



DILEMMA OF ACCESSIBILITY AND MOBILITY IN MAJOR CITIES OF PUNJAB

THE CASE OF GUJRANWALA CITY

TECHNICAL REPORT



TRANSPORT PLANNING UNIT (TPU)

TRANSPORT DEPARTMENT, GOVERNMENT OF PUNJAB

December 2013

DISCLAIMER

This report is meant to serve as a guidance note for the City District Government Gujranwala, Tehsil Municipal, and Secretary District Regional Transport Authority offices to plan and prepare cost estimates. However, while preparing PC-1, approval and tendering etc, all legally prevalent procedures should be followed and all approvals/sanctions should be sought as per law.

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	RATIONALE FOR THE STUDY	5
1.2	AIM OF THE STUDY	6
1.3	OBJECTIVES OF THE STUDY	6
1.4	METHODOLOGY	7
1.4.1	First Stage	7
1.4.2	Second Stage	7
1.4.3	Third Stage	8
1.5	STUDY AREA – THE GUJRANWALA CITY	10
2	PREVAILING MOBILITY FACILITIES IN THE CITY	14
2.1	PARKING SPACE	14
2.2	ENCROACHMENTS	15
2.3	PUBLIC TRANSPORT in GUJRANWALA	18
2.4	High Occupancy Vehicle Operational Routes	20
2.4.1	B-1-Kamonki to Aziz Cross	20
2.4.2	B-2-Chan da Qilla to Gakhar	20
2.4.3	B-3-Aziz Cross to WAPDA Town via Khiali Mor	20
2.4.4	B-4-Sheikhupura Morr to Wazirabad	22
2.4.5	B-5-Daska to Gulshan Iqbal Park	22
2.4.6	B-9- Sheikhupura Morr to Alipur Chatta Khan C.N.G Petrol Pump	22
2.5	Light Occupancy Vehicle Route	29
2.5.1	W-01- Sheikhupura Morr to Qila Didar Singh	29
2.5.2	S-05-Jinnah Stadium to Sialkot Bye-pass via Munir Chowk, Khokhar Kee	29
2.5.3	S-10-Aziz Cross to Chicherwali and S10-A-Aziz Cross to Chan-da-Qila	29
2.5.4	S-11-More Aminabad to Aminabad Toan	29
2.6	NON-OPERATIONAL ROUTES AND THEIR CHARACTERISTICS	34
2.6.1	B-6-Behari Colony to Rahwali Cantt	34
2.6.2	B-7-Zamindara Stand to Dharam Kot Chowk	34
2.6.3	B-8-Tatley Aali to Aziz Cross	36
3	ANALYSIS OF PUBLIC TRANSPORT SYSTEM IN GUJRANWALA	38
3.1	PUBLIC TRANSPORT USER PERCEPTION SURVEY	38

3.1.1	SAMPLE SIZE	38
3.1.2	Gender.....	38
3.1.3	Age.....	39
3.1.4	Personal Income/month	40
3.1.5	Occupation	41
3.1.6	Purpose of Trip	41
3.1.7	Frequency of Public Transport Utilization	43
3.1.8	Private Vehicle Access	43
3.1.9	Reasons for Not Using Public Transport	44
3.1.10	Perception regarding Network/ Route System of Public Transport.....	45
3.1.11	Operating Hours of Public Transport.....	46
3.1.12	Frequency of Public Transport.....	47
3.1.13	Safety and Security Arrangements.....	48
3.1.14	Access to Bus Stop.....	49
3.1.15	Bus Stop Facilities	50
3.1.16	Comfort and Convenience Offered by the Public Transport	51
3.1.17	Convenience of Transfer of Public Transport.....	53
3.1.18	Important factors contributing towards Improvement of Public Transport.....	53
3.2	Illegal PUBLIC Transport Operations	55
3.2.1	Disadvantages of Illegal Transport	58
4	PUBLIC TRANSPORT ACCESSIBILITY LEVEL ANALYSIS	60
4.1	Methodological Framework	61
4.2	Existing Public Transport Service Area Analysis:.....	62
4.3	Accessible Distance to a Bus Stop	63
4.4	Public Transport Accessibility Levels (PTALs):	64
4.4.1	Components of the PTAL Method.....	65
4.4.2	Defining Points of Interest	66
4.4.3	Public Transport Access Points	66
4.4.4	Walk Access Times.....	66
4.4.5	Closest Facility.....	67
4.4.6	Identify Valid Routes	67
4.4.7	PTALs Indices	69
4.5	ACCESSIBILITY AUDIT AND RECOMENDATIONS	70

4.5.1	GIS Database Development.....	70
4.5.2	Inverse Distance Weighted:	70
4.6	Bus Stop: A Dynamic Environment ~ Analysis and Recommendations	83
4.7	Attributes of a Bus Stop	86
4.8	Bus Stop Environment	92
4.8.1	Location of Bus Stop	92
4.8.1.1	Safety.....	92
4.8.1.2	Operating.....	92
4.8.1.3	Types of Bus Stop Layout.....	95
4.8.1.4	Stop Spacing.....	96
4.8.1.5	Layout of Bus Stop.....	98
REFERENCES.....		103

LIST OF FIGURES

Figure 1-1: Dimensions of Social Exclusion	3
Figure 1-2: Sustainable Urban Environments.....	4
Figure 1-3: Methodology Adopted for the Study	9
Figure 1-4: Location Map of Gujranwala	10
Figure 1-5: Boundaries of Gujranwala Towns under CDGG	11
Figure 1-6: Transit Locations within/ around the city (Google Amended)	13
Figure 2-1: – Aziz Cross to Kamonki B-1 Route	21
Figure 2-2: Chan Da Qilla to Ghakkar B-2 Route	23
Figure 2-3: Route Alignment of Aziz Cross to WAPDA Town Bus B-3 Route	24
Figure 2-4: Sheikhpura Morr to Wazirabad Railway Station B-4 Route.....	25
Figure 2-5: Actual Route Alignment of Gujranwala- Daska Bus B-5 Route	26
Figure 2-6: – Current Route Alignment of Gujranwala- Daska Bus B-5 Route.....	27
Figure 2-7: Sheikhpura Morr to Alipur Chatta Khan C.N.G Petrol Pump B-9 Route	28
Figure 2-8: Sheikhpura Morr to Qila Didar Singh W-01 Route	30
Figure 2-9: Jinnah Stadium to Sialkot By-pass S-05 Route	31
Figure 2-10: Aziz Cross to Chicherwali S-10 Route	32
Figure 2-11: Aziz Cross to Chan Da Qilla S-10A Route.....	33
Figure 2-12: Behari Colony to Rahwali Cantt B-6 Route.....	35
Figure 2-13: Zamindara Stand to Dharam Kot Chowk B-7 Route	36
Figure 2-14: Aziz Cross to Tatley Aali B-8 Route	37
Figure 3-1: Male and Female Percentage among Commuters.....	39
Figure 3-2: Age Distribution of Commuters.....	40
Figure 3-3: Income Distribution of the Commuters	41
Figure 3-4: Occupation Distribution of the Commuters	42
Figure 3-5: Purpose of Trips made by the Commuters.....	42
Figure 3-6: Frequency of Public Transport Utilization.....	43
Figure 3-7: Private Vehicle Access among the Commuters	44
Figure 3-8: Reasons for of Public Transport over Private Transport.....	45
Figure 3-9: Perception regarding Network/ Route System of Public Transport.....	46
Figure 3-10: Perception about Operating Hours of Public Transport.....	47
Figure 3-11: Perception about Public Transport Frequency	48
Figure 3-12: Perception about Safety and Security Arrangements.....	49
Figure 3-13: Perception about Accessibility to Public Transport Network.....	50
Figure 3-14: Perception regarding Bus Stop Facilities in the City	51
Figure 3-15: Comfort and Convenience Offered by the Public Transport	52
Figure 3-16: Convenience of Transfer offered by the Public Transport System.....	53
Figure 3-17: Important factors contributing towards Improvement of Public Transport	54
Figure 3-18: Selected Locations and Percentage share of Illegal Transport	56
Figure 3-19: Percentage share of Illegal Transport at Different Locations along G.T Road....	57
Figure 3-20: Illegal Boarding at Different Locations	58

Figure 4-1: Methodological Framework adopted in GIS.....	61
Figure 4-2: Inclusion and Exclusion Zone around a Bus Stop	62
Figure 4-3: Service Area of B-1 Kamonki to Aziz Cross Route	73
Figure 4-4: Service Area of B-2 Chan Da Qilla to Ghakkar Route	74
Figure 4-5: Service Area of B-4 Sheikhupura Morr to Wazirabad Railway Station Route	75
Figure 4-6: Service Area of B-5 Daska to Gulshan Iqbal Park Mor Route	76
Figure 4-7: Service Area of B-9 Aheikhupura Morr to Ali Phur Chatta Petrol Pump Route....	77
Figure 4-8: Service Area of Prevailing Network	78
Figure 4-9: Public Transport Accessibility Levels of Prevailing Network.....	79
Figure 4-10: Proposed Public Transport Network	80
Figure 4-11: Proposed Network Service Area	81
Figure 4-12: Public Transport Accessibility Levels of Proposed Network	82
Figure 4-13: Bus Journey Cycle	83
Figure 4-14: Feature of the Bus Stop Environment	87
Figure 4-15: Bus Stop Layout Objectives.....	93
Figure 4-16: Critical Dimensions.....	94
Figure 4-17: Ramp Gradient	95
Figure 4-18: Types of Bus Stop Layout.....	97
Figure 4-19: Plan View of Bus Stop	98
Figure 4-20: Plan View of Bus Stop Shelter.....	99
Figure 4-21: Front Elevation of Bus Stop Shelter	100
Figure 4-22: Bus Stop Sign Post.....	101
Figure 4-23: Bus Stop Location in vicinity of Traffic Signals	102

TABLE OF TABLES

Table 1-1: Total Traffic Volume and Passenger at the intersections around the City	12
Table 2-1: Intersections Inventory Survey Results	15
Table 2-2: Road Inventory Survey Results	16
Table 2-3: Road Inventory Survey Results	17
Table 2-4: Specified Urban Public Transport Routes in Gujranwala	19
Table 4-1: Model Parameters for PTALs Calculation	67
Table 4-2: Public Transport Accessibility Levels.....	69
Table 4-3: Population Served After Public Transport Improvement.....	72
Table 4-4: Population Served After Public Transport Improvement.....	72
Table 4-5: Analysis of Prevailing Bus Stops in Gujranwala City	89

ACKNOWLEDGEMENT

Transport Planning Unit has been established at Transport Department, Government of the Punjab to conduct Transport Planning, Traffic Assessment and Management Studies for cities of the Punjab. The TPU team conducted field surveys, held discussions with the officials concerned of the Government Departments, Administration of the Gujranwala District and residents of the city to prepare and complete this report. The TPU team highly appreciates the contribution of The Urban Unit for their valuable input and contribution during different stages of the study especially for Public Transport Planning Surveys

The team would like to convey their special appreciation to the people of Gujranwala for their interest, time and input during the field surveys. The TPU team would like to acknowledge the officials from City District Government Gujranwala and Tehsil Municipal Administrations (TMAs) for the provision of relevant data, guidance, and comments. Special thanks to young students of Punjab College, Gujranwala for conducting Household Information Surveys with full dedication and responsibility. The TPU team would also like to appraise the efforts of Secretary, DRTA Gujranwala for facilitating field visits and providing data related to public transport services in the city. It is worthy to appreciate the PDMFC and the Urban Unit for providing GIS maps for the study area.

Finally, the team would like to convey their special appreciation to The Commissioner and The District Coordination Officer, Gujranwala for his continuous guidance and support during this study.

LIST OF ABBREVIATIONS

CBD:	Central Business District
CDG:	City District Government
DCO:	District Co-ordination Officer
DRTA:	District Regional Transport Authority
EDF:	Equivalent Doorstep Frequency
GIS:	Geographical Information System
GoPb:	Government of Punjab
G.T:	Grand Trunk
HOV:	High Occupancy Vehicle
IDW:	Inverse Distance Weighted
LOV:	Low Occupancy Vehicle
M/C:	Motorcycle
POI:	Point of Interest
PSVs:	Public Service Vehicles
PTA:	Provincial Transport Authority
PTAI:	Public Transport Accessibility Index
PTALS:	Public Transport Accessibility Levels
RIS:	Road Inventory Survey
ROW:	Right of Way
SWT:	Scheduled Waiting Time
TMA:	Tehsil Municipal Administration
TMP:	Transport Master Plan
TPU:	Transport Planning Unit
UC:	Union Council

1 INTRODUCTION

Economic and social development of any city is allied with the sufficiency of its transport network. It is because transport systems, in particular, public transport network connect people with their desired activity locations. In case of non-availability of accessibility and mobility means, people are considered socially excluded from the society. Social exclusion in fact depends on the level of accessibility and mobility provided by the transport network. Undoubtedly, accessibility and mobility are the basic requirements of a public transport network allowing its users to participate fully in different activities in a given society. Every individual has a distinctive accessibility and mobility requirements with respect to other individual; whereas the accessibility and mobility rights of the individuals in the society remain the same (Tyler, 2002). Different groups in a society, for e.g., disabled people, elderly people, men and women, use public transport and have their own specific requirements with respect to land use. Therefore, a large transport network cannot ensure maximum efficiency until it provides all the necessary facilities and ease of access and movement, i.e., accessibility and mobility to its users (Wachs et. al., 1973; Tyler, 2002). This is because human behavior is a function of a decision-making process which in case of feeling of lack of comfort and ease of traveling through a precise mode of transport will lead towards utilization of either other means of transport or in non utilization of transport resulting in social exclusion.

Indeed people need transport to reach activities; but in fact these are locations which are connected by the transport network as people originate their journey from one location i.e., house, job, etc to other location i.e., house, shopping centre etc (Moseley, 1979; Jong et al., 1996). The interaction of the driver, transport and road creates a traffic environment which has a psychological and social relationship with both the local environment and society. This relationship can induce much stress and society has a responsibility to provide an adequate transport system which reduces this stress and conflict as much as possible (Gunnarsson et al., 1990).

The issue of the interaction of location and travel is central to community design, urban economics, and regional planning (Levinson et al., 2005). Integration of land use and transport is a key policy objective which has directed towards the implementation of new techniques and procedures to measure accessibility which is difficult to achieve (Hine et al., 2000a; Halden, 2002). The debate of integration of land use and transport has highlighted important phenomenal terms like social exclusion, transport poverty or transport disparity.

Social exclusion is a process, which causes individuals or groups, who are geographically resident in a society, not to participate in the normal activities of citizenship in that society (Burchardt et al, 1999). Social exclusion is a multi-dimensional process, in which various forms of exclusion are combined: participation in decision-making and political processes, access to employment and material resources, and integration into common cultural processes; when combined, they create acute forms of exclusion that find a spatial manifestation in particular neighborhoods (Madanipour et al., 1998). Department for Transport (DfT) in Britain (2000) has defined this term as people are excluded from the activities they wish to undertake either spatially, temporally, financially, and personally.

Importantly, the term social exclusion is not the explanation of the basic terms such as poverty, scarcity etc., which are generally used in policy making but it is considered as more dynamic phenomena which encircles the sphere of the social life of any individual in any society (Balla and Lapeyre 1997; Lee and Murie, 1999).

Different dimensions of social exclusion are physical exclusion, geographical exclusion, exclusion from facilities which is based on the location or on the nature of the facilities themselves, economic exclusion, time based exclusion, fear based exclusion, and space exclusion (Church et al. 2000; Graffon et al, 2001). A more wide range of dimensions are economic, living space, mobility, organized, personal, personal political, social networks, societal, and temporal (Kenyon, Rafferty and Lyons, 2003).

Journey environment through any public transport mode is governed by the dimensions of the social exclusion as people are socially excluded if they find the transport infrastructure location inadequate or their origin or required destination is not linked properly with the transport system i.e. geographical exclusion, if the transport system does not provide necessary information about bus timings or the time at which they want to make a journey is not served by the transport i.e. temporal exclusion, if they feel insecure while standing at a stop or during off peak hours i.e. at night times the buses are not safe to travel i.e. fear based exclusion, if there is no shelter or sitting arrangements at stops or bus depots or the buses are not equipped with facilities for the disabled people requirements i.e., exclusion due to facilities themselves or the cost of travelling is higher than their affordability i.e., economic exclusion and if there are any disparity in their mobility i.e., for disable people i.e., personal or mobility exclusion.

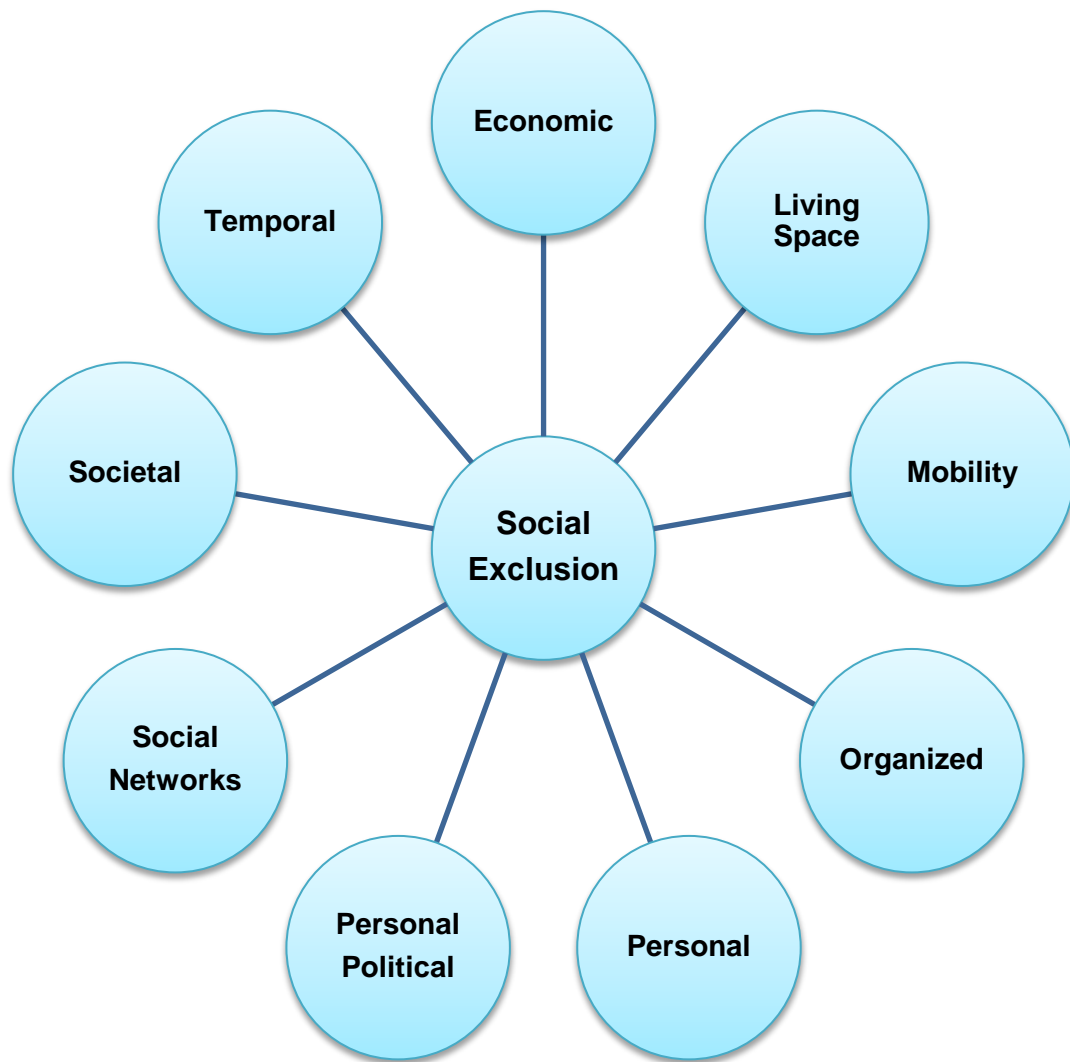


Figure 1-1: Dimensions of Social Exclusion

Social exclusion and its different dimension as shown above (Figure 1-1) are integrated by Azmin (2005) with urban design, transport and the facilities necessary to enable or afford movement as shown in Figure 1-2.

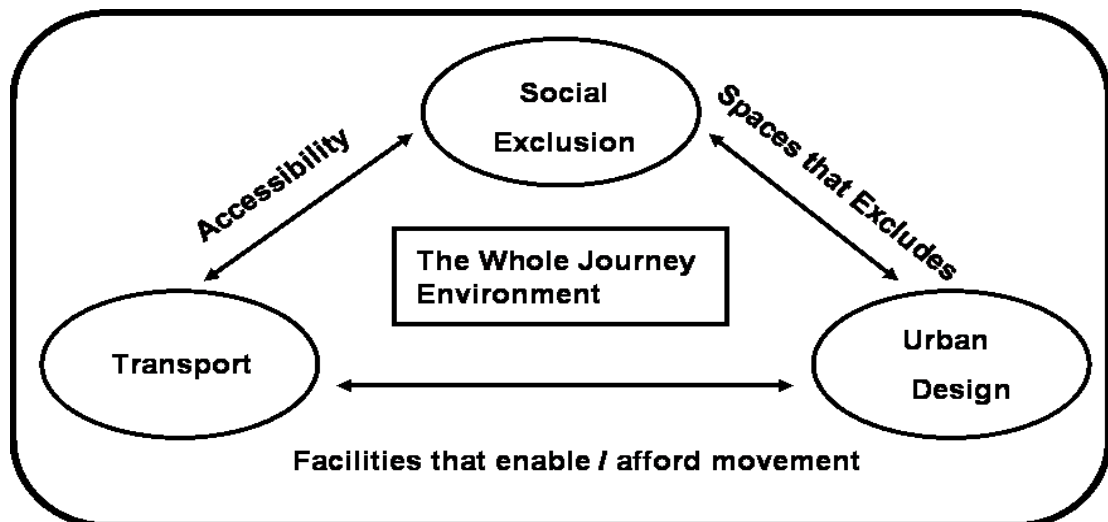


Figure 1-2: Sustainable Urban Environments – The Whole Journey Environment
(Azmin – Foulandi, 2005)

In a sustainable urban environment social exclusion is a function of accessibility which interlinks transport, urban design/ land use and social exclusion; if hindrance in accessibility is observed then these links will be affected resulting in breakage of the whole journey environment. Lack of efficient public transport system especially in developing countries has resulted in rapid motorization and emergence of para-transit systems. This development is a major policy challenge for the decision makers and serves as a key reason of exclusion for social groups having limited income. In reality, in the last three decades, rapid changes in existing land-use patterns, separation of residential and employment locations by large distances due to expanding cities, and reduced access to public transport services have encouraged the ownership and use of private cars and alternate para-transit means to make both ends meet¹. People are now heavily dependent on these alternate modes for their scheduled (essential) and occasional journeys due to time, convenience, privacy and cost². There is a range of impacts of this growing travel by alternate mode culture, road congestion, reduced public transport network capacities, and infrastructure deficit. Undoubtedly, these

¹ David Banister, "The Sustainable Mobility Paradigm", *Journal of Transport Policy* 15, no. 2 (November 2008): 73-80.

² Campaign for Better Transport, "Car Dependency Scorecard, 2010", http://www.bettertransport.org.uk/system/files/car-dependency-scorecard_1.pdf (Accessed 18 October, 2013).

impacts are affecting the economic development of cities, too³. The reason solicited for this phenomenon is based on the fact that socially excluded people cannot attain those jobs which they can; also they have to travel larger distances for economic opportunities which are not available to them in their neighborhoods due to geographical exclusion. In both cases, public transport plays a key role as it links the residential location with the economic opportunity locations.

Literature reveals that major cities in developed countries are greatly dependent upon the efficiency of public transport networks for social cohesion as compared to developing nations. In contrast, mobility based on private motor vehicles in developing world is becoming increasingly difficult with respect to travel cost, travel time, and provision of financing for expanding road capacities and maintenance of existing road network. In addition, mobility by private means is aggregating fragmented travel patterns resulting higher transport cost not only for the individuals but also for the society. Therefore, policy maker seeks public transport as an alternative and preferable mode of travel to the private cars to enhance social cohesion and integration in the society.

1.1 RATIONALE FOR THE STUDY

This study is conducted on the request of City District Government (CDG), Gujranwala. The CDG Gujranwala aims to provide, sustainable integrated and safe transport services to all in their area and to achieve its desired aim, made a request to the Urban Unit, Planning and Development Department, GoPb for assistance. The Urban Unit requested Transport Planning Unit, a unit developed within Transport Department solely for the purpose of strategic planning in Punjab province to conduct the underlying study.

Transport Planning Unit (TPU) is mandated to develop, maintain and manage the transport systems of major cities of the Punjab through well thought out sustainable transport plans and not by haphazard ad-hoc spot solutions. TPU had already conducted a study “Improvement of Urban Transport in Gujranwala City” focusing on the financial opportunities and constraints faced by the operator plying public transport on five routes in the city. The report highlighted

³ Peter Headicar, *Transport Policy and Planning in Great Britain* (London: Oxford brooks University, 2009).

various factors affecting revenues and subsidy payments; however, it did not address accessibility and mobility issues. The need for this study was further stressed out by the results of the previous study in which it was highlighted that public transport utilization in the city is remarkably less in comparison to other modes operating in the city. The reason highlighted by the people was that the prevailing network in the city follows a unique alignment and almost all routes in the city pass through a single corridor i.e. Old GT Road. Contrary, All residential areas are located in adjoining vicinity of this corridor whereas commercial areas act as buffer between this corridor and the residential locations. Interestingly, the city has observed outward growth towards/ around the Bypass road which acts as peripheral boundary between urban and rural Gujranwala areas. Recent developments have extended the boundary of the urban areas further ahead of the By-pass roads. People living in these residential area have to commute to the main GT road first then make a transit journey to their desired locations; resulting in higher cost, long journey time and accessibility issues. The underlying report focusing on these issues conducts an assessment of prevailing public transport network in context of accessibility and mobility barriers and how these can be improved.

1.2 AIM OF THE STUDY

The underlying study aims to examine whether existing public transport network impose social exclusion through mobility and accessibility barriers among people or not; if so, which measures can be implemented to enhance people participation in the society through better accessibility and mobility.

1.3 OBJECTIVES OF THE STUDY

Following constitute the objectives of the study:

- To review and analyze the accessibility and mobility levels offered by the available public transport network through GIS based analysis
- To identify low public transport accessibility areas in the city through Public Transport Accessibility levels (PTAL) where improvements in network alignment are of utmost necessity to enhance public transport share in modal split

- To identify the percentage of people who were denied of accessibility to activity locations by the existing public transport network and who can be socially included through improvements in route alignment
- To examine whether bus stop serves as mean of accessibility and mobility or create barriers in access to facility locations?

1.4 METHODOLOGY

Methodology for this study highlighted in Figure 1-3 involves composite approach encompassing descriptive, quantitative and quantitative analysis approach. Assessment of existing state of affairs was done by field visits, consultation meetings, Focus Group Discussions and GIS based analysis encompassing Network Analysis and PTAL Approach. Assessment helped to define the accessibility levels offered by the prevailing infrastructure. In fact, utilization of both subjective and objective approaches helped to assess the prevailing conditions and propose necessary improvements required to enhance public transport service delivery.

1.4.1 First Stage

Descriptive analysis and preliminary survey constituting first stage of the methodology helped to understand the limitations, constraints and opportunities offered by prevailing public transport network including bus stops. Previous studies, reports were reviewed to examine the network developed. Furthermore, these studies helped to examine the rationale for development of such type of network and for infrastructure provision. In addition to above, studies conducted globally were examined to identify attributes pertaining to a sustainable public transport system. The reason for this review was to examine the prevailing bus stop infrastructure against globally accepted bare minimum standards acceptable for an efficient public transport network. Review of bus stop facilities helped to identify the shortcomings in the available infrastructure and propose recommendations as per global standards.

1.4.2 Second Stage

In the second stage quantitative, qualitative and analytical analysis helped to establish the accessibility and mobility deprived areas and the number of people who are denied public transport service. Focus group discussion constituted qualitative analysis whereas user

perception survey constituted the qualitative analysis part. Results of both quantitative and qualitative analysis were triangulated which helped to establish the existing Level of Service (LOS) of public transport operating in the city. The LOS helped to establish the performance of the public transport network. Subsequently, accessibility and mobility audit was carried out to establish the service area of the existing network and number of people served by the bus service.

1.4.3 Third Stage

Recommendations constitutes the third stage of the study where in realignment of the prevailing network was carried out to enhance the service area of the public transport service. Moreover, design of an efficient public transport stop bus is proposed for commuters comfort and preference for public transport service.

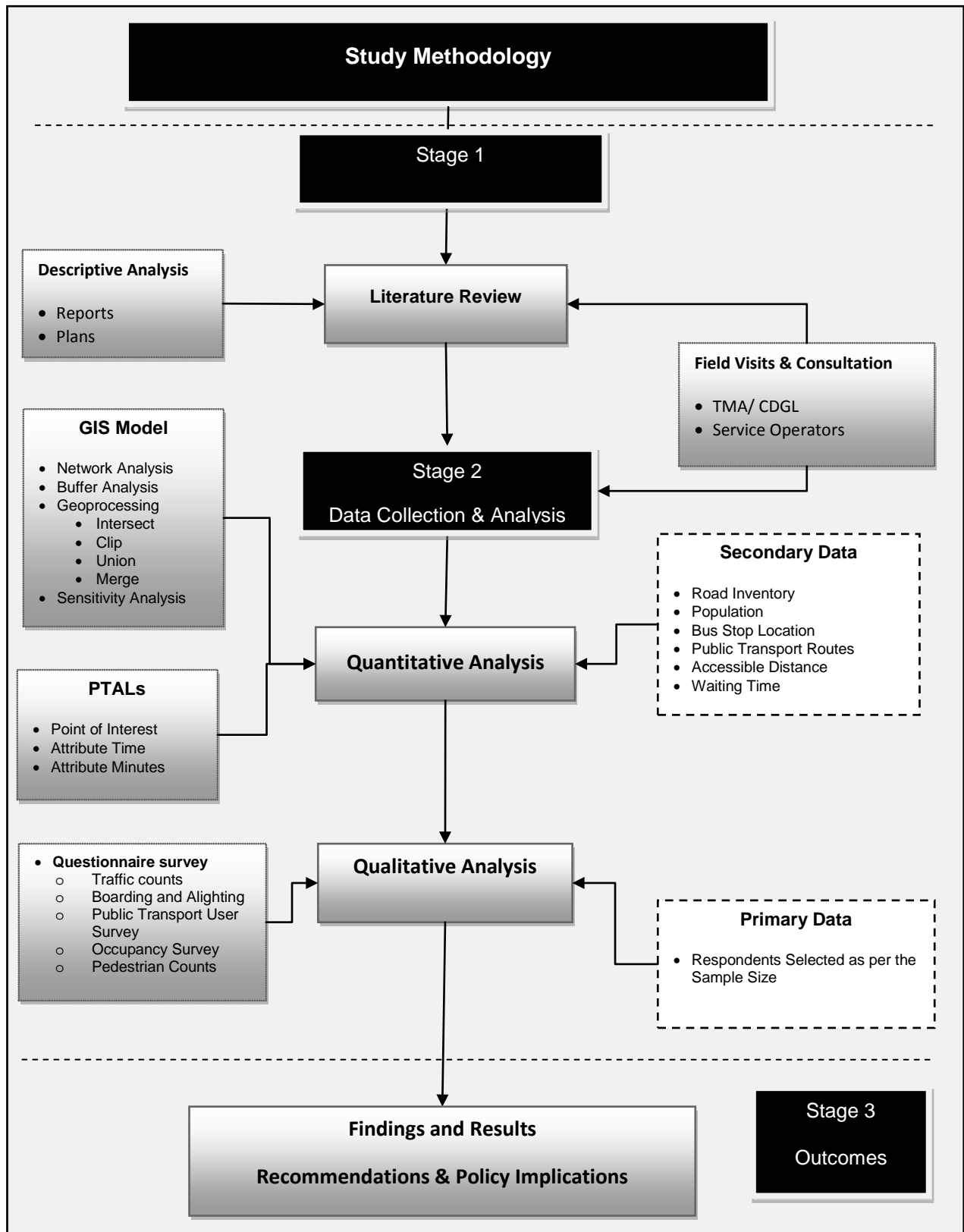


Figure 1-3: Methodology Adopted for the Study

1.5 STUDY AREA – THE GUJRANWALA CITY

The case of Gujranwala city is indistinguishable to any other city in Pakistan where travel patterns are highly influenced by the characteristics of customary public transport, para-transit modes, social and cultural norms and safety apprehensions. Though the city has developed remarkably in the last three decade and emerged as an industrial hub of the province but like any other city of Pakistan it has undergone the identical pattern of urban development i.e. initial growth along the transit corridor and subsequently outward movement towards periphery rural areas. The study area considered for this study includes urban Gujranwala area surrounded by the Bypass Road at its periphery.

Gujranwala being the industrial city of the Punjab province is the seventh largest city in Pakistan with a population of approximately 2,661,360. The city shares borders with Ghakhar Mandi and some small towns and villages. Due to extensive road links, the city has flourished within the manufacturing and agricultural markets. The city is on the Grand Trunk (G.T) Road, which allows logistical connections to other parts of the province as shown in Figure 1-4.

