GOVERNMENT OF PAKISTAN
MINISTRY OF COMMUNICATIONS
NATIONAL TRANSPORT RESEARCH CENTRE

***

MITIGATION OF CONGESTION AT AN URBAN BUS STOP (FAIZABAD)

NTRC - 168

M.SHAMSUDDIN QURESHI
DEPUTY CHIEF

M. SAYYAR
RESEARCH OFFICER

AUGUST, 1993

C O N T E N T S

ACKNOWLEDGEMENT

Solution of traffic problems at Faizabad requires sincere and dedicated efforts of all the concerned, but special gratitude is certainly due to Mr M. Sadiq Swati, Senior Chief, NTRC who very intelligently pointed out the aggravated traffic congestion problem and provided able guidance at every stage of the Study. It was through the support of Mr M. Aslam Farouk, Chief, NTRC which has helped in finalising this Study.

Other helpers have been many but special thanks are expressed for Dr S.Ghias-ul-Haq, Deputy Chief for his useful comments on financial and economic aspects of the Scheme and also to Mr M. Kazim Idris, Deputy Chief for necessary help and guidance for the study and in preparing the Final Report.

Thanks are also due to Rao Muhammad Iqbal Khan, Senior Superintendent of Police, Government of the Punjab, District Rawalpindi, Punjab for providing traffic police help in carrying out traffic surveys and to Mr Makeen Shahbaz, Director Traffic, Rawalpindi Development Authority, for technical discussions on improving the traffic conditions at Faizabad. Special thanks to Mr Zahid Safi, Librarian for providing the most wanted research literature of the related field for the study.

The laborious work done by the field staff especially Mr Mahmood Raza, E.I. for computerisation of the field surveys data, and Mr Tariq Mahmood, Stenographer for typing the Report is gratefully acknowledged.

EXECUTIVE SUMMARY

Our Urban areas are characterized by a continuing rapid rate of growth both in population and spatial coverage, a proliferation of commercial and industrial centres, an increase in car and other individual modes of transport (particularly smaller size vehicles) and a continuous decline in Government operated large size buses. The traffic congestion problem has been particularly exacerbated by encroachment both by fixed objects, illegally parked vehicles and a tendency to use 'Bus Stop' as '"Bus Stands". As a result, utilization of all the urban roads is far below their design capacity and causing hazards.

Murree Road, a 6-Lane dual carriageway provides one of the most important arterial link between the twin-cities of Islamabad and Rawalpindi. However, it faces a very serious congestion problem near Faizabad mainly due to the afore-mentioned reasons which in the absence of an effective enforcement of traffic regulations have tended to aggravate day by day. Interestingly on the road section just preceding Faizabad i.e. Shamsabad there is no traffic jam/congestion, while almost traffic conditions are similar, the prima-facia difference is due to the fact that Public Service Vehicles (PSVs)are not parked on this section of Murree Road.

In order to quantify this problem with a view to identify the role and extent of each contributing factor so that a

comprehensive traffic improvement plan be prepared, NTRC in collaboration with the Rawalpindi Traffic Police launched a joint venture. The NTRC Traffic Management Team paid several visits and recorded observations which depict the following scenario:-

1. There is no proper place at Faizabad where an incoming Bus/Wagon/Suzuki-Pickup can stop to pick or drop the passengers. These pick or drop operations invariably take place in road lane (approximately 200 meters) by both the incoming and outgoing traffic. This causes reduction in right of way and thus impedes traffic flow.

2. Majority of passengers come or go towards Khyaban-e-Sir Syed Road. The Buses , Wagons, Suzuki pick-ups and Taxis wait for a long time for the passengers at this section of the road at Faizabad Bus Stop.

3. The signals at the intersection of Khayaban-e-Sir Syed and Murree Road and at the intersection of Murree Road and Shahrah-e-Islamabad are not synchronized properly which causes some additional delay to the vehicles and passengers.

4. Public Service Vehicles do not follow any time schedule and as a result they reach here in bunches and block the whole traffic.

5. Some Vehicles stay as long as 15-30 minutes which illustrates that there is a marked tendency to use this Stop as a Bus Stand. Accumulation of vehicles at the stop results in a severe constriction and in aggravating the traffic congestion.

6. Besides heavy flow of traffic, parking of Taxis and private vehicles as well as loading and unloading of goods vehicles also takes place on the road during the peak period.

7. The pedestrians are at high risk as no proper pedestrian crossing point has been provided.

8. The footpath and one lane of the road (on either side) has been encroached by the shopkeepers and vendors. Besides at places the electricity/ telephone poles have been fixed on the road way which cause obstruction to the traffic.

9. Poor enforcement has resulted in sustaining the congestion problem.

These observations identified that the problem stemmed primarily from the bus, wagon stop where a number of vehicles were found waiting for passengers coming from Pir-Vadhai, Lahore and Murree for Islamabad or Rawalpindi and vice versa. These vehicles defy traffic rules and keep waiting for passengers in two or some time three lanes, making it difficult for the other road users to pass by resulting in an extreme bottleneck. This also established the poor state of enforcement of traffic regulations by the traffic police.

For problem rectification, a traffic improvement plan was prepared by the NTRC Traffic Management Team with the help of some additional data obtained through surveys. These surveys determined the places of origin and destination of the passengers using the Faizabad stop, waiting time of PSVs at this stop and the traffic count at Faizabad Bus stop. Number of padestrians crossing the road and accident data were also obtained.

As per the survey results a Traffic Improvement Plan was prepared, the salient features of which are as under:-

1. A proper place as a Stop for various types of PSVs has been designated.

2. On-road parking specially during peak hours upto 200 meters length of road in both directions of the Faizabad Stop has been recommended to be totally banned.

3. It has been strongly recommended that various types of encroachments should be removed and full right of way should be acquired.

4. The drivers of PSVs should be restricted in the proposed bus lane only.

5. The trend to use the stop as a stand must be curbed.

6. Various types of PSVs should not be allowed to stay for more than the embarking and disembarking time of various passengers through strict enforcement.

7. Proper pedestrian crossing facility has been proposed.

8. Proper road signs, lane markings and cat eyes may be provided/fixed at this site. Guard rails both at the intersection and at the foot paths may be installed/provided to habitize the pedestrians to use only the Zebra Crossings for crossing the road.

9. (8 to 10 feet) wide footpath clear from any sort of obstruction or encroachment has been recommended to be available for the pedestrians throughout 24 hours.

10. Adequately educated and trained Traffic Police Officials have been stressed to be posted to ensure the implementation of the Scheme.

The scheme envisages to improve the traffic flow at the Faizabad Bus Stop on Murree Road. It has been estimated that the annual financial benefits of Rs 0.27 million would not only meet the operation and maintenance cost of Rs 75,000/= per year, but the net savings will also recover the entire capital cost of Rs 0.8 million within a period of 5 years. In addition to direct financial benefits, there are significant annual economic benefits in terms of saving in VOCs (to the extent of Rs 1.311 million per year) and time savings of Rs 8.85 million for the occupants of cars, wagons and buses plying on this route. Thus the proposed Scheme stands justified both on financial and economic grounds.

CHAPTER - I

INTRODUCTION

1.1. INTRODUCTION

It is the aim of transportation engineer to reduce travel time of people, the hazards of accidents, disturbance by noise and air pollution, to improve the layout, service and handling of passengers and freight. All these things can be achieved only, if a road is constructed which is congestion free throughout its design life, because when a road becomes congested, there are not only more chances of accidents, noise and air pollution but also the handling of the passengers and freight becomes difficult and risky and travel time of commuters using the road increases considerably.

Congestion may happen due to many reasons for example under estimation by the planner of the volume of traffic which a road will serve during its design period or due to the occurance of some other development in the adjacent areas or due to poor enforcement as the case in the majority of third world countries and also due to wide spread motor car ownership and many other reasons. So any one or more of the above reasons may cause congestion.

This research report deals with the congestion problem occuring during peak periods at an urban bus stop named as Faizabad Bus Stop near the Faizabad intersection on Murree Road Rawalpindi.

Faizabad Bus stop is situated on the main Murree Road where most of the traffic come from Rawalpindi to Islamabad and vice versa. Islamabad is the Capital city of Pakistan which is surrounded by Rawalpindi, populationwise the 4th biggest city of Pakistan. The twin-cities having a population of about 1.135 million according to 1981 census (Rawalpindi 795,000 and Islamabad 340,000) cover an area of 1053 Sq.Km. (Rawalpindi 143 Sq.Km and Islamabad 910 Sq.Km). In the year 1981 the corresponding number of vehicles in the twin-cities were about 62,000 vehicles (Rawalpindi 60,000 and Islamabad 2000 vehicles only). The estimated population for the year 1991 of the twin-cities is 1.434 milions (Rawalpindi 906,400 and Islamabad 527,443) showing an incremental rate of 2.64% per annum whereas the number of vehicles increased to 140,887 vehicles (Rawalpindi 97,435 and Islamabad 43452) showing an incremental rate of 9.55% per annum.

1.2. FAIZABAD AND ITS SURROUNDINGS

Faizabad is situated on the main Murree Road at the boundary line of Capital Development Authority (CDA) and Rawalpindi Municipal Corporation (RMC) whereas some of its

streets come under the jurisdiction of CDA and some under the jurisdiction of RMC.

Faizabad Bus Stop is situated approximately 600 feet away from the intersection of Islamabad-Lahore Highway (Shahrah-i-Islamabad) and Murree Road towards Rawalpindi on the Murree Road. Another road (Khyban-i-Sir Syed road) coming from Pirvadhai (a major Bus terminal of the twin-cities) also terminates on Murree Road at Faizabad at a distance of 200 feet from the Islamabad bound stop area. Faizabad Bus Stop (Islamabad bound) is also connected with the Khyban-i-Sir Syed Road by two streets. One street is between the post office and the transporter's union office and the other is near the market (adjacent to the office of survey of Pakistan). Both these streets terminate at a taxi stand on the Khyban road where some illegal stands of buses and wagons have developed for different intercity routes of Punjab and NWFP cities.

The former street has developed illegally by making shops of different eatable things whereas the later street is legal and mainly furniture business is carried out in this street and off side the road adjacent to this street are a few furniture manufacturing factories. There is a big plot near the intersection of Khyban-i-Sir Syed road and Murree road. There are also some tea shops and cheap resturants adjacent to the footpath, a Suzuki pickup stand is also situated little behind the Islamabad bound stop in front of a market near the office of survey of Pakistan from where suzukies service on Faizabad-Chack Shahzad route (rural area of Islamabad) plies.

On the other side of the road (Rawalpindi bound stop) at Faizabad there is a big under construction market and show rooms of furniture along the footpath adjacent to the stop area. Also a famous School of Rawalpindi Madrassa Faizul-Islam Complex is situated on this side of the road. Opposite to the Suzuki stand, there is also a big market. A branch road from Shahrah-i-Islamabad meets Murree road here which is used by the traffic coming on that road towards Rawalpindi side to enter on Murree road or to shift to Khyban-i-Sir Syed road via Murree road near the Bus stop area. All the above described physical details can be seen in the drawing attached at annexure-I.

Faizabad is a big trade centre mainly of furniture as it is evident by the presence of furniture shops and factories. As many of the passengers coming towards Rawalpindi or going outside Rawalpindi change their vehicles here so they do stay for a short time here and take light refreshment from here due to which the business of cheap resturants and tea shops flourishing at Faizabad. Other businesses are also carried out at Faizabad.

1.3 CONGESTION AT FAIZABAD BUS STOP

The existing urban transport infrastructure of Rawalpindi/Islamabad has not been able to cater for the present increasing traffic. The population of the twin cities has significantly increased over the past decade. Moreover, the rise in income level resulted in an increase in Car ownership rate.

The present car ownership has been estimated as 33 cars/1000 persons in Rawalpindi and 55 cars/1000 persons in Islamabad (Year 1991). Commercial vehicle too got an increase to serve the increasing population. Also as Islamabad is the Capital city of Pakistan so there is always a fairly high number of passengers from all over the country who want to visit Islamabad for different purposes. As the majority of these passengers come either through buses, coaches or rail whereas the major intercity bus terminals and railway station is situated in Rawalpindi, then they go to Islamabad via Faizabad and also there is a great number of commuters from Rawalpindi working in different offices in Islamabad, and they also pass through Faizabad. The road width at Faizabad is sufficient to cater this flux of traffic but due to poor enforcement leading to undisciplined behaviour of commercial vehicle drivers, encroachment of footpaths by shopkeepers and kerb lane by vendors, loading, unloading and parking of the vehicles on the road here, the Faizabad Bus Stop remains congested throughout the day. This congestion at Faizabad is further enhanced by the non synchronization of the signals at the intersection of Murree Road and Khyaban-i-Sir Syed road and at the intersection of Shahrah-i-Islamabad and Murree Road as shown in the drawing attached at Annexure-I. Due to which it happens that when a vehicle especially trailer truck from Lahore to Islamabad road enters on the Murree road to turn to its right side to Khyban-i-Sir Syed road it blocks the whole Islamabad bound traffic and also Rawalpindi bound traffic at Faizabad.

Keeping in view the importance of Faizabad Bus Stop area this congestion problem at Faizabad Bus Stop needs rectification and thorough investigation.

1.4. REASONS AND CONSEQUENCES OF THE CONGESTION.

The reasons for congestions at Faizabad Bus Stop and its consequences may be under lined as :

a. Faizabad Bus Stop is located near to such an intersection where a fairly high number of passengers come from the near by Bus Stop of Lahore - Rawalpindi route either to

go to Rawalpindi or Islamabad, also a high percentage of passenger come from PIRVADHAI (General Bus Stand) who want to go to Islamabad and vice versa so there is always rush of passengers as well as vehicles. The congestion intensifies during morning, evening and some times in afternoon peak hours for which the available roadway width is too short to cater such a large number of vehicles through the leg.

b. There seems to be lack of training or discipline or both of the traffic police personnels to tackle such a problem because most of the time they either stand idle in the centre of the road or engage in talks with drivers or when a driver violates certain traffic rule they stop him at the centre of the road without taking any notice that how much hurdle it creates in the smooth running of through traffic. Secondly they usually just warn the drivers of public service vehicles but not challan them for such serious breaches of traffic rules.

c. The road users i.e. mainly drivers of the commercial vehicles and motorist do not care for double parking and wrong parking by using footpaths as car parks at the rush hours. So it depicits that they have a lack of knowledge or carelessness so their behaviour of using the road need to be improved.

d. There is a large queue of taxis on Islamabad bound side of the roadway in order to catch the passengers without catering how much inconvenience they cause to the through traffic. It has also been observed that the number of taxis increases during the rush hours, because in these hours their chances of catching the passengers also increase.

e. Some buses and wagons wait for long time on the stop for passengers resulting in the lack of space for the incoming buses and wagons which also stop here and cause double parking.

f. As there is no other place for loading and unloading of goods on both sides of the road. Therefore loading and unloading of goods for the nearby shops do take place by using the roadway by the trucks etc which further reduce roadway width for through traffic.

g. Roadway has been encroached at several sections especially on the Islamabad bound side of the road resulting in the reduction of roadway width.

h. The shopkeepers have extended their shops to the middle of footpath leaving hardly space of 2 to 3 feet for a pedestrain to walk on it. So the pedestrians walk on the roadway which may cause accidents.

i. Some poles of electricity, telephone and sign boards have been installed on the roadway which result in reduction of effective width of road for road users.

j. A plot of the size of about 8 to 10 Kanals has been illegaly occupied by the shopkeepers resulting in formation of a mini bazar where there is always rush of customers and this contributing to the congestion.

k. Buses and Wagons drivers start crawling from the stop upto the intersection for picking the passengers in the moving vehicle from the centre of the road resulting blockade of traffic.

1.5 OBJECTIVES OF THE STUDY

The principal objectives of this study are to relieve the traffic congestion which occur during peak periods at the Faizabad Bus Stop (Murree Road) and to reduce the delays in movement of the vehicles and passengers at the existing roadway width by using appropriate traffic management techniques.

1.6 SCOPE OF THE STUDY

Traffic congestion on the important roads in urban areas is a chronic problem which causes delays and accidents to vehicle including pedestrians. As Faizabad Bus Stop is situated near the intersection at Faizabad on Murree Road which is a very important and busy one as almost all the traffic of Rawalpindi enter into Islamabad and vice versa so a proper traffic management scheme is suggested to alleviate traffic congestion which occurr over there. This traffic management scheme is relatively inexpensive and is capable of early implementation. This includes an education compaign for the road users as well as per enforcement staff and also demonstration of successful implementation of the scheme by the NTRC staff if traffic controlling authorities feel necessary.

1.7 METHODOLOGY OF THE STUDY

The methodology adopted for the mitigation of congestion at Faizabad Bus Stop consist of the following steps:-

a. First of all it was physically visited in the morning and evening peak hours (06.30 to 09.30 AM and 05.00 to 08:00 PM) to asses the causes of congestions. During these visits all the movements and happenings related to traffic flow were carefully observed and discussed with the superiors to seek their advice. Then the original layout plan was prepared on large scale to indicate the exact situation of encroachment and may be seen at Annexure-II. In the light of observations a letter was sent to Senior Superintendent of Police (S.S.P), Rawalpindi to help NTRC Traffic Staff in carrying out the field surveys at Faizabad Bus Stop to quantify the problem.

b. In the light of observations 4 pilot surveys were suggested to know the exact causes of congestion. These surveys were Passenger Embarkation and Disembarkation Survey (PEDS), Passenger Origin and Destination Survey (PODS), Classified Vehicle Counting Survey (CVCS), and Vehicle Waiting Time Survey (VWTS). The Questionnaires developed to carryout these surveys attached at Annexure-III. Also it was decided to carry out each survey for fifteen minutes only in the morning and fifteen minutes in the evening. After carrying out the surveys their results were compiled.

c. From the data analysis and results of pilot surveys it was decided to carryout detailed field surveys i.e. Passenger Embarkation and Disembarkation Survey (PEDS), Passenger Origin and Destination Survey (PODS), Classified Vehicle Counting Survey (CVCS), and Vehicle Waiting Time Survey (VWTS), for three hours in the morning (i.e. 0630 Hrs to 0930 Hrs) and three hours in the evening (i.e. 1700 Hrs to 2000 Hrs). The Pedestrian Crossing Count Survey (PCCS) was conducted only for peak hours i.e. from 08.00 to 09.00 Hrs in the morning and from 1700 to 1800 Hrs in the evening. For these surveys the Questionnaires were also modified based on the experience of the pilot survey. The rest of the two pilot surveys i.e. PEDS and PODS were dropped from the actual field surveys because from the results of pilot surveys of these two types, the required result were achieved.

d. Also a layout plan of the existing road and footpath at Faizabad Bus Stop was prepared showing all the obstructions on the road and footpaths as attached at Annexure-II. Then to compare the existing roadway and footpath width with the actual right of way at Faizabad.

The layout plan of the Murree Road at Faizabad was obtained from the office of the Punjab Highways Department, Rawalpindi.

e. Also accidents data at Faizabad from January, 1989 to December, 1992 was obtained from Rawalpindi Police.

f. Then after editing and analysing the data of the field surveys and on the basis of actual right of way of Murree Road at Faizabad the design of the Bus Stop at Faizabad was out lined (Annexure-IV).

g. On the basis of observation and results obtained from the data analysis some conclusions and recommendations made in the research report may be seen in Chapter-V.

CHAPTER - II

LITERATURE REVIEW

2.1 TRAFFIC MANAGEMENT (12)

Traffic Management is an integral element of the transport planning process and has the specific role of recognizing the real world today, and its applications and treatments are usually directed a solution to immediate problems in the context of a recognition of longer term transport planning strategy.

Traffic Management can be defined as an approach which views an entire system of traffic elements as an entity rather than individual elements, and seek to design and manage the individual elements. So that they complement one another and function as a total system with the objective of optimising total urban area movement of people and goods.

This definition clearly highlighted one of the most important functions of traffic management strategy as being a systematic approach to the application of traffic engineering techniques to provide equity, efficiency and safety for the transport of people and goods within urban area.

Thus traffic management primarily involves the application of comparatively low cost techniques (compared with the large expenditures associated with major new road projects) to attain the most effective safe and efficeint use of existing road space. In traffic management there are no perfect solutions to meet all ills but there are available to the traffic engineer a wide range of tools and techniques which can be effectively used in providing solutions to particular problems e.g. reduction of congestion, facilitation of traffic flow and reduction of road accidents etc.

Some of the techniques commonly adopted in different traffic management schemes are intersection chanelization, road closures, intersection control, round-abouts , signals, time settings, parking control, assign bike ways etc whereas in many situation the success of any traffic management scheme depends upon strict enforcement. Because without enforcement and evaluation for the scheme the use of traffic management techniques is nothing but wastage of time and money.

2.1.1 Exclusive Bus Lanes (with flow)

Bus lanes, both with flow and contra flow, are the most common ways of giving buses priority in urban areas. In almost

all cases, buses benefit from the priority treatment, but other traffic suffers as a result, and in some cases appreciably. Not infrequently claims have been made that in particular schemes both buses and other traffic have gained, but such cases are alsmost always the result of simultaneous introduction of a traffic management measure. Without the priority component it seems likely that other traffic would have benefitted even more.

The practice in some cities of reserving a lane of the carriageway exclusively for bus traffic, is possible only in situations where the carriageway is of adequate width and a lane can be easily spared for the buses. This implies that there should be at least two lanes on the side on which the buses will operate. For reasons of convenience of alighting and embarking passengers at the kerb, the exclusive lane has to be adjacent to the kerb.

With flow priority lanes are unlikely to provide appreciable net benefits unless the degree of saturation of the traffic flow prior to installing the lane is greater than 90 percent. Nevertheless, the benefits which can be obtained at high flows can be large and, even though the heavy flow may last for only a short time during the peak, installation of a withflow bus lane may be very worthwhile. There are also many other advantages such as lower fuel consumption, less congestion on the roads and less pollution. Further, a capacity of approximately 40,000 seats per hour or 550 buses per lane per hour is possible on exclusive bus lanes.

