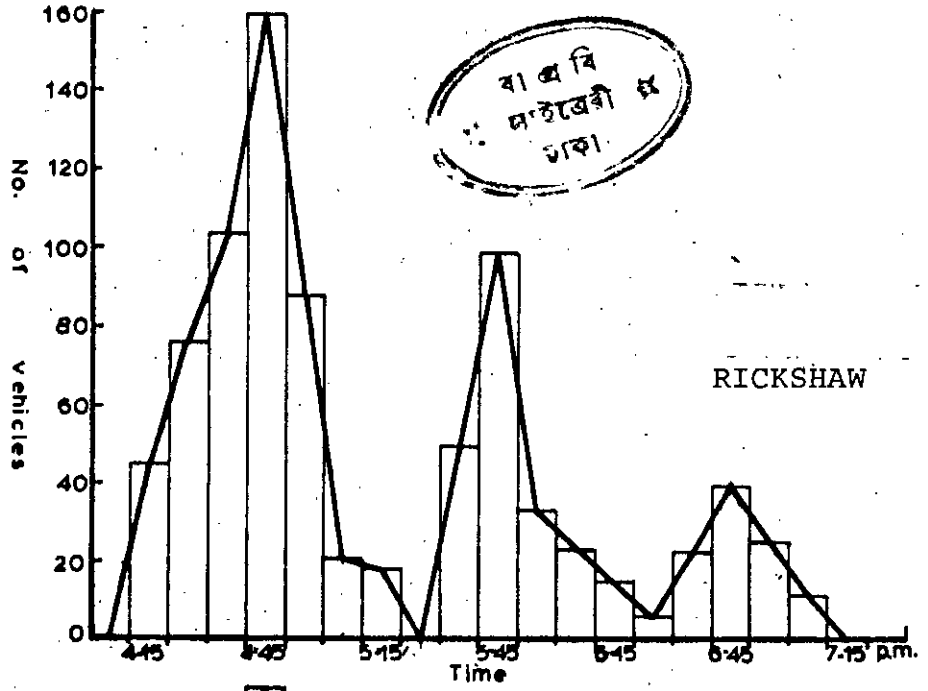
MAJOR AFFECTED VEHICLES IN THE CONGESTION

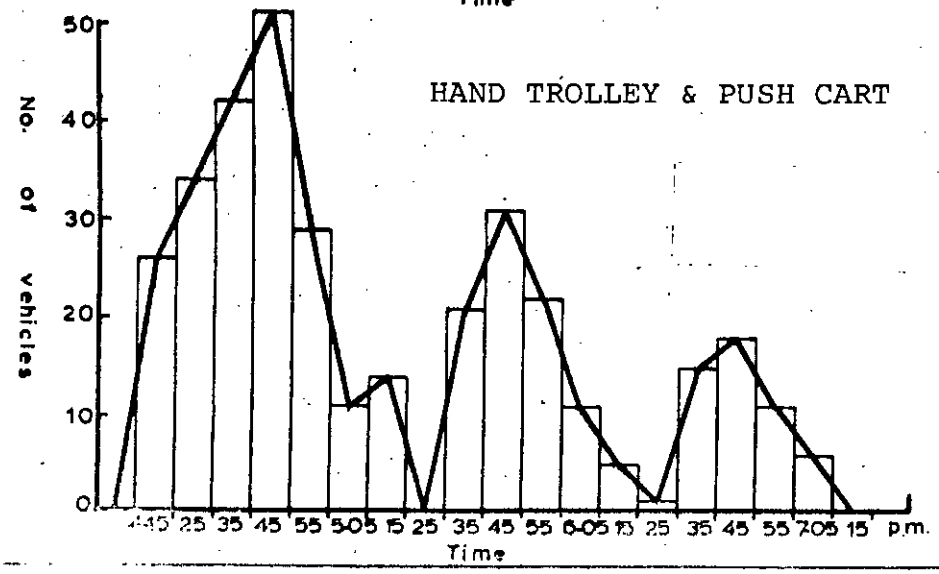
(Imamganj Junction)

Weather : Fine Day of the week : Monday

23rd July 1979







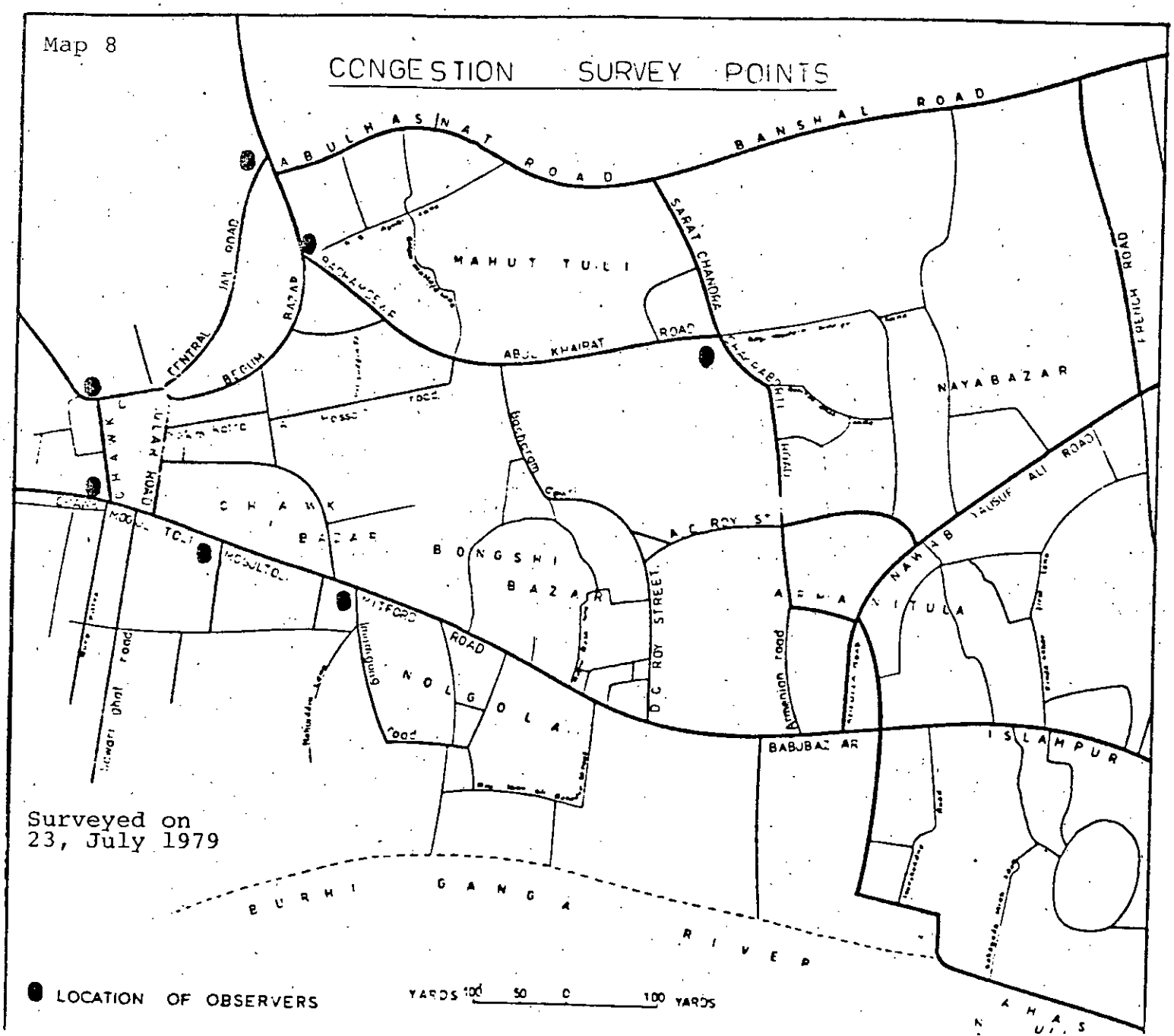
Source: Field Investigation

The congestion delayed upto 7:05 pm. that is, the total time span was about 3 hours. In a true sense, it was not a continuous one but having some intervals (see Fig.10) of 5 to 10 minutes when traffic was able to move again. From the graph the highest peak occurred at around 4:40 pm. and three smaller peaks later. In between peaks the traffic started to move a bit but very slowly. The total number of affected vehicle is so high that the hold up occurred very easily again and again.

CASE STUDY 2: JAIL ROAD JUNCTION:

It is the nodal point of four main roads namely Nazimuddin Road, Jail Road, Abul Hasnat Road and Begum Bazar Road. This junction was chosen as a case study because congestion occurrs very frequently here. The landuse around this junction is different to the Mugultuli area. Central Jail gate is situated here. There are shops in Abul Hasnat Road. Bangladesh Rifle (BDR) Camp is also situated there with some other posts around the area. Nazimuddin Road is the single most important Road for the entrance of trucks to the study area from other parts of Dacca City. They usually follow the route: Nazimuddin Road, Abul Hasnat Road, Sarat Chandra Chakravarti Road and finally to Mugultuli Road. Trucks coming from the study area usually leave by Jail Road or Abul Hasnat Road. That is, most of the Trucks doing business in the study area have to pass through this junction. The average road width of these four roads are Jail Road - 25 feet, Nazimuddin Road - 25 feet, Abul Hasnat Road 25 feet and Becharam Dewri 15 feet.

On the survey evening (23rd. July, 1979), it was marked that trucks were entering Old Dacca (through Nazimuddin Road) from 4:15 pm. onwards. It seems to be a trend over the past


Map 8
CONGESTION SURVEY POINTS
ABDUL HASNAT ROAD
BANSHAL ROAD
SARAT CHANDRA CHATTERJEE ROAD
MAHUT TULI
ABDUL KHAIRAT ROAD
CENTRAL JAIL ROAD
BEGUM BAZAR
NAYABAZAR
FREECH ROAD
CHAWK BAZAR
BONGSHI BAZAR
A C ROY ST.
NAWAB YUSUF ALI ROAD
WATFORD ROAD
NOLGOLA
D C ROY STREET
Armenian road
BABUBAZAR
ISLAMPUR
BURHI GANGA RIVER
Surveyed on
23, July 1979
LOCATION OF OBSERVERS
YARDS 100 50 0 100 YARDS

few days that they were entering earlier and earlier in the afternoon. Observers were posted at around 4 pm. At that time the traffic flow was smooth and it started to increase in volume around 4:30 pm. At the junction of Begum Bazar and Abul Hasnat Road, three hand trollies and five rickshaw were parked. About 4:35 pm. two trucks came through Nazimuddin Road and slowed down there. One truck coming out of Abul Hasnat Road (Fig. 11) had a difficult right hand turn. The roundabout infront of Dacca Jail is quite large and is situated badly. When one more truck and two private cars came through Begum Bazar Road they aggravated the situation. The corner of Abul Hasnat Road projects into the street and is a blind one. With so many rickshaws, push carts and hand trollies, congestion occurred very rapidly. Trucks queued up at Nazimuddin Road and blocked the road, which prevented the vehicles coming from Chawk Bazar to get past. So Jail road became blocked. The queue of vehicles grew longer and longer in all the connecting roads, especially the line of trucks along Nazimuddin road.

The congestion continued upto 4:50 pm. until two trucks were able to go upto Begum Bazar with the help of two private cars, which turned back and smoothed the situation to some extent. When the traffic started moving again, some rickshaw pullers became crazy and started overtaking to go first. In doing so, three rickshaws became locked in by sticking their wheels in to each other. Another overloaded push cart tried to move by overtaking. Unfortunately three full bags of flour dropped down. All other people started shouting at them. One full bag of flour spread on the street. The total flow again stopped at that point.

Most of the rickshaws turned and went back except those trapped in the middle. There was a complete absence of the

TABLE 24

NUMBER OF AFFECTED VEHICLE AT JAIL ROAD JUNCTION AND EXTENDED AREA (23rd. July, 1979).

Time	jail road					EXTENDED AREA (ESTIMATE)*				
	Truck	Rick	HT+ PC+ BC	Baby Taxi	Car	Truck	Rick	HT+ PC+ BC	Baby Taxi	Car
4:35 pm.	2	8	0	2	0	6	24	0	6	0
4:45 "	4	45	2	0	1	12	135	6	0	3
4:55 "	6	37	5	1	2	18	111	15	3	6
5:05 "	3	30	0	0	2	9	90	0	0	6
5:15 "	8	25	5	1	1	24	75	15	3	3
5:25 "	6	200	7	0	6	18	200+	21	0	18
5:35 "	11	152	7	5	4	33	152+	21	15	12
5:45 "	3	37	2	4	0	9	101	6	12	0
5:55 "	1	15	1	0	0	3	45	3	0	0
6:35 "	14	90	6	-	3	42	270	18	0	9
7:15 "	17	50	2	2	3	51	150	6	6	9
7:35 "	12	45	1	7	1	36	135	3	21	3
7:45 "	0	5	1	0	0	0	15	3	0	0
8:05 "	2	23	1	1	2	6	69	3	3	6
8:15 "	6	65	7	1	3	18	195	21	3	9
8:25 "	2	14	3	5	3	6	42	9	15	9
8:35 "	1	5	1	2	0	3	15	3	6	0
8:45 "	0	3	0	0	0	0	9	0	0	0

(+) These two figures were not multiplied by 3 as the number itself is quite high.

* How the figure for number of affected vehicles was derived is discussed in appendix.

Source: Field Investigation.

TABLE 25

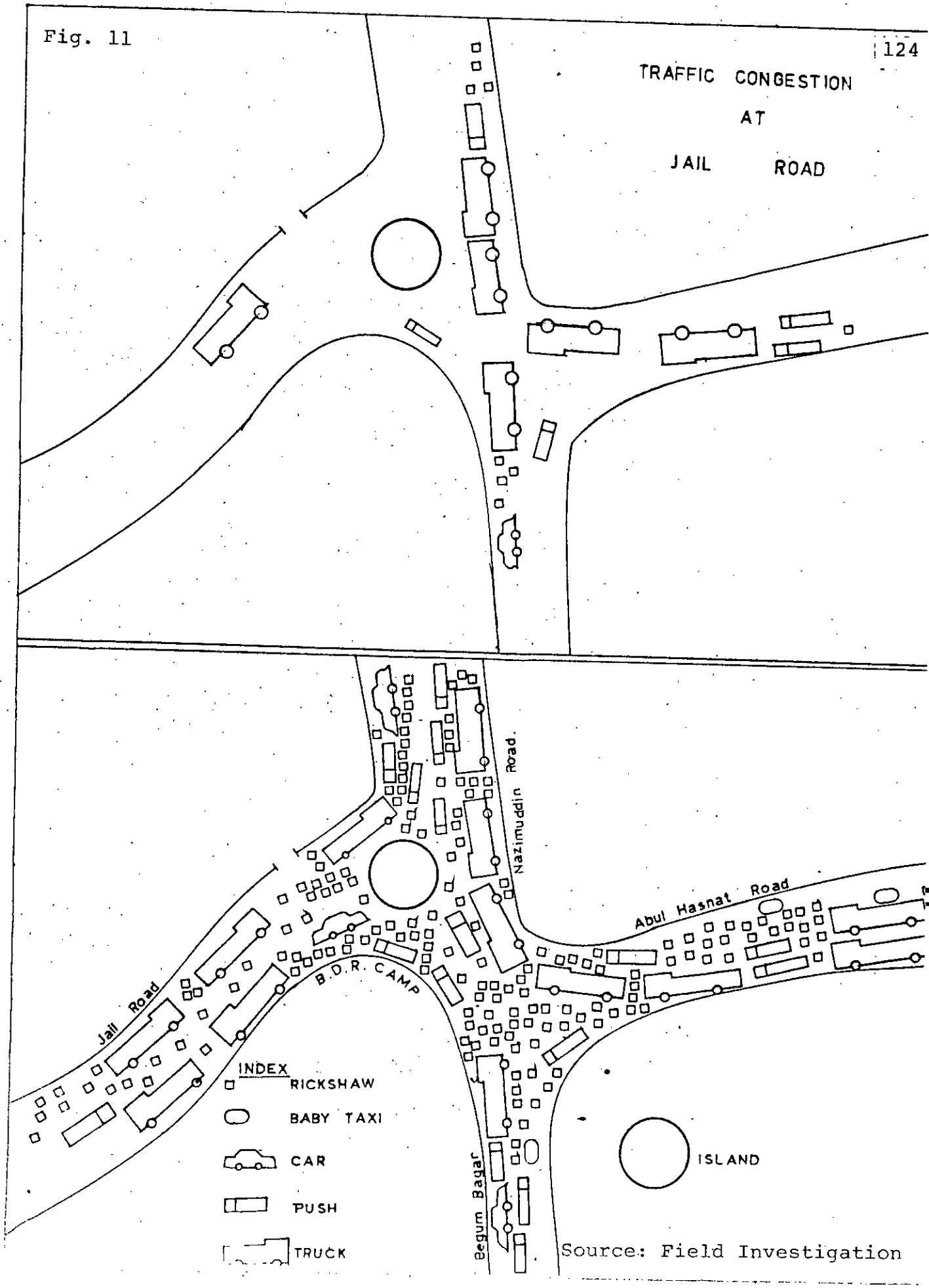
NUMBER OF AFFECTED VEHICLE ON CONNECTING ROADS (COUNT TAKEN 7:15 pm. - 7:30 pm.)