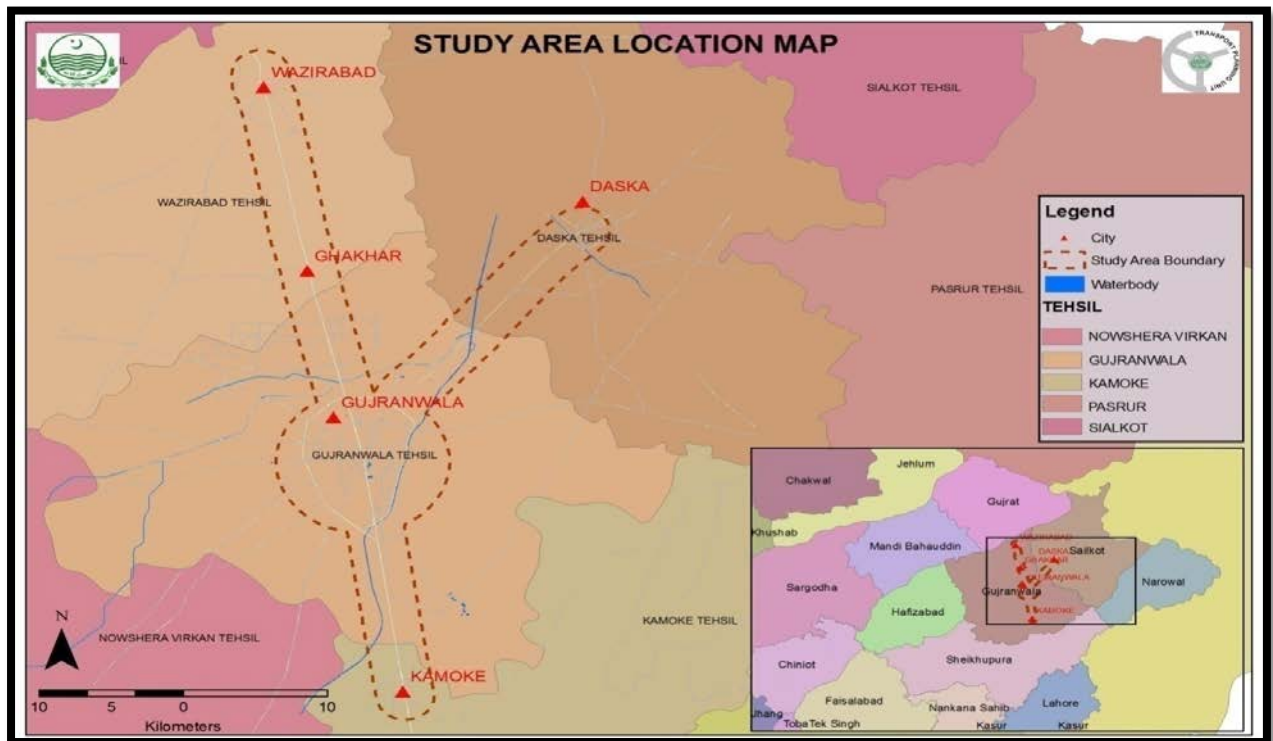


Figure 1-4: Location Map of Gujranwala

According to the new Local Government System, Gujranwala district (which was previously comprised of five main Tehsils Gujranwala City, Gujranwal Sadar, Kamonki, Nowshehra Virkan and Wazirabad) has now become Gujranwala City district administered by City District Government Gujranwala (CDGG) and that comprises of the following towns:

1. Aroop
2. Kamoke
3. Khiali Sheikhpure
4. Nandi Pur
5. Noshehra Virkan
6. Qila Didar Singh
7. Wazirabad

The boundaries of these towns have been shown in the following Figure 1-2.

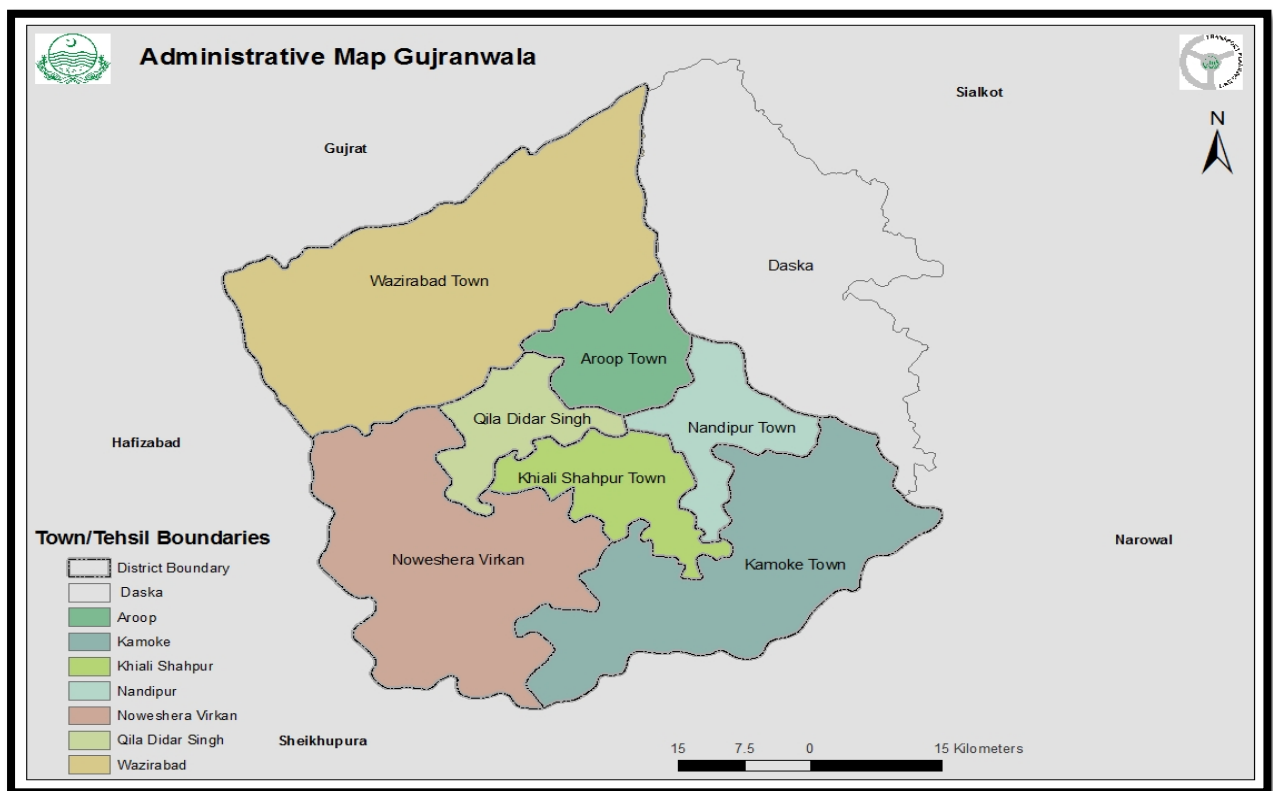


Figure 1-5: Boundaries of Gujranwala Towns under CDGG

The details of the town/ tehsils for this particular study were important because it is to be used as spatial unit of analysis in adopted Methodology.

Nonetheless, the city serves as the industrial heart of the province and provides jobs to people in both industrial/ manufacturing and agriculture sector. Moreover, it also provides employment opportunities for the people living in neighboring towns and villages who commute on daily basis to various manufacturing units located in the city. Likewise, the city serves as commercial centre and people of neighboring towns/ villages commute to the CBD area for retail shopping purposes through transit intersections highlighted in Figure 1-6 below. Importantly, due to its development along the National Highway N5, most of prime land uses encompassing CBD area, facilities and services such as schools, offices, hospitals, etc are located along this road. Presence of these services results in generation of significant passengers trips as indicated in Table 1-1.

Table 1-1: Total Traffic Volume and Passenger at the intersections around the City
(Source: Traffic Management Study for Gujranwala City, TPU)

Sr. No.	Name of Intersection	Total Traffic Volume (PCUs)
1.	Chan Da Qila Chowk	81544
2.	Judicial Colony Chowk	29700
3.	Wapda Town Chowk	88690
4.	Khiali Bypass Chowk	27222
5.	Jinnah Rodhian Chowk	35707
6.	Malhi / Nowshera Sansi Chowk	92624
7.	Nowshera Road / Awan Chowk	751
8.	Alam Chowk	58932
9.	Nawab Chowk	90565
10.	Alipur Chowk	49851
11.	Pindi Bypass Chowk	179081
12.	Sui Gas Chowk	68609
13.	Moafiwala Chowk	51270
14.	Sialkot Bypass Chowk	51067
15.	Chicharwali Pull Chowk	47626
16.	Ferozwala Chowk	60478
17.	Kanganiwala Bypass Chowk	65972

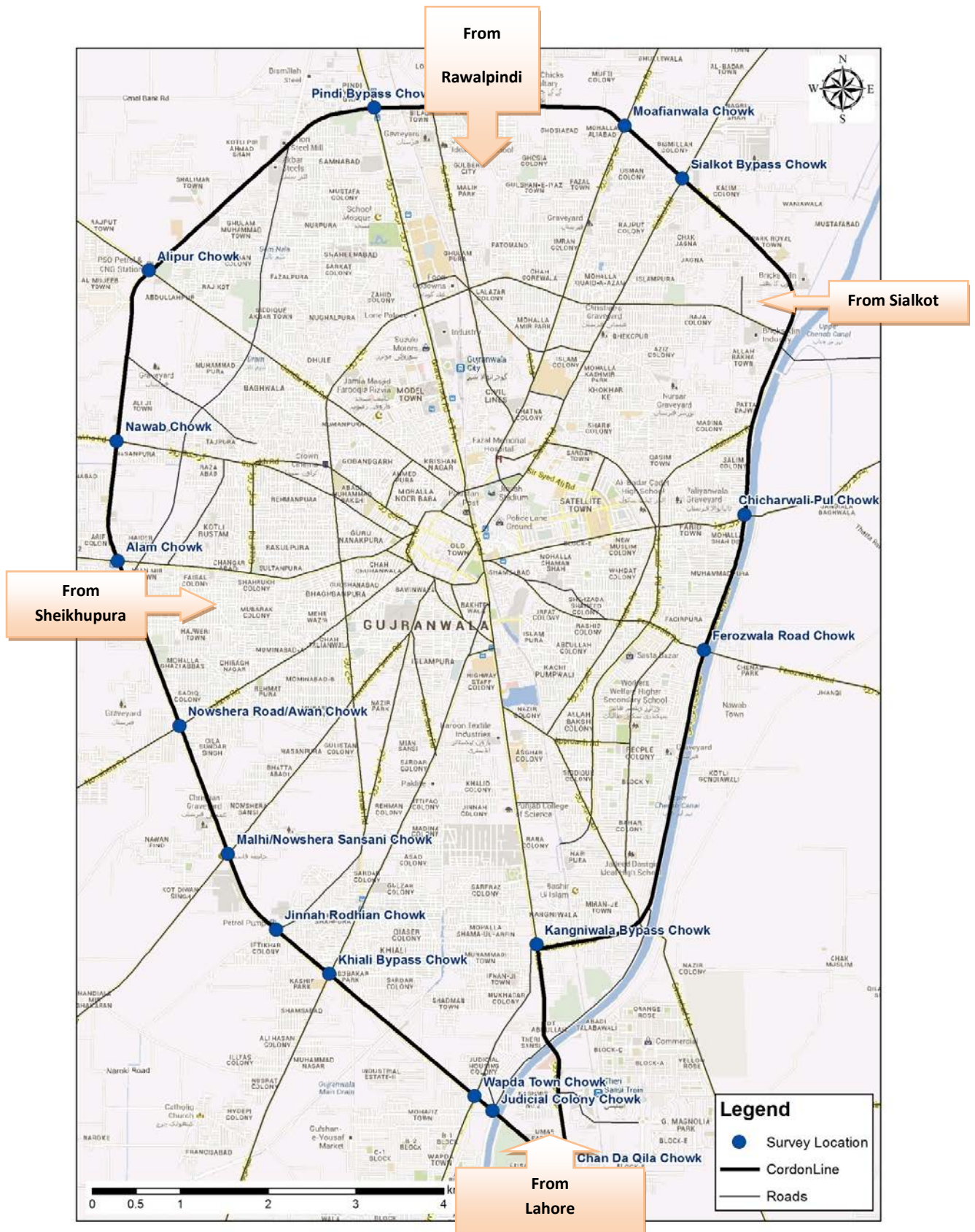


Figure 1-6: Transit Locations within/ around the city (Google Amended)

2 PREVAILING MOBILITY FACILITIES IN THE CITY

The city of Gujranwala has experienced significant vehicular trip growth like any other major city of the province within last two decades due to rapid increase in population, urban development, banks car leasing policy, universal trend of migration towards urban centers to access better employment opportunities. Presently, the city major arterials/secondary roads connecting G.T road with Gujranwala Ring Road include Sheikhpura road, Gonlanwala road, Jinnah road, Nowshehra road, Garjakh road, Kacha Khiali road, Hafizabad road and Nowshehra sansi road. Likewise, the roads connecting G.T road with Sialkot bye-pass are Sialkot road, Pasrur road, Ferozewala road, Kacha Fatomand road, Kashmir road and Pakka Fatomand road.

The existing capacity of the most of these roads constituting the urban road network of the city is not adequate to cater for huge traffic demand especially during Peak Hours. Schools, colleges and markets have limited road access and egress, therefore, traffic congestion is usually observed during peak hours at various locations. Road geometry, Right of Way and lack of alternative transportation improvements are some of the major constraints which are causing traffic congestion on the primary and secondary roads (Traffic Management Report, TPU-2014). Results of the Road Inventory Survey classifying the existing road network of the city into primary, secondary and local roads is explained below in Table 2, 3 and 4 and clearly depicts the situation discussed above. Importantly, all these roads also constitute the public transport network of the city and the differential mobility observed by the car users is likewise observed by the public transport users; in fact, due to its size, public transport is more hampered by these constraints; thus resulting in longer journey time.

2.1 PARKING SPACE

Availability of adequate parking space is another major hurdle in the city. There are number of small industries, schools, colleges and institutions in the city; while majority of them have no allocated parking spaces for their employees/workers. People are forced to park outside their workplaces on roads and streets causing congestion and obstructions for other road users. Similar case is observed with educational institutions where lack of parking spaces results in congestion especially in Peak Hours. There is an urgent need of policy change for promotion of sustainable parking procedures through regulation, enforcement and education of people.

2.2 ENCROACHMENTS

Encroachment is another major cause of congestion on roads. Commercial activities and movement of hand carts on Footpaths/ walkways are major reasons of encroachment. The main encroached area along G.T road is Sheikhupura Morr to Lari Adda where shops on both sides are encroached with permanent construction, goods counters, and hawkers. Likewise, other major commercial roads especially those within the CBD area are encroached with hawkers and shop keepers; thus reducing space for mobility especially pedestrian movement.

Table 2-1: Intersections Inventory Survey Results

Sr. No.	Intersection Name	Type	Zebra Crossing	Pedestrian Signal	Island for Pedestrian Movement	Pedestrian Signage
1	Denga Phatak	Uncontrolled	No	No	No	No
2	Sheranwala Bagh	Uncontrolled	No	No	No	No
3	Sialkoti Darwaza	Uncontrolled	No	No	No	No
4	Alam Chowk	Uncontrolled	No	No	No	No
5	Gondala Wala Phatak	Uncontrolled	No	No	No	No
6	Maafiwaala Chowk	Uncontrolled	No	No	No	No
7	Munir Chowk	Uncontrolled	No	No	No	No
8	Pindi Bypass	Signalized	Yes	No	Yes	No
9	Shaikhupura Morr	Uncontrolled	No	No	No	No

Table 2-2: Road Inventory Survey Results

Sr. No.	Road Name	Width (ft)	Enchroachment			Sidewalk	Zebra Crossing	Pedestrian Signage
			Yes/No	TYPE	%age of Length			
1	Alama Iqbal Road	34	Yes	Illegal Parking	10%	Yes	No	No
2	Eminabad Road	50	No	Nil	Nil	Yes	No	No
3	Ferozwala Road	38	Yes	Illegal Parking/Shops	100%	No	No	No
4	Hafizabad Road	34	Yes	Shops	100%	Yes	No	No
5	kacha Eminabad	60	Yes	Illegal Parking/Shops	100%	Yes	No	No
6	Nighar phatak Road	30	No	Nil	Nil	No	No	No
7	Sheikhupura Road	44	Yes	Shops	20%	No	No	No
8	Dulley Road	40	Yes	Hawkers/Shops	70%	Yes	No	No
9	Fato mand Road	18	Yes	Hawkers/Shops/Illegal Parking	50%	No	No	No
10	Gondlawala road	62	Yes	Parking/Shops	50%	Yes	No	No
11	Hospital Road	64	Yes	Shops/Illegal Parking	60%	Yes	No	No
12	Kacha Fatomand Road	18	No	Nil	Nil	No	No	No
13	Nowshera Road	42	Yes	Shops	80%	Yes	No	No
14	Sialkot Road	68	Yes	Shops/Hawkers	60%	Yes	No	No
15	Aroop Road	24	No	Nil	Nil	No	No	No
16	Bazar KhaRoadan	38	Yes	WorkShops/Shops/Hawkers	100%	Yes	No	No
17	Circular Road	28	Yes	Shops	100%	No	No	No
18	Civil Hospital DHQ	42	Yes	Illegal Parking	20%	No	No	No
19	College Road	52	Yes	Shops	100%	Yes	No	No
20	Dastgeer Road	24	Yes	Illegal Parking	50%	No	No	No
21	DC Road	32	Yes	Illegal Parking/Shops	20%	No	No	No
22	Ghanta Ghar	24	Yes	Illegal Parking/Shops	100%	Yes	No	No
23	GhoRoador Road	32	Yes	Illegal Parking/Hawkers	50% /100%	Yes	No	No
24	Gill Road	22	Yes	Illegal Parking/Shops	30%	No	No	No
25	Gurjkah Road	32	Yes	Shops	30%	Yes	No	No
26	Jail road	32	Yes	Jail	50%	No	No	No
27	Jamia Masjid Road	16	No	Nil	Nil	No	No	No
28	Jinnah Road	40	Yes	Illegal Parking	50%	No	No	No
29	Kacha Khiali Road1	16	No	Nil	Nil	No	No	No
30	Kashmir Road	44	Yes	Illegal Parking	5%	No	No	No
31	Main market road	68	Yes	Illegal Parking/Shops	50%	Yes	No	No
32	Mian Sansi Road	32	No	Nil	Nil	Yes	No	No
33	Nowshera Sansi Road	16	Yes	Shops	60%	No	No	No
34	Parao Road	48	Yes	Illegal Parking/Shops	50%	Yes	No	No
35	Qazafi Road	16	Yes	Shops	50%	No	No	No
36	Rex Cinema Road	14	Yes	Illegal Parking	50%	No	No	No
37	Sui Gas Road	12	No	Nil	Nil	No	No	No
38	Tipu Road	18	No	Nil	Nil	No	No	No
39	Academy Road	20	No	Nil	Nil	No	No	No
40	Ahmad Nagar Road	20	No	Nil	Nil	No	No	No
41	Airbase Road	16	No	Nil	Nil	No	No	No
42	Alipur Chatha Road	22	No	Nil	Nil	No	No	No
43	Approach Road	18	Yes	Illegal Parking/Shops	100%	No	No	No
44	Atta Muhammad Road	16	Yes	Shops	50%	No	No	No
45	Awami Road	16	No	Nil	Nil	No	No	No
46	Bajwa Road	16	No	Nil	Nil	No	No	No
47	Bazar Road	24	Yes	Illegal Parking	100%	Yes	No	No
48	Canal Bank Road	16	No	Nil	Nil	No	No	No
49	Cantt Road	24	No	Nil	Nil	No	No	No
50	Cemetery Road	16	No	Nil	Nil	No	No	No
51	Chenab Gate Road	50	No	Nil	Nil	No	No	No
52	CMH Road	16	No	Nil	Nil	No	No	No
53	Dinga Phatak Road	22	Yes	Illegal Parking	100%	Yes	No	No
54	Exchange Road	50	Yes	Shops	40%	No	No	No
55	DC Colony To Cantt Road	55	No	Nil	Nil	Yes	No	No

Table 2-3: Road Inventory Survey Results

Sr. No.	Road Name	Width (ft)	Enchroachment			Sidewalk	Zebra Crossing	Pedestrian Signage
			Yes/No	TYPE	%age of Length			
56	GaRoaden Town Road	45	No	Nil	Nil	No	No	No
57	Garjakh Road	16	Yes	WorkShops/Others	50%	Yes	No	No
58	General Bus Stand Road	22	Yes	Hawkers	50%	No	No	No
59	Ghakka Mitter Road	16	No	Nil	Nil	No	No	No
60	Ghalib Chowk Road	24	Yes	Hawkers/Illegal Parking/WorkShops	70%	Yes	No	No
61	Ghosia Flyover	24	No	Nil	Nil	No	No	No
62	Gondlanwala Road	60	Yes	WorkShops/Illegal Parking	50%	Yes	No	No
63	GT Road-Skp Road link	40	Yes	WorkShops/Illegal Parking	40%	Yes	No	No
64	Gujranwala Cantt Road	24	Yes	Shops	30%	No	No	No
65	Haidri Road	14	Yes	Hawkers/Illegal Parking	100%	Yes	No	No
66	Kachehri Road	52	Yes	Illegal Parking	50%	No	No	No
67	Khajoor Wali Road	16	No	Nil	Nil	No	No	No
68	Lamba Wali Road	16	No	Nil	Nil	No	No	No
69	Lohian Wala Bypass	60	Yes	WorkShops/Illegal Parking	60%	Yes	No	No
70	Madni Road	20	No	Nil	Nil	No	No	No
71	Mandiala Road	30	No	Nil	Nil	No	No	No
72	Markaz-e-Sanat Road	16	No	Nil	Nil	No	No	No
73	Model Town Road	65	Yes	Illegal Parking	50%	Yes	No	No
74	Model Town Square Road	65	No	Nil	Nil	Yes	No	No
75	Munir Road	26	Yes	Illegal Parking	50%	No	No	No
76	Muslim Road	20	No	Nil	Nil	No	No	No
77	N5 G.T Road to Isb	60	Yes	Illegal Parking	100%	No	No	No
78	Nomania Road	16	No	Nil	Nil	No	No	No
79	Octroi Post Road	22	No	Nil	Nil	No	No	No
80	Pasrur Road	34	No	Nil	Nil	Yes	No	No
81	Prince Road	16	No	Nil	Nil	No	No	No
82	Rahwali Gate Road N	52	No	Nil	Nil	No	No	No
83	Rahwali Gate Road S	52	No	Nil	Nil	No	No	No
84	Railway Road	30	No	Nil	Nil	No	No	No
85	Rustam Road	16	No	Nil	Nil	No	No	No
86	Sadiq Road	16	No	Nil	Nil	Yes	No	No
87	Session Court Road	30	Yes	Hawkers	20%	No	No	No
88	Shelton Road	26	No	Nil	Nil	No	No	No
89	Stadium Road	20	Yes	Shops	50%	No	No	No
90	Station Road	24	Yes	Shops	20%	No	No	No
91	Sugar Mill Road	30	Yes	Illegal Parking	40%	No	No	No
92	Suvay Wala Road	18	No	Nil	Nil	No	No	No
93	Tower Road	16	No	Nil	Nil	No	No	No
94	Wadala Road	16	No	Nil	Nil	No	No	No
95	Zia ul haq Road	22	Yes	Illegal Parking	10%	No	No	No

Evidently, traffic management is a major concern in the city. Problems arising from traffic related issues are increasing day by day. The pavement structure of various roads has been improved by the City District Government over the years to regularize traffic on primary corridors but these measures have not ease the congestion situation. There is lack of signalized traffic junctions and weak enforcement of traffic rules which often results in grid lock during Peak Hours, causing congestion on G.T road subsequently on local roads. Following are some of the key constraints observed in the city.

1. Insufficient road network, inadequate right of way, substandard road geometry and junction design.
2. Inadequate roadside features (footpaths, medians, channelizing islands, bus stops, street lights, traffic signs and signals).
3. Illegal operations of Qingqis/Auto Rickshaws.
4. Centralization/Concentration of business area within Sheikhpura Morr and Lari Adda.
5. Mix traffic phenomena on roads.
6. Encroachments along roadside.
7. Lack of traffic sense among drivers.
8. Weak enforcement of traffic rules.

2.3 PUBLIC TRANSPORT in GUJRANWALA

Realizing the importance of public transport as substitute mode of transport best equipped to cater for congestion public transport network for the city has been devised which include both High Occupancy Vehicles (HOV) i.e. Buses and Low Occupancy Vehicles (LOV) i.e. Wagons and Suzukis routes as listed below in Table 5. The below mentioned HOV and LOV routes are the legal/ notified mode of public transport in the city because these have been notified by the District Regional Transport Authority and Provincial Transport Authority. Contrary to, Auto-Rickshaws and Qingqis are also operating in the city; however these are illegal mode of public transport as they have not been approved by the local transport administration

High Occupancy Vehicles (HOV) route in Gujranwala city mainly operates along G.T road whereas few of the areas of the city are either accessed by Suzukis or Wagons. There are defined route for Suzukis and Wagons too. Wagons are widely used for intercity transport; their

destination/origin is Gujranwala GBS and Star Travel (a D-class bus stand). Wagons departing from GBS to Gujrat and Wazirabad often picks-up local passengers from G.T road. Likewise, Suzuki service operates between Gujranwala and Sialkot bypasses.

Auto Rickshaws or Qingqis being illegal mode operate on Hail and Go method i.e. stopping at various locations including both notified and illegal stops. According to Rickshaw Union President, there are more than 8000 Qingqi/ Auto rickshaws operating in the city.

Eight stage carriage routes were defined for Gujranwala in Punjab Gazette dated June 2006. The defined routes are mentioned in the Table 2-4. Presently, City Tour is the only bus company providing urban transport services in the city. City Tours is allowed operations along 8 routes, however only four routes are currently in operation. Apart from above mentioned 8 notified routes wherein Diesel Buses operate, a new bus Route was notified wherein Environment Friendly CNG buses are under currently under operation by City Tour.

Table 2-4: Specified Urban Public Transport Routes in Gujranwala

Sr. No.	ROUTE No.	ORIGIN & DESTINATION	No. of Vehicles in Operation
HOV (Bus) Urban Routes			
1	B-1	Kamonki to Aziz Cross	34
2	B-2	Chan Da Qilla to Ghakkar	18
3	B-3	Aziz Cross (Pindi Bye-pass) to WAPDA Town	8
4	B-4	Sheikhupura Morr to Wazirabad Railway Station	12
5	B-5	Dasks to Gulshan Iqbal Park Mor	10
6	B-6	Behari Colony to Rahwali Cantt	0
7	B-7	Zamindara Stand Dharam Kot Chowk	0
8	B-8	Tatley Aali to Aziz Cross	0
9	B-9	Sheikhupura Morr to Alipur Chatta Khan C.N.G Petrol Pump	11
LOV (Wagon) Urban Routes			
9	1	Sheikhupura Morr to Qila Didar Singh	9
LOV (Suzuki) Urban Routes			
10	5	Jinnah Stadium to Sialkot Bye-pass via Munir Chowk, Khokhar Kee	14
11	10	Aziz Cross to Chicherwali Bye-pass	17
12	10-A	Aziz Cross to Chan-da-Qila Bye-pass Road	21
13	11	More Aminabad to Aminabad Toan	8

2.4 High Occupancy Vehicle Operational Routes

The following HOV routes are currently in operation in Gujranwala city.

- 1) B-1 Kamonki to Aziz Cross.
- 2) B-2 Chan Da Qilla to Ghakkar.
- 3) B-4 Sheikhupura Morr to Wazirabad Railway Station.
- 4) B-5 Dasks to Gulshan Iqbal Park Mor.
- 5) B-9 Sheikhupura Morr to Alipur Chatta Khan (CNG Bus Route)

2.4.1 B-1-Kamonki to Aziz Cross

Komonke is an important Tehsil of Gujranwala district connected through Grand Trunk (G.T) road. The route is approximately 30 kms long. The total numbers of operating buses on this route are 34. A number of work and shopping trips originates from this area. The route plan with some important bus stops locations is shown on Figure 2-1.

2.4.2 B-2-Chan da Qilla to Gakhar

This route is overlapped with two other high frequency routes i.e. B-1 and B-4 along G.T road. The company is currently operating its 18 buses on this route covering 27 Kms. The route has been temporarily extended to WAPDA town to accommodate passengers. The proposed route alignment for B-2 is approximately 24 Kms however; it is covering additional 3 Kms. The route plan of B-2 with some important bus stops locations is shown on Figure 2-2.

2.4.3 B-3-Aziz Cross to WAPDA Town via Khiali Mor

This route is initially non-operational however later bus operations started. The originally proposed route alignment of B-3 is 14 kilometers. This route had been merged with the B-2 due to the construction of overhead bridge by National Highway Authority (NHA) during last two years. The route B-2 has been extended from Chan Da Qilla to WAPDA town. The realignment passes through WAPDA town as it is one of the affluent towns of the Gujranwala and creates high passenger demand. Majority of working class uses public transport to reach their destinations in WAPDA town and other nearby areas. The actual route alignment of B-3 route is shown in Figure 2-3.

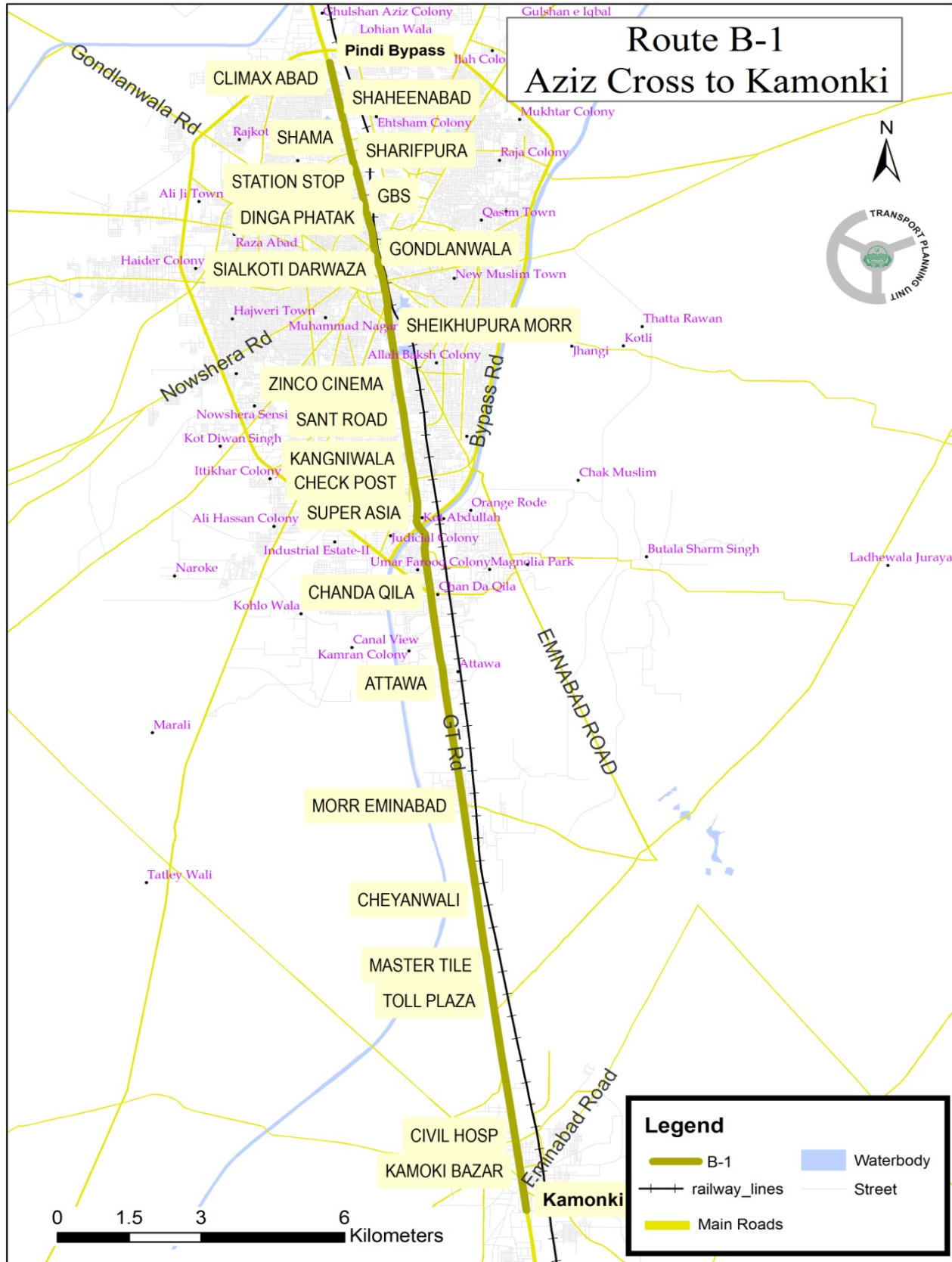


Figure 2-1: – Aziz Cross to Kamonki B-1 Route

2.4.4 B-4-Sheikhupura Morr to Wazirabad

B-4 is the most important and profitable route. The company has deployed 12 buses on this route along G.T road covering 34 Kms. The route alignment plan of B-4 with some important bus stop locations is shown in Figure 2-4.