Where bus flows are insufficient to justify a bus lane, opening the reserved lane to other easily identified categories of vehicle, such as taxis, can provide significant overall benefits as well as easing the passage of buses, though the inclusion of other vehicles should not be regarded as a substitute for a properly-designed bus lane with an adequate setback and width. Bus lanes generally have been successful in reducing travel time for both buses and cars.

Bus priority measures are a cheap and easy way to provide some aid to bus services. The journey time can be considerably reduced and journeys by bus become more attractive. Regularity of the buses also can be improved.

To be successful, the bus-lanes should be created for a good length of the road instead of in small bits. An effective enforcement-policy is a prime requisite for safety. Satisfacotry signing and marking of the lanes and adequate publicity are also needed. In some developing countries, short bus lanes are provided to "educate" the road-user, prior to a continuous and more exterior reserved bus lane being introduced.

The introduction of bus lanes in Nottingham concluded that the overall saving in bus time due to the use of bus lanes was greater than that observed during the morning peak. While the saving in time during the evening peak per bus was one and a half to two minutes, no significant change from car to bus travel was observed.

A withflow bus lane may be placed on the nearside of the carriageway as shown in figure-1 although in certain circumstances, such as within gyratory systems or at approaches to traffic signals where a right turn or straight ahead movement is required, or in one-way streets, the offside might be more appropriate. Withflow bus lanes should be delineated by carriageway markings rather than a physical barrier. Before the introduction of bus lanes the following things should be considered:

i. their times of operation (i.e. peak-hour lanes may operate from 0700 AM to 1000 AM and/or from 0400 PM to 0700 PM . All day lanes may operate between 0700 AM to 0700 PM.

ii. their use by other traffic (e.g. cycle, taxi, coach and emergency vehicles).

iii. the signing of the bus lanes (i.e. for enforcement); and,

iv. the design of the bus lane (i.e. width and setback distance.

A comparative evaluation of expected benefits to buses against the cost of installation and any estimated disbenefits to other traffic may be undertaken along the following lines.

Bus lanes should be considered where they:

i. give a real advantage to buses;

ii. do not significantly reduce overall network capacity or cause congestion by inducing excessive queues;

iii. yield a net benefit to the community;

iv. have minimal adverse effects on road safety, frontages and on the adjacent environment; and,

v. may assist the flow of other traffic.

2.1.2 Bus Stop

It is defined as a single location between but not close to intersections well identified by signs and physical features. It often has some kind of refuge for passengers and in many cases an off-line bay (baylane) is provided to allow buses to stop without interrupting other traffic. In developed countries Bus Stops on opposite side of the same road are located tail to tail as shown in figure-2, as these are safer. The pedestrians using the stops tend to cross behind the buses where approaching vehicles on the same side of the road see them more clearly.

The two main components in road traffic in both developed and developing countires are buses and cars. They normally interact with each other and this intersection may result in problems of different nature and emphasis. The proportions in which each of these vehicle types appear on most urban roads depend on local conditions for example it is common to find a relatively low number of buses in most cities in the industrialized world this number is higher in Central Business Districts (CBDs) and the traffic behaviour of these buses may affect the overall efficiency of the transport network there. In contrast buses often appear in fairly high number in developing countires consisting more than 50% of the vehicles on some corridors.

Thus the problems generated in each of these typical situation will, of course be different; the best solutions to these will have to be specific to local conditions. For example there is a whole range of bus priority schemes that can be implemented to support and assist bus operations priority at the intersections, bus lanes, bus only links etc. These are good measures when the main problems is to protect buses from the congestion generated by other traffic. But at bus stops a good deal of the delay to bus passengers takes place, and seems to be caused by interference among buses rather than with other vehicles. These phenomena become increasingly complex and require solutions of increased sophistication.

Probably the most crucial element in the traffic efficiency of bus operations is the behaviour at stop. As bus creates a temporary pinch point, reducing the road capacity at the duration of stop which causes delay to the buses and other traffic also.

This delay can be minimised both to buses and other traffic if the buses are run schedulewise, keeping in view the presence of passengers at stops and the capacity of stops otherwise over saturation will occur at stops. In order to avoid excessive delays the drivers will start loading and unloading

passengers away from the designated stops area, even making use of adjacent lanes thus disturbing the whole traffic pattern and causing accidents. So the capacity of bus stop should be carefully determined and the drivers should be discouraged to stay for more time which result in over saturation of the stop by strict enforcement measures.

2.1.3 Schedule of PSV(4)

The revenue earning capacity of a passenger bus transport undertaking to a large extent is dependent upon a well planned time table adequately serving the passenger's requirements and eliminating the operations of unnecessary journeys. A time table is a schedule of timings indicated in a chronological order (using a 24 hours standard pattern) at which buses start from, or pass through or arrive at terminals or bus stops at a particular time check point or any other point or points on a route. The main requirement of every timetable is an indication in as clear and concise form as possible, so that the essential details of the routes operated are readily ascertainable. Obviously, therefore the time table is a handy reference for passengers.

A bus schedule is however the duty which a bus has to perform to conform with the timings in the time table. Thus if five buses are scheduled to perform all trips shown in a time table of a route or an inter-linked route, there will be five bus schedules. The same time table could be discharged by employing four buses with tight bus schedules and by over taxing buses or by employing six buses involving more capital, reduced bus utility and more manpower. Thus the schedule influences the efficiency with which the inputs to the bus service are utilized, i.e. buses, manpower etc ;and also influences the services provided to the customers, i.e. the attractiveness of the service in terms of frequency, timing convenience etc and hence the revenue generating ability of the service.

The art of scheduling bus services is to maximize utilization of equipment (hence maximizing revenue generation) and minimise "dead" mileage and eliminate wasteful mileage hence minimizing operating costs.

The earning capacity of a large bus company can be adversely affected if the bus schedules prove wasteful or unrealistic involving more drivers (or driving hours) and or overtaxing of a bus which increase maintenance costs. Therefore a schedule should be planned based on existing information and as well as the forecast information (forecasting should be realistic) as to reduce in both operating cost and capital cost.

Two points should be considered for designing a schedule.

1. the quality of service provided for the user.

2. the profit to the operator.

The quality of service as far as passenger is concerned as involving travel time, waiting time and comforts during the ride. The profit depends on the revenue and expenditure.

An essential feature of urban transport operation in particular is that it is very peaked in the morning and evening when a substantial portion of the total traffic is carried. During which hours the requirement of buses is more to respond to the demand whereas during the off peak hours that much buses or vehicles may not be needed so to over come this gap between demand and supply during peak and off peak hours a systematic and well planned withdrawal of vehicles should be exercised and also to ensure minimum disturbance to the regularity of headway during the transition between peak and off peak periods. Thus making the schedule for peak and off peak ensure smooth flow of traffic and efficient use of energy and labour whereas by keeping the schedule same for both these periods either the number of buses will be more than the demand in the off peak period or the number of buses will be less than the demand in the peak period thus causing inconvenience to the passengers and traffic and also causing more pollution and wasteful use of money and energy. Bunching of buses in any case may however be avoided.

2.2 CAPACITY OF ROAD (5)

2.2.1 Basic Capacity

It is the maximum number of passenger cars that can pass from a given point on a lane or roadway during one hour under the most nearly ideal roadway and traffic conditions that can possibly be attained.

It assumes that all vehicles travel at the same velocity and at the minimum spacing allowed by the average driver when trailing on other vehicle. Observed relations between vehicle spacing and velocity are shown in fig 1 for several roadway conditions. Basic capacities computed from these spacings are given in fig 2. Five conditions are assumed for the computation of basic capacity these are:-

a. There must be at least two lanes for the exclusive use of traffic travelling in one direction.

b. All vehicles must move at approximately the same speed which is governed by the slowest drivers and lies between 30 and 40 mph.

c. There must be practically no commercial vehicles.

d. The widths of traffic lanes, shoulders, and clearances to vertical obstructions beyond the edge of the traffic lane must be adequate.

e. There must be no restrictive sight distances, grades, improperly super elevated curves, intersections or interference by pedestrians.

2.2.2 Possible Capacity

Possible capacity is the maximum number of vehicles that can pass from a given point on a specific lane or roadway during one hour under the prevailing roadway conditions. It is less then basic capacity because it recognizes impairment in one or more of the five conditions assumed in establishing basic capacity.

2.2.3 Practical Capacity

It is the maximum number of vehicles that can pass from a given point on a lane or roadway during one hour without the traffic density being so great as to cause unreasonable delay hazard, or restrict on to the driver's freedom to maneouver under prevailing roadway and traffic conditions.

There are three methods for measuring delay and restrictions to drivers i.e. a. Speed range b. Passing opportunity to maintain a desired speed c. Operating speed.

All these methods depends upon volume of traffic and thus can be taken as measurement of congestion.

2.3 CONGESTION (5,9 AND 10)

When the traffic volume on a road reaches such that it drastically decrease the speed range (which is the difference between the highest and lowest speeds on a road) due to which the vehicles are closely spaced or density of vehicles increases for the same length of road which in turn decreases passing opportunity (the ratio of the number of passings required per kilometre of highway for drivers to maintain a desired speed to

the number of passings that they can actually perform) then that road is said to be congested. Thus the three factors of speed difference, passing opportunity and operating speed are all measures of congestion. Traffic congestion is the biggest challenge facing the transportation professional today. Congestion not only increases delays and travel time of passengers but is also a hazard to environment also because with the accumulation of vehicles the air is more pollouted with noise and fumes. Congestion also places significant social and economic costs on any society for example a survey in california (USA) revealed that over 300,000 work hours are lost to congestion every day at cost of over $ 2 million per day similarly in Washington D.C delays to commercial truck companies caused by urban congestion have been conservatively estimated at between $ 4 and $ 7 billion per year.

Research studies uptill now have revealed that five primary factors are responsible for traffic congestion they are:-

a. Increase in the home-to-work trips

b. High-density development along the roads

c. The rapid rate of sub-urban growth

d. Decrease in house holds rate

Any one or more of the above causes may result in traffic congestion. In the beginning in order to overcome congestion it was thought to build new roads or increase the width of existing roads. But inspite of high economic costs it did not solve the problem but rather resulted in increased traffic on roads that have been widened and thus the congestion problem remained.

This led to traffic management techniques and now efforts are underway to overcome congestion using the available roadwidth with the help of appropriate traffic management techniques.

2.4. ROAD SAFETY (11)

The safety of all road users is vital to the consideration of all urban road or traffic matters. Any thing that is perceived to have an adverse effect on safety has become and will remain an issue of public concern. As a consequence much attention is needed to the treatment of accident sites and to make public aware of road safety.

As an individual and as an organization we must continue to work to reduce the current number of injuries and fatalities on our roadway systems. The number of fatalities throughout the world currently exceeds 500,000 persons annually. In the USA alone there are 48,000 fatalities and 1.8 million injuries per year, totaling 65 billions in accident losses. Thus the pain suffering and economic loss from highway related accidents far exceeds the toll exacted in all the armed conflicts between the nations but it is painful that it is focus of very little public concern. Like war the roadway accidents predominantly claim our youth, before or during their most productive years, and thus rob nations of their most valuable resource the future building force. Therefore it is high time to take steps in overcoming the barriers standing in the way of a dramatic improvement in road safety. And as a professional of the field we should not accept the highway death and injury toll and should take action to convince the society of the gravity of traffic safety problem and to provide effective solutions to the problem.

2.4.1 Road Accidents (1,2 and 7)

Road Accidents consitute the most serious of all the social costs of transportation these not only cause vehicle damage but also some precious human lives and limbs are also lost in these every year. The number of people killed each year in Denmark is approximately 1200 whereas the figure in Great Britain reaches 8000 and in the United States is 50000 and in Pakistan is 4000. Whereas the number of injured is much more than the number of persons killed in the accidents. Many vehicles are partially or fully destroyed which is a great economic loss to the national resources. An effecient and systematic approach to accident prevention and mitigation is therefore clearly desirable.

Road users in general are exposed to greater risk in urban areas than elsewhere but these risks vary greatly with the mode of travel. Statistically pedestrians, cyclists and motorcyclists are more likely to become involved in accidents than other vehicle occupants per unit distance travelled and their injuries are more likely to be serious or fatal than the others. Young and elderly pedestrians and teenage cyclists and motorcyclists are particularly vulnerable. Therefore the prevention and mitigation measures become more essential and necessary in urban areas than in other areas. These measure include physical measures like improvements to lighting, signing or road layout and other measures such as education and publicity.

But before adopting any measure the particular spots the reason causing accidents in that area should be dug out to know

whether accidents happen due to fault in geometric design or some other fault and then in accordance with that the preventive measure be adopted.

2.4.2 Pedestrian Safety (1)

All road users are pedestrians for one or more stages of every journey. Shorter distance journeys are likely to be made on foot and over 60% of journeys under 1.5 Kms long are made solely on foot but pedestrians journey rarely exceed 3 Kms for most trip purposes. In urban area about one third of all journeys are made entirely on foot.

Pedestrians, particularly the young and elderly, are the most vulnerable group of road users. It is essential to consider their needs within the transport system to give them equal and sometimes greater consideration with other road users and to plan accordingly.

At major bus stops where vehicles for different routes ply on both sides of the road. The majority of pedestrian movement is local in nature and takes place for crossing the road to shift from one route vehicle plying in one direction to another vehicle on the other side of the road plying on a different route. It therefore follows that the problem of Pedestrian/Vehicle conflict must be an important consideration in such a situation in highway design and traffic management. So attention needs to be paid to minimizing risk and providing facilities for pedestrians which are primarily safe, convenient and pleasent to use. Thus it establishes that a pedestrian crossing at such places should be provided. There are different formal pedestrian crossings may be seen in figures-3 and 4.

Now to justify a particular formal pedestrian crossing the formula PV^2 recommended by the department of transport U.K. is used (Reference Roads and Traffic in Urban Areas by the Institution of Highways and Transportation with the department of Transport) where P=Number of pedestrian/hour across a 100 m length of the road and V=the Number of vehicles in both directions (vehicles/hour).

The value of PV^2 should be the average over the four busiest hours of the day and a formal crossing is generally justified when PV^2 is greater than 10^8. The values for justification of a formal pedestrian crossing is given in the table No.14.

2.4.3 Traffic Signs (5)

The most common device for warning, regulating and informing drivers is the traffic sign. Although signs are not needed to confirm the driver's knowledge of the recognized rules of the road, they are essential wherever special regulations apply or where directions or notice of approaching hazards must be communicated to the driver.

Permanent signs are commonly of metal protected by a rust resistant coating, although waterproof plywood and wooden boards are sometimes employed. Bolts, screws, and fittings must be non-corrosive to avoid discoloration. Signs having significance at night must be illuminated or reflectorized. Illumination may be by lights in or behind the sign or by independently mounted flood lights and reflectorization is by reflector buttons, strips of polished metal and paint containing glass beads.

Sign positioning depends on the purpose of the sign and the circumstances peculiar to each location.

2.4.4 Parking Controls

Parking controls bring in a number of benefits: a reduction in accidents, an increase in the road capacity which is available for use, preservation of the environment and so on. As regards parking the relative issue to examine is how closely do parking controls relate to road use in congested conditions. As far as regular users who make short trips for businesses are concerned, the number of parking occasions may well correlate highly with road use. But this may not be the case with those who park vehicles for a long duration but less frequently. Thus it would appear that encouragement of short term parking and restriction of road use are to some extent suitably contradictory objectives. Difficulty will also be caused in respect of residents, since they may park for long periods when not contributing at all to congestion at critical times of the day. Other differences are that with some systems of parking control, through traffic, taxis and public transport vehicles will not be influenced. It is because of these drawbacks in the system that parking control cannot be the final answer to traffic restraint.

2.4.5 Lane and Road Markings

Clear and efficient signing is an essential part of highway and traffic engineering and a road with poor signing or with badly maintained signs is an unsatisfactory road. Road-users depend on signing for information and guidance; highway authorities depend on signing for the efficient working and the subsequent enforcement of traffic regulations, for traffic

control, and as an aid to road safety. Signing includes not only signs on posts but also carriageway markings, beacons, studs, ballards, traffic signals and other devices.

Signs must give road users their message clearly and at the correct time. The message must not be ambiguous and must be speedily understood; it must be given not too soon for the information to have been forgotten before it is needed, and not too late for the safe performance of consequent manoeuvres.

The types of signs and carriageway markings, available for use are prescribed by Regulations. Limiting the number of types of signs available assists in their quick recognition as does for any particular category of sign, uniformity of shape, colour and border. It also makes available to highway authorities a set of standard signs and saves them the labour of design. It aids the courts in giving the same meaning to standard signs. Quick recognition is further aided by using different shapes and colours for different sign groups, e.g. warning signs are triangular with black symbols, white background and red borders.

Uniformity of signs is not however enough, uniformity in use is a desirable objective. For instance, warning signs sited at different distances from their hazards in different places could confuse a road user accustomed to only one district.

To obtain the fullest benefits of uniformity there must not only be uniformity of signs but also uniformity in their use, in their siting and their illumination.

2.5 TRAFFIC SURVEYS (6)

Collection of information regarding any thing is called survey whereas collection of information that is concerned with the planning, design and operation of all devices that aid the flow of traffic are termed as traffic surveys. Among these come all the elements of traffic engineering from geometric design to the record of vehicle flow, accidents and parking facilities.

In 1930, in USA when the initial improvement of main rural roads had established definite flows of motor traffic, it became increasingly apparent that future growth of the country's highway transportation system should be on scientific rather than on haphazard basis. From the data at hand that time it was unanswerable to decide which road to be constructed or improved first and how to make long term planning. This led to the conduction of different surveys like volume count etc. With the passage of time new problems like congestion, parking etc were

realized for which new survey and new techniques for collection of new type of data were adopted. An example of it will be origin and destination survey etc.

2.6 EDUCATION (5)

Road accidents involve, and are inevetiably caused by the people who use the road system, which may be any member of a society. It has been found that road user error is a factor in about 95% of road accidents. So to reduce accident rate it is a good way to educate the people the rules of traffic aiming at the safety of the people.

Education and training programmes mounted at both local and national level should aim to raise the level of understanding and skills of road users and assist in improving attitudes and behaviours. Although a relationship between such programmes and accident reduction is not easily demonstrated it does not detract from their value but underlies the need to ensure that the programmes are well defined and effectively presented.

Publicity programmes should complement traffic engineering measures aimed at accident reduction and should be designed to achieve specific objectives in terms of improved behaviour knowledge or attitudes for specific target groups (e.g. children pedestrians, drivers, etc). Priority objectives and target groups should be determined by rigorous accident analysis. Ideally this should be supplemented by collecting and analysing road user behaviour, knowledge and attitude data, reviewing past experience about the effectiveness of different types of programmes.

2.7. ENFORCEMENT (3)

When we design a traffic controlling scheme or make a certain regulation in order to ensure smooth flow of traffic, it will be fruitful only and only if it is enforced in merit and spirit by the law enforcing agencies otherwise how perfect a traffic controlling scheme or law is, it will not give the desired results if not properly implemented or enforced. This shows how essential the enforcement is in the art of traffic. As without enforcement all the engineering and management measures become meaningless. The Police all over the world feels that there are too many unconvicted road-traffic offenders. However, there is a wide variation in effectiveness of enforcement. For example, the level of enforcement of simple parking restrictions is quite effective in developed countries whereas it hardly exists in most developing countries. It is only at selected

places in the UK that one finds extensive parking in blatant defence of the resulations, whereas in Pakistan almost everywhere parking on the road prevails. Similarly the enforcement techniques and tools vary between the developed countries and developing countries. However developing countries can learn from the developed countries in terms of centralization of police traffic controls of introducing more upto date signal equipment and of introducing more durable road markings, particulary using thermoplastic paint.

CHAPTER - III

FIELD SURVEYS AND DATA ANALYSIS

3.1 INTRODUCTION

To design a proper traffic management scheme for mitigation of traffic congestion at Faizabad Bus Stop, the prevailing situation of traffic flow was observed keenly in order to find out various hinderances (physical or behavioural) occured in smooth flow of traffic few pilot surveys were make. But to materialiaze this plan and to verify the extent of observations it was sought to carry out some traffic surveys.

3.2 PILOT SURVEYS AND THEIR CONCLUSIONS.

In view of the observations the following surveys were suggested :

a. Passenger Origin and Destination Survey (PODS).

b. Passenger Embarkation and Disembarkation Survey (PEDS).

c. Vehicle Waiting Time Survey (VWTS).

d. Classified vehicle Counting Survey (CVCS).

Before commencement of these surveys their Questionnaires were developed. In order to test these Questionnaires in the field, these surveys were carried out on the pilot basis between 07:30 Hrs and 08:30 Hrs. Each survey was conducted for fifteen minutes only. All four surveys were carried out in both directions of the road (Islamabad and Rawalpindi bounds stops).

In the light of pilot surveys the Questionnairs were modified and their shortcomings were removed and the results for origin and Destination Survey was finalized. Some conclusions were also made.