Roads	Truck	P.Cart	H.Trolley	Car	Rick.& Baby.
Nazimuddin Road	27	2	2	1	25
Abul Hasnat Road	101	90	95	30	60
Jail Road	15	4	2	1	65
Begum Bazar Road	2	3	2	0	17
Total	145	99	101	32	167

Source: Field Investigation.

Fig. 11

TRAFFIC CONGESTION AT JAIL ROAD



Source: Field Investigation

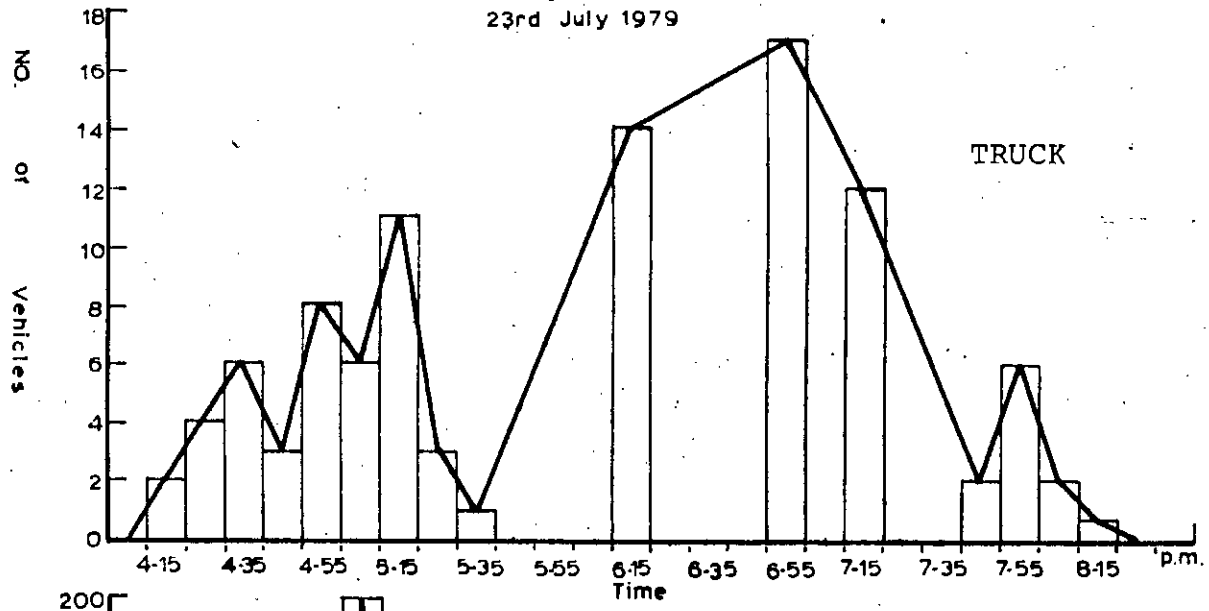
Fig: 12

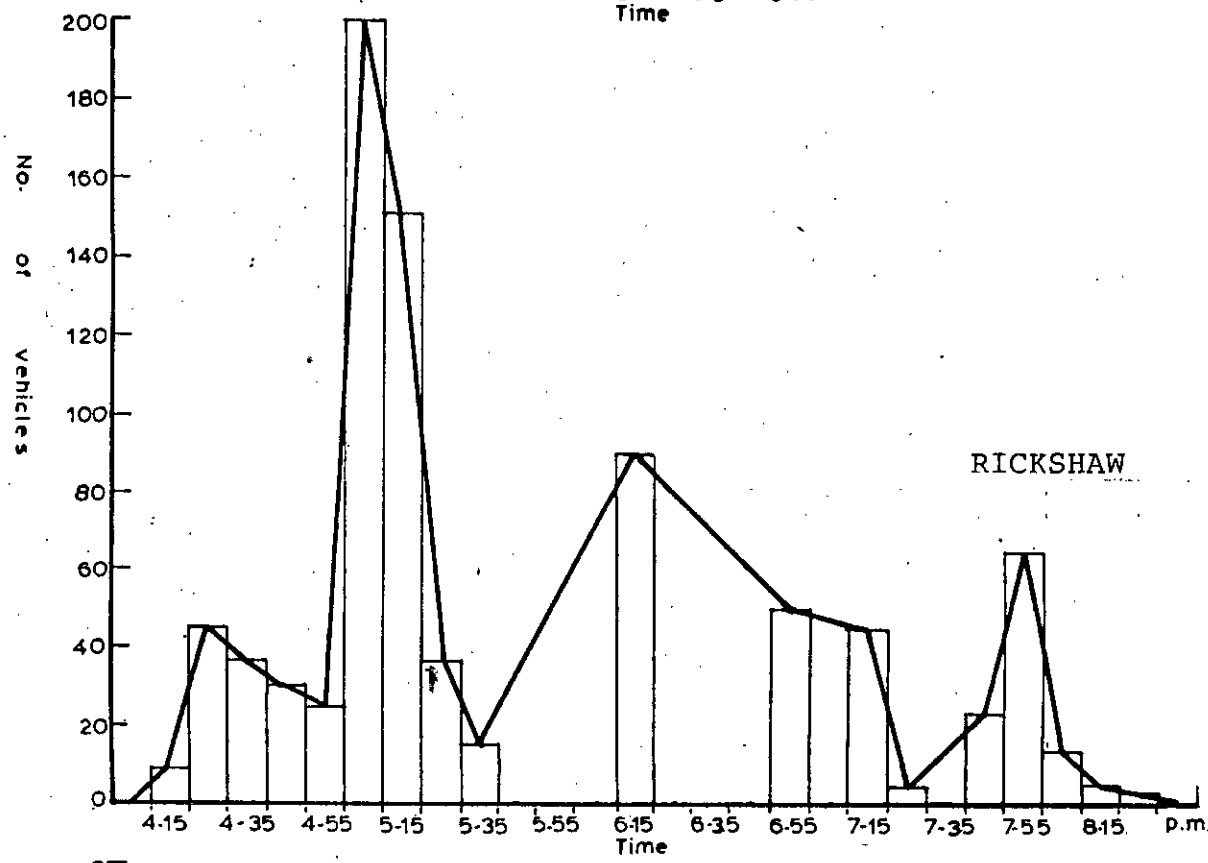
MAJOR AFFECTED VEHICLES IN THE CONGESTION

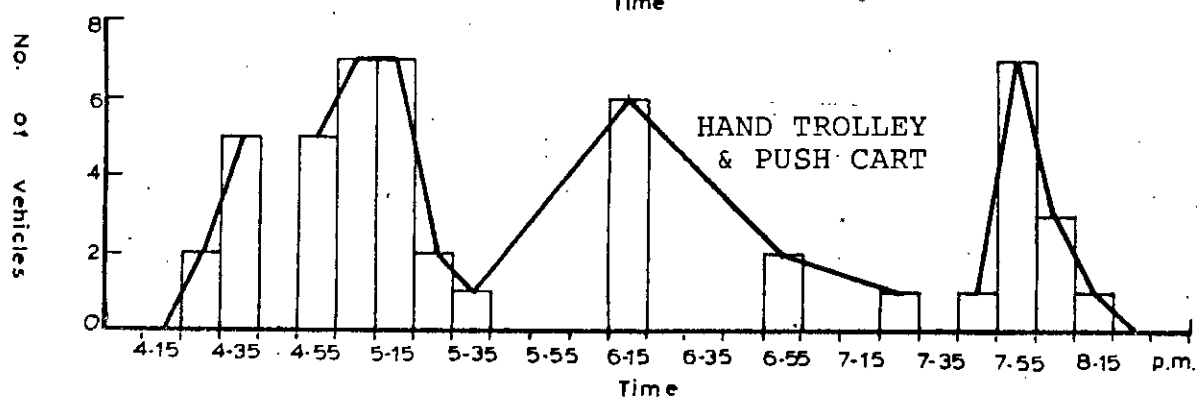
JAIL ROAD

Weather : Fine Day of the week : Monday

23rd July 1979







Source: Field Investigation

uniformed traffic policemen in that area. Many private individuals got involved in trying to direct the traffic with the assistance of soldiers and police from the BDR camp. From the graph (see graph) it can be seen that the congestion situation was more severe at Jail Road junction than at Mugultuli. The graph shows three peaks, with a short interval of traffic flow of 10 and 15 minutes. The composition of traffic affected here was different from Mugultuli. More trucks (55). cars(5) and rickshaws (167) were affected and fewer push cart and hand trollies. (Figures refer to 7:15 pm.) The duration of congestion was from 4:30 pm. until 8:45 pm. at night. Old Dacca was almost isolated from the rest of the city as Nazimuddin Road was closed. The number of affected vehicles is given in Table - 23.

At around 8:45 pm. Dacca Jail area was finally clear. But then the lorries which were freed from Dacca Jail went up to Chawk Bazar Islampur Road and caused a small hold-up there at 8:15 pm. which remained for 30 minutes.

On the survey evening, the total study area suffered from congestion at many different points (Map). In the meantime other vehicles stopped coming to the study area from outside to avoid the congestion.

THE COSTS OF CONGESTION IN OLD DACCA:

It is a very ambitious job to assess the cost of congestion at a point. What can be assessed from a congestion? How to measure the cost of frustration, anger, inconvenience, discomfort and the cost to the society as well as the environment ? Cost involved in a congestion include:

1. Time cost
2. Money cost
3. Social and Environmental costs.

Only the time cost can be properly calculated. And such calculation provides only a rough and crude estimate of the costs of congestion in Old Dacca as well as in the study area. However, an attempt to measure both time costs and monetary costs is made below:

Methodology of assessment:

To estimate the cost only the major vehicles which were affected have been considered. They include - trucks, hand trolley, push cart and bullock cart (as one category) and rickshaws. Other affected modes (e.g. pedestrians) were not considered. For each congestion point (case 1 and 2), the total time lost by different vehicles has been calculated from the graph according to the number of vehicles against time period. To try to estimate the monetary cost involved , total time lost (by each mode) has been multiplied by the amount of Taka per hour it costs to hire that mode of transport (Fig. 10, 12).

As the estimation is boud on so many assumptions, two estimation have been made: (1) A high estimation and (2) A low estimation.

As so many potential errors are involved in this estimation, the errors should be clearly identified at the outset.

(1) The calculation assumes that all rickshaw pullers are fully occupied. But actually some of them earn more, and others less, in an hour.

(2) The earnings of rickshaw pullers varies during the day (more in peak hours) which is ignored here.

(3) It was assumed that the cost of delay is uniform for all quantities of time. That is, for example, a loss of 4 minutes to 1000 people is equal to a loss of 40 minutes to 100 people, which is not true in reality.

(4) It was assumed that all groups of people are equally affected and suffer equal costs by delay.

(5) These figures take no account of the extra costs borne by diverted traffic, which may be substantial.

(6) Only certain types of vehicles have been considered while other vehicles, pedestrians and head loaders have been ignored.

(7) It ignores the costs of lost business by shopkeepers and hawkers in the congested area.

Cost estimates were made for different modes (Taka lost per hour) on the basis of interviews and from questionnaire survey. The costs selected were:

(i) Taka lost per hour by a truck is 50 Taka (low estimate) and 70 Taka (higher estimate).

(ii) Taka lost per hour by a rickshaw puller is 4 Taka (low estimate) and 6 Taka (high estimate).

(iii) Taka lost by push cart puller/hand trolley puller is 5 Taka (low)and 6 Taka (high).

CASE : 1

COST OF CONGESTION AT MUGULTULI JUNCTION:

Truck

Total time lost - 108 hours (4 pm. to 7 pm.)
Total Taka lost - 108 X 50 = 5400 Taka (low estimate)
108 X 70 = 7560 Taka (high estimate)

Hand Trolley/Push Cart/B.Cart:

Total time lost 697 hours (4 pn to 7 pm.)
Total Taka lost 697 X 5 = 3485 Taka (low estimate)
697 X 6 = 4082 Taka (high estimate)

Rickshaw:

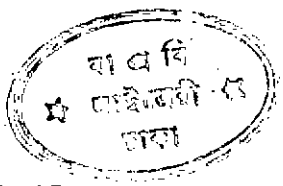
Total time lost 1510 hours (4-7 pm.)
Total Taka lost 1510 X 4 = 6040 Taka (low)
1510 X 6 = 9060 Taka (high estimate).

So Total Taka lost 5400 + 3485 + 6040 = 14925 Taka(low estimate).
And Taka 7560 + 4082 + 9060 = 20702 Taka (high estimate).

CASE: 2

COST OF CONGESTION AT JAIL ROAD JUNCTION

In a similar process to Imamganj Mugultuli junction the cost was estimated.



Truck:

Total time lost (4:15 - 8:45 pm. - 163 hours
Total Taka lost (low estimation) - 163 X 50 = 8150 Taka
High Estimation 168 X 70 = 11410 Taka.

Hand Trolley and Push Cart:

Total time lost - 72 hours.
Total Taka lost - 72 X 5 = 360 Taka (low estimate)
And 72 X 6 = 432 Taka (high estimate)

Rickshaw:

Total time lost - 1415 hours.
Total Taka lost - 1415 X 4 = 5660 Taka (low estimate).
And 1415 X 6 = 8490 Taka (high estimate).

Total Taka lost = 8150 + 360 + 5660 =14170 Tk.(low estimate)
Total Taka lost = 11410+ 432 + 8490 =20332 Tk.(high estimate)

Therefore, estimated cost on Jail Road alone was Taka 14,170(low) to Taka 20,332(high). To estimate the total cost of the four roads together, multiplying up by a factor of 3 and adjusting for rickshaws at 5:30 pm,[1] brings the total estimate cost to between Taka 35,000(low) and Tk.55,00 (high).

[1]The figures are multiplied by a factor 3 because the traffic congestion count was made on one road only, while 4 roads in total were affected.

Conclusion:

Major traffic congestion occurs in Old Dacca nearly every day of the week, often several times a day, at many different places. The scale of the traffic jam is breath-taking. Delays of more than two hours are common place. Frequently the area is cut off from other parts of the city, and sometimes even pedestrians cannot move in the jam.

The costs of this congestion are very substantial. Yet no monetary payment is actually made at the point of congestion. Nor do the different road uses pay in proportion to their contribution to the traffic jam. The arrival of even a single truck, into a near-saturated road, for example, can bring the traffic to a standstill. Yet the costs paid by the truck are very close in size to the costs paid by other road users (Taka 50 per hour for a truck, Taka 5 for a rickshaw-estimated) If a monetary cost could be calculated for a single major traffic jam, it is estimated that the total cost would be not less than Tk.15,000 to Tk.55,000 in a single evening-enough to pay for more than a 100 traffic policemen in a month.

Nonetheless the costs incurred are very real: lost wages to the rickshaw pullers, lost business to the shopkeepers, reduced efficiency to the truck operators. It is not surprising that rickshaw pullers avoid the area in the evening.

It is quite clear now that the cost is very high indeed and something must be done to reduce the problem. But what? To solve the problem we need first to analyse causes of the problem. We have seen that main problem is the large volume of traffic. But why is volume of traffic increasing? Mainly because the landuse is changing. Let us study the change of landuse that is taking place in the study area.

CHAPTER 8

THE CHANGING LANDUSE OF THE STUDY AREA

In this section an analysis is made about the nature of landuse exchange: how landuses have changed in past year; what are the new landuses which have arrived; and in addition, how the density has increased in residential as well as commercial areas. This analysis is based upon the findings from different surveys. These surveys included the surveys of transport agencies and households, (see appendix) and a detailed survey of a sample area which gave a detailed picture of landuse and how it has changed.

The area selected for detailed landuse study is located opposite to Mitford Hospital (see map). This area was selected because it was believed to be typical of the wider study area. It had been developed to a high density, and contained a wide range of landuses, including an important medicine market. In total the area covered 7.7 acres of land approximately. In total 93 buildings were surveyed. This included nearly all of the pucca and kutcha (tin sheed) buildings in the area, but excluded road side stalls and similar very temporary constructions. It is believed that more than 90% of all buildings in the 7.7 acre study area were included in the survey.

