CRITICAL ANALYSIS OF EXISTING PUBLIC TRANSPORT SYSTEM AND DEVELOPMENT OF FUTURE MODEL ON MODERN LINES FOR MAJOR CITIES OF PAKISTAN

QAISER ANEES KHURRAM

2008-NUST-MS PhD-MEM-12

ADVISOR

BRIG DR NAWAR KHAN

DEPARTMENT OF ENGINEERING MANAGEMENT

COLLEGE OF ELECTRICAL AND MECHANICAL ENGINEERING

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Guidance & Examination Committee

Name: Brig. Dr Nawar Khan Signature : _____

Dept: Engineering Management

Name: Dr. Ather Masood Signature : _____

Dept: Engineering Management

Name: Brig Dr. Akhtar Nawaz Signature : _____

Dept: Dean Academics

Name: Dr. Mehmood Anwar Khan Signature : _____

Dept: Mechanical Engineering

Advisor's Name : Brig. Dr. Nawar Khan Signature : _____

Dept: Department of Engineering Management Date : _____

Head of Department	Dated	Dean / Commandant	Dated

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TO

MY MOTHER

Who has always been source of inspiration for me.

ABSTRACT

Ever since invention of wheel revolutionized the life of ancient man, science and technology is regularly bringing magical changes in the society. Latest technologies have greatly improved the living standards of people in almost all spheres of life. Modern means of public transport and associated network, i.e. road transport, trains and subways have great impact on the day to day life of people in the developed countries. The travelling times and distances have reduced manifold where latest public transport systems are in place. The people can reach to their work places swiftly, safely and by spending less. This modernization has completely changed the life style of common people and brought efficiency in their daily working.

Modern public transportation system has also played a role in increased economic growth and overall development of the society. This area has been under greater focus in developed countries and their efficiency is now dependent on how effectively they can transport their work force to offices, work places. However, there has been less emphasis on the development of descent and efficient public transport network in Pakistan due to which our people face serious problems in managing their daily affairs. Besides, poor means of transportation has adverse effects on overall efficiency and behaviour of our people. Therefore, there is a need to select and integrate most suitable transport system with related facilities, infrastructure for public transport for our cities. This will not only help people to commute to their work places conveniently but will have far reaching effects on overall development of our society and the country.

The purpose of this research work is to carryout a critical analysis of existing urban transport system with a view to suggest a latest, efficient and cost effective public transport model with improvement in existing roads network, organizational control, policies, strategies and fleet of vehs for major cities in Pakistan. The related factors such as governance, capacity building and urban planning will also be identified and included to the overall findings of the research.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF GRAPHS

LIST OF ABBREVIATIONS

Serial	Word	Abbreviation
1.	KRTC	Karachi Road Transport Corporation
2.	KCR	Karachi Circular Railway
3.	PRTC	Punjab Road Transport Corporation'
4.	PUTC	Punjab Urban Transport Corporation
5.	LDA	Lahore Development Authority
6.	NTRC	National Transport Research Centre
7.	FUTS	Faisalabad Urban Transport Society
8.	NGO	Non Governmental Organization
9.	LTS	Lahore Transport System
10.	MTDF	Medium Term Development Framework
11.	ADB	Asian Development Bank
12.	LRMTS	Lahore Rapid Mass Transit System
13.	PUTP	Provincial Urban Transport Policy
14.	DPL	Development Policy Loan
15.	TSM	Traffic Systems Management
16.	PRT	Personal Rapid Transit
17.	OD	Original Destination
18.	WTT	waited travel time
19.	CDA	Capital Development Authority
20.	RDA	Rawalpindi Development Authority
21.	ITA	Islamabad Transport Authority
22.	RTA	Rawalpindi Transport Authority
23.	RRT	Rapid Rail Transit System
24.	PIMS	Pakistan Institute of Medical Sciences
25.	LRT	Light Railway Transit

CHAPTER 1
INTRODUCTION
CRITICAL ANALYSIS OF EXISTING PUBLIC TRANSPORT SYSTEM AND DEVELOPMENT OF FUTURE MODEL ON MODERN LINES FOR MAJOR CITIES OF PAKISTAN

"The ideal transport mode would be instantaneous, free, have an unlimited capacity and always be available. It would render space obsolete. This is obviously not the case. Space is a constraint for the construction of transport networks. Transportation appears to be an economic activity different from the others. It trades space with time and thus money" (translated from Merlin, 1992).

1.1 Background

Science and technology has played a vital role in improving the living standard of people. Modern life is fast, very calculated with no room for wastage of time. Everyday, millions of people go to their offices and work places using different types of public transport. Considering the importance of public transport, all the advanced countries have focused on this area and developed an efficient and cost effective public transport network for their people. However, this important area has been neglected in Pakistan. It is perceived that that half of the energy of our people is spent in the process of reaching to their workplace for duty in the morning due to non availability of decent and comfortable transport. Resultantly, it has adverse effect on overall efficiency, conduct and behavior of our people.

Science and technology has played a vital role in almost all areas of human activity. Management and integration of technology for improving public transportation is considered imperative for providing decent and effective means of travelling for our masses. This will not only provide comfort but will also reduce expenditure as well as increase efficiency of our workforce.

The adoption of new / modern ways of travelling will also bring foreign investment, transfer of technology, tech expertise as well as job opportunities. Internationally, this area has been

thoroughly researched and technologies have been developed for betterment of people. However, very less research work has been carried out in Pakistan specific to our environment. That is why our people are forced to travel by substandard means of transport.

1.2 Problem Statement

People of Pakistan have been deprived of one of the basic necessity of life i.e. good quality public transport which they need everyday to commute to their work places and back home. This deficiency at national level results in a substantial wastage of productive man hours, breeds inefficiency and creates chaos / traffic related problem in all major cities.

The developed countries in the world have paid adequate attention towards this aspect and come up with effective public transport management solutions for their public. China, for example, with the population of over 1.3 billion has addressed this issue upfront and has come up with very effective, low cost and efficient public transport system which is available in abundance for their people.

Therefore, there is a dire need to study contemporary public transport systems with a view to improving our own public transport sector for the benefit of common people. The system should be able to provide an efficient, cost effective and comfortable means of commutation for our people so that they can reach to their work places with ease, safety and respect.

1.3 Objectives of Research

a. To critically analyze existing public transport system available in major cities of Pakistan, its shortcomings and inadequacies with a view to suggesting a better substitute.
b. To analyze the prospects of integrating different modes of transport for improving overall public transport system of Pakistan.
c. To get feedback from people of various fields of life about the effects of poor means of transportation available in the country.
d. To interact with relevant government departments responsible for public transport management, to know their problem areas / bottlenecks in the way of improvement.

e. To study public transport system of contemporary countries to recommend a modern means of public transportation for people of Pakistan.

f. To suggest a latest, efficient and cost effective public transport model for major cities of Pakistan.

g. To give recommendations for future study on the subject.

1.4 **Research Methodology**

The research methodology for the paper includes:-

a. Literature reviews of :-

(1) Historical overview of public transport planning and policy in Pakistan.

(2) Present system of public transport available in Pakistan.

(3) Analysis of problem areas, limitations and bottlenecks in the way of developing efficient and modern public transport system for Pakistan.

(4) Study of contemporary public transport system available in developed countries.

b. Interactive sessions with relevant government and private agencies to get their views on the subject.

c. Study of the possibilities of integrating mix of transport modes for development of public transport network.

d. Development of public transport model for major. Rawalpindi and Islamabad.

e. Recommendations and conclusion.

The study / research of above mentioned areas / factors would help to identify the shortcomings and weaknesses, in our existing policy and system of public transport as well as impediments in the way of development of better public transport model.

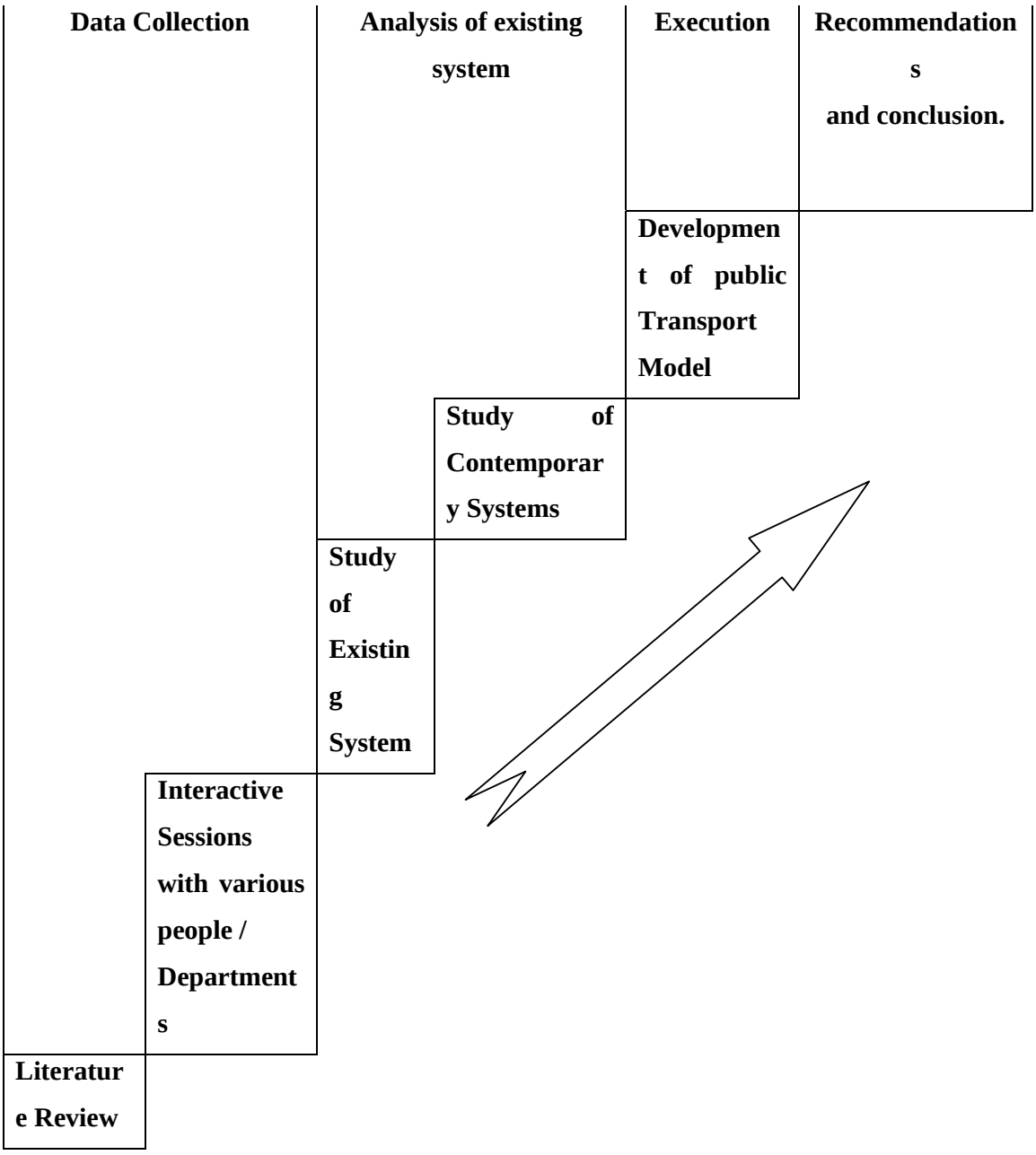


Figure 1.1 Research Methodology

1.5 Structure of Thesis

1.5.1 Literature Review

The research work required literature review to focus on four major areas; historical perspective, existing public transport system of Pakistan and its shortcomings, the public transport models available in the world and selection of suitable model for Pakistan. The salient's are:

a. **Historical Perspective - Evolution of Public Transport System**. The history of the "concept" of public transport is as old as the first ferries which were part of Greek methodology. The 2nd Chapter explains the evolution of the concept of public transport system and its development through ages. It also draws references of development of transport methods in developed countries.

b. **Analysis of Urban Traffic and Transportation**. Third chapter discusses the need and urgency for development of Urban Public Transport system for any developing country like Pakistan. It also sheds light on some of the impediments in the way of developing an effective public transport system in Pakistan.

c. **Evaluation of Existing Public Transport System in Islamabad-Rawalpindi** Chapter four deals with the evaluation of existing public transport system in twin cities, its short comings and weaknesses.

d. **Traffic Safety And Environment In Urban Areas**. Chapter five deals with inter related safety issues and traffic environment in urban areas in particular the twin cities of Islamabad – Rawalpindi.

e. **Public Transport Model For Islamabad-Rawalpindi**. Chapter six gives the comparison of available public transport models and suggest the most suitable model keeping in view the existing infrastructure to provide an effective public transport facility which is characterized by reliability punctuality, human comfort and safety.

f. **Immediate – Short Term Traffic Management Actions For Improving Existing Road Network and Traffic Situation in Islamabad - Rawalpindi**

Chapter seven gives the description of immediate traffic management actions and techniques required to improve the existing infrastructure (road/route networks, road maintenance, level of service, road user behavior, organizational structure etc).

g. **Recommendations**. Chapter eight gives comprehensive recommendations The recommendations pertain to both the selected model for public transport for Pakistan cities as well for future study of the subject.

h. **Conclusion**. The chapter concludes the research.

CHAPTER 2

HISTORICAL BACKGROUND – EVOLUTION OF PUBLIC TRANSPORT SYSTEM

2.1 What is Public Transport

Public transport including public transportation, public transit system, or mass transit system means a shared passenger transportation service which is available for use by the general public. It is different from other modes like cab and car pooling which are not shared by strangers without special permission or arrangement.

2.2 Different Modes of Public Transport

There are various different types of public transport modes which include buses, trolleybuses, trams and trains, 'rapid transit' like metro/subways/undergrounds trains and ferries system as available in Europe and other modern and developed countries. Similarly, intercity public transport is also available, like airlines, luxury buses, and intercity rail. Bullet trains and high-speed rail networks have also been developed in many parts of the world, specially Japan.

The most important characteristics of the public transport system is that it runs to a scheduled timetable with the most frequent services running to a headway. Share taxi offers on-demand services in many parts of the world and some services will wait until the vehicle is full before it starts. Para transit is sometimes used in areas of low-demand and for people who need a door-to-door service.

City or urban public transport is managed and provided either by the government or private transport operators. Financially, the public transport services are usually funded by fares charged to the passenger. Services are normally regulated and possibly subsidized from local or national tax revenue. Fully-subsidized, zero-fare services used to be available but nowadays, public has to pay the fare and government generally give some subsidy. Some of the public transport means are discussed as follows:-

a. **Bus and Coach**

Bus services are the most common means of public transportation which are used on conventional roads and prescribed routes to transport numerous passengers on shorter journeys. Buses have low capacity compared with trams or trains but can operate on conventional roads, with relatively easily managed and inexpensive bus stops to serve the passengers. There are various configurations:-

(1) Buses are commonly used in smaller cities and towns, in rural areas as well for shuttle services supplementing in large cities.

(2) Bus rapid transit i.e. buses operating on dedicated right-of-way, much like a light rail.

(3) Trolleybuses are electric buses that use overhead wires to get power for traction. This system has been intensively employed in China.

(4) Online Electric Vehicles are buses that run on a conventional battery, but are recharged frequently at certain points via underground wires.

(5) Coach services use coaches (long-distance buses) for suburb-to-main city or downtown areas or for longer distance transportation. The vehicles are normally equipped with more comfortable seating, a separate luggage compartment, video and possibly also a toilet. They have higher standards than city buses, but less no of halts enroute to save time.

b. **Trains**

Trains or passenger rail transport is most widely used arrangement for public mass transit. It is the conveyance of passengers by means of wheeled vehicles specially designed to run on railways. Trains allow transportation of very high capacity on short as well as long distance. However, the system requires elaborate track infrastructure and a number of stations to be constructed enroutes. The urban rail transit consists of trams, light rail, rapid transit, people movers, commuter rail and funiculars. Commuter rail is part of an urban area's public transport; it provides faster services to outer suburbs and neighboring towns and villages. The trains are required to stop at all stations, that are located to serve a smaller suburban or town center. The stations often

being combined with shuttle bus or park and ride systems at each station. Its frequency could be up to several times per hour, and commuter rail systems may either be part of the national railway, or operated by local transit agencies. Following arrangements are in practice:-

(1) Intercity rail is long-haul passenger services that connect multiple urban areas. They have few stops, and aim at high average speeds, typically only making one of a few stops per city. These services may also be international.

(2) High-speed rail is passenger trains operating significantly faster than conventional rail the speed upto 300 kilometers per hour or more. The most reliable and efficient systems have been built in Europe and Japan, which are as good as air travel, i.e. such train systems offer long-distance rail journeys as quick as air services, with the advantage of lower prices such train system uses electricity instead of combustion and we have more cost effective.

c. **Trams and Light Rail**

Trams are small trains which run in city streets on dedicated tracks. Similar to conventional trains, trams have higher passenger capacity than normal buses. However, they must follow dedicated infrastructure with rails and get power through wires placed either above or below the track. Such systems are less flexible than buses. Light rail is a modern version of conventional tram. It has a dedicated right-of-way not shared with other traffic, step-free access and increased speed. Light rail lines are, thus, essentially modernized means of traveling.

d. **Metro / Underground / Rapid Transit**

Metro or underground trains system are in fact the rapid transit railway which operates in urban environment / area with a very high capacity and frequency. These characteristic distinctly separate such systems from other traffic. Systems are able to transport large amounts of people quickly over short distances with little land use. These days more than 160 cities have rapid

transit systems in place totaling more than 8,000 km (4,971 mi) of track and 7,000 stations. Besides, approx twenty-five cities have their systems under construction.

e. **Ferry**

A ferry is a boat or ship, used to carry (or *ferry*) passengers, and sometimes their vehicles, across a body of water. A foot-passenger ferry with many stops is sometimes called a water bus. Ferries form a part of the public transport systems of many waterside cities and islands, allowing direct transit between points at a capital cost much lower than bridges or tunnels, though at a lower speed. Ship connections of much larger distances (such as over long distances in water bodies like the Mediterranean Sea) may also be called ferry services.

2.3 Public Transport - Historical Perspective

Means of conveyances and transportation for public hire are as old as the first ferries, and the earliest public transport was water transport. On land people walked sometimes in groups and on pilgrimages, as noted in sources such as the Bible and Canterbury Tales or at least in the Old World rode an animal. Ferries are part of Greek mythology — corpses in ancient Greece were buried with a coin underneath their tongue to pay the ferryman Charon to take them to Hades.

Figure 2:1 Historical Perspective

Figure 2:2 Historical Perspective- Omnibus

Some historical forms of public transport are the stagecoach, traveling a fixed route from coaching inn to coaching inn, and the horse-drawn boat carrying paying passengers, which was a feature of European canals from their 17th-century origins. (The canal itself is a form of infrastructure dating back to antiquity — it was used at least for freight transportation in ancient Egypt to bypass the Aswan cataract — and the Chinese also built canals for transportation as far back as the Warring States period. Whether or not those canals were used for for-hire public transport is unknown; the Grand Canal was primarily used for shipping grain.) The omnibus, the first organized public transit system within a city, appears to have originated in Paris, France, in 1662, although the service in question failed a few months after its founder died; omnibuses are next known to have appeared in Nantes, France, in 1826. The omnibus was introduced to London in July 1829.

a. **Concept of Public Transport During British Rule of India**

The history of public transport development in British India could be traced back to the development of railway system for India under British Rule. The first passenger train started from Howrah to Hoogly, currently in India in 1853.

Figure 2:3 Public Transport Concept During British India

The areas which are now part of Pakistan were connected by railway in 1860s; The first section was built between Karachi and Kotri. By mid 1860s, many cities now in Pakistan were connected by the railway to the rest of the country. The railway network in Pakistan was extended to the Afghanistan border in 1878 and to Zahidan, Iran, in 1918. In total, British India had an extensive network of railways of 41,000 miles in 1944; of this total, 8,070 miles was in the areas of Pakistan. In addition to intercity railway development and operation, the British government introduced urban public transport services. The Karachi Tramways Act was passed in 1884, and the first steam tramway was opened for operation in 1885 along with the horse-drawn tram. Subsequently, these trams were converted to petrol engine trams in 1908. Despite this development, the Tonga (horse-drawn carriages) was the only means of public transport in Pakistani cities until late 19^{th} century.

These urban tramways and intercity railways were augmented by buses

providing feeder services. Like Karachi, the city of Lahore was connected with the railway network and, in 1904; the locomotive workshops were established there to fulfill the needs of the extensive railway network. Additionally, new and wider roads were constructed in Lahore, and bus-based public transport was initiated to connect the major civic and government buildings located on the Mall Road. The Model Town Lahore Co-operative Society had not only developed its own municipal services, but also initiated a bus-based public transport service that connected the town to the rest of Lahore. Overall, these public transport facilities altered the face of transport system in Pakistani cities.

b. **Concept of Public Transport in Pakistan – An Over View**

(1) **Early Era (1947 – 1990)**

In 1947 when Pakistan came into existence, the railways was the most valuable asset of the country and the only intercity public transport system available. At that time, North Western Railway of Pakistan carried the largest number of passengers in Pakistan (Govt. of Pakistan, National Planning Board 1957). The First Five Year Plan (1955-60) and proposed a strong and powerful railway system and corresponding road network to operate side by side and complement each other. As per proposed plan 70% of total investment was to be made for infrastructure for railways and 30% for development of food network.

(2) In urban areas, motorized traffic was very limited until 1947. For example, in the city of Lahore, homes, work places, bazaars (commercial areas), and community places were located in a mixed land use pattern within a short distance. Therefore, walking was the largest mode of transport followed by Tonga (horse-drawn carriage). In spite of this fact, Omni Bus was operated in the cities of Lahore and Karachi, while tramway provided services in Karachi only. The Omni Bus (public transport) service has been a public monopoly from the beginning of its inception and expanded both in organization and resource over time. On the other hand, the tramway in Karachi was

abolished in the early 1970s, the beginning of its inception and expanded both in organization and resource over time. On the other hand, the tramway in Karachi was abolished in the early 1970s.

(3) The Motor Vehicle Act 1939 was amended in 1951, and the Road Transport Board was established in Punjab with the mandate to provide efficient, adequate, economical, and coordinated public transport for the public in the province. In 1957, the (West) Pakistan Road Transport Board was established inline with the recommendation of the First Five Year Plan (1955-60). Similarly, the Karachi Road Transport Corporation (KRTC) was created in 1959 to established bus-based urban public transport in Karachi. In the Second Five Year Plan (1960-65), the roads sector was allocated more financial resources (Govt. of Pakistan, Planning Commission 1960) with fol explanations:-

(a) Road transport is more suitable to the conditions and requirements of Pakistan.

(b) The motor vehicle is more adaptable than the railways to varying degrees of traffic intensity and permits a greater degree of speed and efficiency in haulage over short distance.

(c) There is close relationship between the volume of transport and the level of economic activity because each depends upon the other (Govt. of Pakistan, Planning Commission 1960).

(4) Accordingly, the large cities of Pakistan followed the perception and initiated works for construction of new roads and implementing road-based public transport. The Second Five Year Plan allocated considerable finances to the (West) Pakistan Road Transport Board to procure 500 new buses for intercity public transport (Government of Pakistan, Planning Commission 1960). For urban transport, funds were allocated to the Karachi Road Transport Corporation (KRTC) for

building up a fleet of 1200 buses, procuring 700 vehicles in addition to the 500 procured under First Five Year Plan (Govt. of Pakistan, Planning Commission 1960). The Second Plan took further initiative to encourage the private sector to come forward and run road based public transport. The reason for inviting private sector was the rapid population growth that resulted in the enhanced requirement in the demand of public transport matching to the population growth. After this initiative i.e. involvement of private sector, private wagons started their services on predesigned routes to fulfill the shortfall of public transport. As a matter of fact, it was due to private sector that requirement of public transport was met to an extent.

(5) **Karachi Circular Railway**

The Second Five Year Plan (1960-65) also proposed establishment of the Karachi Circular Railway (KCR) as the first (and last to date) rail-based urban public transport project in Pakistan (Govt of Pakistan, Planning Commission 1960).

Figure 2:4 Karachi Circular Railway

The KCR was projected to serve the requirement of whole of Karachi. It was planned to be an efficient and economical transport service for the residents of Karachi (Govt. of Pakistan, Planning Commission 1960). Accordingly, the work started and some sections of the KCR were built. This service was very efficient and successful in the first 15 years. Subsequently, it declined due to lack of investment in the infrastructure and proper maintenance. For Lahore, the Master Plan proposed a mass transit system like Karachi circular railway in 1965 to connect existing railway that passes through the city (Govt. of Punjab 1973). However, Lahore mass transit plan could not materialize due to various reasons.

In 1977, the Punjab Road Transport Corporation'(PRTC) and Punjab Urban Transport Corporation (PUTC) were established for Punjab (Lahore Development Authority and World Bank/International Development Association 1980). The mandate of PRTC and PUTC was to provide an efficient, adequate, economical, and properly coordinated system of road-based intercity and urban public transport services, respectively. PUTC was also responsible to provide bus stands; develop amenities; purchase, manufacture, maintain, and repair buses; and provide other related services in urban areas. Later, PUTC developed its own maintenance and body building workshops, central stores, offices, and a central transport training institute. Although public-owned Omni Buses were merged into PUTC, it had always been short of buses due to a lack of investment by the government and international organizations. To fulfill this deficiency, PUTC and the Volvo International. Development Corporation completed a study for the Model Urban Transport System in Lahore (Volvo 1980). The PUTC-Volvo Model Transportation System project comprised transport planning, organizational restructuring, capacity building and the provision of vehicles. This study identified different issues for an efficient bus-based public transport network in Lahore. It recommended a continuation of the mixed public and private bus

system. As a result of this study, 350 Volvo buses were gifted by the Swedish government to Lahore. These buses were added to the fleet of PUTC.

Although Omni Buses were merged with PUTC and the Volvo buses were introduced, PUTC did not expand its fleet as required to cope with the enlarged system of routes and growing demand in Lahore. Therefore, PUTC tried to attract private sector by starting a leased buses scheme on specific routes run and managed by the private sector (LDA 1997). However, all these efforts were not successful over time and, gradually, PUTC bus services declined. Due to lack of investment, new buses were not purchased after 1989. Therefore, the public-owned bus system in Lahore managed by PUTC collapsed after being operational for a couple of years. Finally, the government disbanded the PUTC in 1998.

(6) **Public Transport Development Plans (1991 – 2000 and onward)**

(a) National Transport Research Centre (NTRC) published the draft National Transport Policy in 1991. According to the policy, bus based public transport system was preferred over rail based mass transit system for metropolitan cities of Pakistan (Government of Pakistan, NTRC 1991). Main reason for such preference was limited Financial assistance from the World Bank to develop expensive rail based transportation infrastructure. The policy suggested to provide public transport in sufficient number of low income people with subsidized service (Government of Pakistan NTRC 1991). The policy also proposed to encourage and invite that the private sector to augment Government's effort by providing efficient and high-quality public transport services for the middle class. A number of steps were proposed to encourage the private sector, such as soft loans, a reduction of custom duty, and tax incentives on import of vehicle spare parts.

(b) **Prime Minister's Public Transport Scheme, 1991**

In 1991, the Prime Minister's Incentives Scheme to Revamp the Public Transport Scheme was initiated by the Nawaz Sharif's government (Govt. of Pakistan, Ministry of Communication 1991). This policy included incentive packages to import taxis, buses, and mini-buses for an efficient public transport system. Such as duty free imports of taxis, buses, and mini-buses; loan arrangements from banks at a 15 per cent annual interest rate and special registration numbers for new public transport. This policy was implemented, and the public transport fleet was upgraded.

(c) **Public Private Partnership**

In 1990s, two cities of Punjab province (Faisalabad and Lahore) conducted an innovative experiment to run public transport services by creating NGOs in collaboration with local private operators (Anjum and Russell 1997; LDA 1997). Accordingly, the Faisalabad Urban Transport Society (FUTS) was created in 1994 followed by the Lahore Transport System (LTS) in 1997. The FUTS and L TS were registered with the provincial Social Welfare Department with funding arranged from private operators. These NGOs were regulated by the law of social companies and administrated by a governing body. The governing body typically comprised concerned government officers, community representatives, transporters, and bus owners.

This governing body was developed on the basis of public-private-community participation to provide efficient public transport services in Faisalabad and Lahore cities. These NGOs generated their funds through the private sector, renting existing infrastructure facilities and setting higher fares. The most interesting features of these NGOs were the setting of

their own fares (without approval of the government) and enforcement. Initially, this experiment (especially in the case of FUTS) was successful in providing efficient, reliable, and decent public transport services by incorporating the private and community sectors in the decision making process. However, lack of investment by the private and public sectors in inducting new vehicles made this venture unsuccessful.

(d) **10 Years Perspective Development Plan**.

In 2000s, the federal Planning Commission prepared a draft Transport Policy through an in-house process (Govt. of Pakistan, Planning Commission 2000). This document also presented a bus-based public transport system as the transport solution for metropolitan cities in Pakistan. The policy was the first to propose reserving special bus lanes at grade or grade-separated road infrastructure. The policy encouraged revitalization of the KCR as an urban rail line; the KCR had been abandoned in the late 1990s. This policy also encouraged the private sector to operate public transport.

The Ten Year Perspective development Plan and a Medium Term Development Framework (MTDF) were prepared by the Planning Commission to be implemented between 2001 and 2011. The MTDF stated that the "development of an efficient public transport system primarily based on buses needs to be linked to mass transit systems, with light rail as an option" (Govt. of Pakistan, Planning Commission 2005). However, no money has yet been allocated for the recommended public transport system.

The latest effort to formulate a National Transport Policy was initiated at the end of 2003, through technical assistance from the Asian Development Bank (ADB and Govt. of Pakistan, NTRC 2003). Stage one of the assistance appeared in the form of a report, "Assessment of Critical Current Transport Sector

Needs," prepared by international consultants appointed by the ADB. However, this document was silent on the assessment and development of public transport in Pakistani cities. Stage two of the technical assistance, which will mainly contain sub-sector policy statements, has not yet been completed.