3.2.1 Passenger Origin and Destination Survey (PODS)

This survey was conducted for 15 minutes in the pilot phase of the surveys. In this survey both the embarked and disembarked passengers of the Buses, Wagons and Suzuki Pickups were interviewed to ask about their Origin and Destination. The four places of Origin and Destination were designated as Islamabad, Rawalpindi, Pirvadhai and Outside the city. During the survey a total of 52 embarked and 47 disembarked passengers were interviewed of the above three modes (Tables 1 and 2). Out of total embarked passengers 46.2% were of the Buses, 17.3% were of the Wagons and 36.5% were of the Suzuki Pickups. Out of total

embarked Bus passengers 33.3% were of the origin Rawalpindi, 58.3% were of the origin Privadhai and 8.4% were of the origin outside the city. Out of total embarked Wagon passengers 88.9% were of the origin Rawalpindi and only 11.1% were of the origin Pirvadhai. Similarly the origin of the 100% embarked Suzuki Pickup passengers was Rawalpindi. The destinations of 100% embarked passengers from all the modes was Islamabad. Similarly out of total disembarked passengers 40.4% were of the Buses, 19.2% were of the Wagons and 40.4% were of the Suzuki Pickups. The origin of 40.4% Bus passengers, 19.2% Wagon Passengers and 21.2% Suzuki Pickup passengers was Rawalpindi. Whereas the origin of 99.2% Suzuki Pickup passengers was Islamabad. Out of total disembarked Bus passengers 57.9% were of Islamabad destination, 26.3% were of Pirvadhai destination and 15.8% were outside the city destination. Out of total disembarked Wagon passengers 66.7% were of Islamabad destination and 33.3% were of Pirvadhai destination. Similarly destinationwise the disembarked passengers from Suzuki Pickups were as 15.8% to Islamabad, 10.5% to Rawalpindi, 52.6% to Pirvadhai and 21.1% to outside city.

3.2.2 Conclusions From Pilot Surveys

a. The places of Origin and Destination of the passengers those who use this Bus Stop have been determined and it was decided to drop the PODS.

b. The vehicles type which actually pass from Faizabad should be considered and counted and the vehicle type which was not recorded in the pilot survey such vehicle did not include in vehicle counting survey Questionnaire.

c. The passenger embarkation and disembarkation survey should be carried out in such a manner that alongwith counting the number of embarked and disembarked passengers their respective time of embarkation and disembarkation should also be noted.

d. In order to have a clear picture of the congestion at the stop the vehicles accumulation survey should also be carried out for the peak hours.

e. Also to know the number of pedestrians crossing the road. A pedestrian count survey should also be carried out.

f. The accidents data for the last three years may be collected to determine the risk involve in crossing the road by the pedestrians.

On the basis of conclusions of the pilot surveys the following field surveys were suggested :

1. Classified Vehicle Counting Survey (CVCS)

2. Vehicle Waiting Time Survey (VWTS)

3. Passenger Embarkation and Disembarkation time Survey (PEDTS)

4. Vehicle Accumulation Survey (VAS)

5. Pedestrian Crossing Count Survey (PCCS)

In order to observe the actual situation of congestion during peak hours traffic, it was decided that only three field surveys mentioned above at S.No. 1,2 and 3 may be carried out for one day each for three hours in the morning (between 0630 and 0930 Hrs) and three hours in the evening (between 1700 and 2000 Hrs) and the survey at Sr.No.4 and 5 may be carried out for peak hours only between 0800 and 0900 Hrs in the morning and between 1700 and 1800 Hrs in the evening.

The above mentioned five surveys were carried out according to the questionnaires annexed at annexure III. For these surveys the vehicles those to be taken into account and the actual number of survey staff required for each survey is given as under :

Sr.No	Field Survey	Types of Vehicle	Required Staff
01.	C V C S	Bus, Wagon, Suzuki Pickup, Taxi, Motor Cycle, Car/Jeep, Pickup, Truck and Flying Coach	06
02.	V W T S	Bus, Wagon, Suzuki Pickup and Taxi	10
03.	P E D T S	Bus, Wagon, and Suzuki Pickup	12
04.	V A S	Bus, Wagon, Car, Taxi and Suzuki Pickup	06
05.	P C C S	Padestrians (age-wise)	08

But due to non availability of the required number of staff, these surveys had to be carried out with the help of four field surveyors only and one person which could cover one mode only had to cover two to three modes. Therefore a little percentage of vehicles may have been missed by these surveyors due to the extra work they were covering in the absence of required number of staff. So a slight descripancy may have occured during data collection.

3.3 QUESTIONNAIRES

Although there are five types of Questionnaire but justification of the CVCS, VWTS and PEDS Questionnaires is enough.

The first questionnaire of CVCS is for Classified Vehicle Counting and is very simple in which each vehicle type is written in the space against vehicle and in the space below each type vehicle its number is recorded with respect to time and thus classified numbers of each vehicle and the total number of vehicles can be calculated very easily.

The second questionnaire of VWTS is about vehicle waiting time survey in which the first column is for noting the registration number and the second for noting the entering or leaving time. The purpose of noting the registration number is that to identify a vehicle with respect to its leaving or entering time in the bus stop area and thus to determine its total time of stay at the stop.

The third questionnaire of PEDS is for Passengers embarkation/ disembarkation time survey in which the first columns is to know the number of embarked and disembarked passengers and the second column is to note time taken by passengers for embarkation/ disembarkation.

3.4 METHODOLOGY OF FIELD SURVEYS

The methodology adopted for field surveys was as under :

a. The questionnaires of the field surveys were discussed and their pros and cons were clarified.

b. All the survey staff including team leader was briefed about the field surveys procedure, that how to carry out these surveys and how to tackle difficulties which may occur in their way in the field.

c. Before the commencement of these surveys the required things were arranged and for the evening hour's survey the lighting arrangement was made.

3.5 DATA ANALYSIS OF FIELD SURVEYS

The details of data analysis are given as under:-

3.5.1 Classified Vehicle Counting Survey

Classified vehicle counting survey was carried out from 0630 to 0930 Hrs in the morning and from 1700 to 2000 Hrs in the evening. In the pilot phase of this survey all types of vehicle were taken into account but it was determined that only Bus, Wagons, Suzuki Pickups, Flying Coaches, Taxis, Car/Jeeps, Trucks and Motorcycles mainly ply on this route so only these types of vehicle were taken into account. This survey was performed with an interval of fifteen minutes at Islamabad Doual Stop only. In the morning hours a total of 3863 vehicles were counted and in the evening hours a total of 3077 vehicles were counted. The classified number and percentage of all the above mentioned types of vehicles both for morning & evening hours are given in the table No.3. A graph between total number of vehicles verses hourly time interval of 15 minutes has been plotted (may be seen in figures-5 and 6). Peak hours has been determined from 0800 to 0900 Hrs in the morning and from 1700 to 1800 Hrs in the evening respectively. Also the figures-7 and 8, are showing the percentage of the classified vehicles both for the morning and evening hours. As per graph the dominant mode as in all the motorized communities both for the morning and evening hours was determined as motor car. Whereas over all, the number of vehicles were more in the morning hours then in the evening hours because in the morning hour people used to go for Work, Business, Shopping etc.

3.5.2. Vehicle Waiting Time Survey

Vehicle waiting time survey was performed for Buses, Wagons, Suzuki Pickups and Taxis which are the main public transport vehicles and ply over this route for different destinations. This survey was also carried out with an interval of 15 minutes. During this survey the leaving and entering time alongwith the registration numbers of all the above mentioned types of vehicle were noted and then compared by their registration number in the office and thus the difference between leaving and entering time of a particular vehicle gave us the total time of stay of that vehicle at the stop. Then the total number of these vehicles were grouped together according to their time of stay at the stop i.e. 1 minute, 2 minutes, 3 minutes etc and finally brought to the tabular form as shown in the tables No.4,5,6 & 7 respectively.

During this survey the time was watched for a total of 406 and 357 Wagons, 233 and 217 Taxis, 203 and 105 Buses and 62 and 71 Suzuki Pickups in the morning hours and evening hours respectively and thus determined their time of stay at the stop. The number of vehicles for which the time of stay at the stop was determined 68% and 75% of Wagons, 60% and 94% Buses , 32% and 28% of Suzuki Pickups and 61% and 83% of Taxis in morning and evening hours respectively from the CVCS in these hours. This percentage is quite satisfactory to know the time of stay of all above mentioned types of vehicle. The percentage of Buses, Wagons, Suzuki Pickups and Taxis alongwith waiting time in minutes are given in the tables 4,5,6 and 7 respectively.

Table No.4 shows that waiting time for the buses was grouped from 1 minute to 20 minutes in which 16.75%, 9.36% and 12.31% of the Buses waited for 2,3, and 6 minutes respectively in the morning hours whereas in the evening hours, 23.73%, 17.8% and 11.86% of Buses waited for 2, 3 and 4 minutes respectively.

Table No.5 shows that waiting time for the wagons was grouped from 1 minutes to 11 and above minutes, in which 1,2 and 3 minutes waiting time was for 75.12%, 8.13% and 5.17% of wagons in the morning hours (0630 to 0930 hours) and 23.05%, 19.05% and 15.97% of wagon in the evening hours (1700 to 2000 hours) respectively.

Table No. 6 shows that waiting time for Suzuki Pickups was grouped from 1 to 15 and above minutes in which 1,2 and 3 minutes waiting time was for 15.52%, 24.20% and 17.74% Suzuki Pickups in the morning hours (0630 to 0930 hours) and 40.85%, 15.50% and 4.22% of Suzuki Pickups in the evening hours (1700 to 2000 hours) respectively.

Table No.7 shows that waiting time for the Taxis was grouped from 1 to 10 and above minutes in which 1,2 and 3 minutes waiting time was noted for 67.81%, 15.02% and 3.43% of Taxis in the morning hours and 58.53%, 13.82% and 7.84% of Taxis in the evening hours respectively.

It is evident from results shown in the tables No.4,5,6 and 7 that the above percentages of vehicles with respect to 1 to 3 minutes clearly shows that 30% of all the four types of public service transport vehicles stay at the stop for more than 3 minutes, rather upto 20 minutes for Buses, 10 minutes for Wagons, 15 minutes for Suzuki Pickups and 10 minutes for Taxis which is too much. Thus the lengthy stay of these vehicles at the stop causes much trouble to the other incoming vehicles.

3.5.3. Passenger Embarkation and Disembarkation Time Survey

This survey was carried out for Wagons and Buses from 0630 hrs to 0930 hrs in the morning and from 1700 to 2000 hrs in the evening with an interval of 15 minutes. The results are shown in table Nos.8,9,10,11 and 12 respectively. This survey was conducted for Suzuki Pickup in the morning hours only as the rush of Suzuki Pickup passengers is not worth mentioning. In the morning hours a total of 253 embarked passengers were counted of 64 Buses with their time of embarkation and 837 disembarked passengers with their time of disembarkation of 95 buses and in the evening hours a total of 88 embarked passengers with their time of embarkation were counted of 25 buses and similarly a total of 927 disembarked passengers with their time of disembarkation of 79 buses were counted. Similarly in morning hours a total of 358 embarked passengers of 119 wagons and 303 disembarked passengers of 104 wagons with their time of embarkation and disembarkation were counted. The corresponding numbers of these vehicles in the vehicle counting was 339 buses and 598 wagons in the morning hours and 112 buses and 474 wagons in the evening hours thus for 30% and 70% of the buses and 28% and 26% of wagons the number of embarked and disembarked passengers and time of embarkation and disembarkation was counted respectively in the morning and evening hours which is a sufficient percentage for sampling. For the Suzuki Pickups a total of 270 embarked passengers for 39 vehicles and 205 disembarked passengers for 23 vehicles were counted alongwith their respective time of embarkation and disembarkation in the morning hours only. The number of Suzuki Pickup in the morning was 198 from the vehicle counting survey thus 20% Suzuki Pickups were covered in the passenger embarkation and disembarkation time survey. From the above mentioned figures the average time of embarkation comes out to be 2 second per bus passenger, 3 seconds per wagon passenger and 4.5 second per Suzuki Pickup passenger whereas the average disembarkation time comes out to be 1.8 second per bus passengers, 3.2 seconds per wagon passenger and 2.5 seconds per Suzuki Pickup passenger.

The times of embarkation and disembarkation clearly establish that the vehicles need a stay at the stop only for two to three minutes to pick and drop the passengers and the extra stay beyond this time is unnecessary and causes hinderence to the through traffic which should be discourged.

3.5.4 Vehicle Accumulation Survey

Vehicle Accumulation Survey was carried for the peak hours only from (0800 to 0900 Hrs) in the morning and from (1700 to 1800 Hrs) in the evening. This survey was carried out with an interval of 5 minutes. In this survey the number of Buses, Wagons, Taxis and Suzuki Pickups which occupy the stop was noted as given in a table No.13. This clearly shows that half of the road way width is occupied by these stationary vehicles and only half of the roadway width is left for passing the through traffic as such huge accumulation result in double parking.

Table No.13 shows that during morning time maximum 36 vehicles were found parked from 0805 to 0810 Hrs and during evening time maximum 27 Vehicles were found parked from 1715 Hrs to 1720 Hrs at the stop.

3.5.5. Pedestrian Crossing Count Survey :

This survey was conducted on a later date after the other surveys. This was carried out only for the peak hours between 0800 and 0900 hours in the morning and from 1700 to 1800 hours in the evening for a 100 meter length of road adjacent to the stop area.

In this survey two teams comprising of two person each were made. Each team was counting in a 50 meter length of road the number of pedestrian crossing the road with respect to their ages from Rawalpindi bound stop to Islamabad bound stop and from Islamabad bound stop to Rawalpindi bound stop as have been designated in the survey questionnaire. As this survey was carried-out for a 100 meter length of road, thus four persons satisfactorilly conducted this. During this survey a total number of 2155 passengers and 2138 were counted in the morning and evening peak hours respectively and their classified number (age-wsie) and percentages are given in table No.14.

It is evident from the results shown in the table No.14 that pedestrian crossing flow is more in the morning as compared to the evening. To suggest what type of pedestrian crossing may be proposed the formula is used as PV^2. By comparing the results of PV^2 through the values given in the table No.15. Then the type of pedestrian crossing can be proposed.

In near future at Faizabad intersection the fly over would be constructed by the CDA and atleast 25 square acres of land would be acquired by the CDA. During construction a little portion of the Murree Road at Faizabad Bus Stop would be occupied. Hence the Bus, Wagon and Suzuki-Pickup stops have been proposed near to the Survey of Pakistan Office. The Taxis/Rickshaws would also be allowed to stay near to the place of Bus, Wagon and Suzuki-Pickup stop to pick and drop for the passengers for a limited time.

3.6 ACCIDENTS DATA

Faizabad Bus Stop area comes under the jurisdication of two police stations i.e. Sadiq Abad Police Station and New Town Police station. The accidents data for the last three years i.e. from January 1990 to December, 1992 was obtained from these stations. The total number of accidents and their year-wise distribution may be seen in table No.16. The accidents record show that most of the accidents i.e. 18.18% occur in the months of June and December respectively. Out of the total number of accidents in the study area the highest accidents were 44.45% of vehicle to pedestrians. The second highest were 33.33% of vehicle to vehicle. Next to them were 11.11% of vehicle to motorcycles and also 11.11% of vehicle to bicycles. These accidents involve not only vehicle damage but also casualties from minor injries and serious injuries to fatalities.

From the above figures it is clear that almost 45% of the accidents involve pedestrian which clearly establishes that the pedestrians are at high risk at this place. This phenomena has also been observed that due to congestion all the drivers try to pass from here quickly fearing to be delayed therefore run their vehicles with extra speed and the pedestrian also try to cross the road quickly which is frustrated by high vehicular flow and thus lead to accidents.

In the end it is also worth mentioning that the record of accidents is invariablly under stated as many vehicle owners involved in the accidents do not register the case with the police but settle it mutually on site in order to avoid the lengthy legal procedures.

CHAPTER - IV

PROPOSED TRAFFIC MANAGEMENT SCHEME

4.1 INTRODUCTION

The aim of this case study is to enssure steady and smooth flow of traffic at Faizabad Bus Stop on Murree Road based on the low cost traffic management techniques, rather than doing any major changes in the infrastructure.

The traffic congestion at Faizabad Bus Stop on Murree Road occures due to poor behaviour of the road users, lack of road signs, lack of proper lane and road markings, the mis-match of signal time settings at the intersection very close to the Bus Stop and the lack of pedestrian facilities (e.g. pedestrian zebra crossings, sheltered bus stops, pedestrian guard rails etc.).

On the basis of the results obtained from the data analysis the traffic management scheme has been designed to overcome some of the existing problems by using appropriate traffic management techniques as given below:

(a). to provide proper lane markings;
(b). to provide road markings in general;
(c). to provide stop lines and give-way lines at the pedestrian crossings;
(d). to install proper standard road signs;
(e). to restrict on-road parking;
(f). to designate proper bus stops and bus bays;
(g). to provide pedestrian (zebra/signalised) crossings;
(h). to install and maintain guard rails at the footpath and medians where they are necessary;
(i). to fix the Cat eyes very close to pedestrian crossings at the stop line;
(j). to rebuild broken footpaths;
(k). to maintain and ensure 8 ft width of footpaths throughout;
(l). to install and maintain street lights;
(m). to close the illegal side streets where appropriate;
(n). to check & restrict loading and unloading of the goods vehicles during peak periods; in the Bus stop area (i.e. between Survey of Pakistan Office and intersection at Khyban-e-Sirsyed Road and Murree Road as shown in Annexure-I)
(o) to train the staff of the traffic police for proper enforcement of the existing traffic rules and also to educate the road-user.

4.2 PROPOSED SCHEME

According to the existing traffic conditions, the objectives of this study have been carefully considered and the low cost traffic management scheme is proposed to relieve traffic congestion at the Bus Stop area. This scheme is based on the following low cost traffic management techniques:-

4.2.1 Removal of the Encroachments

At Faizabad Bus Stop the much needed right of way and footpaths have been encroached and are being used for business purposes may be seen in photographs (Plate No.5,6,7,8 and 9). These encroachments are either of permanent nature or temporary nature as shown in the original layout plan at annexure-I. These encroachments are a big impediment in the smooth flow of pedestrian as well as vehicular traffic on the road and therefore must be removed.

4.2.2. Construction and Maintenance of Foothpaths.

Apart from encroachment of the footpaths at Faizabad, these have not been properly maintained by the concerned authorities. Due to this the pedestrian use the roadway for their movement which not only result in increased accidents (refer to accident data where percentage of pedestrian in accidents is extremly high) but also causes reduction in roadway width for smooth running of traffic. It is, therefore, suggested that a 8 feet wide footpath free from any sort of encroachment should be provided and maintained regularly as shown in the improved lay out plan. The ramps should be provided where they are needed/necessary.

4.2.3. Lane/Road markings.

There is no lane marking on the road at Faizabad at all. So there is a need to employ stripes to delineate roadway centre lines, lane boundaries, no passing zones, pavement edges, stop lines etc at various locations as shown in the improved layout plan Annexure-II.

4.2.4 Exclusive with flow Bus Lanes.

An exclusive with flow bus lane atleast of 200 ft at the stop area may be provided on both sides (i.e. east and west sides) of the major road (Murree Road) at Faizabad as shown in the improved layout plan (Annexure-II), if it is possible that its enforcement is likely and that the law permits such a development. The bus lane would be beneficial, it would:

(a). reduce delays and queues;
(b). reduce journey times by bus (and by private transport);
(c). reduce accidents;
(d). reduce conflict as buses pull out from the main traffic flow;
(e). maximise the use of the carriageway width for other vehicles; and
(f). promote public transport.

4.2.5. Bus, Wagon, Suzuki Pickup and Taxi/Rickshaw Stops.

An effective traffic management scheme puts emphasis on proper place for stoping of PSVs. So for proper embarkation & disembarkation of the passengers at the stop could be taken place. Hence the places have been designated for the stops for two buses, two wagons, three Suzuki-pickups and a stand for the taxi/rickshaw off side the road at Islamabad and Rawalpindi bound stops to reduce hurdle in smoother flow of through traffic as shown in the improved lay out plan. The dimensions taken for buses, wagons and suzuki pickups stop places are 30' x 10', 15'x 8' and 10'x 6' respectively. These places have been augmented by an appropriate gap between each bus, and each wagon for over taking maneuvers.

4.2.6 Buse/Wagon/Suzuki-Pickup/Taxi/Rickshaw/Stop Signs Boards.

The stop signs of each of these types of vehicles should be installed to guide the in coming the concerning driver where he has to stop his vehicle. Also the place designated for Bus/Suzuki-Pickup/ Wagon/Taxi/Rickshaw should be properly marked with a capital word as shown by B for bus stop, W for Wagon stop and S for Suzuki Pickup stop as shown in the improved layout plan at Annexure-IV.

4.2.7 Installation of Traffic Signs.

All the required traffic signs as suggested in the scheme should be properly installed at the suitable locations in order to give direction or warning to a driver who come on the road according to the demand of situation e.g. no parking, pedestrian crossing, stop signs etc.

4.2.8 Installation of Time Schedules

A time schedule for each type of PSV as proposed in the traffic management scheme should be exhibited on a board installed with respective stop line. These schedules should clearly indicate duration of stay of that vehicle at the stop with bold letters.

4.2.9. Provision of Pedestrian Zebra Crossing.

The 10 feet wide left bound staggered Zebra crossing should be properly marked on the roadway to provide the pedestrian a safe place for crossing the road. This Zebra crossing would be in the form of alternate white lines having a black road surface between them. The location of this would be between the two stops in the opposite direction as shown in the improved layout plan at Annexure-IV.

4.2.10. Installation of Pedestrian Guard Rails & Fences

The purpose of providing Pedestrian Guard Rails and Fences is to prevent Pedestrian coming on the road except at the specified locations as shown in the improved layout plan and thus to habituate the people to use the proper crossing places to cross the road. These guard rails would be of steel bars of four feet high from the footpath level installed at its edge and of six feet high fences at the median from the Survey of Pakistan Office to the intersection near Khayaban-i-Sir Syed road.

4.2.11. Installation of Beacons

At night time the traffic signs and pedestrian crossing the road etc are not clearly visible to the drivers so becaons are recommended to avoid any mishap involving pedestrians.

4.2.12. Fixation of Cat-eyes.

Zebra crossings and road way markings are not fully visible at night time as the drivers visibility is poor even with the installation of the beacons and so in order to avoid any untoward incident at night the cat eyes are recommended to be installed at the stop lines near to zebra crossing on both sides of the road to illuminate these things properly.