Results of the Landuse Survey:

The landuse survey revealed that the landuse of the area has been changing at a rapid rate. New buildings are being constructed new floors added to existing buildings, and old buildings are being put to new uses

A very large number of the buildings were in "multiple" use. About 41% of the buiilgings were in multiple use and these accounted for a majority of the total floor space. In general, it was only the smaller buildings which were in single use only. Because many of the residential houses were in multiple occupation, and many of the shops also served as offices and godowns, it was not possible in this survey to list the total number of shops, godown and residential units, nor the total floor space allocated to each use.

A good picture of the landuse, however, was gained by studying the uses to which individual buildings were put.

TABLE 26

NUMBER OF BUILDINGS IN MULTIPLE USE

	SINGLE USE				MULTIPLE	VACANT	TOTAL
	Residence	Shop	Godown	Factory Workshop	Use*		
Number of Buildings	16	19	7	4	38	9	93

* Multiple use includes:

Residence + Shop
Residence + Shop + Godown
Residence + Shop + Godown + Office
Residence + Others
Shop + Godown
Shop + Godown
Shop + Others.

(Others included Cinema, Mosque and Church).

Source: Field Investigation

Thus the landuse varied both horizontally and vertically. The dominant landuses were residential, shopping (mainly medicines), godowns (mainly lighter goods shch as chemicals and medicines) and ancillary activities including restaurants, a cinema, Mosques and a Church. It was likely, therefore, that the survey area would generate a complete cross-section of all types of traffic: commuters, shopping, wholesale and recreational traffic. But how much traffic would the area generate? This depended on the intensity of land-use which is now analysed below.

The Intensity of Landuse in The Survey Area:

To measure the intensity at which the land was being used in the survey area, an estimate[1] was made of the overall plot ratio[2] of the area. The average plot ratio across the survey area was calculated to be 0.98. This figure was arrived at by dividing: total floor space (329000 square feet) by the area of the plot (=7.7 acres).

So plot ratio was $\frac{32900}{7.7 \times 4890 \times 9} = \frac{329000}{335412} = .98.$

Thus, approximately an overall plot ratio of 1 which is very high.Other area of Dacca, such as Dhanmondi, for example, may have a far lower plot ratio, possibly 5 times

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[1] The estimate was made by calculating the total floor space in the 93 buildings. The floorspace of each building was estimated by pacing out the length and breadth of the building, and then multiplying the base area by the number of floors. Errors are likely in this technique because (i) the space taken up by partioning walls has been included, (ii) in each case it was assumed that the building was rectangular, (iii) many buildings contained a small hut or room on the roof, which was not included. Despite these errors, it is believed that the results were accurate to within + 15%.

[2] Plot ratio is a measure of the intensity of landuse in an area.It is caluclated by dividiing the total built-floor space in a land plot by the total ground area of the plot itself.

less (e.g. 0.2 or less).

In fact, many areas of Old Dacca have a higher plot ratio. The figure obtained for this survey area may be lower because:

1) The area was once a high class residential area with several large buildings and large grounds (gardens, open space) which thus reduce the intensity of landuse. For example, the survey area contains a church with approx. 1 acre of open space and a Cinema Hall with quite a lot of open space.

2) The surveyed area was large and included several minor roads and alleyways.

But when smaller areas were considered, plot ratios of 2 or 3 were quite common place. The maximum plot ratio found in the survey area (for indivual buildings) was 5. Thus the intensity of landuse in the survey area was everywhere exceptionally high.

TABLE 27

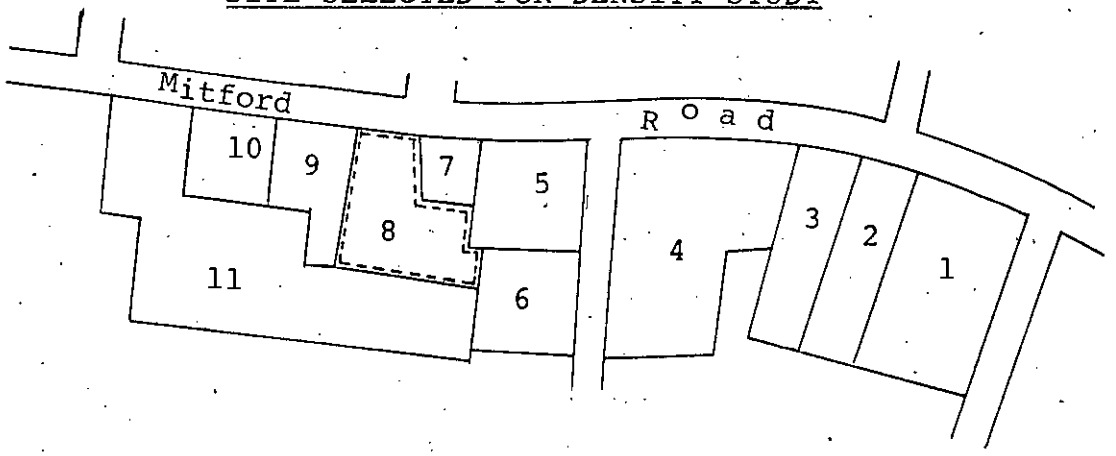
INTENSITY OF LANDUSE

Building	Plot size in Sq. Ft	No. of people residing + working
1	2900	18
2	900	53
3	1600	20
4	4000	8
5	1300	Locked
6	600	15
7	550	6
8	700	— 2
9	1000	10
10	1100	81
11	8900	314
	Total 23500	525

Source: Field Investigation

To illustrate the high densities at which people are living and working in Old Dacca, we took one section of a street facing the Mitford Hospital (sketch). This section of street (approximately 100 yards long by 25 yards wide) contained 10 buildings of various ages. In addition, the foundations for one new building were being laid.

SITE SELECTED FOR DENSITY STUDY



----- under construction

Sketch not in Scale

To total number of people living and working was recorded at 525 people. The area of the site was approximately 0.54 acre. So, the density of population per acre was estimated to be approximately 972 people per acre.

We can therefore estimate that the density of population in a typical part of the survey area was nearly 1000 people per acre. This figure which we believe to be an under estimate. Because (1) some of the units surveyed were locked (2) respondents sometimes did not include servants and relatives who were also living there (3) the figure does not include homeless people who sleep in doorways and street stalls, nor customers, visitors and street-sellers, who also make up the population of the survey area and add to

the road traffic. Thus it is believed that a better estimate of the actual density of population of people living and working for most of the day in this site would perhaps be closer to approximately 1200 to 1400 people per acre. This site selected for study is believed to be typical of the other parts of the study area, and gives a fair guide to the high densities throughout old Dacca.[1] Since shops tends to stay open until late at night it was felt appropriate to include people at work in the total figure.

Thus population density (and thus traffic generation) is very high in the study area. Yet the density is likely to increase still further in the future .

In the example above it seems probable that the density will rise within the next few years to perhaps 2000 people per acre. Two new buildings are under construction, and many vacant units are waiting to be filled (there were 15 vacant units in one building alone) So a considerable increase in population density is yet to take place.

This conclusion was true of the area as a whole. But what has been the extent of this increase in density? The following sections now examine the rate at which new floor space has been added to the survey area in the past.

The Creation of New Floorspace in the Survey Area:

The land use survey examined the rate at which new floor space had been created in the survey area. We examined the age of the buildings and whether any extensions had

[1] The choice of only a small and specific site of ½ acre might seem arbitrary and possibly misleading. But because of the near complete absence of public open space in the area(e.g. pavements, school grounds,parks etc.) the space which the people occupied in that half an acre was effectively the only space that they had access to (except for mosques, resteraunts etc.) This ½ acre therefore represented the space they could utilise.

been built. It was found that a lot of buildings in "Old Dacca" were in fact of quite recent origin. Nearly two thirds (63%) were constructed since 1930, and one third (33%) had been constructed since 1950 (in the survey area).

TABLE 28

YEAR OF CONSTRUCTION OF THE BUILDINGS

Number of Floors	DATE OF CONSTRUCTION						TOTAL
	Before 1930	1930 -49	1950 -59	1960 -69	1970 Onwards	Age Unknown	
1	22	9	3	4	2	4	44
2	12	16	3	1	2	2	36
3	1	2	1	3	1	0	8
4	0	0	0	1	1	0	2
5	0	0	1	0	2	0	3
TOTAL	35	27	8	9	9	6	93
of which the number with extension was:	5	6	3	4	5	3	26

Source : Field Investigation

The analysis of the amount of floorspace added to the survey area by buildings of different ages revealed that the great majority of the total floorspace was of recent origin. 76% of building floorspace had been built since 1930, yet the road layout was designed before 1930 (Here the figure does not include floorspace added in extensions to buildings built before 1930). Furthermore, the more modern buildings (i.e. built since 1950) were generally bigger in size and much more likely to have had extensions built. Half of the buildings built since 1950 (15 out of 31) had extensions. Table 29 shows that the great majority of the total floor-

space was of recent origin. Nearly half of the total building floor space (47%) had been built since 1950 although many of the new buildings replaced older, smaller buildings, so the net gain in floorspace is actually less. Thus the figures suggest that although the road network of the survey area was designed more than 100 years ago, since that time the quantity of floorspace (and hence the intensity of landuse) has increased enormously. Much of this increase has taken place in recent years.

TABLE 29

CREATION OF NEW FLOORSPACE

Building floorspace (in 000 sq.ft.)	Number of Buildings surveyed (age)					TOTAL	
	Before 1930	1930 -49	1950 -59	1960 -69	1970 & onwards	No.of building	fl.sp. 000 sqft.
Less than .200	5	0	1	1	0	7	0.9
.2 - .5	2	5	0	0	0	7	3.0
.5 - 1.0	6	3	0	2	2	13	8.9
1.0- 2.0	4	4	2	0	2	12	16.4
2.0- 3.0	10	3	1	1	0	15	35.9
3.0- 5.0	5	3	1	2	0	11	38.6
5.0- 7.5	1	5	1	2	1	10	57.2
7.5-10.0	1	2	1	1	1	6	52.0
10.0-15.0	1	2	0	0	1	4	47.0
15.0-30.0	0	0	0	0	1	1	24.3
30.0-50.0	0	0	1	0	0	1	44.7
Total Bldgs.	35	27	8	9	8	87*	-
Floorspace (Total)	77.3	98.4	66.7	33.4	53.0		328.8

* For 6 buildings the floorspace was not calculated,but these buildings were all very small in size.

Source: Field Investigation.

A few large buildings of recent construction dominated the total provision of floor space. For example, 10 buildings constructed since 1950 accounted for 129,000 sq.ft.which was 40% of the total floorspace. These large modern buildings were usually of mutiple use. Probably they were built without any effective form of planning control.

One 5 storied building (opposite to Mitford Hospital) clearly illustrates the impact of these modern building in the study area. This building was built in 1959, with extensions added in 1972, 1974 and 1976.

TABLE 30

MULTIPLE USE OF A LARGE MODERN BUILDING IN THE SURVEY AREA

Floor	NUMBER OF UNITS					
	Shops	Work-shop	Godown	Reside-ntial.	Office	Others
5	0	0	0	25	0	0
4	0	3	10	15	0	0
3	0	0	5	25	3	0
2	5	0	15	7	5	2
Ground	36	0	0	0	0	0
Total Units	41	3	30	72	8	2
Total No.of people	92	8	21	183	21	10

Source: Field Investigation.

Large buildings such as this one substantially increase the volume of traffic in the study area. They also overload water, sewerage and electricity supply. The conclusion is that the lack of any effective form of building control has

allowed a considerable number of large buildings to be constructed in the study area, thus significantly adding to the overloading of the road network and other facilities.

Extensions of Buildings:

The growth of intensity of landuse in the area is even more dramatic, when extensions to existing buildings are considered.

TABLE 31

YEAR OF CONSTRUCTION OF THE EXTENSION.

Year of extension	1965-70	1971	1972	1973	1974	1975	1976	Total
Number of Buildings extended	2	2	5	2	5	2	2	30
Approximate floor space added ('000 Sq. Ft.)	3.9	1.4	20.7	0.9	26.9	3.1	13.7	70.6

NB: There were 6 other building extensions for which the date was unknown.

Source : Field Investigation

Beyond the mid-1960's people cannot easily remember when extensions were added, so this study concentrated on recent extensions built during the last 15 years. The figures illustrate a tremendous rate of building activity, which is still continuing. For example, floor space added in extensions since 1971 was estimated to be 70.6 thousand Square Feet, i.e. 21% of total floor space of this survey area.

26 out of 93 buildings (i.e. 28%) had extensions added. This figure corresponded closely with a result obtained from the household survey (taken across the study area as a whole). Residents (from 100 households) were asked whether there had been any extension made to their houses: 31(31%) replied that one or more extensions had been made, and a very large number of these extensions had been made in recent years.

TABLE 32

DATE OF EXTENSION TO (MAINLY) RESIDENTIAL BUILDINGS*

Extension Time	Buildings	Extension Time	Buildings
1960		1970	2
1961		1971	1
1962		1972	3
1963	1	1973	7
1964	1	1974	4
1965	2	1975	6
1966		1976	2
1967	1	1977	1
1968		1978	3
1969	2	1979	1

* Based on 100 separate buildings in the Household Survey. Results for the early 1960's and earlier are probably inaccurate, as people cannot remember that for back.

Source: Field Investigation.

The results therefore revealed that there is a tremendous intensification of landuse taking place in the study area, with the addition of new floorspace.

Conclusion:

Although the study area is well known as "Old Dacca", in fact construction of new buildings is still continuing in the area. Old, smaller buildings are being replaced by replaced by large modern buildings, which are adding a substantial floor space to the area and are being used for multipurpose. The landuse of the area is growing more intense as new floor space is added by new constructions and extensions.

But at the same time the intensity of landuse and hence the level of traffic has been rising because of a greater use of existing floorspace: that is more and more people are sharing existing buildings, and the use of the building itself is changing, these changes are now examined below.

Increases in Residential Densities

Let us discuss the situation of the residential areas. In general we know that Old Dacca is a highly dense populated area. The residential density has increased very much in the last 10 years through increased Household occupancy. A very interesting picture is illustrated from the table below (Table 33) derived from the house hold survey. This illustrated the rate of increased density in the area over time.

TABLE 33
NUMBER OF FAMILIES LIVING IN THE BUILDING

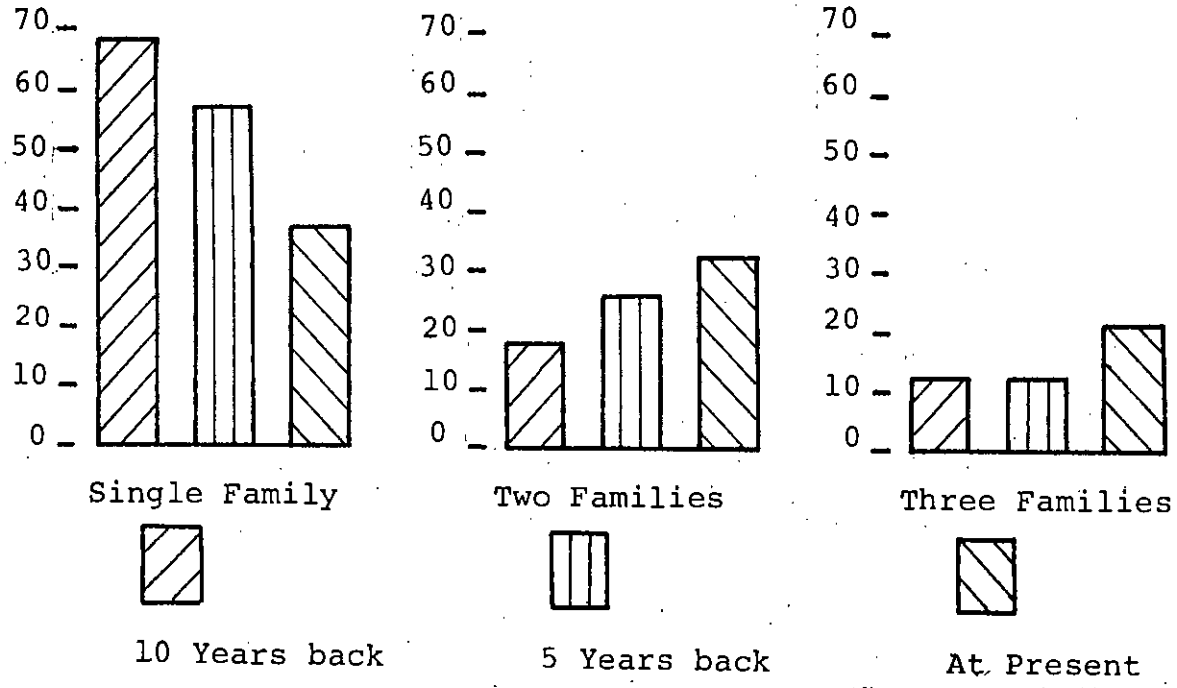
Time	Number of families living in the Building:						
	1	2	3	4	5	6	7
At present	38	32	21	4	3	2	3
5 Years back	57	26	13	3	2		1
10 Years back	69	18	13	0	3		

Source: Field Investigation

It will be more clear with a graph

Fig. 13

Number of Families Living in the Building



From the graph, it can be seen that there are more families occupying or sharing the same building now than 5 or 10 years ago. As the number of single family buildings has declined, the number of two and three family buildings has increased. It seems very likely that room density has also increased over time, but no figures were obtained for this factor. These figures were derived from the household survey of 100 buildings in the study area (see above). There are some doubts about the reliability of the figures,* but they give a clear general guide. For example,

At present 229 families are living in 100 buildings
5 Years ago 183 families used to live in 100 buildings
10 Years ago 159 families used to live in 100 buildings

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* The household survey was rather baised towards higher income groups.