In early 2000, the Integrated Master Plan (2001-2021) was prepared in Lahore to guide future development (LDA 2004a). Like all previous Master Plans prepared for Lahore, this plan favored the urban road network and ignored the potential of developing public transport. Accordingly, the first five-year program for transportation development in Lahore proposed to include 94.8 percent of funding for road development, management, and maintenance and only 5.2 percent for a public transport terminal (LDA, 2004a). Clearly the plan is a road development plan, not, as it is called, a comprehensive transport plan.

In 2005, the Government of the Punjab, Transport Department, commissioned MVA Asia Ltd (international consultants) to develop a network for a mass transit system (Govt. of Punjab, Transport Department 2006). The study recommended a rail-based four-line network called the Lahore Rapid Mass Transit System (LRMTS). This rail system was proposed on the assumption that air-conditioned franchised buses introduced in the past became successful due to the rising income of the growing population. Therefore, people were willing to pay for a better service. However, no evidence was provided in support of this argument.

In 2005, the Government of Punjab prepared a Medium Term Development Framework to be implemented in 2006 to 2009. Under this framework, urban development policy objectives encompassed the establishment of an Urban Commission for

preparing a comprehensive urban policy. It was proposed that a Provincial Urban Transport Policy (PUTP) would be developed to guide the future Comprehensive Urban Transport Strategy for Lahore. This strategy will be a part of the proposed Lahore City Development Strategy, which would be prepared with the technical and financial assistance of Cities Alliance. The Alliance supported cities in preparing city development strategies that "link the process by which local stakeholders define their vision for their city and its economic growth, environmental and poverty reduction objectives, with clear priorities for actions and investments" (Cities Alliance 2006: 1). The strategy would be implemented by the proposed Punjab Large Cities Development Policy Loan (DPL), with technical and financial assistance from the World Bank (World Bank 2006). The objectives of the proposed DPL project complement city development strategies to promote economic growth in the major cities of Punjab. This growth would be achieved through metropolitan level strategic planning, integrated infrastructure investment programs, and efficient urban service delivery. The improvement of urban transport is one of the key areas in the project.

This historical review shows that a number of policy documents were produced at the national, provincial, and local levels that addressed public transport directly or indirectly in Pakistan. These policy documents consistently affirmed the need for the development of public transport. Reasons why this development has not happened will be discussed in the succeeding chapters.

CHAPTER 3

URBAN TRAFFIC AND TRANSPORTATION

3.1 Introduction

Pakistan like other Asian countries is strongly perusing urbanization. According to World population growth records, the growth will reach almost 200 million by the year 2015. National planning and development process must be taken in to account to avoid problems associated with high population growth. If Pakistan wants to grow economically and enhance its image in the world community, then increased importance must be given to transportation in the urban areas. Policies formulated and implemented today, will have a decisive effect in the future.

3.2 Transport Planning

The transport system can have an influence on land development. Transportation of people in urban area depends on demography and land to be used. For a developing country like Pakistan, the urban system can be seen as composed of interrelated sub systems. The transportation system itself includes elements such as individual transport, public transport and goods transportation. In the development process, it is important to consider all these interrelated elements. Urban transportation planning and development is a complex subject spanning over different disciplines. Continuous planning is key to success for any project including public transportation. It should not be taken as one time effort by government authorities.

3.2.1 Tasks to be Performed

An efficient and safe urban transportation system demands considerable resources. Aim of a well performed planning is to ensure a good public transport system, traffic safety and environmental situation at the lowest possible costs. One of the most important component of planning the traffic in urban areas is transportation planning corresponding to the population growth in the cities and degree of motorization. Decision-makers at higher level must be given an understanding of the fact that an efficient and safe urban transport system demands considerable resources for the planning as well as implementation, operation and maintenance. Use of land and urban structure are inseparably connected with the planning the traffic and transportation. In western cities transportation aspects many a times are decisive

for the possibilities to develop new residential and industrial areas or the order of their implementation. For an efficient function the traffic planning needs to be organized in a way that the traffic and transportation planning is made an integrated part of the total urban planning i.e, data collection, strategic planning, detailed design of the traffic environment and the planning of the public transport operation. Proper planning assumes greater importance for rapidly growing cities. A series of planning activities can be identified as following:-

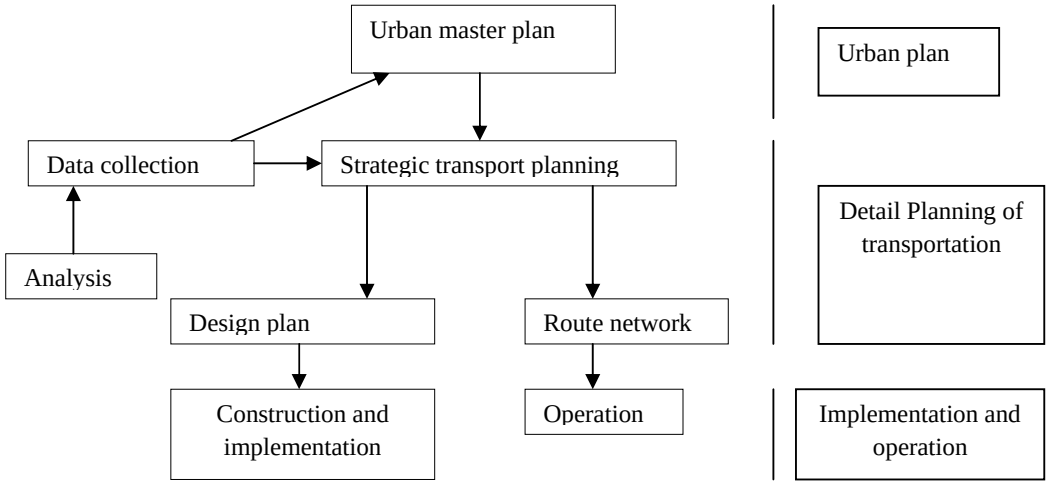


Figure 3:1 Planning Activities

The overall urban planning is concretized in the master plan, which gives the pre-requisites for the traffic and transportation planning. Traffic is, however, a vital part of the master plan which demands an active role of the traffic planner in the master planning process. No land use changes should be made before the traffic consequence is identified and resources secured for the according measures in the transportation system. The master plan provides some of the necessary data for the traffic and transportation planning and, in return, the traffic analyses should give an important input to the master planning work concerning the traffic and transport consequences of different land use alternatives. The traffic and transportation planning is carried out at two levels, the strategic level, where the main features of the transportation system are outlined, and the detailed level, where the plans for the implementation and operation of the different parts of the system are prepared. These aspects are favoured if the traffic and transportation planning is executed by one organizational unit within the Development Authority of the city, which covers the whole traffic planning spectrum and has the knowledge and manpower resources to enable it to convey the traffic planning points of view in a credible way.

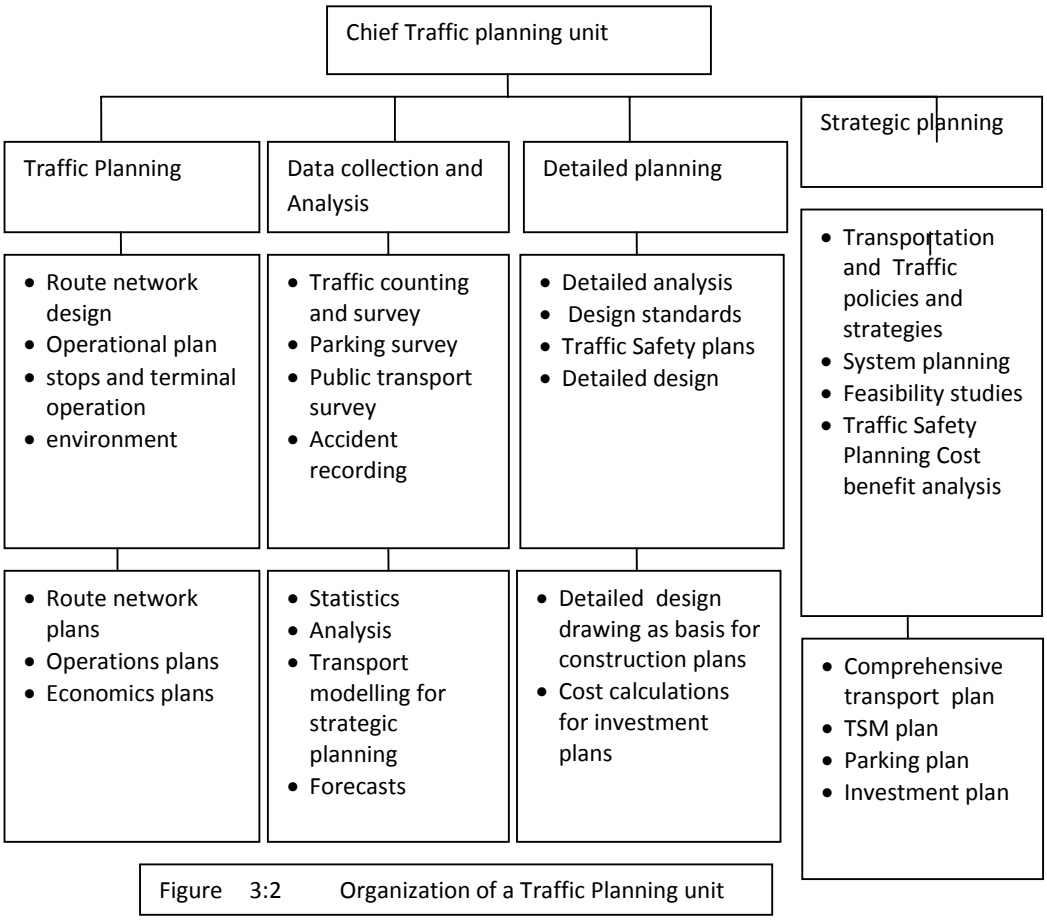


Figure 3:2 Organization of a Traffic Planning unit

3.2.2 **Organization - City Traffic Planning Unit**

The organization of a traffic planning unit should reflect the overall principles of the traffic and transportation planning. It should promote the continuity of the information flow and of the technical working process. The need for continuity does not, however, imply that one person should manage a traffic improvement scheme all the way from data collection to final design. Each step in the planning process is a specialist job which requires special education, training and practical experience. A reasonable way to organize a traffic planning unit would be to let the organization reflect the step wise character of the planning process. TSM stands for Traffic Systems Management, which means the preparation of a traffic circulation plan for an area, often aiming at traffic safety and environmental improvements. Roughly speaking, the product of one sub-unit should be the suitable input material for the next sub-unit and the next planning step. However, to make these products as useful as possible an interaction between the sub-units is necessary through the whole planning process.

3.2.2.1 **Manning Plan**

Cities always grow and require larger demand for qualified traffic and transportation planning There should be one man for one function as highlighted in the figure below which shows an initial basic manning plan for a Traffic Planning Unit. Each of the main work tasks of the unit has been provided with one specialist, except for the public transport planner and traffic safety specialist, who are working half time with the strategic planning and half time with the detailed planning. Beside the key personnel in the figure draftsmen and general office staff are needed. The development of the planning work –as the city grows and with larger demand for qualified traffic and transportation planning – will show if and when it is necessary to add further staff to the different specialties.

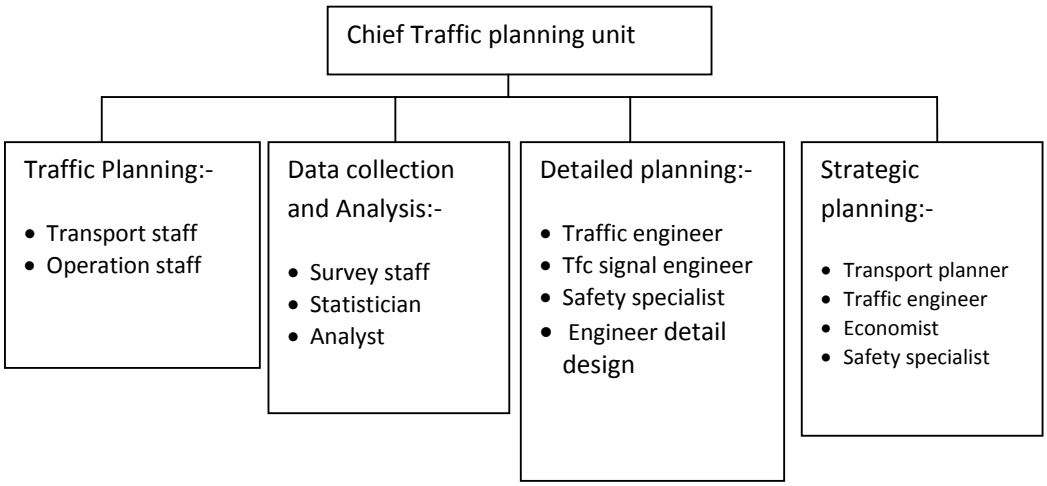


Figure 3:3 Manning Plan

3.2.3 **Main Planning Activities**

3.2.3.1 **Data Collection and Analysis**

All traffic and transport planning aims at changes of or additions to the existing situation. It should not be carried out without a thorough knowledge and an appropriate evaluation of the present situation. Collected input data and analysis of the existing conditions form the basis for the description of the present reality. There is an indispensable need for data on population, land use, transport infrastructure, degree of motorization, travel pattern, modal split, traffic flows, traffic accidents, environmental situation etc. and, at least for the central parts of the city, also the parking situation. Equally indisputable is the need for proper

methods and tools (computer programs) to analyze these data and the capability to draw the correct conclusions as a basis for strategic decisions as well as for the detailed planning.

3.2.3.2 **Traffic Surveys**

They are meant to serve periodical counts at a number of fixed points in the road network. The road traffic counts and surveys are of various types depending on the purpose. These counts are strategically carried out on chosen weeks/days of the year. The aim is to find out the general development of the traffic flows in the city and to establish the pattern of yearly, weekly and daily traffic variations as a basis for the dimensioning of roads and intersections and as an input to the traffic modelling and simulation of future situations. Special counts/surveys in areas where changes are expected, e.g the implementation of a new road link or a TSM scheme. Especially in the latter case the flow counts can be complemented by number plate surveys at certain points in order to establish the traffic flow pattern. These counts can be used as an input to "micro-scale" modelling and simulations as a guidance at the planning work.

3.2.3.3 **Parking Surveys**

Number of parking cars in an area and the parking time distribution is the main aim in deciding the requirement for public ease and comfort level. These are generally required not only in the central parts of the city but may also be of interest in industrial areas and retail business concentrations. The surveys should give the number of parking cars in the areas and the parking time distribution. In some cases it may be relevant to investigate the purpose of the visit by interviews. The results are used as a basis for a parking plan for the area – total number of parking places and the distribution of long-term and short-term parking and their location. For example the number of cars parked by workers in office requires permanent parking and must be separate as compared with public places like markets etc.

3.2.3.4 **Transport Surveys**

The design, dimensioning and operation of the public transport system is very important factors in designing a public transport system, especially, for the planning in cities where a relatively low percentage of the travellers have a modal choice for longer trips (a large portion of captive riders). The surveys are mainly of two types as follows:-

a. Extensive survey at stop.

b. On board passenger interview surveys.

These surveys are done to find out the number of passengers and the travel pattern. The result is a set of public transport trip matrices for different trip purposes (e.g work, school and other) on sub-area or stop level. The matrix is used for the modelling and simulations of alternative public transport systems. . Once a reliable matrix has been determined, regular follow ups can be made with very limited data collection and the utilization of modern computerized estimation methods. City covering surveys of this type are resource consuming and generally repeated only in 5-10 year periods. In fast growing cities with a rapidly growing degree of motorization there might be a reason to do it more often, at least for the areas where major changes have occurred

3.2.3.5 **Accident Survey**

The accident recording is necessary for an efficient traffic safety planning, both concerning geographical locations and types of actions.

3.2.3.6 **Analysis**

The analysis of the collected data aims at following:-

a. The identification of places for short-term actions and which type of measure to take.

b. The creation of a stable basis for the scenario-making and simulation of future situations in the strategic planning.

3.2.3.7 **Gothenburg, Sweden –Example of Urban Traffic Planning Unit**

Traffic planning unites are in operation in many developed countries. One of the city of Sweden i.e Gothenburg is chosen to study its traffic planning unit. Gothenburg is a medium size European city. Its traffic Office has been gradually created on the bases of 30 years empirical experience which during this time period has gone through its motorization process of the qualitative and quantitative needs of a modern traffic and transportation planning in a city. The city is comprised of 430,000 inhabitants. The traffic planning is executed by a Traffic Office. Beside the traffic planning, the office also is responsible for other activities

such as the maintenance and operation planning and the economic planning for the whole traffic sector.

The traffic has the yearly budget of SEK 1.5 billion, of which around 1 billion for public transport purpose. In addition the city gets a yearly contribution from the Swedish Ministry of transport of SEK 1 billion for infrastructural investments in the transportation system during the coming ten years. The office staff directly related to the traffic and transportation planning according to the principles explained in this chapter is shown below:-

	MSC	**Engineer**	**Others**	**Total**
Chief traffic office	1			1
Administration			6	6
Data collection Analysis	3	3	4	10
Strategic planning	5	2	1	8
Detailed planning	1	7	3	11
Public transport planning	2	6	2	10
Total	12	18	16	46

Table 3:1 Traffic Office in Gothenburg Sweden- Manpower

3.3 Planning Process Strategies

The formulation of traffic and transportation strategies is the means to meet new general situations (political, economical, population, attitudes, environment etc.) and to create new and suitable situations on the transportation arena. All urban planning is a planning under uncertainty. However, to do any planning at all, a probable future must be outlined or forecast, which at least indicates the anticipated direction and speed of the development. Concerning forecasts only one thin is certain – they are not absolutely true. The planner must be prepared for alternative developments and formulate his strategies accordingly. The strategy should to adapted to the general direction of the development but have an “elasticity” which makes it possible to adapt to a reasonable span of alternative courses of events,

indicated by the figure below, mainly by only "quantitative" changes. In the planning proves, the position within the "span" should be periodically identified and the validity of the chosen strategy checked. In this chapter is described a variety of traffic and transportation strategies as a background for the ones finally chosen.

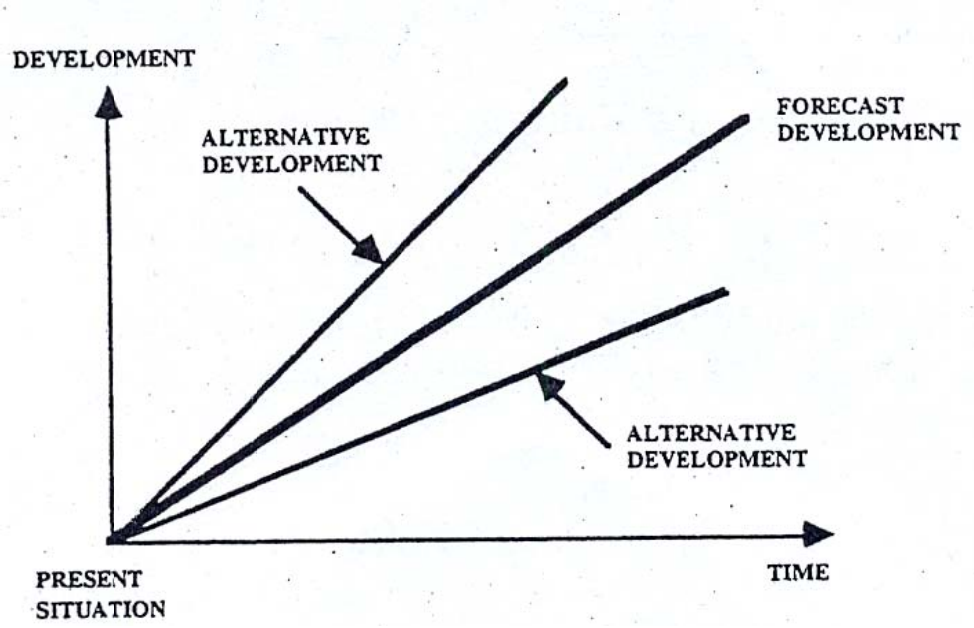


Figure 3:4 Forecast and Alternative Developments

3.4 An Over View of Public Transport in Rawalpindi - Islamabad

The public transport situation in the twin city of Islamabad – Rawalpindi, has reached an alarming proportion and there is an urgent need to take appropriate actions. Recognizing the critical importance of an effective and adequate urban transportation and continued sorry state of affairs in all the major cities in the country Government from time to time, has constituted a number of commissions, Committees, Working Groups, panels of experts of local as well as foreign consultants to study the problem and recommend measures of improvement. Many reviews and reports (for urban transport problems and their solutions have been elaborately identified and sound recommendations made in these reports but unfortunately very few of these have been actually implemented, as a result the problem continues to plague our cities. Let us examine the public/urban transport situation in other major cities as under and learn to avoid mistakes being done in other cities in and outside Pakistan.

3.4.1 **Lessons from Asia and Europe**

There are definite lessons to learn from the experiences of other countries, and Pakistan may still have time to prepare for the future. Fol examples are considered to draw lessons for our environment.

3.4.2 **Cities of Asia, Europe and USA**. Developing cities in Asia have adopted very different approaches to the urban transport problem with equally different results. While Singapore is widely regarded as the model example of a coherent and effective urban transport policy, the notorious traffic situation in Bangkok appears to have reached a point of no return. Even with travel speeds at rush hour below 2 km/hour and one person in seven suffering from respiratory disease because of air pollution, several hundred new cars are still added each day to its congested streets. There are certainly lessons to learn from the experiences of other countries, and Pakistan may still have time to prepare for the future. For example, important cities to be looked are mainly cities in industrialised countries and the traffic and transportation development there in connection with the “car explosion” which mainly occurred after the Second World War. The possibility to own and use a private car released a desire for free mobility which increased the possibilities to find jobs, service, recreation and social contacts within a wider area, and which made the necessary trips much more comfortable and less time concerning. The desire for improved living conditions could also be satisfied as distances became less important. These two conditions lead to the urban sprawl which from a traffic and transportation point of view had several negative effects. The trip lengths increased considerably which “cemented” the need for a car. As still many jobs and service functions remained in the central areas of the cities the traffic situation there, especially in old city cores, became troublesome because car riding is a space concerning way to travel. The cars need not only roads to move on but also considerable spaces for parking. For an office worker, for instance, the parking o his car takes about as much space (or more) as his work place in the office. The city centres threatened to deteriorate, both environmentally and economically. The rapidly growing car traffic and city area called for large investments in the road network. It showed, however, difficult to “build away” the traffic problems with, at that time, both an increasing city population and an increasing car ownership. The forecast rapid growth of the population and a positive development of the private economy – increased motorization – will raise the same type of traffic and transportation planning problems in the twin cities Islamabad/ Rawalpindi.

The motorization process had, however, also general political aspects. Around 1960 a leading Swedish social democrat said that the rapidly growing car ownership was one of the most significant signs of the democratization process in our time. It was supposed to lead to an increasing social equity. This equity was, however, counteracted in another way because even if a majority of the households could afford to have a car a considerable portion of them would not. Furthermore far from all the members of car owning households would have the car available for all their daily trips. Public transport would still have an important social role. Public transport, however, faced big problems in the new situation. The increased car riding meant a receding number of customers. The urban sprawl lead to longer trips and a higher production cost per trip. Quite soon it became impossible to keep up a reasonable self-financed public transport standard at reasonable fares. Either the level of service had to fall to low level or the public transport had to be subsidised by tax money. At least in Europe, where social welfare systems were rapidly improving (the economical situation was good) the latter solution was chosen. In Europe public transport stopped being “business” in the 1960’s and began to be looked upon as a part of the “transport welfare”. At the moment most cities are struggling to provide an “acceptable” public transport service financed at least to 50% by the fare box. The new situation also implied a big functional problem for public transport. From the beginning it was meant to be an attractive alternative to walking in still area wise small but growing cities. At least when it had left the horse drawn stage it was an easy task to offer a more comfortable and less time consuming way to travel. Today the task has been completely changed to offer an attractive alterative to car riding which, at least for conventional public transport, is impossible if the use of the private car is unlimited.

Probably most important aspect which could improve the situation in these countries was the lacking ability to foresee the combined effects of the urbanisation process, the increasing car ownership and the unlimited use of cars in the city environment (traffic volumes, need for road investments, traffic safely, environmental impacts etc). Such consequence descriptions are today possible to prepare by computer simulations of different alterative future situations. In many cities the development resulted like the one shown below:-

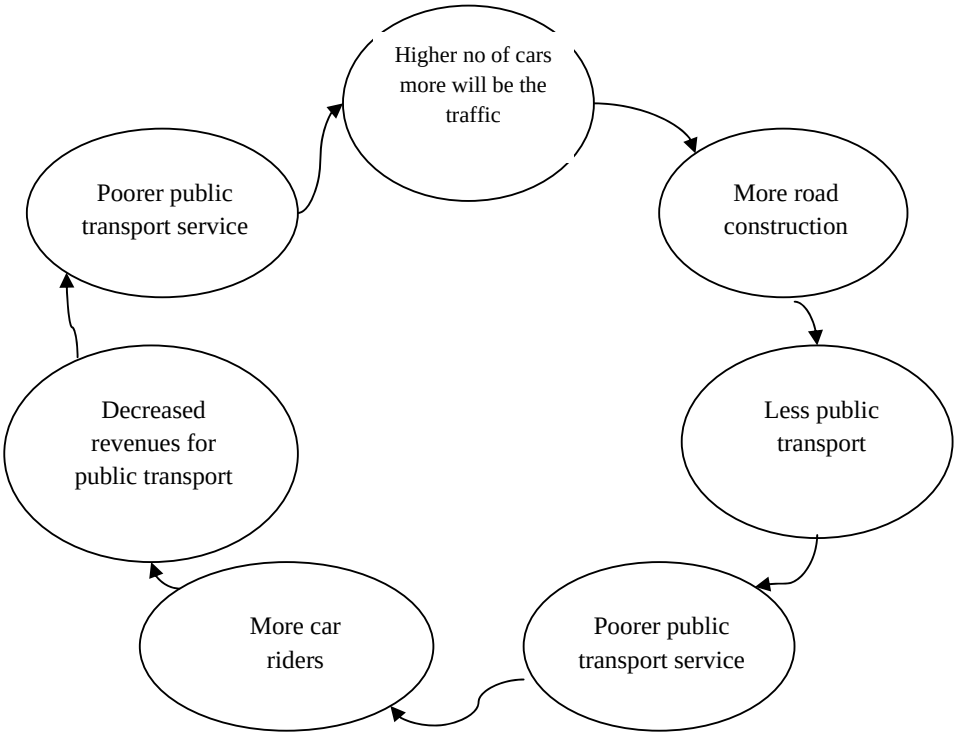


Figure 3:5 Car Based Transport Effects

3.4.3 **Twin Cities (Islamabad- Rawalpindi)**

Planning in twin cities has neither the organizational status nor the proper staff which is properly educated and trained. There is a poor understanding of the magnitude and complicity of urban traffic and transport planning. Various deficiencies can be recognised. There are few preparations for the planning data collection, correct base effective planning tools e.g. computer program systems etc. Similarly the allocation of economic resources to the road network is not always related to capacity needs. Compare for instance the need for capacity and road standard between Constitutions A venue and Shahrah-i-Kashmir north of sector H-8 or between Shahrah-i-Islamabad and Murree Road. Too little attention has been given to the public transport system, its operation and future development. According to what has been said above, public transport is going to face problems of different types as the degree of private motorization increases in the cities. It is important to, as early as possible, define its future role in the "transportation society". . The answer to certain questions have a clear impact on the design of the public transport system the type of system, the travel standard offered and the operational strategies as well as the organizational, financial and management structure. The following questions are to be answered:-

a. Should it be a purely complementary transport system taking care of the "leftovers" and, if so, with which level of service and subsidies, dictated by social aspects?

b. Should it be as competitive as possible to private transport and, if so on which terms?

3.5 Impediments in Urban Transport System Development

a. **Policy shortfalls**. Non existence of clear Urban Transportation Policy is seriously hampering the streamlining of public transportation by transport managers of cities. Urban Transportation Policy has been shifting from one extreme position to another. There is no clear understanding of the role of private sector and the responsibility of the Government in providing urban transport. Not only the question of private and public share remains undecided so far, the responsibility for public sector has also been tossed between federal and provincial governments with occasional suggestion that it is really the responsibility of the local municipal corporations. Also there have been repeated suggestions that the public sector corporations must be run on strict commercial lines and lower modes of transport i. e. rickshaws, mini-buses, etc must be eliminated. This stems from the fact that there has been a remarkable lack of understanding of the nature of urban transport operation and how it should be run. There is hardly any urban bus transport system, even in the most developed countries of the world (who run their urban transport operation with fullest autonomy and maximum efficiency), which is running on commercial lines. The revenues, due to fare structure, seldom exceed 40-60% of the total operating costs. The reasons for not meeting the operating costs from fare box are as follows:-

(1) The urban transport is used by the lowest income segment of the society, who are not in a position to pay the full cost of the services. As such raising the fares even to break-even level, is not socially desirable.

(2) The urban mass transport facility are generally used by low-income groups of organized labour which makes raising fares in step with cost increases politically very difficult.

(3) The Government as part of its social responsibility have to provide transport to serve areas not justified on the basis of traffic.

b. **Financial Constraints**. Lack of adequate finances triggers a very vicious circle. The public sector corporations have been constantly starved of the needed funds. The usual response of the management to lack of funds is to cut down on level of maintenance which results in more frequent breakdown of vehicles which in turn has adverse effect on revenues and thus management is forced to cut further (usually maintenance) and the process goes on. The natural result of lack of clear cut urban transport policy on the part of Government has been in the form of inadequate finances. The magnitude and source of financing has varied from time to time, and all kind of methods including securing of commercial loans have been tried and failed. Infusion of funds has been sporadic, in short burst and mainly in the form of addition to fleet without complementary supporting facilities. Instances abound where even no space was available for night parking of buses and chassis lying for years for want of funds for body building. Such investments are not only wasteful but also very counter productive as they create serious problem of absorption and obsolescence over a very short period.