4.2.13. Installation of Light Posts

Light posts at the Bus Stop make visible Public Service Vehicles in the night to the passengers and vice versa. So the light posts may be installed at the Islamabad bound and Rawalpindi bound Bus Stop as shown in the improved layout plan (Annex-IV). The regular maintenance of the light posts is necessary.

4.2.14. Restriction On-Road Parking

The volume of traffic in the study area is so high. Hence on-road parking should be strictly probibited in both directions and for this purpose no parking boards in 200 meter length from the stop lines on both sides of the road should be installed and also it should be strictly enforced between 0700 and 1000 Hrs in the morning and also between 1730 Hrs and 2030 Hrs in the evening.

4.2.15 Education

All above mentioned measures at first instance for a period of one month after the installation and execution work should be taught to the road users at Faizabad by traffic police and also with the help of media. Hence publicity for this scheme may be done properly to educate and train the road users for implementing this scheme to give the required benefits. Specially the drivers of PSVs should be made aware of time schedules and pedestrian may be asked to cross the road at a proper place etc.

4.2.16. Enforcement.

After the education or publicity period, strict measure should be taken by the enforcement personnels in the form of issuing challans to the drivers, cancellation of route permits and other road penalty measures to the road users. As enforcement is the essence of success for this scheme.

4.3 COSTS AND BENEFITS OF THE SCHEME

The costs and benefits of the scheme are described below :-

4.3.1 Costs of the Scheme

The proposed scheme is based on the estimated cost of Rs. 0.8 million and its main components are given in Table No. 17 which are self explanatory. As installation of the guard rail is a main item of expenditure of the scheme, so it is necessary to explain here that a total amount of Rs 0.35 million (including installation/ polishing charges) would be incurred on it. The guard rail of 200 ft in length would be installed at the footpath on both sides of the road for which 3200 Kilograms(Kgs) steel of "1/2" inch diameter (dia) is required and the guard rail of 500 ft in length would be installed at the median for which 9600 Kgs steel of "1" inch dia is required.

The bulk costs of Rs. 0.8 million would be incurred in the first financial year while introducing the scheme. After completion of the scheme, the annual recurring cost of the scheme would be Rs. 75,000/= as estimated in the table No.17 below :-

4.3.2 Financial Benefits

The facility of the off street car parking in the Scheme would provide parking spaces for 30 vehicles (i.e. 10 spaces for long and 20 spaces for small vehicles). The Car Park will be run by the concerned authorities for 12 hours (i.e. 08.00 AM to 08.00 PM) a day for 300 working days in a year and it is expected that there will be a turn out of 15 vehicles per hour and each would be charged parking fees @ Rs 5/= per trip. Hence the annual revenue earned from the Car Park would be Rs 270,000 (12x300x15x15). The parking will be free of charge between 08.00 PM to 08.00 AM.

The cash-flow at Table No.18 shows that after meeting the recurring cost of Rs 75,000/- per annum the total capital cost of the project would be fully recovered within 5 years.

4.3.3 Economic Benefits

Following are the different types of public and private transport vehicles having different seating capacity which ply on the route :-

i.	Government owned buses	65 seats
ii.	Privately owned buses	45 seats
iii.	Minibuses	26 seats
iv.	Wagons (Paratransit)	14 seats

The Economic Benefits of the Scheme with regard to this traffic would be in terms of :-

a) Savings in Vehicle Operating Costs; and
b) Savings in Time

Each of these benefits are briefly described below :-

4.3.3.1 Savings in Vehicle Operating Costs (VOCs)

The scheme would improve the operating speed by 10 Km/hr (i.e. from 30 to 40 Km/hr) in the study area over a distance of one kilometer (i.e 0.5 km on each side). Hence the VOCs would decrease due to increase in speed of 10 Km/hr for different types of vehicle (13).

After improving the study area, it is important to mention that beside reduction in VOCs the reduction in traffic congestion on the road will also takes place to the extent of 10-20% over a distance of one kilometer. It is evident from table No. 19 that the savings in VOCs per annum would be Rs 1.311 million.

Hence, reduction in congestion will also reduce the fuel consumption of the vehicles upto certain extent. However, the same has not been estimated because of limited scope of the Study.

4.3.3.2 Savings in Time

The time savings of the Bus, Wagon and Car occupants have been valued at the non working time rates as given below (14) :-

Time Cost per hour for a Bus Occupant is Rs. 4.00
Time Cost per hour for a Wagon Occupant is Rs. 5.00
Time Cost per hour for a Car Occupant is Rs.10.00

It is evident from the table No 20 that the Economic benefits per annum from this scheme in terms of time savings would be Rs 8.85 million. Values have been estimated for 5 minutes time savings per occupant for one year (i.e. 300 days) of operation of the scheme after its implementation for peak hour traffic. Changes have been proposed for the expected flow of traffic for 5 years.

In addition to the above benifits, there will also benifits to other road users like Taxi, Rickshaw, Motorcyist, etc.

4.3.4 Conclusions

The scheme envisages to improve the traffic flow at the Faizabad Bus Stop on Murree Road. The preceding discussion clearly shows that annual financial benefits of Rs 0.27 million will not only meet the operation and maintenance cost of Rs 75,000/= per year but the net savings will also recover the entire capital cost of Rs 0.8 million within a period of 5 years. In addition to direct financial benefits there are significant annual economic benefits in terms of saving in VOCs (to the extent of Rs 1.311 million per year) and savings in time would be Rs 8.85 million to the occupants of cars, wagons and buses plying on this route. Thus the Scheme stands justified both on financial and economic grounds.

CHAPTER - V

CONCLUSIONS AND RECOMMENDATION

Faizabad Bus Stop is located near such an intersection where a fairly high number of passengers come from Pirvadhai Rawalpindi, Lahore-Rawalpindi routes either to go to Rawalpindi or Islamabad, so there is always rush of passengers as well as vehicles. Moreover there is no well defined stop where incoming vehicles can stop properly to pick and drop the passengers. Due to which all the pick and drop operations are made at the centre of the road which not only obstruct the through traffic but is also hazardous for passengers so it is proposed that a proper place for the stop should be designated at Faizabad where only at that place the vehicles may be allowed to stop and pick and drop the passengers. The proposed stop should have a capacity of 2 Buses, 2 Wagons and 3 Suzuki Pickups in length at a time and may be seen in the improved layout plan for which proper lane marking with bold letters for each vehicle type should be done. The exclusive with flow bus lane may also be provided at Islamabad bound and Rawalpindi bound Bus Stop, upto a 200 ft length from the stop line.

It is also suggested that all Bus, Wagon and Suzuki Pickup and Taxi drivers should be enforced by the traffic police to use their designated stop only. As the majority of passengers come to the stop from Khayaban-e-Sir Syed road. So the stop should be located some where near to the Khayaban-e-Sir Syed road, most suitably adjacent to the street connecting these two. The stop should also be furnished with the stop sign boards for each vehicle type with lighting arrangements.

It has been observed that vehicles come in bunches in the morning and evening rush hours to this stop resulting in double parking and long waiting time at the stop. For this it is suggested that vehicles should be run according to a given schedule from their terminals and at this stop they should not be allowed to wait more than 2-3 minutes and also a compaign should be raised by the traffic police to check the route permits of the Public Service Vehicles those come on this road so that illegal route vehicles be derouted/stopped.

All the encroachments including the electric poles and advertising board on the road from the 200 Meter from the intersection of Khayaban-e-Sir Syed road and Murree Road on the Islamabad and Rawalpindi bound stops should be removed.

It has been observed at Islamabad bound stop of the Road that some shopkeepers have extended their shops to the middle of the footpaths and some hotels even made their fire burners on the footpaths which are very dangerous to the pedestrians so the

pedestrians are compelled to walk on the road way which may cause accidents. Therefore, it is suggested that the footpath should be cleared of all the obstructions to the pedestrians and atleast 8 feet wide and clear footpath should be provided on both sides of the road for pedestrians atleast between Survey of Pakistan Office and the intersection at Khayaban-i-Sir Syed Road. If possible then at the Bus/Wagon stop this width of footpath be increased to 10 ft. Also pedestrian zebra crossing is suggested near the gate of Faizul-Islam High School (on the Islamabad to Rawalpindi side of the road) so that the school going children and other public can safely cross the road.

It has been observed that a full lane of the roadway is occupied by Taxis which intesify the congestion. The presence of such a large number of Taxis here is due to the fact that here they can catch passengers and also a portion of passengers need Taxis over here as infernced from the VWTS pilot survey it is,therefore suggested that either a Taxi stand off side the road should be provided here or atleast a Taxi waiting area for 3 vehicles at a time may be provided on the road near to the propsed stop.

The 200 meter of the road area from the intersection of Khayaban-e-Sir Syed road and Murree Road to Rawalpindi side should all the time be clear of any obstruction to the traffic. For which because of high vehicular flow on road parking in this area be prohibited and also loading and unloading of goods on the road in this area should not be allowed during peak times i.e. (0700 to 0900 Hrs, 1300 to 1500 Hrs and 1830 to 2030 Hrs).

To avoid any congestion on the Murree Road and at the Faizabad intersection on Islamabad Highway it is proposed that the traffic signals should be kept in order.

It is also suggested that the street near the proposed stop which connects the Murree Road with Khayaban-e-Sir Syed Road should be closed for every type of vehicular traffic and it should be paved only for pedestrians walk.

It is also proposed that the footpath adjacent to the proposed stop should be closed with fences except near the entry point to the vehicle so that in-discipline road crossing by the pedestrian be discouraged.

As there is no proper space available at Faizabad near the propsed stop where the passengers can take refugee in case of rain or scroching heat in the summer so a passenger shelter be provided on both sides of the Murree Road at the proposed Bus/Wagon stop.

REFERENCES

1. Institution of Highways and Transportation, The Department of Transport UK, 1987, "Roads and Traffic in Urban Areas".

2. M.Sadiq Swati and A.J.Downing, Road Accidents in Pakistan NTRC 64

3. M.S.Qureshi, Low cost Measures of management and control of Traffic on an arterial road in developing countries "A case study in Pakistan" Dec. 1989.

4. Khalifa Afzal Hussain "Time Tabling and Bus Schedules-I " Bus Logistics for Developing Countries. First Edition, 1980.

5. Laurence I. Hewes and Clarkson H. Oglesby, Chapter-8 Highway Design, Highway Engineering, Modern Asia Edition, 1960, Printed 1970.

6. Economic Commission for Asia and the FAR EAST Bangkok Thailand,"Introduction", Manual on Traffic Surveys, 1971.

7. Clifford Sharp & Tony Jennings, Chapter 6 "Accidents", Transport and the Environment, Leicester University Press 1976.

8. J. Gipson, I. Baeza and L. Willumsen, "Bus Stops, Congestion and Congested Bus Stops" Traffic Engineering & Control Journal June, 1989.

9. Marshall Jacks, JR. "Urban Congestion - A Local Problem Requiring a National Response" ITE Journal, February, 1989.

10. Walter H. Kraft "Traffic Congestion - What have we learned?" ITE Journal February,1989.

11. TRRL's Overseas Development Administration, Towards Safer Roads in Developing Countries, A Guide for Planners and Engineers, 1st Edition, 1991.

12. Eng. Pervaiz Sani, Notes on "Traffic Management Techniques" Transport & Traffic Engineering Management Unit (TEMU), Peshawar, January, 1993.

13. A.Majeed, Vehicle Operating Costs, NTRC-169 (Revised).

14. Shamim Ahmed Khan, Benefits From Transport Infrastructure Improvement, NTRC-160, December, 1992.

PHOTOGRAPHS DESCRIPTION

The photographs depicit a very common scenario at Faizabad Bus Stop area resulting from the non synchronization of the signals at the intersection of Murree Road and Khyaban-e-Sir Syed Road and the intersection of Murree Road and Shahrah-e-Islamabad. In such situations the traffic police desperately try to prevent the queue building on the Murree Road but without any success as is clear from photograph No.1 while in the photograph No.2 the police sergeant present there find himself helpless to sort out the queue building problem on the Murree Road.

The photographs No. 3, 4, 5, 6, 7, 8, 9, 10 and 11 show on road parking and occupation of a full lane of the roadway by the taxis which clearly establish that the through traffic is left with a little space to the passengers bottleneckling thus blockage of road oftenly these snaps show some encroachment on the road whereas some vendors and pheriwalas run their business using the roadway and some wrong alignment and installation of the poles on the roadway these in turn result in the embarkation and disembarkation of the passengers by the PSVs in the centre of the road which is not only impedent to the through traffic but is also a danger to the safety of the passengers. Police Official or any other do not bother to check these. The photographs demonstrate that due to the extension of shops adjacent to the footpaths the pedestrians are left with a little space to pass and only one person from one direction can handling manage to walk on the footpath at one time and the rest are compeled to walk on the road which endanger his life also the presence of fire burners.

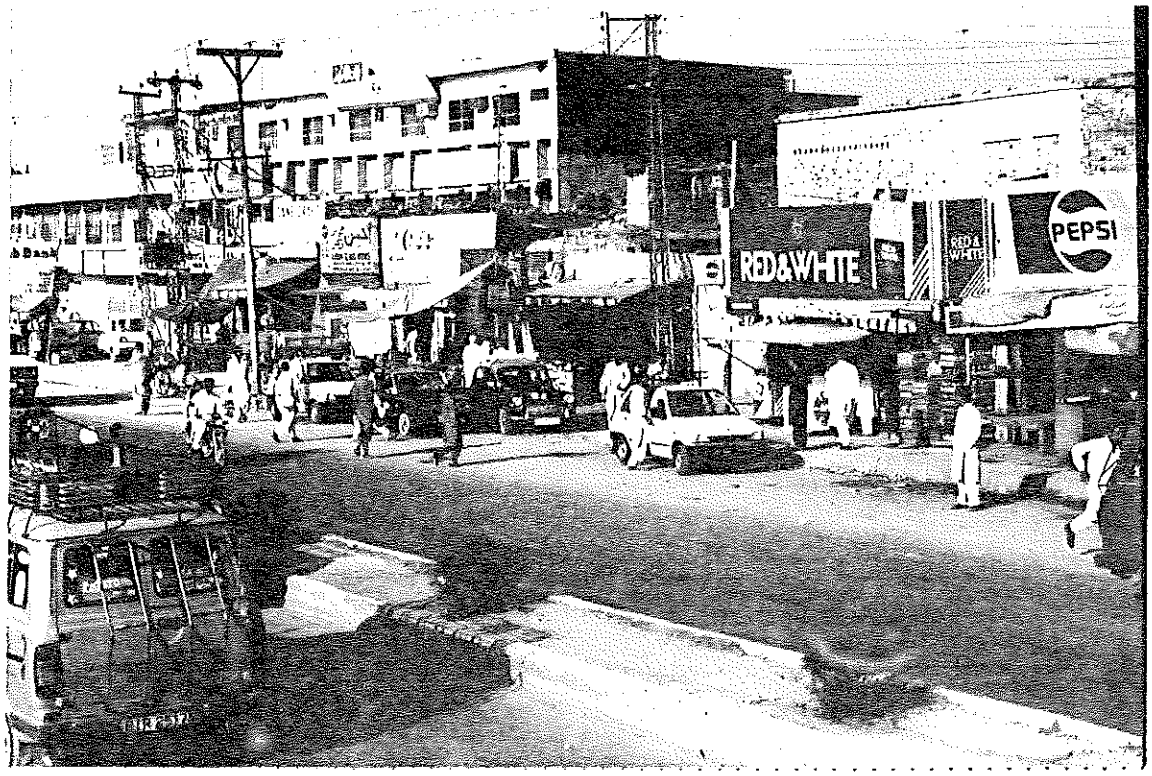
The photographs No. 12, 13, 14, 15, 16, 17 and 18 show the non presence of any definite location of the stop for the PSVs due to which they stop in a haphazard and disarayed manner anywhere from the office of Survey of Pakistan to the Intersection of Murree Road and Khayban-i-Sir Syed road to pick and drop the passengers. This causes in-convenience to the other traffic. Also the presence of no facility for crossing the road by the pedestrians is visible by the persons intending to cross the road at different section with utmost care and risk.

The photographs No. 19, 20, 21 and 22 show that if the PSVs are bound to stop adjacent with the footpath overhere in a fashion show as envisaged in the proposed traffic scheme will result in so much clear roadway for the other traffic this will definitely reduce bottle necklening and congestion.