These are figures for higher income groups of people. So, it can be assumed that increases in residential occupation densities have been even greater for lower income groups. Indeed, as one example found, the Old Horse and Elephant stables of a Nawab (King/Raja) is now used as a hostel of 100 students, where once it housed only a single family.

Change of Landuse in the Area:

The landuse of the study area has also intensified to a great extent because the use of many buildings has changed (Table 34).

TABLE 34

CHANGE OF USE OF BUILDINGS IN SURVEY AREA

Change of Use: Total	1949	1950 -59	1960 -69	1970 -79	Total
	6	7	5	20	38
Resident to include Shop or Office or Godown	4	2	3	6	15
Shop to Shop	1	4	1	7	13
Shop to Godown	0	1	0	0	1
Others	1	0	1	7	9
NO CHANGE					37
DON'T KNOW					18

*Based on Landuse Survey

Out of 93 buildings (surveyed), 38 (41%) buildings have changed in use. The remaining 37 buildings had no change and 18 building were unknown. From the table it is marked that most of these buildings had changed their use recently. Out of 38, 20 (53%) buildings have changed after 1970.

The change of use was mostly from pure residential purposes to other users (other users included Shop, Office or Godown). About half of the buildings changing in use were, originally, purely residential.

Other forms of changes also took place, such as, Shop to Shop, Shop to Godown, and Others. The change of Shop to Shop and "other changes" are given below:

Shop to Shop	Others
Glass-Medicine	Hotel-Aluminium
Clothes-Medicine/Aluminium	Biscuit Factory-Aluminium
Wood-Paintings	Hospital-Hostel
Books-Aluminium/Chemical	Mosque-Mosque/Medicine
Cosmetics-Medicine/Aluminium	Cycle-Restaurant
Food-Medicine/Aluminium	Office-Workshop
	Office-Hardware
Clothes-Silver	Tailoring-Vacant
Clothes-Perfume	Tailoring-Office
Clothes-Medicine	
Food-Plastics	
Glass-Chemicals	
Shoes-Cleaners	
Food-Aluminium	

The above results suggested that many food, clothes and tailoring shops had ended up as medical, chemical and aluminium shops. As the survey area contained an important medicine market serving both the Mitford Hospital and Dacca and even regional markets, this pattern of change clearly reflected how the medicine market had grown in importance.*

In general, commercial activities had developed more here, and it is believed that these results (indicating how the medicine market had grown) gives a good illustration

* It should be noted that the figures considered change of landuse only for the existing buildings and takes no account for old buildings which were demolished and replaced by a new building.

how other important markets have expanded in the study area as a whole (e.g. Chawk Bazar and Moulovi Bazar).

The Emergence of Transport Agencies in the Study Area:

Further evidence of the growing importance of commercial activities in the study area is provided by examining the emergence of Transport Agencies. The following analysis is based on the results of the Transport Agency Survey taken across the study area as a whole (32 TA's were interviewed out of an estimated total of 86 in the study area).

Transport Agencies are important as they carry large volumes of goods using especially heavy vehicles. Because of an improved interdistrict road network, road transport has become increasingly popular. Road transport is quicker, more secured, cheaper. It is also true that it is a very profitable business in comparison to many other businesses. The transport agencies only work as the media between businessmen and truck owners, as most of them have no vehicle.

Many transport agencies have established in the study area quite recently (Table 35).

TABLE 35

YEAR OF ESTABLISHMENT OF TRANSPORT AGENCIES IN THE STUDY AREA:

Year	Number of T.A.	Percentage
1975-79	10	31%
1970-75	15	47%
1965-70	5	16%
1960-65	2	6%
Total No.of T.A. Surveyed.	32	100%

Source: Field Investigation.

Some of the Transport Agencies have moved to this place, whereas the majority of them are in their original Location.

TABLE 36

MOVEMENT OF TRANSPORT AGENCIES

Movement	Number	Percentage
Original Place	22	69%
Moved	10	31%

Source : Field Investigation

Those who moved to new addresses nearly all moved after 1969. The causes of movement were:

TABLE 37

CAUSES OF MOVEMENT.

Causes	No.	%
1. Accommodation problems.	7	70
2. In quest of a more successful area.	2	20
3. Ownership changes of the Agency business.	1	10

Source : Field Investigation.

The previous use of the Transport Agency buildings (all 32 agencies) were:

TABLE 38

PREVIOUS USE OF TRANSPORT AGENCY BUILDINGS

Godown	21%
Residential	19%
Another T.A.	19%
Vacant Land	16%
Shop	16%
Hotel	3%
Unknown	6%

Source : Field Investigation.

Thus, many of the transport agencies have occupied existing commercial buildings (shops and godowns) while many have taken over from residential use and vacant land.

In conclusion, the dramatic rate of growth of the transport agencies in the study area (nearly 80% established since 1970) provides a clear indivation of both the rapidly growing commercial importance of the area, and the increasing use of lorry transport for the movement of goods.

Conclusion:

The landuse in the study area is becoming more complex and intense. Not only are new buildings being put up on a large scale, but the net floor space added to the area is quite high. New modern big buildings are dominating the landuse. These buildings are of multiple use. Extensions to new and old buildings are being built throughout the study area. At the same time, new landuses are coming in, replacing the previous use of the building at a high rate now-a-days.

The addition of new floorspace, the intensification of residential (and other) densities, and the change of landuse in the direction of commercial activities are all contributing

to the growing volume of traffic. The new commercial landuses, in particular, are generating increasing volumes of heavy goods traffic.

The change of landuse in the study area is taking place in a completely unplanned, uncontrolled way. Particularly significant are some of the new, large buildings. These have dramatically increased the total floorspace of the area and added to the commercial uses. Many of them have been constructed right up to the edge of the road, preventing any possibility of widening the roads in the future. Such large buildings generating so much traffic are obvious targets for planning control. But no such control exists.

CHAPTER 9

QUALITY OF ROAD IN THE STUDY AREA

In the previous chapter it was found that the area had experienced a rapid change of landuse particularly over the last several years. As a result, the traffic volume as well as the mode was changed to a new level. Building control had failed to stop development of landuses. But while the traffic generated was rising rapidly, the road capacity was greatly reduced by lack of care and neglect of the authorities.

The road capacity was reduced in two ways

1. By reduction of road width
2. By poor road surface quality.

From the road inventory survey, the amount of road reduction has been recorded. Measurement was taken at different distances in every single road of the study area from which average width of those roads was calculated. Two measurements have been taken.

1. Theoretical width: that is ; actually what is the width of the road which could operate if the road was used to its full extent.
2. Practical/Operational Width; In practice, how much of the road width is under use. To compare these two figures, the percentage has been calculated for every road.

It was found that on an average, road width has been reduced by 20% in the study area. (Traffic inventory table).

Furthermore, reduction of road capacity by the poor quality of road surface was estimated to be not less than 10%.

So combined, road capacity was reduced by 30%. In some roads, the percentage of reduction was more: for example in Chawk Circular road 32% (from 34' - 23') Nawab Yusuf Road 29% at Imamganj and Nolgola 40%.

The underlying cause which reduce the width of the road are due wholes at the side of the roads and presence of obstacles on the roads. Nobody will disagree that surface quality of different roads in the study area is worse than any other roads of new Dacca. It was difficult to rank the roads into different categories as all of them are comparatively poor compared to roads in new Dacca. So ranking has been based on the quality of roads in the study area.

Four different ranks have been suggested for the study area (1) Good* (2) Medium (3) Poor and (4) Very poor.

Among 30 surveyed roads,ranking resulted in the following table:

TABLE 39

QUALITY OF ROADS IN THE STUDY AREA.

	ROAD FUNCTION				
Quality of roads	A Main	B Secondary	C Tertiary	D Lanes	Total
Good	1	1	3	1	6
Medium	2	5	4	3	14
Poor	0	2	3	4	9
Very poor	0	0	1	0	1
Total	3	8	11	8	30

Source: Field Investigation.

* A"good" road would be metalled have a reasonably smooth surface, with few obstacles in the road. A"Very poor" road would be muddy, have a bumpy pitted surface,with many obstacles.

It is worth noting that most of the roads category A and B are only of medium and poor quality (or very poor quality companed to new Dacca). Why the surface quality is so bad ? Partly because of lack of maintenance, and partly because heavy vehicles plying on these roads cause substantial damage, especially overloaded vehicles like trucks and push carts.

The result is a significant reduction in traffic speed, especially for non-motorised vehicles such as rickshaws and hand-trolleys. Feet slip on the muddy surfaces, and heavy loaded vehicles get caught in bumps in the road.

Besides that, road obstacles reduced the road capacity significantly. From the Figures 14 and 15 below it can be imagined why and how the road quality is so bad. Examples were taken from Imamgonj Road and Chawk Circular Road which are two important roads.

At Imamgonj Road, the road width has been reduced by 40% because of 23 different obstacles within 390 yeards approximately.

Obstacles are of two types.

(1) Permanent obstacles which are not easy to remove.

(2) Temporary obstacles which can be easily removed.

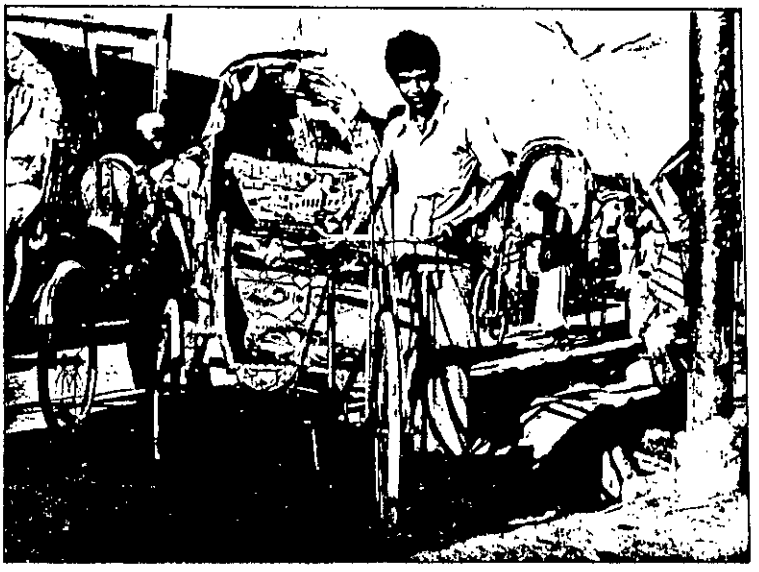
Permanent obstacles included mainly Telephone and Telegraph poles, watertaps, Power boxes for electricity, unauthorized constructions and so on.

Temporary obstacles included hawkers, garbage, holes and works in the middle of the road and uncovered man-holes.

Swarighat Road

Bara-Katra Road

Surface Quality of Roads in the Study Area.



Chawk Circular Road and Jail Road Junction.

The poor quality of the roads and the presence of so many obstacles reflected a failure to take proper care of the roads.

The following Municipal activities are supposed to be applicable in the study area.

a. Road Maintenance.
b. Street Clearing.
c. Refuse Disposal.

From the experience of different interviews taken from people of Dacca Municipality[1] it is clear that Old Dacca is now some kind of a burden to them. All the steps being taken are considering parts of New Dacca only and keeping Old Dacca by the side. Is this happening because very few high officials travel to that area, or because it is a problem area ?

Street Clearing and refuse disposal are not very regularly done. Road maintenance directly reflects the lack of Coordination among agencies. One will be surprised to know that in the study area, five different authorities are responsible for different roads. How can one expect good Coordination ?

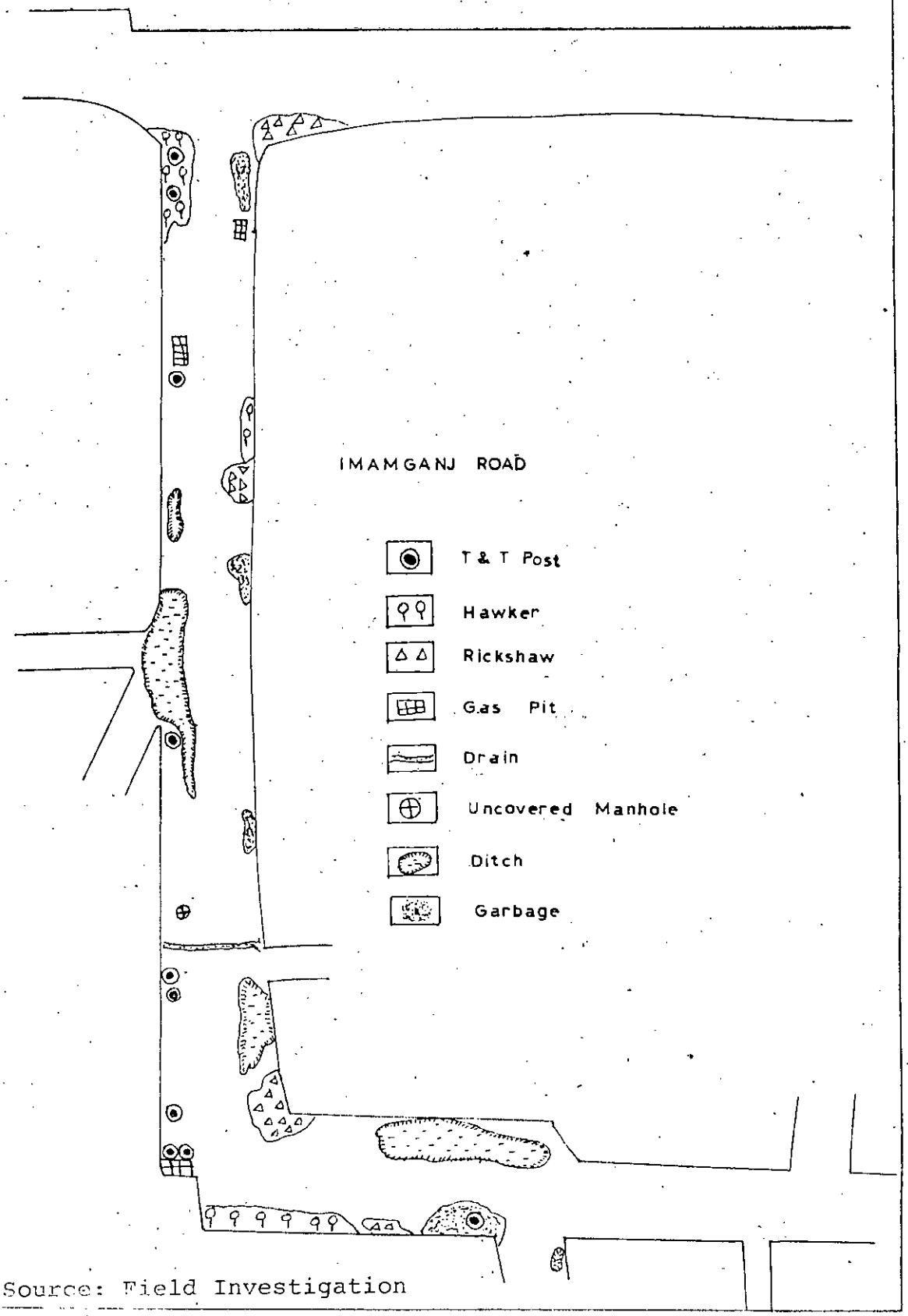
Roads	Authority
1. Islampur-Mugultuli	Roads and Highways
2. Urban Road, Jail Road	Municipality
3. Mitford Medicine Market	Dacca Improvement Trust(DIT)
4. Ahsanullah Road	IWTA
5. Chawk Circular Road	Private Maintanance

[1] Interview with Executive Engineer, Dacca Municipal Corporation 20th March 1979.