2.4.5 B-5-Daska to Gulshan Iqbal Park

The permitted 27 Kms alignment of this route passes through Sialkot road, Gujranwala but it is temporarily rerouted / realigned by the bus company due to the construction of this road and is diverted to Aziz cross and Sialkot bye-pass. The route has been extended up to Sheikhupura Morr. Currently 10 buses are operating on this route covering 31 Kms. The current bus route is operating on 22 Kms of original permitted alignment and additional 9 Kms due to rerouting as shown in Figure 2-5 and 2-6 respectively.

2.4.6 B-9- Sheikhupura Morr to Alipur Chatta Khan C.N.G Petrol Pump

This route operates from Sheikhupura Morr to Alipur Chatta Khan C.N.G Petrol Pump. Currently 11 Environmentally Friendly CNG buses are operating on this route. The route plan of B-9 with some important bus stops locations is shown on Figure 2-7. Importantly, B-9 serves more as an Intercity Route in nature than as an Intra-city Route. Nonetheless, it follows the primary corridor in the city and connects major land uses especially CBD are so it is termed as Intra-city Route.

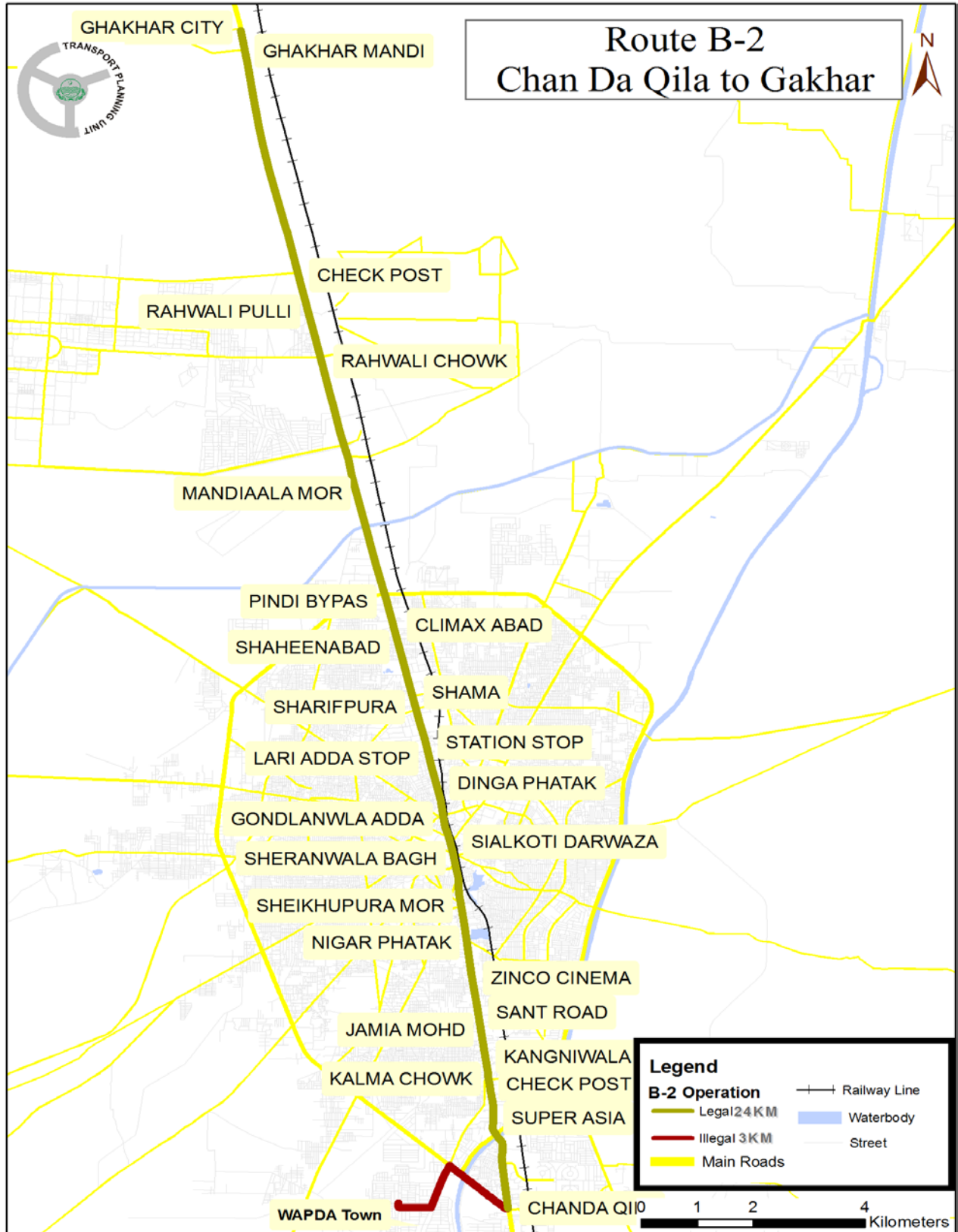


Figure 2-2: Chan Da Qilla to Ghakkar B-2 Route

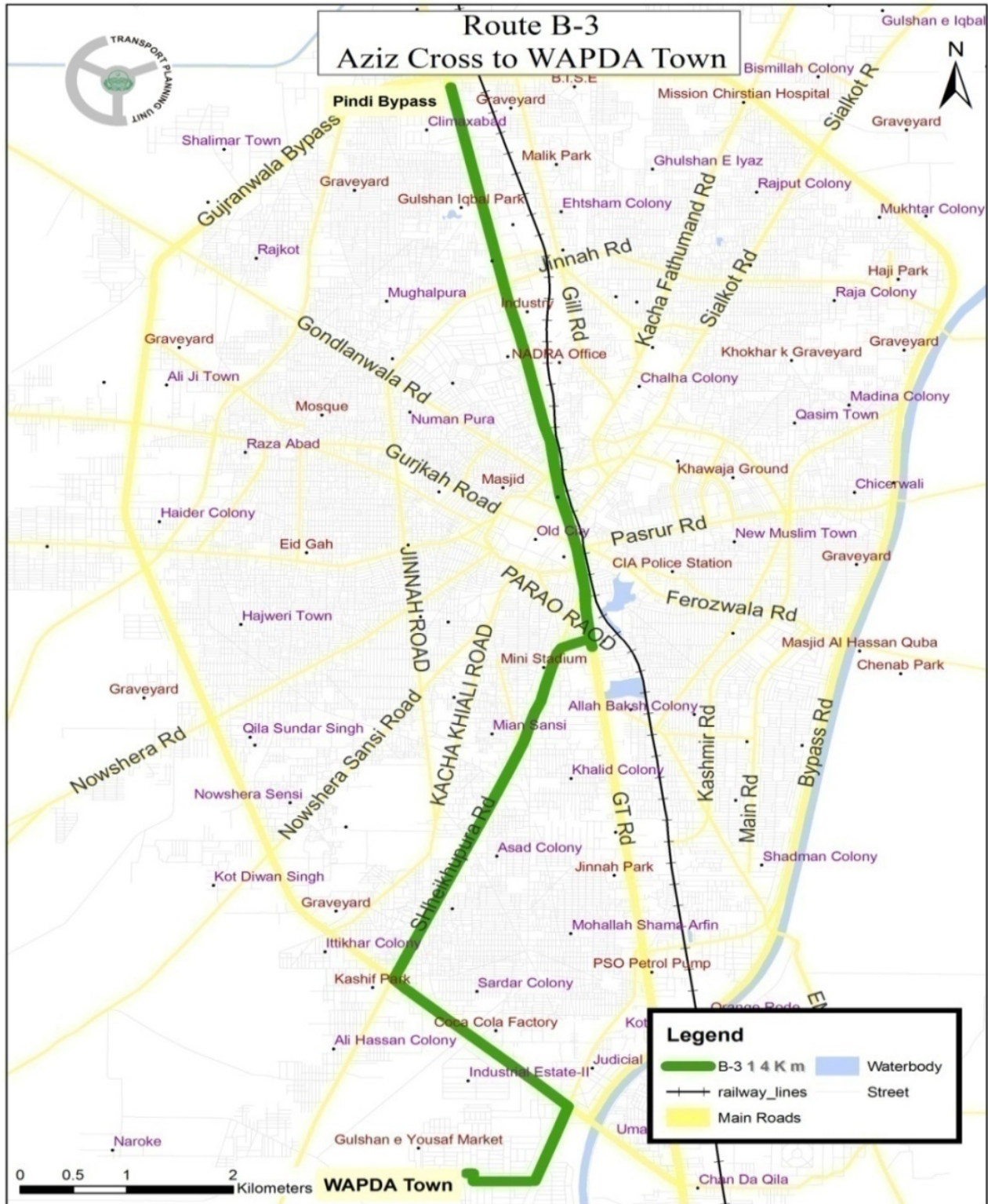


Figure 2-3: Route Alignment of Aziz Cross to WAPDA Town Bus B-3 Route

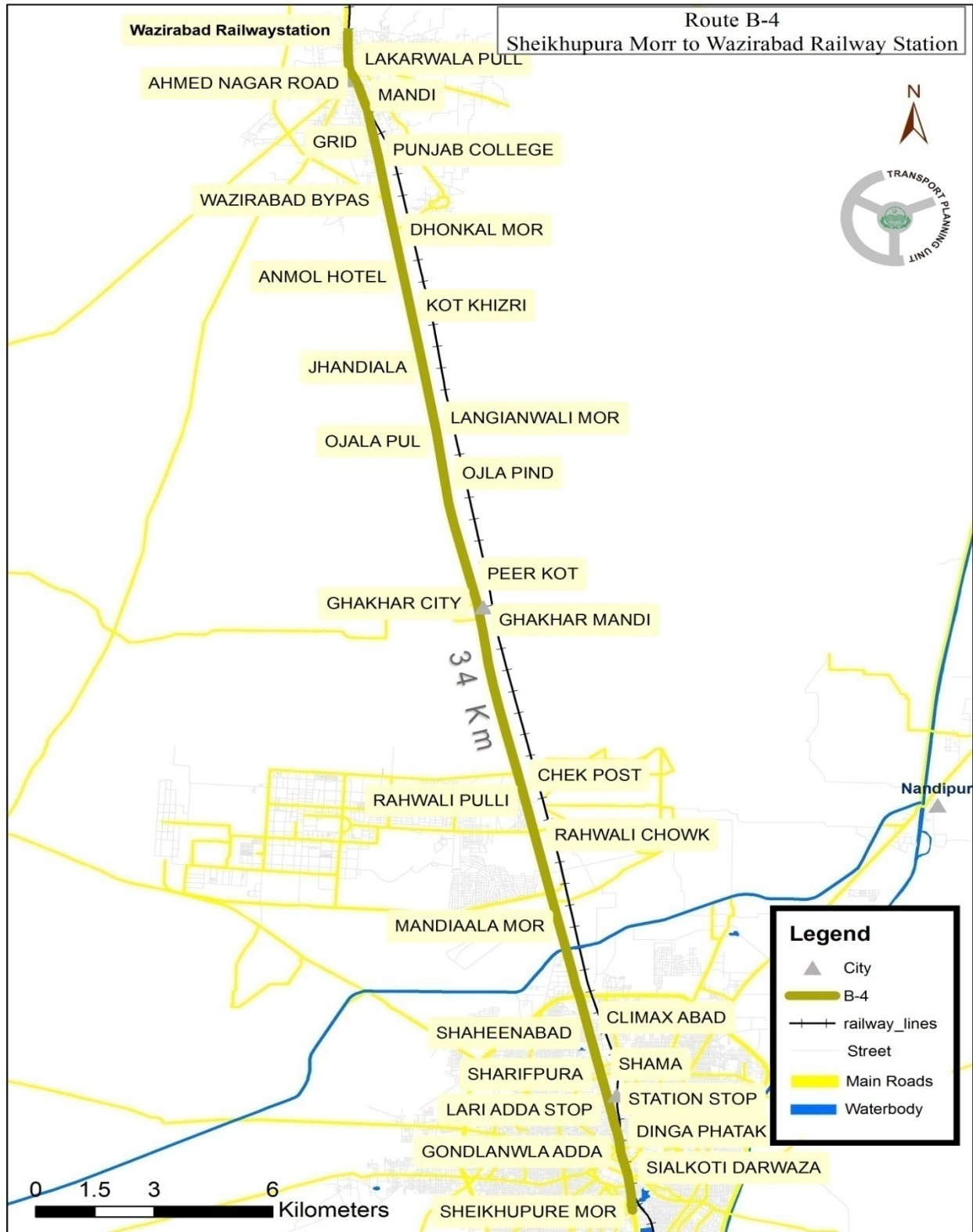


Figure 2-4: Sheikhupura Morr to Wazirabad Railway Station B-4 Route

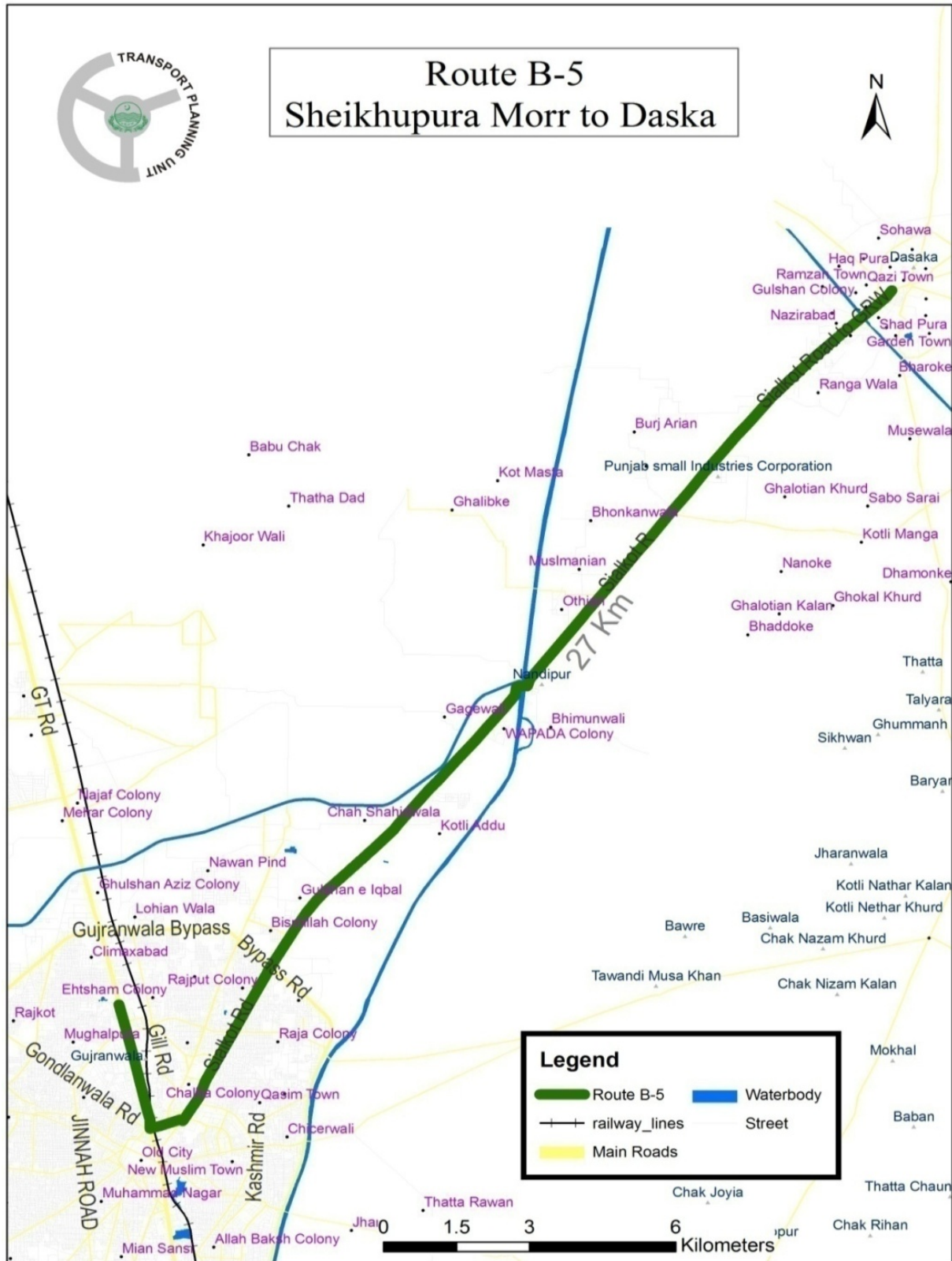


Figure 2-5: Actual Route Alignment of Gujranwala- Daska Bus B-5 Route

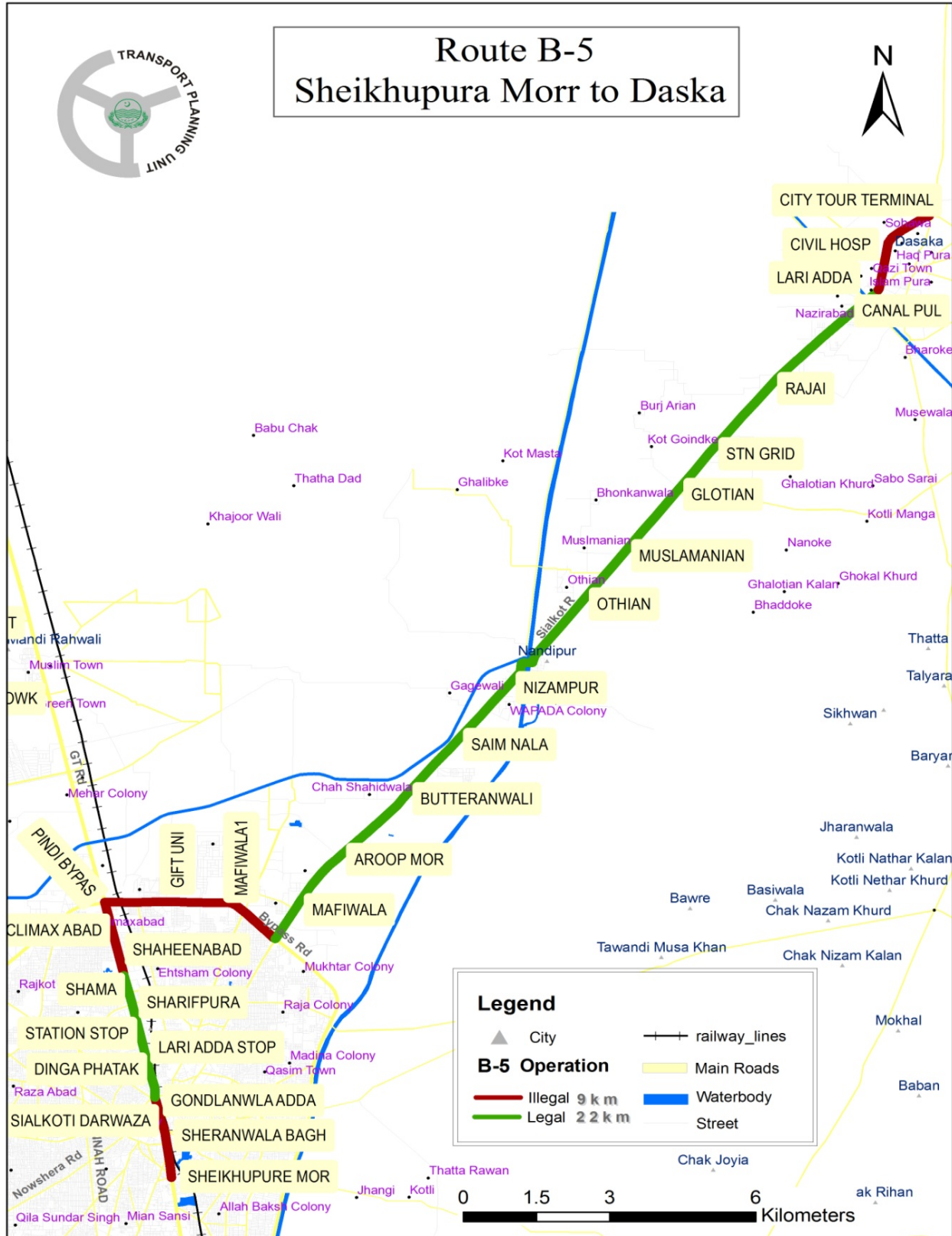


Figure 2-6: – Current Route Alignment of Gujranwala- Daska Bus B-5 Route

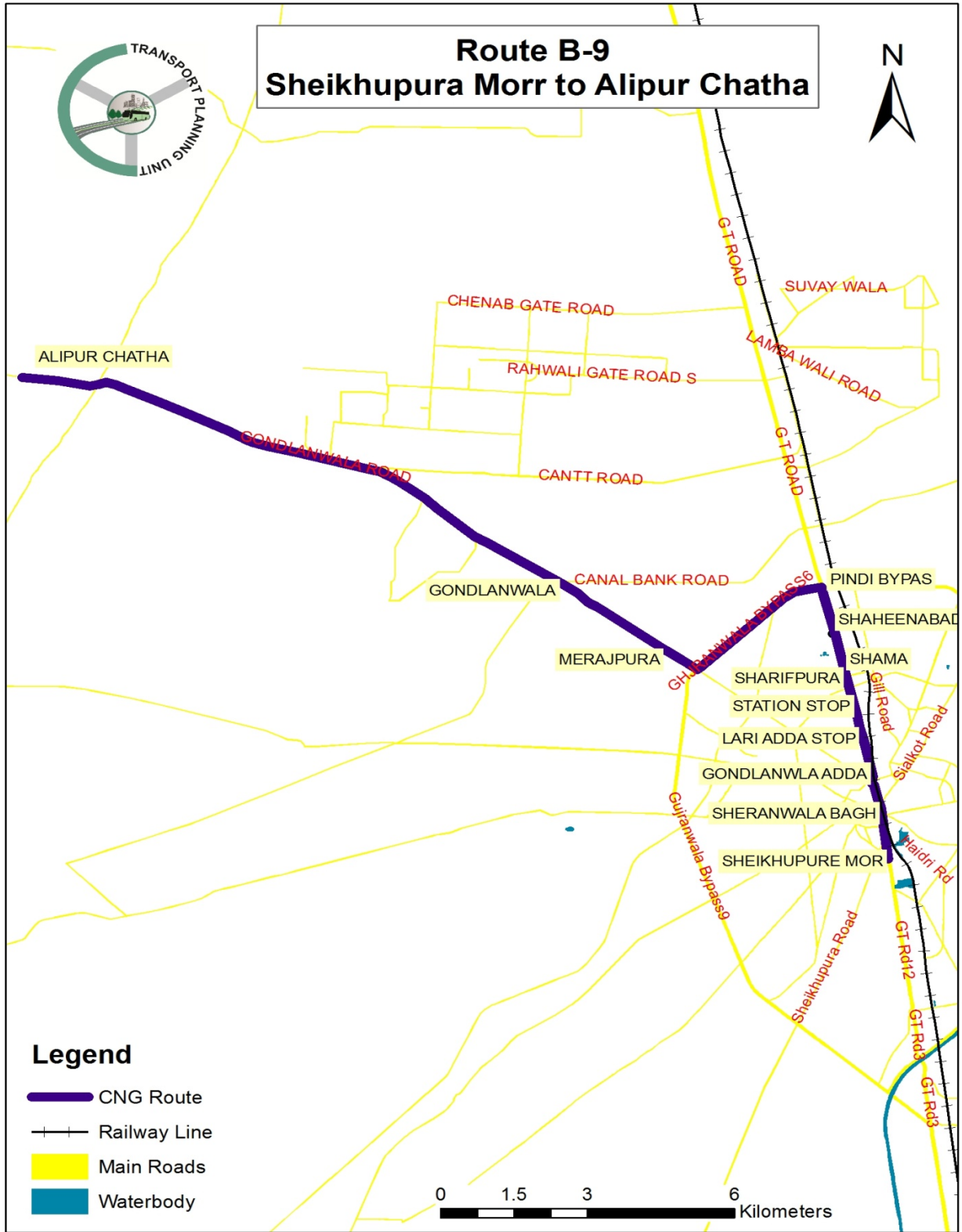


Figure 2-7: Sheikhupura Morr to Alipur Chatta Khan C.N.G Petrol Pump B-9 Route

2.5 Light Occupancy Vehicle Route

2.5.1 W-01- Sheikhpura Morr to Qila Didar Singh

There is only one wagon route in the city which operates from Sheikhpura Morr to Qila Didar Singh i.e. more of an intercity route than an intra-city route. Presently, 9 wagons are operating on this route. The route alignment is highlighted below in Figure 2-8. This more of an intercity route; however, Alam Chowk the route enters urban areas of Gujranwala city and passes through residential areas located in the East side of city so it is termed as an Intra-city Route.

Over the years, Suzukis have emerged as an alternate mode of public transport at places where either initially passenger demand was too passable to Wagon or Buses seating capacity or due to land use i.e. where in Wagons or Buses cannot operate due to limited space. Importantly, Suzukis serves as feeder service in the city and connect important land located on the periphery of the city with the CBD.

2.5.2 S-05-Jinnah Stadium to Sialkot Bye-pass via Munir Chowk, Khokhar Kee

This route operates from Jinnah Stadium to Sialkot Bye-pass via Munir Chowk, Khokhar Kee as shown in Figure 2-9 below. Presently, 14 Suzuki Ravi Loader transformed into public transport carrier operate on this route.

2.5.3 S-10-Aziz Cross to Chicherwali and S10-A-Aziz Cross to Chan-da-Qila

Two Suzuki routes operate from Aziz Cross. One route i.e. S-10 starts from Aziz Cross and terminate at Chicherwali Bye-pass as shown below in Figure 2-10. Presently more than 17 suzuki vans are operating on S-10 route. The other route i.e. S-10A initiates from Aziz Cross as its predecessor and terminates at Chan-da-Qila Bye-pass as shown in Figure 2-11. Presently 21 suzuki vans are operating on S-10A route.

2.5.4 S-11-More Aminabad to Aminabad Toan

This route operates from More Aminabad to Aminabad Toan. Presently, 8 Suzuki Ravi Loader transformed into public transport carrier operate on this route.