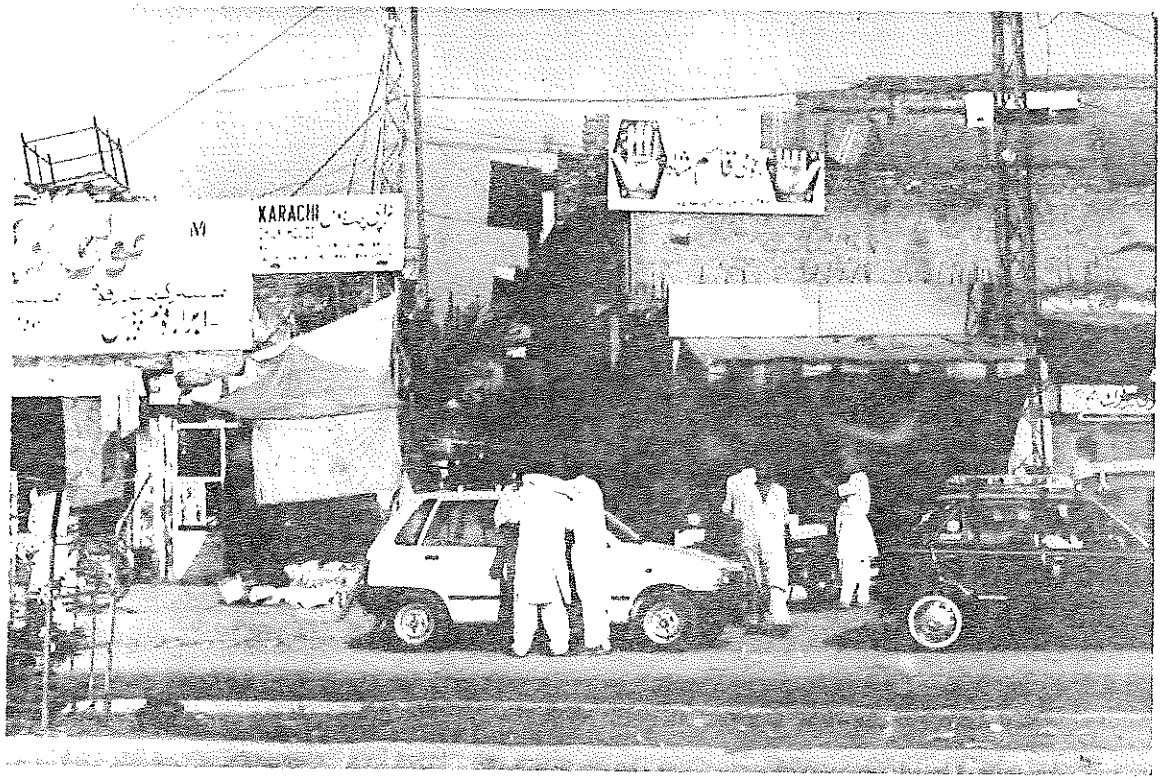
PHOTOGRAPH NO: 1

PHOTOGRAPH NO: 2

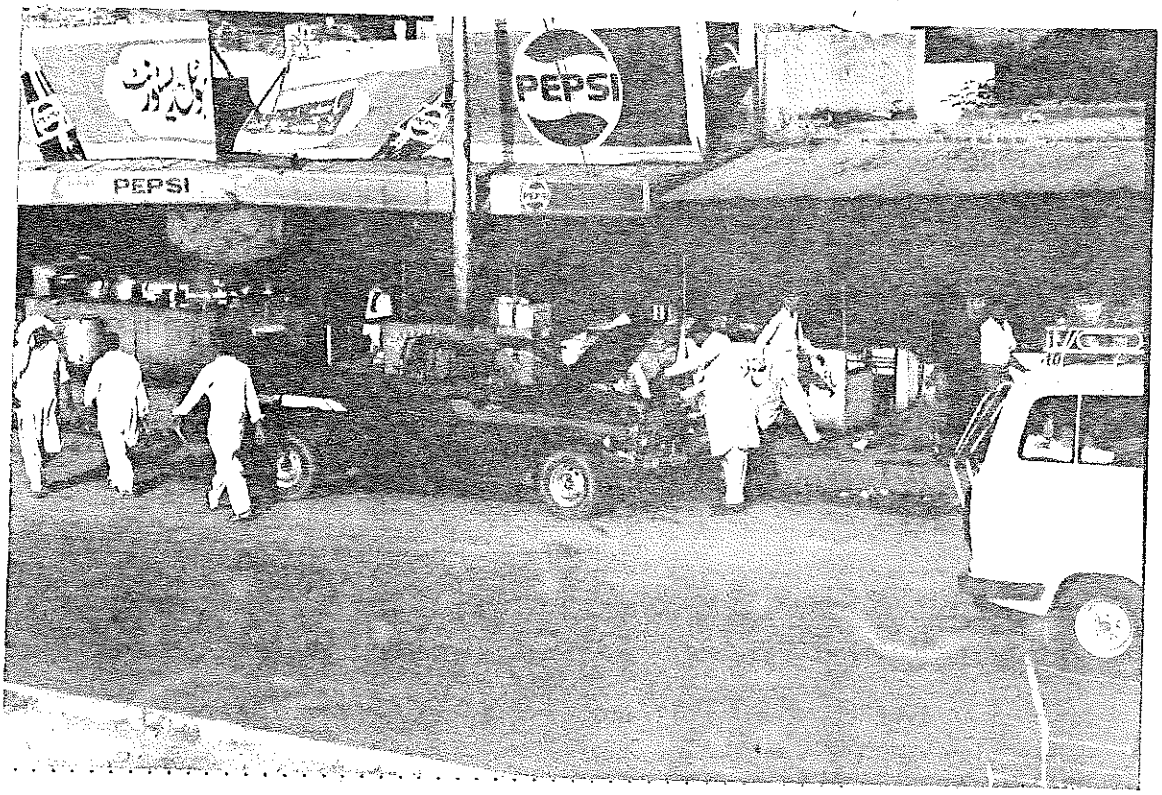
PHOTOGRAPH NO: 3



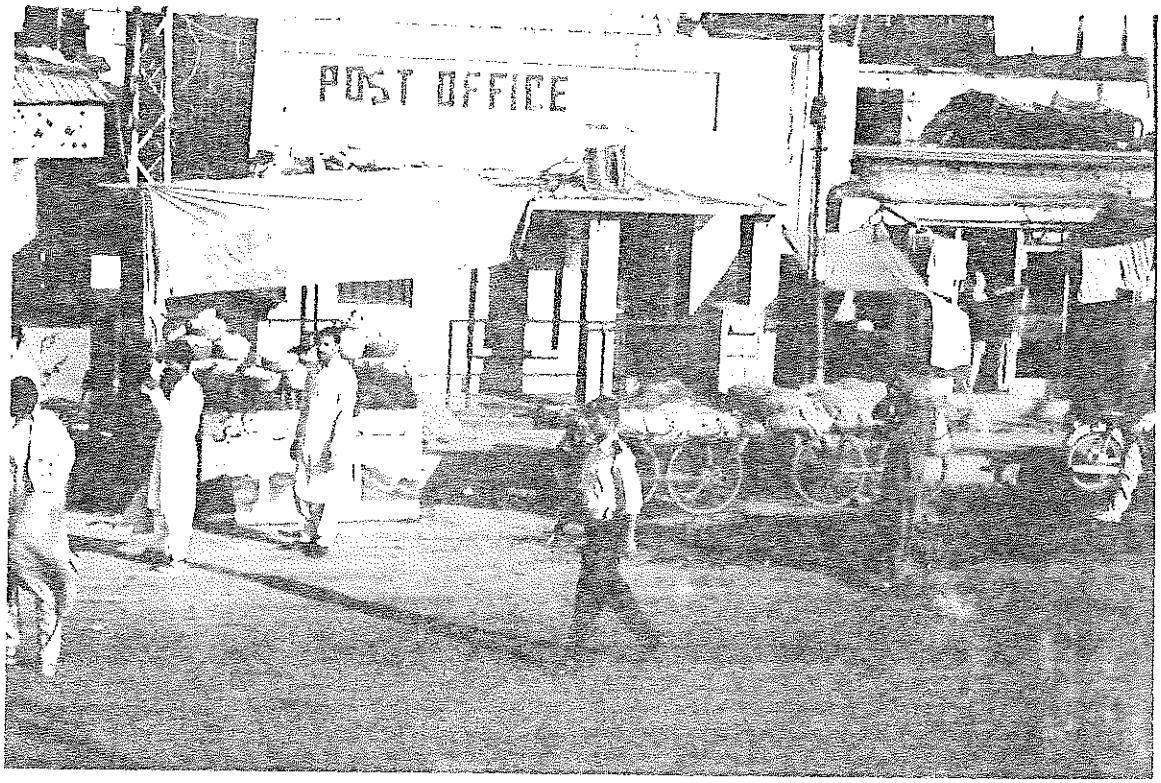
PHOTOGRAPH NO: 4



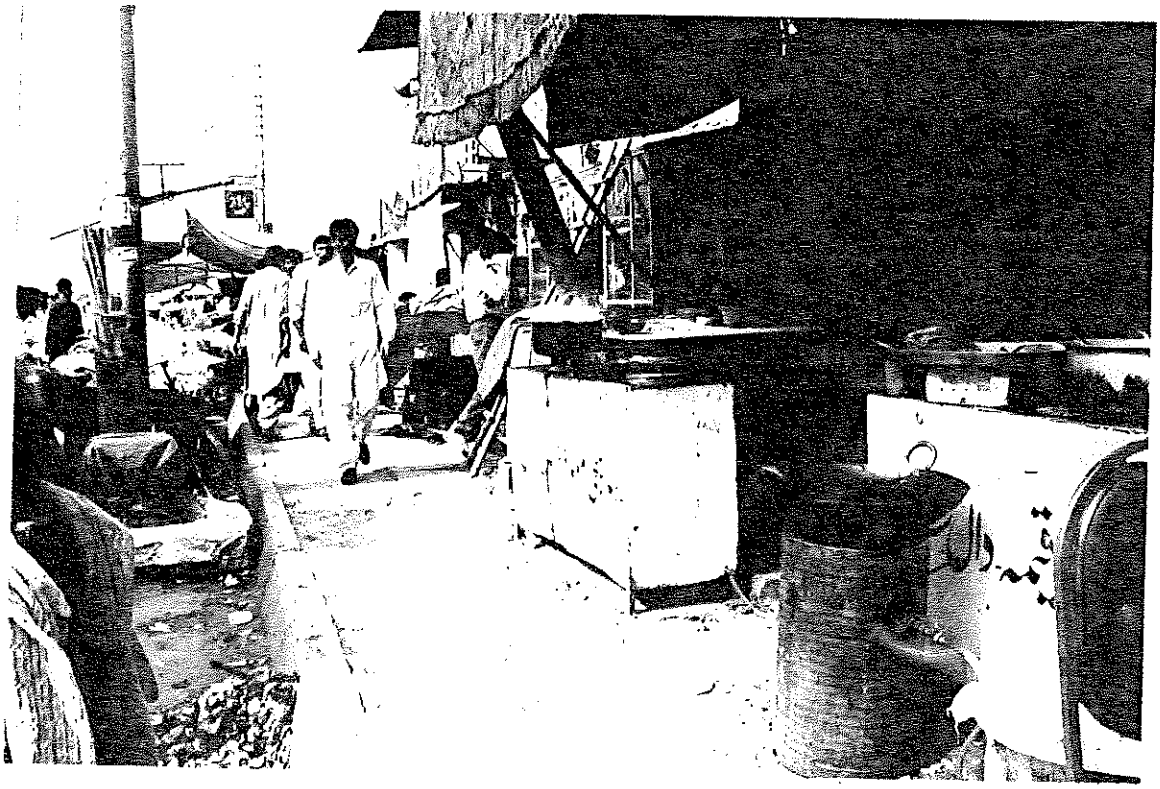
PHOTOGRAPH NO: 5



PHOTOGRAPH NO: 6

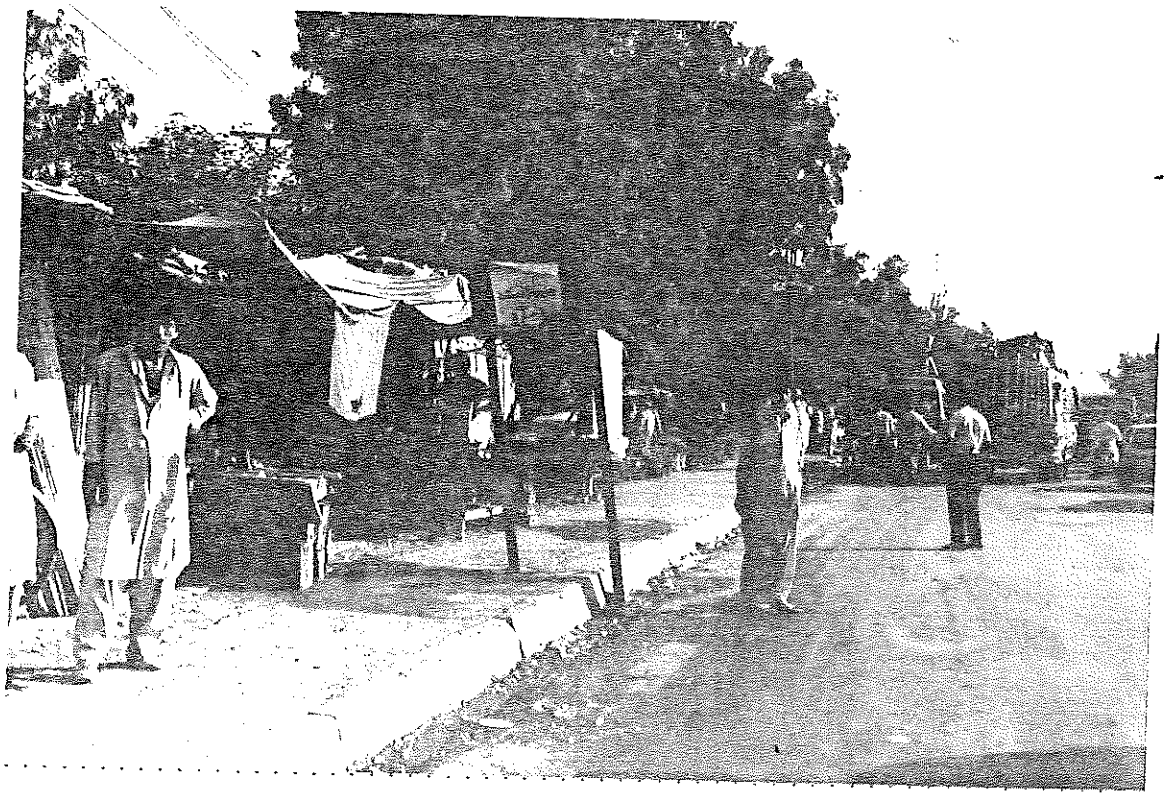


PHOTOGRAPH NO: 7



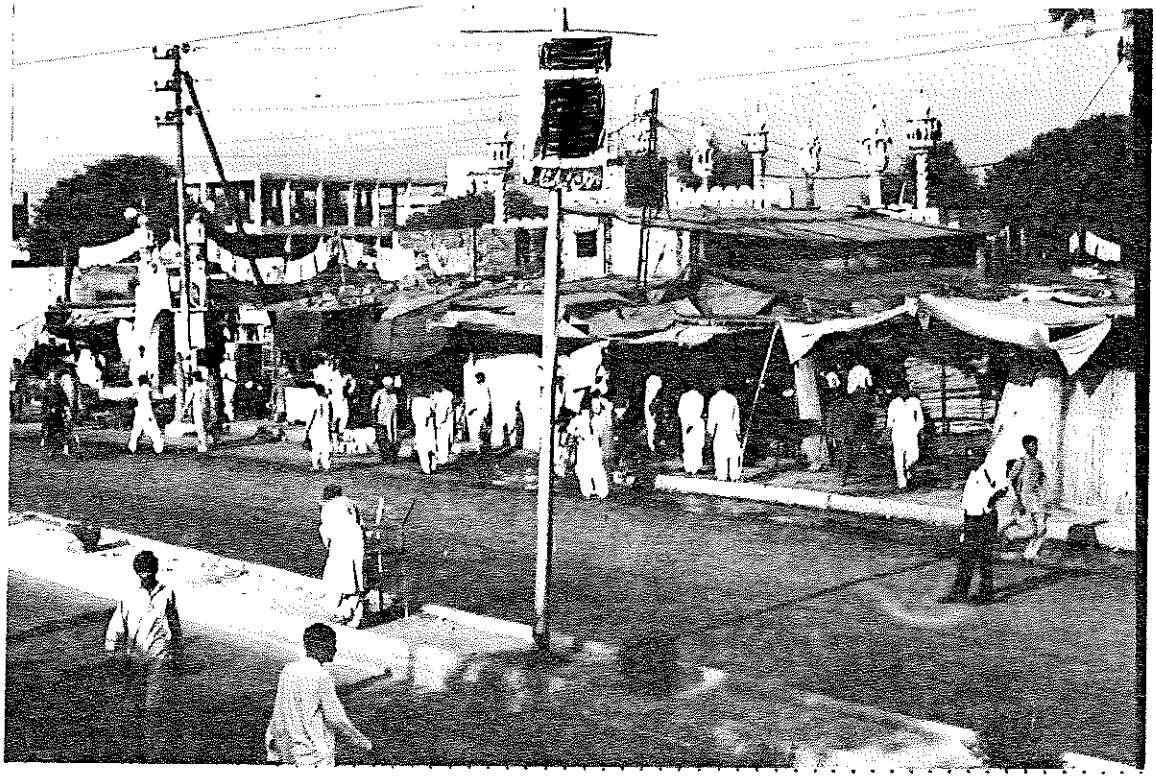
PHOTOGRAPH NO: 8

PHOTOGRAPH NO: 9

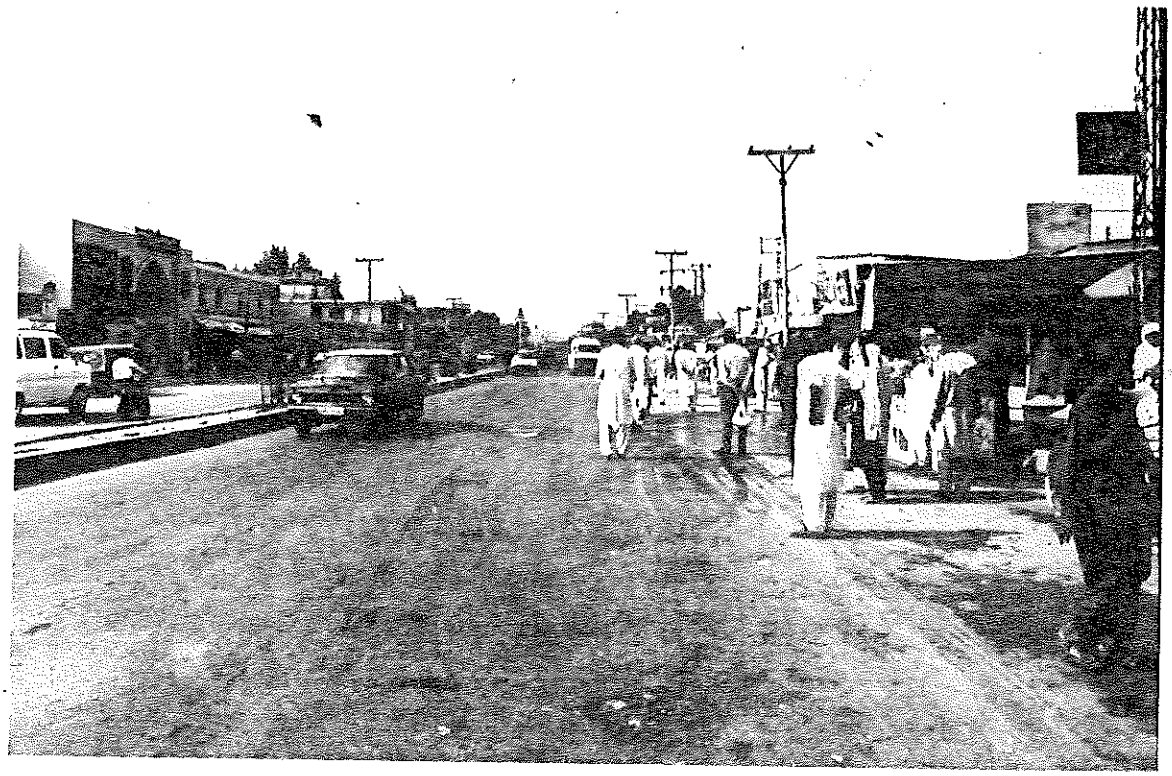


PHOTOGRAPH NO: 10

PHOTOGRAPH NO: 11

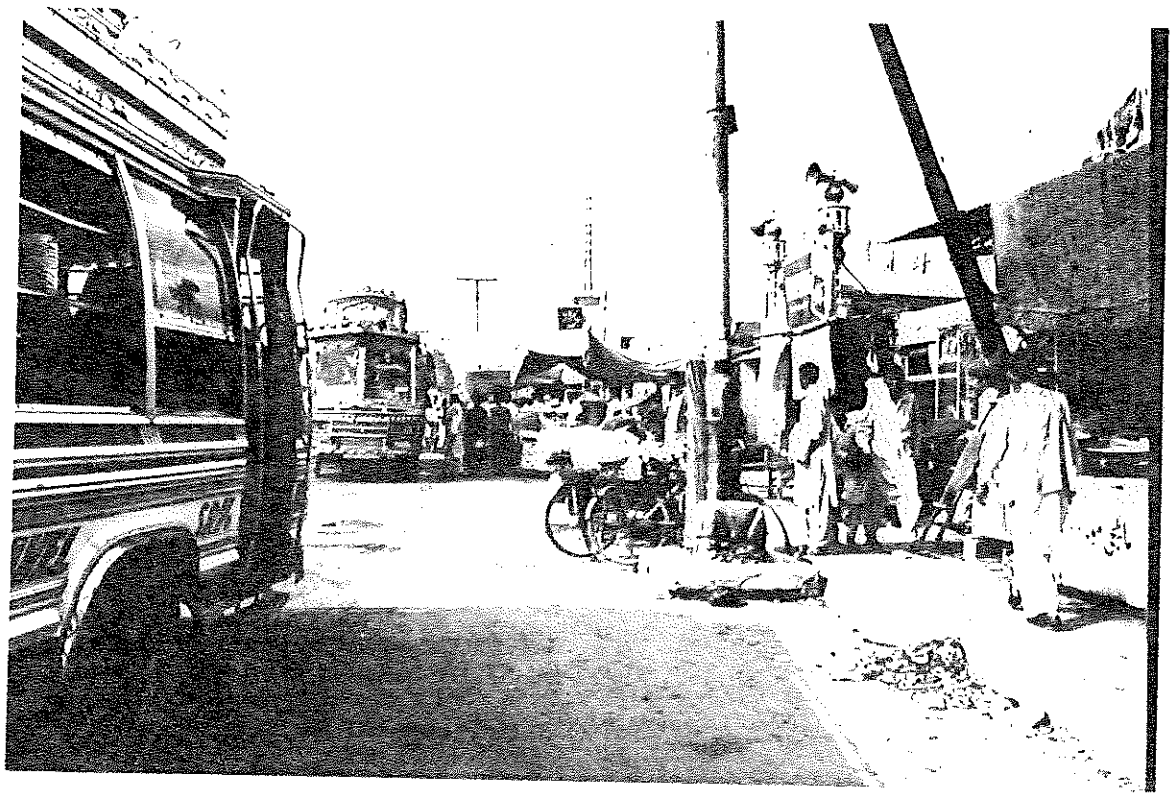


PHOTOGRAPH NO: 12

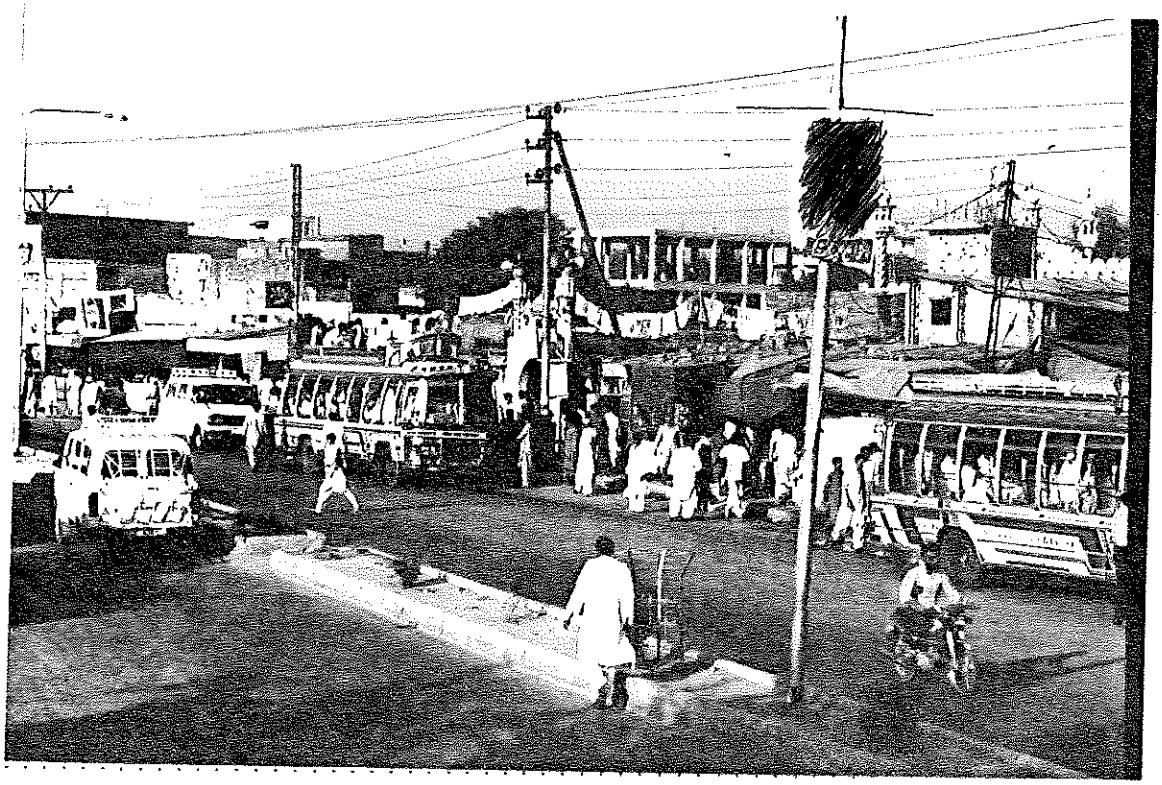


PHOTOGRAPH NO: 13

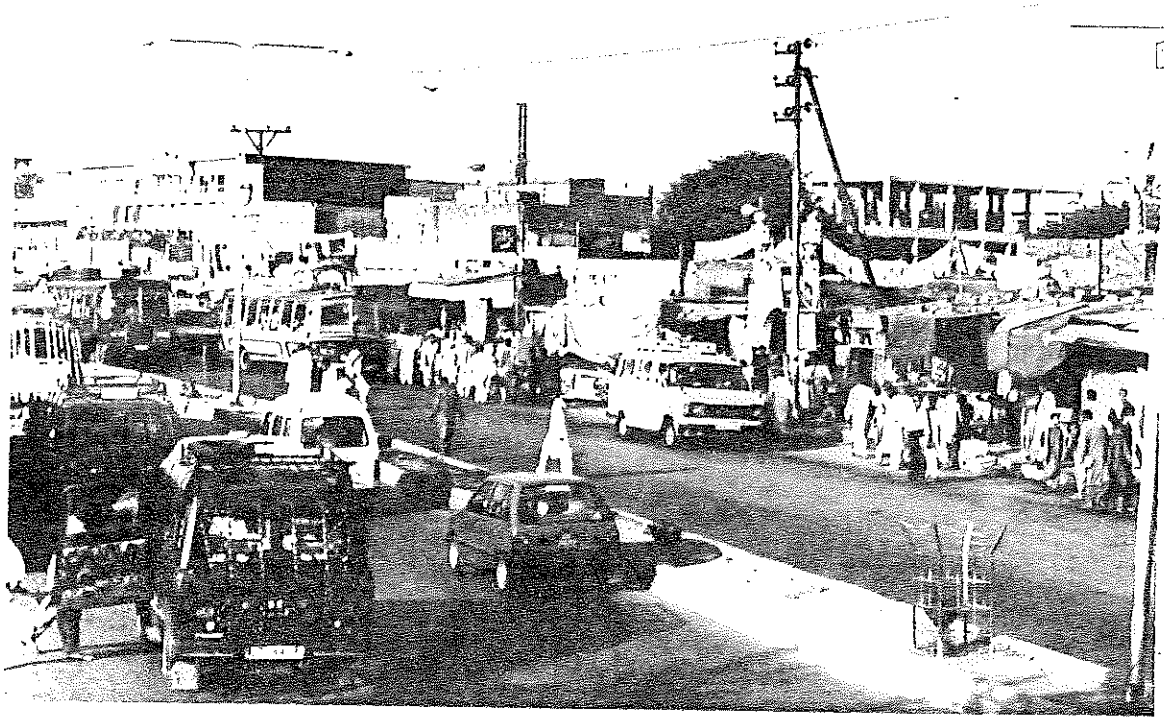
PHOTOGRAPH NO: 14



PHOTOGRAPH NO: 15



PHOTOGRAPH NO: 16

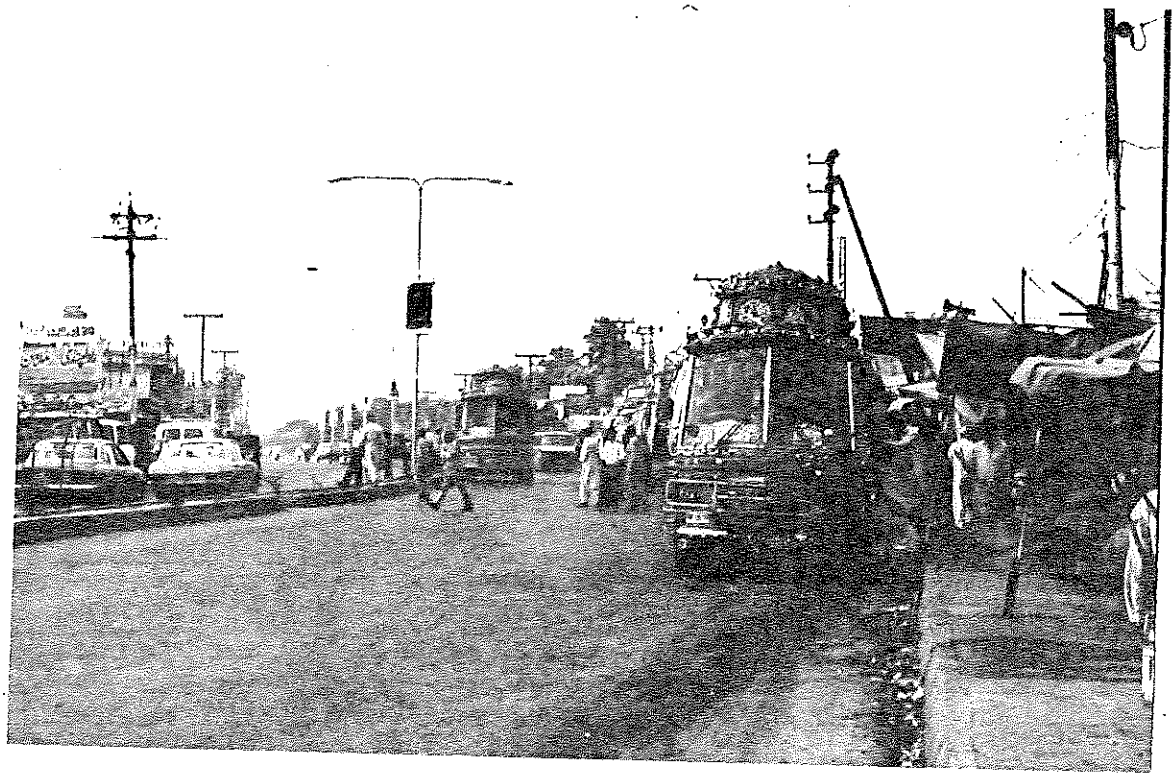


PHOTOGRAPH NO: 17

PHOTOGRAPH NO: 18

PHOTOGRAPH NO: 19

PHOTOGRAPH NO: 20



PHOTOGRAPH NO: 21

PHOTOGRAPH NO: 22

Table No.1 ORIGIN AND DESTINATION OF EMBARKED PASSENGERS

Direction: Islamabad Bound Stop Weather: Sunny:
(Figures in Percentage)

Destination / Origin		Islamabad			Rawalpindi			Pirvadhai			Outer City			Total		
		B	W	SP	B	W	SP	B	W	SP	B	W	SP	B	W	SP
Islamabad																
	B				-			-			-			-		
	W		X			-			-			-			-	
	SP						-			-			-			-
Rawalpindi																
	B	15.4				X		-			-			15.4		
	W		15.4						-			-			15.4	
	SP		36.5							-			-			36.5
Pirvadhai																
	B	27.0			-						-			27.0		
	W		01.9			-			X			-			01.9	
	SP			-			-						-			-
Outside City																
	B	03.8			-			-						03.8		
	W		-			-			-			X			-	
	SP			-			-			-						-
Total:-		46.2			00			00			00			46.2		
			17.3			00			00			00			17.3	
				36.5			00			00			00			36.5

Table No.2 ORIGIN AND DESTINATION OF DISEMBARKED PASSENGERS

Direction : Rawalpindi Bound Stop : Weather Sunny:

Destination / Origin		Islamabad			Rawalpindi			Pirvadhai			Outer city			Total		
		B	W	SP	B	W	SP	B	W	SP	B	W	SP	B	W	SP
Islamabad																
	B				-			-			-			-		
	W		X			-			-			-			-	
	SP						04.3			10.6			04.3			19.2
Rawalpindi																
	B	23.4						10.6			06.4			40.4		
	W		12.8			X			06.4			-			19.2	
	SP		06.3						10.6			04.3			21.2	
Pirvadhai																
	B	-			-						-			-		
	W		-			-			X			-			-	
	SP			-			-						-			-
Outside City																
	B	-			-			-						-		
	W		-			-			-			X			-	
	SP			-			-			-						-
Total:-		23.4			00			10.6			06.4			40.4		
			12.8			00			06.4			00			19.2	
				06.3			04.3			21.2			08.6			40.4

Note : B = Bus, W = Wagon and SP = Suzuki Pickup

TABLE NO. 3 VEHICLES COUNTING AT FAIZABAD BUS STOP

TIME	1	2	3	4	5	6	7	8	9	10
Morning Time										
A	26	8	2	11	19	9	0	0	75	01.9
B	25	10	4	12	22	11	1	0	85	02.2
C	43	17	8	16	44	12	0	1	141	03.7
D	62	17	5	25	62	23	2	2	198	05.1
E	56	22	16	45	96	20	0	6	261	06.8
F	83	33	10	75	140	39	2	4	386	10.0
G	71	34	29	96	127	55	5	2	419	11.1
H	36	49	22	162	153	32	3	8	465	11.7
I	53	80	43	190	224	45	8	4	647	16.7
J	49	28	18	125	165	48	1	0	434	11.2
K	53	24	23	92	173	52	1	1	419	10.8
L	41	17	18	87	134	36	0	0	333	08.7
Total										
	598	339	198	936	1359	382	23	28	3863	100.0
	15.5	8.8	5.1	24.2	35.2	9.9	0.6	0.7	100.0	
Evening Time										
M	45	06	33	50	112	18	0	0	264	08.6
N	51	10	02	37	128	28	1	2	289	09.4
O	30	22	18	24	145	16	0	0	255	08.3
P	40	07	20	29	116	27	1	1	241	07.8
Q	42	13	21	29	139	25	2	0	271	08.8
R	41	07	25	27	162	35	2	0	299	09.7
S	39	06	22	18	116	29	0	0	230	07.5
T	34	08	17	22	162	27	1	0	271	08.8
U	43	06	11	18	111	27	2	0	218	07.1
V	36	08	19	23	136	18	0	0	240	07.8
W	46	06	17	21	144	26	2	0	262	08.5
X	27	13	20	18	143	16	0	0	237	07.7
Total										
	474	112	255	316	1614	292	11	3	3077	100.0
	15.4	3.6	8.3	10.3	52.5	9.5	0.4	0.1	100.0	

MORNING TIME

A=0630-0645 B=0645-0700 C=0700-0715 D=0715-0730 E=0730-0745
F=0745-0800 G=0800-0815 H=0815-0830 I=0830-0845 J=0845-0900
K=0900-0915 L=0915-0930

EVENING TIME

M=1700-1715 N=1715-1730 O=1730-1745 P=1745-1800 Q=1800-1815
R=1815-1830 S=1830-1845 T=1845-1900 U=1900-1915 V=1915-1930
W=1930-1945 X=1945-2000

1= Wagon 2= Bus 3= S.P/Up 4= M/Cycle 5= Car/Jeep 6= Taxi
7= Truck 8= F.Coach 9= Total Vehicles 10= Percentage

Table No. 4 BUSES WAITING TIME AT THE STOP

Weather : Sunny
Morning : 0630 Hrs to 0930 Hrs Evening : 1700 Hrs to 2000 Hrs

Time (Minutes)	Morning (203)	% Age	Evening (105)	% Age
01	0		0	
02	16.75		23.73	
03	09.36		17.80	
04	08.87		11.86	
05	09.36		06.78	
06	12.31		04.24	
07	07.39		02.54	
08	08.87		01.69	
09	03.94		01.69	
10	04.43		02.54	
11	04.93		02.54	
12	02.46		03.39	
13	02.95		01.69	
14	00.98		0	
15	01.48		01.69	
16	02.46		0.85	
17	0		0.85	
18	01.48		0.85	
19	0		03.39	
20	0.50		0.85	
21 & Above	01.48		11.03	

Table No. 5 WAGONS WAITING TIME AT THE STOP

Weather : Sunny
Morning : 0630 Hrs to 0930 Hrs Evening : 1700 Hrs to 2000 Hrs

Time (Minutes)	Morning (406)	% Age	Evening (357)	% Age
01	75.12		33.05	
02	08.13		19.05	
03	05.17		15.97	
04	03.94		08.12	
05	02.46		04.20	
06	02.22		05.04	
07	00.25		04.76	
08	00.25		02.52	
09	00.74		02.52	
10	00.74		01.41	
11 & Above	00.98		03.36	

Table No.6 SUZUKI PICKUP WAITING TIME AT THE STOP

Weather : Sunny
Morning : 0630 Hrs to 0930 Hrs Evening : 1700 Hrs to 2000 Hrs

Time (Minutes)	Morning (62)	% Age	Evening (71)	% Age
01	14.52		40.85	
02	24.20		15.50	
03	17.74		04.22	
04	08.06		05.63	
05	03.23		04.22	
06	01.61		04.22	
07	03.23		04.22	
08	01.61		02.83	
09	0		07.04	
10	01.61		01.41	
11	03.23		01.41	
12	06.45		01.41	
13	04.84		01.41	
14	01.61		04.22	
15 & Above	08.06		01.41	

Table No.7 TAXIS WAITING TIME AT THE STOP

Weather : Sunny
Morning : 0630 Hrs to 0930 Hrs Evening : 1700 Hrs to 2000 Hrs

Time (Minutes)	Morning (233)	% Age	Evening (217)	% Age
01	67.81		58.53	
02	15.02		13.82	
03	03.43		07.84	
04	04.72		01.84	
05	01.29		02.77	
06	03.00		03.22	
07	01.72		02.77	
08	0.43		03.22	
09	01.29		02.30	
10 & Above	01.29		03.69	

Table No.8 EMBARKED AND DISEMBARKED BUS PASSENGERS

Weather : Sunny Morning : 0630 Hrs to 0930 Hrs

Time	Total Veh.	Embarked Passengers	Time Sec.	Total Veh.	Disembarked Passengers	Time Sec.
0630 to 0645	01	03	15	01	06	03
0645 to 0700	02	07	13	03	16	32
0700 to 0715	06	15	34	06	84	100
0715 to 0730	07	41	52	08	79	204
A =	16	66	124	18	185	364

Embarkation Time per Passenger = 3.02 Seconds
Disembarkation Time per Passenger = 1.97 Seconds