Fig: 14

ROAD- QUALITY

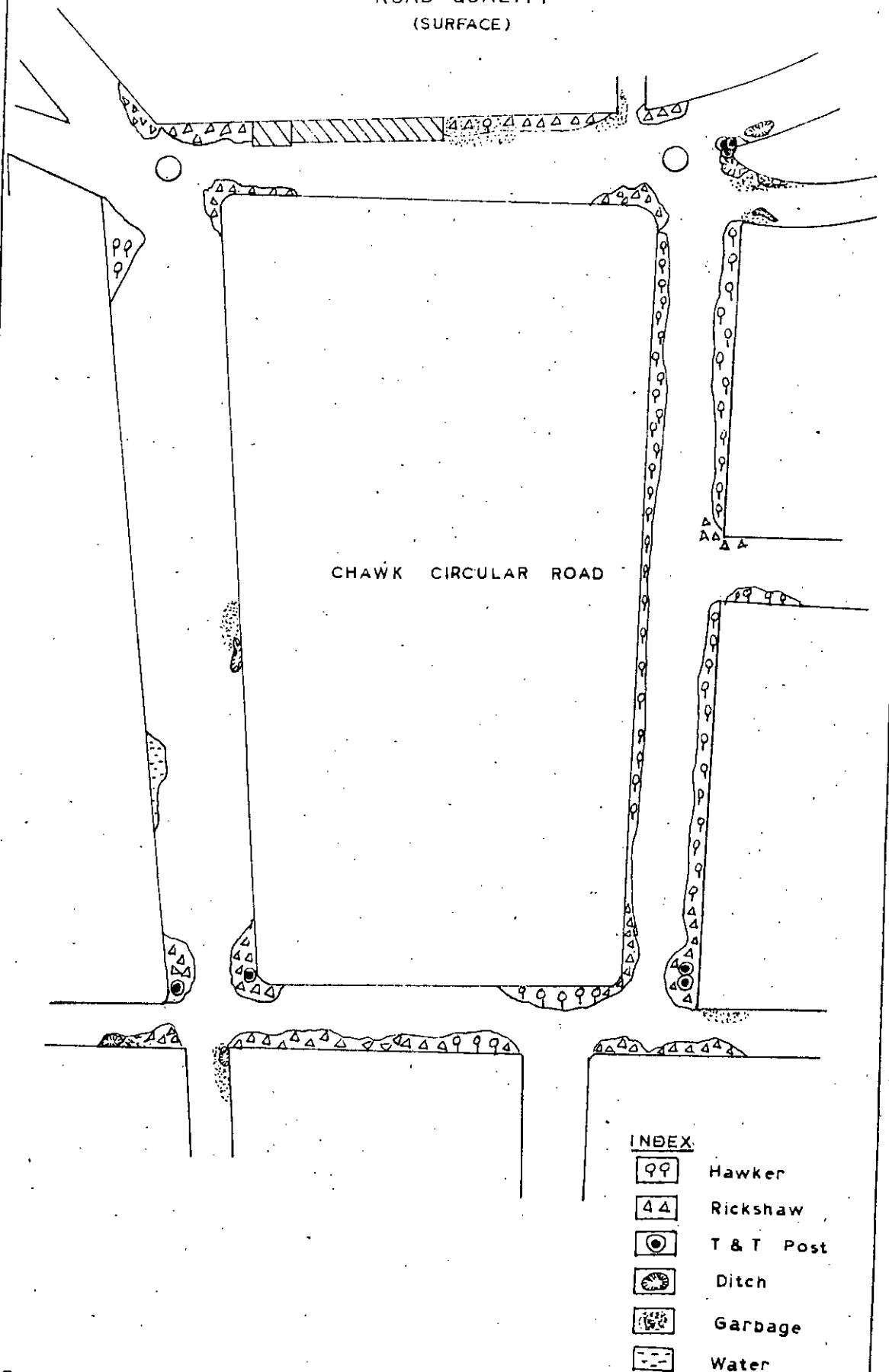
(SURFACE)



Source: Field Investigation

Fig: 15

ROAD QUALITY
(SURFACE)



Source: Field Investigation

Too many authorities are responsible for roads. For better service, all the roads should be place under one authority.

Conclusion:

The traffic problem in Old Dacca area is highly influenced by the poor quality of road in the area. Reduction of road capacity by different agents is quite significant. A policy for road development should be equally emphasized in Old and New Dacca which is lacking now. Good surface quality can increase the road capacity quite substantially.

CHAPTER 10

TRAFFIC GENERATION AND FAILURE OF TRAFFIC MANAGEMENT

The causes of traffic congestion in the study area can be discussed under two broad heads:

They are: 1. Reasons for the high volume of traffic.
2. Failure of traffic control measures.

(1) The Reasons for the High Volume of Traffic:

Under this head, analysis will be carried out about the nature of traffic generation in the study area. Who is generating what type of traffic at what time of the day ? To answer these questions, several questionnaire surveys were carried out. Analysis was obtained from the figures gathered from the origin destination survey, and from separate surveys of households, shopkeepers, transport agencies, and godowns. Further information was also gathered by interviewing truck drivers, truck owners, traffic police and other related bodies(see appendix for detailed methodology).

The Type of Traffic Generated by the Study Area:

One of the identified main causes of traffic congestion is the sheer volume of traffic moving in the study area. Why is the volume so high ? To answer this question an origin/destination study was carried out. It is very clear from the table below that the study area itself was generating a high volume of traffic (that is local traffic). 82% traffic was found to be local and a further 11% was generated by the landuses close to the study area (which can also be called local in a wider sense). Only 7% traffic was through traffic.

It is more interesting that nearly all the heavy vehicles were purely local traffic, having business in the study area (for example Trucks (86%), Bullock cart (76%), Hand-trolley 83%) and Push Cart (74%). Only a few Motor Cycles, Bicycles and Rickshaws (12%) accounted for through traffic. It should be noted that trucks going for inner district journey usually load or unload goods in the study area and so they were considered as local traffic.

So it is obvious that the landuse of the study area itself is generating the sheer volume of traffic. And that is why the traffic can not be diverted to some other roads to minimize the problem of congestion.

Let us analyse how different landuses are accounting for and sharing this volume of traffic over the days. House holds, Shopkeepers, Godowns and Transport Agencies are now discussed below.

TABLE 40

LOCAL AND THROUGH TRAFFIC OCCURING IN THE STUDY AREA

Mode of Transport	Total Journey mode	Local Traffic	Through Traffic	Traffic originated close to the study area	Percentage of Journey to total Journey
All types	501	410 (82%)	34 (7%)	57 (11%)	100%
Rickshaw	205	169 (82%)	27 (12%)	9 (4%)	41%
Hand-Trolley	95	79 (83%)	2 (2%)	14 (14%)	18%
Push Cart	62	46 (74%)		16 (26%)	13%
Bullock Cart	13	10 (76%)		3 (23%)	3%
Bicycle	4	2 (5)%	2 (50%)		1%
Truck	81	70 (86%)	2 (2%)	9 (10%)	16%
Baby Taxi	19	17 (89%)		2 (11%)	4%
Motor Cycle	10	6 (60%)	1 (10%)	3 (30%)	2%

Source: Origin/Destination Survey on 9th & 23rd. July 1979 Monday in the evening. Weather-Fine.

Traffic Generated by Households

From the study area, 100 sample households were selected from 100 separate buildings. One family was interviewed from each building about the journeys made by the members of the households in the previous 24 hours. Those journeys were recorded which started or ended from home. So the intermediate journeys were not counted.

Most of the people interviewed were engaged in business (50%) and service (20%)* Monthly income varied from less than 500 to more than 10,000 Taka* which suggested that most of them were of middle and higher income group. As such, this represents a significantly biased sample, since lower income people are believed to acount for the greater number of people in the study area. However, there is some justification in giving greater emphases to middle and high income groups here, as they are more likely to pay for transport(rather than only pedestrian). Thus the survey gave some guide to traffic vehicle generation. The results showed that households mostly generated light vehicular traffic like Rickshaw (65%) to the area (Table 41). Also a significant number of pedestrain traffic (22%) was generated by Households. Most of the journeys are concentrated in the morning and afternoon period.

TABLE 41

MODE OF TRAVEL BY RESIDENTIAL PEOPLE IN THE STUDY AREA

(information of 24 hours on 10th August 1979)

Mode:	Rick-shaw	On foot	Car	Bus	Baby Taxi	Motor cycle	On Boat	Bi-cycle	Total
No.of Journey	267	94	27	13	5	2	3	1	409
Percent	65%	22%	7%	3%	1%	4%	7%	2%	100%

Source: Household questionnaire survey.

* See Table 1 & 2 in the Appendix.

Most journeys made from the house in the morning were made within a short period (7-9 am.) while journeys to the home were distributed over a longer time (1-8 pm) but with a high peak at around 1 pm. to 2 pm.

TABLE 42

NUMBER OF TRIPS MADE AT DIFFERENT TIMES OF THE DAY*

Time	6-7 am	8-9	10-11	12-1	2-3	4-5	6-7	8-9	10-11 pm.
From the House	33	139	21	4	11	7	2	5	
To the House	1	3	6	23	81	41	12	20	20

Source: Field Investigation

The peak number of trips occurred because, in the morning, everybody is busy to go to their job(office,school,shop etc.), and the purpose of journey is mainly job oriented. In the evening, people have leisure time when journeys are made to meet friends, to see relations,shopping, Cinema and so on.

In conclusion, in the study area, residential blocks generated quite significent volumes of traffic throughout the day, with major peaks in the early morning, midday and early evening. The main modes of transport used were(i)rickshaws and (ii)pedestrian, and the results correlated closely with the observed traffic counts.

Traffic Generation by Godowns:

Godowns are one of the main landuses generating heavy vehicles to the study area. 20 godowns were selected from 2 areas where godowns are concentrated,namely Swarighat and Imamgonj.

The godowns handled mainly both modern finished goods (Battery, Flasks,baby Food Textiles, Cycle tubes, Cigerattes etc.) and bulky raw materials (rice,Flour, Pulses Oil).

* It is believed that the number of trips generated by households from the home in the evening was underestimated. This was because the wording of the question(See Appendix) gave a bias to trips from the home' made in the morning and to trips 'to the home' in the evening.

TABLE 43

TYPE OF GOODS HANDLED BY GODOWNS

Type of goods	No.of Godowns
Modern Manufac-tured goods	9
Raw Materials	11

Source : Field Investigation

For the bringing-in of goods, the Godowns mainly used trucks, bullock carts (mainly used for unloading goods from boats to godowns) and some push carts. Very few head loaders and hand trollies were used for the bringing - in of goods.

TABLE 44

USE OF MODE OF TRANSPORT FOR RECE-IVING GOODS

Mode	Total	Percent
Truck	17	39
Bullock cart	10	23
Push Cart	8	18
Head Loading	5	11
Boat	2	5
Rickshaw	1	2
Hand Trolley	1	2

Source: Field Investigation.

This suggested that Godowns mainly brought in bulk goods in larger quantities. The goods came mainly from the following.

1. Within the study area.
2. Within Dacca City
3. District Towns.

Many of the finished goods came in by truck from the new industrial estates of Dacca like Tejgaon, Tongi, Narayanganj. Raw materials, on the other hand, sometimes came in by boat and were transferred to bullock cart and push cart.

For the despatch of goods, godowns mainly supplied goods to businessmen and shopkeepers in large units, while private individual buyers were few in number. Their customers came from all points (study area, Dacca and other districts). This suggested that godowns in the study area were serving the whole of Bangladesh, but the majority of the customers were from within Dacca Citv. It also gives a clear picture of a two-way flow of goods. That is, the same localities are both sending and receiving goods (although the goods coming in from an area may be different to the goods returning to the area). The figures above which illustrate the transport mode used for receiving and despatching indicate that goods were coming in larger quantities (using truck, bullock cart, boat) while being despatch in smaller units (using more rickshaws and head-loaders). The mode also depended upon the nature of trip. If it is a inter-district trip, then a truck will be used. The distribution of goods occured more frequently than the receipt of goods. From the main business hours of godowns, the main hours of traffic generation were identified.

To summarise the table into a simpler form;

TABLE 45

RECEIPT AND DESPATCH OF GOODS FROM GODOWN

Receives Goods				Despatch Goods		
Not fixed	AM only	PM only	AM to PM	AM only	PM only	AM to PM
2	5	8	5	4	5	11

Source: Field Investigation

It was concluded that the hours at which godowns receive goods were mainly afternoon and evening (8 out of 20 were pm.). The few that received goods in the morning only were largely because the goods arrived by bullock cart and head loaders, for whom there are no road time restrictions. So, for receiving goods the maximum demand is pm. which is largely influenced by the 5 pm. restriction on trucks.

The despatch of goods was much more evenly spread throughout the day - i.e. morning, afternoon and evening. This was largely because the distribution was in smaller units, frequently employing vehicles which are light and not subject to time restriction (rickshaw, push cart, head loaders). However, significant numbers despatched goods in pm. only (5 out of 20) and many dispatched in pm. in addition to am. (11 am. (11 out of 20).

To conclude, the hours and type of traffic generated by the godowns correlated closely with the figures obtained in the traffic counts. In particular, the number of large vehicles (truck, push cart, hand trolleys) were significantly higher in the afternoon and evening periods. It was also notable that finished manufactured goods arrived mainly by truck (from the Industrial Estates and Chittagong). It seems likely that the growth of these industrial estates, and the rising volume of imported finished goods, may have contributed to a shift in the nature of traffic in the study area: that is, away from dependency on river transport towards a greater emphasis on truck (road) transport.

The Traffic Generated by Shopkeepers (Wholesalers and Retailers)

The study area is characterized by wholesale and

Change of Mode of Transport:
From Push Cart to Truck
(Chawk-Mugultuli at 4:20 pm).

Change of Mode of Transport:
From Boat to Bullock Cart
(Swarighat at 4:30 pm).

retail shopping. They are important generators of traffic, and serve not only Dacca city but all over Bangladesh. 30 shops were selected for survey (subjectively) to include most of the types of goods they traded in, and also to cover both wholesale and retail shopping. Type of establishment was:

TABLE 46

TYPE OF ESTABLISHMENTS (SHOP)

Wholesale	10
Retail	12
Wholesale & Retail	8
Total	30

Source: Field Investigation

The types of goods they handled were mainly food stuffs (pulse, flour,sugar,oil) and textiles, stationry, paint, cosmetics, crockery, etc.

Goods generally came in smaller quantities using light vehicles (execpt that the wholesalers tended to receive larger quantities and frequently used trucks). Goods came from many different locations: from the study area, Dacca and other Districts. Goods coming from Districts in fact came almost entirely from the ports of Khulna and Chittagong (80%) and were believed to be mainly imported goods. The table below shows from where shops received their goods:

TABLE 47

SOURCE OF GOODS RECEIVED BY SHOPS

Local Area	Dacca	Districts
26	20	26

Source: Field Investigation

As the total above is more than 30, it shows that some shops get their goods from more than one area.(for example, both from Dacca and other districts). The main customers of the shops were private individuals, businessmen and other shops (50%, 42% and 8% respectively). Again the location of customers were from all over Bangladesh, but especially Dacca Town. Most of the shopping centres (New Market, Baitul Mukarram, Hawker Market, Ramna Bhaban etc.) in Dacca city are important customers. The study area therefore acted as a staging post in the distribution of imported goods throughout Bangladesh. Shopkeepers usually despatched their goods through light vehicles e.g. rickshaw, baby taxi, push cart and a considerable number of pedestrians. The nature and mode of transport used by shop keepers suggests that, just like godowns, shopkeepers also bring in goods in larger quantities and distribute in smaller units, but at a lower level. That is, bringing-in in smaller quantities (compared to godowns) and despatching in even smaller units.

Let us analyse the time of receiving and despatching goods by shopkeepers. To summarise the table below it was found that retail shops and wholesalers received goods mostly in the morning.(see table 5 in the appendix).

TABLE 48

MAIN HOURS OF BUSINESS.

Receiving goods				Despatching goods		
am.only	pm.only	am.to pm.	Don't know	am.	pm.	am.to pm.
21	0	8	1	3	9	18

Source: Field Investigation

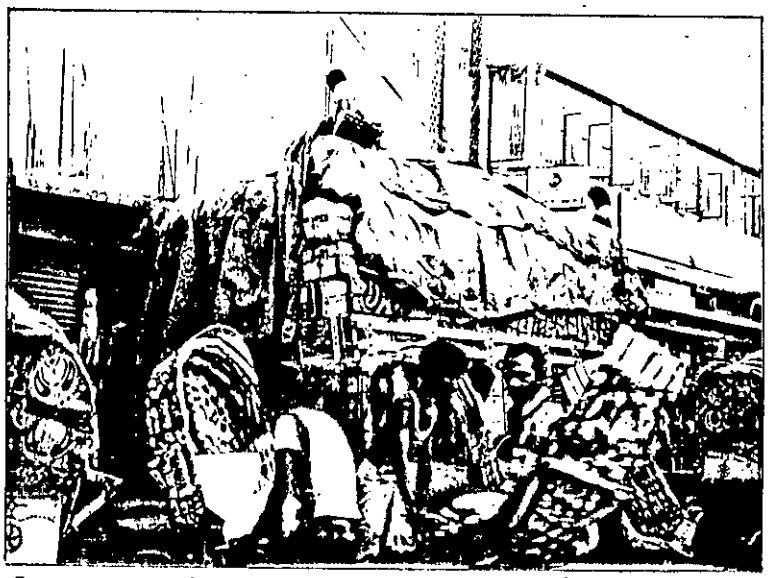
Hawkers Occupying Road Space (& ....!)
at Chawk Circular Road.