Private sector have even worse situation. Due to non availability of easy credit or loan facilities to private urban transport operators the private sector have their hands cuffed. As a result, the entrepreneur resorts to securing the credit from private sources which though very easy to obtain, carry very high interest rates and most cruel terms of recovery of the loan The loans are administered by anti-social elements and incidences of high handedness are very common.

c. **Uncontrolled Fares/ Lawless Regulations**. The urban transport in the country is greatly over-regulated by the Government in terms of fares. The fare increases have been mostly adhoc, insufficient and too late. Inadequacies of the fare can be judged from the fact that the cost of tyres, tubes, POL,

chassis and labour has gone up from 1000-1800% since 1970 whereas the fare increases are only a fraction of this. The problem would not have been very bad had the urban transport exclusively been in public sector. The difficulty arises because of the fact that the private sector also provides a large share of urban transport. Since private sector is there for financial consideration only they rightly feel no moral and social obligation to carry traffic at the subsidized rates. This has been a constant source of trouble in the past and need to be resolved. There are certain other indications which point toward a very serious situation developing as detailed below:-

(1) The turn-over of ownership in public transport is very high. Instances abound where the investor (s) who entered the field for social reasons (ownership of public transport is still considered a status symbol) often with hard earned saving from working abroad or selling moveable/immoveable assets, quickly found out that it was no longer an attractive proposition and got out, suffering considerable financial loss in the process.

(2) The rate of induction of new buses has gone down considerably, while number of smaller vehicles has been very high in recent years. This indicates lack of adequate sources of financing and non profitability of larger vehicles.

(3) No recognized high class entrepreneur is willing to invest in urban road transport due to very un-attractive return. As a result, the ownership has gone into the hands of middle and lower middle income group (often multi ownership or self-operated).

(4) It is feared that if it is allowed to continue, the problem may attain un-manageable proportion and may result in very serious political as well as economic repercussions. An indication of the seriousness of the situation is obvious from the rampant over-loading, overcharging and other acts of lawlessness prevailing in urban transport.

d. **Student Concession**. The student's concessions are improperly and inequitably administered. Students have been granted a fixed fare for all travel. There are three basic issues in students concession namely:-

(1) Private sector obligation.

(2) Mode of financing.

(3) Misuse of concession.

However, any loss borne by public sector road Transport Corporation is made up at the end of the year by making up the difference. This, however, is not automatic and requires detailed exercise and is often not paid promptly. On the other hand, the buses plying in the private sector do not receive any reimbursement for student travel. This is a constant source of irritation and often results in unpleasant and ugly incidences involving students and private bus owners.

e. **Labour Laws**. Litigation under the labour laws seriously impedes the discipline especially in the Urban Transport Corporations. Serious consideration need to be given to alleviate the problem. The number of cases involving litigation under the labour laws is so high that prompt application of the laws is almost impossible.

f. **Quality Manpower**. At present, Political government is appointing non-professionals on managerial jobs. There is dearth of skilled manpower to organize, manage, operate, repair and maintain the fleet especially in the Urban Transport Corporation which require skilled system managers, financial analysts, drivers, technicians, works managers and depot managers. Similar is the situation in lower positions though with a lesser degree.

g. **Management Chaos.** Proper attention is required to improving the flow of traffic on urban roads. Management practices in the existing system frequently fail to achieve the optimum conditions and in fact, often contribute to delay, fuel waste, increased pollution and frustration. Mere provision of more passenger vehicles (buses, mini-buses, etc) will not effectively alleviate

the problem of urban transport unless proper attention is given to improving the flow of traffic on urban roads. It primarily involves the application of comparatively low cost solutions (compared with the large expenditures associated with major new road projects) to attain the most effective, safe and efficient use of existing road space as a means to check the rising demand for road based public transport. Fortunately, possibilities do exist for the improvement of urban transport system through introducing of traffic management techniques.

h. **Fleet Maintenance**. Due to following three factors maintenance of fleet is very difficult, namely:-

(1) Procedural and autocratic difficulties in procurement of stores.

(2) Large element of pilferage.

(3) Low productivity of staff.

Maintenance of urban transport fleet in general and public sector corporations in particular leaves much to be desired. The extent of poor maintenance is manifest from the average life of 5-6 years for buses as compared with 18-20 years for most developed countries and a very large proportion (often as high as 40% of off road buses as compared with 15% for most developed countries. Serious consideration needs to be given to cover this very crucial aspect, without which it would not be possible to evolve an efficient urban transport system.

3.6 Public Transport Strategy

3.6.1 **Travel Standard**. The travel standard of a car is superior to public transport if it can be used without any restrictions and disturbances. If public transport has to compete as a good alternative to car riding it should come as close as possible to the qualities of a car. The discussion below is based on the concept of conventional, route bound public transport systems, bus, rail or mixed. Different types of demand responsive systems such as dial a bus is considered very expensive and PRT (Personal Rapid Transit) has not been judged suitable for the Islamabad/Rawalpindi area during the foreseeable future. In a long term perspective it

is assumed that the degree of motorization has risen to a level where the individual motorized traffic, especially the car traffic has become a problem, both from road capacity and environmental aspects. A public transport must qualify the following requirements for the comfort of the general public:-

a. **Short Walking Distances**. In order to compete with the car, standing outside the front door, a very dense route network with many stops is required to be established. This is only possible to attain with a flexible bus system.

b. **Availability**. It must be available on a short notice, 24 hours a day or, at least, early in the morning till late night.

c. **Direct Trips**. This means a large number of routes in order to cover as many destinations as possible from one starting point. It is, however, even with a dense bus route network not possible to cover all Original- Destination combination (OD combination) without transfers between routes.

d. **Level of Comfort**. For the twin cities air conditioned public transport with all passengers seated is the main requirement for competing with a car. This can only be accomplished by very comfortable public transport vehicles and a reasonable capacity utilization.

e. **Short Travel Time**. The car always goes the shortest way possible and has no intermediate stops. For a good pubic transport service the average Travel time (door to door) is 1.5-3 times as long as by car. A conventional route bound public transport system can usually not compete with the car concerning the travel time.

Public transport should be planned as an acceptable complementary system for trips which for various reasons can not or should not be made by the private motor vehicle, however , in a motorized society it could not realistically be expected to compete with the car/motorcycle. Following are the reasons:-

a. The traveler can not afford to have a motor vehicle.

b. The traveler does not have a driver's license.

c. The traveler does not have a car/motorcycle available at the time of trip.

d. No parking place is available at the destination or parking charge is high.

e. The road network can not be dimensioned to correspond to the car travel demand at the time for the trip (peak hours).

f. The car trip involves areas where car traffic is banned for environmental reasons.

The first three reasons refer to the fact that far from all travelers will ever have the possibilities to go by car/motorcycle for all trips. Two groups of travelers are especially exposed young people and women. Reasons 4-6 clearly point out the city centers, where it is difficult to provide road capacity and parking spaces and where it from environmental points of view is desirable to limit the motor traffic. The aspects above indicate that the public transport system should be able to give a reasonable service for all types of trips in all original/destination combinations but with a concentration of the level of service to the city centers. All earlier experience shows that it is impossible to keep people from using their cars only by improvements of the public transport. If an unlimited car use cannot be allowed there has to be a combination between car restrictive measures and public transport improvements and adaptation of the public transport system according to the travel demand and to desired limitations of the car traffic. It should be understood that we are now talking about a situation where the combination of a good level of public transport service and self financing is a problem. In this situation it is necessary that the public transport system design is well adapted to the travel demand and that the operation organized in a way that makes it possible to respond to the demand efficiently. Certain priorities have to be decided which are discussed in the examples below:-

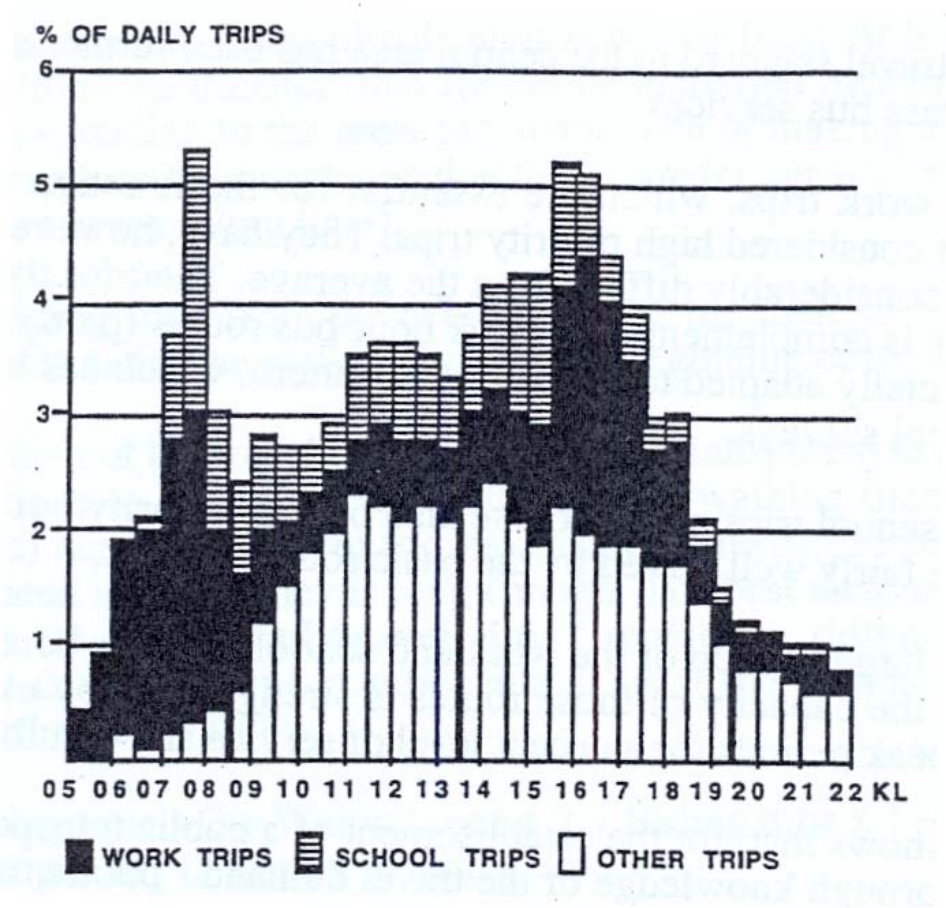


Figure 3:6 Daily distribution of the public transport trips in Gothenburg

3.6.2 **Travel Demands**

The daily variation of the travel demand both concerning intensity, trip purposes and travel pattern is one of the great problems for public transport. An example from Gothenburg, Sweden has been taken to establish travel demand priorities. The figure 3.5 shows how public transport demand is distributed over the day. This information is needed to be able to establish supply vs demand so that capacity utilization is made uniform.

Public transport has an important role to play in people's lives and for the good function of the city. The city Gothenburg had at the time a population of 430.000 inhabitants and a car owner ship of 325 cars per 1000 inhabitants. The modal split car/public transport was 70/30 for the whole city and the whole day but for the central area it was 45/55 due to both better public transport services versus this area and to a restrictive parking policy in the central parts of the city. The total number of daily public transport trips was 300000. Around 40% of all

trips had their origin or/and destination in the central area. Around 80% of the trips were made directly without any transfer, which indicates both that the route network is fairly well planned and that many people use public transport only if the service is good. Otherwise they take their cars. Public transport operations in the city were subsidized up to 65% by local taxes.

This is a picture of the public transport rider ship in a highly motorized society. The peak periods, especially the morning peak, are dominated by the work and school trips (there are no special urban school services), while the mid day and evening off peak periods are dominated by the other trips. This knowledge of the public transport rider ship has to a great extent affected the planning of the route network and the level of service:-

a. Rapid express bus services has improved the travel standard to the central area.

b. The basic route network (in operation all day) is strongly oriented versus the central area for two reasons, a large portion of the trips are related to the area and it needs a good public transport service in order to make the car restrictive measures.

c. **School Trips**. Of course, the school trips are of high priority but have been found to be fairly well served by the basic route network.

d. **Work Trips**. The work trips, which are essential for the function of the city, have been considered high priority trips. They have, however, a travel pattern that considerably differs from the average. Therefore the basic route network is complemented by peak hour bus route (partly of express type), especially adapted to the work trip pattern, which has been identified by special surveys.

e. As a large portion of the work and school trips are bound for the central area the capacity of those routes is strengthened by extra buses during the peak periods for a decent level of service and comfort.

There is needed a thorough knowledge of the travel demand public transport surveys and a clear traffic policy, for the establishment of a public transport strategy. Indication in this case is priority to work trips and trips to the central area.

3.6.3 **Travel Standard Priorities/Strategies**

Surveys on people's attitudes show that there, among others, are three basic pubic transport qualities which have high priority, namely **short travel time, short headways and direct trips**.

Short travel time to spend as possible is one of the main interests of the city inhabitants, on traveling which from their point of view is an unproductive activity. The public transport trip time has to be reduced in following aspects:-

a. **Walking Time to a Stop**. The walking time is depending on the density of the area, the coverage of the route network and on how well the route network is planned in relation to population concentrations.

b. **Waiting Time at the Stop**. The average waiting time is related to the headways. For short headways, 5-10 minutes, it is generally half the headway. For long headways the waiting time can be shortened by the release of time tables if the punctuality in the system is good.

c. **Riding Time**. The riding time depends on the running speed of the vehicles and of the distance between stops. Thus there is a conflict between the desire for short walking time and high riding speed. Short waling times mean many stops and a lower riding speed. The walking time is, however, looked upon as considerably more inconvenient than the riding time, at least if the riding comfort is good.

d. **Transfer Time Between Routes**. Between routes if the route network does not provide a direct trip. The transfer time depends on the headways of the two routes. At long headways is often practiced transfer fitting which means that the time tables for the two routes are fitted to each other in order to minimize the transfer time for major passenger flows. For feeder bus traffic transfer fitting should always be practiced. At level of service calculations the transfer time should be increased by a number of minutes corresponding to the mere

inconvenience of making a transfer (a figure internationally accepted is that this transfer penalty should correspond to 5 minutes riding time).

f. **Walking Time from the Nearest Stop to the Final Destination**. The same aspects as for the walking time at the beginning of the trip.

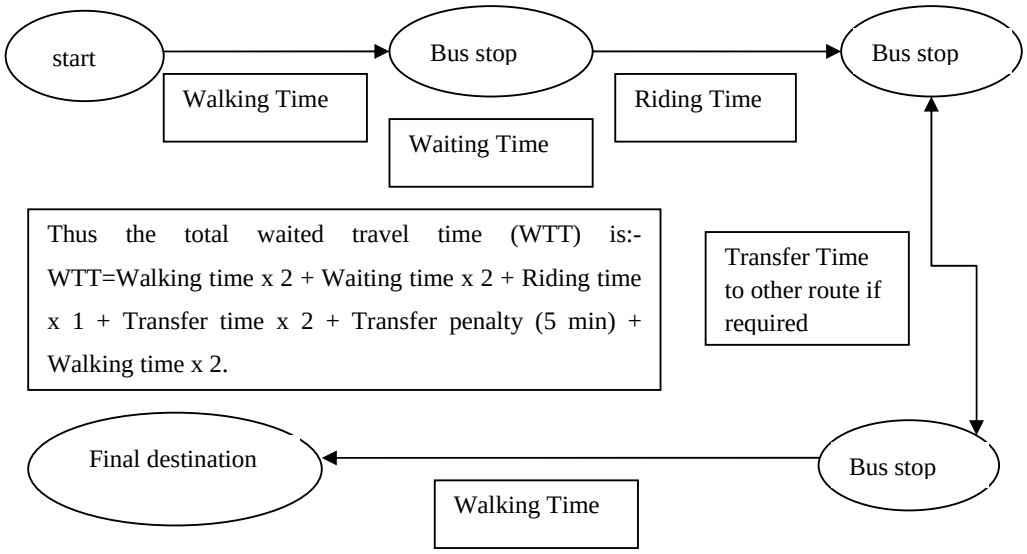


Figure 3:7 Travel Time

Figure above shows how at the assessment of the travel times in the public transport system all the trip time components have to be weighted together. Long walking times (long distances between stops) and transfers can for instance to some degree be compensated by high riding speed if the journey is long enough. The best measure of the quality of wait 1 and the other time components at least the wait 2.

To produce as many direct trips as possible a good knowledge of the travel demand pattern is demanded, the route network should reflect the travel pattern. For long term forecasts it is necessary to establish a number of travel habit parameters to put into a forecast model. These parameters have to be based on the present travel habits and intelligent guesses concerning the future development. Based on experiences from other cities which have gone through the same motorization process as the expected one in Islamabad/Rawalpindi. The forecasts will suffer from uncertainties, the development of the population land use, travel habits and demographic factors (e.g. the percentage of the population in gainful work) are involved.

Therefore they should be used carefully as a basis for decisions on a major reconstruction of the public transport system, such as the introduction of new system types like light rail or subway, unless also the short and medium term studies indicated the future need for them. In this respect the planning should be made in a way that solves the short term problems well but keeps various alternatives and the freedom of action for the more distant future open. Shortening the headways can be an expensive way to improve pubic transport. In order to halve the headways twice as many vehicles and drivers are needed. Furthermore, when public transport gets economic problems one of the underlying factors is an improved private economy, people can afford cars or motorcycles. A general improvement of the private economy has also shown to imply that the driver costs take an increasing portion of the total public transport operation costs (in for instance, Sweden the driver cost is around 2/3 of the direct operation costs). Therefore the tendency will be towards larger vehicles in order to reduce the production costs per passenger. With reasonable capacity utilization larger vehicles mean longer headways, quite contradictory to what people want. The measures used to counteract this effect have been to distribute time tables for the different routes and to keep up a good regularity and punctuality in the operation If people know when the bus is coming and can rely on it, they don’t have to wait for a long time at the bus stop.

3.6.4 **Route Network Strategies**

For the design of the public transport system two main aspects have to be discussed i.e the principles for the route network construction and the system type (bus rail or mixed). The aspects of course affect each other but the main strategies are presented separately. The travel demand and travel standard priorities are ofcourse an important background for the route network and system design.

Concerning the route network design two distinctly different principles can be distinguished, the direct trip strategy and the trunk line feeder line strategy.

Direct Trip Strategy

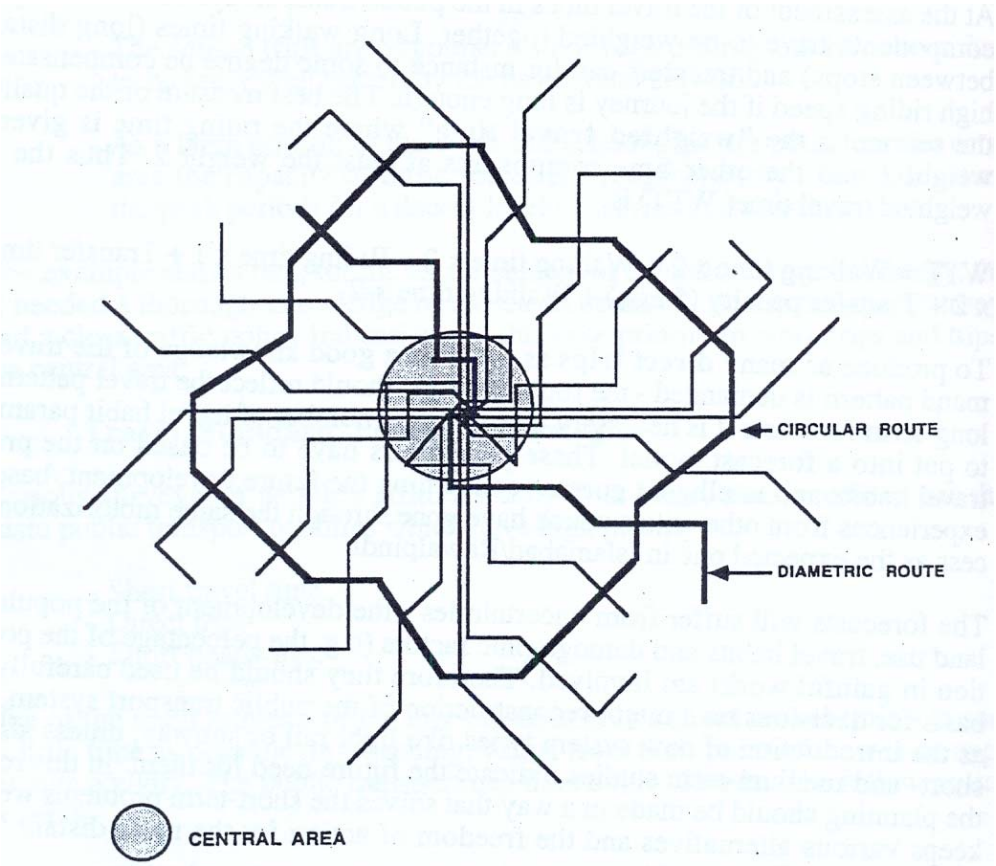


Figure 3:8 Direct trip Route Network

The direct trip route network, see the figure above, emphasizes the fact that people attach great value to not being forced to transfer between different routes. The route network pattern thus should reflect the major travel flows in the travel demand matrix. Some general route network characteristics are:-

a. The network includes a large number of routes in order to provide as many origins, destination combinations as possible with direct trips.

b. Many routes lead to the central area which normally is a dominating trip destination. These routes are not radial but diametric in order to provide direct trips also between different city sectors.

c. The network generally includes various circular route elements in order to provide direct trips also for tangential traveling.

d. The route alignments are not straight and the distances between stops are short. This means a rather low average speed and long trip times. This is however, at least partly compensated by the fact that the passengers are saved from the time loss and inconvenience of transfers.

e. The dense route network implies that a large number of vehicles/drivers is needed if fairly short headways should be provided.

Trunk Line - Feeder Line Strategy

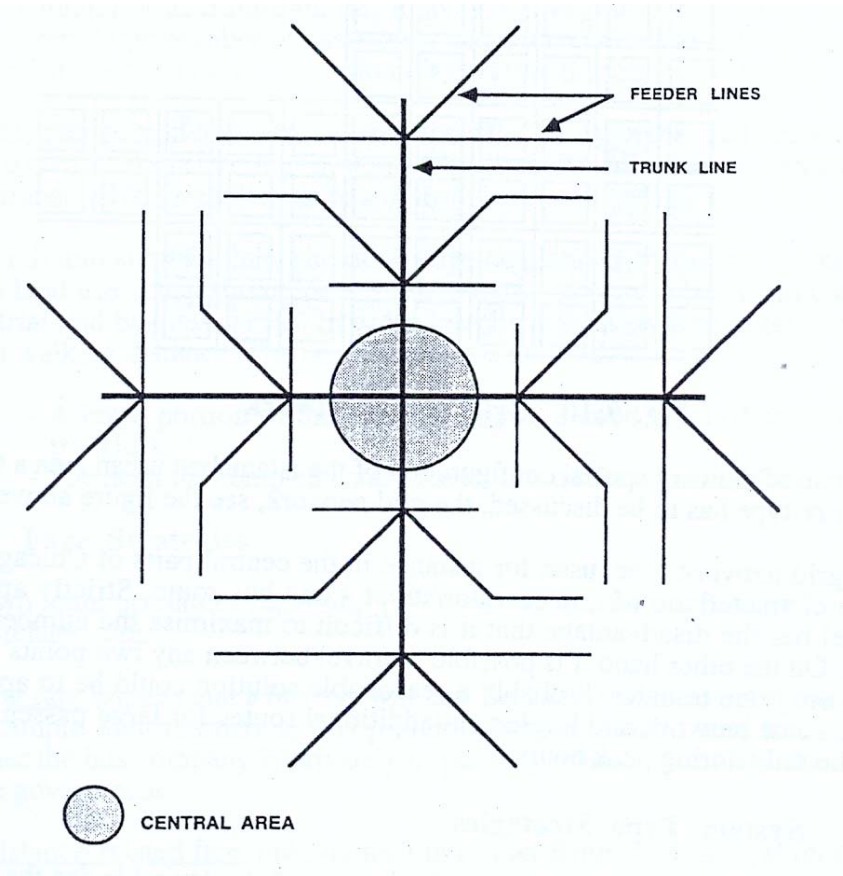


Figure 3:9 Trunk line-feeder line route network

In the picture above the direct trip network has been converted to a trunk line feeder line system. There are various reasons to do so:-

a. A large portion of the traveling is concentrated to a small number of corridors which are demanding high capacity. This gives the possibility to use large (and fewer) vehicles and still keep up a good headway. Less vehicle kilometers have to be produced per passenger kilometer.

b. A few trunk line corridors could be given a high operational standard and a high average speed. The transport efficiency of the corridor could motivate investments in bus lanes/bus ways and grade separation or preferential signal treatment at intersections. The large number of passengers in the corridors could give room for express services, especially versus the central area, which further would reduce the trip times.

It is however, unavoidable that a large percentage of the passengers have to transfer and that it will be difficult to keep up good headways on the feeder lines (the time tables of the feeder and trunk lines should be coordinated at the feeder points). To what degree this is compensated by the higher riding speed on the trunk lines has to be carefully studied before a route network conversion is decided. The resulting travel standard (WTT) has to be weighed against the more efficient use of vehicles and lower operation costs.

The Grid Network

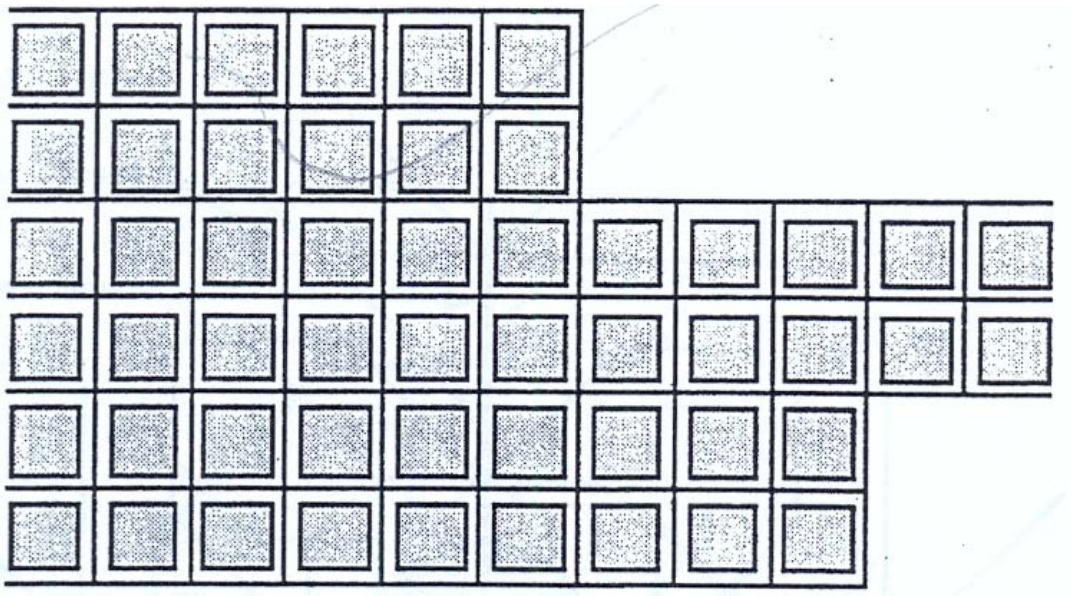


Figure 3:10 Grid route network

Because of the very special configuration of the Islamabad urban area a third route network type has to be discussed, the grid network, see the figure above. The grid network type, used for instance in the central parts of Chicago, has the main characteristic of one corridor/street, one bus route. Strictly applied this model has the disadvantage that it is difficult to maximize the number of direct trips. On the other hand it is possible to travel between any two points in

the city with only one transfer. Probably a reasonable solution could be to apply a grid basic route network and implement additional routes for large passenger flows, maybe only during peak hours.

Spider Network

The existing road network in Rawalpindi represents spider networks as shown in the figure below:-

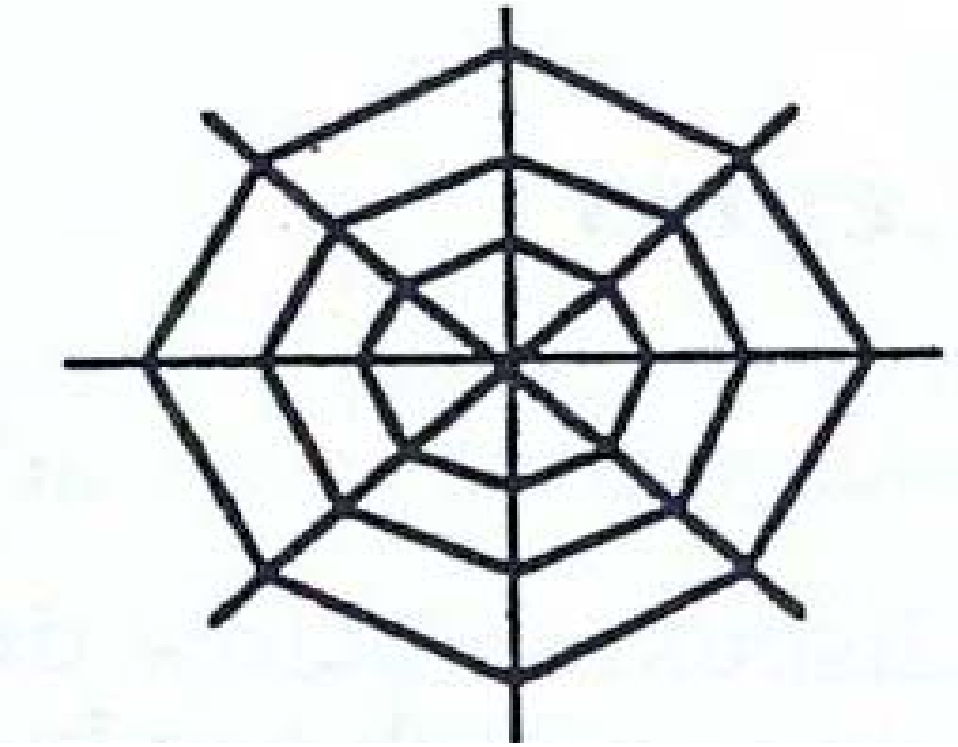


Figure 3:11 Spider route network

This network represents a bit complicated arrangement to work out travel demand, transfer pattern etc.