0730 to 0745	04	25	52	07	87	114
0745 to 0800	06	15	30	09	68	101
0800 to 0815	08	34	67	07	92	117
0815 to 0830	05	38	74	08	57	88
B =	23	112	223	31	304	420

Embarkation Time per Passenger = 1.99 Seconds
Disembarkation Time per Passenger = 1.38 Seconds

0830 to 0845	07	27	76	10	65	106
0845 to 0900	09	18	33	12	57	134
0900 to 0915	05	12	22	13	125	248
0915 to 0930	04	18	39	11	101	194
C =	25	75	170	46	348	682

Embarkation Time per Passenger = 2.27 Seconds
Disembarkation Time per Passenger = 1.96 Seconds

Average Embarkation Time Per Passenger = 2.07
Average Disembarkation Time Per Passenger = 1.77 Seconds

Note:- Sec. = Second, Veh. = Vehicles, Passg. = Passengers

Table No.9 EMBARKED AND DISEMBARKED BUS PASSENGERS

Weather : Sunny Evening : 1700 Hrs to 1800 Hrs

Time	Total Veh.	Embarked Passengers	Time Sec.	Total Veh.	Disembarked Passengers	Time Sec.
0500 to 0515	01	03	06	07	99	236
0515 to 0530	02	09	09	08	133	163
0530 to 0545	04	14	33	08	116	214
0545 to 0600	04	16	36	06	59	137
A=	11	42	84	29	407	750

Embarkation Time per Passenger = 1.86 Seconds
Disembarkation Time per Passenger = 1.84 Seconds

0600 to 0615	01	02	05	05	52	88
0615 to 0630	02	06	25	10	85	182
0630 to 0645	04	16	32	07	54	109
0645 to 0700	03	09	23	07	65	123
B=	10	33	85	29	256	502

Embarkation Time per Passenger = 2.57 Seconds
Disembarkation Time per Passenger = 1.96 Seconds

0700 to 0715	01	03	15	06	58	116
0715 to 0730	01	02	05	06	73	110
0730 to 0745	00	00	00	06	89	127
0745 to 0800	02	08	19	03	44	81
C=	04	13	39	21	264	434

Embarkation Time per Passenger = 03 Seconds
Disembarkation Time per Passenger = 1.65 Seconds

Average Embarkation Time Per Passenger = 2.48 Seconds
Average Disembarkation Time Per Passenger = 1.82 Seconds

Note:- Sec. = Second, Veh. = Vehicles, Passg. = Passengers

Table No.10 EMBARKED AND DISEMBARKED WAGON PASSENGERS

Weather : Sunny Morning : 0630 Hrs to 0930 Hrs

Time	Total Veh.	Embarked Passengers	Time Sec.	Total Veh.	Disembarked Passengers	Time Sec.
0630 to 0645	05	08	53	07	20	77
0645 to 0700	04	09	19	04	11	41
0700 to 0715	09	27	70	09	25	58
0715 to 0730	12	28	95	13	49	124
A=	30	72	237	33	105	300

Embarkation Time per Passenger = 3.29 Seconds
Disembarkation Time per Passenger = 2.86 Seconds

0730 to 0745	15	64	153	14	48	147
0745 to 0800	09	26	65	06	19	47
0800 to 0815	10	27	73	07	27	77
0815 to 0830	12	46	96	11	24	79
B=	46	163	387	38	118	350

Embarkation Time per Passenger = 2.37 Seconds
Disembarkation Time per Passenger = 2.37 Seconds

0830 to 0845	11	29	68	06	14	77
0845 to 0900	07	26	51	06	15	47
0900 to 0915	13	32	126	11	26	85
0915 to 0930	12	36	109	10	25	107
C=	43	123	354	33	80	316

Embarkation Time per Passenger = 2.88 Seconds
Disembarkation Time per Passenger = 3.95 Seconds

Average Embarkation Time Per Passenger = 2.85
Average Disembarkation Time Per Passenger = 3.26 Seconds

Note:- Sec. = Second, Veh. = Vehicles, Passg. = Passengers

Table No.11 EMBARKED AND DISEMBARKED WAGON PASSENGERS

Weather : Sunny Evening : 1700 Hrs to 1800 Hrs

Time	Total Veh.	Embarked Passengers	Time Sec.	Total Veh.	Disembarked Passengers	Time Sec.
0500 to 0515	01	06	20	16	52	149
0515 to 0530	04	07	27	12	46	126
0530 to 0545	03	11	31	12	36	151
0545 to 0600	06	18	64	13	50	132
A=	14	42	142	53	184	558

Embarkation Time per Passenger = 3.38 Seconds
Disembarkation Time per Passenger = 3.03 Seconds

0600 to 0615	02	03	07	05	12	36
0615 to 0630	03	05	59	09	30	100
0630 to 0645	02	05	15	10	32	107
0645 to 0700	06	11	43	12	34	117
B=	13	24	124	36	108	360

Embarkation Time per Passenger = 5.17 Seconds
Disembarkation Time per Passenger = 3.33 Seconds

0700 to 0715	02	03	12	08	30	83
0715 to 0730	01	01	06	10	33	84
0730 to 0745	01	02	08	08	24	93
0745 to 0800	04	07	29	09	26	96
C=	08	13	55	35	113	356

Embarkation Time per Passenger = 4.23 Seconds
Disembarkation Time per Passenger = 3.15 Seconds

Average Embarkation Time Per Passenger = 4.26 Seconds
Average Disembarkation Time Per Passenger = 3.17 Seconds

Note:- Sec. = Second, Veh. = Vehicles, Passg. = Passengers

Table No.12 EMBARKED AND DISEMBARKED SUZUKI PICKUP PASSENGERS

Weather : Sunny Morning : 0630 Hrs to 0930 Hrs

Time	Total Veh.	Embarked Passengers	Time Sec.	Total Veh.	Disembarked Passengers	Time Sec.
0630 to 0645	01	10	42	01	12	70
0645 to 0700	01	08	40	01	08	60
0700 to 0715	02	16	90	02	16	80
0715 to 0730	03	14	65	01	03	15
A=	07	48	237	05	39	225

Embarkation Time per Passenger = 4.94 Seconds
Disembarkation Time per Passenger = 5.77 Seconds

0730 to 0745	04	17	99	--	--	--
0745 to 0800	03	28	150	--	--	--
0800 to 0815	03	20	62	07	92	117
0815 to 0830	03	19	106	08	57	88
B=	13	84	417	31	304	420

Embarkation Time per Passenger = 4.96 Seconds
Disembarkation Time per Passenger = Seconds

0830 to 0845	04	25	109	02	07	41
0845 to 0900	05	35	172	--	--	--
0900 to 0915	04	27	119	01	01	04
0915 to 0930	06	51	160	05	09	40
C=	19	138	560	08	17	85

Embarkation Time per Passenger = 4.06 Seconds
Disembarkation Time per Passenger = 05 Seconds

Average Embarkation Time Per Passenger = 4.65
Average Disembarkation Time Per Passenger = 5.38 Seconds

Note:- Sec. = Second, Veh. = Vehicles, Passg. = Passengers

Table No.13 VEHICLES ACCUMULATION AT THE STOP

Time	Bus	Wagon	Car	Taxi	S-Pickup	Total
Morning Peak						
0800-0805	9	5	0	10	8	32
0805-0810	8	6	3	10	9	36
0810-0815	7	2	0	11	8	28
0815-0820	13	3	0	6	8	30
0820-0825	9	5	0	8	9	31
0825-0830	8	8	0	9	10	35
0830-0835	8	6	0	9	11	34
0835-0840	4	9	0	9	11	33
0840-0845	8	6	0	12	8	34
0845-0850	11	6	0	9	8	34
0850-0855	4	12	0	7	9	32
0855-0900	8	4	0	9	11	32
Total:-	97	72	3	109	110	391
Evening Peak						
1700-1705	5	12	0	4	0	21
1705-1710	4	14	0	5	0	23
1710-1715	5	7	0	5	0	17
1715-1720	9	13	0	5	0	27
1720-1725	7	10	0	5	0	22
1725-1730	7	12	0	4	0	23
1730-1735	5	8	0	5	1	19
1735-1740	4	12	0	5	0	21
1740-1745	6	8	0	3	0	17
1745-1750	1	0	0	2	0	03
1750-1755	6	11	0	3	1	21
1755-1800	5	7	0	3	0	15
Total:-	64	114	0	49	2	229

Table.No.14 BOTH WAY PADESTRIAN CROSSING COUNT SURVEY

Morning				Evening		
Age Group	0800 to 0830 Hrs	0830 to 0900 hrs	Pedes. Total	1700 to 1730 Hrs	1730 to 1800 Hrs	Total
6-10	51	62	113 5.2%	37	28	65 3.0%
11-15	113	84	197 9.1%	62	74	136 6.2%
16-20	86	97	183 8.5%	93	84	177 8.5%
21 and above	703	959	1662 77.2%	723	1037	1760 82.3%
Total	953	1202	2155	915	1223	2138