Road Seized by Drums at Swarighat.

21 out of 30 shops received only in the morning and a few (8 out of 30) receive both morning and pm. (afternoon and evening). No shops received goods only in the afernoon/ evening. The reasons why goods arrived in the morning were because it was convenient for customers, profitable market price existed at that time, and also it was convenient for the shop keepers (stocks in the shops are lower early in the morning).

Retail shops sell through out the day and their customers mostly came on foot or rickshaw. So goods despatch occurred from 8.00 am. even up till 9.00 pm. Busiest time for customers was usually both morning and late afternoon and evening. It was notable that wholesalers, on the other hand, only usually finished their agreements with the customers in the morning, and then despatched the goods in the evening. This was became many of the customers purchased more than one item, visiting several different shops. Customers of wholesale shops then took delivery from different shops or godown in the evening. Many of the wholesalers do not keep large quantities in their shops but they store the goods in their godowns, and then deliver goods from the godown to the place where the customer would like (transport agency, launch, boat, other shop etc.). They only use the shop for keeping samples and smaller quantities. Many customers from outside Dacca city hire a truck to carry their goods if the quantity is too heavy to carry with them. Otherwise small businessmen often take delivery before evening in order to catch a bus, launch or train in time to go back to their home. Transport Agencies work as a media between businessmen (customer) and the truck owners, since most of the Transport Agencies do not own their own truck. It is quite common that more than one customer will share a truck. The truck is usually parked close to the shop or

Over Loading of Hand Trolley at Jail Road.



Over Loading taking placing at Chawk Circular Road at 3:15 P.M.

Transport Agency and the goods are carried to the truck from the shop by head loaders, hand trolleys and push carts. Thus most of the hand trolleys, push carts and head loaders are directly related to the loading and unloading of trucks.

The Traffic Generated by Transport Agencies.

Like godowns, Transport Agencies play a significant role in the study area. There are approximately 80 Transport Agencies in the study area. A large number of these have been established since after 1970's (see above) and generate substantial volumes of heavy vehicular traffic, which is one of the causes of traffic congestion. The location of Transport Agencies are frequently not at all suitable for handling heavy vehicles. 32 Transport Agencies were selected from the area for study. It is also true that Transport Agencies tend to concentrate in specific areas. To analyse the figures it was found that nearly all (91%) of the Transport Agencies used head loaders and push carts for loading and unloading. Except on Sunday, they work every day of the week where Monday and Tuesday were referred to as the busiest days.

Almost 100% of loading took place in the evening. Unloading frequently precedes the loading. Some unloading took place in the morning (6 out of 32) but the majority unloaded in the afternoon and early evening, and then reloaded the truck. Nearly all the Transport Agencies said that unloading and loading took place AFTER 5 pm. In fact, observation and the traffic count proved that many trucks were entering the study area (Old Dacca) and loading/ unloading BEFORE 5 pm. To illustrate this point, a selection of replies to the question at what times do you usually (1) Load and (2) Unload? is presented below ;

SAMPLE OF TIMES OF UNLOADING AND LOADING TRUCKS BY TRANSPORT AGENCY

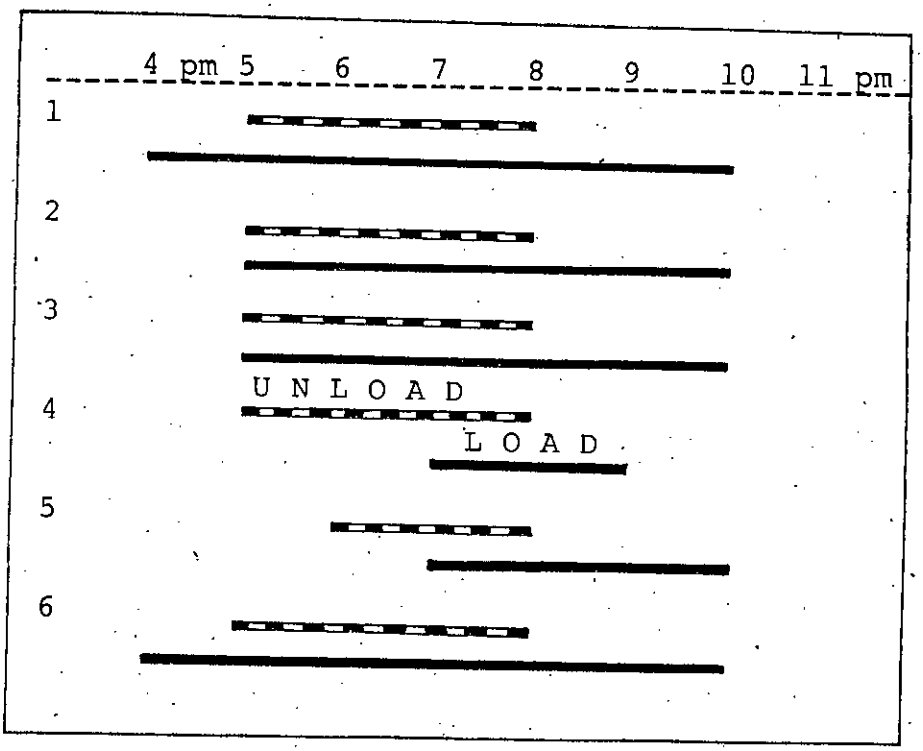


Fig. 16

Clearly, the above figures illustrate that the hours of unloading tend to be slightly earlier than the hours of loading, so from this we can conclude that it is a common practice to unload the truck and then reload with the new goods for despatch to the Districts. And in order to do this, many truck drivers were breaking the 5.00 pm. truck restriction.

(2) The Failure of Traffic Management in the Study Area.

The most common and visible fact of the failure of traffic management in the study area is the breaking of the 5 pm. restriction rule by trucks. The rule about entering the area is commonly broken. But the rule does not make sense to the truck users. It does not suit their needs.

The truck drivers usually do not own the truck but hire it on a daily basis from the truck owner. The driver pays a fixed amount and it then depends on him to use the truck profitably. To operate the truck most profitably, there are powerful reasons why the truck driver would want to break the 5.00 pm. restriction.

There are two major reasons. Firstly, to avoid getting caught in the evening traffic congestion. Secondly, the time needed for unloading and reloading the truck is in any case not sufficient if the truck driver enters only after 5.00 pm. Time is needed both for unloading and reloading and the congestion may waste much of this needed time).

Thus there is a very strong economic incentive to bring the trucks in earlier and it is economically worth paying a bribe to the traffic police to do this. Often the truck will have finished reloading by 11-12 at night and then will start off for the districts. Trucks are mainly coming and going to and from Chittagong and other District towns. For example, 13 out of 32 Transport Agencies mentioned Chittagong as their origin (probably for bringing imported goods up to Dacca). Destinations were usually the main District towns such as Mymensingh, Tangail, Pabna, Faridpur, Dinajpur, Bogra and so on. Frequently these journeys to the District towns involve a ferry crossing (e.g.Aricha, for trips to West and North West Bangladesh; Daudkandi for Comilla and Chittagong). There is usually a long queue of trucks waiting at the ferry (especially at Aricha ferry). So the sooner the truck can join the queue, the better.

So drivers prefer to leave Dacca earlier and secure a good place in the queue. If they leave Dacca by 10 pm. or 11 pm, they will arrive at Aricha, for example, by 12 mid night or 1.00 in the morning. The truck is parked in the

queue and the driver can take his rest and be ready to catch the ferry as soon as possible the next day.

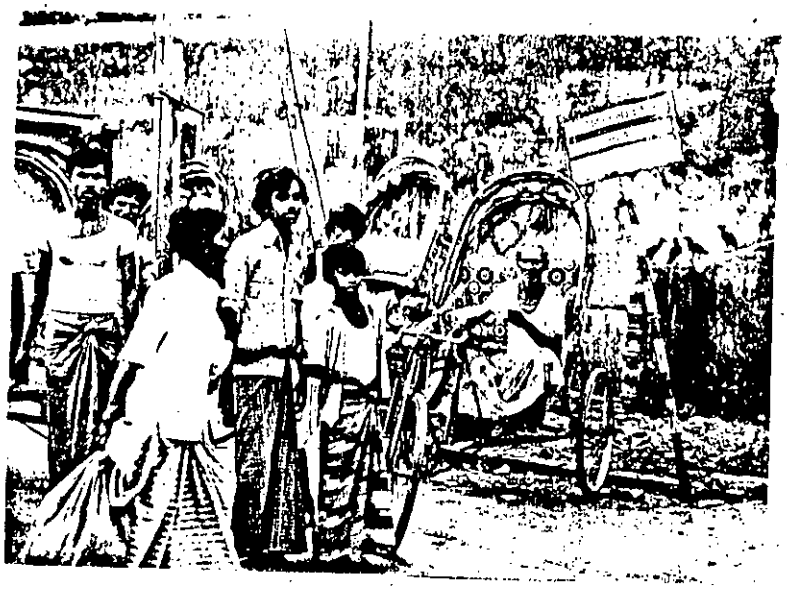
They may not catch the earlier ferries of the day as private cars and buses are given the first priority. But the further up the queue the truck the sooner he will get a place on the ferry.

Other Traffic Management Rules which are being broken.

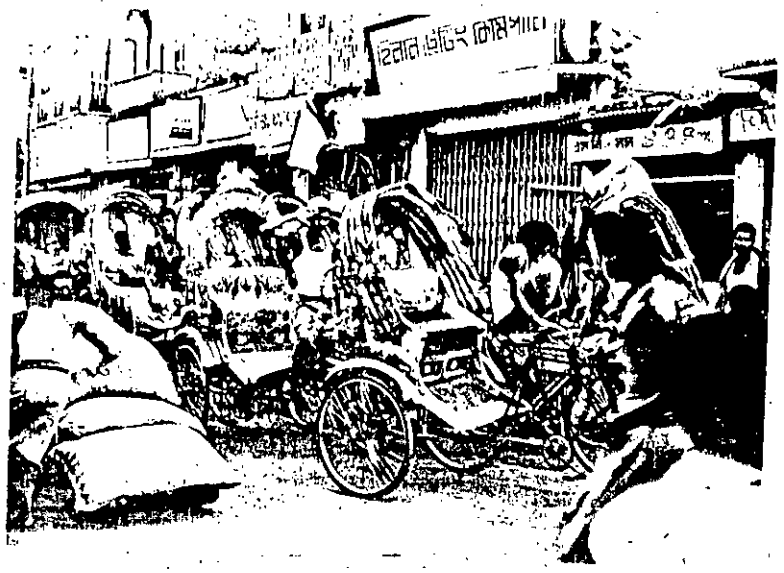
Parking control and control of loading and unloading is one example. In Old Dacca, as well as in the study area, parking is prohibited on certain streets at most times of the day. This is applicable for all forms of transport - e.g. trucks, push carts, baby taxi, rickshaw and so on. But in practice, nobody bothers about it: But why?

The main reason is because there is almost no alternative space for the parking and unloading of heavy vehicles (e.g. trucks) in the study area. But the need for parking space is so high that the rule is usually broken by bribing. There is only one rickshaw stand and one tempo stand (near Chawk Circular Road). But rarely can one find a rickshaw there. Rickshaw pullers and baby taxi drivers go for the most competitive position for their business. Chawk Circular road is always full of rickshaws and baby taxi's occupying most of the road space, and parking especially on street corners.

Note: One further factor encourages truck users to begin their unloading and loading as soon as possible in the afternoon and evening. The nightly curfew in Dacca (beginning at 12.00 midnight) means that truck users cannot be operating if they do not have a curfew pass. So it is clear that the 5 pm. rule is a bad rule. The rule which does not make any sense to the users is a rule which is more likely to be broken, and it would perhaps be better to have no rule than to have a bad rule.



Number of Rickshaws at Authorised Parking Space.



Number of Rickshaws at Unauthorised Parking Space.

On-street loading and unloading by heavy vehicles is one of the main causes of congestion. It reduces the road whdth very much and gives rise to traffic congestion.

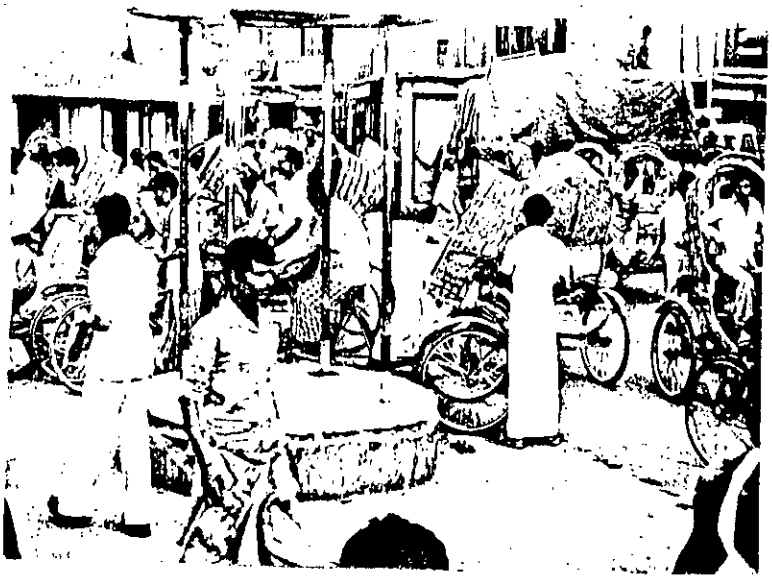
Overloading: In traffic rules and regulations, there is a limitation of carrying for every mode of transport. For example,2 passenger and one child for rickshaw, no double riding on a cycle not more than 5 tons in a 5 ton truck etc. But actually the amount of overloading going on is really fantastic. In a 5 ton truck, they are carrying at least 8 tons of goods to make the business profitable. This also happens for buses, push carts, hand trolleys, rickshaw and so on. This is another source of taking bride. Sometimes over-loaded push carts and hand trolleys cause a traffic jam. They move so slowly, and are critically affected by the quality of the road surface. A wet muddy surface (as is common on many roads) or a pot hole can bring the non-motorised vehicle to a halt, and thus stop all other traffic.

One way street: In the study area, Chawk Circular Road and part of Islampur Road is supposed to be one way street. But to implement the rule, it needs enforcement: that is, a traffic control system. The allocation of traffic police in Old Dacca is not at all sufficient to deal with the problem. Lack of Traffic Police Islands and the rare presence of Traffic Police makes enforcement of this rule unlikely. So nobody is obeying the one way system.

Street Signs/Traffic Lights:

Few traffic signs can be found (and no traffic lights) in the study area. Those signs which were put up long before are almost invisible and make not the slightest difference to people.

* Interview with truck driver



Loading Taking Place in Absence of Traffic Police at 3:15 pm at Chawk Bazar.

Presence of a White Police Man (Chawk Circular Road).

Conclusion :

In the study area, techniques of traffic management are not working at all and the main reason is the absence of alternative ways to carry on the traffic activities. That is lack of parking space is indirectly encouraging on-street parking for loading and unloading. The economic pressure compelled people to do so.

CHAPTER 11

SUMMARY AND CONCLUSIONS

The traffic problem is faced in most urban areas throughout the world. The problem arises because of the growing number of road vehicles in urban areas and the potential conflict between the vehicles. The result is delay to the road users, accidents and loss of life, and damage to the environment. Together these diminish the quality of life.

Traffic congestion arises partly because the town or city road network was not designed to cope with the new forms of road transport and their increasing numbers. The old roads are unsuitable for new needs. To deal with the problem of traffic congestion, three basic approaches can be tried. They are (i) Adapting the town to the traffic. (ii) Adapting the traffic to the town and (iii) Doing nothing (hoping that the problem will solve itself).

Doing nothing may occasionally be the best solution. But sometimes the situation is simply too bad and something has to be done. From past experience it has been found that adapting the traffic to the town is a costly solution and may not solve the problem in the long term. The building of new roads may simply lead to congestion reappearing at a higher level. Building and landuse controls are slow to have effect - they are concerned more with preventing future problems than solving the problems of today, and in any case require a strong planning system for their implemention. An alternative is to adapt the traffic to the town. This can be done by controlling the numbers of vehicles, and controlling the ways in which the vehicles use the road. The control of total numbers is a "blunt instrument" - it does not solve

the problems of specific areas. An alternative is to control road use through traffic management techniques. This approach is cheap and flexible and can increase the road capacity significantly.