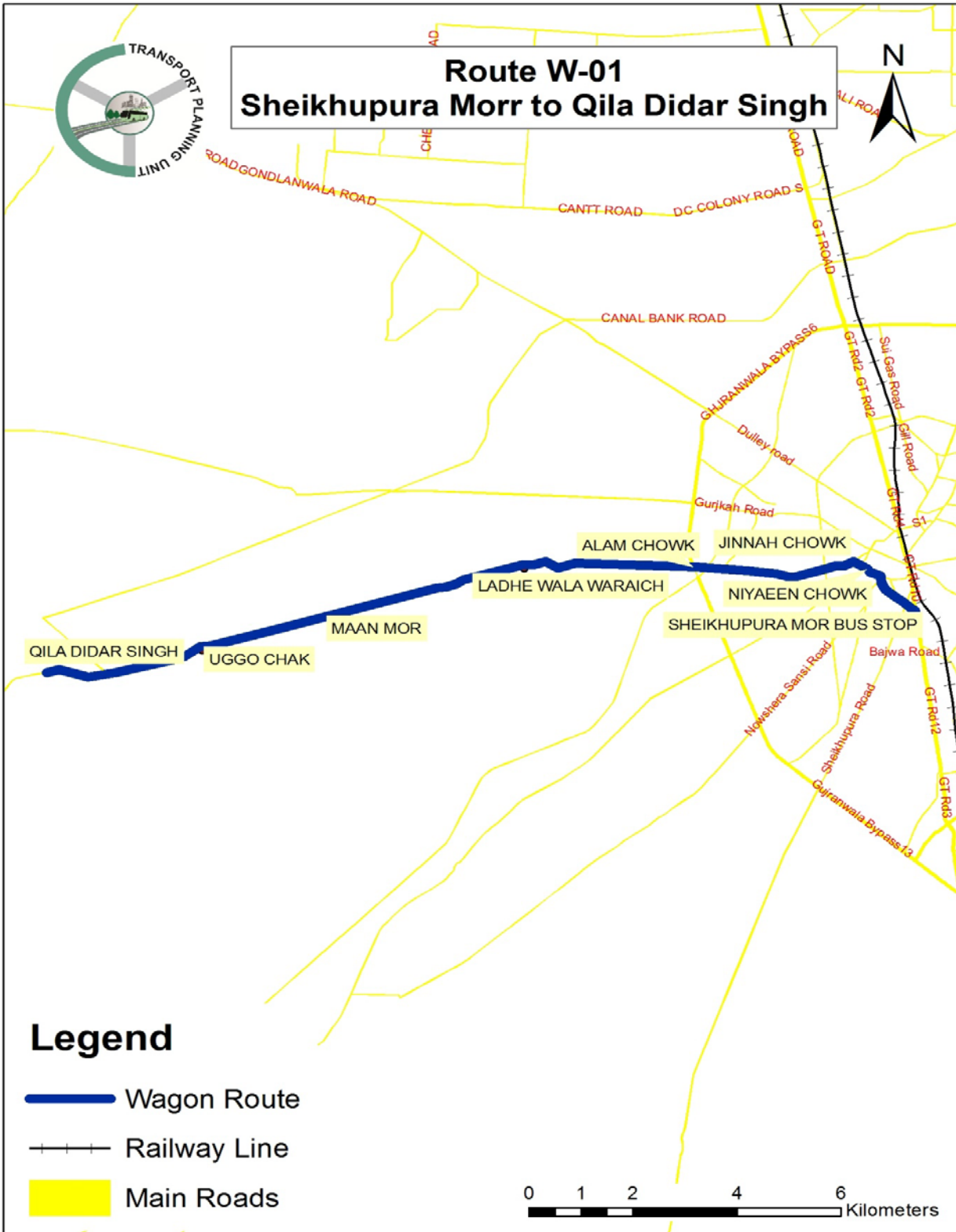


Figure 2-8: Sheikhupura Morr to Qila Didar Singh W-01 Route

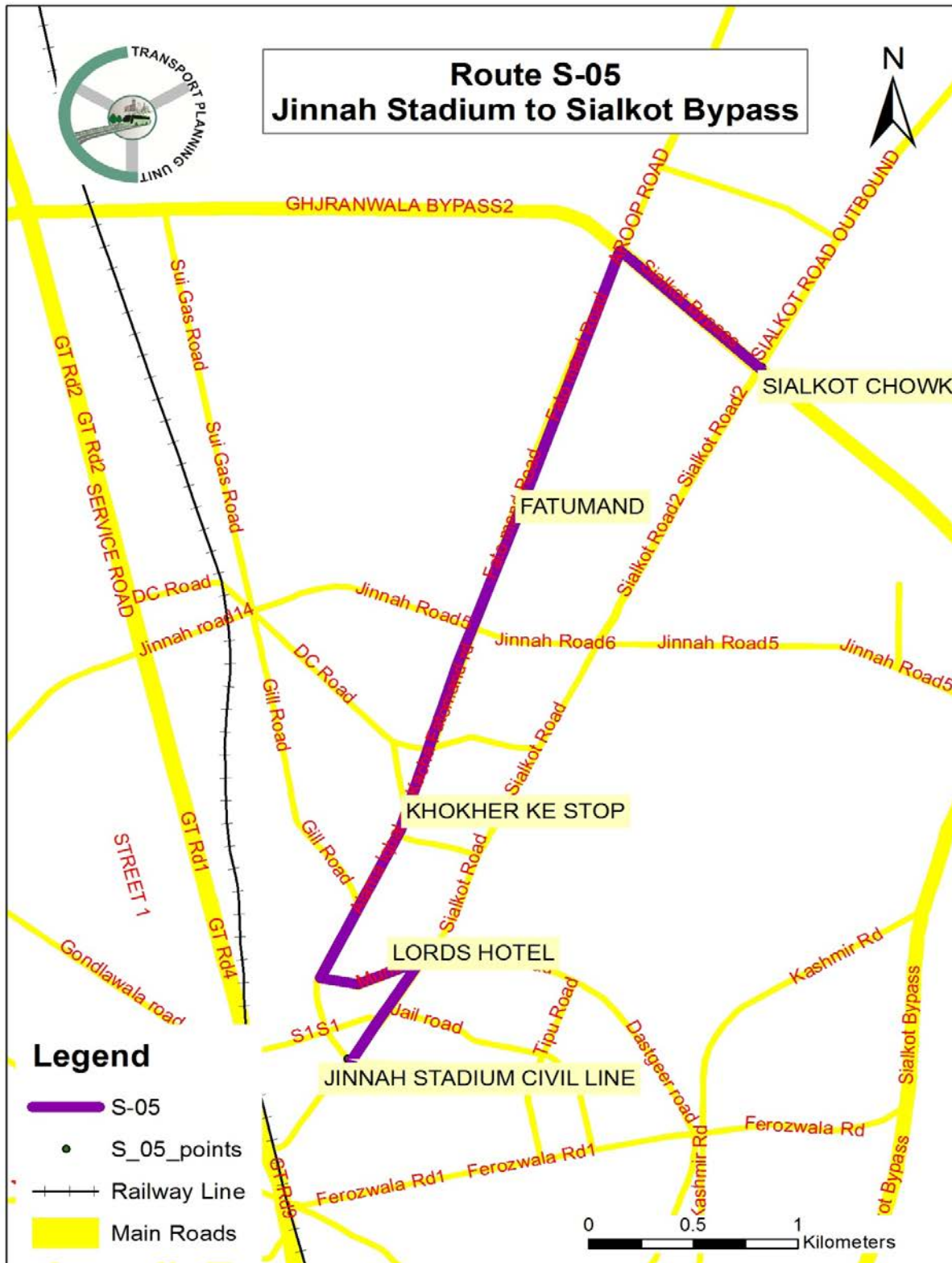


Figure 2-9: Jinnah Stadium to Sialkot By-pass S-05 Route

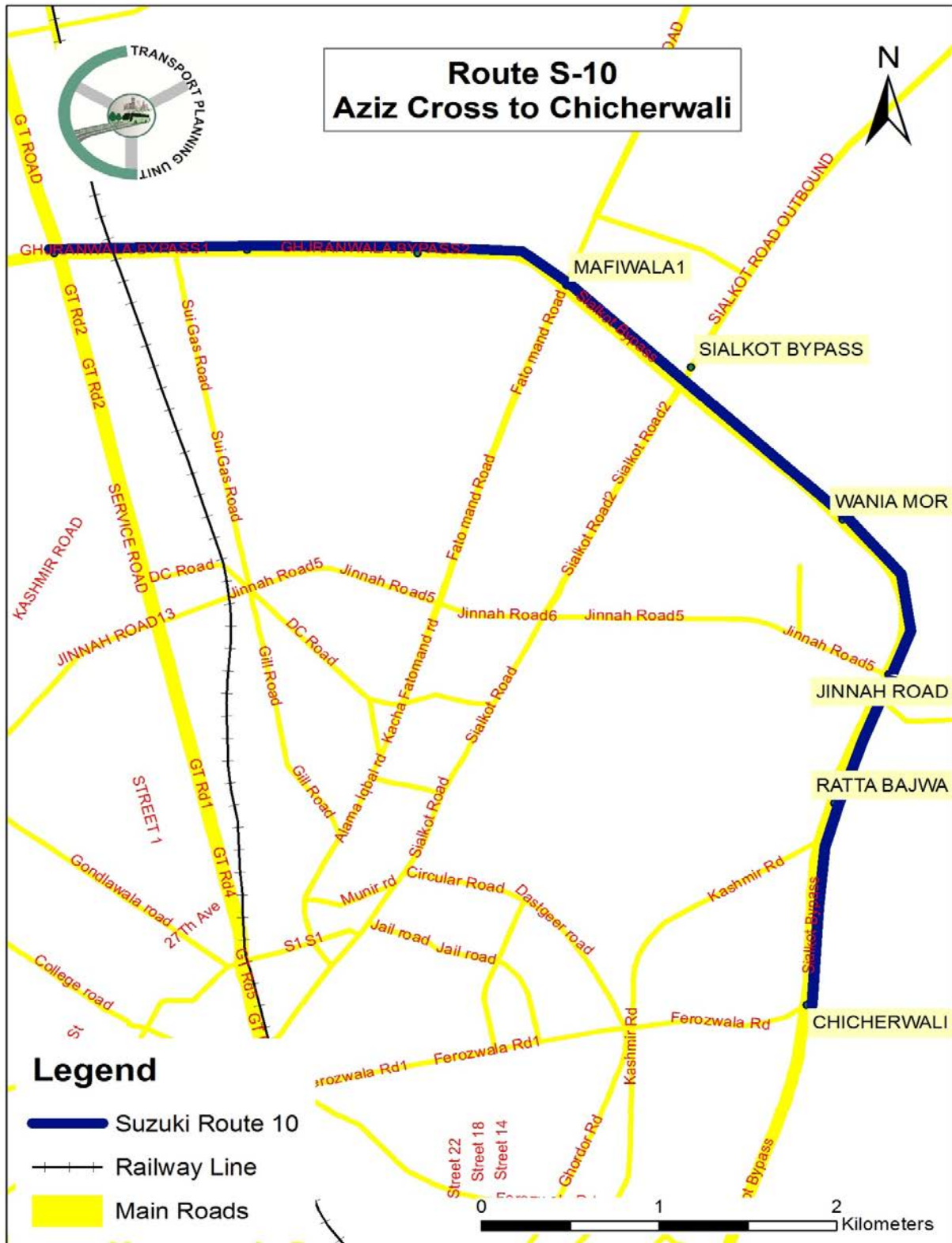


Figure 2-10: Aziz Cross to Chicherwali S-10 Route

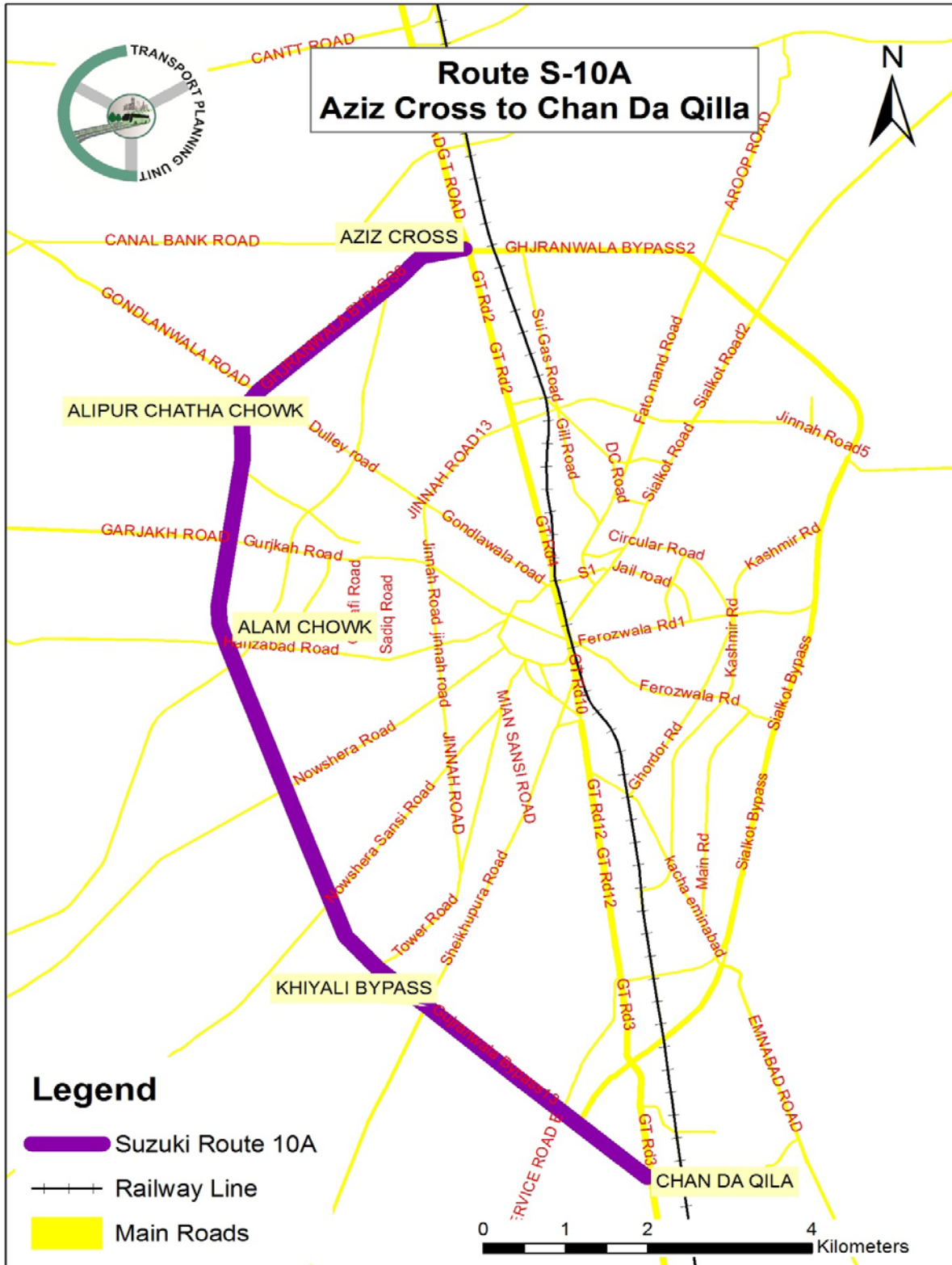


Figure 2-11: Aziz Cross to Chan Da Qilla S-10A Route

2.6 NON-OPERATIONAL ROUTES AND THEIR CHARACTERISTICS

2.6.1 B-6-Behari Colony to Rahwali Cantt

Behari and Peoples Colony have high population density. Moreover other commercial activities in the markets places occur near these areas. However, this route is currently non-operational due to the following reasons;

- An underpass below the railway line is constructed with low vertical clearance, moreover; inadequate geometric design and right of way i.e. width and turning radius at one end also restricts the access and egress of high roof vehicles.
- At grade railway crossing along the underpass has inadequate right of way and cause traffic jams during train movements.
- Number of schools and colleges are located along this route. Traffic congestion is usually observed during peak hours around the underpass and surrounding locations resulting in long stoppage time for heavy vehicles
- 80 percent of the route length overlaps with the other operational routes except the small portion from Peoples Colony Morr to Behari Colony.

The above mentioned circumstances discourage HOV operators to operate buses on this route. The traffic conditions at Nigar phatak and underpass will get even worse if HOV operations are permitted at this location. The route alignment of B-6 is shown in Figure 2-12.

2.6.2 B-7-Zamindara Stand to Dharam Kot Chowk

Pasrur Road is an important link connecting G.T road with Gujranwala-Sialkot Bypass. Some section of Pasrur Road in the city area is newly constructed. Bus operations along this route are observed initially but inadequate 'U' turnings near Zamindara stand, the users' attitude restricted the operations. The route alignment of B-7 is shown in Figure 2-13.

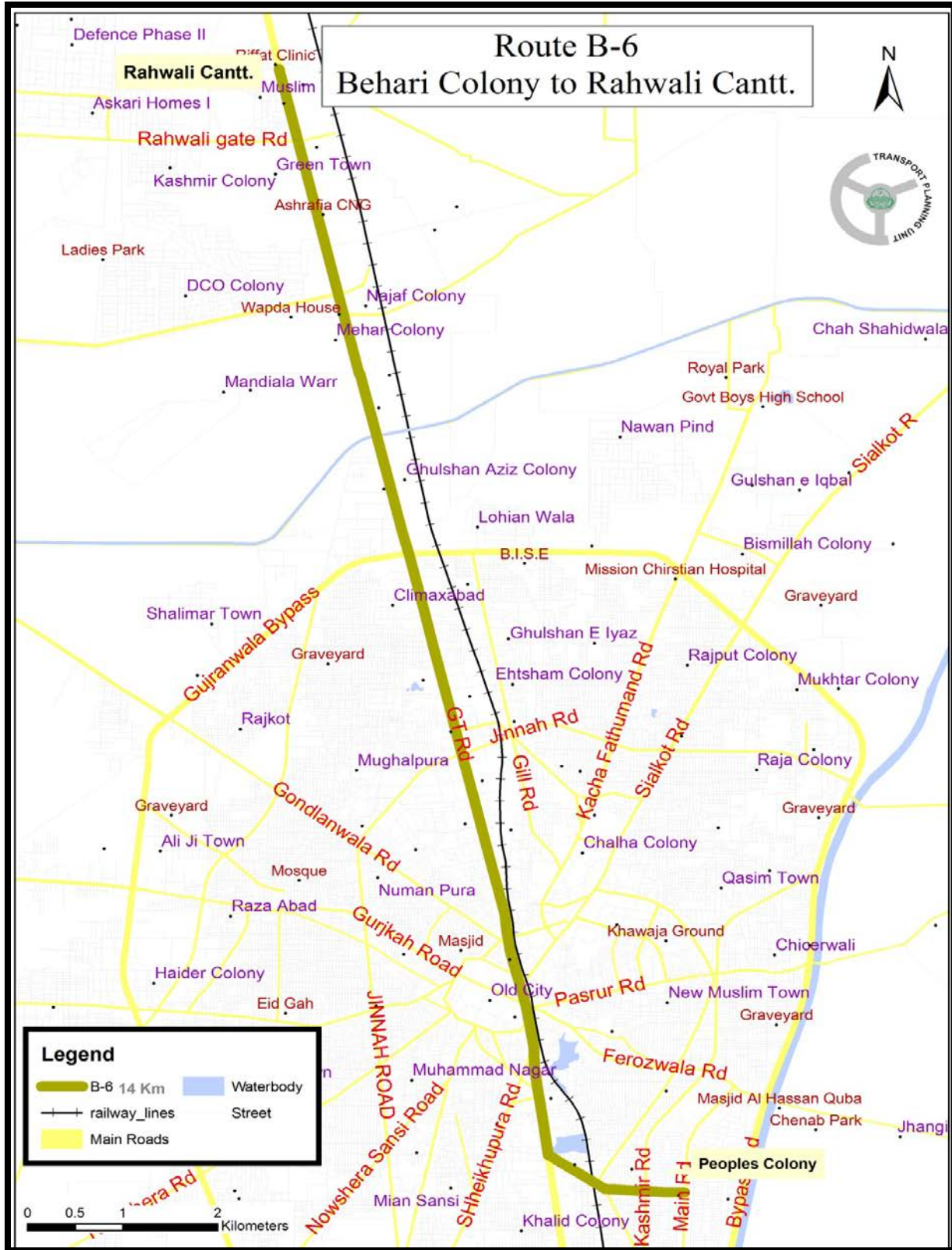


Figure 2-12: Behari Colony to Rahwali Cantt B-6 Route

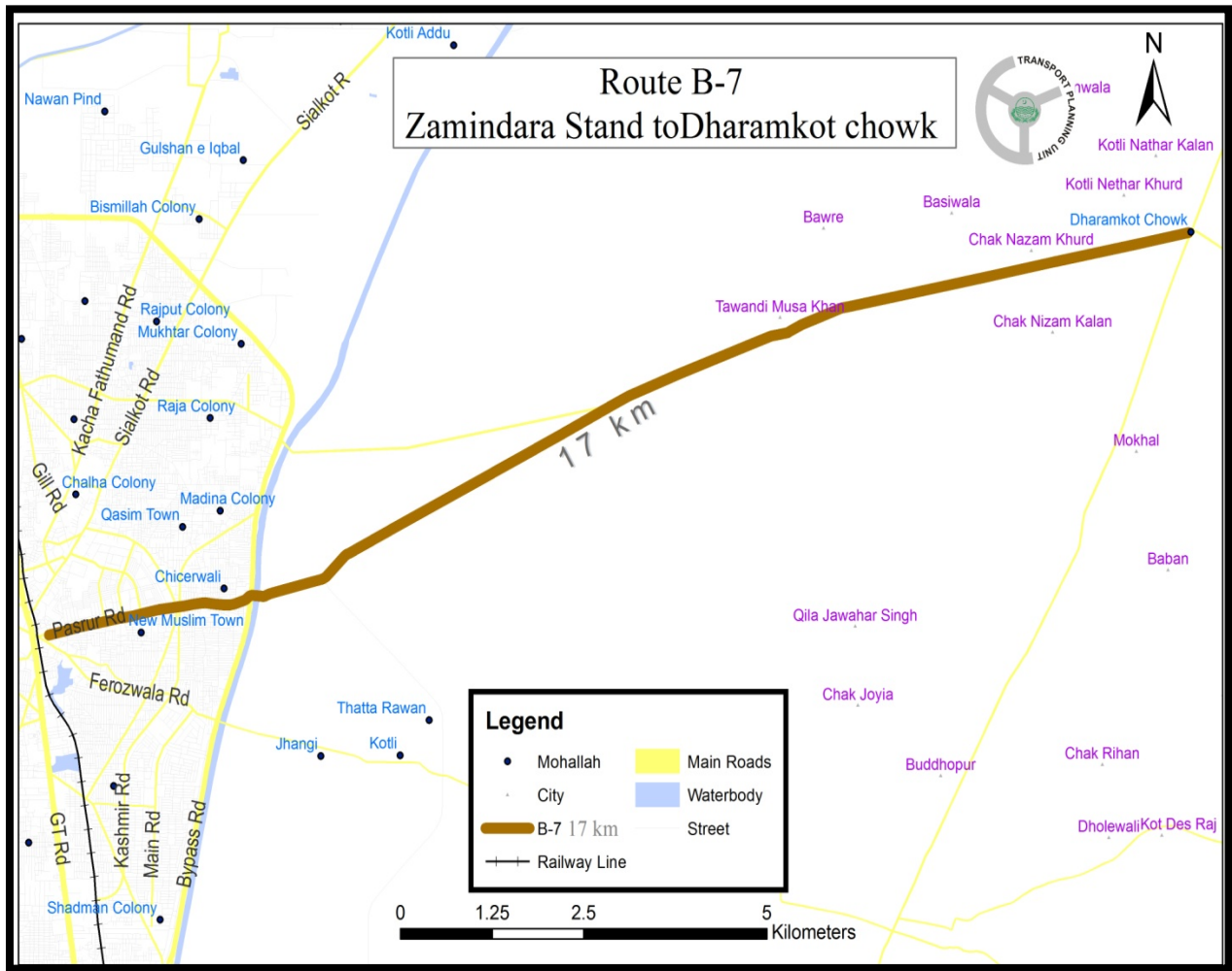


Figure 2-13: Zamindara Stand to Dharam Kot Chowk B-7 Route

2.6.3 B-8-Tatley Aali to Aziz Cross

Tatley Aali is densely populated village on Gujranwala-Sheikhupura road. Most of the route length overlaps with B-3 route except some portion from Khiali chowk to Tatley aali. Currently the NHA overhead bridge construction is underway at Khiali chowk which makes this route non operational. Figure 2-14 shows the route alignment of B-8 route.

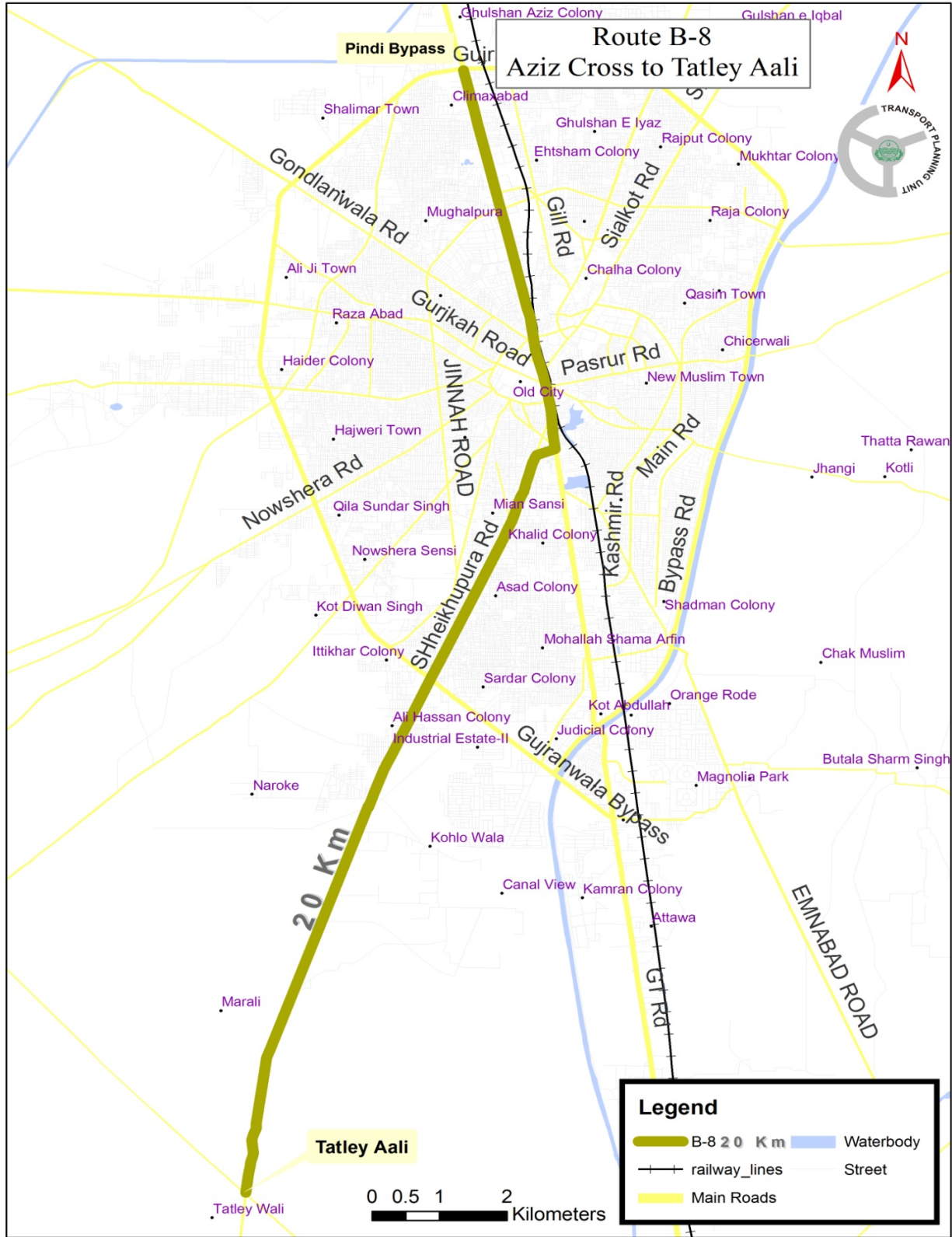


Figure 2-14: Aziz Cross to Tatley Aali B-8 Route

3 ANALYSIS OF PUBLIC TRANSPORT SYSTEM IN GUJRANWALA

3.1 PUBLIC TRANSPORT USER PERCEPTION SURVEY

3.1.1 SAMPLE SIZE

A sample size of 1% of daily average ridership i.e. 45,000⁴ has been considered for the underlying study. To ensure adequate stratification, various age groups were consulted, and data was collected during peak and off-peak hours, weekdays and weekends. In total, 450 survey forms were distributed; however 439 forms were returned. The filled forms were analyzed through statistical tools Microsoft Excel and SPSS.

3.1.2 Gender

Males and females both were interviewed with an aim to obtain and record perception/ view/ response from both the groups using public transport. Figure 3-1 highlights that among the users, 85% are male and 15 % are female users. Evidently, male use public transport more than women, which is identical to prevailing transport patterns in any city of the province.

⁴ Public Transport Surrences (2012) – Transport Planning Unit

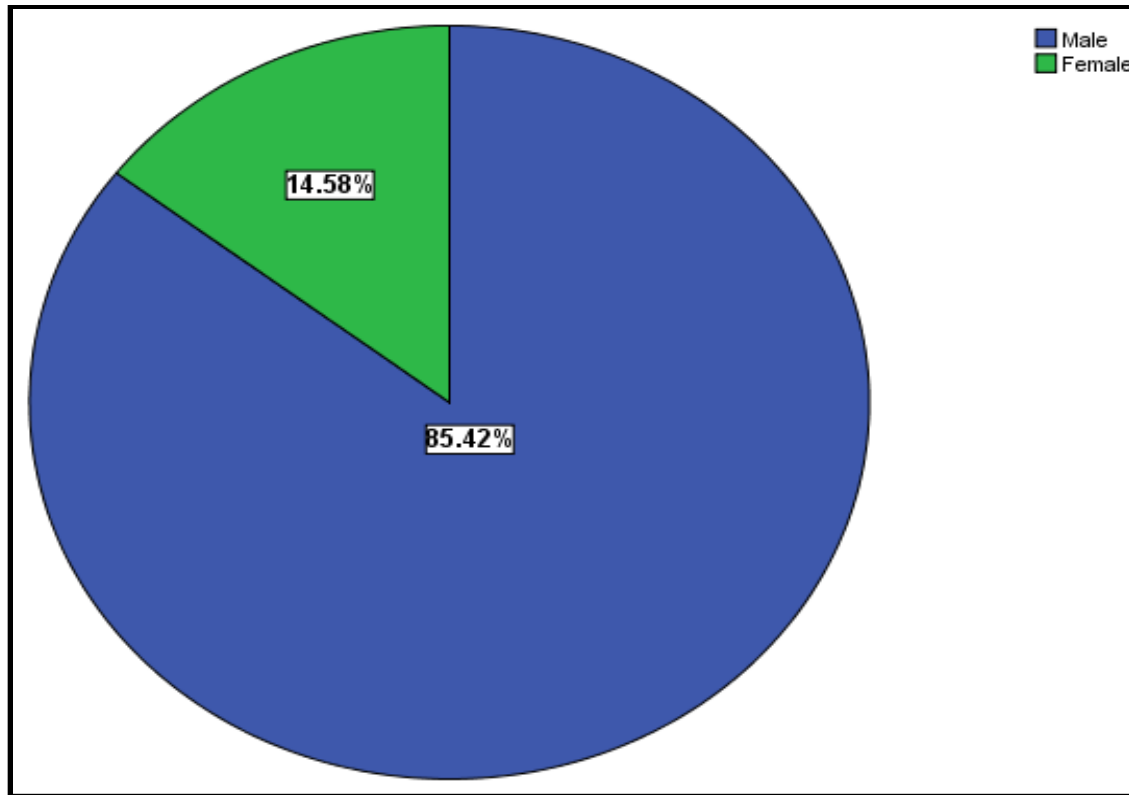


Figure 3-1: Male and Female Percentage among Commuters

3.1.3 Age

The survey conducted also included question regarding age of users of public transport. The purpose was to identify the dominant age groups who mostly use public transport in the city. This will help to provide required public transport infrastructure as per these groups needs. The most dominant group identified during survey has an age of 20 to 40 years (Figure 3-2). They constitute around 50% of the total public transport users with respect to age groups.

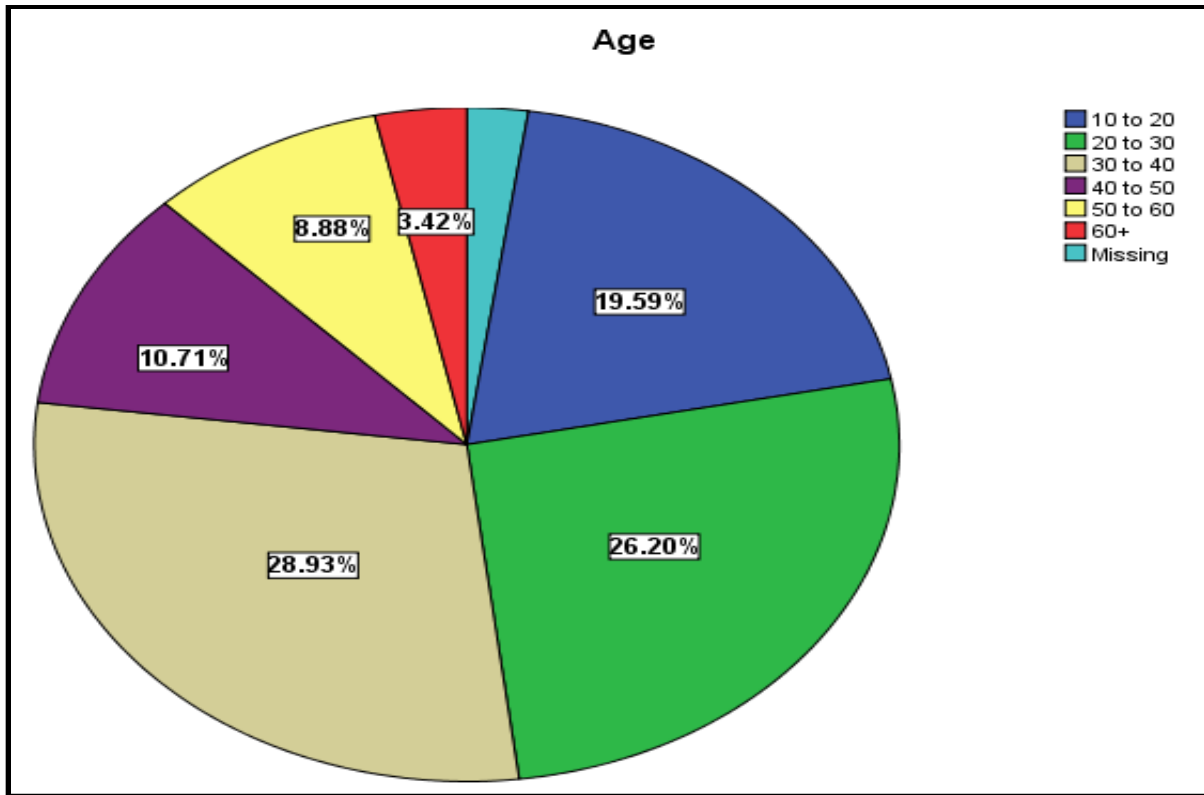


Figure 3-2: Age Distribution of Commuters

3.1.4 Personal Income/month

Personnel income has a direct relation with the usage of public transport. Figure 3-3 below highlights that 19.82% of the public transport users have income less than Rs. 5,000. Likewise, households having monthly income between Rs. 5,000 and 10,000 are 20.27% and households having monthly income between Rs. 10,000 and 15,000 are 5.69%; this clearly depicts that the public transport in the city is mostly used by low income households. Contrary, a significant number of middle income households i.e. 25.97% use public transport which indicates that potential of public transport is huge in the city.

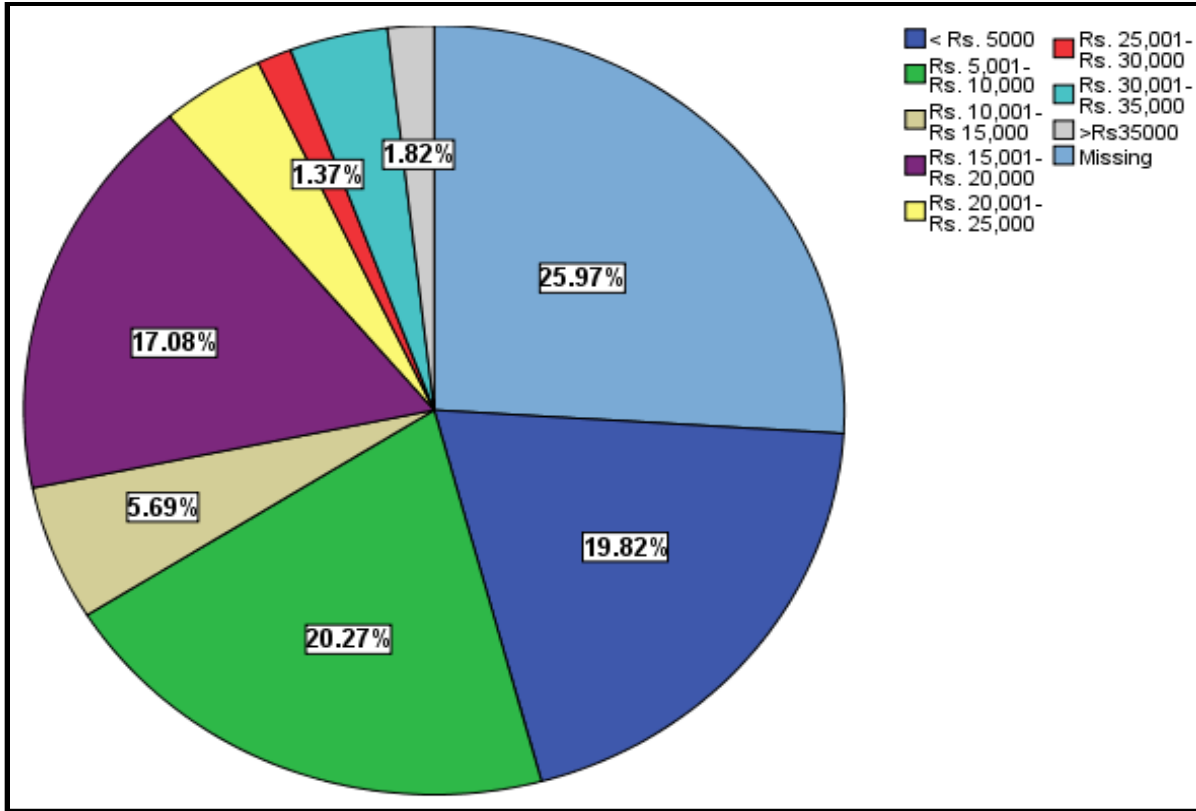


Figure 3-3: Income Distribution of the Commuters

3.1.5 Occupation

Queries regarding occupation of the public transport users were also made during the survey. This was important for establishing the demand for the public transport fleet during the hours of the day. Household belonging to Service, Sales mostly use public transport. Likewise, a large number of students use public transport to access their desired activity locations as highlighted by Figure 3-4 below.

3.1.6 Purpose of Trip

Trip purpose is one of the important factor contribute in the selection of mode. Public Transport users were asked about the purpose of their trips. It was highlighted that most of people use public transport for accessing their work places as shown in Figure 3-5 below. It is evident that home, work, education and shopping trips making most of the public transport usage in terms of trip making.