3.6.5 System Type Strategies

The table below shows the vehicle and system types for the two route network strategies:-

Network type	Bus	Vehicle type Tram/light rail	Remarks
Direct trip network	X	X[1)]	1) If a few heavy corridors can be identified
Trunk line feeder line network	X	X	
Grid network	X		

Table 3:2 Relation network type/vehicle type

The direct trip route and grid route networks are generally pure bus systems. The direct trip strategy demands a large number of routes which would be very expensive to provide by using a rail system. Furthermore a bus system is very system is very flexible and can easily be adapted to changes of the travel demand pattern, both by changes of the route network and the bus sizes. The direct trip strategy may demand moderations of both route network and operation due to changes of the land use and travel pattern which take place during a comparatively short time period, e.g. ten years. In a trunk line feeder line system the feeder lines are generally bus routes. This gives rich possibilities to adapt the feeder pattern and capacity as the land use and travel pattern in the feeder sector change. The trunk lines can be operated by large buses with good operational conditions (bus ways, buys lanes, priority at traffic signals) or as tram/light rail lines or subway lines. The rail solutions demand a very high and stable for a long time period (to motivate the large investment).Roughly can be said that buses, due to their flexibility in the road network, can be sued to create area covering systems while heavier rail systems, especially rapid mass transit, always are corridor serving. Light rail and subway lines should always be planned according to existing and future land use. They should pass through dense city areas (residential as well as industrial and business areas) in order to collect as many passengers as possible within walking distance. The benefit of this is twofold:-

a. A large portion of the passengers gets a good level of service without transfers.

b. The need for complementary feeder bus traffic is minimized.

3.6.6 **Fare Strategies**

The two main principles regarding fare construction are the flat fare and the distance related fare. The flat fare implies that a bus trip will cost the same regardless of the distance. In for example South America, this principle is predominant. The distance related fare, predominant in former British colonies, is related to the number of kms traveled. Often, as in Islamabad/Rawalpindi, the pricing is decreasing so that a longer trip will be less expensive per km but still more expensive in absolute terms.

Combinations of the two principles occur, based on fare zones or fare stages. Some European countries, e.g. Sweden, have operated systems with only a few zones which is then more like the flat fare. The recent shift in general ideology regarding welfare issues, however, now seem to favour constructions in which the fare better reflects the production cost.

In addition to the function of financing the operating costs for the bus company, the construction of the fare system also has wider implications and can be considered as one of potential tools in an urban transport policy. Some examples are given below:-

a. **Distance Dependent Fare System** A distance, related fare punishes long trips and favors the short ones. Because of the larger time loss by using public transport, instead of care for long trips the distant depending fare encourages car riding. As a large portion of the work trips, especially to the administration centre, are long, this will contribute to an increase of the peak hour traffic pressure on the eastern part of Islamabad.

b. **A Flat Fare System** A flat fare favours the long trips and may encourage car use for shorter trips. For these, however, the time saving, counted in minutes, is smaller than for long trips and the effect in terms of increased car traffic will not be so big.

c. **Free Transfer Fare System** In a fare system that allows free transfers the longer trips will be even more favoured as they involve more transfers than the short ones. This, however, demands organizational changes in order to get a fair distribution of the revenues among the vehicle owners.

3.6.7 **Traffic Safety Aspects**

Before the passengers are entering the public transport vehicles and after they loft them they are pedestrians and as such belonging to the most vulnerable group of road users. This has to be taken into account at the planning of the walking ways to the stops and at the design of the stops and terminals.

3.6.8 **Environmental Aspects**

In the western countries, especially in Europe, considerable efforts have been made to make the buses more environmentally feasible:-

a. To reduce the noise by better silencers.

b. To reduce air pollution by improved diesel engines with catalytic cleaning of the exhaust gases and by the use of improved diesel oil, alcohol or earth gas. These new types of buses are in use some of the cities as a part of the bus fleet but it will take some time before the whole bus fleets are renewed.

Another type of bus namely the hybird bus is still under development which will be propelled by a combustion engine but can switch over to batteries in environmentally sensitive areas. Pure battery buses can so far only be used for short routes in central areas as their operation range between recharging of the batteries is short.

This development has made and will further make the buses far more environmentally harmless. It should be noticed that of all the air pollution from the traffic in a motorized society, the public transport vehicles are responsible only for a small part. One of the main issues is of course whether to install electric system which means trolley buses, rail systems or electric buses on special bus ways. This will mean environmental improvements in the streets and in local areas but in the larger context it is important how the electricity is produced, water, nuclear, by oil or coal power plants. In Shanghai, for instance, half of the bus fleet are trolley buses but the electricity is provided by a coal power plant within the city boundaries, owned by the bus company.

3.7 **Bicycle and Pedestrian Strategies**

How popular the bicycle riding will be as the cycling implies a certain amount of physical effort, to a large extent depending on the topography and the climate of the city in question.

Cities, where the bicycle plays a significant role in the urban transportation, are generally flat and have a climate that allows cycling the year around. Typical examples are Amsterdam, the Netherlands and Shanghai, China, where bicycle is an important component in the city traffic and has to be accordingly considered in the traffic planning.

The topography of Islamabad and Rawalpindi is favorable for bicycle riding but the road and traffic conditions are in many places deterrent and also the climate is so warm that people avoid physical exercise such as bicycling. At least office and business staff does not like to arrive to work with wet shirt. The situation for pedestrians is often neglected. It should be observed, however, that we are all pedestrians at some point. Even a car user is a pedestrian for part of his trip e.g after parking the vehicle. Pure pedestrian trips are short and mainly staying within sub areas. Most of the pedestrians outside the areas are on their way to an adjacent area or to/from the nearest bus stop or parking space. Therefore, pedestrians have to be taken into account in the overall traffic planning. Following table shows the arrangement for bicycle operation:-

Road Class	**Bicycle Arrangements**
1	Separate bicycle paths. Grade separated bicycle crossings.
2	Separate bicycle paths. Grade separated bicycle crossings or crossings only at signalized intersections.
3	Separate bicycle paths or if the width of the main carriageway so allows and the traffic flow is moderate, marked bicycle lanes of 1.5 meters in each direction.
4	Bicycles mixed with other traffic if the recommended speed limit of 30 km/hour is implemented.

Table 3:3 Recommended bicycle arrangements

Where separate bicycle paths are implemented it can in many cases be suitable to design them as combined two way bicycle/pedestrian paths. This is less space consuming and more economical. The paths should have a dividing line between the bicycle and pedestrian lanes.

A city wide bicycle program should be prepared with the following implementation principles:-

a. Make the installation of bicycle facilities a standard at the construction of new areas and roads.

b. Implement bicycle facilities in old areas, starting where the bicycle flows are largest.

c. Connect the sub areas by bicycle paths and create a city covering bicycle network.

3.7.1 **Pedestrians**

The implementation of pedestrian facilities is mainly matter of traffic safety. Pedestrians should generally be physically separated from all other traffic. They should have the possibility to move without any conflicts with motor traffic and, where necessary, be resolutely prevented from coming into such conflicts. Pedestrian arrangements in connection with roads of the different classes are shown by the table below:-

Road class	**Pedestrian arrangements**
1	Separate pedestrian paths. Grade separated pedestrian crossings
2	Separate pedestrian paths. Grade separated pedestrian crossings or crossings only at signalized intersections.
3	Separate pedestrian paths or sidewalks. Marked and signed pedestrian crossings.
4	Pedestrians mixed with other traffic if the recommended speed limit of 30 km/hour is implemented. Sidewalks at long local streets which work as collector exits/entrances for a larger area. Marked and signed pedestrian crossings at intersections with road class 3.

Table 3:4 Recommended pedestrian arrangements

3.8 **Conclusion**

An urban transport strategy for Islamabad/Rawalpindi should aim at efficient use of road

infrastructure, good mobility for all categories of people, safety and environmental protection.

CHAPTER 4

THE EVALUATION OF EXISTING PUBLIC TRANSPORT SYSTEM IN ISLAMABAD-RAWALPINDI

4.1 Introduction

A well planned, well equipped and orderly operated public transport system which is run by the principle of profitability for the operators at the same time as it contributes to the overall city objectives would provide the best possible service to the inhabitants in the twin cities. The public transport system (both planning and operation) in Islamabad-Rawalpindi suffers from several deficiencies and does not fulfill the requirements above. The quality and performance of the public transport in the twin cities, predominantly provided by the private sector, depends on many factors such as:-

a. A basic transportation policy.

b. The planning and controlling agencies.

c. The route network structure.

d. Road conditions and traffic environment.

e. Ownership and organization of the operation.

f. The vehicle fleet (Public transport vehicles at present consist of Buses, Minibuses, Wagons or Suzuki Pickups).

g. Operation and operation control.

This chapter aims to identify various types of problems and deficiencies and to suggest suitable measures to be taken in order to improve the situation. These measures can involve practically all the different parts of a public transport system, service strategies, planning, route network, traffic movement and environment, operation principles, fare structure etc. Some of the improvements can be carried out in a short term perspective while others may take a considerable time, and may even demand changes of prevailing laws and regulations.

4.2 Existing Traffic and Transportation Policies and Planning

4.2.1 Policies

At present no articulated public transport policy has been formulated as a part of a comprehensive traffic and transportation policy for Islamabad/Rawalpindi urban areas. Such a policy should be formulated on following lines:-

a. The quality of the public transport in the twin cities should be brought to and continuously kept at a level of service that makes it a reasonable alternative to car driving. Such a policy is highly motivated in cities which are at the same time rapidly growing and in the beginning of the motorization process. It ensures the mobility of people without owning any motor vehicle. By offering a public transport alternative, the use of private cars could be controlled and possibly restricted in areas where cars are least desired. Especially large is the risk for traffic cardiac in Rawalpindi which is densely populated and has limited options for the improvement of the road network capacity.

b. Public transport should be planned as a part of the total transportation system and thereby be given its proper role in the transportation society. For example those areas where cars are least desired should be given the best accessibility by public transport.

c. The basic principle should be that the public transport is publicly planned and monitored but privately operated.

d. The planning of the public transport system and the control of the operation should be performed by the proper authorities in the twin cities i.e CDA and RDA. There is a requirement for an integrated and comprehensive traffic and transportation planning. The control function is vital because even a well planned public transport system with not yield desired results if not controlled properly on modern lines.

e. The policy should be established at the city government level which should be based on cooperation between the two cities as they are depending on each other and therefore need one coordinated public transport system policy.

4.3 Planning

4.3.1 Organizational Aspects

a. The institution presently responsible for the public transport planning and control is the Regional Transport Authority. In addition Islamabad Transport Authority (ITA) and the Rawalpindi Transport Authority (RTA) are responsible for issuance of bus permits to operate on various routes. The planning authority is reported to be lacking some important qualities, necessary for an adequate and efficient planning such as:-

(1) Trained and competent planning staff.

(2) A through knowledge of the travel demand pattern in the twin cities.

(3) Important information based on which the public transport is expected to play a role in the overall transportation system.

(4) A close cooperation with CDA and RDA necessary for coordination of route network plans and physical design of operational environment.

(5) A proper legislation that allows the execution of plans and control of the operation.

b. Under these circumstances it is difficult to carry out any effective and reliable planning and to ensure that it corresponds to the travel demand and to decided policies and strategies.

c. There are good reasons for the further development of the basic principle of publicly planned and privately operated public transport. Such a system can work well if properly organized and controlled. If the future development of the public transport in the two cities will include heavy and investment intensive mass transit components, a mixed public/private ownership and operation should be considered. If the two system types can not be brought to an effective cooperation for operation and fare system, a completely publicly owned and operated public transport system is the only option.

d. Urban public transport is a part of the total transportation system in Islamabad/Rawalpindi and is thus basically an urban function. It is therefore

questionable whether the responsibilities for the planning and monitoring of the system should be separated from the urban planning functions at CDA and RDA as is the case now or otherwise.

4.3.2 **Route Network Planning**

In cities where the public transport route network is predominantly privately operated and has grown step by step during a considerable time period, the network, and the number of buses operating the different routes, normally shows a configuration which can be assumed to roughly reflect the pattern of the major travel demand. This is simply because it is along these routes it is profitable to operate. There is, however, no thorough knowledge of the travel demand. This makes it impossible to control if the vehicle resources are allocated in the most efficient way, or if the existing resources are sufficient to satisfy the travel demand at a good level of service. A route network which is created according to operators maximum profit principles will leave weak areas and origin destination combinations with poor or no service even if it is desirable that they are provided with travel possibilities from a transport policy point of view. This will especially be the case if the vehicle resources are ineffectively utilised even for the service of large passenger flows. Poorly served areas are mainly found in Rawalpindi to some extent also depending on the poor conditions of the road network.

4.3.3 **Operation Planning and Control**

a. The only present activity that can be referred to the concept of operational planning is the issuing of permits to vehicle owners to operate a certain route. The issuing of permits seems, however, not be based on an analysis of the present and potential travel demand along the different routes. There is little control and no statistics concerning the number of vehicles which really are in daily operation on the routes and there is no planning of frequencies/headways for different periods of the day. Basically, operational planning is up to the operations themselves. The lacking control of the operation leads to various misbehaviours of the drivers, such as:-

(1) They do not operate the routes they are assigned to.

(2) They do not stick to route alignments but make deviations as they find suitable.

(3) They do not operate the whole route length at all runs but make short turnings when the travel demand on a part of the route is low.

(4) They do not start immediately, or after a planned layover time, when they have reached a terminal or a turning point but stay there long enough to fill the vehicle which results in an irregular operation.

(5) Their reckless behaviour at stops causes delays in the operation, disturbs other traffic, implies accident risks and is inconvenient for the passengers.

4.4 Vehicle Fleet

The number of vehicle permits assigned to the operation within and between the two cities is shown by the table below. A recent survey of total 67 routes has indicated that the number of permits quite well reflects the number of vehicles in operation even if it was found that the vehicles to a large extent operated other routes than they were assigned to.

Vehicle Type	Islamabad	Rawalpindi	Both Cities	Total
Bus routes	3	4	-	7
Minibus Routes	3	7	3	13
Wagon routes	10	7	13	30
Pickup routes	4	9	4	17
Total	20	27	20	67

Table 4:1 Routes Statistics

Vehicle type	Islamabad	Rawalpindi	Total Number
Bus	35	47	82
Minibus	86	139	225
Wagon	88	240	328
Suzuki Pickup	38	578	616
Total	247	1004	1251

Table 4:2 Details/Number of Public Transport Vehicles

As can be seen from the table the larger vehicle types are predominant in Islamabad and the smaller types in Rawalpindi. Counted by seats this means that around 30% of the available transport capacity (route permits) is assigned within Islamabad 30% within Rawalpindi and 40% to the travelling between the two cities. The table below shows an international comparison on the provision of public transport services. The comparison is not based on the number of vehicles. There are various vehicle sizes in different cities but on “capacity seats” per 1000 inhabitants, which include also the standing passengers in the larger vehicles:-

City	Inhabitants	Capacity seats per 1,000 inhabitants
Gothenburg, Sweden	430.000	100[1)]
Hannover, Germany	510.000	95[1)]
Curitiba, Brazil	1.600.000	92[1)]
Aachen, Germany	253.000	88[1)]
Shanghai, China	7.000.000	84[1)]
Portland, USA	600.000	80[1)]
Malmo, Sweden	234.000	73[1)]
Calgary , Canada	717.000	70[1)]

Seoul, Korea	10.200.000	64[1)]
Athens, Greece	3.600.000	74[1)]
Sevilla, “Spain	700.000	32[1)]
Delhi, India	8.400.000	25[1)]
Bombay, India	12.600.000	21[2)]
Islamabad/Rawalpindi	1.650.000	8[3) 4) 5)]

1) Incl, subway or light rail

2) Excl, commute trains

3) Minibuses and buses licensed

4) If only the available PRTC buses are counted the figure is 6.

5) If the small vehicles are included the figure is 28

Table 4.3 International comparison of public transport supply

4.5 **Route Network**

The Islamabad/Rawalpindi urban area is served by 48 public transport routes, operated by buses, minibuses, wagons or Suzuki pickups. 15 of the routes operate only in Islamabad and 11 in Rawalpindi while 22 routes are connecting the two cities as shown by the table below:-

Vehicle type	Islamabad	Rawalpindi	Both cities	Total
Bus routes	2	-	4 [1)]	6
Minibus routes	-	-	5	5
Wagon routes	7	2	9	18
Pickup routes	6	9	4	19
Total	15	11	22	48

Table 4:4 Public transport routes

The figures below show the main features of the route networks of the different types in the two cities.

Islamabad – Route Network

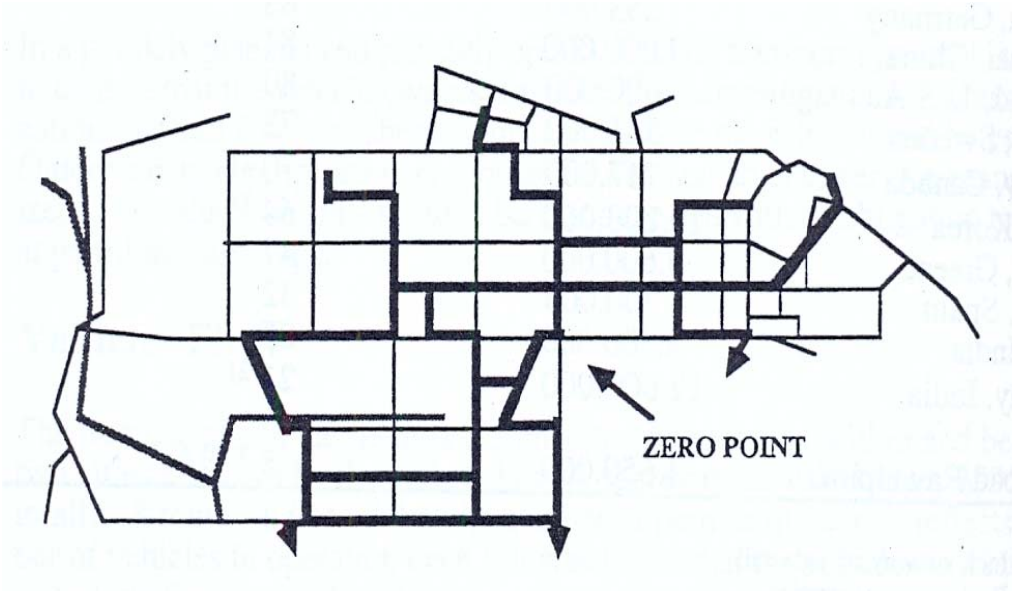


Figure 4:1 Present bus route network in Islamabad

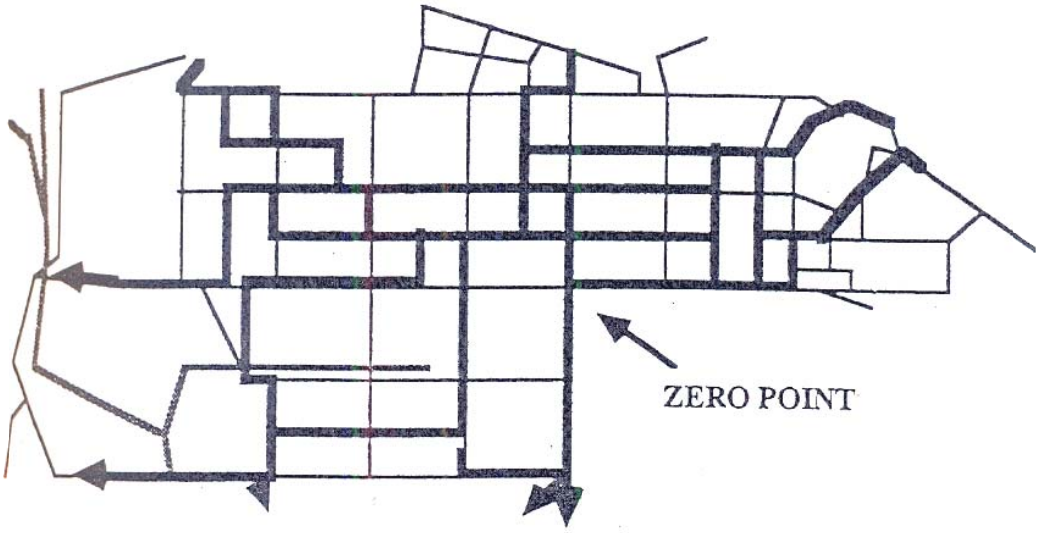


Figure 4:2 Present wagon route network in Islamabad

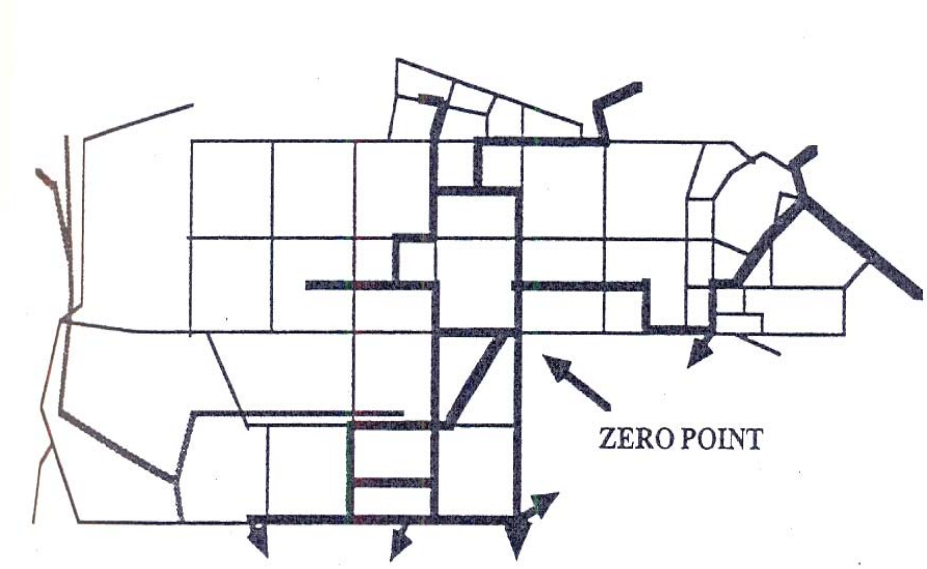


Figure 4:3 Present Suzuki pickup route network in Islamabad

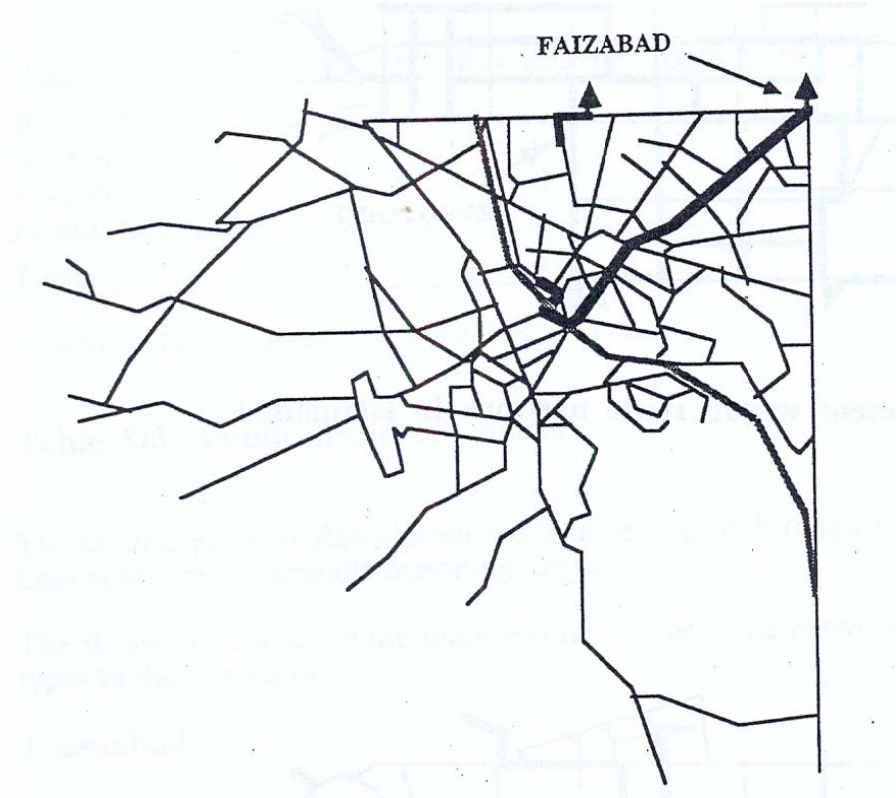


Figure 4:4 Present bus route network in Rawalpindi

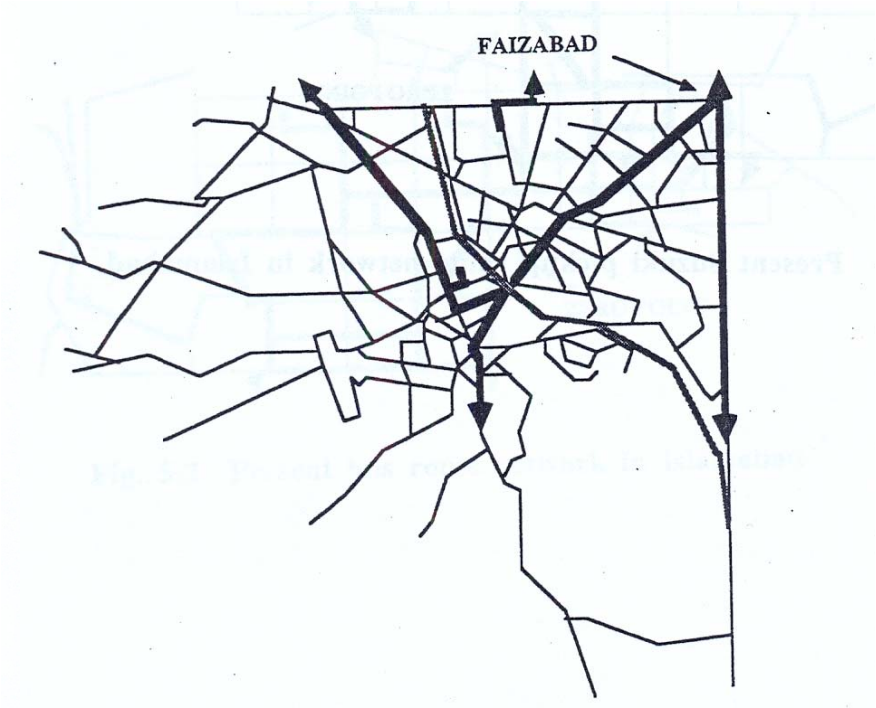


Figure 4:5 Present minibus route network in Rawalpindi

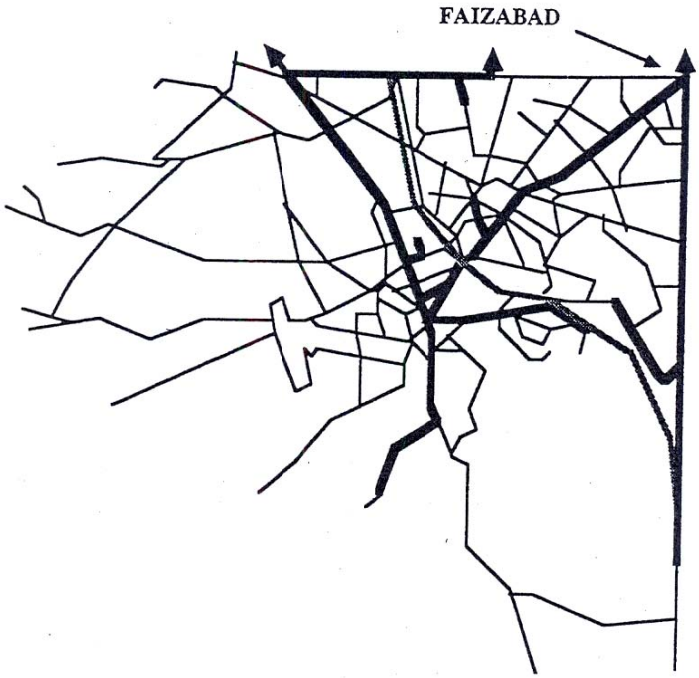


Figure 4:6 Present wagon route network in Rawalpindi

Figure 4:7 Present Suzuki pickup route network in Rawalpindi

Three areas are especially well provided with bus routes-F6/Secretariat, the areas south of Jinnah Avenue (G6-G-9) and the General Bus Stand in Rawalpindi. Area coverage of the route network is fairly good in already developed parts of Islamabad. In Rawalpindi some areas are clearly under-served- the areas east and west of the General Bus Stand and the eastern part of central Rawalpindi (north of the railway). To some extent the situation depends on the poor condition of the road network. Concerning the route network structure it is not possible to have a detailed opinion without a major public transport survey. When this is done the network should be planned and the necessary vehicle resources assigned to the different routes.

4.6 Level of Service

The level of service is judged by several components which all are involved in the trip making:-

a. **Walking Distance/Time**. Walking distance/time, which is a measure of the accessibility to the public transport system.

b. **Waiting Time**. Waiting time (at stops), which depends on the frequency of the service and the available information on the operation.

c. **Riding Time**. Riding time, which beside the trip length is depending on the operation environment (running speed) and the bus stop times?

d. **Number of Transfers**. Number of transfers, which depend on the ability of the route network to reflect the travel demand pattern.

e. **Travel Comfort**. Travel comfort, which is mainly depending on the design of the vehicles and the capacity utilization. To this category the bus stop conditions can also be referred.

f. **Fares**. The price of the trip.

g. **Information**. On routes, time tables, fares etc. in order to make the public transport system easy to use.

To assess the total travel time as a measure of the level of service the various time components have to be summed together. Behavioural research has shown that the different ways of spending the time are felt differently by the passengers. The best measure of the quality of the service offered is the weighted travel time (WTT), where the riding time is given the weight 1 and the other time components, felt as more inconvenient, are assigned higher weights, in the western environment at least 3. The mere inconvenience of making a transfer is generally estimated to be equivalent to 5 minutes riding time beside the time it requires. Thus the total weighted travel time is:-

WTT=Walking time x 2 + Waiting time x 2 + Riding time x 1 + Transfer time x 2 + Transfer penalty (5 min per transfer) + Walking time x 2.

The WTT is used as a measure of the effort that is demanded of the passenger to make a public transport trip. Long walking times, long distances between stops and transfers can for instance to some degree be compensated by high riding speed if the journey is long enough.