Table No.15 SUGGESTED WARRANTS FOR FORMAL PEDESTRIAN CROSSING FACILITIES

Sr. No.	2 PV 8	P	V	Preliminary Recommendation
01	Over 10	50 to 1100	300 to 500	Zebra
02	Over 2x10	50 to 1100	400 to 750	Divided Zebra
03	Over 10	50 to 1100	Over 500	Pelican
04	Over 10	Over 1100	Over 300	Pelican
05	Over 2x10	50 to 1100	Over 750	Divided Pelican
06.	Over 2x10	Over 1100	Over 400	Divided Pelican

Table No.16 NUMBER OF ACCIDENTS AT FAIZABAD BUS STOP

Months	Year-wise No. of Accidents			Total Number of Accidents	% of Accidetns
	1990	1991	1992		
January	00	01	00	01	9.09
February	01	00	00	01	9.09
March	00	01	00	01	9.09
April	00	01	00	01	9.09
May	00	00	01	01	9.09
June	01	01	00	02	18.18
July	00	00	00	00	00
August	00	01	00	01	9.09
September	00	00	00	00	00
October	01	00	00	01	9.09
November	00	00	00	00	00
December	01	00	01	02	18.18
Total:-	04	05	02	11	100.00

Table No.17 COST ESTIMATES OF THE TRAFFIC MANAGEMENT SCHEME

ITEM	COST IN PAK.RUPEES CAPITAL	Maint/Opr(per/yr)
Road and Lane markings	50,000	15,000
Installation of Beacons	20,000	2,000
Installation of Road Signs etc.	10,000	2,500
Construction of Footpaths	50,000	5,000
Installation of Guard Rails	350,000	20,000
Construction of off-Street Car Park	100,000	18,000
Construction of Central Refugues/ Cat-eyes	20,000	2,500
Construction of Sheltered Bus Stops	100,000	10,000
Publicity Cost	20,000	-
Police Enforcement	20,000	-
Planning and Development of Scheme	40,000	-
Administrative Cost	20,000	-
1) Total Cost	800,000	75,000

Note:- Maint = Maintenance Opr.= Operational

Table No. 18 CUMULATIVE REVENUE OF CAR PARK

(Rupees)

Year	Operation/Maintenance Cost	Revenue	Net Revenue	Cumulative Revenue
1.	75,000	270,000	195,000	195,000
2.	75,000	270,000	195,000	390,000
3.	75,000	270,000	195,000	585,000
4.	75,000	270,000	195,000	780,000
5.	75,000	270,000	195,000	975,000

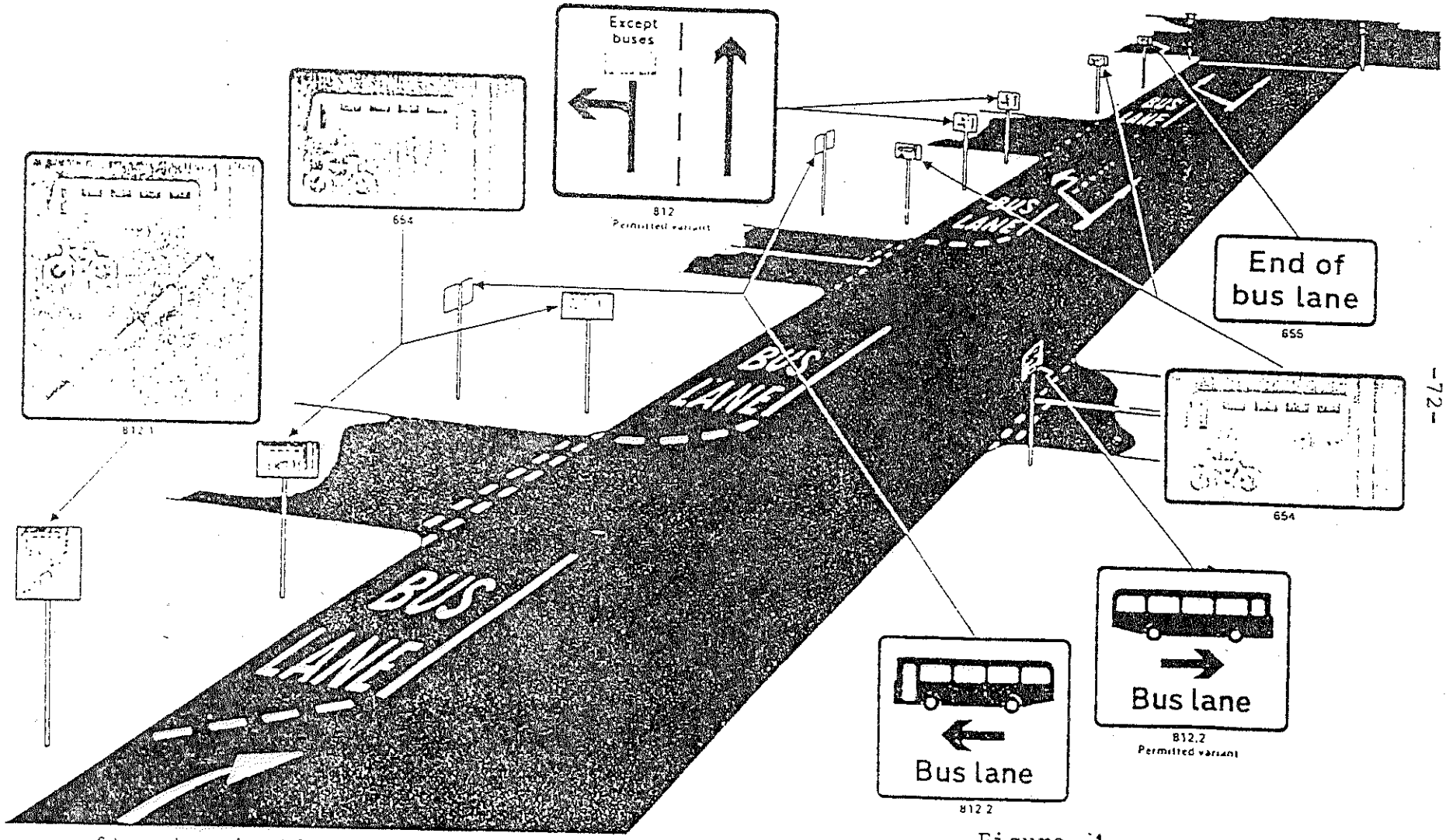
Table No. 19 SAVINGS IN VEHICLE OPERATING COSTS

Types of Vehicle	VOC per Km		Savings Per Veh Per Km	Average No. of Vehicles per hr.	No. of Vehicles Per day (12Hrs)	Total Savings of VOC in 300 days (Rs.)
	30 Km/Hr	40 Km/Hr				
Car	4.63	4.10	0.53	500	6000	954,000
Wagon	2.80	2.54	0.26	150	1800	140,400
Bus	5.36	4.85	0.51	100	1200	183,600
Truck	8.53	7.62	0.91	10	120	32,760
Total	-	-	-	-	-	1,310,760

Or say 1.311 million.

Table No. 20 TIME SAVINGS TO THE CAR, WAGON AND BUS OCCUPANTS

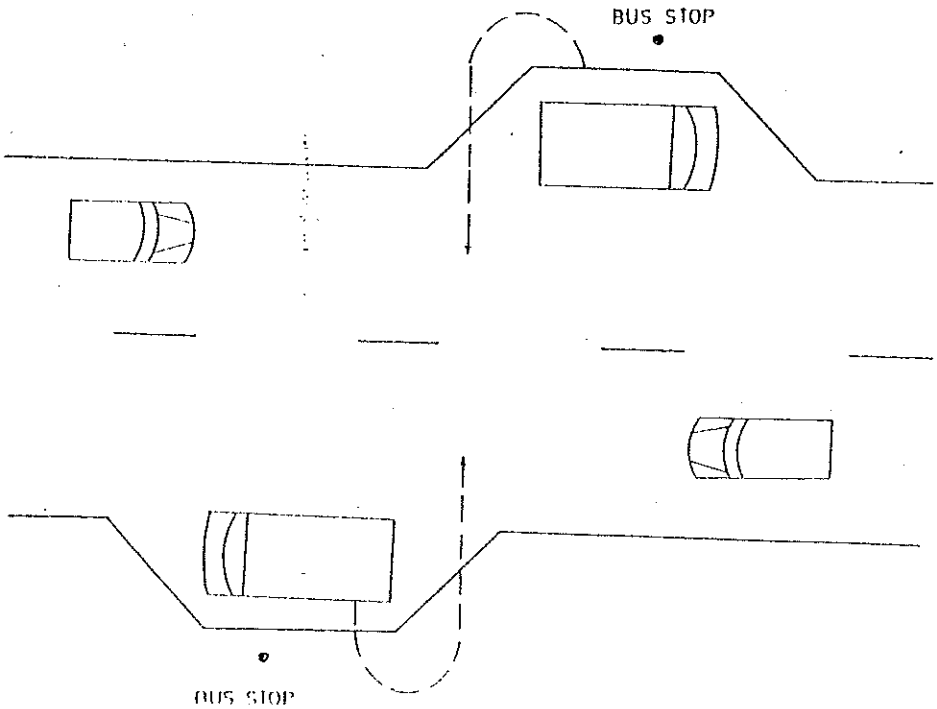
Types of Vehicles	No. of Occups.	Av.No.of Vhs/hr.	No.of Vhs/day	Time Cost per hour (Rs.)	Estimated Value of Time Per Year (Rs.)
Car	02	500	6000	10	3,000,000
Wagon	10	150	1800	05	2,250,000
Bus	30	100	1200	04	3,600,000
Total :	-	-	-		8,850,000



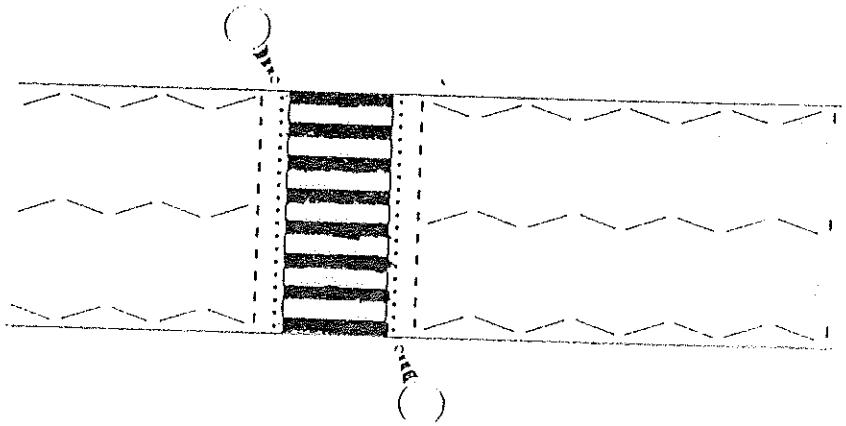
Schematic layout of a with-flow bus lane [NB. Sign numbers refer to the Traffic Signs and General Directions 1981]

Figure 1

FIG 2 TAIL TO TAIL BUS STOPS ON OPPOSITE SIDES OF THE ROAD



Zebra Crossing Undivided



Zebra Crossing Divided

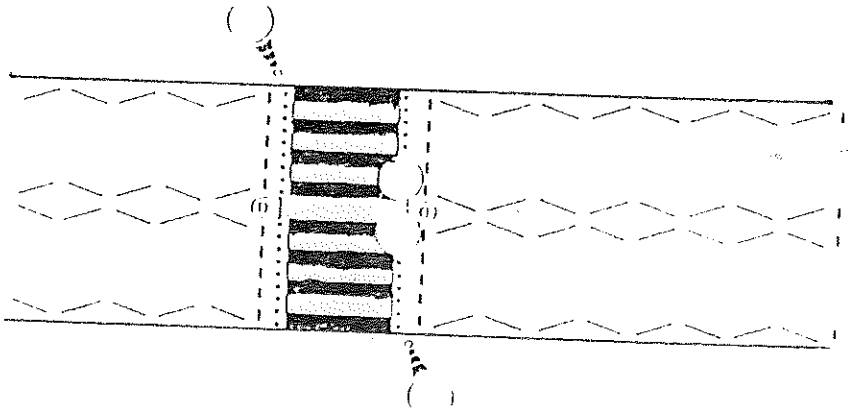
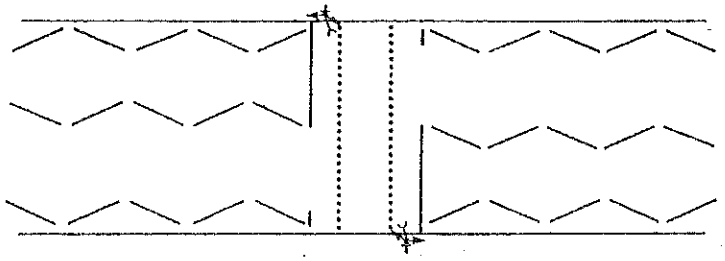
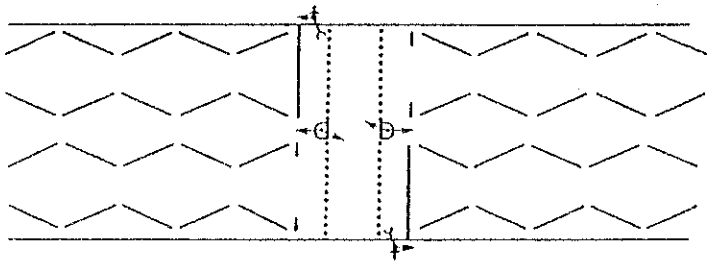


Figure 3 [illegible]

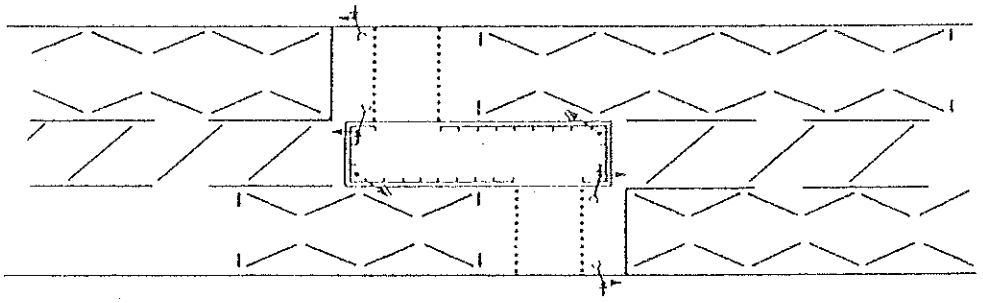
Pelican Crossing on Two Way Road
without Central Refuge.



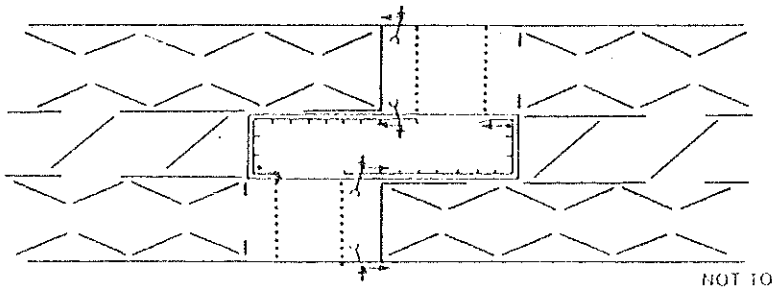
Pelican Crossing on Two Way Road
with Central Refuge.



Pelican Crossing of Two Way Road
Left Hand Stagger (Preferred).



Pelican Crossing on Two Way Road
Right Hand Stagger.



NOT TO SCALE

Figure 4 Layouts for pelican crossings

FIG. 5. VEHICLES COUNTING AT FAIZABAD BUS-STOP

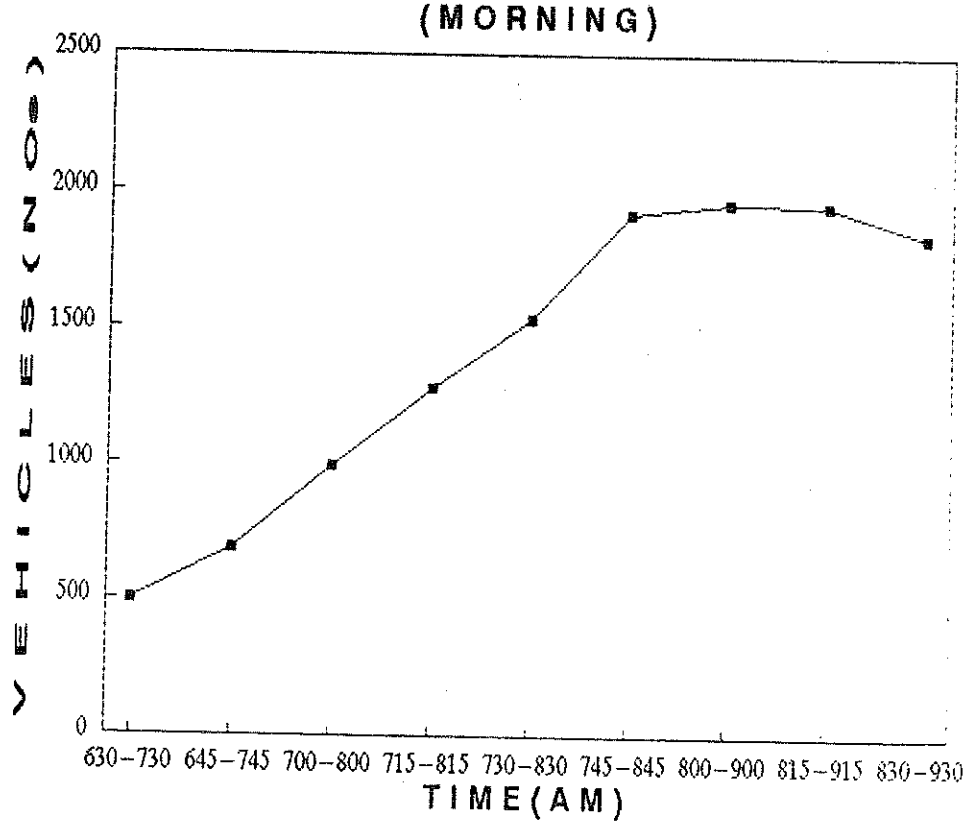


FIG. 6. VEHICLES COUNTING AT FAIZABAD BUS-STOP

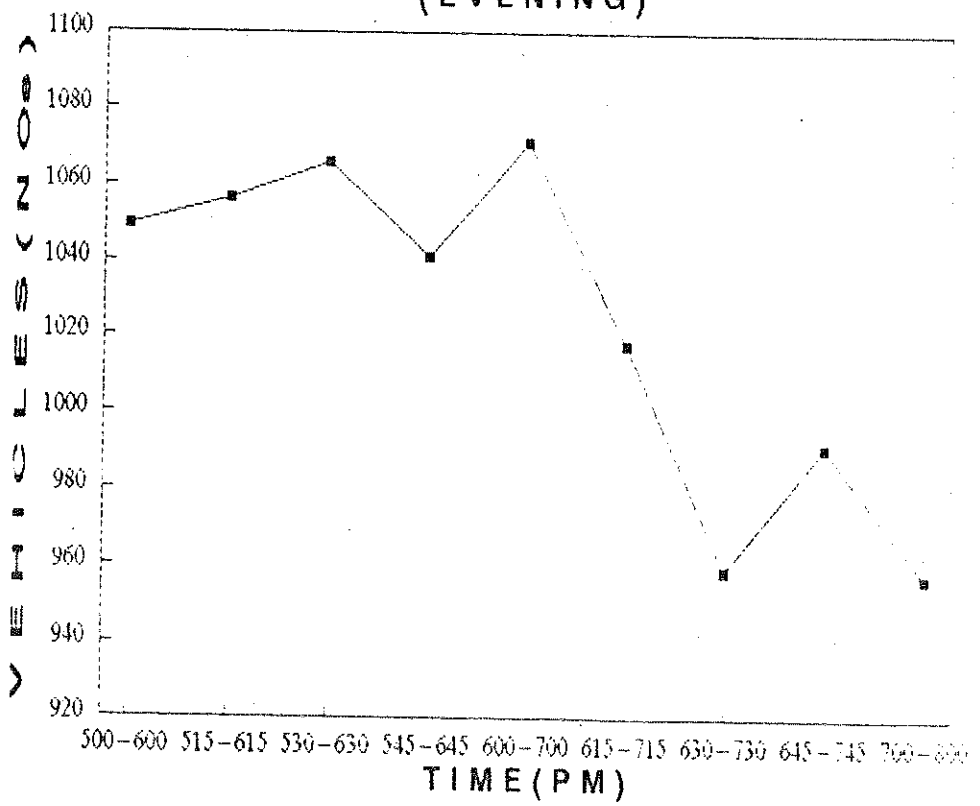


FIG. 7. VEHICLES COUNTING AT FAIZABAD BUS-STOP

(M O R N I N G 0630 – 0930 HRS)