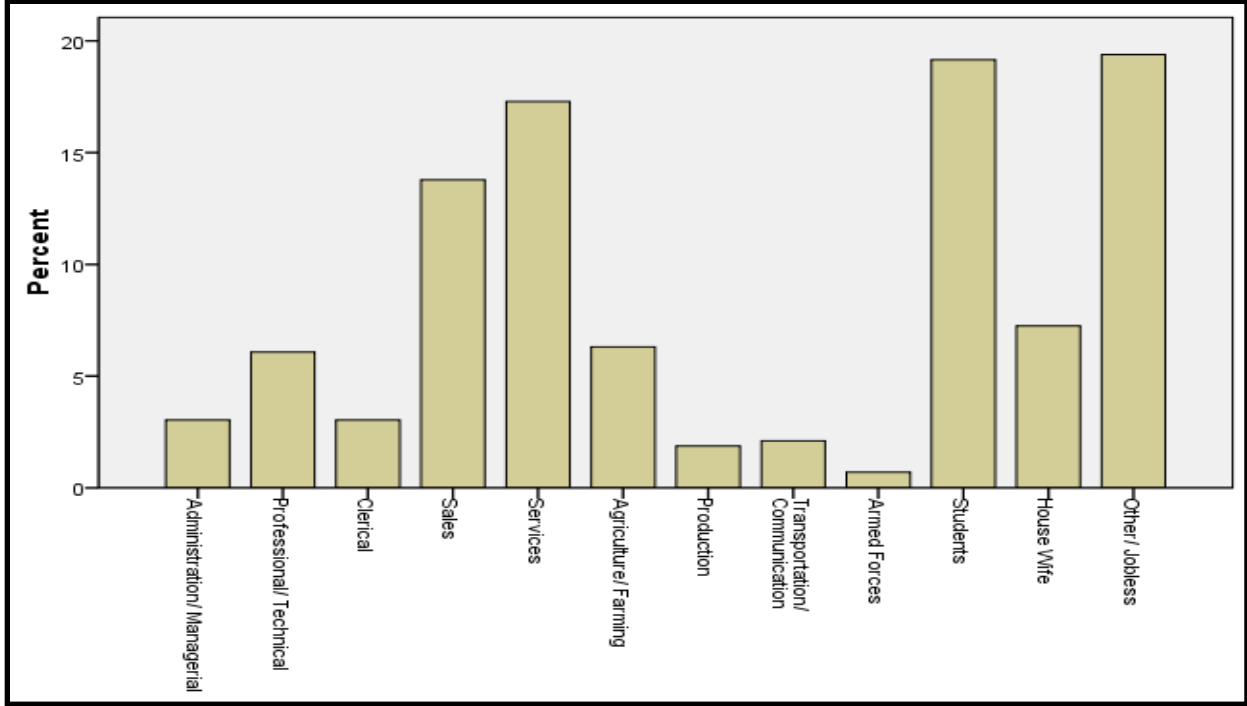


Figure 3-4: Occupation Distribution of the Commuters

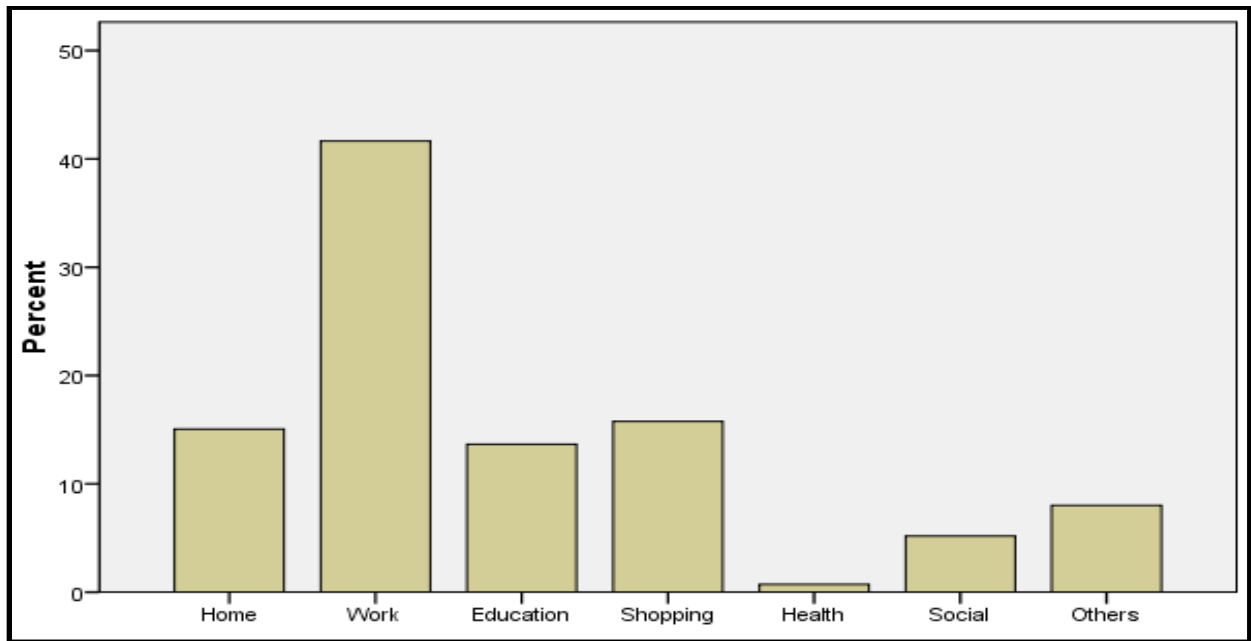


Figure 3-5: Purpose of Trips made by the Commuters

3.1.7 Frequency of Public Transport Utilization

Importantly, around 48.06% of the household use public transport everyday for accessing their desired locations whereas 17.08% of the household use the service once in a week as shown below in Figure 3-6. Evidently, there is a huge demand of public transport in the city.

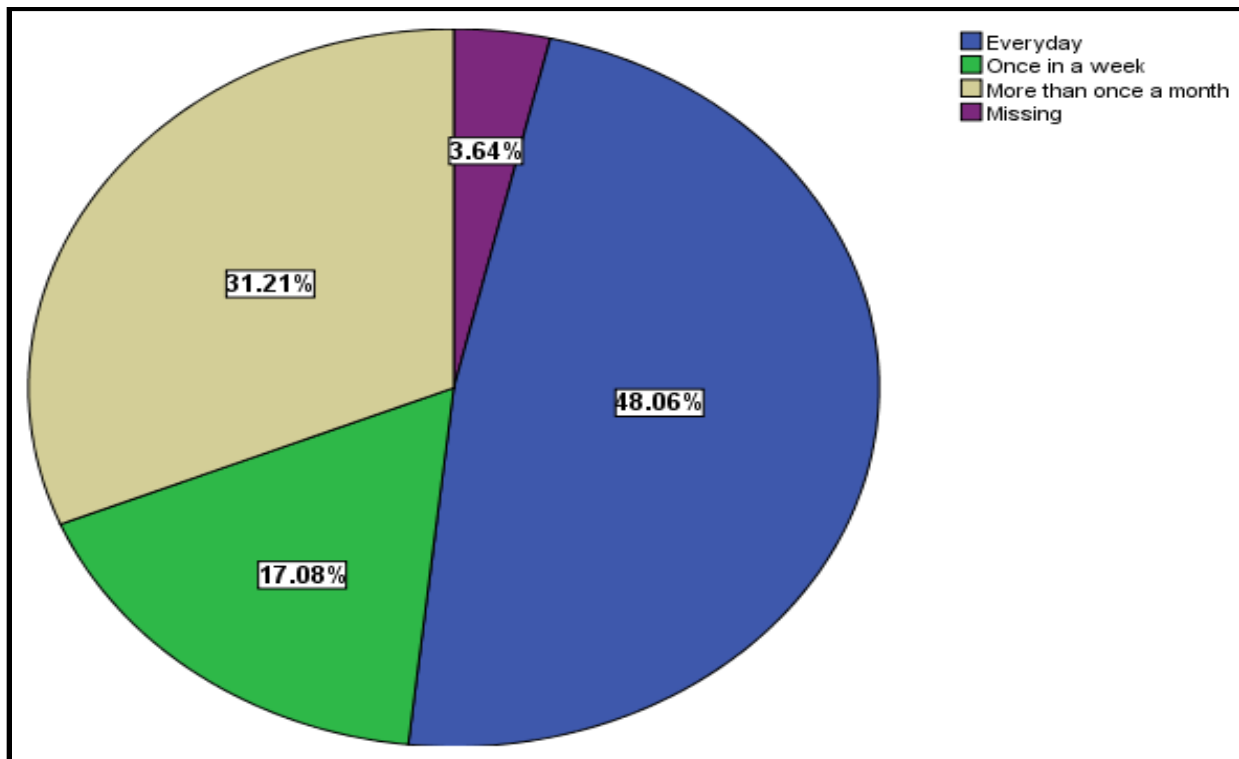


Figure 3-6: Frequency of Public Transport Utilization

3.1.8 Private Vehicle Access

Almost 50% of people who use public transport don't have access to private vehicle own vehicle. Out of 50% of people who stated that they have access to private vehicle, Further 30% of people stated that the vehicle is owned by one member of their family and in case of non-availability, they have to opt for alternate modes of transport to access their desired activity locations.

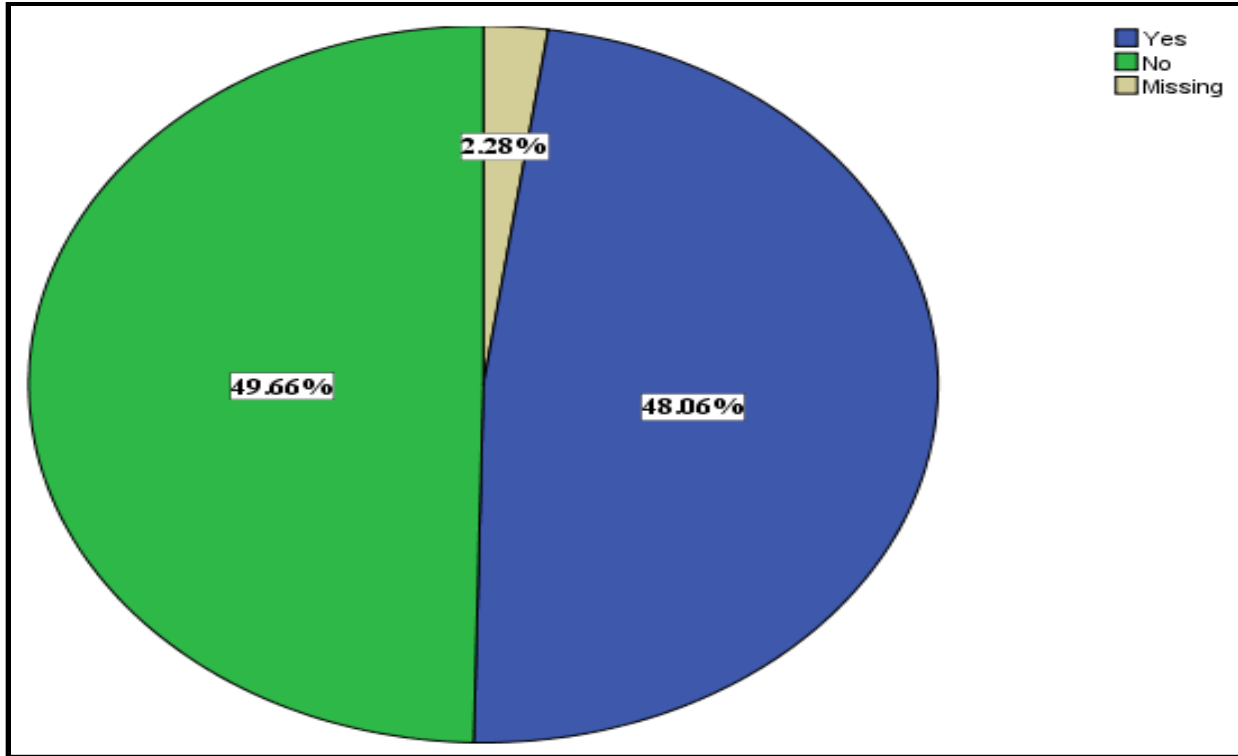


Figure 3-7: Private Vehicle Access among the Commuters

3.1.9 Reasons for Not Using Public Transport

This question was included to examine the factors / causes that compel people to use private transport. Results shown in Figure 3-8 reveal that availability and affordability are the major factors that attract people towards the use of private transport. Importantly, affordability here refers to motorcycle not private cars. The respondents were of the opinion that motorcycle allows flexible mobility patterns i.e. vehicular access from the residence doorstep to desire destination with least cost; thus making motorcycle more affordable than public transport.

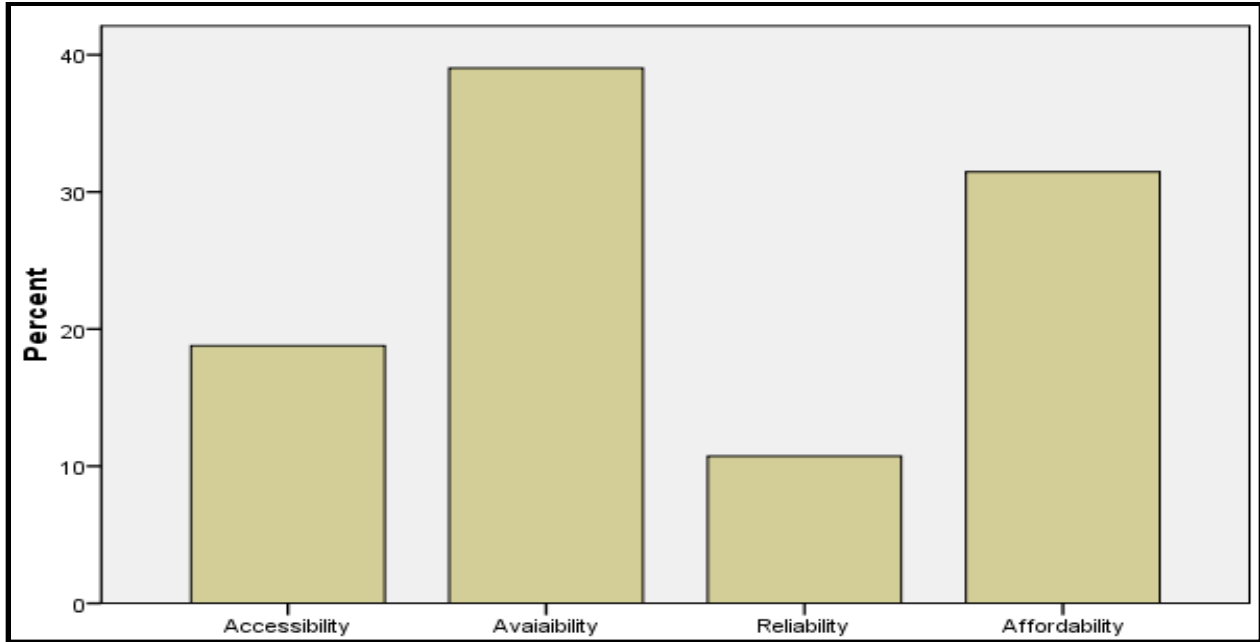


Figure 3-8: Reasons for of Public Transport over Private Transport

3.1.10 Perception regarding Network/ Route System of Public Transport

Perception regarding Network/ Route System is very important to evaluate the efficiency of a public transport network. Figure 3-9 reveals that almost 33% people are of the opinion that route alignment of public transport system is neither good nor bad. But on the other hand about 40% people are of the opinion that the prevailing system route alignment is bad. When asked for this opinion, respondents stated that all HOV routes follow GT Road a primary corridor bisecting the city into two halves whereas residential areas are not located along the GT Road; which creates problems in terms of accessibility.

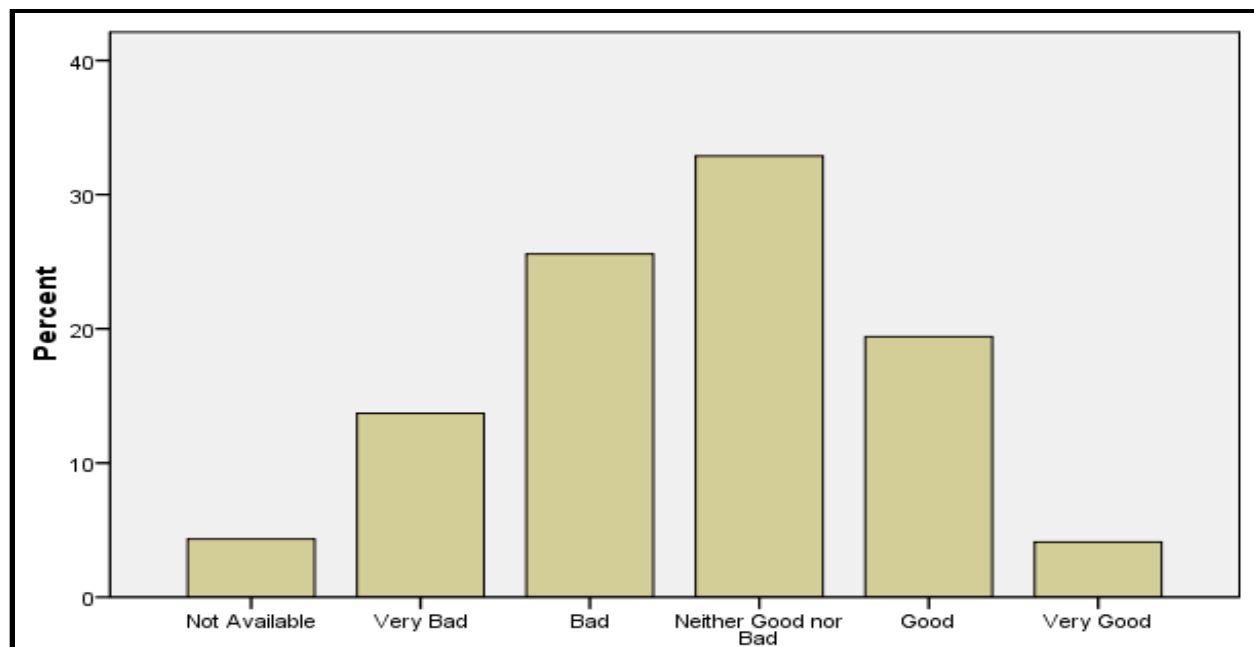


Figure 3-9: Perception regarding Network/ Route System of Public Transport

3.1.11 Operating Hours of Public Transport

Operating hours of public transport is critical for the efficiency assessment of any prevailing public transport network. Operating hours should be according to the needs and travel patterns of the people while keeping in view the efficiency and operational requirements i.e. equity for all should be adhered and where trade off has to be made; then beneficiaries must be people. A mix response was observed by the Respondents (Figure 3-10) as they were of the opinion that operating hours of existing public transport are neither good nor bad. It is because the frequency of using public transport during a day is singular i.e. people use public transport to access their work places and in off-Peak hours prefer to use alternate mode of transport. The afore-mentioned statement is augmented by the fact that around 40% people rated the operations hours bad.

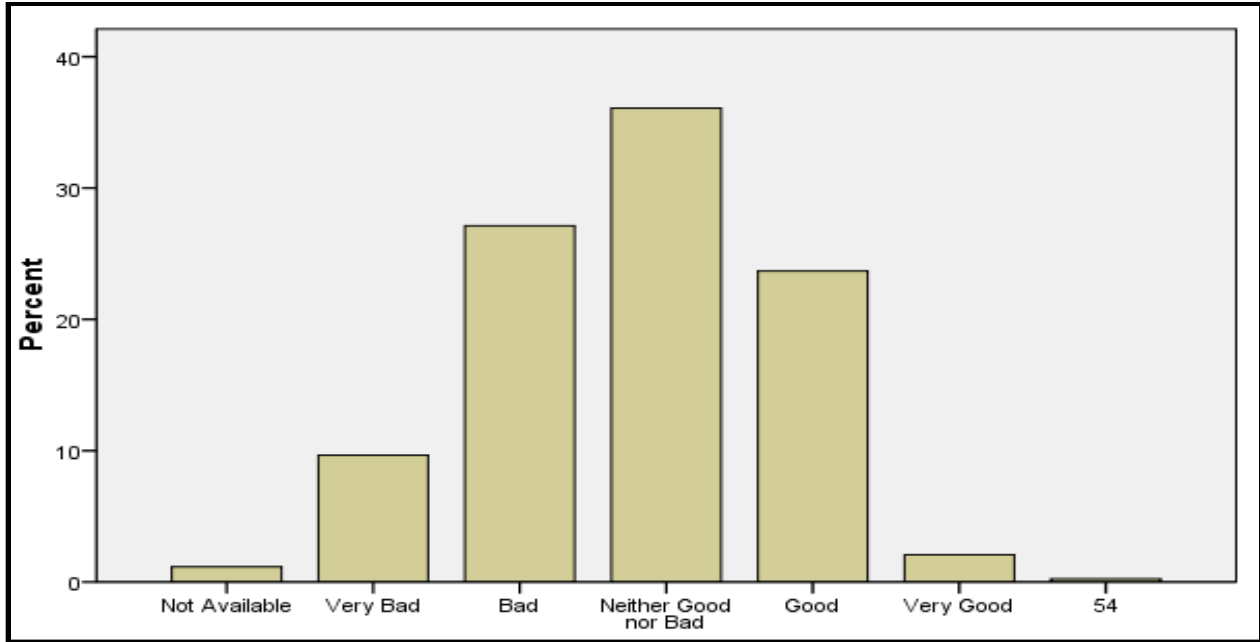


Figure 3-10: Perception about Operating Hours of Public Transport

3.1.12 Frequency of Public Transport

One of the important factors contributing towards efficiency of any public transport system is its frequency on any route. Figure 3-11 reveals perception regarding frequency of the public transport service in the city. Around 40% of the respondents were of the opinion that service frequency is bad and does not correspond with their journey needs. Likewise, more than 30% people replied that neither the service good nor bad as they are not dependent on the public transport system. The opinions of the commuters are augmented by the fact that apart from HOV service, LOV service operates in the city on the basis of full seat i.e. the LOV only leave its origin once the all the seats of the vehicle are occupied no matter how long commuters have to wait for full occupancy.

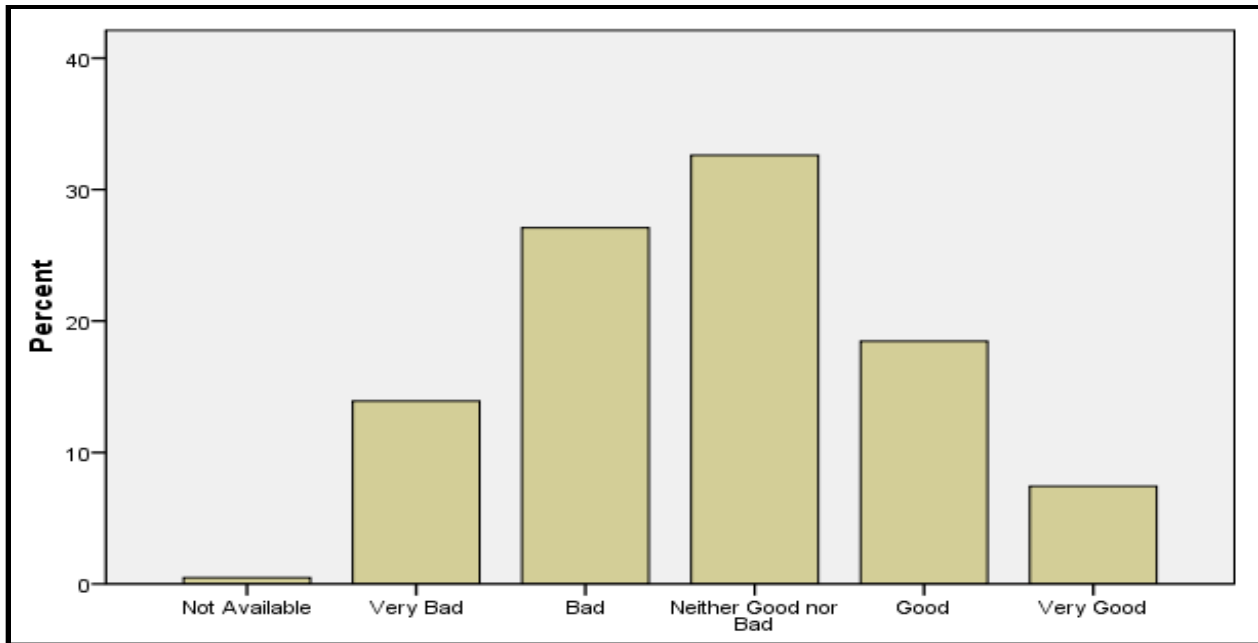


Figure 3-11: Perception about Public Transport Frequency

3.1.13 Safety and Security Arrangements

Public transport users were probed regarding safety and security arrangements and hazards related to public transport. Around 52% people responded with bad or very bad regarding the safety condition as shown in graphical view in Figure 3-12.

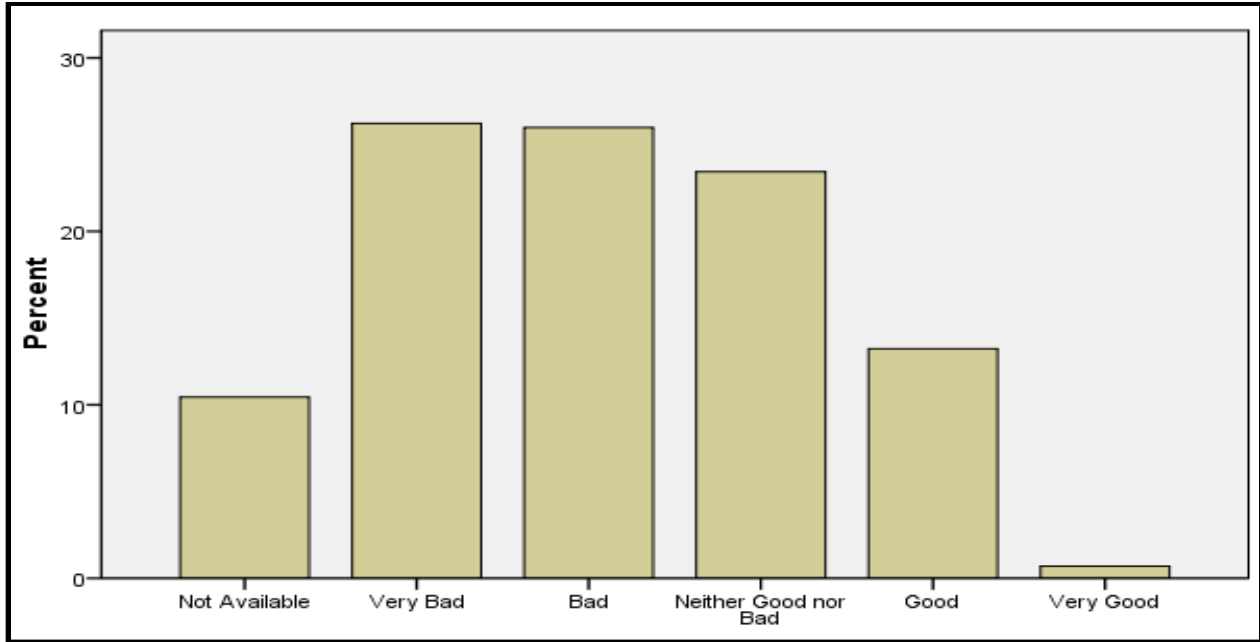


Figure 3-12: Perception about Safety and Security Arrangements

3.1.14 Access to Bus Stop

Accessibility plays an important role in public transport network efficiency and sufficiency. The prevailing accessibility levels to desired activity locations through public transport are termed as bad. Though a majority of respondents had neutral opinion (Figure 3-13) in this regard but when further inquired they stated that they do not rely on public transport. Also, Qingqi have enhanced their mobility as it always available from their door step. In terms of people mobility though Qingqi has facilitated people however being a non-efficient, unsafe and environmentally adverse mode of transport threatens and creates negative externalities for HOV and LOV public transport system.

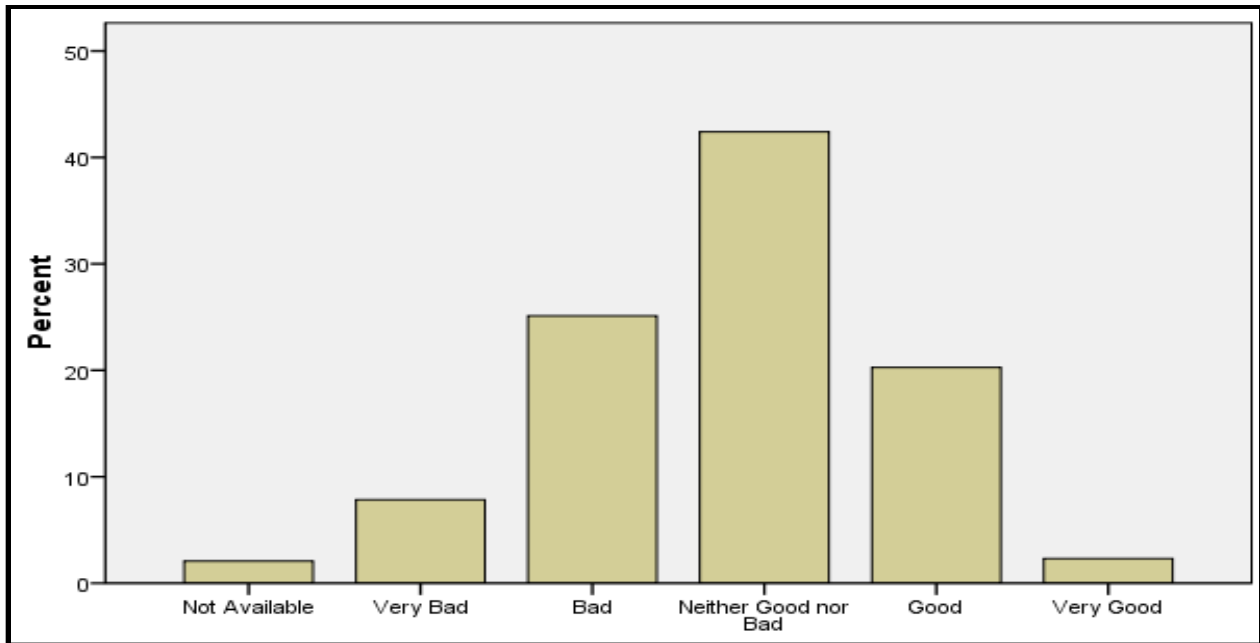


Figure 3-13: Perception about Accessibility to Public Transport Network

3.1.15 Bus Stop Facilities

Bus stop plays an important role in people mobility as it integrates land use with the transport network. Public transport users had adverse perception (Figure 3-14) about facilities available at the bus stops. It is because there does not exist any bus stop with all the requisites in the city; although, CDG has constructed some bus stops with stops signs however these also lack in terms of timetable, light, security etc..

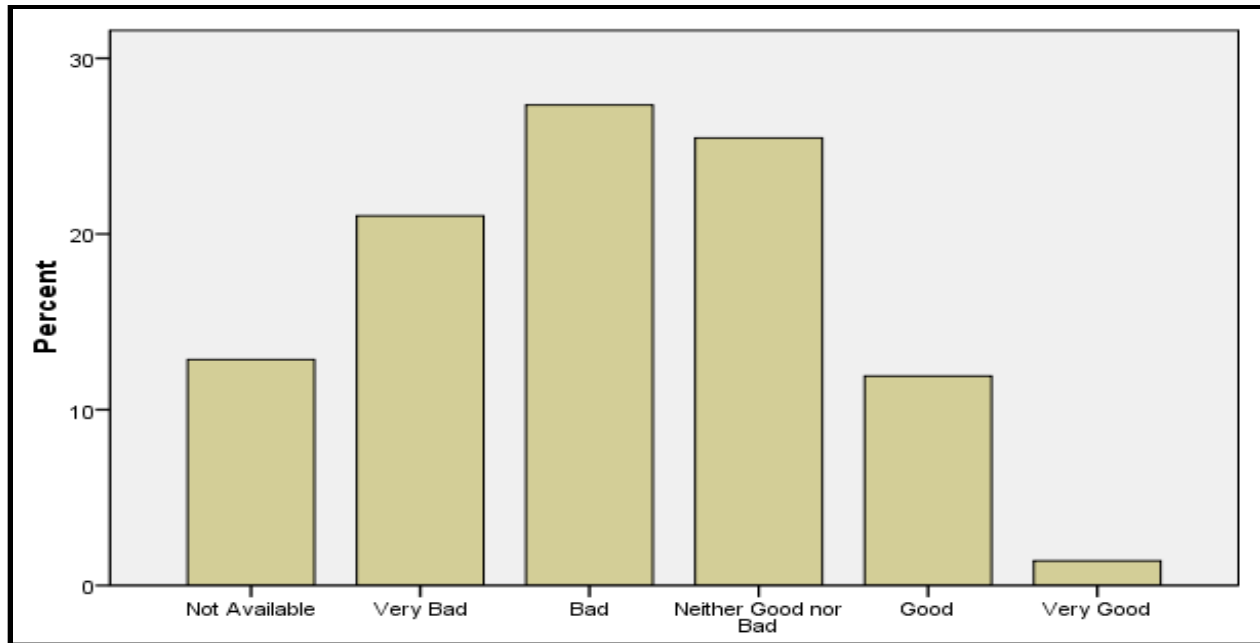


Figure 3-14: Perception regarding Bus Stop Facilities in the City

3.1.16 Comfort and Convenience Offered by the Public Transport

Comfort and Convenience is very crucial for developing people trust regarding public transport system efficiency and sufficiency. Figure 3-15 reveals respondents' perception regarding comfort and convenience offered by the public transport system in the city. According to respondents, the prevailing public transport system does not offer comfort and convenience. It is because the seating arrangements, no of standing and sitting passenger in a vehicle, cleanliness, punctuality and driving behavior all creates hurdles and discomfort for the commuters.