4.6.1 Walking Distance/Time

a. **Islamabad**: Bus routes are operated on most service roads and at the sector centres. This implies that a majority of the population should be possible to serve with a public transport route within a walking distance of 500 meters,

corresponding to 7 minutes walking time, if favourable locations of the bus stops is attained, taking into account that public transport vehicles in regular operation should preferably not operate on residential/local roads.

b. **Rawalpindi** One of the study suggested the distribution of walking times for passengers at the bus stops on Murree road as shown by the diagram below:-

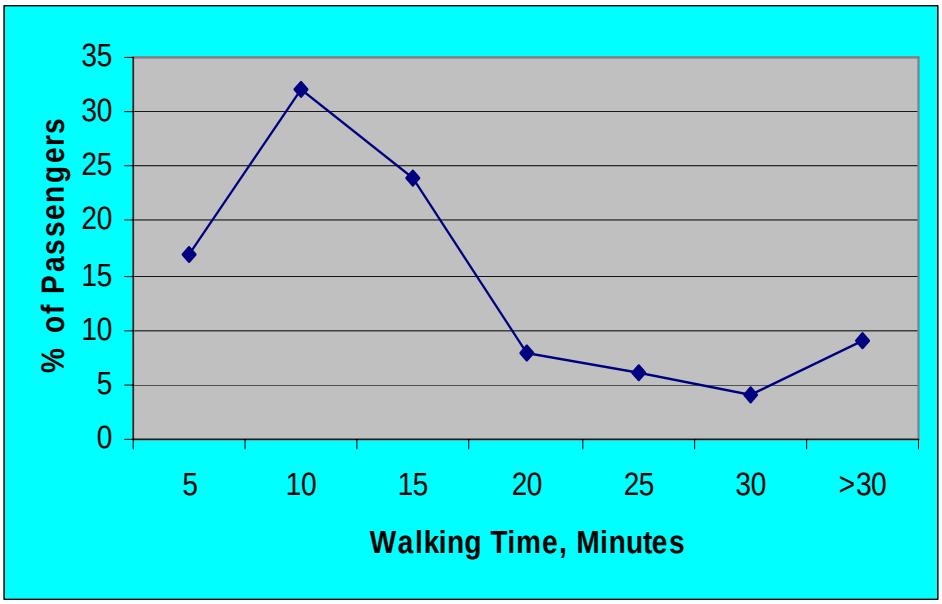


Figure 4:8 Walking times to bus stops in Rawalpindi

c. An often used criteria for walking distances is that practically all passengers should have a distance of less than 500 meters to the nearest stop. This corresponds to a walking time of approximately 7 minutes. In Rawalpindi at most of the places the passengers have longer walking times than the maximum considered to be a reasonable level of service.

4.6.2 Waiting Time

a. There is no possibility to make a calculation of the present waiting times in the Islamabad/Rawalpindi route network based on time tables as no such exist. Based on one of the field survey of 11 out of the 67 routes, was however, observed the round trip times (average for two observed consecutive runs) and

the number of vehicles on each route. Based on these figures the headways of the routes were the following:-

Route	Veh Type	Total Time per round trip minutes	Number of Vehicles	Headway minutes
113	Bus	167	250	0.7
A-1	Bus	228	63	3.6
011	Wagon	125	162	0.8
03	Wagon	193	152	1.3
06	Wagon	183	77	2.4
105	Wagon	139	165	0.8
111	Wagon	240	80	3.0
120	Wagon	139	49	2.8
121	Wagon	123	100	1.2
09	Pickup	159	97	1.6
11	Pickup	96	246	0.4

Table 4:5 Public transport headways survey- 2000

b. According to these figures the waiting time is an almost negligible part of the total trip time, assuming that the vehicles operate with regular intervals (which they do not do) and provided that the capacity utilisation allows the passenger to board the first vehicle arriving at the stop.

c. Various surveys such as MM study indicate that the average waiting time along Murree Road in Rawalpindi is more than 10 minutes.

4.6.3 **Riding time**

a. **Islamabad**. As the capacity utilisation of the road network in general is fairly low and congestions or sluggish traffic flows are rare, the buses can generally move without any onroad delays. At some places the disorderly situation at bus stops slows down the operation. A field study indicates that the average running speed (including the time loss at stops and lay-over time at terminals) is around 20 km/h which is quite reasonable for an urban bus system. The operating speed, however, is unnecessarily reduced by too long lay-over times: the vehicles spend too long time at the end terminals. The public transport riding time is probably around 1.5 times as long as by car (for the total travel time, including walking, waiting and transfer times, the factor is higher and for some origin-destination combinations considerably higher). It is also evident that cars often find more direct routes and that some public transport passengers have to spend time at transfers between bus routes.

b. **Rawalpindi**. In Rawalpindi the overall average running speed for all vehicles is lower than in Islamabad due to a higher capacity utilization of the roads and a disorderly traffic environment. The average bus running speed (including stop times) of somewhat less than 15 km/h. As an average figure, 15 km/h is not alarming in an international comparison, but locally bus speeds can be very low and stand-stills often occur. In particular, the problem with long queues on Murree Road is serious. Running speed for cars is also lower than in Islamabad but these can to some extent find less congested roads.

c. The riding times in both cities appear to be longer during off peak periods than in rush hours, because the buses tend to stay longer at the stops in order to catch as many passengers as possible. As one of he main reasons for the difference in riding time between car and public transport is the bus stop times, these should be brought to a minimum by a proper bus stop design, a reasonable distance between stops and an effective operation at stops. No extra waiting for possible passengers should be allowed.

4.6.4 **Transfers**

a. **Present Situation**. No really useful information on the transfer rate is available. It must also be observed that many of the transfers which appear logical with the present route network configuration are avoided and replaced by long walking distances because of economical considerations of low income people who do not want to pay double fares.

b. **Improvements**. There are mainly two ways to improve the transfer route situation:-

(1) Improve the transfer possibilities at selected important stops by providing route and time table information and agreeable transfer conditions.

(2) Re-planning of the route network in accordance with the travel demand pattern (more direct trips), which demands a knowledge on a rather detailed origin-destination level.

4.6.5 **Travel Comfort**

a. **Vehicles**

(1) **Present Situation**. The present vehicle fleet (permits) is composed of around 90% small vehicles (wagons and pickups) and only 10% buses and minibuses. From a comfort point of view the large vehicles are usually better than the small ones i.e boarding, alighting as well as riding is more convenient.

(2) Suzuki Pickups are extremely uncomfortable. Even wagons are some shat uncomfortable due to over loading with passengers.

b. **Capacity Utilization**

(1) **Present Situation**. No reliable information on bus capacity utilization is available. The field survey on 11 routes showed that the passenger turnover on the seats was on average 5.4. This means that each seat is used by 5.4 different passengers during one round trip. The

figure indicates a high capacity utilisation and probable capacity problems on the most loaded section of the route.

In capacity utilisation, Suzuki pickups have an advantage over other vehicles. They can transport people during peak hours and goods during off peak hours, thus being a flexible and economic public transport resource.

(2) **Improvements**. Improvements are called for both if the buses are over-loaded and if the capacity utilisation is poor. The planning or balanced loadings are made in connection with the general route network planning. When the passenger flow on the route is established this is made in two combined steps as follows:-

(a) Choice of vehicle type for the route.

(b) Choice of the headway/frequency that corresponds to a reasonable load factor, e.g. 80% at the most loaded section of the route as an average for the maximum hour. This principle generally guarantees that nobody (or at least very few) will be left at the bus stop to wait for the next bus. The larger buses the easier this capacity calibration can be done because of the volume elasticity of a large vehicle (standing passengers). The diagram below shows an example of peak hour load profile of a route.

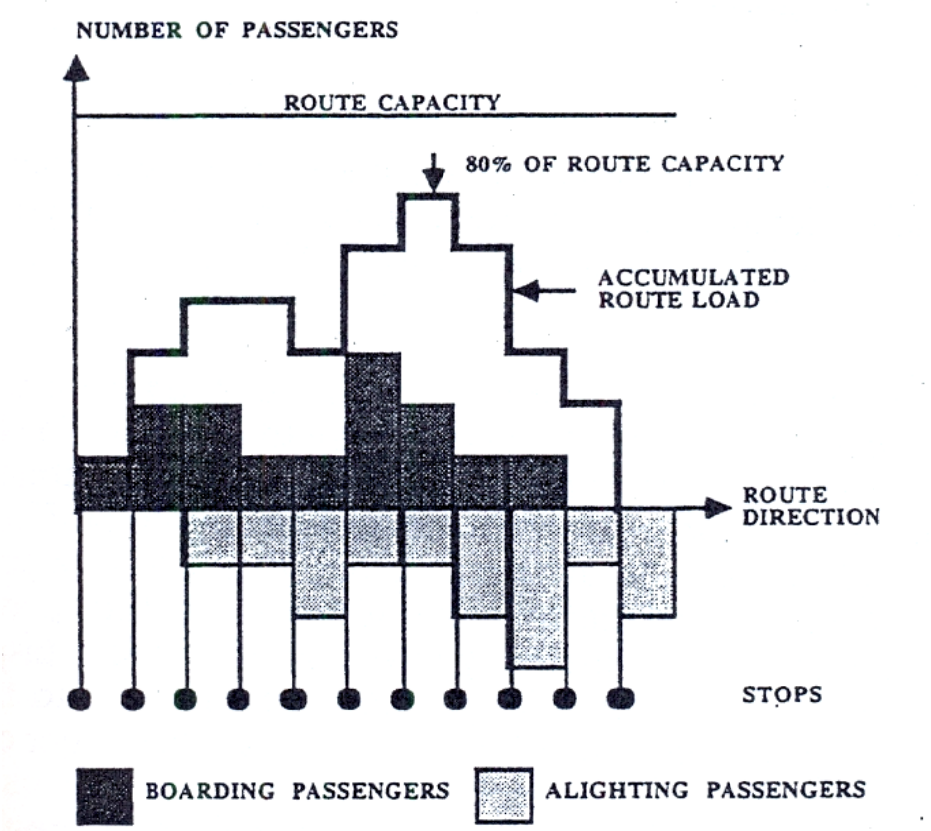


Figure 4:9 Example of bus route load profile

If no route network changes are considered, observations on the loadings along the routes can be made by departure and the frequencies accordingly adapted.

c. **Bus Stop Conditions**. Bus stop conditions are in many places chaotic, mainly depending on the disorderly behaviour of the bus drivers, which causes both considerable inconvenience and accident risks for the passengers.

Figure 4:10 Bus Stop Conditions

4.6.6 **Fares**

a. A distance, related fare punishes long trips and favors the short ones. Because of the larger time loss by using public transport, instead of care for long trips the distant depending fare encourages car riding As a large portion of the work trips, especially to the administration centre, are long, this will contribute to an increase of the peak hour traffic pressure on the eastern part of Islamabad.

Distance		Amount (Rs)
From	To	
0	4	12
4.1	8	15
8.1	14	20
14.1	22	23
22 and above		25

Table 4:6 Fares-Islamabad/Rawalpindi

b. The present organization of the public transport, self financed private operation with a production cost oriented fare system, gives little room for changes of the fare policy. For the long-term perspective it is, however, important to examine various possibilities.

4.6.7 **Passenger Information**

a. AT present the information on the urban public transport system to the travelling public is practically non-existing. There are no route maps available to buy, neither posted at the bus stops. A vast majority of the buses do not carry any signs with route numbers or destinations, the conductors are announcing the destinations at bus stops. This is very inconvenient for the passengers, especially as buses are crowding at many stops or, even worse, around the stops. No time tables or information on the route frequencies exist and the ill disciplined drivers cause an irregular operation.

b. **Improvement**. The information on the public transport system is important both for the bus operators and for the practical mobility of people. The information can be given in different forms:-

(1) Route maps which give direct information on how to travel (which routes) in order to come from one point to another. The benefit of maps

is of course depending on the ability of the riding public to read a map. The largest portion of map readers is probably to be found in the group the most ignorant of the function of the public transport system. Some of them may discover that they have a good public transport connection e.g. for their work trips. Maps can be distributed to the households, sold in shops and posted at bus stops at least the major ones.

(2) Time tables, available to buy and posted at all bus stops. The time tables serve, beside their information purpose, as an instrument to improve the regularity and reliability of the operation, and as a tool for the control that the bus drivers fulfil their obligations, both concerning the frequency and the duty to operate the whole route at all times.

(3) All buses should carry route number signs in order to make it possible to identify them.

(4) Maps and time tables should carry information on the fares.

(5) All bus stops should be designed to be easily identified, and provided with an easy to read sign telling which routes are serving the stop. Buses should be prohibited to pick up passengers elsewhere between the stops.

4.7 **Operational Environment**

4.7.1 **Roads**

(1) **Islamabad**. The general/road conditions, road width, road surface, geometric characteristics etc, are normally sufficient for bus operation on all roads where it is suitable to locate bus routes, except for in some still developing areas. The traffic flows are in most places undisturbed by congestions but the buses (and other traffic) are sometimes unnecessarily delayed at signalised intersections by very long signal cycles.

(2) **Rawalpindi**. Many of the roads in Rawalpindi are not to be considered as suitable for bus traffic because of the poor road standard.

The conditions are supposed to be considerably improved by the implementation of the road reconstruction plan for the central parts of the city. Further road improvements will, however, probably be required, especially in the northern parts of the city in order to attain a better public transport coverage possible and bring about reasonable walking distances. The traffic conditions for public transport are very bad with a sluggish traffic flow most of the day and frequent congestions. Even in the main bus corridor, Murree Road, the average operation speed of the buses is 15 km/h or less.

d. **Traffic Management**. The most usual traffic management measures aiming at the improvement of bus operation is the introduction of bus lanes and preferential treatment at traffic signals. The existence of the former, at least in direct connection with the intersections, considerably facilitates the latter. It should be noted that priority at traffic signals is easier to implement and less disturbing for the other traffic for a small number of large buses than for a large number of small buses. The introduction of bus lanes should preferably by made before the capacity utilization of the road has grown to a level that hampers the bus operation, or as on Murree Road, in connection with a major reconstruction of the road. In some places, especially in Islamabad, there is enough space beside the existing roads for a simple addition of a bus lane.

4.7.2 Terminals

a. At terminals (the end points of the routes) buses are normally supposed to be parked for 5-10 minutes, the lay-over time while the crew rests, fill in documents and serve the vehicle. The lay-over time also gives an opportunity to adopt the next departure to the time table.

In today's situation, where the lay-over time is at the driver's choice and the length is depending on the passenger demand, there are no possibilities to calculate the necessary space and to design the terminal to house the buses in an orderly and rational manner. As a consequence the place often presents a more irregular congestion of waiting vehicles. This situation can only be brought into order if the operations are made regular.

b. **Improvements**. The basic information for the design of terminal is the maximum number and sizes of buses which are going to stay at the terminal at the same time. Here is another reason for the introduction of fixed frequencies as a basis for this calculation. At the design of the terminals several aspects should be taken into account, such as:-

(1) Terminal area should be off road in order not to disturb the moving traffic.

(2) The terminal should provide sufficient off road space for waiting passengers and resting crew.

(3) For the convenience of the passengers they should have the possibility to board the buses during the lay-over time. This means that passengers are moving within the terminal area. They should be able to do so with a minimum of conflicts with other moving buses.

(4) The information at the terminal (signs) should make it easy to identify the places where buses on different routes are stopping for the convenience of the passengers, in order not to delay the buses and to avoid unnecessary passenger movements in the terminal.

4.7.3 Bus Stop Behaviour

As mentioned above many bus stops imply considerable operational problems. Recommendations concerning improvement of bus stops will be presented in succeeding chapters. The most urgent reform, however, is to prevent the buses from stopping outside the designated stop areas.

Figure 4:11 Bus Stop Behaviour

4.7.4 **Encroachments**

a. Bus stops attract encroachments because many passengers are gathering there. Reversibly, large encroachments can attract bus drivers to use them as stops, even if no stop is planned at the place. In the worst cases these locations are not only used as bus stops but also as bus stands. Typical examples are found at some of the intersections on the Khyban-i-Sir Syed. This creates a situation which from capacity utilization and traffic safety points of view is very unsatisfactory.

4.7.5 **Operations**

a. **Drivers**. The drivers in general have a poor training and education in traffic rules and regulations. The private sector operators to a high extent neglect to provide training for their drivers. As a consequence the number of accidents involving public transport vehicles is high. This is especially unfortunate as many people are involved in each accident.

b. **Vehicles**

(1) **Present Situation**. At present the urban vehicle fleet composition dominated by small vehicles, only 2.5% of the route permits include buses, 9.5% are minibuses, 38% wagons and 50% pickups. Without time table (and without the knowledge of how many vehicles are actually operating each route on a specific day) and an efficient control organization, it is practically impossible to ensure a public transport service with good regularity, reliability and capacity sufficiency.

(2) A vehicle fleet with larger and fewer vehicles is much easier to schedule and control. The longer headways (waiting times) are for many routes of no importance as they will still be rather short due to the high capacity demand. For routes with lower frequencies a regular operation and information on time tables can efficiently counteract longer waiting times.

(3) Furthermore a large bus demands less road capacity per passenger than a small one. The large bus can carry 8 times as many passengers as a pickup. 8 pickups demand 3-4 times as much road capacity as a large bus. The use of large buses will also enhance the achievement of a proper bus stop operation.

(4) The road conditions in Islamabad allow an operation with large buses in more places, while the present conditions in Rawalpindi pose considerable restrictions in some areas. This situation will, however, be much improved by the implementation of the road reconstruction plan, which obviously will start with the main public transport corridor, Murree Road, thereby opening the possibility to use large vehicles for the large passengers flows between the two cities.

4.7.6 **Route Allegiance**

(1) At present it is obvious that the route allegiance is failing in at least three ways, especially for the small vehicles.

(a) The drivers do not stick to the route they are assigned to if there is a more profitable one in the neighbourhood.

(b) The buses do not operate the whole route length at all times, but are short turning in order to be able to cover the more profitable parts of the route as much as possible.

(c) The drivers make deviations from the prescribed route alignment in order to collect as many passengers as possible.

(2) All these conditions may indicate that the real operation (as drivers behave today) is better adapted to the travel demand than the planned, route network as well as operation. One reason to believe so is that the drivers run for profit, which on the other hand probably means that they do not, or at least to a little extent, consider also the social aspects of public transport.

(3) A field survey on 11 of the 67 routes showed, even if the numbers of licensed and operated vehicles are practically the same, that the vehicles to a large extent operate other routes than they are assigned to.

Route	Veh Type	Licensed Vehicles	Observed Vehicles	Obs/Lic. Vehicles %
113	Bus	34	85	250
A-1	Bus	232	147	63
01	Wagon	103	167	162
03	Wagon	27	41	152
06	Wagon	202	156	77
105	Wagon	172	284	165
111	Wagon	70	56	80
120	Wagon	184	90	49

121	Wagon	109	109	100
09	Pickup	100	97	97
11	Pickup	50	123	246
Total		1283	1355	106

Table 4:7 Licensed and observed public transport vehicles

4.7.7 **Lay over Time**

a. The lay-over time rest is not defined according to the route length (the drivers need for rest) and the time needed for the crew to fulfil their duties at the terminal. Even if it were, the drivers would probably not give up their bad habit to stay at the terminal as long as necessary in order to fill the vehicle. Furthermore an analysis of the route profile may very well show that this is not the most profitable behaviour. The opposite behaviour, that the driver turns immediately and hurries away in his ambition to collect as many passengers as possible, may imply that he is driving for hours without any rest (in a stressed mood), which is not to be recommended from a traffic safety point of view. Anyway, both behaviours lead to an irregular and unreliable operation.

b. **Improvements**. The only way to improve the situation is to introduce time tables/driver schedules, to attach proper operation obligations to the route permits, and to control the operation. If sample checkups are not found sufficient, dispatchers have to be placed at the terminals, at least the more important ones. Controlled and planned departures from the terminals will also contribute to ease the present situation, with crowding buses at stops and terminals, and make the arrivals of buses along the route more regular to the benefit of the passengers.

4.7.8 **Police Enforcement**

Extended and improved enforcement of laws and regulations by the Traffic Police is needed, especially in the following cases:-

a. A very harsh attitude against ruthless bus driving, in-connection with the ordinary traffic supervision and in special concentrated campaigns.

b. Supervision and control of both bus driver and passenger behaviour at bus stops.

c. Supervision and control of future traffic management improvements such as bus lanes and bus priorities at signalized intersections.

4.8 **Conclusions**

a. An articulated traffic and transportation policy is missing which is required to give clear guidelines for the planning authorities.

b. Public transport planning at CDA and RDA is required as both the cities are inter linked for daily commuters.

c. There is a need for introduction of a public transport control organization to improve the level of service and route permit obligations.

d. A thorough public transport passenger survey needs to be conducted to exactly calculate the travel demand and then carryout necessary planning.

e. There is a need for a better balanced combination (compromise) of level of service and transport economy.

f. There is requirement of strengthening of the private sector organizations for greater possibilities for public transport improvements and coordination of operation and fares.

g. Introduction of larger public transport vehicles i.e buses at priority to improve possibilities for scheduling, time tables and regularity of the operation, better travel comfort, better road capacity utilization and better transport economy.

CHAPTER 5

TRAFFIC SAFETY AND ENVIRONMENT IN URBAN AREAS

5.1 Introduction

Improving traffic safety is a never-ending work. New generations of road users are continuously growing up, new parts are added to the transportation system, the existing system is also ever changing, cities are growing and changing their structure, the motorization process goes on, traffic safety research adds new knowledge and new techniques to solve problems are developed. In average, the costs for traffic accidents in developing countries has been estimated to 1-2% of the GNP. The incentive for traffic safety improvements is thus nation wide, and political in its nature.

5.2 Present Situation

The diagram below shows the development trends concerning the traffic accident fatalities in developed countries and developing countries in Africa and Asia. The diagram shows that the intensive traffic safety improvement work, that has been going on in the developed countries since decades, has given result and that considerable efforts must be made in the African and Asian countries. Beside the human suffering the traffic accidents are growing to be a national economic problem.

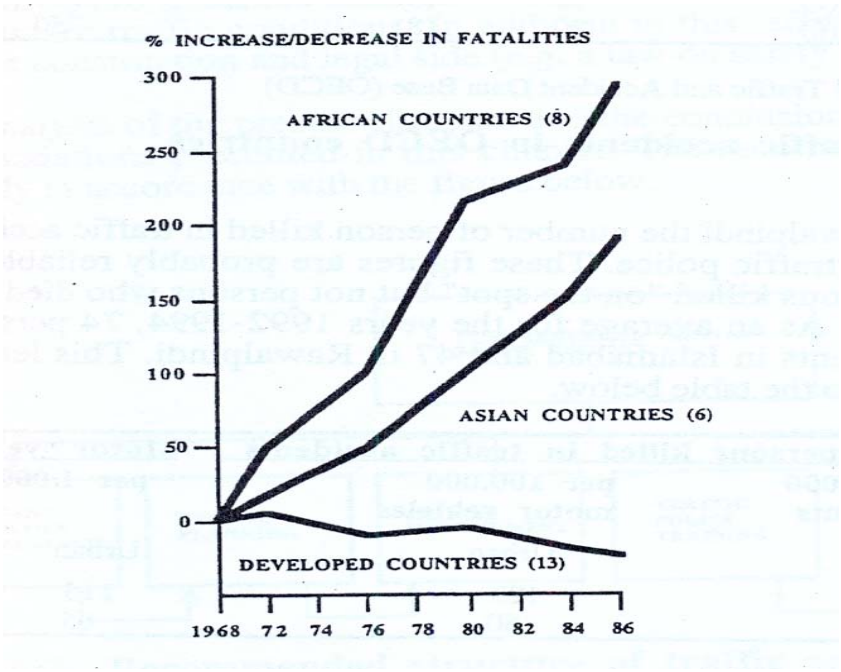


Figure 5:1 Traffic accident development trends

For Islamabad and Rawalpindi the data about the number of person killed in traffic accidents has been provided by the traffic police. These figures are probably reliable, even if they only include persons killed on the spot but not persons who died later at a result of the accident:-

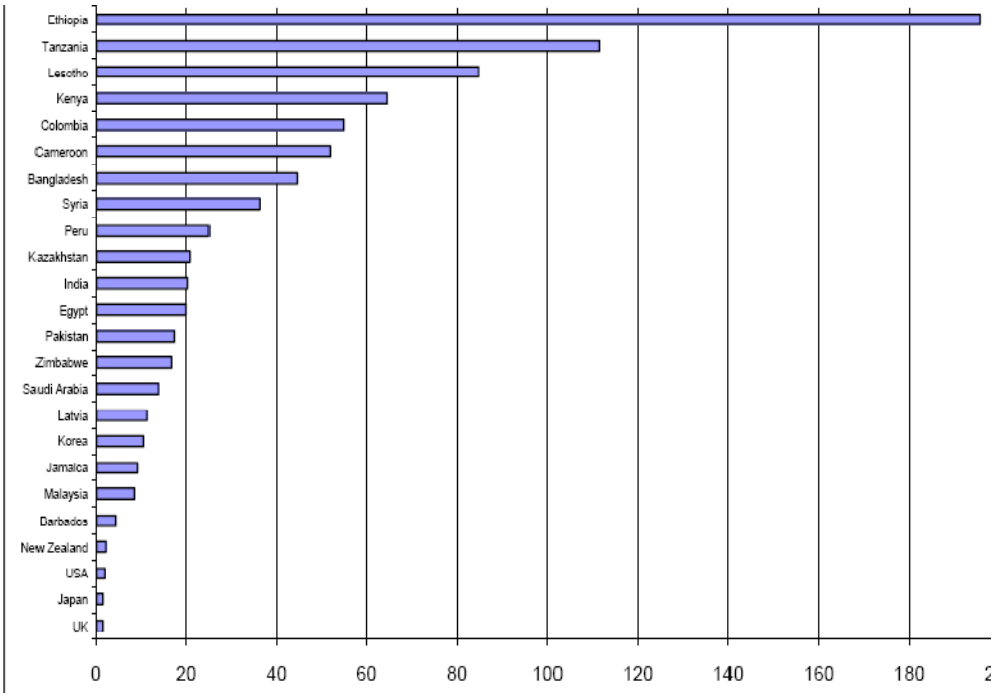


Figure 5:2 Fatalities/ 10,000 Licensed Motor Vehicles In Selected Countries

Year	Inhabitants Number of persons killed in traffic accidents	
	Islamabad	Rawalpindi
2006	103	98
2007	58	190
2008	76	175
2009	105	185
2010	92	143

Table 5:1 No of persons killed in Fatal traffic accidents in Islamabad/Rawalpindi

5.3 Poor Traffic Safety Situation

The analysis of the traffic accident reports, discussions with the Traffic Police and field observations result in the following conclusions concerning the reasons for the poor traffic safety situation:-

a. Insufficient and inadequate driver educating and training.

b. Bad traffic behaviour and discipline by all types of road users, and a very selfish attitude and lacking consideration versus their fellow road users.

c. Insufficient education and training of the traffic planners concerning road safety.

d. Poor traffic environment in many places.

e. Insufficient education training and resources (both personal and technical) of the Traffic Police and, correspondingly, poor traffic supervision and control.

The list above is an example of the well known fact that the traffic safety work has to be involved in all the different components necessary for the development of good urban traffic conditions. In addition to this, efforts should be made on the vehicle construction and legal side (e.g. a law on safety belts and their use). The analysis of the present situation and the conclusions have resulted in the recommendations in this chapter. The recommendations are structured roughly in accordance with the figure below:-

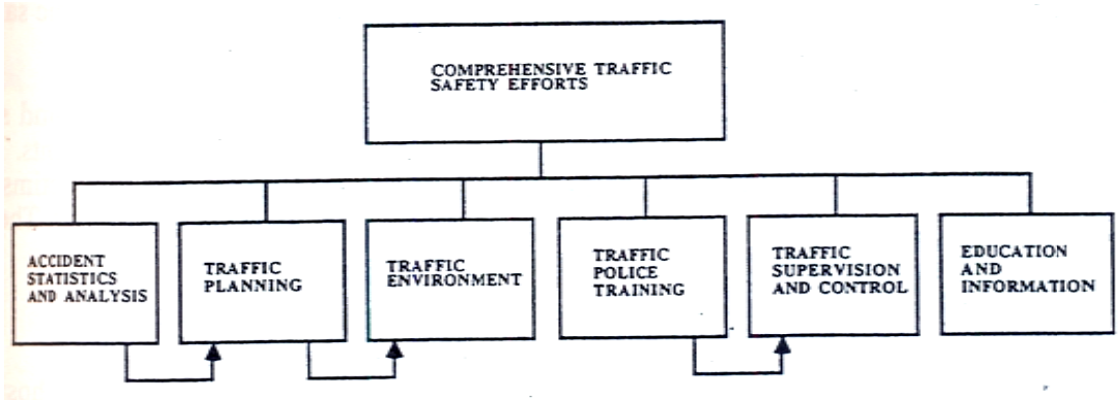


Figure 5:3 Recommended structure of traffic safety work

5.4 Accident Statistics and Analysis

5.4.1 Accident Statistics

One of the most important prerequisites for successful solving of problem is that the problem is well defined. In the case of traffic safety this means, beside generally accepted planning rules, a need of information on the extent of traffic accidents and where and why they occur. Only with this knowledge the right priority could be given to different types and locations of traffic safety measures, thereby using the money involved in the most effective way. At present, all police registered accidents result in a hand-written report which states where the accident happened, roughly how it happened, the types of road users/vehicles involved and if the persons killed/injured. These reports are, however, only used for the judicial procedure and the material is not structured and utilised for traffic planning purposes A lot of good information is thus already available for the traffic planners in the traffic police files but not used. The situation concerning the statistics on traffic accidents can be improved in three main steps.

A first step to increase the knowledge of the traffic accident situation should be to thoroughly review the police reports from the last three years and create a data base which, for each reported accident, gives information on:-

a. Year, date, time of the day.

b. Road link/intersection (as exact location as possible).

c. Types of vehicles/road users involved in the accident.

d. Persons killed/injured and type of road user, vehicle driver, passenger, cyclist, pedestrian.

e. The type of accident, head on collision side collision, crossing pedestrian run over etc as a guidance of the traffic planner at the redesign of e.g. an intersection.