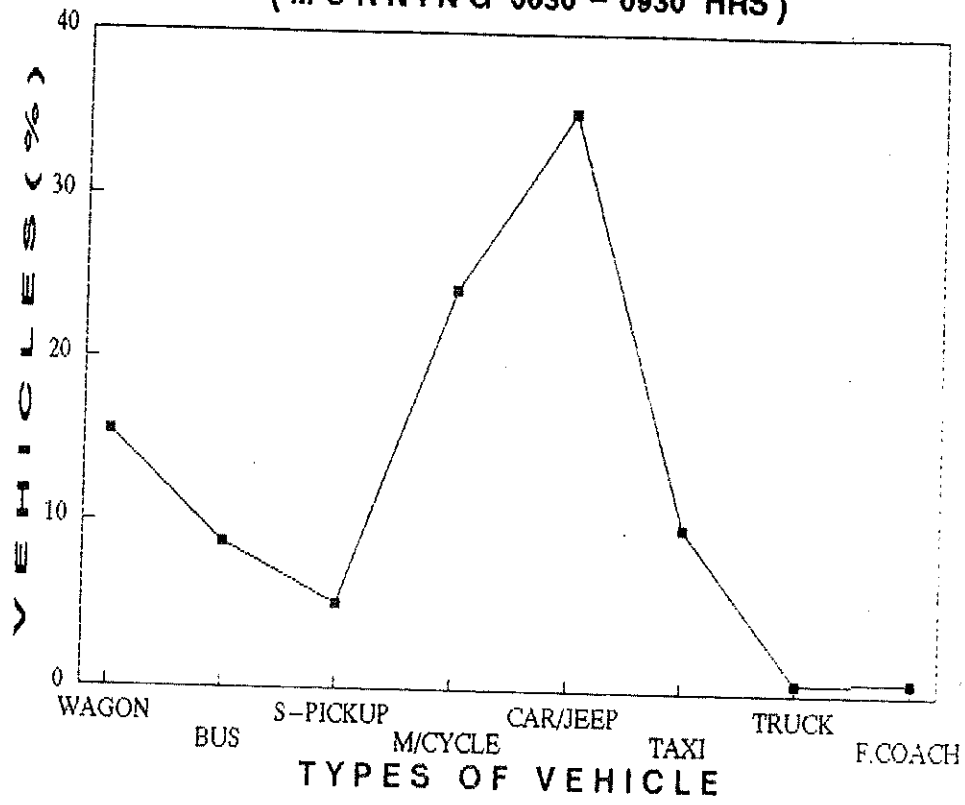
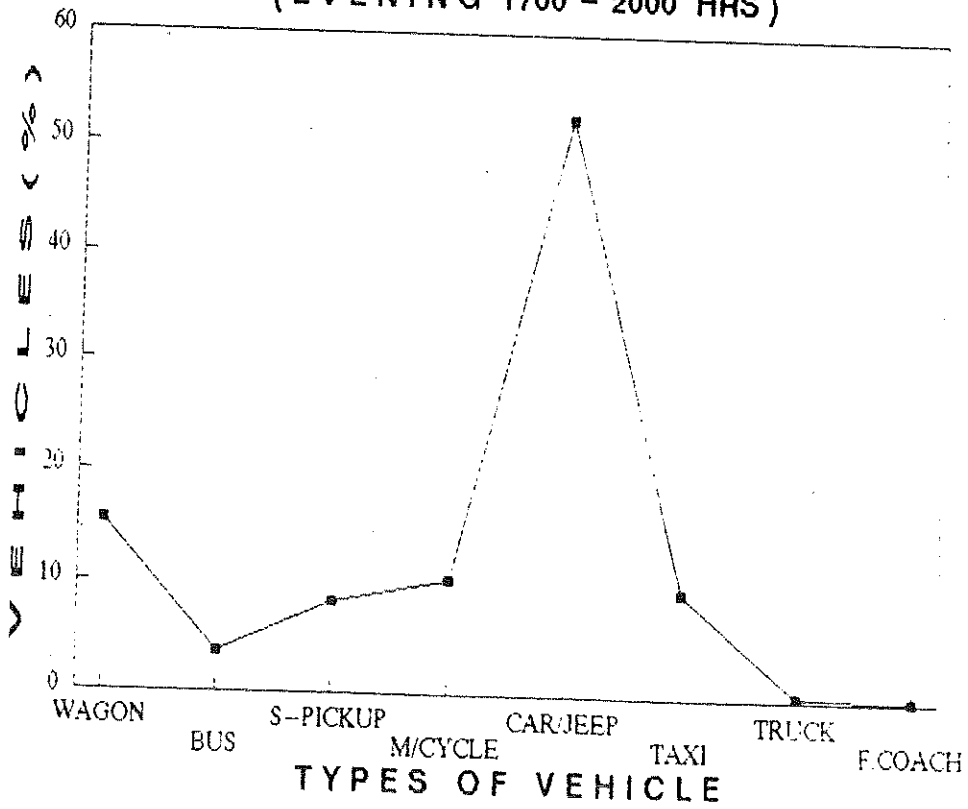


FIG. 8. VEHICLES COUNTING AT FAIZABAD BUS-STOP

(E V E N I N G 1700 – 2000 HRS)



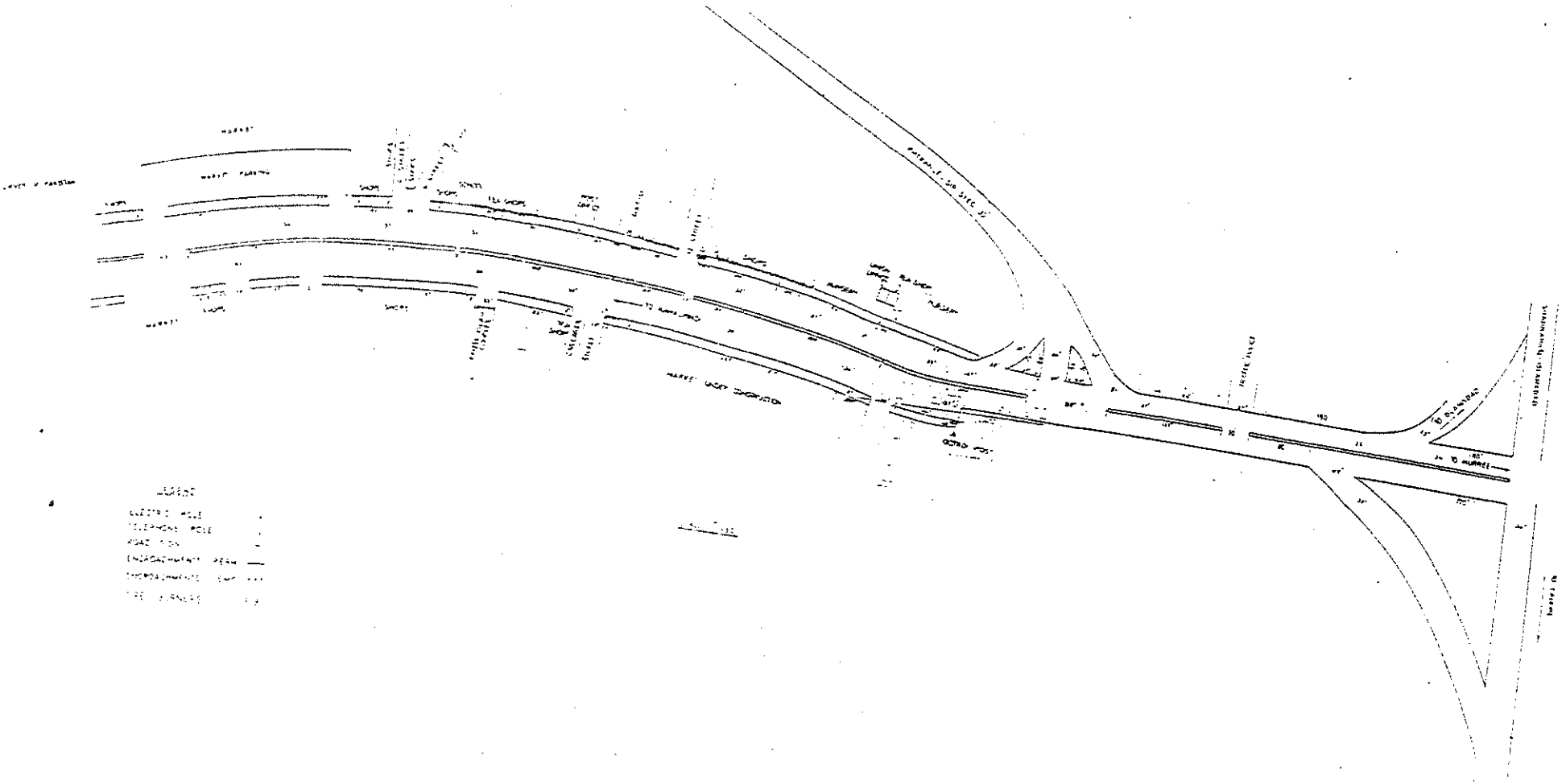
ANNEXURE - I

FAIZABAD BUS STOP

SURVEYOR PAKISTAN - ISLAMABAD HIGHWAY

(SURROUNDINGS)

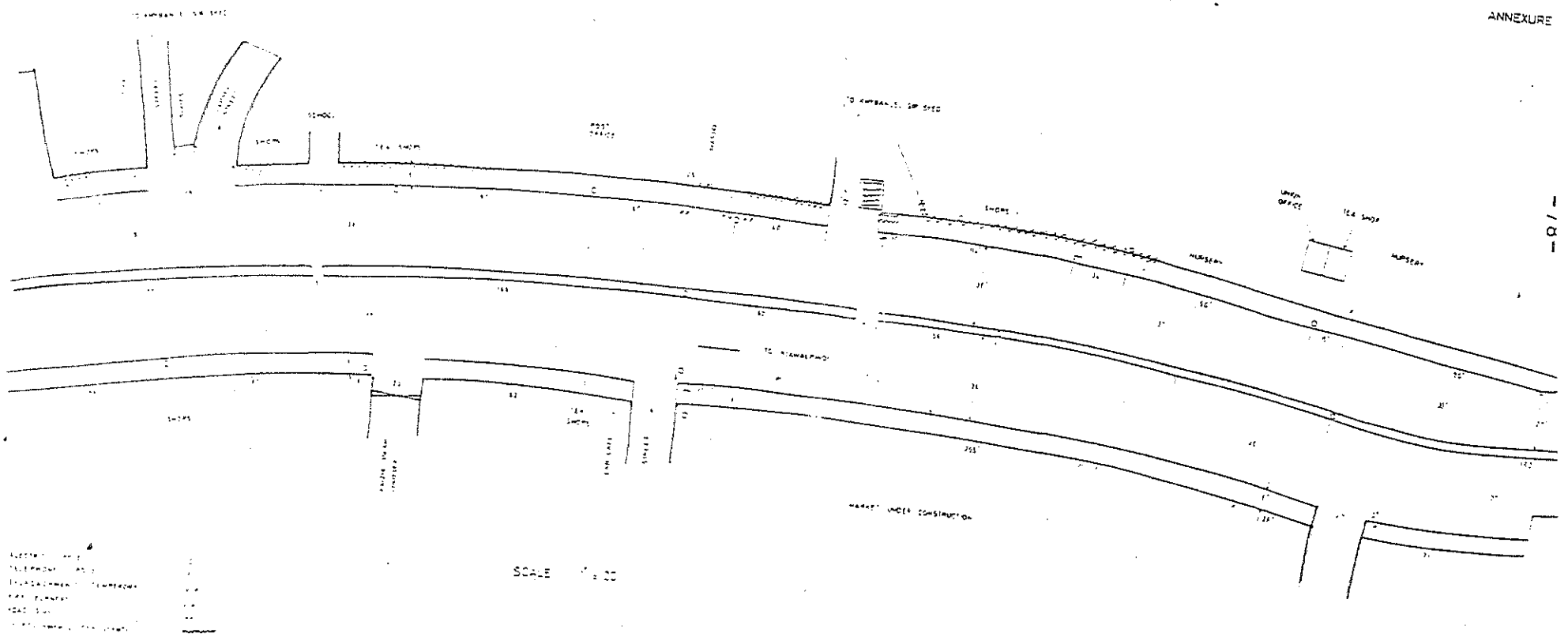
(ORIGINAL LAYOUT PLAN)



ANNEXURE

FAIZABAD BUS STOP

SURVEY OF PAKISTAN – ISLAMABAD HIGHWAY



SCALE

ANNEXURE-III

QUESTIONNAIRES

(Page 80 - 84)

NATIONAL TRANSPORT RESEARCH CENTRE

***

EMBARKED PASSENGER ORIGIN AND DESTINATION SURVEY

Direction: Rawalpindi to Islamabad, Weather : Sunny/Cloudy/Rainy
Mode : Bus/Wagon/Suzuki Pickup Time : 0730 to 0745 Hrs.

Destination / Origin	Islamabad	Rawalpindi	Pirvadhai	Outer city	Total
Islamabad					
Rawalpindi					
Pirvadhai					
Outside City					
Total:-					

DISEMBARKED PASSENGER ORIGIN AND DESTINATION SURVEY

Direction: Rawalpindi to Islamabad, Weather : Sunny/Cloudy/Rainy
Mode : Bus/Wagon/Suzuki Pickup Time : 0730 to 0845 Hrs.

Destination / Origin	Islamabad	Rawalpindi	Pirvadhai	Outer city	Total
Islamabad					
Rawalpindi					
Pirvadhai					
Outside City					
Total:-					

****

NATIONAL TRANSPORT RESEARCH CENTRE

***

PASSENGER EMBARKATION SURVEY

Direction : Rawalpindi to Islamabad, Weather: Sunny/Cloudy/Rainy
Mode : Bus/Wagon/Suzuki Pickup, Time : 0730 to 0830 Hrs.

Time	Mode	Embarked Pax. of (Mode)	1/4	1/2	3/4	F
0730 - 0745						
0745 - 0800						
0800 - 0815						
0815 - 0830						
Total:-						

PASSENGER DISEMBARKATION SURVEY

Direction : Rawalpindi to Islamabad, Weather: Sunny/Cloudy/Rainy
Mode : Bus/Wagon/Suzuki Pickup Time : 0730 to 0830 Hrs.

Time	Mode	Embarked Pax. of (Mode)	1/4	1/2	3/4	F
0730 - 0745						
0745 - 0800						
0800 - 0815						
0815 - 0830						
Total:-						

NATIONAL TRANSPORT RESEARCH CENTRE
***
CLASSIFIED VEHICLE COUNTING SURVEY

Direction : Rawalpindi to Islamabad, Weather: Sunny/Cloudy/Rainy
Mode : Bus/Wagon/S-Pickup/Car/Taxi/M-Cycle/Truck/Jeep/F-Coach
Morning : 0630 Hrs to 0930 Hrs, Evening : 1700 Hrs to 2000 Hrs

Mode / Time	Bus	Motorcycle
0630 To 0645	T=	T=
-	T=	T=
0915 To 0930	T=	T=
T = Total :-		
1700 To 1715	T=	T=
-	T=	T=
1945 To 2000	T=	T=
T = Total :-		

Direction : Islamabad to Rawalpindi, Weather: Sunny/Cloudy/Rainy
Mode : Bus/Wagon/S-Pickup/Car/Taxi/M-Cycle/Truck/Jeep/F-Coach
Morning : 0630 Hrs to 0930 Hrs, Evening : 1700 Hrs to 2000 Hrs

Mode / Time	Bus	Motorcycle
0630 To 0645	T=	T=
-	T=	T=
0915 To 0930	T=	T=
T = Total :-		
1700 To 1715	T=	T=
-	T=	T=
1945 To 2000	T=	T=
T = Total :-		

NATIONAL TRANSPORT RESEARCH CENTRE
***
VEHICLES WAITING TIME SURVEY

Direction: Rawalpindi to Islamabad, Weather: Sunny/Cloudy/Rainy
Mode : Bus/Wagon/S-Pickup/Taxi. Evening: 1700 Hrs To 2000 Hrs
Morning: 0630 To 0930 Hrs (15 Minutes Interval)

Sr. No.	Registration No.	Entering Time	Sr. No.	Registration No.	Entering Time
01	IDE - 8274	0630	26		
02			27		
-			-		
25			50		

Direction: Rawalpindi to Islamabad, Weather: Sunny/Cloudy/Rainy
Mode : Bus/Wagon/S-Pickup/Taxi. Evening:1700 Hrs To 2000 Hrs.
Morning : 0630 To 0930 Hrs (15 Minutes Interval)

Sr. No.	Registration No.	Leaving Time	Sr. No.	Registration No.	Leaving Time
01	IDE - 8274	0635	26		
02			27		
-			-		
25			50		

Direction :Islamabad bound Bus Stop, Weather: Sunny/Cloudy/Rainy
Morning :0630 Hrs to 0930 Hrs, Evening: 1700 Hrs to 2000 Hrs

S.No.	Reg.Number	Entering Time	Leaving Time	Waiting Time (Mins.)
01.	IDE 8274	0630 Hrs	0635 Hrs	05
02.	-	-	-	-
-	-	-	-	-
50	-	0925 Hrs	0930 Hrs	05

****

NATIONAL TRANSPORT RESEARCH CENTRE
***
PASSENGERS EMBARKATION AND DISEMBARKATION TIME SURVEY

Direction: Rawalpindi to Islamabad, Weather : Sunny/Cloudy/Rainy
Mode : Bus/Wagon/Suzuki-Pickup
Time : From: 0630 Hrs To 0930 Hrs.(15 Minutes Interval)

Sr.No	No.of Embarked Pax.	Time	No. of Disembarked Pax.	Time

NATIONAL TRANSPORT RESEARCH CENTRE

***

VEHICLES ACCUMULATION SURVEY

MORNING

Location: Rawalpindi to Islamabad, Weather:Sunny/Cloudy/Rainy
Mode : Car/M-Cycle/Taxi/Wagon/Pickup/Truck/Bus
Time : From 0800 Hrs To 0900 Hrs. (15 Minutes Interval)

Sr. No.	Registration No.	Entering Time	Sr. No.	Registration No.	Entering Time
01			27		
02			27		
03			28		
-			-		
25			50		

Location: Rawalpindi to Islamabad, Weather:Sunny/Cloudy/Rainy
Mode : Car/M-Cycle/Taxi/Wagon/Pickup/Truck/Bus
Time : From 0800 Hrs To 0900 Hrs. (15 Minutes Interval)

Sr. No.	Registration No.	Leaving Time	Sr. No.	Registration No.	Leaving Time
01			26		
02			27		
03			28		
-			-		
25			50		

EVENING

Location: Rawalpindi to Islamabad, Weather:Sunny/Cloudy/Rainy
Mode : Car/M-Cycle/Taxi/Wagon/Pickup/Truck/Bus
Time : From 1700 Hrs To 1800 Hrs. (15 Minutes Interval)

Sr. No.	Registration No.	Entering Time	Sr. No.	Registration No.	Entering Time
01			27		
02			27		
03			28		
-			-		
25			50		

Location: Rawalpindi to Islamabad, Weather:Sunny/Cloudy/Rainy
Mode : Car/M-Cycle/Taxi/Wagon/Pickup/Truck/Bus
Time : From 1700 Hrs To 1800 Hrs. (15 Minutes Interval)

Sr. No.	Registration No.	Leaving Time	Sr. No.	Registration No.	Leaving Time
01			26		
02			27		
03			28		
-			-		
25			50		

NATIONAL TRANSPORT RESEARCH CENTRE
***

PEDESTRIAN CROSSING COUNT SURVEY

MORNING
Weather : Sunny/Cloudy/Rainy Day _____ Date _____

Age Group Years	Number of Crossing Pedestrians from A to B 0800 to 0900 Hrs	
06 - 10		
11 - 15	T=	
16 - 20	T=	
21 & Above	T=	
	T=	

Weather : Sunny/Cloudy/Rainy Day _____ Date _____

Age Group Years	Number of Crossing Pedestrians from B to A 0800 to 0900 Hrs	
06 - 10		
11 - 15	T=	
16 - 20	T=	
21 & Above	T=	
	T=	

EVENING
Weather : Sunny/Cloudy/Rainy Day _____ Date _____

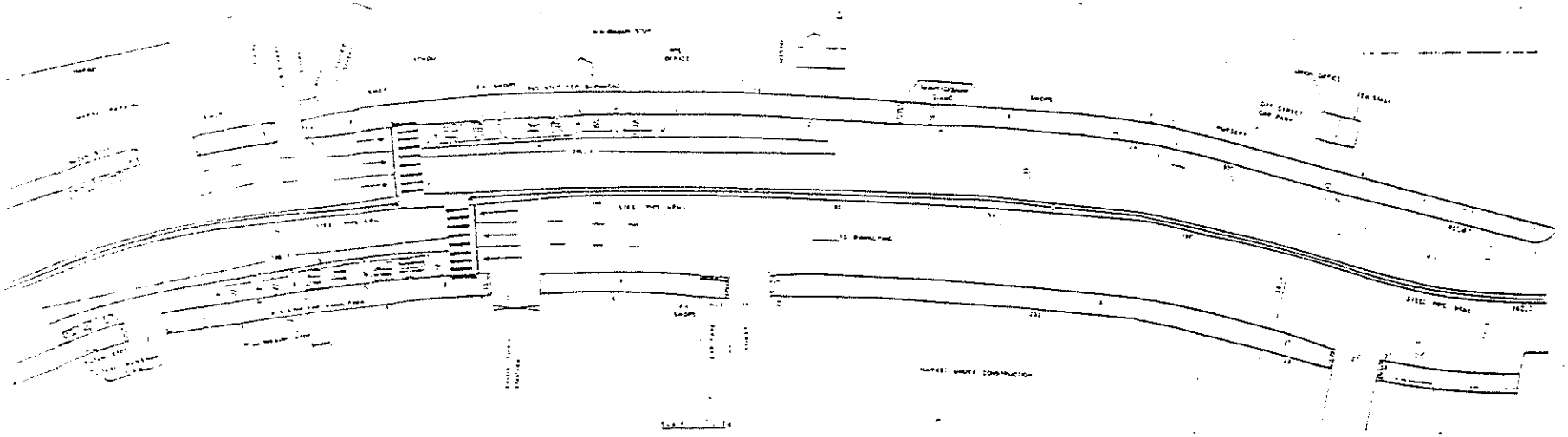
Age.Group Years	Number of Crossing Pedestrians from A to B 1700 to 1800 Hrs	
06 - 10		
11 - 15	T=	
16 - 20	T=	
21 & Above	T=	
	T=	

Age Group Years	Number of Crossing Pedestrians from B to A 1700 to 1800 Hrs	
06 - 10		
11 - 15	T=	
16 - 20	T=	
21 & Above	T=	
	T=	

Note:- A=Islamabad bound Bus Stop & B=Rawalpindi bound Bus Stop

FAIDABAD BUS STOP

ANNEXURE - II



FAIZABAD BUS STOP