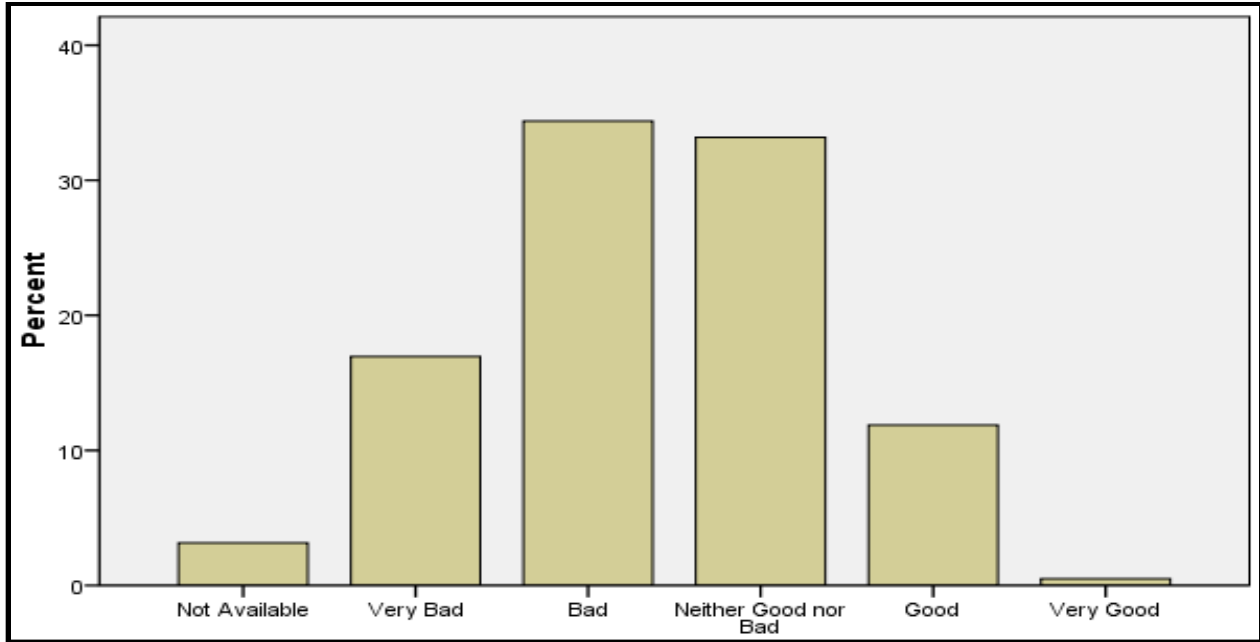


Figure 3-15: Comfort and Convenience Offered by the Public Transport

3.1.17 Convenience of Transfer of Public Transport

One of the significant factors influencing mode choice between public transport and private vehicle is convenience of transfer. Figure 36 highlights the response of the respondents regarding transfer convenience offered by the public transport system in the city. Around 40 % people responded (Figure 3-16) the transfer facility bad or very bad. It is because both HOV and LOV network in the city almost follow an identical alignment i.e. G.T road in the city. In addition, those routes which are devised to connect other parts of the city with the CBD mostly operate on the periphery of the city instead of connecting residential areas with the major commercial, educational and industrial land use.

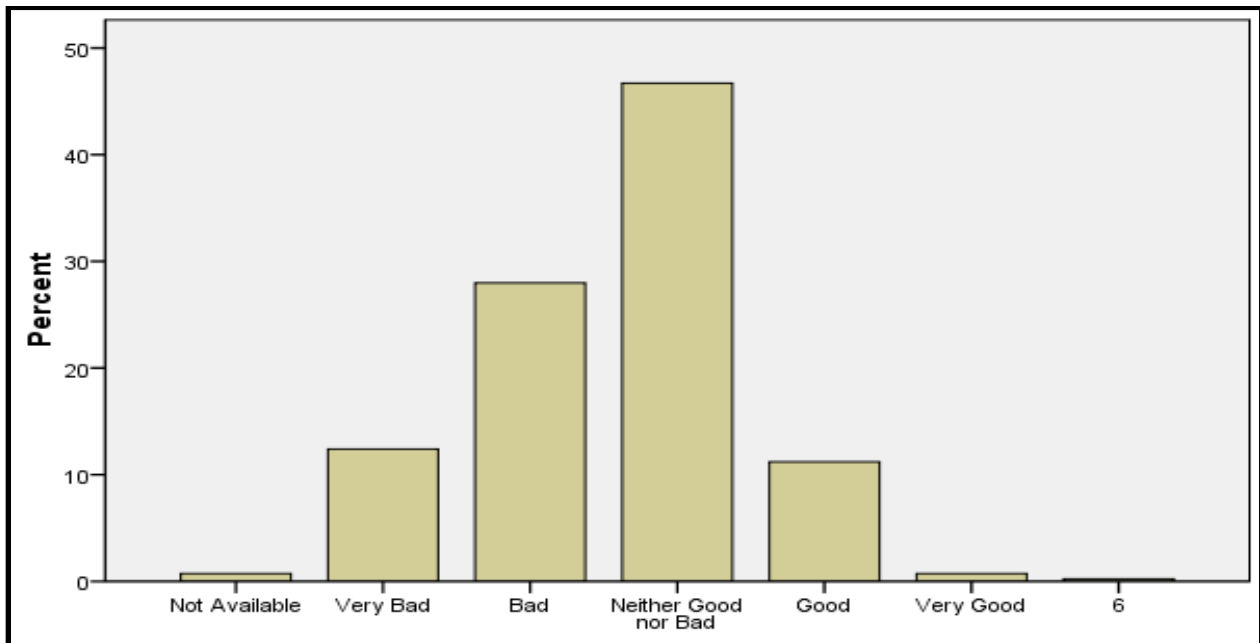


Figure 3-16: Convenience of Transfer offered by the Public Transport System

3.1.18 Important factors contributing towards Improvement of Public Transport

The public transport users were surveyed to assess their perceptions about different factors which needs improvement and can contribute in efficiency of the public transport system. Respondents (Figure 3-17) were of the opinion that route system i.e. network alignment, safety, operating hours and fare structure are the most important factors which require improvements in order to enhance the efficiency of the public transport system prevailing in the city.

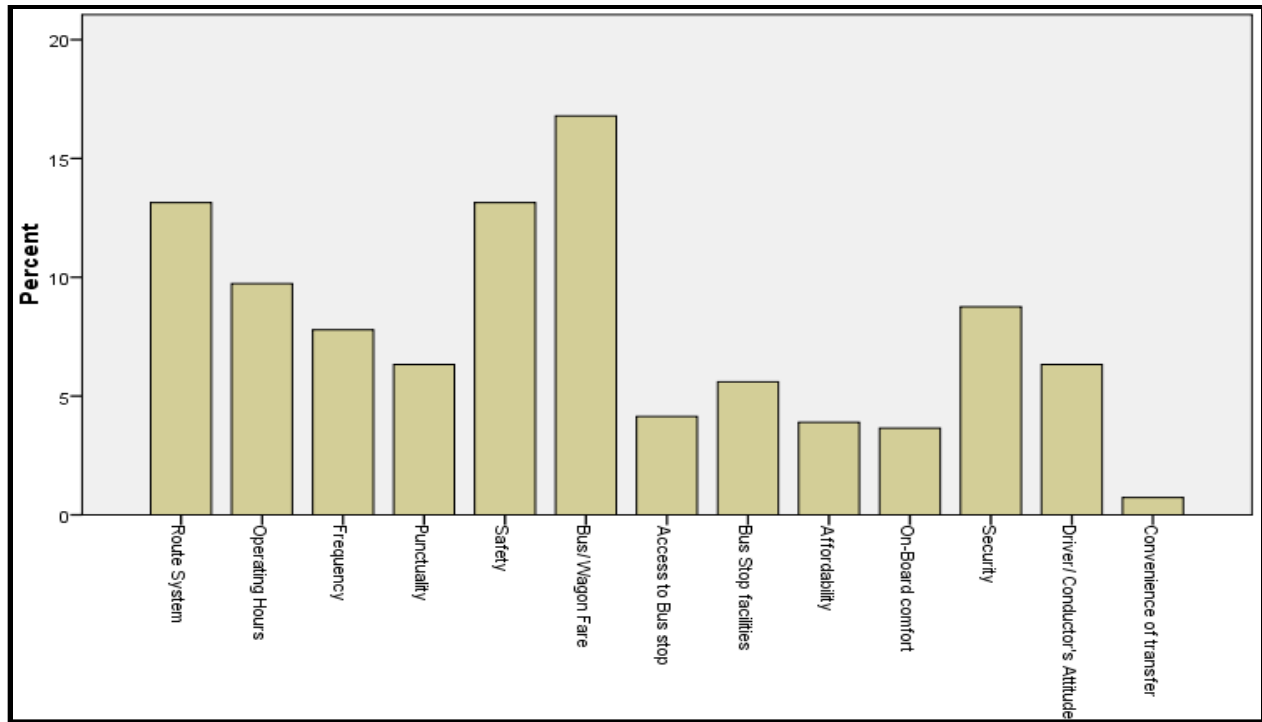


Figure 3-17: Important factors contributing towards Improvement of Public Transport

3.2 Illegal PUBLIC Transport Operations

Illegal public transport operation is the major issue that directly affects the legal public transport operations and sustainability in the city. A survey was conducted to assess illegal public transport operations in the city. The survey helped to determine number of illegal boarding along G.T Road, Gujranwala through Qingqi rickshaws and modified illegally designed Auto rickshaws, intercity wagon services violating intercity operations. The following key locations were selected to estimate the illegal boarding trend in the city. The location and percentage share by illegal modes is shown in Figure 3-18 below.

- Chan Da Qilla
- Sheikhupura Morr
- Sheranwal Bagh
- Sialkoti Darwaza
- Gondlanwala Adda
- General Bus Stand
- Aziz Cross (Pindi bypass)

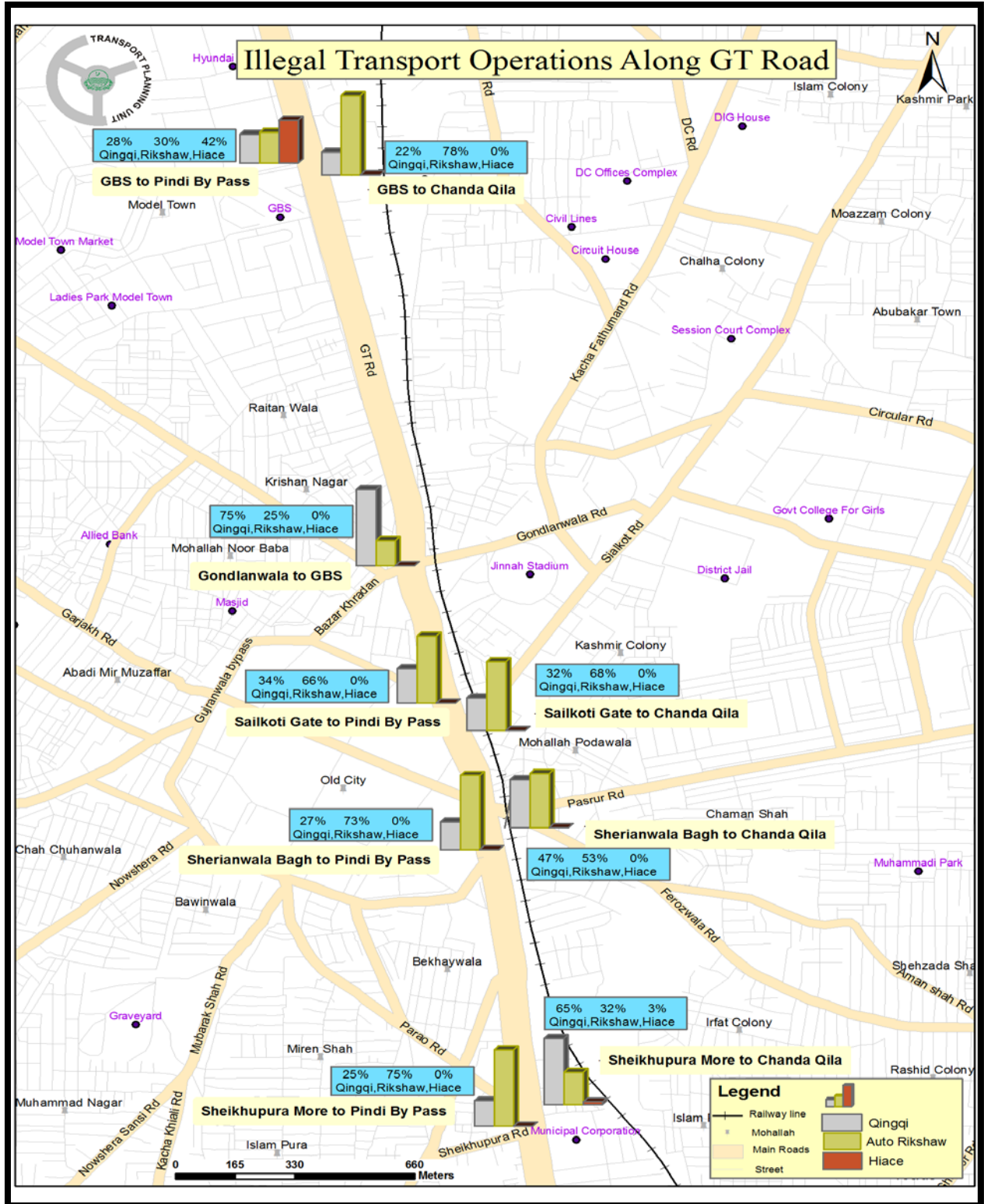


Figure 3-18: Selected Locations and Percentage share of Illegal Transport

Hiace wagons, Qingqis/Auto Rickshaws (both 2 strokes and 4 strokes) are sharing passenger demand with local bus operations; however, the share of Hiace wagons in illegal boarding is only prominent at General Bus Stand. Auto Rickshaws have largest share in illegal public transport operations i.e. boarding and alighting. The percentage share of these three modes is shown in Figure 3-19 below.

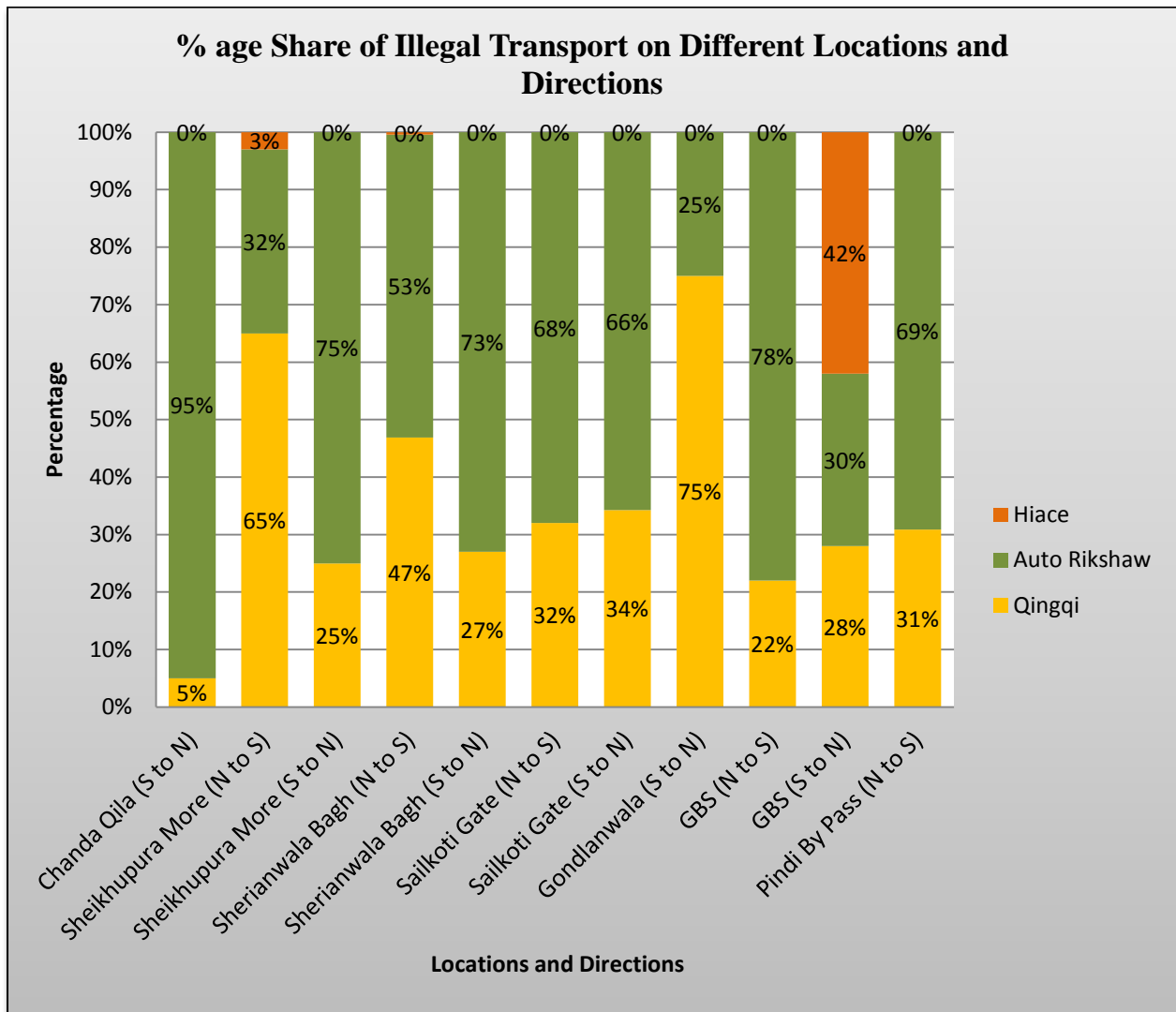


Figure 3-19: Percentage share of Illegal Transport at Different Locations along G.T Road

The results from the survey depicted that more than sixteen thousand passengers daily use illegal transport along G.T Road between Chanda Qilla and Pindi Bypass. Most of these passengers board between Sheikhpura Morr and Gondlanwala. The total number of passengers boarding along G.T Road is illustrated in Figure 3-20.

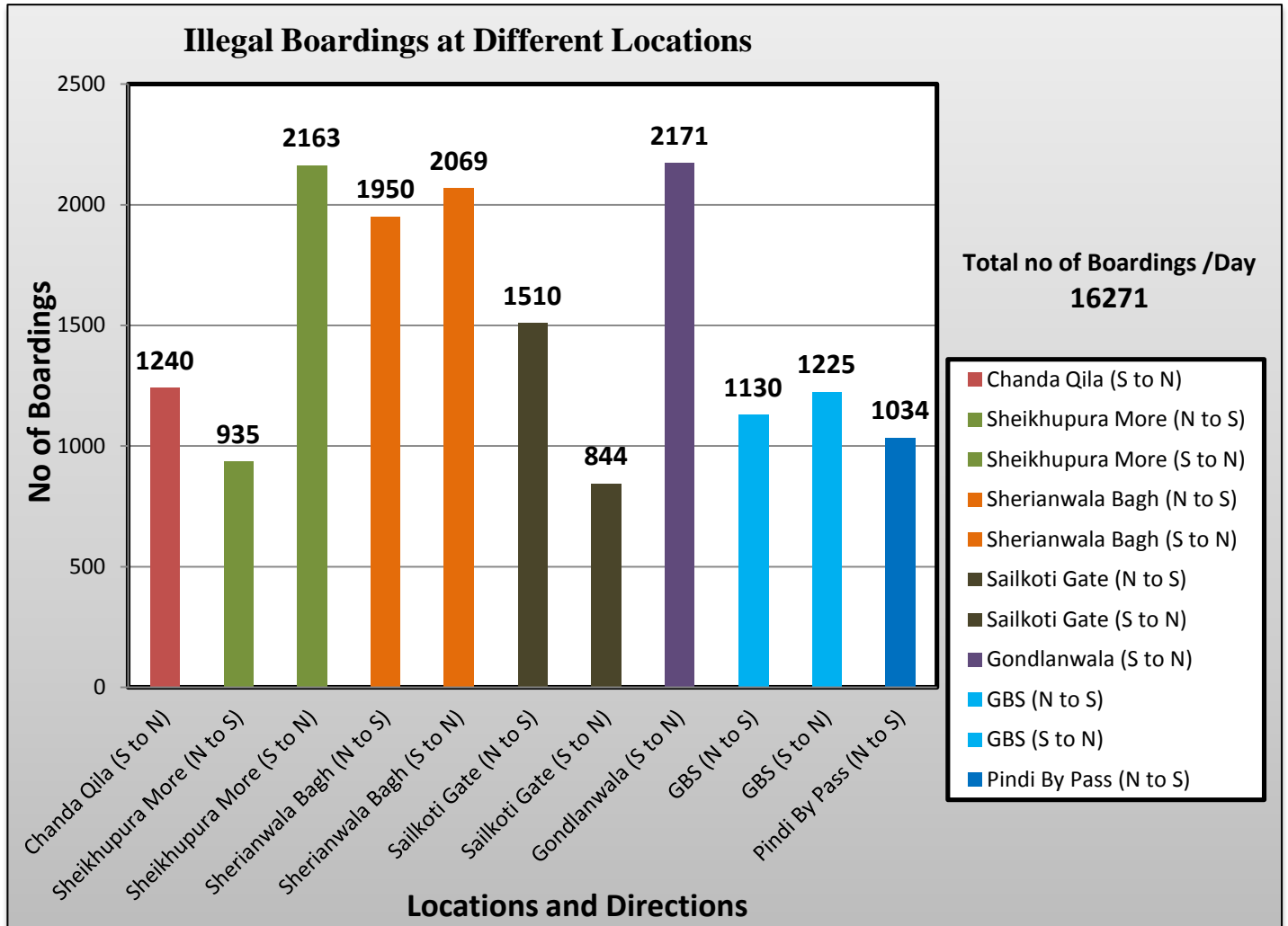


Figure 3-20: Illegal Boarding at Different Locations

3.2.1 Disadvantages of Illegal Transport

The illegal transport influence HOV and LOV operations through easy access offered by it and reduce short distance travelling within the city limits; thus reducing revenue for the legal transport making it financially unviable. Illegal transport also has following disadvantages;

- The haphazard movement of illegal transport has increased road accidents in Gujranwala city.
- The vehicle design of Qingqi rickshaw is uncomfortable and unsafe.
- Majority of those vehicles (illegal) are not properly maintained.
- They (drivers of illegal transport) usually do not hold a driving license, a valid fitness certificate and registration document.
- Numbers of Qingqi'/Auto Rickshaws in Gujranwala city are increasing due to their predecessors; thus resulting in congestion at roads.
- The noise and exhaust emissions limits of Qingqi and 2-stroke rickshaw are much higher than the permissible levels defined in the National Environmental Quality Standards (NEQS). The harmful emissions from exhaust gases have an adverse affects on human health for example it may cause Lung cancer, heart diseases, and even damage brain and nervous system.

4 PUBLIC TRANSPORT ACCESSIBILITY LEVEL ANALYSIS

Evidently, transportation is a measure of relations between localities, neighborhoods, towns, cities and countries as it plays a vital role in terms of connectivity and linkages. It is because transport network development is considered to be one of the keys to rapid modernization and sustainable development. In order to assess the existing condition of public transport in the study area following analysis had been carried out USING Geographical Information System.

- Access Time Analysis
- Existing Public Transport Service Area Analysis
- Public Transport Accessibility Levels

Geographical Information system or GIS has been defined by many researchers. Lyborg (2000) refers to the definition by Burrough and McDonnell (1998) of GIS as a powerful set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes.

Utilization of GIS in transport planning specifically public transport planning has emerged as a key tool for planners in recent decades. The literature describing the range of different theories and tools being implemented have grown tremendously over the last decade. In fact, GIS has played an important role in two parallel planning and development paths; i.e., the spatial perspective and that of transport planning and modeling. The GIS integrate these two different development paths which are a system in their own right and also act as a subsystem or component of composite activity and the space system of real world, through spatial dimension. This functionality of integration by GIS is referred to as the Space as Data Integrator (Berglund, 2001). The developments in GIS and in its functionalities are main factor for its high desirability and usage in specific problems especially in transport modeling and planning (Berglund 2001, Lyborg 2000). In terms of accessibility measurement, GIS can be used to measure both spatial categories i.e. topological accessibility and contiguous accessibility pertaining to public transport provision, service delivery and future planning. Measurement of both categories allow transport planners to evaluate efficiency of a transport network, its usage and results of measures considered necessary for system enhancement and sustainable operation.

Topological accessibility is related to measuring accessibility in a network of nodes and paths, i.e. a transportation network. Contiguous accessibility measures accessibility over a surface. It is a measurable attribute of location, while considering space in a proximate manner (Rodrigue et al., 2006). For underlying research study, both categories were applied to evaluate the existing service areas available in the city.

4.1 Methodological Framework

General Methodology adopted is as follows in Figure 4-1;

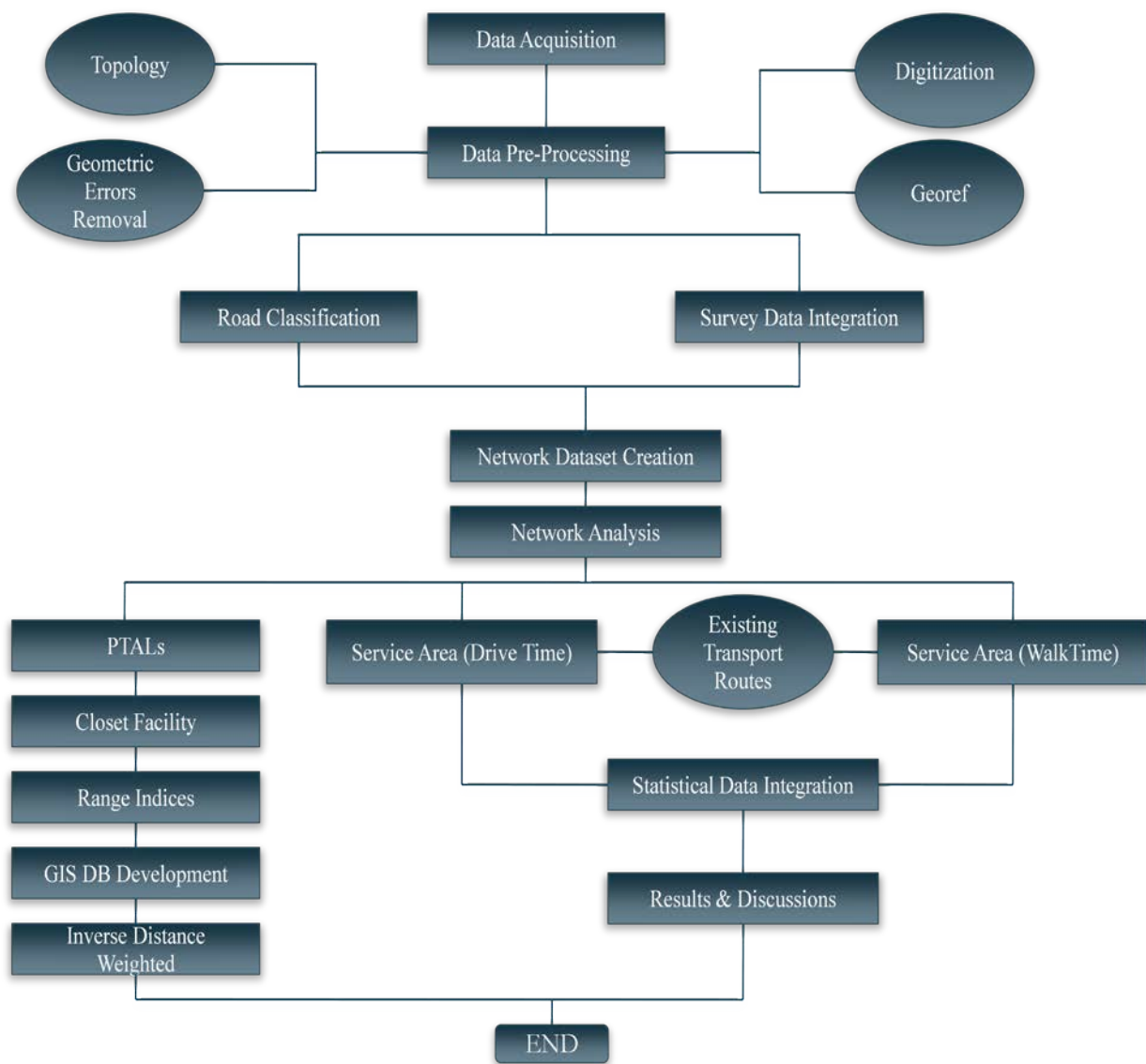


Figure 4-1: Methodological Framework adopted in GIS

4.2 Existing Public Transport Service Area Analysis:

A network service area is a region that encompasses all accessible streets (that is, streets that are within specified impedance). For instance, the 5-minute service area for a bus stop point on a network includes all the streets that can be reached within five minutes from that point. Service areas created by Network Analyst also help evaluate accessibility. Concentric areas created as a result of service area analysis show how accessibility varies with impedance. Once service areas are created, they can be used to identify how many people, how much land, or quantities of anything else is within the neighborhood or region. It is because every bus stop is not reachable for everyone; a highly accessible bus system may be inaccessible by a group in society and this can be examined by the analysis of the bus stops. The area surrounding the bus network can be divided into inclusion zone i.e., the area which is reachable and exclusion zone i.e., the area which is not reachable as shown in the Figure 4-2 (Tyler 2002).

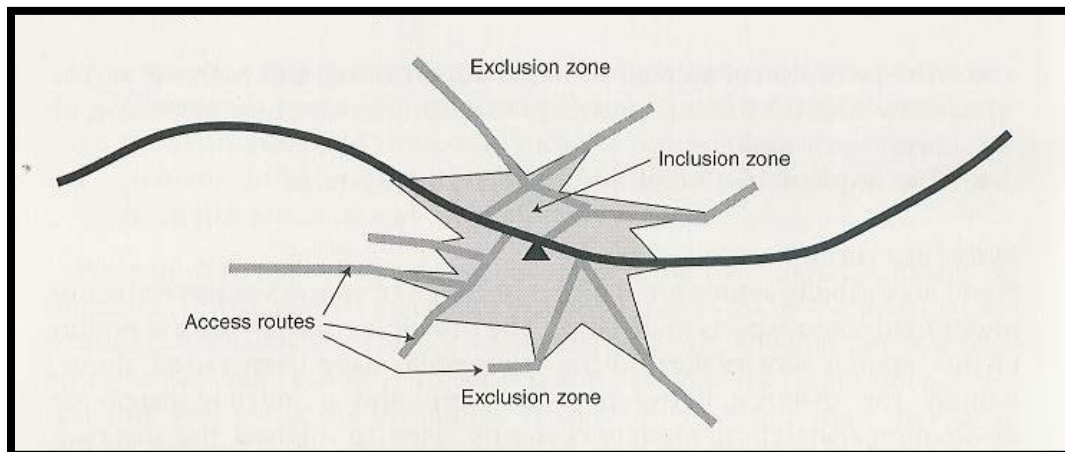


Figure 4-2: Inclusion and Exclusion Zone around a Bus Stop – Accessibility and the Bus System (Tyler, 2002)

In fact there are two important components to be considered for the analysis of the bus stop; location of bus stop i.e., accessible distance to the bus stop and the features or components of the bus stop for example infrastructure available i.e., shelter, kerb height, information etc which influence the decision of people to utilize it thus maximizing its efficiency in the public transport network and in case of non utilization due to lack of adequate attributes results in social exclusion. GIS Methodology adopted in this study covers the first part of bus stop analysis where

qualitative analysis incorporating questionnaire survey and descriptive analysis assess constitutes the second part of bus stop analysis described later in this report.

4.3 Accessible Distance to a Bus Stop

According to Tyler (2002) accessible access distance is defined precisely for a person under the particular circumstances that arise for them in the location of interest and is determined along the pedestrian and public transport routes leading to the bus stop including consideration of the physical environments i.e., crossing, availability of the dropped kerbs, and obstacles in the footway or gradients; thus an access distance acceptable in an analysis must be accessible. Different people belonging to different groups in society i.e., low income households, women, elderly people, disabled people, students, and parents with a baby carts use bus stop for travelling. A single stop could have zones of different access distance from origin to destination i.e., bus stop for different social groups; however, for the underlying study, single access distance was used for analysis. It is because the survey results highlighted that male use public transport service more than women. Likewise, the age group that utilize public transport most ranges from 20 to 40 years which is usually termed as healthy human beings.

Transport for London has recommended approximately 400-700 m of ideal spacing of bus stops and also closer spacing if required in town centers or in residential areas to meet passenger's needs. Considering the urban structure of the city and the users of the public transport network, an access distance of 640 meter considering the prevailing transport link and node system, ability of the users, socio-economic conditions and land use was used for analysis purpose

Service area analysis has been carried out at each bus stop for designated existing public transport routes in the study area to assess the amount of people and area served. A number of factors in the analysis has been incorporated which are listed below

a) Travel Speed

Distances between the Edge-Node links are converted to a measure of time using an assumed average walk speed of 4.8 kph (80 meters per min).

b) Travel Time

In order to calculate the travel time following formula is used:

$$S=V*t$$

Whereas,

S=Length of road segment in meters (m)

V=Travel speed in meter per minute (m/min)

t=walk speed in minute (m)

In case of Gujranwala travel time to serve corresponding areas has been taken in a range of 3, 5, 10 minutes.

The existing public transport routes including stops were digitized in the form of edge-node along the road network. A total of 49 stops were identified and a complete GIS database of current public transport routes was developed using GIS techniques.

c) Calculation of Served Area and Served Population

Served area is calculated by merging and overlaying the time range zones. Served population is calculated by the following formula

$$\text{Population Density} = (\text{Total Population of the City}) / (\text{Total Area of the City})$$

Where,

Total Population of the study area is taken as 4,555,000 persons as per Punjab Development Statistics Report 2012.