This implies a fairly large initial effort which, however, probably could be made by e.g. graduating technical students with the guidance of traffic police staff and traffic planners. It is important that the latter get the right type of data for their planning. After the initial work all police registered accidents should be reported to the traffic planning authorities (CDA and

RDA) in feasible format. As mentioned above, the total accident situation is not known. A second step could be to broaden the knowledge of the persons injured in traffic accidents. This can be done by implementing a routine that the hospitals, where the victims are brought, report all traffic accident cases to the traffic planning authorities. The reports should include:-

a. Time and place for the accident.

b. Type of road user.

c. Degree of injury, severe injury if the victim has to stay at the hospital and light injury if the victim can leave the hospital after treatment.

d. For severe injuries, types of injury and time for recovery, degree of lifelong injury effects and information if the patient has died as a direct effect of the accident e.g. within one month.

During the first two steps and a test period of 6-12 months the report forms and routines should be finally developed and a computerised data base prepared. The third and last step for the creation of good traffic accident statistics is to finally create routines for the continuous accident reporting from the Traffic Police and the hospitals and the structuring of them in the data base. Outputs from the data base, in a form which is suitable for the traffic planners as well as the Traffic Police, should be prepared periodically. As indicated above, the accident statistics should be kept by the traffic planning authorities.

5.4.2 **Traffic Accident Analysis**

The link between the collection/systematisation of the traffic accident data and the choice of measures to be taken is the analysis. It takes an experienced traffic safety planner to translate the information gathered into proper physical measures and/or traffic regulations. The data collected gives information of what happened and the physical conditions at the occasion. The analysis aims to explain why it happened, poor physical environment, improper traffic regulations, negligence of the road user etc. The assumed reasons for the accident will indicate the measures to be taken in order to prevent further accidents of the same kind. A serious attempt to improve traffic safety in urban areas in Pakistan should imply that an Urban Transport Wing at NTRC should have at its disposal both a statistician (to systemise the traffic accident data) and a traffic safety analyst. Then the Urban Transport Wing would

be able to assist cities with methodology, traffic safety planning guidelines and training of local staff in the cities.

5.5 Traffic Planning

The integration of the accident statistics and analysis in the urban traffic planning is illustrated by the figure below:-

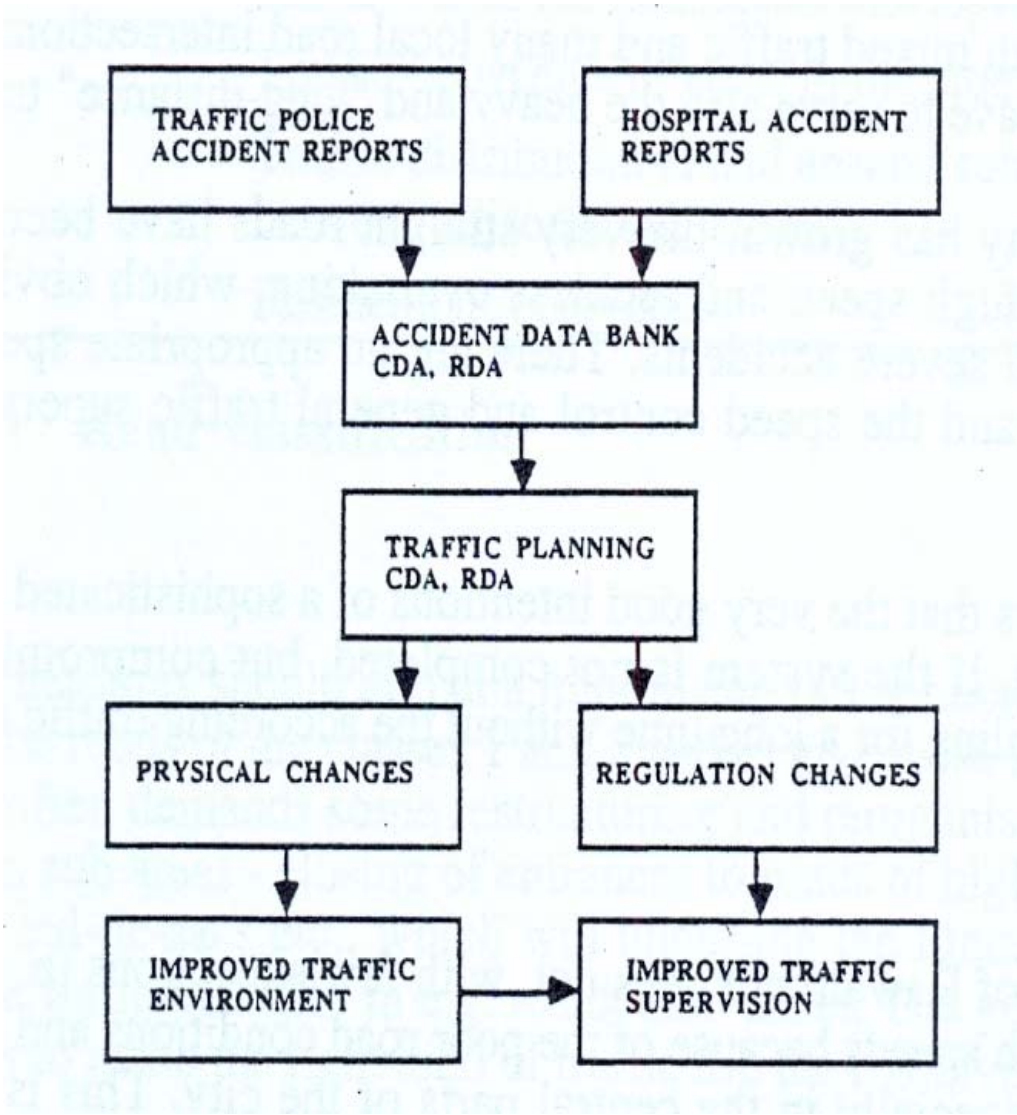


Figure 5:4 Accident statistics and traffic planning

5.6 Traffic Environment

5.6.1 Road Network Structure and Quality

The main road network structure in different cities can show very varying patterns. The figure below illustrates two extreme structures, the grid network patterns and the spider net pattern.

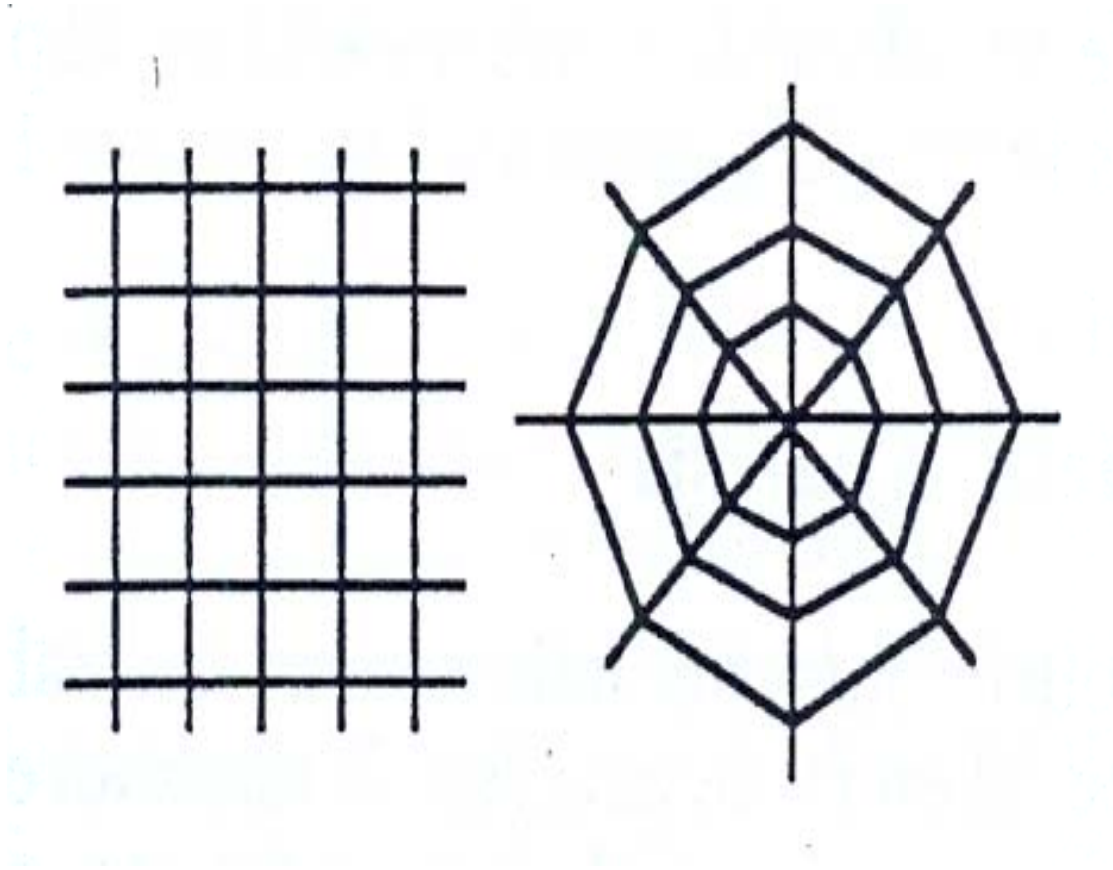


Figure 5:5 Grid structure and spider net structure

The grid network is often found in cities which have initially grown rather rapidly but covering a limited area, e.g. some cities in the U.S. (Washington D.C. is typical) while the spider net structure indicates an older city that has grown slower in an organic way. Islamabad is a typical representative of the grid system, while Rawalpindi represents the spider net structure but, which is the normal case, not as strict and regular as the configuration of the model figure above.

5.6.2.1 **Islamabad**

The grid road network system type and the rapid growth of the city has resulted in two conditions which are negative from a traffic safety point of view:-

a. The roads of the higher classes have not been given the proper design or especially the avenues, have not been constructed at all. There are obviously two reasons for this. They are expensive and the need for road capacity has not yet demanded them. In this situation the service roads, with mixed traffic and many local road intersections and plot entrances, have to serve also the heavy and long distance traffic.

b. As the city has grown, the very straight roads have become long and invite to high speed and reckless of overtaking, which obviously causes many and severe accidents. There are no appropriate speed limits announced and the speed control and general traffic supervision is very poor.

The situation shows that the very good intentions of a sophisticated road network design can be spoiled, if the system is not completed, but compromises and half measures are prevailing for a long time without the according traffic regulations.

5.6.2.2 **Rawalpindi**

The road network of Rawalpindi does not, with few exceptions (e.g. parts of GT Road) invite high speeds because of the poor road conditions and the congested traffic situation, especially in the central parts of the city. This is probably the main reason why the death rate in traffic accidents is lower than in Islamabad. The traffic safety situation in Rawalpindi calls for other types of actions than in Islamabad:-

a. There is no clear road classification and not a proper road design and traffic regulations according to the role of the road in the traffic system.

b. There is a complete traffic mixture on all streets, including main arterials such as Murree Road. All types of vehicles mixed with uncontrolled parking and pedestrians crossing the street wherever they want to. At the implementation of the newly approved road construction and reconstruction plan the problems can be considerably reduced. The different components of the plan should be reviewed with special regard to traffic safety before implementation. In

connection with the realisation of the plan, concentrated efforts should be dedicated to traffic supervision and control.

c. In connection with the presentation of the traffic accident statistics a number of especially dangerous intersections and road links on other roads have been identified and proposals prepared for traffic safety improvements for some of them.

5.6.3 TSM (Traffic Systems Management) Measures

The roads in the network have been divided into four road classes:-

Road Class	Function
1	Long distance traffic to and from the cities. Long distance traffic within the Islamabad/Rawalpindi urban area.
2	Traffic between sub area in the cities.
3	Traffic distribution in and around sub areas and traffic between adjacent sub areas.
4	Residential/local roads.

Table 5:2 Road Classification

The TSM measures should aim at a minimising of the number of intersections on primarily the roads for the classes 1 and 2 and to give these intersection a safe design. This often demands some restructuring and reorganisation of the local road networks in sub areas – closing of entrances to roads of higher road classes, introduction of cul-de-sacs etc, which will underline the function of the local roads and prevent through traffic in e.g. residential areas. The general aim of the TSM measures is to make the right kind of traffic use the right type of road.

5.6.4 Traffic Signs

A city wide review and upgrading of the traffic signing should have a high priority in order to inform the rod users on the traffic regulations and rules and to give the Traffic Police a solid base for the traffic supervision and enforcement. The signing program should start with the

types of signs which have great traffic safety implications, are simple to understand and are easy to enforce by the Traffic Police. Two types of signs corresponding to this description are STOP and GIVE WAY. In some of the main arterials ruthless parking is jeopardising traffic safety which makes also NO PARKING signs to fall into the described category as well as PEDESTRIAN CROSSING signs. Further city wide SPEED LIMIT signing programs should be prepared and implemented.

The implementation of a road sign program requires close collaboration with the Traffic Police. To facilitate this, the signs should not be implemented piecemeal around the city but as far as possible by areas and along corridors. Not too many types of signs should be implemented at the same time. Thus the Traffic Police can concentrate its supervision and enforcement activities both geographically and purpose wise. Implementation of signs in a limited area at one time gives the best effect and saves resources. The fact that a large portion of the road users in an area and along a corridor are the same every day also speaks for this implementations order.

5.6.5 **Road Markings**

Lane markings, stop lines and marking of pedestrian crossings should be introduced as a standard for the road classes 1-3. the same implementation order (for the same reasons) as for the road signs is recommended, especially along corridors where road markings are introduced for the first time. The road users have to be trained to respect the road markings if they should serve their purpose. For instance, today there seems to be little respect for a solid line. At certain places, mainly at intersections, the effect of the painted line could be strengthened by rod studs (cat’s eyes). In the long run the aim should be to make this unnecessary, otherwise the bad habit to respect only lines with studs could be developed. In order to achieve the wanted effect the rod markings have to be continuously maintained.

5.6.6 **Roads Links**

All roads with a paved width of 6 meters or more should be provided with a median line. As the paved section gets wider, lane dividing lines, edge lines and medians should be introduced. The choice between wide lanes and edge stripes depending on the traffic mixture, e.g. the portion of motor cycles and bicycles. The implementation of a median has a very good traffic safety effect. Beside preventing head on collisions it can be used as an intermediate landing for pedestrians at crossings. At the construction of new roads or

reconstruction of existing ones should before the decision on the cross section, the need for separate bicycle lanes or paths as well as sidewalks or pedestrian paths be considered. At intersection approaches lane markings should be introduced in the form of painted lines and arrows showing the straight ahead and turning movements allowed from each lane. Pedestrian crossings and stop lines should be marked very distinctly.

5.6.7 **Traffic Signals**

The implementation of traffic signals is one of the most powerful single traffic safety improvements. A traffic signal program should be carried out for, in the first place, the intersections in the class 1 and 2 roads. Further traffic signals should be installed where the traffic flows or the complexity of the traffic movements make a STOP or GIVE WAY sign insufficient.

The reliability of the traffic signals is important. A traffic signal maintenance unit should be established within the relevant development authorities with the following main work tasks:-

a. To keep up a regular preventive maintenance program according to the life time of bulbs etc.

b. To man an alarm telephone where the police (or the public) can report when immediate actions are required.

c. To change the phasing of the signals when temporary or permanent changes of the traffic flows so require. If the phasing is not in accordance with the traffic flows, the risk for very dangerous red light driving increases considerably.

5.6.8 **Redesign of Intersections**

In connection with the implementation of traffic signals and road signs some redesign of the intersection is often needed. The traffic safety situation may call for actions of this kind also in other places. The most frequent measures are:-

a. Channelisation of intersections.

b. Introduction of roundabouts where the traffic distribution in the intersection makes it suitable.

c. Implementation of medians and islands where painted lines are not sufficient. At present Pakistani road users do not seem to react for lesser information than concrete blocks.

d. Implementation of curb stones and sidewalks to protect pedestrians and to limit encroachments.

e. Widening of the paved section in order to achieve a suitable width in relation to the traffic flows and traffic composition.

f. Especially for Islamabad, Redesign the left turn on red lanes at major intersections. The large radius permits high speed and causes a poor sight angle at the entrance to the next road. The lanes are also too wide which invites to careless driving, e.g. overtaking.

g. Redesign of bus stops and enforcement of a good behaviour of both bus drivers and passenger.

5.6.9 **Road Maintenance**

It is, also from a traffic safety point of view, important that the rods are kept in a good condition. Cases such as the following should be prevented:-

a. The road surface is in such a bad condition that the vehicles cannot keep a straight course. Especially dangerous is if bicycles and motorcycles have to make sudden movements into the carriageway because of damages at the edge of the pavement.

b. The road conditions prevent the road to fulfil its intended function. The road users avoid it.

c. The condition of the road surface does not allow the painting of road markings where needed.

5.6.10 **Pedestrian Facilities**

The best traffic safety improvement is of course to separate the pedestrians from the motor traffic completely. This, however, means pedestrian under and over passes which are expensive and not always possible to implement because of lack of space. Under and

overpasses should be reserved to avoid conflicts with large pedestrian and vehicle flows (also for capacity reasons) at places where it is possible to make sure that the pedestrians use them. The next best solution is to separate pedestrians and motor traffic in time, which is made by signalized intersections. At all construction of new roads appropriate pedestrian facilities should be included. For existing roads measures such as the following should be considered:-

a. Sidewalks where the present situation forces the pedestrians to use the carriageway.

b. Signed pedestrian crossings at intersections.

c. Signed pedestrian crossings where necessary between intersections.

d. Signalised pedestrian crossings where a conflict between large pedestrian and vehicle flows has to be resolved between intersections and a grade separation is not possible.

e. Signed or signalised pedestrian crossings at bus stops.

f. Physical barriers for pedestrians where they are not wanted from a traffic safety point of view.

5.6.11 **Bicycle Facilities**

Bicycles should be prohibited on the road class 1 and 2. Thus the bicycles, should only use the road classes 3 and 4 and their contacts with the road classes 1 and 2 should be limited to crossings at intersections. Where the class 3 and 4 network dos not provide suitable connections between sub areas separate bicycle/pedestrian paths should be implemented. The road surface of the bicycle paths should be at least of the same quality as of the roads, otherwise the cyclists will tend to use the roads instead.

5.6.12 **Motorcycles**

One problem for the present traffic safety situation is the large amount of motorcycles and their use. From a traffic safety point of view motorcycles must be mixed with the other motor traffic. The use of them (especially the number of riding persons) should, however, be heavily supervised. A national (or local) law/regulation on wearing helmets should be considered and enforced.

5.6.13 **Encroachments**

A special traffic safety problem is caused by the encroachments. They attract stopping vehicles and create pedestrian and vehicle movements across the carriageway. Encroachments attracted by bus stops also often cause crowded stops. Encroachments should be completely removed from the road classes 1 and 2 and preferably also from road class 3. Encroachments are, however, not only a traffic problem but also a social one. Many people earn their living there. They should however, never be allowed to be located in a way that they interfere with the moving traffic or force pedestrians out into the roadway.

5.6.14 **Bus Stops**

The traffic safety situation at bus stops is in many places very unsatisfactory. Buses are seen more or less racing at high speed to the stops where they are crowding in a disorderly manner. Passenger movements are not controlled. Even if a bus bay is provided the bay is used by the waiting passengers and the buses are stopping in the carriageway, disturbing the other traffic and causing traffic accident risks. At major stops, buses are staying for a long time to gather passengers.

5.6.15 **Speed Limits**

As a general guideline the following speed limits are recommended:-

a. Road class 1 70-90 km/hour [1)]

b. Road class 2 70 km/hour

c. Road class 3 50 km/hour

d. Road class 4 30 km/hour

e. Roads with signalised intersections 70 km/hour

It is to be noted that these limits are relevant only if the recommended traffic mixture and physical design are achieved. As accidents in connection with overtaking are both frequent and severe the speed limits should be very well supervised.

5.6.16 **Street Lighting**

Street lighting has proven to help prevent traffic accidents at night considerably. All roads should be provided with lighting, the better the higher speed allowed. A first priority should be lighting at all major intersections and pedestrian crossings.

5.6.17 **Silent Traffic**

It is a widespread habit among the drivers to use the horn (and headlights) instead of the brake pedal. This has negative effects:-

a. If the horn (or headlight) does not have the desired effect (to make other roads users yield) the risk for a severe accident is imminent.

b. Road users get so used to perpetual honking that the really dangerous situations are not distinguished in the general noise.

c. Road users become careless and ignore vehicle which are not honking (or twinkling).

These are some of the reasons for prohibiting the use of horns and headlights unless it is necessary in order to avoid an accident.

5.7 **Traffic Police Training**

The traffic policeman is a key person in the traffic safety improvement work. It is obvious that the Traffic Police today has neither the proper training nor the adequate resources for an appropriate traffic supervision and control. Knowledge and good working methods are two important prerequisites and incentives for and effective job.

5.8 **Traffic Supervision and Control**

Efficient and purposeful traffic supervision by the Traffic Police is a necessity in order to teach the road uses a good and responsible traffic behaviour. It is therefore important to obtain the opinion of the Traffic Police concerning proposed changes of the traffic environment and regulations. A regulation which is impossible to enforce will be violated, resulting in greater contempt for all regulations.

5.8.1 **Driver and Vehicle Control**

Periodical vehicle and driver control should be carried out. Because such a check up takes some time, checkpoints should be located off road. Preferably permanent control sites should be implemented at different locations in the road network even if they are used only occasionally.

5.8.2 **Traffic Supervision**

The most important task of the Traffic Police in the traffic safety improvement work is the daily supervision. The policemen should be moving in the traffic in an effort to appear omnipresent. The mere presence of a motorcycle policeman tends to improve traffic behaviour if it is known that he is competent and will intervene at any violation of the rules. Traffic supervision should take measures against hazardous behaviour such as speeding, dangerous overtaking, not respecting traffic signals, road signs and road markings, neglecting to use turning give signals, ruthless but operation at stops, jay walking and cycling, occasional encroachments at the road side etc. It is necessary that the policemen intervene at any observed violation of the rules to avoid giving road users the impression that dangerous behaviour is allowed.

5.8.3 **Accident recording**

The traffic Policemen should be responsible for the accident reporting from the field. Intensified motorcycle patrolling and a radio contact network would effectively contribute to a quicker response on the part of the Traffic Police at the scene of the accident.

5.8.4 **Traffic Signs and Road Markings**

The Traffic Police should cooperate closely in the planning and implementation of programs for these activities. A concentration strategy is recommended in which traffic signs are introduced along a certain corridor or in a certain area instead of being randomly introduced around the city. Then the Traffic Police can concentrate the supervision and enforcement activities to these areas and regular road users there will be forced to learn the meaning of the new signs by repeated and focused enforcement. Road users must be trained to respect the road signs and road markings if these should serve their purpose.

5.8.5 **Traffic Signals**

The implementation for traffic signals is one of the most powerful single traffic safety improvements. It is essential that the respect for them is enhanced which implies a tough supervision by the traffic police. In the long run, general compliance with traffic signals will mean that the Traffic Police will tie up fewer personnel with stationary traffic direction duty.

5.8.6 **Pedestrian and Cyclist Facilities**

Pedestrians and cyclists are two types of road users which are very difficult to control. They are, however, also the most vulnerable ones and a considerable portion for the traffic accident victims usually fall in this category. The use of new facilities (over and underpasses, signalised crossings, sidewalks, pedestrian and cycle paths, passenger areas at bus stops etc) to enhance their safety not only have to be carefully designed but also supervised and enforced.

5.8.7 **Bus Stops**

The chaotic situation at many bus stops demonstrates the need for supervision and control. Also, where physical conditions have been improved by providing bus bays, supervision is necessary in order to prevent buses from crowding into the lanes meant for the moving traffic, causing accidents risks. Furthermore the passengers must be prevented from using the bus bay as a waiting area. At bus stop design improvements, which are urgently needed in many places, an initial supervision is vital. The bus stop supervision also includes the preventing of buses from stopping at other places than the organized bus stops.

5.8.8 **Speed Control**

In connection with the implementation of speed limits and speed limit signs speed control and enforcement by the Traffic police is necessary. Speed control should also be a continuous traffic police activity.

5.8.9 **Traffic Police Equipment**

In order to provide efficient traffic supervision and rapid intervention upon traffic violations, the Traffic Police needs improved means of transportation, communication and speed measuring.:-

a. For traffic supervision the motorcycle is the most suitable vehicle. It is fast and flexible even in dense city traffic.

b. All motor cycles and other police vehicles should be radio equipped and connected to a radio central. Also policemen on foot should have this possibility in order to call on the motorcycle police or other reinforcements when needed.

c. The most dangerous types of accidents happen at overtaking at high speed. The introduction and control of (well signed) sped limits is urgently called for. Radar devices are nowadays being replaced by laser pistols which are very accurate, light and easy to handle and can be operated at longer distances.

5.9 **Education and Information**

The traffic safety improvement work should always include an educational and information component/program. The program should cover all road users, including pedestrians, with special attention given to young people and new motor vehicle drivers. The education and information component is a continuous activity. During the first years it should concentrate on the worst deficiencies and experiment with different methods to find the right approach to the work.

5.9.1 **Drivers**

Earlier experiences from traffic safety discussions in Pakistan has shown that:-

a. The tests for achieving a driver's licence as prescribed by law are both extensive and comprehensive.

b. The existing driving schools were stated to be of low quality (information from the Traffic Police).

c. The supply of the test officers is insufficient and due to the high number of applicants, test officers can spend less than ten minutes with each of them.

In order to improve the situation the following measures should be taken:-

a. The driving schools should be obliged to fulfil certain standards in accordance with the law (a minimum education program should be worked out). If not their pupils should not be accepted by the test officer.

b. No applicant should be accepted by a test officer without an approved pre-test at an authorised driving school.

c. A sufficient number of test officers should be available for a thorough examination of each applicant.

5.9.2 **School Children**

Good traffic knowledge and behaviour has to be founded at an early age. Children moving around on their own are among the most accident threatened groups. Children often take after their parents behaviour which is not always the best. An objective education is motivated. Therefore, Traffic Knowledge should be introduced in the school programs. Earlier experiences from such educational activities show that children are not traffic mature until the age of round 12 years. Younger children are, however, quite capable of learning basic traffic rules even if, being impulsive, they often fail in practice. Thus the education should have two level, one for smaller children and one for teenagers, the potential soon to be drives. Different education material (school books) should be produced for the two levels. Books for small children should concentrate on how to protect themselves against traffic accidents while the more advanced books should offer a preparation to becoming sensible and responsible road users. As small children have difficulties in imagining a situation from a description or a picture, the education should be given an extra touch of reality by the use of children size models or, even better, full scale traffic training facilities. To make the education interesting and to stress the seriousness of the subject it has shown to be a good idea to let staff form the Traffic Police appear as teachers. This kind of long term education has been undertaken in Sweden with good results and has contributed to the give Sweden a top position internationally in the struggle to improve traffic safety.

5.9.3 **Campaigns**

One way to spread information widely and quickly is to arrange information campaigns via different media press, radio, TV, exhibitions, street posters, household pamphlets, posters in buses, trains and public places etc. Individual campaigns should not give broad traffic safety information but concentrate on one subject such as safety belts, motorcycle helmets, children

in the traffic, pedestrian behaviour, ruthless driving or even simpler things such as the meaning of a specific road sign or traffic rule. A campaign should, though narrow in its message, be broad in the media context, which makes it a rather expensive activity. Campaigns of this type are well suited to be carried out on national level. For this and for other reasons it seems motivated that NTRC should be provided with a Traffic Safety Unit covering both highway safety and traffic safety in urban areas. The two have a lot in common, not least concerning education and information.

5.10 Safety Belts

It is a well documented fact that safety belts save many lives on the roads. This is a truth also for urban areas even if the speeds are lower.

5.11 Conclusion

Traffic safety work is not a technical exercise but requires the involvement and cooperation of many different organizations. It is not a one time effort, but one which must be carried out over years or decades.

CHAPTER 6

PUBLIC TRANSPORT MODEL FOR ISLAMABAD-RAWALPINDI

6.1 The public transport model has been proposed on the basis of research for twin cities of Rawalpindi and Islamabad. An effort has been made to propose a model keeping in view the existing infrastructure available, the capacity and capabilities of relevant departments and also taking into account the existing transport fleet which is already available at the disposal. Further, the reference has also been drawn from various transport options available worldwide to come up with the most suitable and the most economical model suitable for our environment.

6.2 For the purpose of study and to draw relevant conclusion for the proposed model of public transport for twin cities of Rawalpindi and Islamabad various types of public transport systems available world over have been studied and explained in succeeding paragraphs.

6.3 Types of Public Transport Systems Available World Over

Fol public transport systems are available world over:-

a. Light Rail Transit.
b. Rapid Rail Transit.
c. Bus only.
d. Bus-Wagon-Pickups.

6.3.1 Light Rail Transit System (LRT)

It refers to a wide range of electrically powered rail system. Example includes trams which operates on tracks and share the road way with other users. This is a very common system available in eastern and western Europe and being used successfully.

Figure 6.1 : LRT System

6.3.2 **Rapid Rail Transit System (RRT)**

The system is termed as Sub Way/ Under ground or Metro. It operates on exclusive rights-of-ways at high speeds and provides the highest transit capacity of about 60,000 passengers per hour in each direction. The system unusually require sophisticated signaling and control devices for maintaining high speeds and frequencies. This system is in practice in Japan, China, European Countries and USA.

6.3.3 **Bus only**. It refers to mechanical road based transport comprising of standard buses of medium and large sizes. Wide variety of buses are available according to requirement of comfort and design. This is one of the most common systems available in developing countries.

Figure 6:2 Bus only System

6.3.4 **Bus-Wagon-Pickups**. It also refers to mechanical road based transport comprising of variety of sizes. It is generally used in densely populated and ill planned cities of developing countries. It is available in Pakistan, India, Bangladesh and Thailand etc.