In Bangladesh, the traffic problem is growing rapidly, particularly in the main cities like Dacca and Chittaging. Old Dacca in particular is suffering from the worst urban traffic problem in Bangladesh. In Dacca City all three approaches to solving the traffic problem have been tried, but none of them has changed the situation very much. Attempts have been taken to adapt the town to the traffic, but with very limited success. New Dacca is fortunate to have wide modern roads But in Old Dacca, the proposals for constructing main roads were never properly implemented: some roads are still only half way done. At the same time, the control of urban change by planning and building controls is amount non-existent.

To try to adapt the traffic to the town, controls have been introduced to limit the numbers of certain types of vehicles, notably rickshaws. But the controls have completely failed, and instead have encouraged corruption. At the same time, there are elaborate traffic management controls in existence, but they also are almost completely ignored.

The traffic problem of old dacca today seems to be the incoming problem of other towns in Bangladesh. So to tackle the future traffic problem, experience can be gained as a guide for the future planning of these towns. A study of traffic in old Dacca was therefore carried out to understand the nature, causes and best approaches to solving the problem.

From the analysis it was found that the traffic demand placed on different roads in the study area was significantly high throughout the day and particularly during two peak periods during the morning and again at late afternoon and evening. The busiest day and the most congested time was a Monday. The traffic volume varied from hour to hour, day to day, and to some extent seasonally. The demand for the roads was so high at the peak periods, especially in the evening, that congestion occurred frequently, particularly at junctions of main roads. It was found that a typical traffic jam in the study area could last from 2 to 3 hours and could cost from 15,000 to 50,000 Taka.

The road network was being used by different modes of transport. Both motorized and non-motorized traffic, sharing the same road, conflicted frequently. The most important modes of transport were the pedestrian and the rickshaw. Other modes were small in number, but their impact on the traffic flow, especially the larger vehicles, was much greater than their small number would suggest. One of the main causes of traffic congestion was the use of heavy vehicles for carrying goods, for example the truck, hand trolley, push cart and bullock cart. It was observed that the numbers of these vehicles increased significantly in the evening, when heavy congestion was more frequent.

The high volume of traffic found in the area was a function of the landuse itself. The landuse of the study area is compact and complex. It has changed very significantly over the last few years, and has intensified in use very much. New big buildings have replaced old smaller ones.

Vertical development of buildings, increased household occupancy rates, changed use of buildings - all these factors have increased the traffic volume to a paramount level. On the other hand, road capacity has been reduced considerably through neglect, notably the encroachment on the road width and poor surface quality. The reduction of road capacity due to holes, poles, garbage and other obstacles was estimate to be approximately 20% on average, and as much as 40% or more in some cases. The poor surface quality of the roads had a severe impact especially on non-motorized vehicles such as the rickshaw and hand trolley. The reduction in road capacity due to this factor was estimated to be not less than 10%.

Different landuses generated different types of traffic at different times. Residential blocks generated mostly pedestrian and light vehicular traffic (rickshaws mostly), particularly in the morning (to go to job), at non(lunch break) and in the evening (Social meeting, shopping etc.).

New landuses in the area, for example, godowns and shops, generated more trucks, push carts and hand trolleys for goods movement. Push carts and hand trolleys were sometimes related to the trucks for loading and unloading. Godowns and wholesale shops generated traffic particularly in the afternoon and evening for receiving and despatching goods. The use of heavy vehicles was important (for godowns and wholesalers) because they dealt with large units. It was noted that the wholesale markets of the area functioned as a major staging post for goods distribution both to Dacca and the district towns of Bangladesh. It was also notable that many of the goods handled were modern manufactured finished products, coming in from Chittagong and from new industrial estates around Dacca.

It seems likely that the growth of these estates, and the rising volume of imported goods, has helped to change the main mode of transport serving the area from the river boat to the truck.

From these many causes, the type and volume of traffic had changed for the worse. A number of traffic management rules have been applied to the study area. But all of them were being broken. Bribing to the police was commonly practised to allow trucks to enter the area before 5 pm. Other rules, for example, to control on street parking and loading and unloading and the one way circulation system were also not obeyed. The rules were broken either because they were inappropriate rules (e.g. the 5.00 pm. restriction) or became no alternatives were provided (e.g. for parking).

So it was clear that the problem was bad enough to demand attention for solving the problem. But what would be the best approach for tackling this problem ?

RECOMMENDATIONS:

What is the best approach: doing nothing, or doing something to improve the situation ? Doing nothing may not be the best approach as, with the rapid change and intensification of landuse, the problem is going to get much worse before it gets better. Again, adapting the town is not a good solution. The landuse is very densely developed (both horizontally and vertically) which will not permit the building of a new road. Even it were possible to demolish buildings on the road line the solution should be a very costly one, which is a luxury for Bangladesh. The alternative is to find same way of controlling the use of the roads. Below a package of recommendations of traffic management techniques are suggested which could be tried for solving the problem.

Time Restriction for Selected Vehicles:

Because the potential traffic demand for the roads at peak periods is too great for the roads to carry, some restrictions on some types or number of vehicles have to be applied. From the analysis it was found that heavy vehicles (particularly Trucks) were one of the causes of traffic congestion. Their numbers were relatively few (compared, for example, to the Rickshaws), and thus restrictions on this category of vehicle would be both simpler and likely to have a greater effect. Furthermore, most of the trips involving rickshaws during the peak periods were trips to work or business. The time of day needed for these trips is thus fixed(e.g. 8:00 am, 1:00 pm, and 5:00 pm). Truck operations(such as loading and unloading) are more flexible, and can more easily take place outside of peak periods.

Both in the morning(9:00-12:30 pm) and evening peaks (4:30-7:30 pm), trucks should not be allowed to get in. 5 pm is a busy time, and to allow trucks to move at this time leads to congestion. But the truck operations need sufficient time to carry out loading and unloading. The off-peak period is suggested to allow trucks to come in or get out of the study area(2:00-3:30 pm) when roads are completely free. Again after 7:30 pm they are free to move. The entry restriction should therefore be relaxed from 2:00 -3:30 pm and 7:30-8:30 am.

Parking Provision for Loading and Unloading:

Along with the time restrictions, parking facility should be provided, otherwise trucks will continue to load on the street as they are now doing. It is neither easy nor cheap to find or creat some parking space in the study area. Possible locations are, for example, at Badamtali Ghat(wide and free of through traffic), and around Armanitola Field,

and along Jail Road. To pay the costs of providing the space, a parking charge should be imposed. And on the narrow main roads, parking and loading restrictions should be rigidly enforced.

One Way System:

Conflict between two way traffic is common particularly between large goods traffic. To minimize this problem a one-way system is proposed for trucks and bullock carts. For example, trucks could enter the study area through Jail road and Abul Hasnat Road to come to Mugulituli and Chawk bazar, and leave the area through Jail Road and Urdu Road. If this did not solve the problem, then a more extensive one way system for all types of vehicles could be considered.

Minor Adjustments to Road Corners:

Most of the junctions in the study area experience frequent traffic congestion. Corner designs are so bad that it is difficult to turn. Minor alteration to road corners would improve the traffic flow substantially.

Banning of Selected Vehicles to Selected Road:

In the study are it was found that a natural hierarchy exists among different roads. Some of these roads were not suitable for vehicles like trucks or bullock carts or pushcarts. Here the vehicles should be banned. For example, Mukim Katra Road, Moulovibazar Road should be banned for trucks and bullock carts. The numbers affected by this restriction would be very small.

Road Maintenance:

Better surface quality will increase the capacity of roads significantly. Likewise, road width can be increased by better maintenance.

Land Use Control:

If the above techniques of traffic management were introduced, it is very likely that the traffic flow would be significantly improved. The volume would rise to a higher level. But if the traffic situation was improved, the disincentive for new landuses to locate in the study area(particularly godowns and wholesale shops) would be reduced. More godowns and shops would be established, and the traffic problem would simply reappear at a higher level. So, the landuse (construction, extension, height and location of buildings) should be controlled. However, even if landuse could be controlled (and at present this seems to be unlikely) there is no way to control the ever increasing demand for vehicle use. If different groups of people in the study area purchase and use more vehicles (especially trucks) than at present, the traffic volume will increase anyway. So, traffic management techniques suggested above are appropriate for the time being. They are suggested for a short term solution. But what to do for the longer period of time?

For a long term solution, there is no other way but the introduction of a new business centre at a new location to solve the problem at Chawk Bazar. This can be done by the policy of Government. If a new wholesale and retail business centre can be established at a suitable location it will help to divert business to that area. The new location should be provided with good access, suitable for wholesale business, enough parking space for loading unloading and other related facilities. People could be encouraged to establish here by incentives such as, low rent, tax free for first few years,

import licences etc. If the new wholesale market were started now, and simultaneously traffic management introduced at Chawk Bazar, after a few years the traffic situation will get worse again and that will act as a push factor to start business at the new market centre. It is a long run process, which may not be profitable for the Government for the first few years, but there is no alternative way to solve the traffic problem of Old Dacca.

APPENDIX

METHODOLOGY

The study adopted the following methodology in order to meet the objectives.

1. Collection of available secondary information from different sources which would be helpful for the study. Information was collected both from literature and organisations who are involved with traffic of Dacca City. Information were collected from maps (road network), interviews with people from Dacca Municipality, Dacca Metropolitan Police, Roads and High ways, Road Research Laboratory and so on.

2. From a reconnaissance survey, the study area was selected. Old Dacca as a whole has been surveyed to understand the problem. In general most of the area of Old Dacca is suffering from traffic congestion problem. The selection of the area was based upon some factors such as; one of the most troublesome areas, one of the most congested areas, and an area which is economically very important to Dacca City. The study area has been selected as it is a multifunctional area and suffering from acute traffic problem. The Study area selected was in Old Dacca and extends from Chawkbazar upto Babubazar - Islampur area. The northern and southern boundary are Dacca Jail and Burhiganga River.

3. A study of existing transportation facilities was carried out. This involved a road inventory survey, which examined the following aspects : road width, surface quality, presence of traffic signs, pavements etc. The survey covered all the primary, secondary, tertiary and even the lanes. A 100% survey has been carried out. On the basis of this information, the roads have been classified. Quality of the roads have been

classified which is applicable in Old Dacca only. If the quality compared to roads of New Dacca then none of them can be grade as good or even medium. Number of obstacle on the roads were counted and classified which reduced the width.

4. Traffic Counts were carried out on selected roads at different hours of the day and on different days of the week. Both pedestrians and motor vehicles were counted, for the first 30 minutes of each selected hour. To know the peak hour a normal typical day was selected- Thursday. From 8 am. to 8 pm. the traffic counts were carried out for one road. To prove the peak hour, a second count was carried out for another road on the following thursday (same weather condition). From the pilot survey it was experienced that the volume of traffic (both pedestrians and vehicles) is too high and impossible to count not less than 2 persons in one way. So on busy roads, 4 persons were employed in each station and on other secondary roads, according to need (3 or 2 persons per station). All types of vehicles has been included in the survey.

5. Origin-Destination Survey : To know the nature of traffic in the study area, an Origin-Destination Survey has been carried out. This was correlated to the mode of transport people were using, and was carried simultaneously with the congestion survey. It was very difficult to stop a vehicle and ask questions about their origin and destination as the roads are very narrow and volume is too high. It would create congestion easily. So we had to wait till congestion occur.

6. Congestion Survey: It was very likely that there would be congestion in the evening period especially on the busiest day. To identify the points of frequent congestion, the nature and duration of congestion, causes of congestion, number of vehicles affected in the congestion, and congestion cost, a survey was carried out at different nodal points. From a pilot survey, main survey points were find out where congestions occurs very frequently. At each node, investigators were appointed from 3 pm. The traffic situation(flow, volume) was informed by taking notes sketches, at regular intervals when congestion occured and the traffic became standing - they carried out the questionnaire survey. 100% of the trucks, push cart, bullock cart and hand trollies were carried out whereas more than 40% of the other vehicles (rickshaw, baby taxi) were interviewed.The number of affected vehicles were counted in every 10 minutes intervels and in some places every 5 minutes intervels. The total situation of the congestion was recorded as a story - how it starts, what happened and how the congestion released. From the duration and number of affected vehicles, the cost of congestion was calculated.

7. Study of Transport Generators:

a) Landuse Survey: As we know, landuse is the key factor for generating traffic. So to have a clear idea about the trip generation pattern, a landuse study was essential. A generalized landuse survey was carried out for the study area. Land use survey was carried out only for the ground floor as it is difficult to show vertical use. A detailed landuse survey was also carried out for a selected area.

b) Household and Commercial Survey: In general the area is refered as a Commercial Area. So key landuses are directly related to commercial activity (Wholesale). The survey comprised of several sets of questionnaire for different groups:-

- Household Questionnaire (100 Household Selected),
- Transport Agency Survey (32 Agencies Selected),
- Godown/Shop Survey (20 and 30 respectively).

100 households were selected from the study area and it was biased to higher and middle income group mainly. The selection of households were random. 32 Transport agencies were selected from two areas where maximum transport agencies are located (namely Imamgonj, and Swarighat).

On the same way, Godowns (20) were selected from concentrated area. Shops were selected from the total study area to include maximum types of goods they deal with.

c) Detailed Landuse Survey of Case Study Area: This survey was done in a specific area of 7.5 acres, to know the change of landuse over time. This information helped to predict the future nature of traffic, density of population and landuse in the study area. The survey calculated the floor space by step-method and eye estimation. The vertical use of the buildings were also recorded. New floor space added to the building by extensions, and vertical constructions were recorded over time. Density of the population was calculated from that area.

STUDY OF TRAFFIC CONGESTION

It was not possible to record all the vehicles around the area affected but only those at Jail Road junction. A continuous count was therefore made at Jail Road. General observation indicated that the total number of vehicles stuck in the traffic jam was not less than three times the number caught in Jail Road. A full census taken at 7-15 pm. of all the roads confirmed this. The estimate for the 'total number of vehicles affected' was therefore made by multiplying the Jail Road count by three (though the numbers of rickshaws at 5-35 pm. and 5-45 pm. have been adjusted downwards as otherwise they would be too high).

APPENDIX

OUTLINE OF MAIN CHARACTERISTICS OF VEHICLES MOVING ON DACCA STREETS

Note: This outline is based mainly on information presented in the Bangladesh Transport Survey, Part 3 Vol.2.'Roads Transport' (1974).

Motorised Vehicles

Bus: These are used for carrying passengers with a theoretical capacity of 50 - 80 persons and average speed is 20 to 38 miles per hour. Both intraurban and inter district routes are covered by buses & couches. In practice, buses are usually heavily overloaded and may carry 100 to 120 people (single decker) and even up to 200 people (double decker).

Trucks: Trucks are mainly used for carrying goods particularly for a longer distance. Speed varies from urban area to periphery. Average speed is 30 miles per hour and load carrying capacity 5 - 6 tons (although different capacity trucks are plying).

Baby Taxi: Baby Taxi usually carry 3 passenger for a longer distance in urban areas (in comparison to rickshaw journey length) at a speed of 15 miles per hour.

Helicopter/Tempo: is the three wheled auto Rickshaws just like the Baby Taxies but in a changed form of sitting arrangement at the back. Usually it carried 8 - 10 passengers for a longer route. Helicopter or Tempo is a new substitute of Public Transport in Dacca.

Motor Car & Motor Cycle: are privately owned and owned by Government Departments and Organisations. The speed is not limited although in urban areas. Car usually run within 30 - 40 miles per hour.

Non-Motorised Vehicles.

Bullock Cart : one of the non-motorized form of transport which carries goods about 2 tons on an average. Average length of trip is 2 - 3 miles and speed is only 2 miles per hour. Operated by one driver, and usually pulled by a pair of bullocks.

Push Cart: also carries good mainly of about 1 ton at a speed of 2 miles per hour. Average length of trip is only 2 miles per hour. Usually operated by three pullers.

Hand Trolleys: similarly to push carts, pulled by three people as a rule, but smaller in size and distance travelled. Loading capacity is also lower than push cart; approximately half the capacity.

Horse Drawn Carts: mainly use for carrying passenger (6 persons) for a short distance. Average speed ranges from 3 - 4 miles per hour. Almost none to be found in Dacca now.

Cycle Rickshaw : The most common form of vehicle in Dacca (approximately 90,000 in 1979). Used for carrying both passengers and goods. Legally may carry only 2 adults and 1 child (Max.) but often carries 3 adults or up to 2 adults and 4 children. Usually operated by two pullers in two shifts of the day. Changeover takes place at 2.00pm. Average speed is approximately 6 miles per hour but varies considerably.

Three - Wheeler : A 'back to front' rickshaw (i.e. 2 wheels in front) use mainly as delivery vehicles, for example for fish, icecream, etc.