The formula to calculate population density is as follows

$$\text{Actual Population} = \text{Population Density} * \text{Area}$$

4.4 Public Transport Accessibility Levels (PTALs):

Public Transport Accessibility Levels (PTALS) are a detailed and accurate measure of the accessibility of a point to the public transport network, taking into account walk access time and

service availability. The method described is essentially a way of measuring the density of the public transport network at different location within the study area.

Walk times are calculated from specified points of interest to all public transport access points' i.e. bus, mini-bus and hiace stops within the study area. The PTAL then incorporates a measure of service frequency by calculating an average waiting time based on the frequency of services at each public transport access point. A reliability factor has been added and the total access time is calculated.

A parameter known as an Equivalent Doorstep Frequency (EDF) is then produced for each point. These are summed for all routes within the catchment and the PTALs for the different modes (bus, mini-bus and hiace, etc) are then added to give a single value. The PTAL is categorized in 6 levels, 1 to 6 where 6 represents a high level of accessibility and 1 a low level of accessibility.

The measure therefore reflects:

- Walking time from the point-of interest to the public transport access points;
- The reliability of the service modes available;
- The number of services available within the catchment; and
- The level of service at the public transport access points - i.e. average waiting time.

It does not consider:

- The speed or utility of accessible services;
- Crowding, including the ability to board services; or,
- Ease of interchange.

The PTAL methodology has been adopted for the Gujranwala city because of its international acceptance. Research using the ATOS (Access to Opportunities and Services) methodology shows that there is a strong correlation between PTALs and the time taken to reach key services i.e. high PTAL areas generally have good access to services and low PTAL areas have poor access to services.

4.4.1 Components of the PTAL Method

The process can be broken down into a series of stages:

- Define the point of interest
- Calculate the walk access times from the Point of Interest (POI) to the service access points (SAPs)
- Identify valid routes at each SAP and calculate average wait time
- For each valid route at the SAPs calculate the minimum total access time
- Convert total access times to the Equivalent Doorstop Frequencies - to compare the benefits offered by routes at different distances,
- Sum all EDFs with a weighting factor in favour of the most dominant route for each mode
- PTALs are then determined using 6 banded levels.

4.4.2 Defining Points of Interest

The exact location of the point of interest may have a considerable bearing on the final PTAL score. The proximity of local public transport services and the nature of the local walk network vary from point to point. If the PTAL is being calculated for a large development, for example a new supermarket, a number of points may be required to reflect different PTALs across the area.

4.4.3 Public Transport Access Points

There are approximately Four Hundred and Thirteen (413) points of interest spatially distributed within and around the study area. For instance where there is a stop either side of the road for each service direction there would be one Service Access Point (SAP).

4.4.4 Walk Access Times

Walk access times are measured from the POI to the SAPs. Distances between the POI and the SAPs are converted to a measure of time using an assumed average walk speed of 80 meters/minute. A number of parameters define the extent of the walk catchment area. For buses, maximum walk time is defined as 8 minutes or a distance of 640 meters. Any SAPs beyond these distances are rejected.

Table 4-1 below summarizes the walk speed, maximum walk distances and reliability factors used in the calculations.

Table 4-1: Model Parameters for PTALs Calculation

Parameter	Unit	Value
Walk Speed	Km/Hr	4.8
Walk Speed	Meters/Minute	80
Bus		
Reliability	Minutes	2
Maximum Walk Time	Minutes	8
Maximum Walk Distance	Meters	640

4.4.5 Closest Facility

The closest facility solver measures the cost of traveling between incidents and facilities and determines which are nearest to one other. The closest facility solver displays the best routes between incidents and facilities, reports their travel costs, and returns driving directions. A closest facility problem was set up to search for Bus Stops within a 640 meter distance of a Point of Interest. Any Bus Stop that takes longer than 640 m to reach are not included in the results. Importantly, the POI is facilities, and the Bus Stops are the incident. Network Analyst allows performing multiple closest facility analyses simultaneously. This means multiple incidents were considered and closest facility (or facilities) for each incident was evaluated. The same has been used to extract the exact number of SAPs that lies in the buffer range of 640 meter from any surrounding POI.

4.4.6 Identify Valid Routes

Routes are identified for each valid SAP while considering following important facts;

- The routes depend on the time period chosen. Generally service frequency data is selected from the peak period of the day;
- Within each route (for example, Sargodha Bypass to Housing Colony Stop) different run/operation patterns are considered as separate entities with separate frequency patterns;

- At any SAP, routes normally are bi-directional. In PTAL calculation the assumption is to take all routes in the one direction;

a) Calculating Total Access Time

Total access time is made up of a combination of factors: combining the walk time from the POI to the SAP and the time spent waiting at the SAP for the desired service to arrive.

$$\text{Total Access Time} = \text{Walk Time} + \text{Average Waiting Time}$$

b) Average Waiting Time

Waiting time is the average time between a passenger arriving at a stop, and the arrival of the desired service. In PTALs passengers are assumed to arrive at the SAP at random. For each selected route, the scheduled waiting time (SWT) is calculated. This is estimated as half the headway (i.e. the interval between services,) where:

$$\text{SWT} = 0.5 * (60/\text{Frequency})$$

To derive the Average Waiting Time, reliability factors are applied to the SWT according to the mode of transport used. The regularity of buses, mini-buses, hiace, and suzukis is affected by a variety of factors. To allow for reliability additional waiting time assumed is 2 minutes.

c) Determination of Equivalent Doorstep Frequency

The access time is converted to an Equivalent Doorstep Frequency (EDF) where:

$$\text{EDF} = 30/\text{Total Access Time (minutes)}$$

This treats access time as a notional Average Waiting Time as though the route was available at the doorstep of the selected POI.

d) Accessibility Index for the POI

Summation of the EDF values gives the accessibility index. There are a number of additional factors that should be considered:

- Routes often travel in parallel for some distance so the range and frequency of destinations are likely to be less than that suggested by the number of routes included in the calculation.
- Travelers often have to change routes in order to reach the desired destination - this can add significant delays to the journey

Transport modes are divided into three groups while halving the EDF values for all but the most accessible or dominant route for each transport mode compensates for these factors:

- Buses
- Mini-Buses
- Haice

Thus for a single transport mode the AIs can be calculated using the following formula:

$$AI_{mode} = EDF_{max} + (0.5 * \text{All other EDFs})$$

Calculating the overall accessibility index is a sum of the individual AIs over all modes:

$$AI_{poi} = \Sigma (AI_{mode1} + AI_{mode1} + AI_{mode2} + AI_{mode3} \dots AI_{mode n})$$

4.4.7 PTALs Indices

The final formula given above calculates the PTAI - the Public Transport Accessibility Index.

These indices can now be allocated to bands of Public Transport Accessibility Levels (PTALs) where band 1 represents a low level of accessibility and 6 a high level. The Table 4-2 below shows the relationship between PTAI scores and the final PTAL levels. A value of 0 would indicate no access to the public transport network within the parameters given.

Table 4-2: Public Transport Accessibility Levels

PTAL	Range of Index	Map Colour	Description
1	0.01-5.00		Very Poor
2	5.01-10.00		Poor
3	10.01-15.00		Moderate

4	15.01-20.00		Good
5	20.01-25.00		Very good
6	25.01-40.1+		Excellent

4.5 ACCESSIBILITY AUDIT AND RECOMENDATIONS

4.5.1 GIS Database Development

The results obtained from PTALs in the form of range indices had been incorporated into GIS spatial database to make spatial representation. Accessibility Index Mode for POI, PTALs and Description from the spreadsheet resulted from PTALs Analysis were spatially joined with the attribute data of every POI present in the study area. The graphical representation was then developed through a GIS interpolation taken known as Inverse Distance Weighted.

4.5.2 Inverse Distance Weighted:

Inverse distance weighted (IDW) interpolation explicitly implemented the assumption that things that are close to one another are more alike than those that are farther apart. To predict a value for any unmeasured location, IDW uses the measured values surrounding the prediction location. The measured values closest to the prediction location had more influence on the predicted value than those farther away. IDW assumed that each measured point had a local influence that diminished with distance. It is because IDW gives greater weights to points closest to the prediction location, and the weights diminish as a function of distance. Moreover, to plot PTALs graphically, using the range indices values IDW measured the local influence of each point of interest and predicted weights that being assigned to interpolate the closest points for generation of a surface representing the accessibility levels in form of colored bands.

Figures 4-3, 4-4, 4-5 4-6, 4-7 and 4-8 below highlights the service area of the HOV network service area; whereas Figure 4-9 highlights the PTALs result for various public transport modes operating in the city. Service area polygons were generated and geo-processed with access zones around bus stops to define the accessible service area in the city. Likewise, service areas generated through Network Analysis and PTALs were subsequently again geo-processed with socio-economic data for each town of the city to examine the passenger catchment area for prevailing transport modes in the city. The analysis spatially represented in above mentioned

Figures highlighted that a significant number of people in the city are denied of Public Transport Service in the city. Prevailing routes serving the city mostly follow a unique primary corridor whereas almost all residential areas are located away from this corridor. People are forced to opt for alternate mode of transport in the city as mentioned earlier. Nonetheless, this limitation can be overcome by re-aligning the network considering the prevailing typology and land use of the city.

Transport Networks when planned in cities usually either follow a grid iron pattern or hub and spoke system based on the prevailing typology of the city. By In case of Gujranwala city, the existing typology is more influenced by Hub and Spoke pattern of development; therefore a hub and spoke system as shown in Figure 4-10 is being developed wherein the G.T Road is to retain its prevailing importance. However, the exiting Ring Road should formulate the outer ring of the Hub and Spoke System and Dulley Road, Sui Gas Road, Sialkot Road, Gurjka Road, Nowshera Road, Kacha Khali Road, Kacha Eminabad Road should be developed as Spokes. Development of such a system will allow access to all parts of the city and will further lead to equity for all in terms of public transport accessibility and mobility. Figure 4-11 and 4-12 clearly augments the concept of Hub and Spoke System. It is because accessibility analysis performed on the propose network evidently depicts that higher number of people are benefited by network re-alignment and can be social included in the society in a better way.

Table 4-3 and 4-4 highlights the number of population served pre and post network transformation. It is pertinent to mention here that the almost 75% of the urban Gujranwala area⁵ falls almost in one Town i.e. Gujranwala City. It is because the statistical analysis is highlighting marginal increase in terms of improvement however spatial representation clearly embarks major improvement. Moreover, higher public transport frequency will further improve the situation. The tentative routes have been chalked out based on Hub and Spoke System; however, these tentative routes can be finalized in consultation with local operators and other concerned stakeholders.

⁵ Administrative Shape File Data for Gujranwala District provided by Urban Unit

Table 4-3: Population Served After Public Transport Improvement

Walktime (Mins)	Served Area (Sqkm)	Served Population
0 to 3	2	12372
3 to 5	5	24208
5 to 10	22	110101

Table 4-4: Population Served After Public Transport Improvement

Walktime (Mins)	Served Area (Sqkm)	Served Population
0 to 3	4	20352
3 to 5	7	35375
5 to 10	30	150916

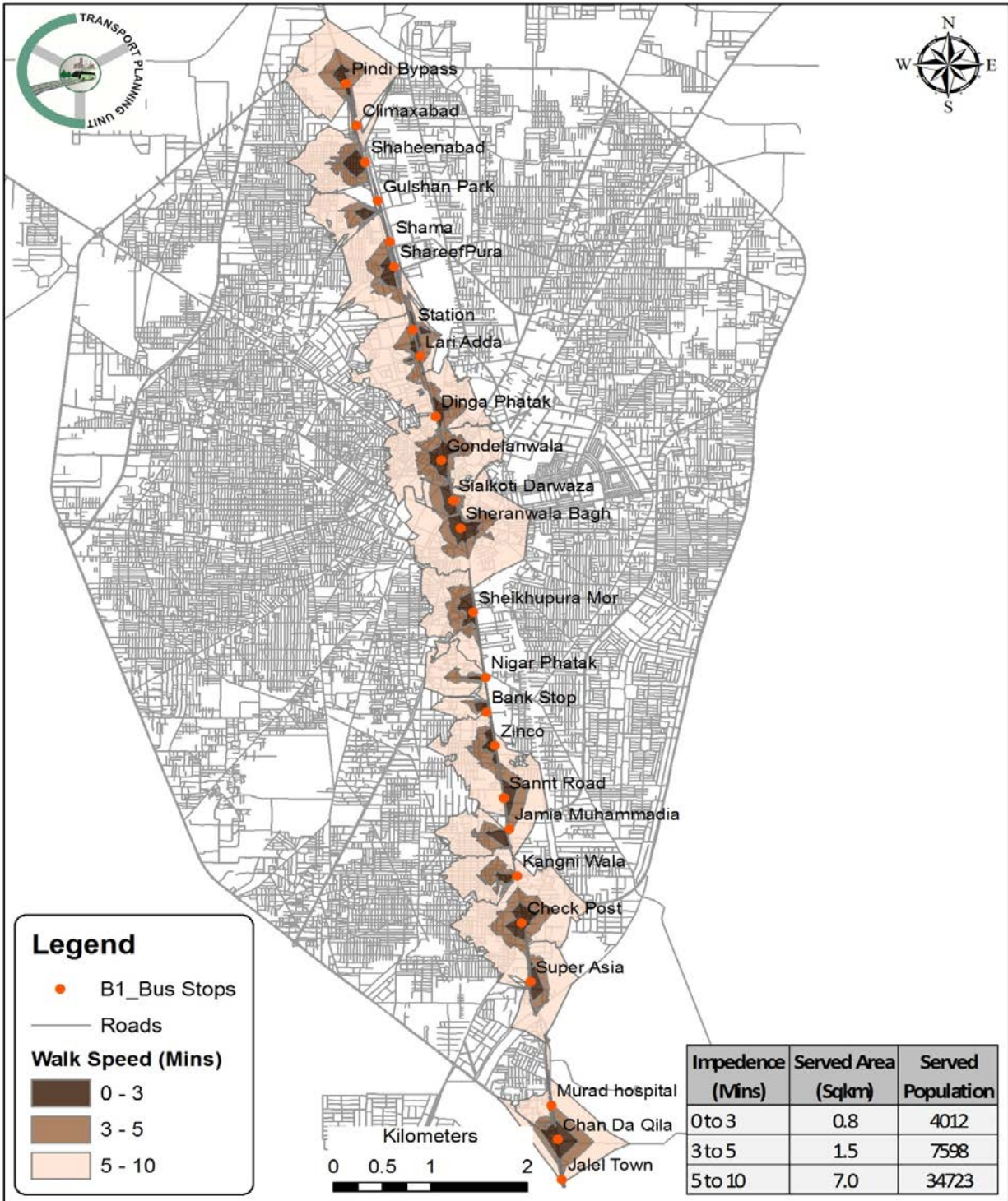


Figure 4-3: Service Area of B-1 Kamonki to Aziz Cross Route

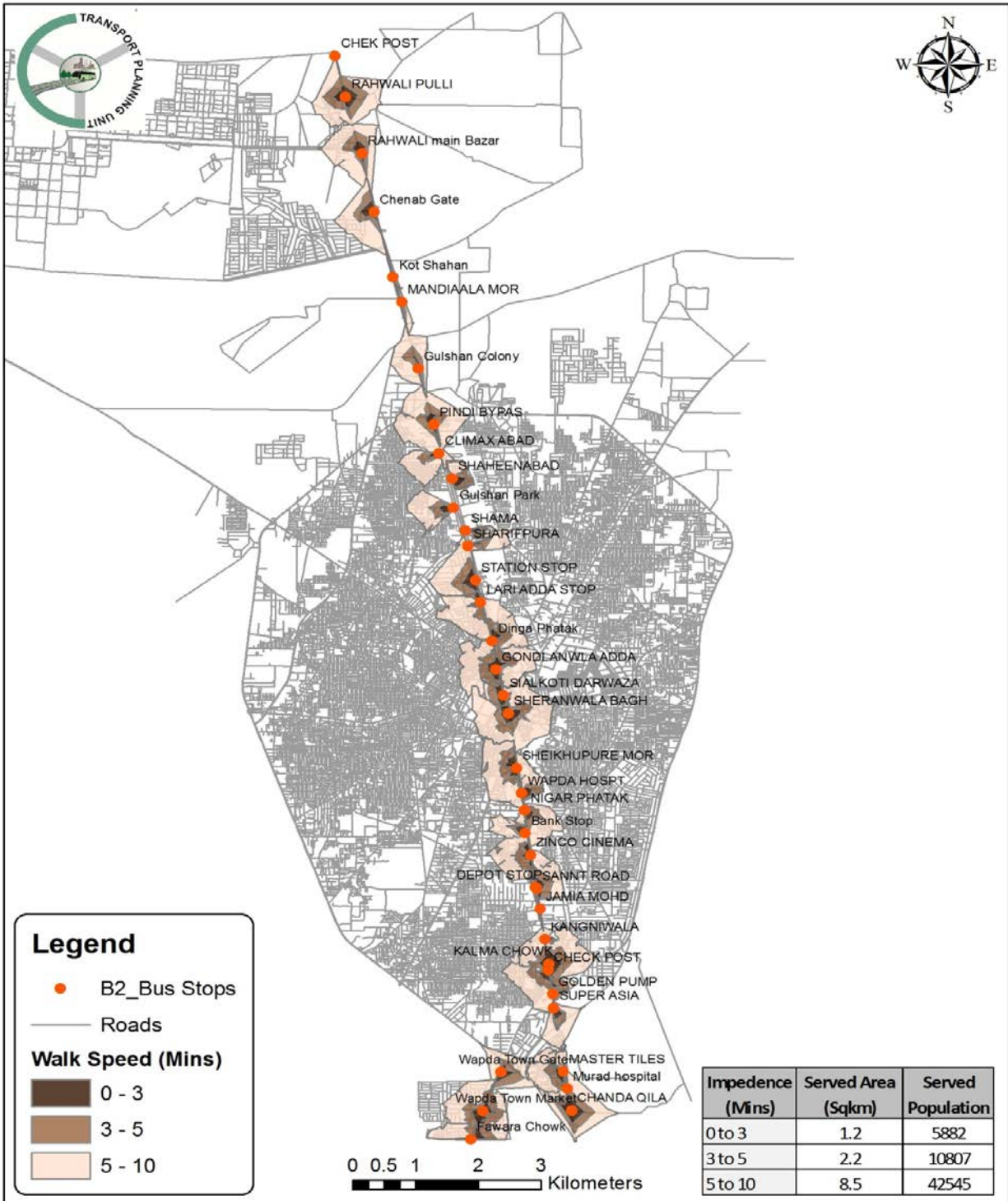


Figure 4-4: Service Area of B-2 Chan Da Qilla to Ghakkar Route

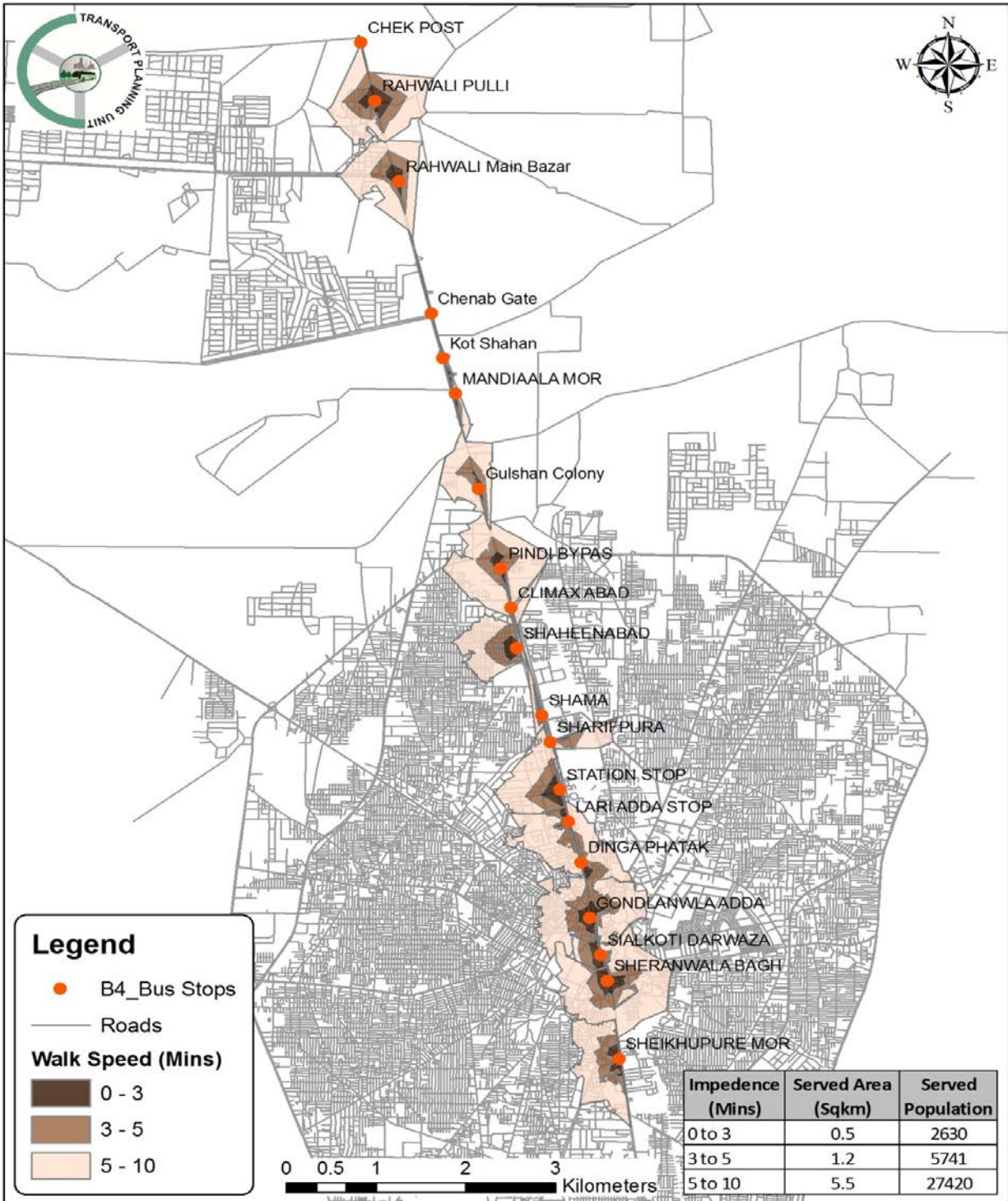


Figure 4-5: Service Area of B-4 Sheikhupura Morr to Wazirabad Railway Station Route

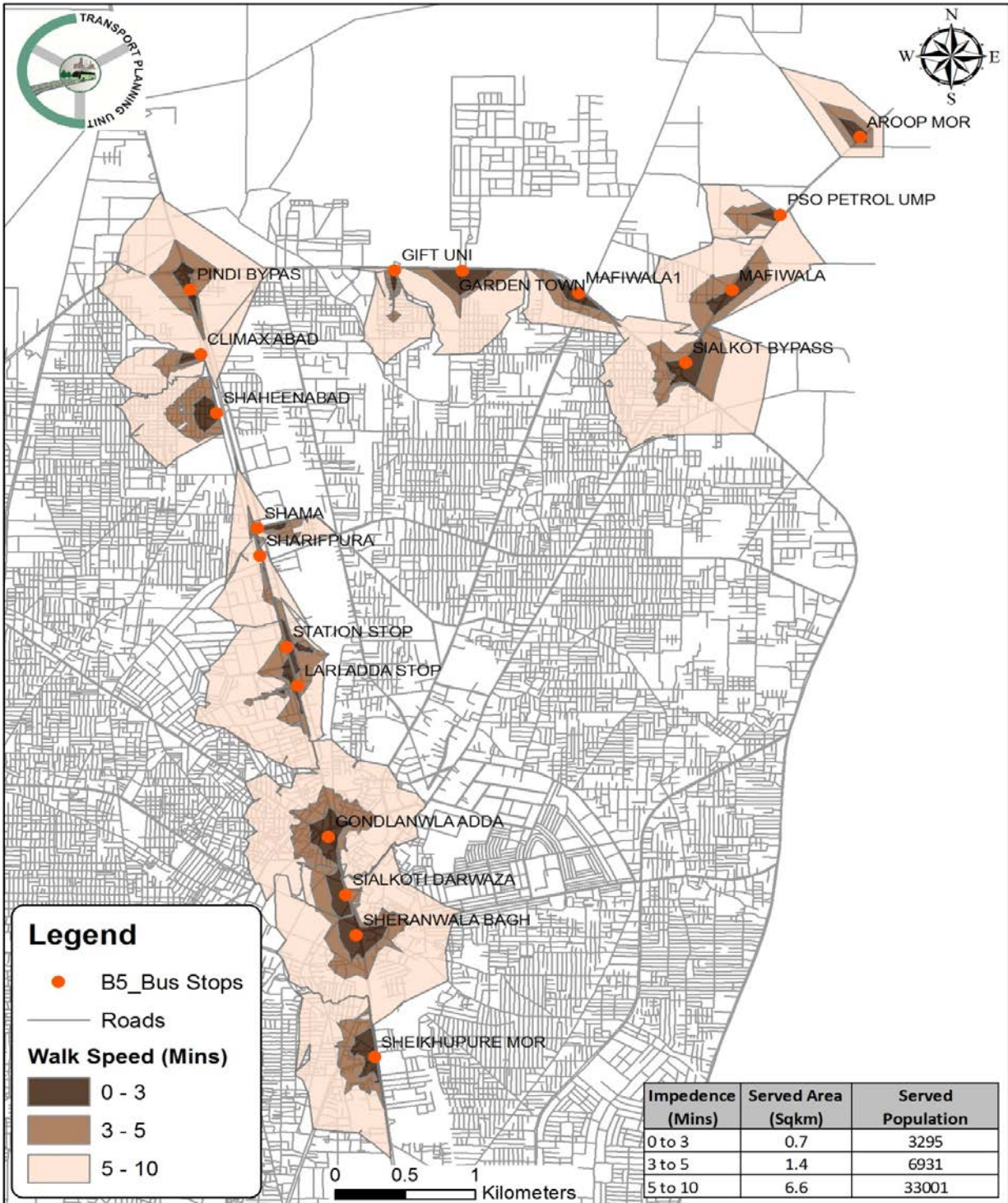


Figure 4-6: Service Area of B-5 Daska to Gulshan Iqbal Park Mor Route

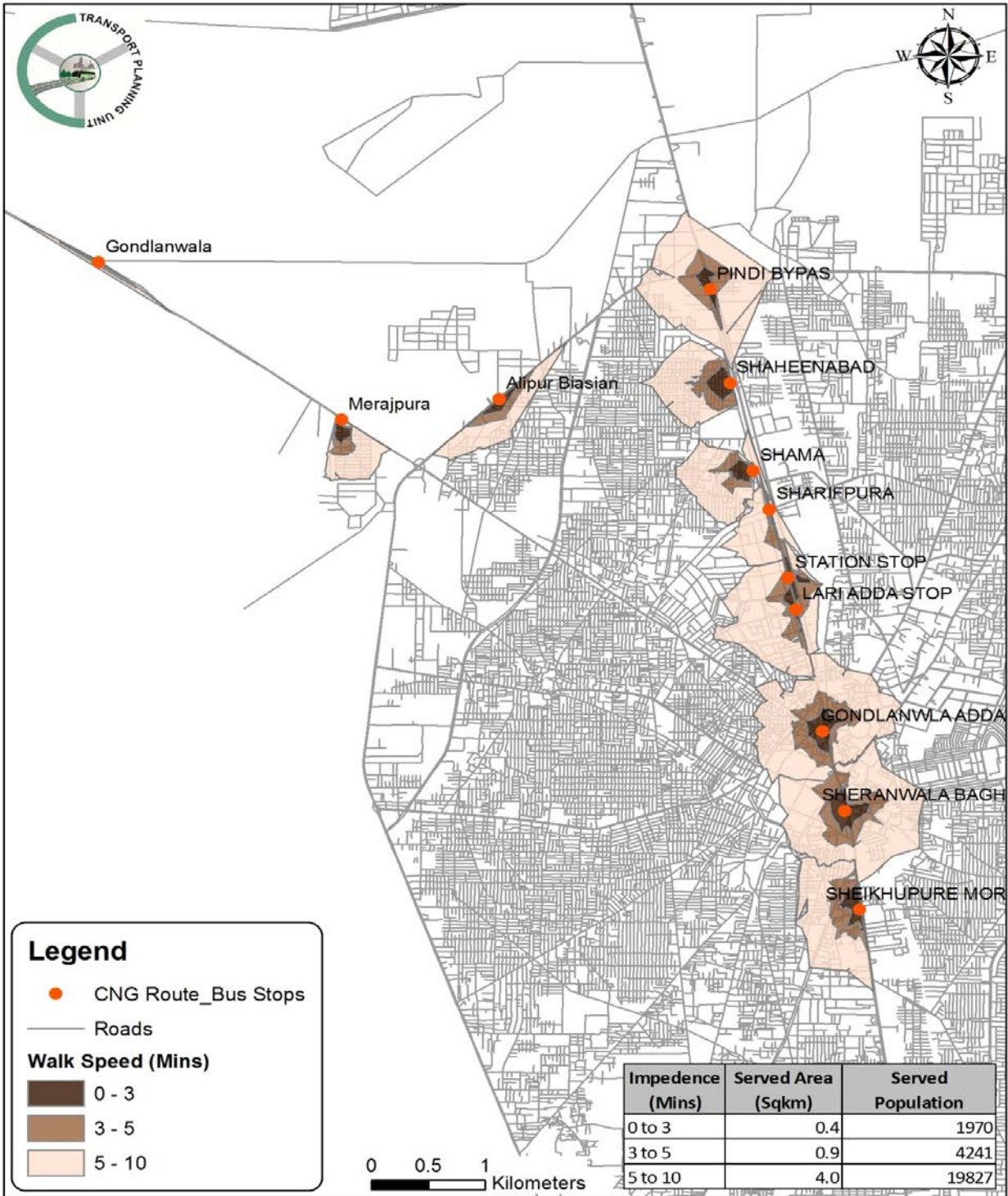


Figure 4-7: Service Area of B-9 Aheikhupura Morr to Ali Phur Chatta Petrol Pump Route