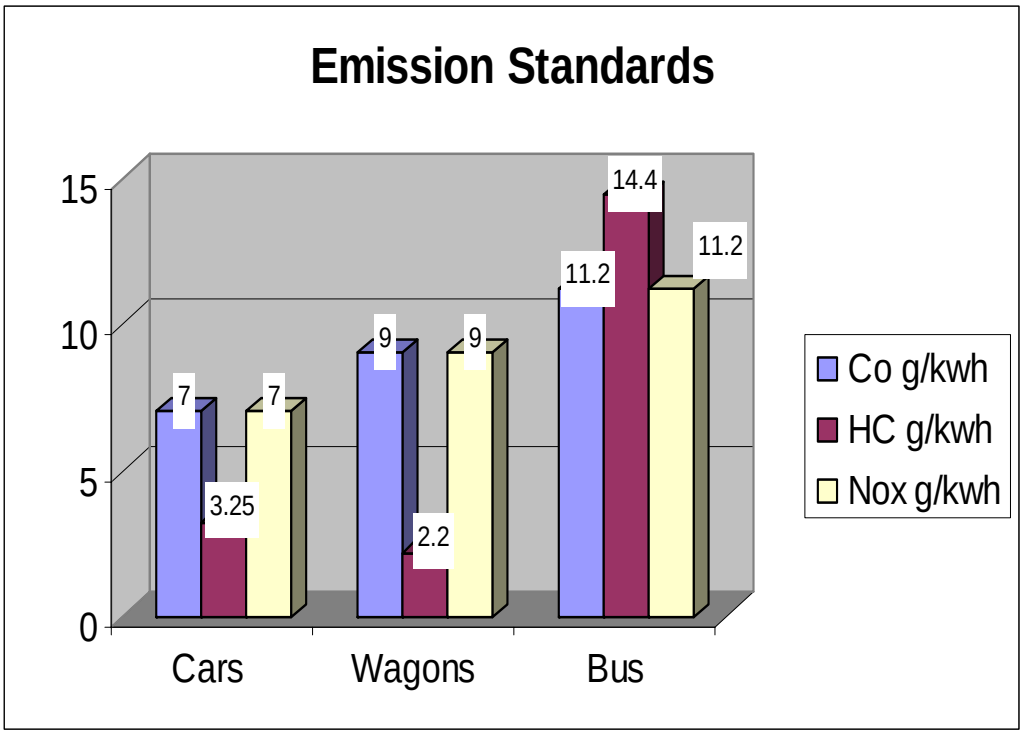
6.3.5 **Sample Survey**

a. Sample Survey on following locations were carried out to examine the traffic volume flow at peak hours that shows that Percentage of cars and motorcycles dominates the peak hrs traffic causing congestion and environmental pollution:-

Location	Time (AM)	Number*
Koh-e-Noor	7:00 - 8:00	24,000
AFIC	7:30 - 8:30	30,000
Committee Chowk	7:15-8:15	15,000
Shamsabad	7:15-8:15	37,000
Islamabad Highway	7:30 - 8:30	43,000

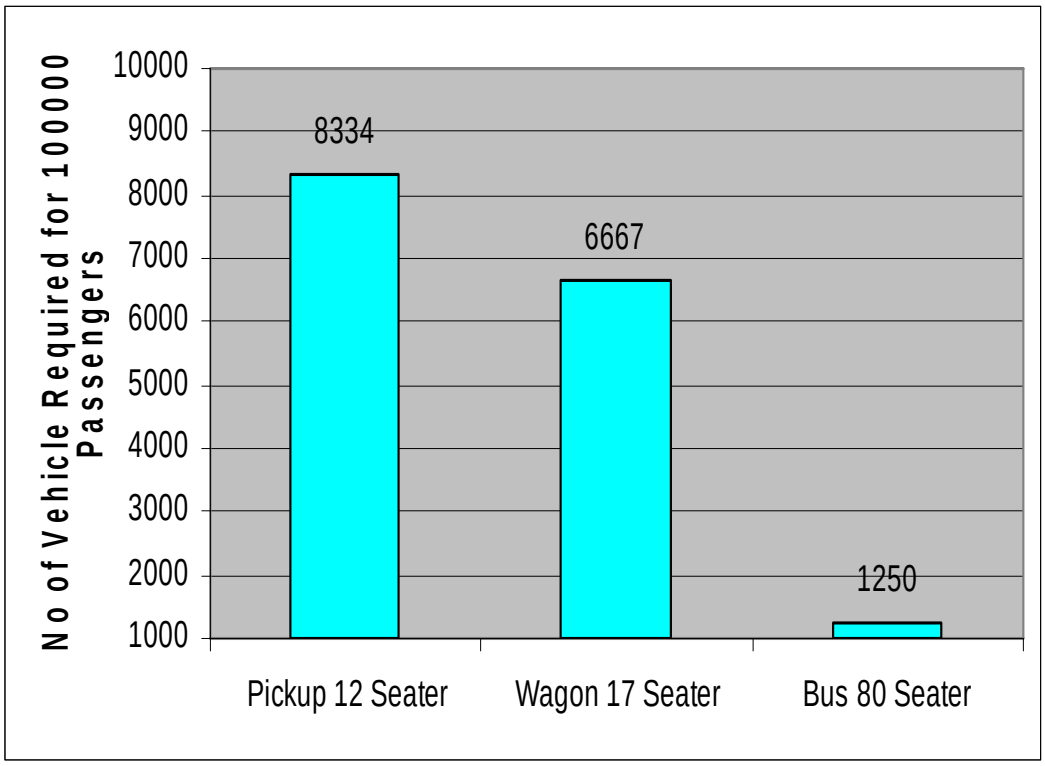
Table 6:1 Sample Survey

b. **Emission Standards**.



Graph 6:1 Emission Standards

c. **Passenger Volume vs Vehicle Capacity.** In terms of average vehicular composition, Buses and Mini-buses constituted about 4.6%, while cars (61%) and motor cycles (20.4%) constituted more than 81% of the total number of vehicles. It is this factor, which has created the congestion problem. The sample survey, suggests the need for proper public transport system preferably **bus system**. This aspect is shown graphically below where lesser number of buses carry same passenger volume as compared to Pickups and Wagons :-



Graph 6:2 Passenger Volume vs Vehicle Capacity

d. The comparison of different modes of public transport (car, pick ups and wagon) vs Bus system reveals that lesser number of buses are required to accommodate same number of individuals, thereby reducing the road congestion & emissions.

e. **Working out Shortfall of Buses for Future Demand**

Based on population growth rate for Twin cities the shortfall of equivalent buses for next 10 years is calculated as under:-

Year	Type						
	Mini Bus		Wagon		Suzuki		Total
	No	Equ. Buses	No	Equ. Buses	No	Equ. Buses	Equ.Buses
01	212	93	948	239	146	27	360
02	215	94	974	246	148	28	368
03	217	95	1062	268	149	28	391
04	237	104	1065	269	153	29	401
05	250	110	1075	271	160	30	411
10(E)	600	300	700	250	800	141	691

Table 6:2 No of Equivalent Buses by Mode in Islamabad

Year	Bus	Mini Bus		Wagon		Suzuki		Motor Cab		Motorcycle		
	No	No	Equ. Busses	No	Equ. Busses	No	Equ. Busses	No	Equ. Busses	No	Equ. Busses	
01	NIL	0	0	0	0	830	155	2683	238	40	1	395
02	106	149	65	133	34	776	145	3227	290	80	2	642
03	127	218	96	86	22	569	106	3677	326	2240	56	733
04	118	249	109	306	77	692	129	4600	405	2440	61	900
05	120	255	112	310	78	700	131	4645	408	2560	64	914
10(E)	47	139	61	240	60	578	159	6780	632	18000	450	1409

Table 6:3 No of Equivalent Buses by Mode in Rawalpindi

f. **Estimated Short fall of Buses**.

City	Population		1981-98 Avg. Annual Growth Rate	2010 Population	Equivalent Buses Required 2005	2015 Population	Equivalent Buses Required 2015
	1981	1998					
Isl	204,364	529,180	5.76	1,036,241	691	1095928	800
Rwp	794,834	1,409,768	3.43	2,113,031	1,409	2958243	1200
Total no of buses required							2000

Table 6:4 Estimated Short Fall of Buses

6.4 Evaluation of Available Systems

The above mentioned public transport systems have their own merits and demerits associated with each which need to be considered dispassionately before we select a system for twin cities of Rawalpindi and Islamabad. Following evaluation of each system will explain its adequacy for Pakistani environment, resources and infrastructure.

a. Light Rail Transit- (LRT)

(1) Dedicated infrastructure is required.
(2) Cost intensive.
(3) Bad experience-Failure of system in Karachi in early 1970s.
(4) High level of education for both operators and users.
(5) Higher training level.

b. Rapid Rail Transit System (RRT)

(1) Dedicated infrastructure is required.
(2) Sophisticated system requirement for safe operation, electronic controls and signaling.
(3) Cost intensive.
(4) Depends on special training/technology.
(5) Very high per km cost of a rapid line as under:-

At grade : 8-27 million US $ /km

Elevated : 23-60 million US $ /km

Underground : 100 million US $ /km

(6) Not flexible once implemented requires further land use to adopt any change.

c. **Bus Only System**.

(1) Cost effective and can be implemented using existing infrastructure.

(2) No special training required.

(3) Easily adoptable to existing land use and travel demand.

(4) Based on indigenous technology- a no of makes and types of buses are being produced in Pakistan i.e. Hino, Isuzu, Nissan etc.

(5) Large capacity can take 60 to 80 passengers at a time.

(6) More comfortable than Wagon and Suzuki Pickups.

(7) Operation and maintenance facilities are readily available.

(8) Environment friendly- can be operated on CNG.

(9) Good experience of Varan and GTS supports the system.

d. **Bus-Wagon-Pickups**

(1) The composition suits densely populated areas with restricted approaches and road networks.

(2) Suits available infrastructure.

(3) Operation and maintenance facilities are readily available.

(4) Environment friendly- can be operated on CNG.

(5) No special training required.

(6) Already in use in Twin Cities.

6.5 **Proposed Model**. Based on the above mentioned explanation and critical reviews of our shortcomings of public transport system as explained at previous chapter, the proposed model is based on a mix of Bus-Wagon-Pickup strategy which is given in succeeding paragraphs:-

a. **Bus Only System for Next 5 Years**

	No	Cost	Total (Rs) billion
Buses requirement based on population growth	2000	5000000	10
Pay (Operational staff incl bus management staff, maintenance persons, drivers and conductors)	14000	-	0.2
Bus stands /terminals	15		1.5
Bus stop	200		0.1
Total estimated cost			11.8

Table 6:5 Bus only System for Next 5 Years

b. **Plan of Induction/ Phase out**. The plan has been made for next 5 years as following:-

Year	Bus	Wagon	Pickup
Present (route permits)	82	553	616
1	500	500	600
2	900	500	500
3	1400	500	400
4	1800	500	300
5	2000	500	300

Table 6:6 Induction/ Phase out Plan Next 5 Years

c. **Suggested Major Routes**

Route	From / To	Remarks
I	Rawat - Faisal Mosque	Through Islamabad Highway, Bahria town, Faizabad, Zero point and Blue area
II	Rawat - Tarnol	Kacheri chowk, Mall road, Sadar and Peshawar road
III	Saddar - Faisal Mosque	Murree road, Marir Hassan Chowk, Committee Chowk, Faizabad, Aab Para, Super Market, Jinnah Super
IV	Kohinoor Mills – Faizabad	I J principal road, Pirwadhai, Pandora Stadium Road
V	Tarnol to Bharakahu	Kashmir Highway, Golra Mor, Pehawar Mor, Convention Hall,

Table 6:7 Major Routes

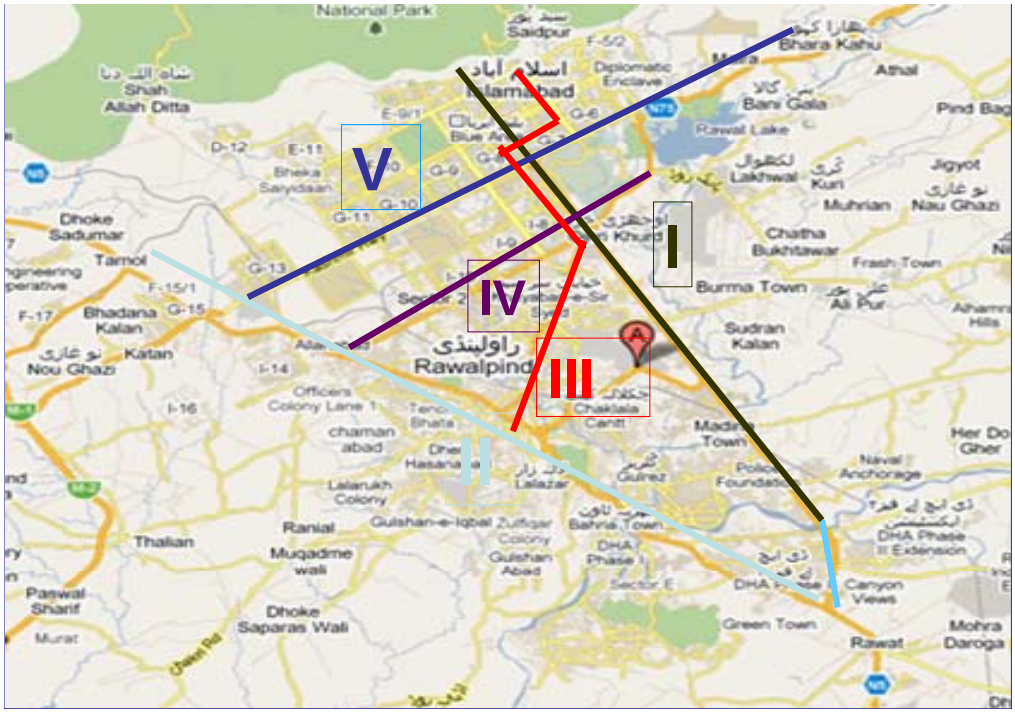


Figure 6:3 Major Routes Bus only System for Next 5 Years

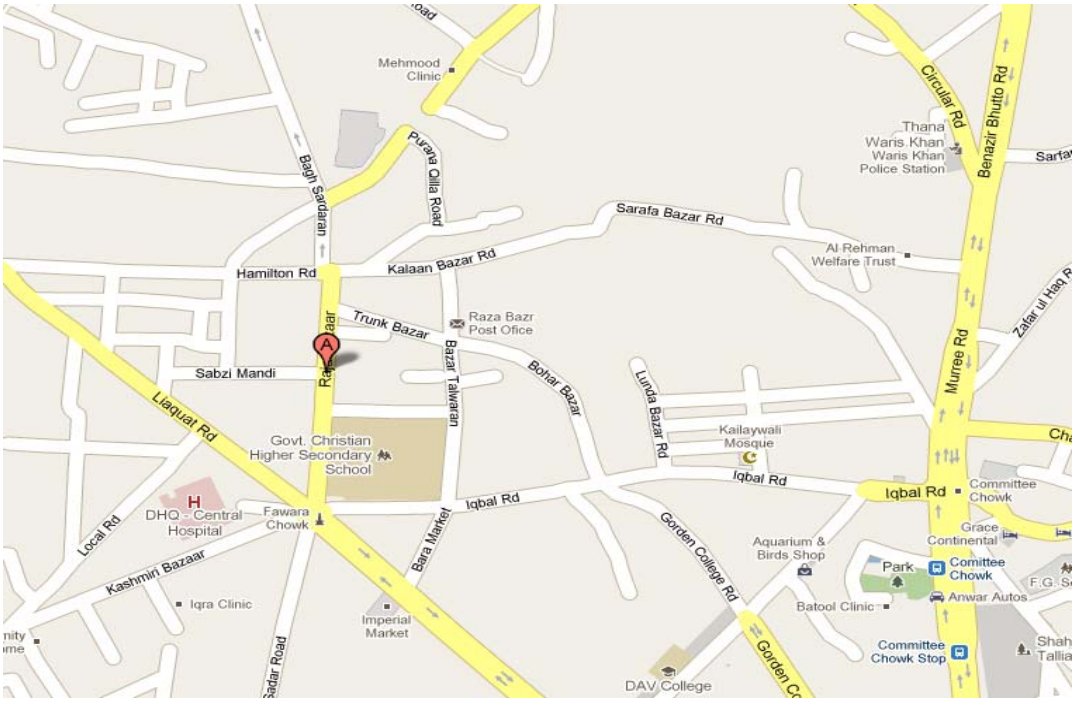


Fig 6:4 Minor Routes Bus, Wagon, Pickups for Next 5 Years

6.6 **Conclusion**

It seems clear that public transport will be a necessity for the majority of people in the future. It is not evident what the “best” solution is, but is not basically a matter of technology further studies should go deeper into the organization and financial mattes. The main issue is the balance between public and private involvement.

CHAPTER 7

IMMEDIATE – SHORT TERM TRAFFIC MANAGEMENT ACTIONS FOR IMPROVING EXISTING ROAD NETWORK AND TRAFFIC SITUATION IN ISLAMABAD - RAWALPINDI

7.1 Introduction

The immediate traffic management work in general area Islamabad-Rawalpindi has been focused on:-

a. Traffic Systems Management (TSM), measures to make minor changes of the road network structure and its use.

b. Immediate traffic management, measures at different points in the road network road links, intersections, traffic regulations, improvement of traffic signs etc.

7.2 Objectives and Scope of Work

7.2.1 The objectives and scope of the immediate and a few short-term management actions are as follows:-

a. Review the road and street network and the traffic situation, in order to identify the most significant and important types of problems.

b. Establish co-operation with the authorities concerned, in order to:

(1) Obtain a mutual exchange of knowledge.

(2) Identify and analyse main problems.

(3) Discuss possible solutions.

(4) Devise ways for a rapid implementation.

(5) Jointly develop principles for the continued work of traffic management.

c. Initiate planning processes together with the authorities concerned, which will continue even after the general area Islamabad-Rawalpindi project is completed.

d. Develop standards for design, implementation and maintenance of the road network.

e. Develop proposals for immediate actions at specific locations aiming at:-

(1) Solving typical and frequent problem types.

(2) Obtaining maximum benefit by the use of low-cost measures.

(3) Make recommendations which can from the basis for future planning.

7.2.2 **Areas Selected for Immediate Management Actions**

Following areas have been selected to focus on immediate management actins which will not only improve the traffic situation but will also reduce accident risks:-

a. Road Network Improvement.

b. General Public Behavior.

c. Vehicle Fleet up gradation and maintenance.

d. Organizational Aspects.

7.2.3 **Road Network Improvement**

Following actions are recommended to be taken immediately for road network improvement:-

a. Proper maintenance of roads be carried out as soon as possible.

b. Construction work already in process to be expedited.

c. Improvement of road marking. This may done immediately.

d. Congestions to be overcome by proper traffic management.

e. Improvement in traffic signs and signals.

f. Provision of foot paths for pedestrians and separate lanes for bicycles and motor cycles.

g. Improvement of bus stops and bus stations.

h. Removal of encroachments.

7.2.4 **Improvement of Behaviors of General Public or Road Users**. Followings steps are recommended on priority basis:-

a. Education program for general public through media be started.

b. Special education of drivers be undertaken.

c. Improvement of road side facilities.

d. Proper guidance through traffic signs and road markings.

e. Effective law enforcement.

7.2.5 **Vehicle Fleet Upgradation and Management**. Following is suggested in this regard:-

a. Induction of new vehicles to remove very old vehicles from the roads.

b. Proper maintenance and tuning of vehicles.

c. Over loading to be discouraged through traffic police.

d. Gradual weeding out of Suzuki Pickups.

7.2.6 **Organizational Aspects**. Organizational measures may be adopted at priority:-

a. Frequent interaction and co-operation among all concerned authorities.

b. Viable planning based on sound long term policies.

7.3 Traffic Accidents

There is no existing procedure of collecting traffic accident information for the purpose of analysis and accident prevention. Nevertheless, the police files contain important information on the accidents, at least for the fatal ones. It is believed that the majority of the fatal accidents are registered by the police. For non-fatal accidents, the share of the accidents

which is reported to the police is not known, but based on relationships from other countries; it is likely that only a minor part comes to the knowledge of the police. The traffic safety situation is highly severe in the entire Islamabad / Rawalpindi area. All the measures as suggested in the chapter pertaining to traffic safety in this research should be immediately implemented.

7.3.1 **Congestion**

No special and systematic data collection has been carried out in the past. In Islamabad, congestion is only a minor problem. In Rawalpindi / Cantonment, congestion is more of a rule than the exception, even at intersections where the traffic load is moderate. Most of the problems of congestion are caused not by the lack of road space but by the improper use of it. The major part of the problems can be at least considerably reduced by traffic management actions as discussed earlier.

7.3.2 **Driver's Behaviour**

Improper driver's behaviour is one of the single most important factor for accidents on roads. There is an urgent need for education of drivers and very strict law enforcement by traffic police. Mostly these are public transport drivers which are ill disciplined. The common practice is to stop anywhere to drop and pick up passengers, even in the very middle of an intersection. Even where bus bays exist drivers tend to stop in the street, intentionally blocking their competitors. This behaviour causes both accidents and congestions.

Accidents occur when the public transport vehicle stop everywhere and there is no proper area neither for the waiting passengers nor for the passengers leaving the bus (often in the middle of the road). The lack of proper locations for the bus-stops also causes undesirable and dangerous choice of walkways by the passengers walking to and from the bus.

The practice of stopping anywhere causes accidents between public transport vehicles and other vehicles, and other vehicles in-between. This is because one never knows when a public transport vehicle intends to stop, and the unexpected halt causes dangerous overtaking. The only solution is use of effective traffic police and law enforcement.

7.3.3 **Encroachments**

Encroachments are basically illegal use of the road space, and come under the category of behaviour of the road users.

In Islamabad, encroachments are a problem only to a small extent. Only a few places, such as the bus stop west of G-9 Markaz and the bus stop east of Aabpara, suffer from this problem.

In Rawalpindi, encroachments are almost the standard feature near all important bus stops and intersections, causing serious problems.

In Cantonment, the problem of encroachments is somewhat less than in Rawalpindi city area. However, at some locations encroachments are the major reason for congestion. All such encroachments must be immediately removal using police as they are both illegal and dangerous.

7.3.4 **The Approach to Immediate Traffic Management Actions**

The study aims to pinpoint the immediate problems in order to find immediate solutions:-

a. In Islamabad / Rawalpindi, two cars can be enough to make a congestion. Three cars can create a minor chaos.

b. When fifty parents come to a school to pick up their children, the entire neighbourhood gets stuck.

c. At intersections where the road markings indicate lining up in two lanes, the often seen behaviour is four to five files.

d. The public transport vehicles stop in the middle of intersections to drop passengers, and for their right-of-way against red light.

e. Even streets 39m (130 feet) wide are completely congested, due to encroachments, total lack of borderlines between the different activities, and a driver behaviour which tends to maximise the conflicts.

The basic philosophy of the approach to the problems can be illustrated by the figure below:-

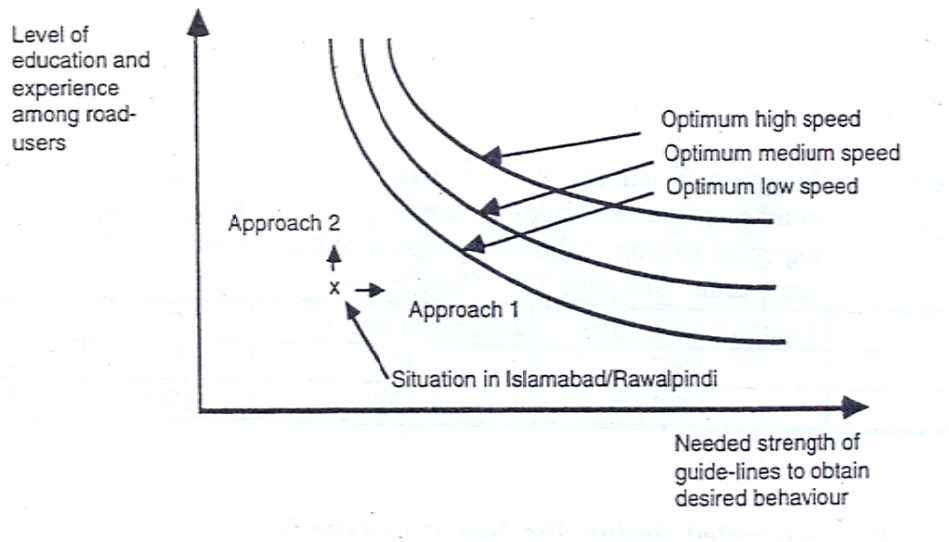


Figure 7:1 Traffic maturity and strength of guide-lines

There is a relationship between the level of traffic maturity of the road users and the strength of the guidelines necessary to give them through the design of the road and intersections. Traffic maturity includes education and experience but also a general acceptance of equality and responsibility among the various actors in the traffic. The guidelines should indicate what actually the correct behaviour is, and which activities are intended to take place where in the cross-section of the road. The lower is level of ability to apprehend the traffic situation and interact with other road-users, the stronger and more distinct guidelines are needed to obtain a response which presents accidents and gives good capacity utilization.

If the level of education / experience is high, the roads and intersections can be given a wider design, giving flexibility for different groups of road users to use the same area, thus increasing the freedom of activity and the capacity. In Islamabad and Rawalpindi there is no harmony between the levels of education / experience and the strength of the guidelines given by the road design. The road network especially the intersections, are far from giving the necessary guidelines to the road users.

In order to improve the traffic situation in Islamabad and Rawalpindi, two different approaches can be made:-

a. Strengthen the guidelines given to the road-users, to a level that matches the existing level of education/experience, by use of traffic management measures.

b. Increase the level of education / experience. This, however, is a more long-term approach.

In a long-term perspective, the most effective approach is a combination of 1 and 2, and the use of both methods is strongly recommended. Based on this philosophy, the present study provides immediate and short-term traffic management actions that have been concentrated on the redesign of the roads, streets and intersections, in such a way that the guidelines given are harmonised with the general behaviour, given by the existing level of education/experience. Another important principle is to make more efficient use of the existing road network, by removing encroachments and bottlenecks and helping the drivers to make the choice of route that gives the best total capacity in the road network. The recommendations can be divided into three main groups:-

a. Recommendations on general regulations and design standards.

b. Start planning processes at the authorities concerned.

c. Immediate traffic management actions at specific problem points.

7.4 **Identification of Problem Points**

The problem points for which recommendations for traffic management actions have been produced, have been identified in close co-operation with the authorities in Islamabad, Rawalpindi and the Cantonment. The problem spots have been selected according to the following principles:-

a. The problem point should be typical and representative for frequent problem types, which makes the recommendations applicable at many places in the road network.

b. The problem types chosen are accidents, congesting, encroachments and environmental problems.

c. The recommendations should be intersecting from a demonstration point of view and be good basis for discussion of principles.

d. The problem point should preferably include public transport, so that many road users can get benefit of the improvement.

e. It should be possible to obtain substantial improvements with low cost measures.

f. The improvement of the problem point should be agreed to have high priority by the authorities concerned, to ensure the implementation of the improvement.

7.4.1 **Over View of Immediate Traffic Management Actions**

The map below gives an overview over the problem points for which recommendations on immediate traffic management actions have been prepared. In the following paragraphs are given brief presentations of four representative immediate traffic management actins, one T-junction, one four-way junction, one roundabout and one road link.

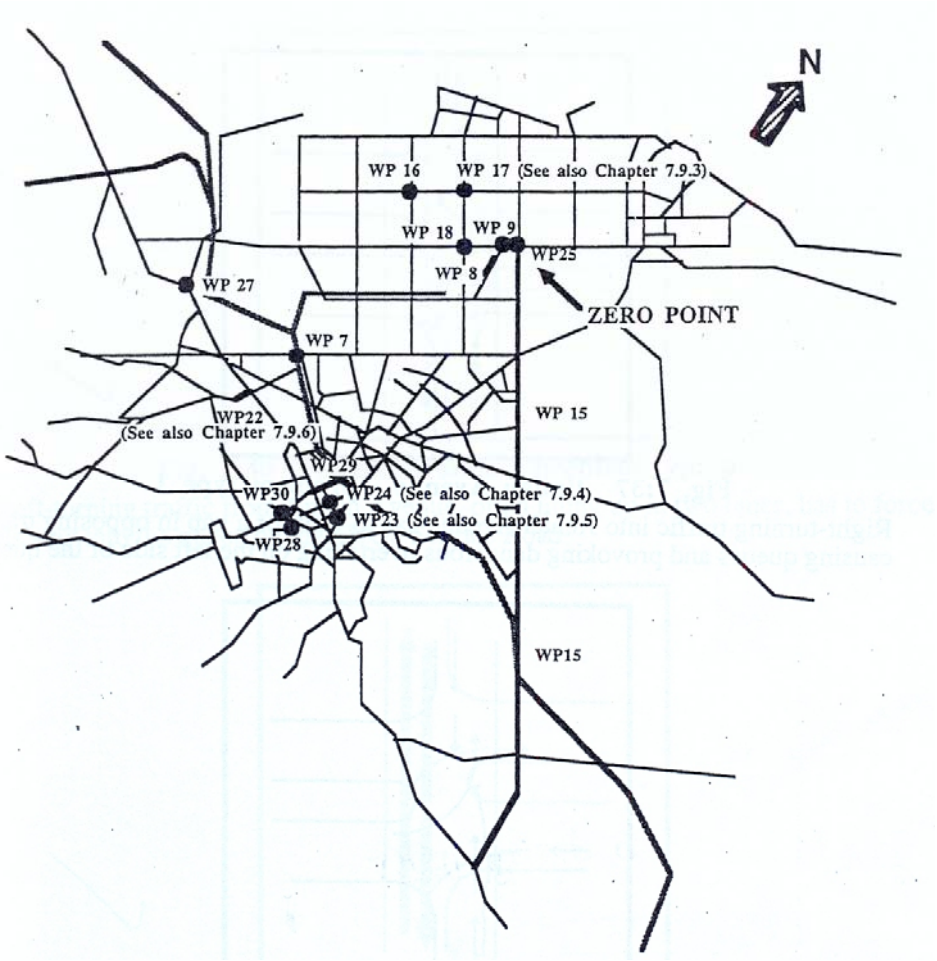


Figure 7:2 Key map for proposed traffic management actions

7.4.2 **<u>The Intersection Jinnah Venue/F8/G8 Service Road West</u>**

7.4.3 **<u>The Problems</u>**

The problem point is located at he present western end of Jinnah Avenue. The problems include both delays and queues, as well as considerable accident risks. This is due to the design of the intersection, which cannot handle the traffic volumes, especially at peak hours. The problems can be summarized as follows:-

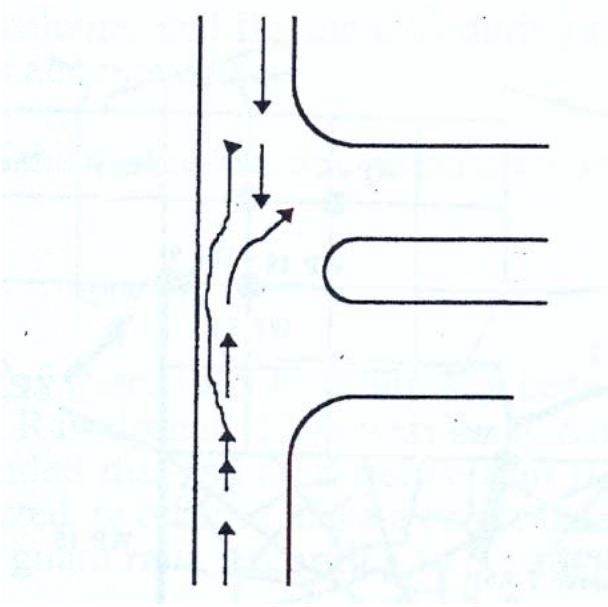


Figure 7:3 Jinnah Venue – Problem type 1

Right turning traffic into Jinnah Avenue has to wait for a gap in opposing traffic causing ques and provoking dangerous overtaking on the left side of the queue.