Pedestrian Transport

Head Loaders and Shoulder Loaders : Many people are employed for moving goods short distances. Loads of up to 2 mounds (80 pounds) can be carried by shoulder loads and 2 mounds (80 pounds) by head loads. Most people are employed around the markets and godowns, for loading and unloading goods.

Traffic Count Survey

Name of the Junction----------

Traffic Moving (direction)---------- from------- Road

Time: Started at----------Finished at----------

Date:---------- Day of the Week--------Weather----------

Enumerator----------

Rickshaw: Empty	1 person	2 persons	Goods

Pedestrian	Head Loading

Baby Taxi	Truck	Push Cart	Bullock Cart	Car	Hand Trolley	Bi-cycle	Three wheels	Motor cycle

Study of Traffic in Old Dacca
(Trip Generation Pattern)
HOUSEHOLD SURVEY

Date.....1979

1. Address of the Building.....
.....

2. How many Families are occupying the building? (at present)

..... Family(s)

3. How many Families occupied it before ?

.....Family (5 Years Back)
.....Family(10 Years Back)

4. Have any extension been built to the building ?

Yes..... No..... (Use mark)

if Yes; how manh time(s).....time(s)

When the Extension been made ?.....
.....

5. Does Your Household own any Vehicle ?

(Use mark) Yes..... No.....

if Yes; Type of the Vehicle.....

6. What is the approximate weekly Transport Expenditure of the Household ?

Taka.....

TRAVEL INFORMATION

Age	Sex	Position in the HH	Occupation	Monthly Income Job-I	Monthly Income Job-II	Travel Information of Last 24 Hours No.of Journeys made yesterday	Purpose of the Journey	Destination/ origin	Time Start	Time Finish	Mode trave
								From the House			
								To the House			
								Other Important			
								From the House			
								To the House			
								Other Important			
								From the House			
								To the House			
								Other Important			
								From the House			
								To the House			
								Other Important			
								From the House			
								To the House			
								Other Important			

STUDY OF TRAFFIC IN OLD DACCA

Interview Schedule for the Shopkeepers/Godowns

Date---------- 1979

1. Name of the Road where the Shop/Godown is located ? ----------

2. Type of Establishment (Use mark)
   Wholesale----------
   Retail----------
   Godown ----------
   Others (specify)----------

3. Type of Goods Handled by the Shop/Godown----------
   (Record in detail) ----------

ARRIVAL

4. How do you bring Goods to your Shop/Godown?
   (Record in detail----------
   ----

5. Where do the Goods mainly come from ?
   (a) Town ---------- (b) Town----------
   District---------- District----------

DEPARTURES

6. Who are your main Customer(s) ?
   (Use mark) Individual (shall scale)----------
   Shop(s)--------- Businessman----------
   Others (specify)----------

7. Where are they mainly located ?
   (Use mark)--------- Dacca (record the Major Locality)
   --------- Outside Dacca (Record Town---------
   District----------

8. How are your Goods Transported to the Buyers?
(Record in detail)----------
---

9. How often do you normally receive goods ? (Use mark)

a) in a day Time(s) in a week Time(s) in a month Time(s)
1 2 3 4 5 1 2 3 4 5 6 1 2 3 4 5

b) Main day/days of a Week (Use mark)

Sun Mon Tu Wd Th Fr St

c) Main Hour/Hours of day

----------to---------/ ----------to ----------

10. Why do you receive the Goods at these Time(s) ?
(Record in detail)----------
---

11. How often do you normally despatch your goods ? (Use mark)

in a day Time(s) in a week (Time(s) in a month Time(s)
1 2 3 4 5 1 2 3 4 5 6 7 1 2 3 4 5 6

b) Main day/days of a week (Use mark)

Sun Mon Tu d Th fr St

c) Main Hour/Hours of a Day

---------- to -------- / ----------to ----------

12. Why do you despatch the goods at these Times ?
    (Record in detail)----------
    ----

13. What Traffic Rules/Regulations you have heard ?

    ----

14. How do these Laws affect your business ?
    (in terms of benefit, loss, inconvenience etc.)

    ----

15. What would you suggest to solve the Traffic problem, specially the Congestion ?
    (Record in detail)----------

Study of Traffic in Old Dacca

TRANSPORT AGENCY SURVEY:

Date----------1979

1. Name of the Road where the Transport Agency is located----------

2. Year of establishment of the Agency----------

3. Year of arrival at this address

4. Previous address of the Agency

---

5. Not applicable (Use mark)

---

6. What are the causes of shifting from the previous address ? (Record in detail)

---

7. What was the previous use of the building ?

---

8. Is there any branch(s) of this Agency ?
(Use mark) Yes ---------- No----------

if Yes; Where? Town----------
District----------

9. Do you Own any Vehicle(s) ?

(Use mark) Yes----------No----------

if Yes; What is the Size of the fleet?

---------2 Years back ----- 5 Years back.

--------- 10 Years Back

LOAD YOU CARRY UNLOAD YOU CARRY

10. Where do you usually--------- Place----------

Place----------

11. Do you use Puch Cart/Head Loader to move the Goods between Customer and Lorry ?

(Use mark) : Yes---------- No----------

if Yes; (Record in detail)

---

12. How Often do you--------- (Use mark);

a) in a day : Times
1 2 3 4 5

b) in a week : Times
1 2 3 4 5 6 7

c) in a month : Times
1 2 3 4 5 6 7

a) in a day : Times
1 2 3 4 5

b) in a week : Times
1 2 3 4 5 6 7

c) in a month : Times
1 2 3 4 5 6 7

LOAD YOU CARRY UNLOAD YOU CARRY

13. On what Day(s) you usually--------(Use mark) ;

sun Mn Tu Wd Th Fr St Sun Mn Tu Wd Th Fr St

14. On what Hour(s) you usually--------

----------pm./am to ----------pm./am. to
----------pm./am. ----------pm./am.

15. What type of Customer you usually Handle ?

(Use mark)	Origin	Destination
Ware House		
Godown		
Shop		
Others(specify)		

Impact of Traffic Congestions:

16. What is the Loss/Effect when you are caught by Congestion?

(Use mark)	Time Lossed	Financial Cost
delayed the journey		
missed the ferry		
others (specify)----------		

17. Who pays the money when the Truck/Lorries are cought by Congestion ? ----------
----

18. What Measures do you take (usually) to avoid the Congestion ? (Record in detail) ----------
---
---

19. Are you Aware of the Various Laws/Rules that are practised in this Area ? Yes---------- No----------

if Yes; (Record in detail) ----------

---

20. How do you come in this Area before Schedule Hour ? (Record in detail)----------
---
---

21. What is the cost of Breaking the Laws/Rules that are practised here ? (Record in detail) ----------
---

---

22. What will you suggest in the Solution of the Traffic Congestion Problem in this Area?

(Record in detail) ----------

Table: 1

Monthly Income (from the House Hold Survey):

Less than 500	... 7
501 -- 1000	... 58
1001 -- 2000	... 37
2001 -- 3000	... 21
3001 -- 4000	... 5
4001 -- 5000	... 9
5001 -- 6000	... 3
6001 -- 7000	... 4
7001 -- 7000	... 1
8001 -- 9000	... 2
9001 --10000	... 2
10000 and above	... 1

Source: Field Investigation

Table: 2

Occupation of the Respondents:

Business	...	110
Lawyer	...	3
Land Lord	...	2
Teacher	...	1
Service:		
3000 and above	..	-
2500 " "	..	-
2000 " "	..	1
1500 " "	..	7
1000 " "	..	9
Less than 1000	..	22
Service in Private Farm	..	1
Contractor	..	1
Retired Person	..	2
Student	..	46
House Wife	..	5
Technician	..	1
Shop Keeper	..	4

Source: Field Investigation

Table: 3
Road Inventory Findings:

Name of the Road	Average Width of Road in Ft. Theo.	Pract.	Reduction of Road in %	Road Quality	Note
Chawk Circular	34	23	32	Medium	TP,TI,PS
Mukim Katra	17	13	23	Poor	-
Mughultuli	17	16	06	Medium	-
Mitford	32	26	18	Medium	TS
Babu Bazar	34	24	29	Medium	FP
Islampur	25	21	16	Poor	-
Nazimuddin	28	23	18	Good	TI
Abul Hasnat	25	20	20	Good	-
Armanian Street	22	18	18	Good	-
Armanitola	32	28	12	Medium	-
Nawab Yusuf	38	27	29	Medium	TP
Sarat Chandra Chakravarty	38	26	31	Medium	-
Azizullah	50	40	20	Medium	PS, TS
G. D. Kabiraj	35	30	14	Medium	TS
Akmal Khan	36	30	13	Medium	-
Badamtali	50	39	22	Good	-
Begum Bazar	15	13	13	Poor	-
K. S. Azmal	13	09	30	Poor	-
Moulivibazar	22	17	22	Medium	-
Bara Katra/Swarighat	18	14	22	Very Poor	-
Becharam Dewri	17	15	11	Poor	-
Abul Khairat	18	16	11	Poor	-
D. C. Roy	20	17	15	Good	-
A. C. Roy	25	21	16	Good	-
Imamganj/Nolgola	33	19	40	Poor	-
Rjani Bosh	12	11	09	Poor	-
Jail Road	32	25	21	Medium	TP, TI
Urdu Road	32	24	25	Medium	-
Water Works	18	16	11	Medium	-
Nanda Kumar Dutta	10	08	20	Poor	

Note: TI= Traffic Island, TP= Traffic Police, PS= Parking Space
FP= Presence of Foot Path.

Source: Field Investigation

Table: 4

Hours of Loading and Unloading by the Transport Agencies:

Hours of Loading	Place	Hours of Unloading	Place	Types of* customers
pm				
5 to 12 pm	Chawk	9 am to 5 pm	Ctg.	Sk./Imp.
5 to 8 pm	Chawk	8 am to 12 pm	Raj.	Gd./Sk.
5 to 10 pm	Chawk	5 pm to 8 pm	Chawk	Sk.
7 to 10 pm	Armanitola	24 Hours	Ctg.	Wh/Gd./sk
5 to 10 pm	Swarighat	6 am to 10 am	Tang	Gd.
7 to 9 pm	Chawk	5 pm to 8 pm	Mymen	Sk.
6 to 10 pm	Ctg.	6 pm to 10 pm	Whole Bangladesh	Sk./Imp
5 to 11 pm	Armanitola	Do	do	Wh./Sk./Gd.
7 to 10 pm	Chawk	6 pm to 8 pm	Chawk	Gd.
6 to 11 pm	Chawk	5 pm to 12 pm	Bogra	Sk./Gd.
4 to 10 pm	Chawk	5 pm to 8 pm	Farid.	Sk.
5 to 12 pm	Ctg.	5 pm to 5 am	Chawk	Sk.
5 to 12 pm	Ctg.	10 am to 5 pm	Dacca	Sk.
5 to 12 pm	Ctg.	9 am to 5 pm	Chawk	Sk./Imp
5 to 7 am	Ctg	Whole Day	Dacca	Sk./Imp
Whole Day	Ctg.	5 pm to 12 pm	Dacca	Sk.
5 to 10 pm	Ctg.	9 am to 4 pm	Chawk	Sk./Imp
5 to 12 pm	Chawk	5 pm to 12 pm	Chawk	Sk./Imp
5 to 12 pm	Chawk	24 HOURS	Pabna	Sk.
5 to 10 pm	Ctg.	5 pm to 10 pm	Chawk	Sk./Imp
7 to 10 pm	Chawk	6 pm to 9 pm	Rangpur	Sk.
7 to 10 pm	Water W.	8 pm to 12 pm	Dinaj.	Gd.
5 to 12 pm	Chawk	5 pm to 12 pm	Chawk	Sk./Imp
5 to 12 pm	Chawk	5 pm to 12 pm	Chawk	Sk./Imp
5 to 12 pm	Ctg.	10 am to 7 pm	Chawk	Sh./Imp
5 to 12 pm	Ctg.	5 pm to 12 pm	Chawk	Sk./Imp
5 to 12 pm	Chawk	8 am to 9 am	Chawk	Gd./Sk.

*Sk.= Shopkeepers, Gd.= Godown, Wh.=Ware House, Imp.=Importers.

Source: Field Investigation

Table: 5

Main Hours of Business by Shopkeepers:

RECEIVING GOODS			Nature of Goods**	DISPATCHING GOODS		
Mode*	Origin	Time		Mode*	Dest.	time
Tr./Ht./Rk	1, 2	8 am to 12 am	Oil: W	Tr./Rk.	2	8 am to 6 pm
Rk./Ht.	1, 2	8 am to 9 am	Oil: W+R	Rk./Ht.	2	7 am to 12 am
Hl./Rk.	1,2	7 am to 9 am	Grocessary:R	Ft.	2	8 am to 12 am
Rk.	2	8 am to 9 am	Grocessary:R	Ft./Rk.	2	7 pm to 8 pm
Hl./Rk.	1	10 am to 12 pm	Stationary:R	Ft./Rk.	2	8 pm to 9 pm
Hl.	1	9 am to 12 pm	Grocessary:R	Ft.	2	8 am to 12 pm
Pc./Hl.	3	10 am to 12 pm	Stationary:W	Rk./Bt.	2, 3.	6 pm to 10 pm
Tr./Pc.	3	8 am to 9 am	Suger: W	Pc./MTr.	2, 3.	6 pm to 10 pm
Ft.	1	10 am to 11 am	Stationary:R	Ft.	1, 2.	8 am to 10 pm
Hl./Rk.	1	11 am to 1 pm	Stationary:R	Rk./Ft.	2	8 am to 10 pm
Hl./Rk.	1, 2.	7 am to 8 am	Grocessary:R	Ft./Rk.	2	8 am to 8 pm
Hl./Ht.	1, 2.	10 am to 11 am	Stationary:R	Ft.	2	12 pm to 7 pm
Hl./Rk.	2	7 am to 2 pm	Grocessary:R	Rk./Ft.	2	7 am to 8 pm
Hl./Tr.	3	8 am to 10 am	Textile: W	Tr./Rk.	2, 3.	4 pm to 5 pm
Tr./Pc.	2, 3.	10 am to 3 pm	Textile: W	Pc./Hl.	2, 3.	3 pm to 8 pm
Rk./Hl.	1	8 am to 2 pm	Grocessary:W+R	Rk./Ft.	2	7 am to 9 pm
Hl.	3	4 pm to 6 pm	Lock/Scissors: W	Rk./Ft.	2, 3.	10 am to 3 pm
Tr./Rk./Hl.	3	10 am to 10 pm	Textile:W	Rk./Ht.	3	9 am to 9 pm

For Note please the next page.

CONTD.

RECEIVING GOODS				DISPATCHING GOODS		
Mode *	Origin	Time	Nature of Goods**	Mode *	Destinstion	Time
Ft.	1	8 am to 9 am	Grocessary:R	Rk./Ft.	2	8 am to 11 pm
Ft./Hl.	1, 2.	9 am to 12 pm	Plastic	Hl./Rk./Bt.	2	5 pm to 6 pm
Rk./Ft.	1, 2.	8 am to 11 am	Toy: W Grocessary:R	Ft.	2	1 pm to 11 pm
Hl./Rk.	1- 2.	8 pm to 12 pm	Grocessary:R	Ft./Rk.	2	6 am to 9 pm
Tr./Pc.	3	Not Fixed	Cycle Parts:R	Rk.	2, 3.	2 pm to 8 pm
Tr./Pc.	2	7 am to 2 pm	Hard Ware:W+R	Rk./Pc.	2, 3.	9 pm to 11 pm
Bt.	2	7 am to 11 am	Medicine:W+R	Rk./Bt.	2, 3.	7 am to 12 pm
Tr./Hl.	3	7 am to 11 am	Pulses: W+R	Pc./Bc./Hl.	2	8 am to 5 pm
Tr./Hl.	2	2 pm to 6 pm	Crokeries:W+R	Rk./Pc.	2	8 am to 7 pm
Tr./Bt.	2	8 am to 12 pm	Paint: W+R	Hl./Rk.	1	8 am to 5 pm
Tr./Pc.	2	11 am to 3 pm	Hard Ware:R	Pc./Rk./Hl.	2, 3.	8 am to 2 pm
Rk.	1, 2.	10 am to 12 pm	Medicine:R	Ft./Rk.	2	7 pm to 10 pm

Mode*: Tr.; Truck, Pc; Push Cart, Bc.; Bullock Cart, Ht.; Hand Trolley, Rk.; Rickshaw, Hl.; Head Loading, Bt.; Baby Taxi, Ft.; On Foot.

Nature of Goods; W: Wholesale, R: Retail

Origin/Destination: 1= Within the Study Area, 2= Within Dacca, 3=Inter-District (Whole Bangladesh).

Source: Field Investigation

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