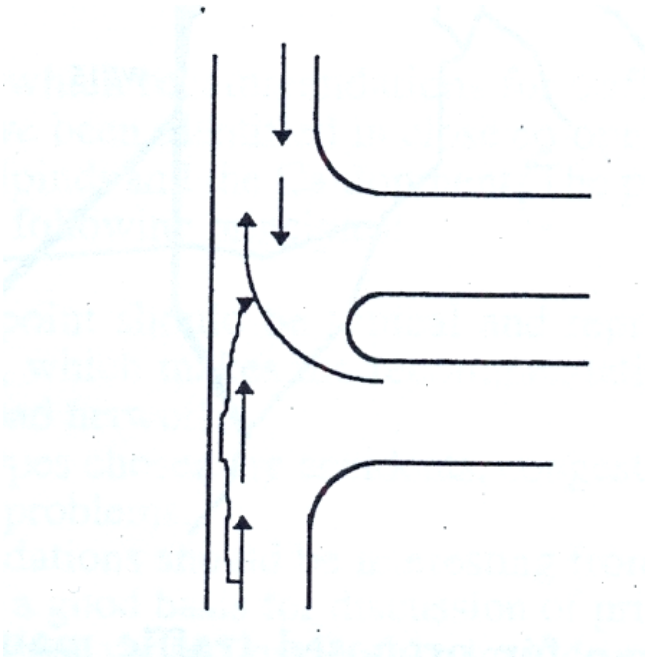


Figure 7:4 Jinnah Venue – Problem type 2

Right turning traffic from Jinnah Avenue risks accidents with straight on going traffic F8/G8 Service Road, which is overtaking on left side of the queue waiting to turn right into Jinnah Avenue.

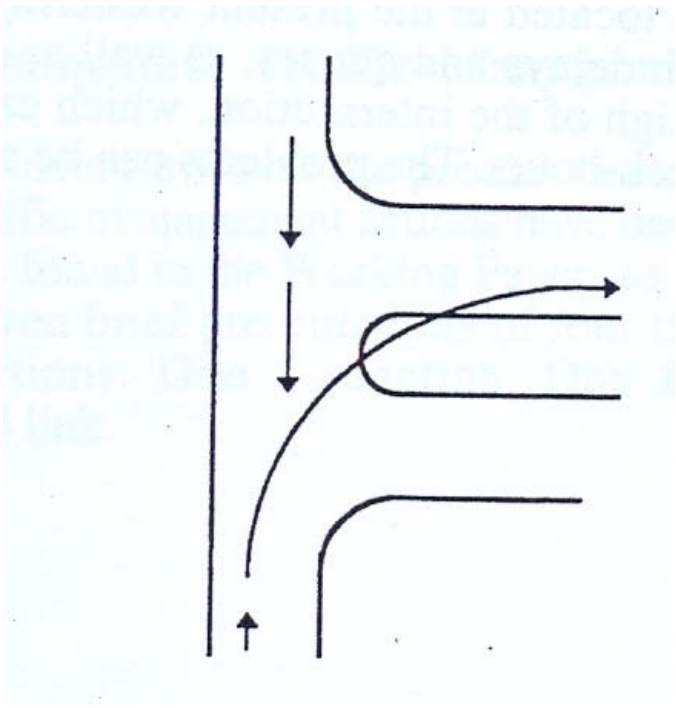


Figure 7:5 Jinnah Venue – Problem type 3

Right turning traffic into Jinnah Avenue often uses the central reserve on Jinnah Avenue in order to cross before the opposing traffic.

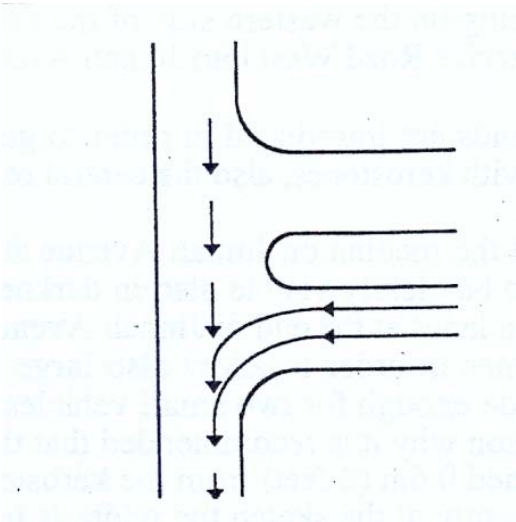


Figure 7:6 Jinnah Venue – Problem type 4

Left turning traffic from Jinnah Avenue, often lining up in two lanes, has to force its way into the queue on the F8/G8 Service Road.

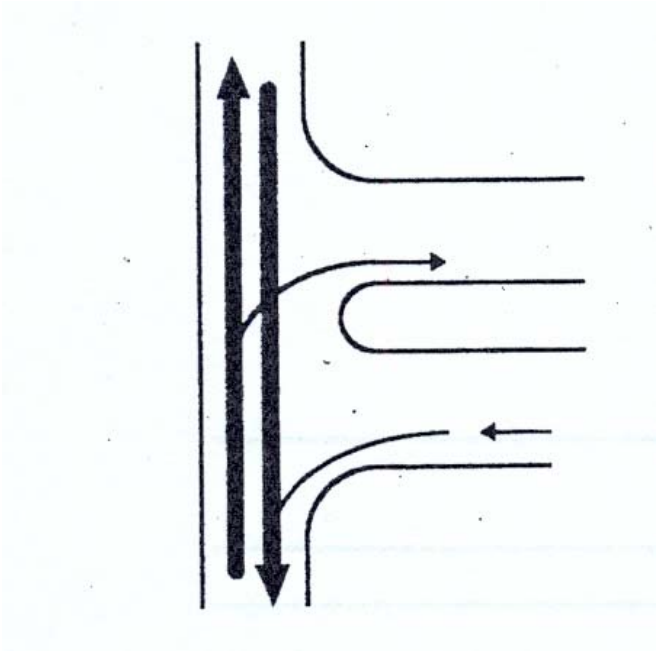


Figure 7:7 Jinnah Venue – Problem type 5

High speed on the G8/F8 Service Road increases the difficulties and risk of accidents both for the right turning into and from Jinnah Avenue and for the left turning from Jinnah Avenue.

7.4.4 **Recommended Immediate Actions**

To solve the problems of queues and accident risks at the intersection between Jinnah venue and F8/G8 Service Road West, the intersection has to be redesigned. To ensure the correct driver behavior and reduce the conflicts, the new solution must give well defined lanes.

The two sketches below show the existing situation and the recommended immediate action. The improvement is based on a low cost redesign, with a minor widening of the road, and using road markings, cat's eyes and kerbstone. The recommended immediate action is meant to be built as first stage of the future intersection, when Jinnah Avenue is extended westwards. By the widening of the Service Road south of the intersection, a separate left turn lane form Jinnah Avenue is obtained on the link down to the G8 Service Road North. By widening on the western side of the Service road a separate right turn lane from G8 Service Road West into Jinnah Avenue is obtained. Three divisional islands are introduced in order to guide the drivers. All islands should be provided with kerbstones, also the central reserve on

Jinnah Avenue. All three islands and the median on Jinnah Avenue should be bordered by small cat's eyes in order to be clearly visible also in darkness.

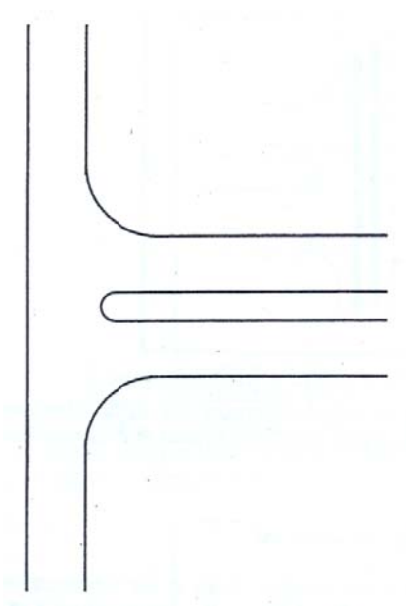


Figure 7:8 Intersection Jinnah Avenue//F/G8 Service Road West - Present situation

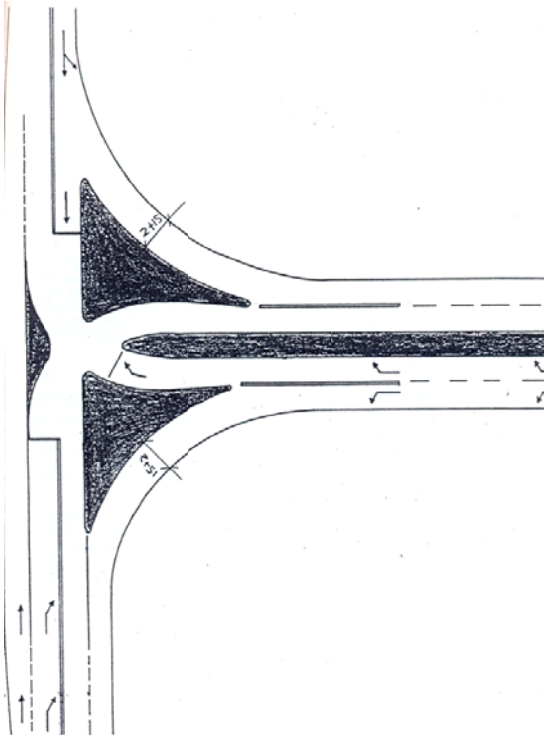


Figure 7:9 Intersection Jinnah Avenue//F/G8 Service Road West

Recommended Improvement

7.4.5 **The Intersection Murree Road / Adamjee Road**

7.4.6 **The Problem**

In co-operation with Cantonment Board and the traffic police, the intersection Murree Road / Adamjee Road in Rawalpindi Cantonment has been selected as a problem point where measures should be taken immediately. The intersection suffers from congestion almost all thorough the day but especially in peak hours morning and afternoon. Beside the large traffic flows, the congestion is due to the drivers, often forcing their way in the opposing lane. Furthermore, the pedestrian facilities are very poor at intersection. On Adamjee Road, west of the intersection, Suzukis increase the problems by standing close to the road of the intersection, Suzukis increase the problems by standing close to the road and to the intersection in the opposing direction.

7.4.7 **Recommended Immediate Actions**

The intersection should be redesigned by use of low-cost measures, in order to improve the circulation. The most important measure would be to introduce central barriers to prevent the traffic to use the opposing lanes. The road markings should be improved to ensure that the vehicles line up orderly in straight lanes in front of the intersection, and that they stop at the stop line. To obtain the intended behavior, it is recommended to strengthen the road marking by use of cat’s eyes of the large and elevated type.

The pedestrian facilities should be improved to ensure the correct pedestrian behavior at the intersection. The Suzuki stand could be kept, but the Suzukis must line up in direction west, opposite of today. This will give a smooth flow into the stand, and no U-turns have to be made going out from the stand. To increase the capacity of the intersection, it is recommended to widen the western approach of Adamjee Road from 2 to 3 lanes. The recommended solution is shown by the sketches below:-

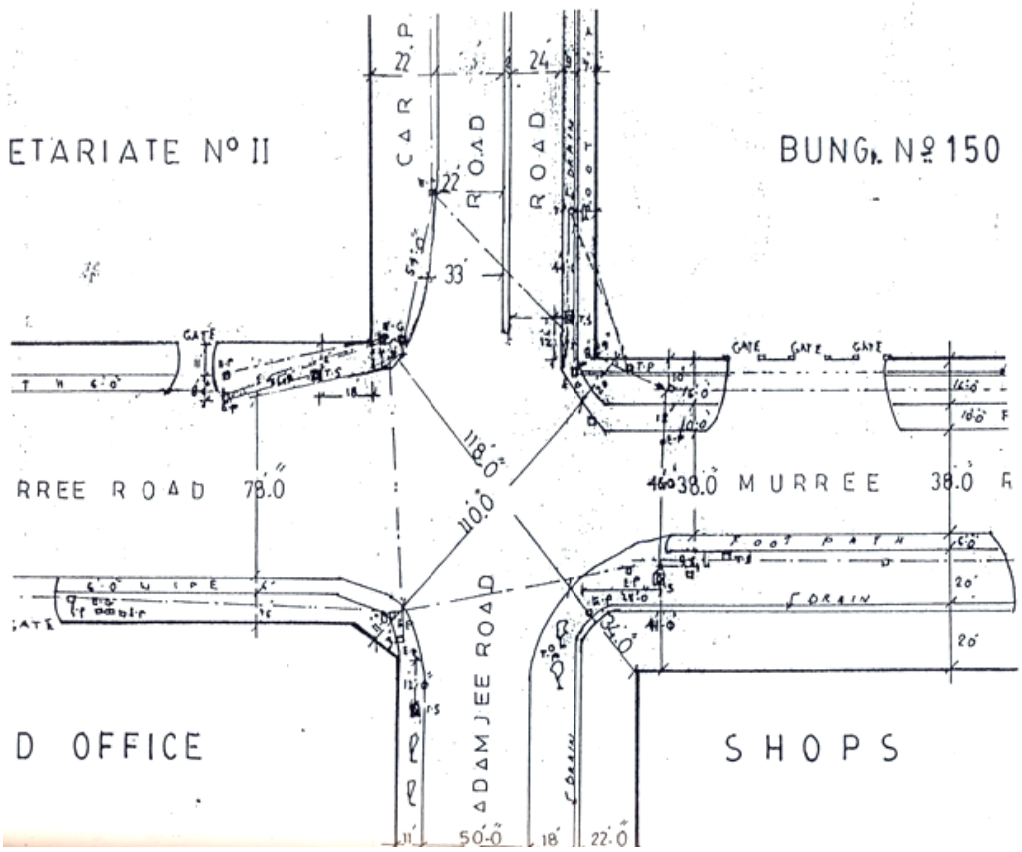


Figure 7:10 Intersection Murree Road/Adamjee Road -Present Situation

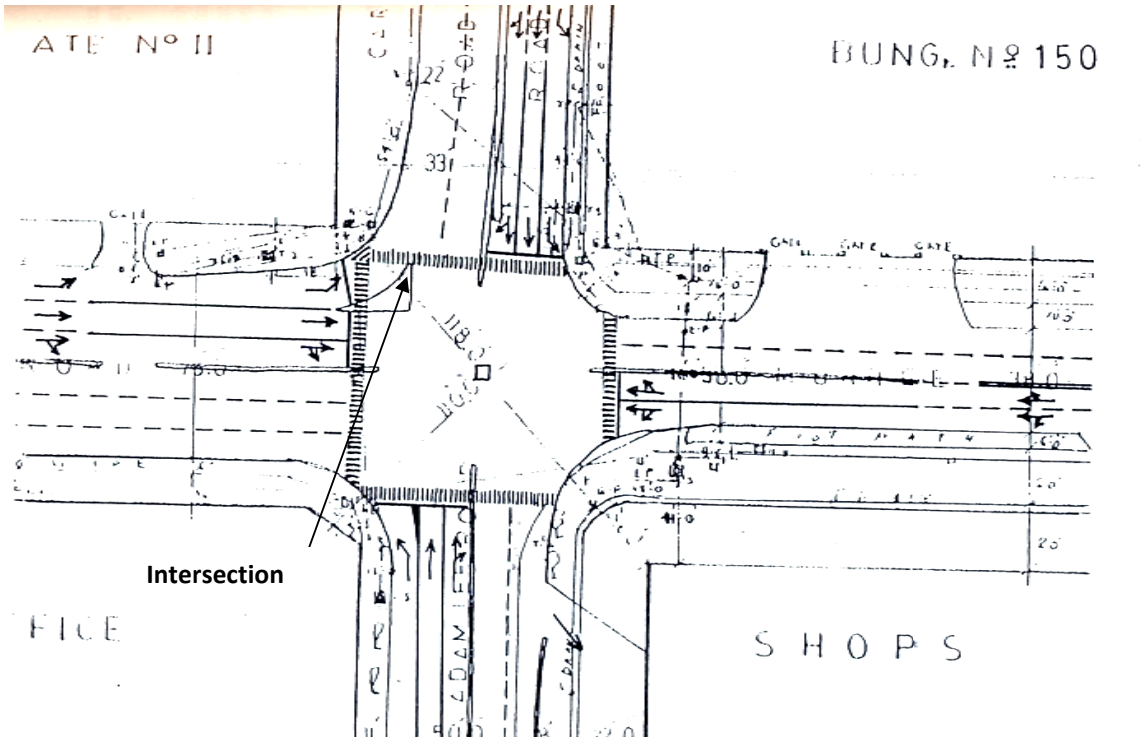


Figure 7:11 Intersection Murree Road/Adamjee Recommended Redesign

7.4.8 The Intersection Sarwar Road / Adamjee Road / Sir Syed Road

7.4.9 The Problems

Most of the day, the intersection is well-functioning, with only minor problems. However, the intersection is too wide and large, with poorly defined lanes and a general lack of pedestrian facilities. Such an intersection design reduces the capacity and increases the accident risks, compared to more will-defined intersection. Furthermore, located close to F G Sir Syed Girls School, the intersection faces special problems at the beginning and end of the school day, when parents come in their cars to bring or pick up their children.

7.5 Recommended Immediate Actions

Today's design of the intersection is almost a roundabout, although it does not function as a roundabout where the traffic in the intersection has the right of way before the traffic going into it. Given the traffic pattern in the intersection, with four legs almost equal in traffic volume, a reconstruction into a complete roundabout seems to be the best solution. Additionally, the pedestrian facilities at the intersection should be improved especially

considering the large number of school children. It is also important to provide a sufficient number of parking/stopping places close to the school, in order to avoid parents' cars to block the road.

7.5.1 **Islamabad**

A few other easy and short term measures are as follow:-

a. **G9 Markaz, West End, Bus Stop Direction North**

Problem. Congestion, misbehavior by the bus-drivers, pedestrian accidents.

Solution. Long divider, located so that the trees come in the middle. Bus bay inside the divider. Sidewalk along west side of bys bay. Difference in level to create a borderline for congestion. Pedestrian fence on existing divider and on suggested bus bay divider. Openings and zebra crossings, located as continuations of pedestrian streets going into the residential area on west side of Markaz road.

b. **Bus stop Aabpara, Municipal Road**

Problem. Congestion, misbehavior by the bus-drivers, pedestrian accidents.

Solution. Widening of the footpath at the intersection with the road along the north side of Aappara Marked, creating a distinct start of a long bus bay. Improved pedestrian fence on existing divider, fewer but improved pedestrian crossings.

c. **Intersection G8 Service Road west and G8 Markaz Road**

Problem. Traffic accidents, due to an unclear right of way situation and, coming from G8 Markaz, difficult to see G8 Service Road west.

Solution. Give way sings at G8 Service Road west, giving Markaz Road right of way (it is dualised). Improve footpath and zebra crossings.

d. **Carpeting G-11 Markaz Road**

Problem. Khyaban-e-Sir Syed is encroached and congested at several points. Traffic diversion is desired. G-11 Markaz Road could divert some of the traffic to Islamabad, ut is not carpeted, thus attracting only a small traffic flow.

Solution. Carpeting.

e. **Bus stops at Shahrah-i-Islamabad**

Problem. Buses stopping, no bus bays, delay for other traffic, accidents.

Solution. Bus bays at the places where buses use to stop be designed with divider.

f. **Footpath along Old Said Pur Road**

Problem. Many pedestrians to the different schools. No footpath.

Solution. Implement a footpath, probably at east side of Old Said Pur Road.

g. **Blue Area Service Road South**

Problem. Half finished for long time. The plan is a dualised road, one-way driving on both sides, parking in the middle.

Solution. A solution with no parking at the divider would have been better, eliminating the drivers/pedestrians crossing of the road.

h. **Dhokri Chowk at Murree Road**

Problem. Large open intersection, too high speed.

Solution. Canalization.

i. **Rawal Dam Chowk**

Problem. Very confusing intersection. At side roads: Frequent driving in opposing direction and on the wrong side of an island.

Solution. Redesign the intersection. Large roundabout?

j. **Shahrah-i-Islamabad / H8 Service Road South**

Problem. Extremely dangerous four-way junction, due to high speed at Shahrah-i-Islamabad.

Solution. Close the opening in the median of Shahrah-i-Islamabad and implement U-turn possibilities with separate U-turn lane.

k. **Bus stop PIMS (Pakistan Institute of Medical Sciences) entrance north**

Problem. Existing bus bys wrongly located, and not used.

Solution. New bus bays closer to the PIMS entrance, pedestrian fence on existing divider, zebra crossing.

l. **Intersection Khyaban-i-Suhrawady / link to Shahrah-i-Kashmir at Aabpara**

Problem. Conflict between traffic from the link from Shahrah-i-Kashmir turning right into Khyaban-i-Suhrawardy direction east and traffic going straight north-south through the intersection.

Solution. Central divider at link to Shahah-i-Kashmir.

7.5.2 **Cantonment**

a. **GT Road / Mall Road**

The entire length of GT Road / Mall Road should be improved. Some sections of the road are encroached, and there are a number of accident points along the road.

b. **Improvement**

(1) Installation of concrete blocks or guard rails between the edge of the carriageway and all the activities taking place at the sides of the road, clearly defining the carriageway for the moving motorized traffic.
(2) Many intersections should be channeled.
(3) Bus bays.
(4) Bus stands behind a guard rail.

c. **The Saddar Bazar**

Problems. Congestions, encroachments, accidents, no pedestrian facilities.

Principles of improvement

(1) Traffic system management.

(2) Traffic management actions.

(3) Possible to adapt solution principles from Misrial Road: Three different levels for the three main activities on the road. Cross-section and width of the carriageway may vary according to type of road.

(4) Remove all encroachments, hawkers through police effort.

(5) Construct footpaths for pedestrians.

(6) Create parking places.

CHAPTER 8

RECOMMENDATIONS

8.1 Based on the search analysis of existing system and proposed model for improvement of public transport system for twin cities of Rawalpindi and Islamabad a number of recommendations have been made for implementation by relevant departments at various levels. These recommendations take care of policy matters, aspects of Traffic planning, road network improvement, operation and operational environment and traffic safety issues. If seriously considered and implemented, these recommendations are likely to bring changes for overall improvement of public transport sector of the country with a particular focus on Rawalpindi and Islamabad. Comprehensive recommendations are given in succeeding paragraphs.

8.2 Policy Framework

a. A comprehensive and well thought-out policy for establishment of Urban Public Transport System and facilities be formulated at the National level under Ministry of Communication.

b. Based on the National Urban Public Transport policy, the provincial Government to formulate their own policies for respective provinces. For twin cities of Rawalpindi and Islamabad (since they are interdependent a common policy be formulated at Federal Government level).

c. Availability of basic statistics for transport sector is of vital importance. All essential data be collected with the help of Bureau of Statistics or relevant department for various cities and for Islamabad and Rawalpindi.

d. There is an urgent requirement of conducting fresh and comprehensive passenger survey to calculate the exact travel demand. This will help formulate realistic policy.

e. Transport management should be an integral part of overall transport policy and it must not be left to private sector alone. For Islamabad and Rawalpindi, the overall traffic management to be handled under the umbrella of CDA and RDA.

f. Specific allocation should be made for public transport management projects with a special emphasis on educating general public and law enforcement.

8.3 **Traffic Planning**

a. Urban transport wing at NTRC to be further organized and strengthened with the objective of rendering analytical and consultation services to city governments and private sector running the public transport.

b. Planning capabilities of CDA and RDA also need augmentation in terms of qualified staff, required resources and funds.

c. Responsibility for public transport planning and monitoring be transferred to CDA and RDA for twin cities of Islamabad and Rawalpindi.

8.4 **Public Transport Model**.

a. Predominantly "**Buses Dominated**" public transport model with a mix of Wagons and gradual phasing out of Suzuki Pickup has been formulated and recommended for adoption in twin cities of Islamabad and Rawalpindi. This model is based on 5 years requirement up to year 2015.

b. Being cost effective (as compared to Rapid Rail Transit System) and implementable with the help of existing infrastructure (with some improvements) may be put through detailed feasibility study at the Govt level and implemented as soon as possible.

c. Yearly financial allocation and necessary financial assistance through International donor agencies such as ADB, World Bank and IMF be perused vigorously without wasting time.

d. Local bus manufacturers such as Ghandhara, Nisan, Isuzu, and Hino Pak must be taken in to the loop of over all planning and execution of the project. This will also give a boost to the local automobile industry and create thousand of jobs.

8.5 Road Network Improvement

a. A comprehensive road improvement plan for Islamabad and Rawalpindi be formulated and implemented. A guide line in this regard can be taken from Pakistan Army which has recently improved road infrastructure within Rawalpindi Cantonment area. Road improvement plan to address following issues:-

(1) Construction of footpaths for pedestrians.

(2) Provision of cycle and motorcycle lanes where possible.

(3) Uniform design of intersection.

(4) Provision of service roads where space is available.

(5) Construction of overhead bridges and underpasses for pedestrian at critical intersections.

(6) Uniform traffic road signs.

(7) Clear and proper road markings.

(8) Provision of reliable traffic lights at all intersections.

(9) Provision of descent and comfortable arrangements at bus/wagon stops or waiting areas.

(10) Clearing of roads of encroachments.

8.6 Operation/Operational Environment

a. CDA and RDA to establish an operation control wing to monitor and secure good operational conditions for the public transport vehicles on all roads of Islamabad and Rawalpindi. Following actions are require in this regard:-

(1) Establish fixed bus stop locations and give all terminals a proper design and code number.

(2) Design and implement a rationalized and integrated short term route network for Islamabad and Rawalpindi.

(3) Review the bus & wagon terminal locations from the point of view of ease of operation as well as public convenience. Make new bus terminals if required.

(4) Prepare for and start implementation of a changeover to larger vehicles i.e buses.

(5) Establish an effective organization for operation control with adequate staff, resources and transport.

(6) Arrange for proper repair and maintenance of buses and wagons fleet in consultation with their private owners.

(7) Design and implement a city wide program for uniform implementation of road signs and road markings.

(8) Improve the situation for pedestrians and bicyclists through construction and earmarking of footpaths, special lanes, road signs and traffic signals.

(9) Enforce prohibition and removal of encroachments.

(10) Ensure maintenance of public facilities like bus stops, bus terminals availability of foot paths and bicycle lanes for designated public through advertisements, education of public and enforcement by traffic police.

8.7 **Traffic Safety**

a. Formulate overall traffic safety plan for the twin cities at CDA and RDA level in consultation with cities traffic police.

b. Include professional traffic safety specialists in the overall planning at Ministry, CDA and RDA level and make traffic safety an integral component of overall public transport planning of twin cities.

c. Arrange regular coordination, meetings between traffic planners and traffic police.

d. Implement designated speed limits through traffic police.

e. Periodically collect and analyze traffic accident data for subsequent preventive actions through media campaigns, law enforcement etc.

f. Design and execute an extensive education and training program for traffic police of the twin cities on the lines of Motorway Police with adequate resources, transport and authority.

8.8 Recommended Frame Work block diagram is attached as Anx ‘A’.

Frame Work Block Diagram

Anx 'A'

Statistical Data

Policy Formulation National Level

Research Input From NTRC

Funds Allocations **Policy Guidelines** **Feed Back**

Transport Planning Provincial Governments

Transport Planning and Operation By CDA/RDA

Training of Staff At CDA/RDA

Coordination of CDA/RDA

Traffic Signal & Traffic Signs

Law Enforcement Agencies

Route Network Improvement

Education & Training of Police

Facilities for Road Users

Accident Data Collection

Operations / Operational Environment

Maintenance

Traffic Safety

Bus Wagon Pickups

Prohibition of Encroachment

Bus Stop Management

City Government Private Transporter

Bus Terminals Management

Feed Back

8.9 Conclusion

Provision of efficient, cost effective and comfortable public transport is the prime responsibility of the government. However, this area has been constantly neglected in the past and there are serious public transport deficiencies prevailing in all the cities of Pakistan. All the weak links and policy shortfalls have been identified in this research and a workable, cost effective public transport system has been proposed for twin cities of Rawalpindi and Islamabad. If due attention is given, the situation can be improved in next 5-10 years in all the major cities of Pakistan. The solution of problem lies well within our capability. The only missing link is right focus and determination to solve the problem.

If an elaborate system of public transport is conceived and implement by the govt , it will have far reaching effects on life and behaviour of public towards their jobs. The overall efficiency and productivity is likely to increase manifolds. Besides, it will give a boost to local automobile and construction industry thereby creating many job opportunities.

8.10 Areas recommended for future research

Following areas having bearing on the subject of public transport are recommended for future research:-

a. Prospects for adoption of rapid rail transit system.

b. Environmental aspects of large scale mass transit systems.

c. Fuel/Energy requirement and adoption of CNG based public transport system.

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