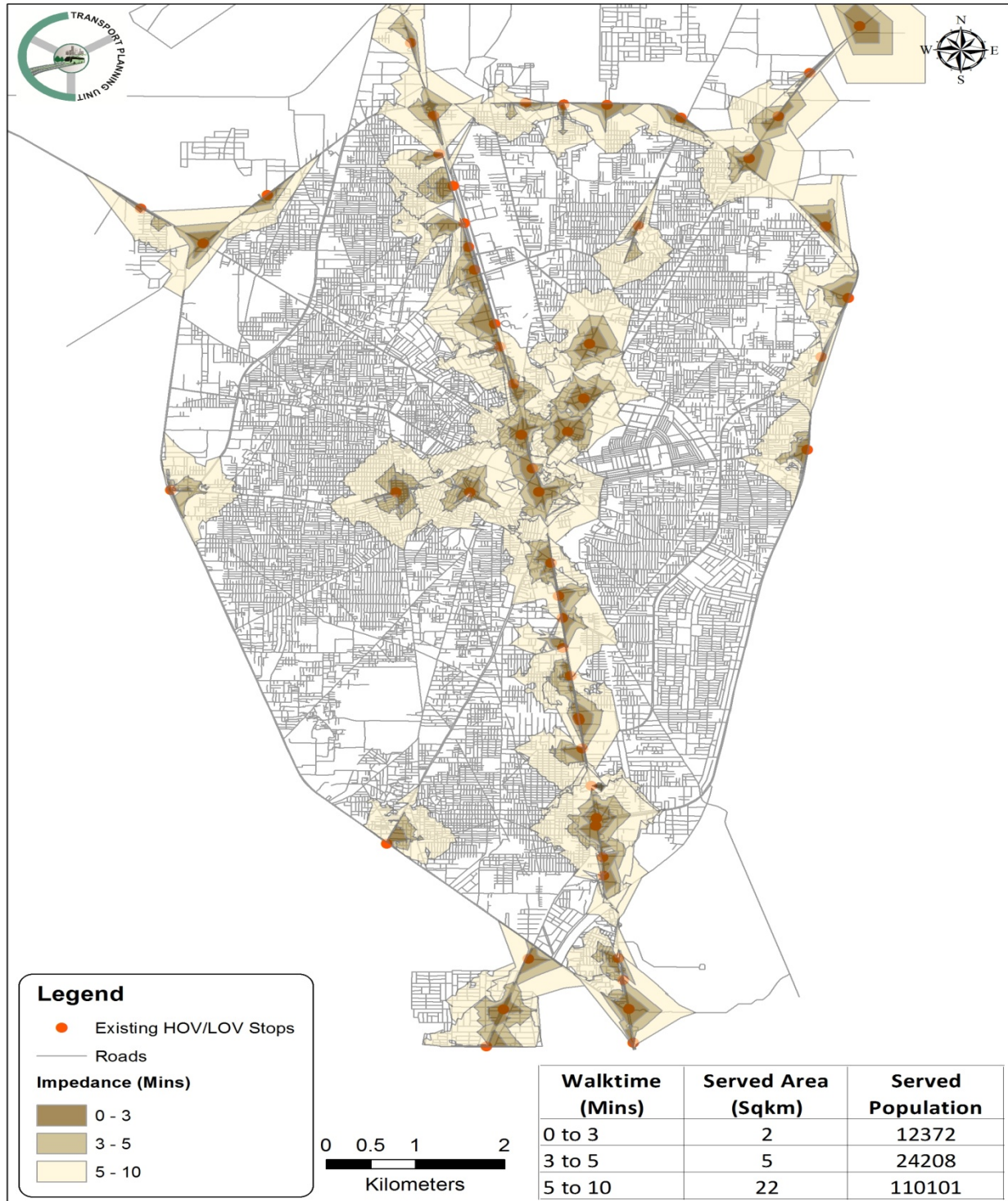


Figure 4-8: Service Area of Prevailing Network

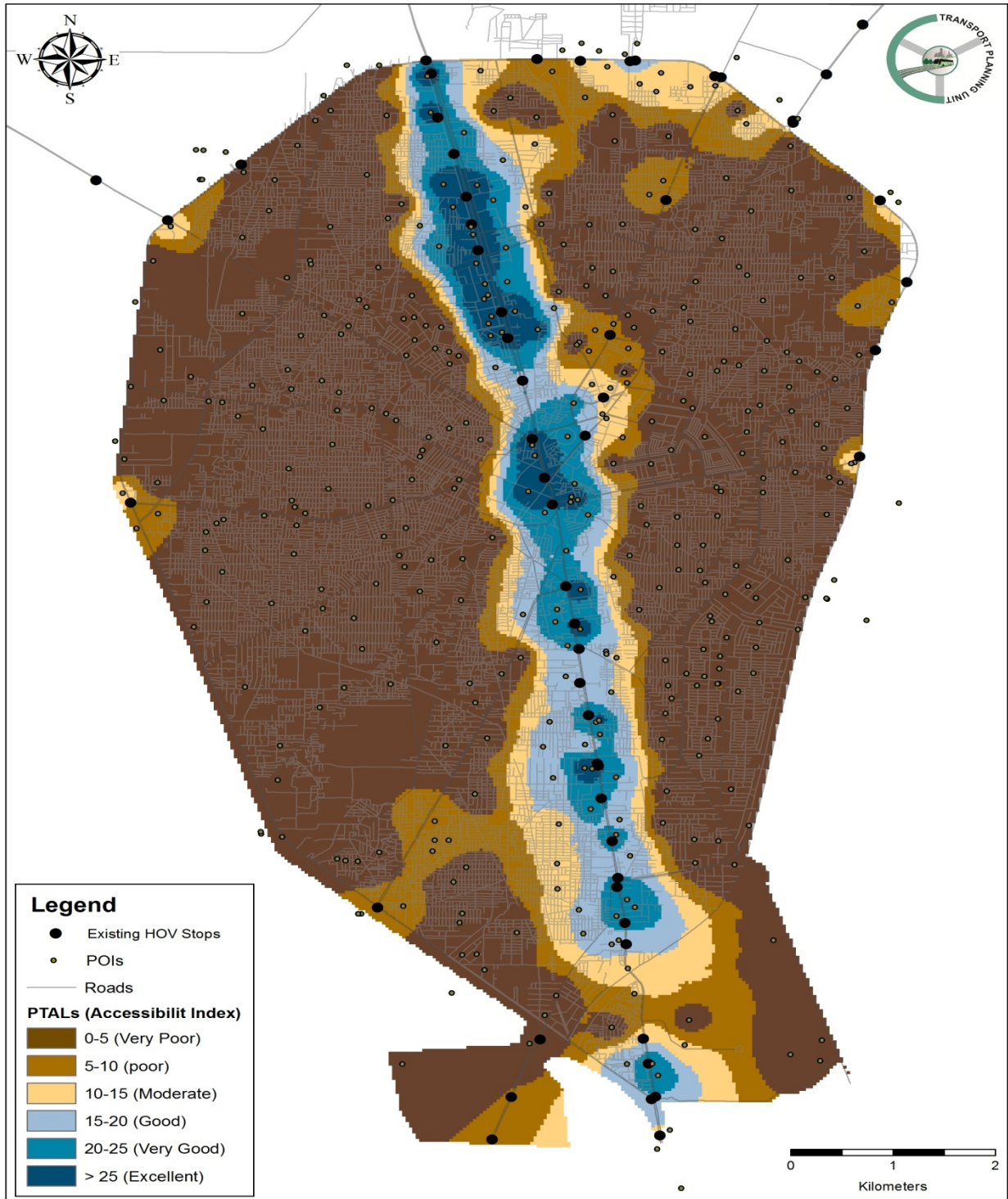


Figure 4-9: Public Transport Accessibility Levels of Prevailing Network

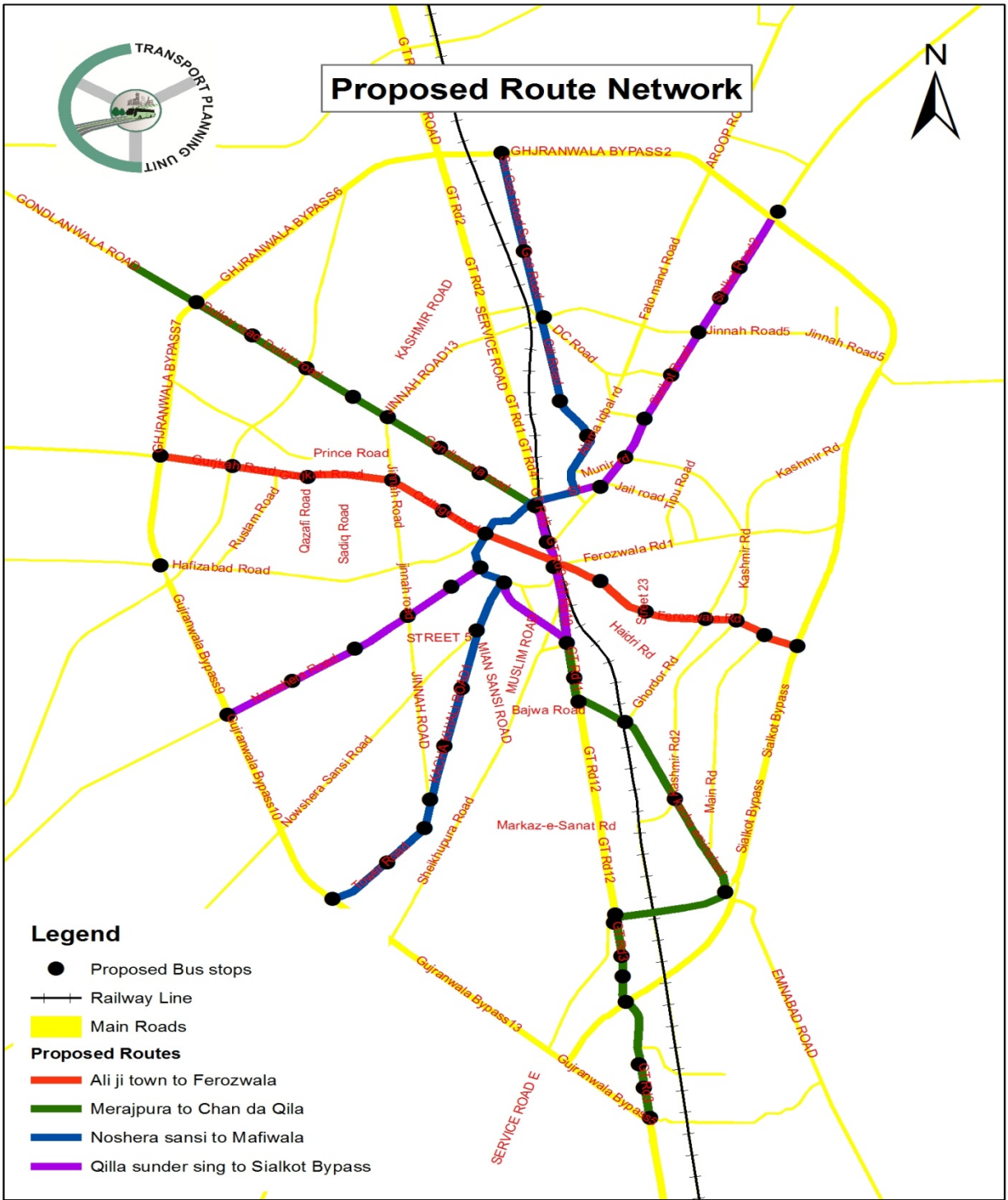


Figure 4-10: Proposed Public Transport Network

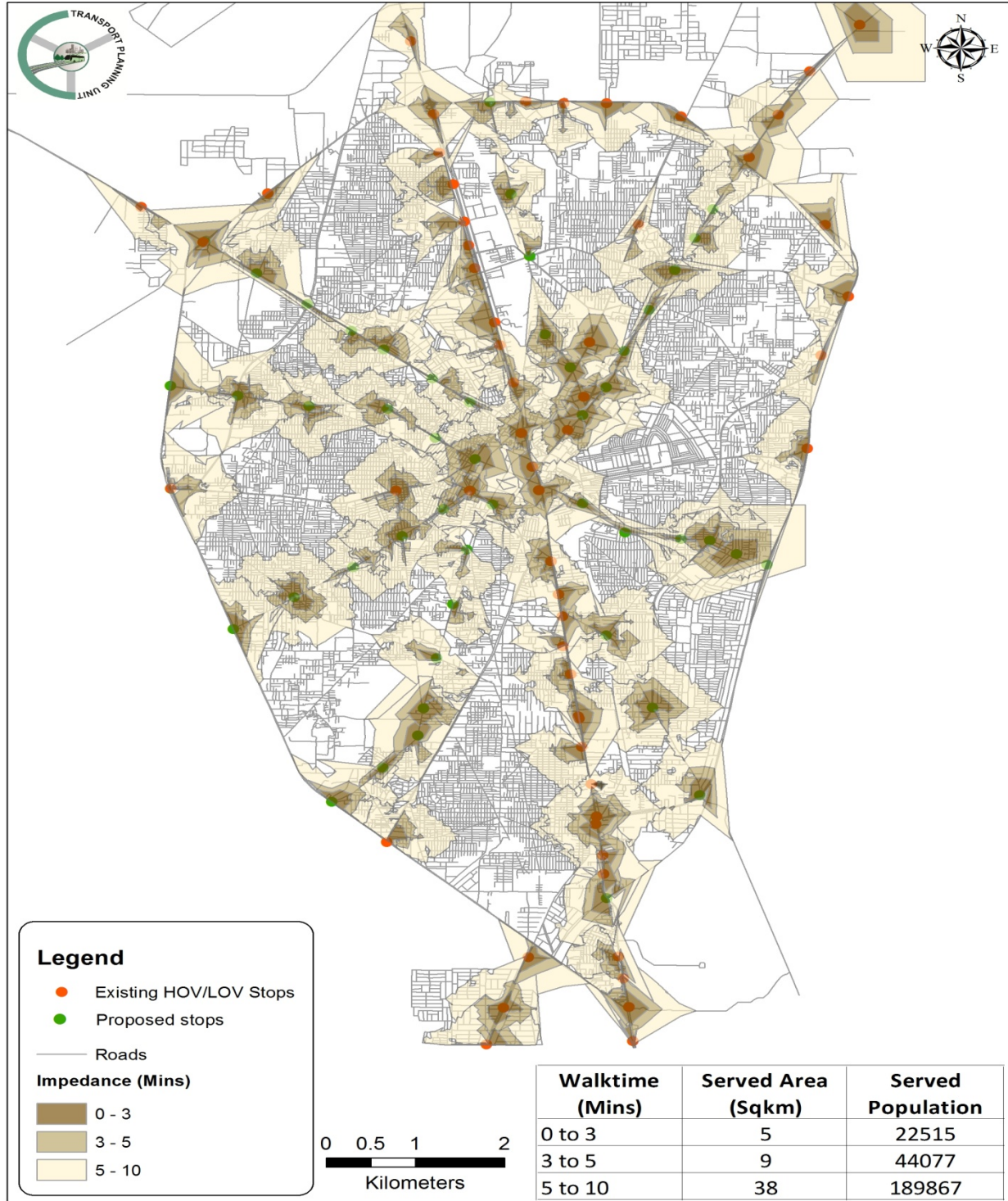


Figure 4-11: Proposed Network Service Area

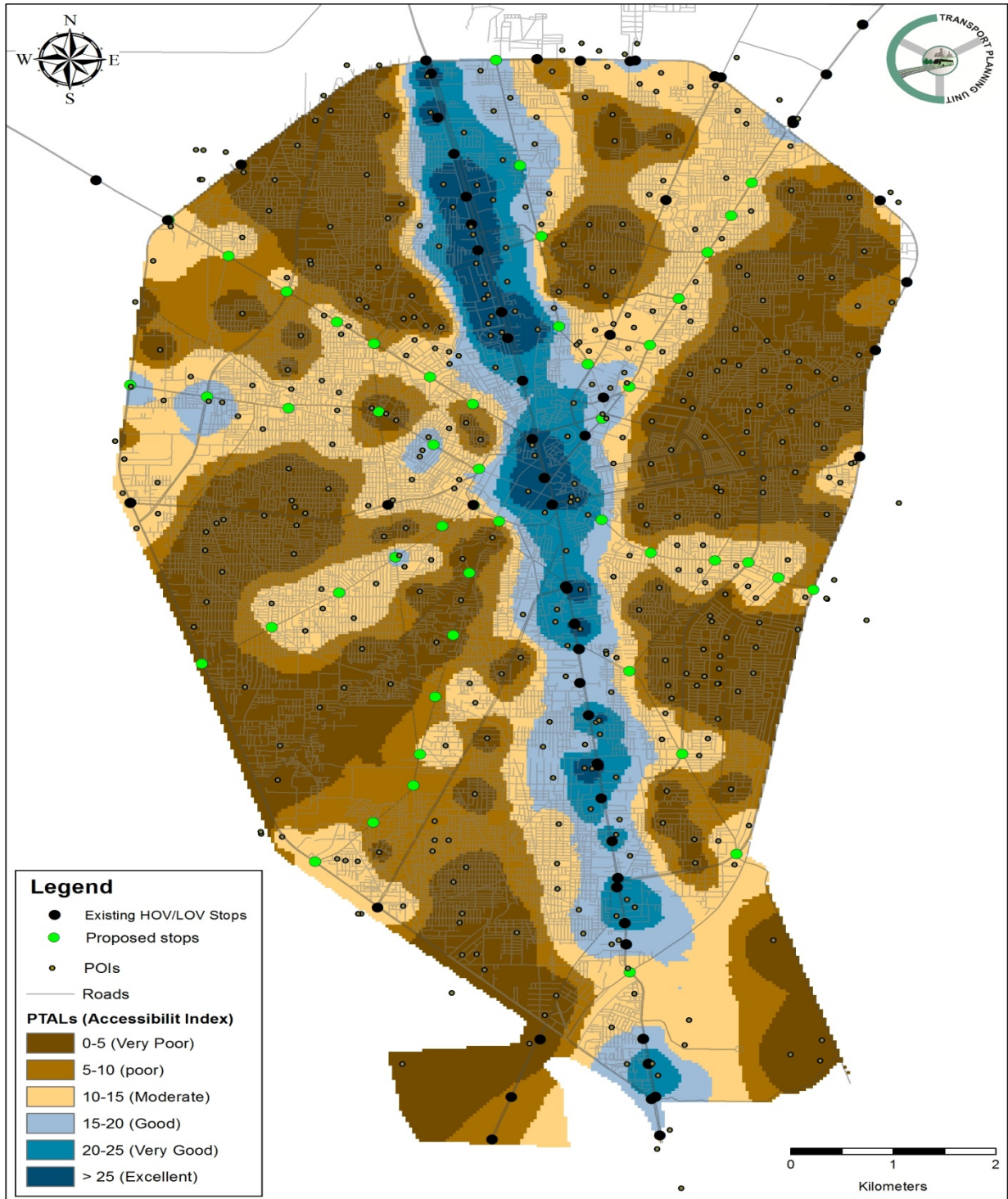


Figure 4-12: Public Transport Accessibility Levels of Proposed Network

4.6 Bus Stop: A Dynamic Environment ~ Analysis and Recommendations

The measure of sufficiency of a physical bus network depends upon the ability of people to reach its bus stop i.e., if the access distance to a bus stop becomes too large, people will be unable to reach it and will be excluded from the activities they would otherwise be able to reach by using the bus system (Tyler, 2002). But in fact the sufficiency of the physical bus transport also depends upon the level and provision of transport infrastructure because in case of inadequate transport infrastructure facilities people will be excluded from the society as they will not be able to utilize the transport rolling stock because of these inadequate facilities.

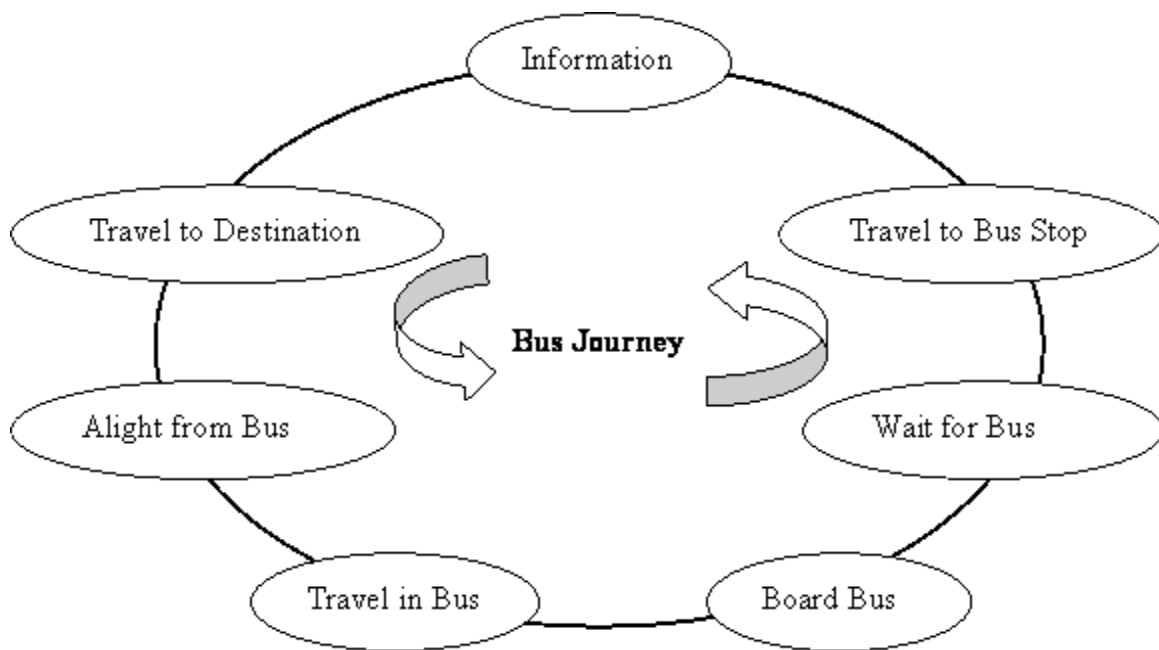


Figure 4-13: Bus Journey Cycle - Recommended Accessible Guidelines for Public Transport Operators in Ireland

The above mentioned public transport journey process highlights the different important sub-components involved in a complete journey. Each of these sub components is a whole process in itself depending upon many factors and elements. Tyler (2002) suggested that a public transport system can be reviewed from four prospective in relation to its bus stops: global, macroscopic local and microscopic. The global view corresponds to the user's needs in order to reach the bus stop, and the requirements of buses with respect to the number and location of bus stops. The

macroscopic view of bus stop corresponds to the extent to which the bus stop operates within the system as a whole, and is concerned with the ability to deliver sufficient capacity i.e., relates to specification of bus stops in terms of berth for buses and the available space for passengers. How a bus stop interacts with other activities nearby, i.e., pedestrians and vehicular traffic highlights the local perspective of the bus stop. The microscopic view concerns with detailed design of various elements of a bus stop such as vertical and horizontal gap between buses and platform i.e., kerb height, location or position of the shelter, information or seating arrangements.

Undoubtedly, the bus stop is a place where pedestrians transform into a passenger or vice versa i.e., it can be viewed as an interchange (Tyler et. al., 2002; TfL, 2006). Bus stop area is such a location where different people perform different kind of actions. People who utilize these bus stops have different perspective of bus stop being highlighted by Tyler et. al, (2002, 140-141). These are as follows:-

Users of the bus stop like a place:

- where they can wait comfortably and safely for a bus service to which they can easily access, that will arrive within a time that is reasonable enough to wait and that is going to take them where they want to
- which they can identify easily
- where they can find about the bus service (arrival and departure times, destinations and other information)
- where they can find out about the area around the bus stop so that, on alighting from a bus, they can find their way from the bus stop to their destination

Bus drivers want a place:

- that is easy to identify in the street space
- that is easy to stop at
- that is devoid of parking and delivery-vehicle problems

- where passengers can board and alight as quickly as possible
- that has no obstacles that can be struck by the bus on arriving or leaving the stop
- that is consistent in its design so that all bus stops feel same
- that is easy to leave and re-enter the traffic stream
- where it is easy to see passengers boarding and alighting from the bus

Bus operators want a place:

- where the bus can stop without problems
- where the bus can re-enter the traffic stream as easily as possible
- which imposes the least possible delay

Traffic planners want a place:

- that is safe for buses to stop with a minimum disturbance to traffic
- that is cheap to install and maintain
- that will incur minimal opposition from users, nearby residents and businesses and bus operators

People living near to bus stops like a place:

- that is not too far from their home
- that is not outside their home
- that is not unsightly

Traders based near to a bus stop like a place

- that is close to their business (if they believe that bus users are core customers)

- that is far away from their business (if they believe that bus users are not their core customers)
- that does not obstruct view of their premises
- that does not obstruct access for delivery vehicles and customers

Pedestrians want a place:

- that does not obstruct their use of the footway
- that does not make them feel insecure

Car drivers want a place:

- that does not interfere with the traffic system in anyway
- that does not eliminate or reduce parking”

All these requirements of different stake holders are difficult to achieve in the constrained urban environment therefore usually the initial importance is given to the needs of public transport user, drivers and operator; afterwards other stake holders are considered.

4.7 Attributes of a Bus Stop

It is important to view the bus stop as an interchange, rather than simply a location along a bus route where buses stop, comprising only a post with a flag, and a shelter with seating arrangement. The bus stop environment contains a number of features that need to be considered, as illustrated in Figure 4-14.

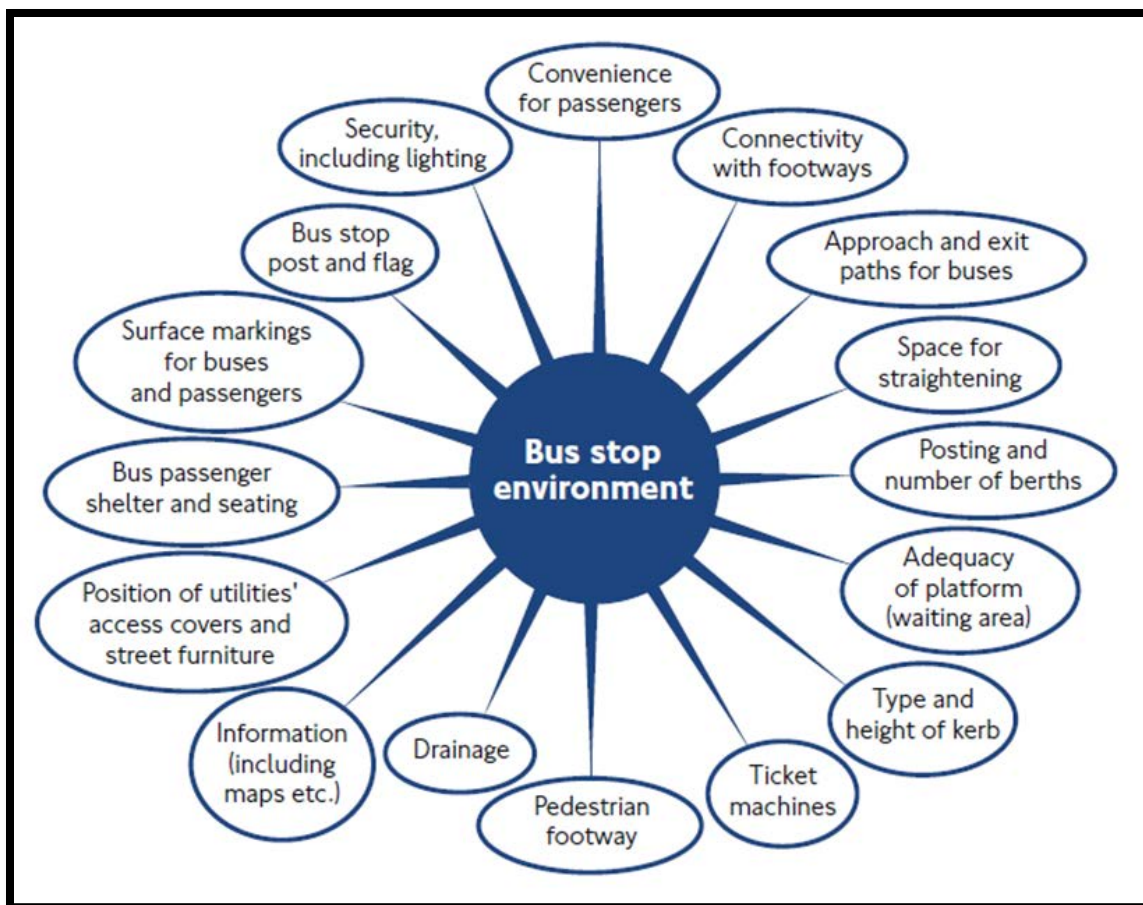


Figure 4-14: Feature of the Bus Stop Environment

Transport for London during up graduation of accessible bus stop guidelines highlighted the important features of the bus stops; these are convenience for passengers, connectivity with footways, approach and exit paths for buses, space for lightening, posting and number of berths, adequacy of platform(waiting area), type and height of kerb, ticket machines, pedestrian footways, drainage, information (including maps etc), position of utilities access covers and street furniture, bus passenger shelter and seating, surface marking for buses and passengers, bus stop post and flag and security including lighting. Tyler (2002) also described different important components for accessible bus stops like kerb height, shelter location, information, footways, surface marking, etc.

National Disability Authority (2005) in Recommended Accessibility Guidelines for Public Transport Operators stated different important points such as location, raised kerbs, footpath and crossing facilities, traffic management including parking and loading/unloading restrictions, shelters, lighting, security, marking and signage including bus stop poles, seating, bicycle parking facilities, information provision and maintenance and cleaning critical to the development of high quality accessible transport infrastructure for all the public transport operators. For this study, following important features according to users' needs are considered.

- Information (including maps etc)
- Bus stop post and flag
- Bus passenger shelter (seating)
- Security including lighting
- Footpaths and crossing
- Surface marking for buses i.e. bus cage and for passengers i.e., bus stop area
- Type and height of kerb
- Baby cart or wheel chair parking
- Traffic management including parking and loading/unloading restrictions

This study focuses on macroscopic, local and microscopic view of bus stops; which encircles the three important constituent of the bus journey cycle i.e., wait for bus, board bus and alight from bus in the above journey cycle and we studied how bus stops affect accessibility within the transport system and built environment. The prevailing bus stops in the city were surveyed and evaluated on the basis of above mentioned attributes. The results are highlighted below in Table 4-5. Evidently, all the bus stops in the city lack almost all attributes; thus resulting in transport disadvantage and social exclusion for the people.

Table 4-5: Analysis of Prevailing Bus Stops in Gujranwala City

Sr. No	Bus Stop	Road	Information (Including maps etc)	Bus Stop Post and flag	Bus Passenger Shelter (Seating)	Security including lighting	Footpaths & crossing	Surface marking for buses (bus cage, bus stop area)	Type and height of kerb	Baby cart or wheelchair parking	Traffic management including parking and loading/unloading restrictions
1	ALIPUR BIASIAN	Gujranwala bypass	X	X	X	X	X	X	X	X	X
2	AROOP MOR	Sialkot road	X	X	X	X	X	X	X	X	X
3	BANK STOP	GT Road	X	X	X	X	X	X	X	X	X
4	CHANDA QILA	GT Road	X	X	X	X	X	X	X	X	X
5	CHECK POST	GT Road	X	X	X	X	X	X	X	X	X
6	CHEK POST RAHWALI	GT Road	X	X	X	X	X	X	X	X	X
7	CHENAB GATE	GT Road	X	X	X	X	X	X	X	X	X
8	CLIMAX ABAD	GT Road	X	X	X	X	X	X	X	X	X
9	DEPOT STOP	GT Road	X	X	X	X	X	X	X	X	X
10	DINGA PHATAK	GT Road	X	X	X	X	X	X	X	X	X
11	FAWARA CHOWK	Wapda Main Blvd road	X	X	X	X	X	X	X	X	X
12	GARDEN TOWN	Sialkot bypas	X	X	X	X	X	X	X	X	X
13	GIFT UNI	Sialkot bypas	X	X	X	X	X	X	X	X	X
14	GOLDEN	GT Road	X	X	X	X	X	X	X	X	X

	PUMP										
15	GONDLANWALA	GT Road	X	X	X	X	X	X	X	X	X
16	GONDLANWALA ADDA	GT Road	X	X	X	X	X	X	X	X	X
17	GULSHAN COLONY	GT Road	X	X	X	X	X	X	X	X	X
18	GULSHAN PARK	GT Road	X	X	X	X	X	X	X	X	X
19	JALEL TOWN	GT Road	X	X	X	X	X	X	X	X	X
20	JAMIA MUHAMMADIYA	GT Road	X	X	X	X	X	X	X	X	X
21	KALMA CHOWK	GT Road	X	X	X	X	X	X	X	X	X
22	KANGNIWALA	GT Road	X	X	X	X	X	X	X	X	X
23	KOT SHAHAN	GT Road	X	X	X	X	X	X	X	X	X
24	LARI ADDA STOP	GT Road	X	X	X	X	X	X	X	X	X
25	MAFIWALA	Sialkot road	X	X	X	X	X	X	X	X	X
26	MAFIWALA1	Sialkot bypas	X	X	X	X	X	X	X	X	X
27	MANDIAALAMOR	GT Road	X	X	X	X	X	X	X	X	X
28	MASTER TILES	GT Road	X	X	X	X	X	X	X	X	X
29	MERAJPURA	Alipur Chatha road	X	X	X	X	X	X	X	X	X
30	MURAD HOSPITAL	GT Road	X	X	X	X	X	X	X	X	X
31	NIGAR PHATAK	GT Road	X	X	X	X	X	X	X	X	X
32	PINDI BYPAS	GT Road	X	X	X	X	X	X	X	X	X
33	PSO PETROL UMP	Sialkot road	X	X	X	X	X	X	X	X	X

34	RAHWALI MAIN BAZAR	GT Road	X	X	X	X	X	X	X	X	X
35	RAHWALI PULLI	GT Road	X	X	X	X	X	X	X	X	X
36	SANNT ROAD	GT Road	X	X	X	X	X	X	X	X	X
37	SHAHEENAB AD	GT Road	X	X	X	X	X	X	X	X	X
38	SHAMA	GT Road	X	X	X	X	X	X	X	X	X
39	SHARIFPURA	GT Road	X	X	X	X	X	X	X	X	X
40	SHEIKHUPUR E MOR	GT Road	X	X	X	X	X	X	X	X	X
41	SHERANWAL A BAGH	GT Road	X	X	X	X	X	X	X	X	X
42	SIALKOT BYPASS	Sialkot road	X	X	X	X	X	X	X	X	X
43	SIALKOTI DARWAZA	GT Road	X	X	X	X	X	X	X	X	X
44	STATION STOP	GT Road	X	X	X	X	X	X	X	X	X
45	SUPER ASIA	GT Road	X	X	X	X	X	X	X	X	X
46	WAPDA HOSPT	GT Road	X	X	X	X	X	X	X	X	X
47	WAPDA TOWN GATE	Wapda Main Blvd road	X	X	X	X	X	X	X	X	X
48	WAPDA TOWN MARKET	Wapda Main Blvd road	X	X	X	X	X	X	X	X	X
49	ZINCO CINEMA	GT Road	X	X	X	X	X	X	X	X	X

The above mentioned or new stops should adhere i.e. developed as per bellow mentioned bus stop environment.

4.8 Bus Stop Environment

4.8.1 Location of Bus Stop

In selecting a site for placement of a bus stop, the need for present and future passenger amenities are an important consideration. If possible, the bus stop should be located in an area where typical improvements, such as a bench or a passenger shelter, can be accommodated in the public ROW. The final decision on bus stop location is dependent on several safety and operating elements that require on-site evaluation. Elements to consider in bus stop placement include the following:

4.8.1.1 Safety

- Passenger protection from passing traffic;
- Access for people with disabilities;
- All-weather surface to step from/to the bus;
- Proximity to passenger crosswalks and Curb ramps;
- Proximity to major trip generators;
- Convenient passenger transfers to routes with nearby stops;
- Proximity of stop for the same route in the opposite direction;
- Street lighting

4.8.1.2 Operating

- Adequate Curb space for the number of buses expected at the stop at one time;
- Impact of the bus stop on adjacent properties;
- On-street automobile parking and truck delivery zones;
- Bus routing patterns (i.e., individual bus movements at an intersection);
- Directions (i.e., one-way) and widths of intersection streets;
- Types of traffic signal controls (signal, stop, or yield);
- Volumes and turning movements of other traffic;
- Width of sidewalks;
- Pedestrian activity through intersections;

- Proximity and traffic volumes of nearby driveways

The ideal bus stop layout should achieve the following objectives as shown in Figure 4-15.

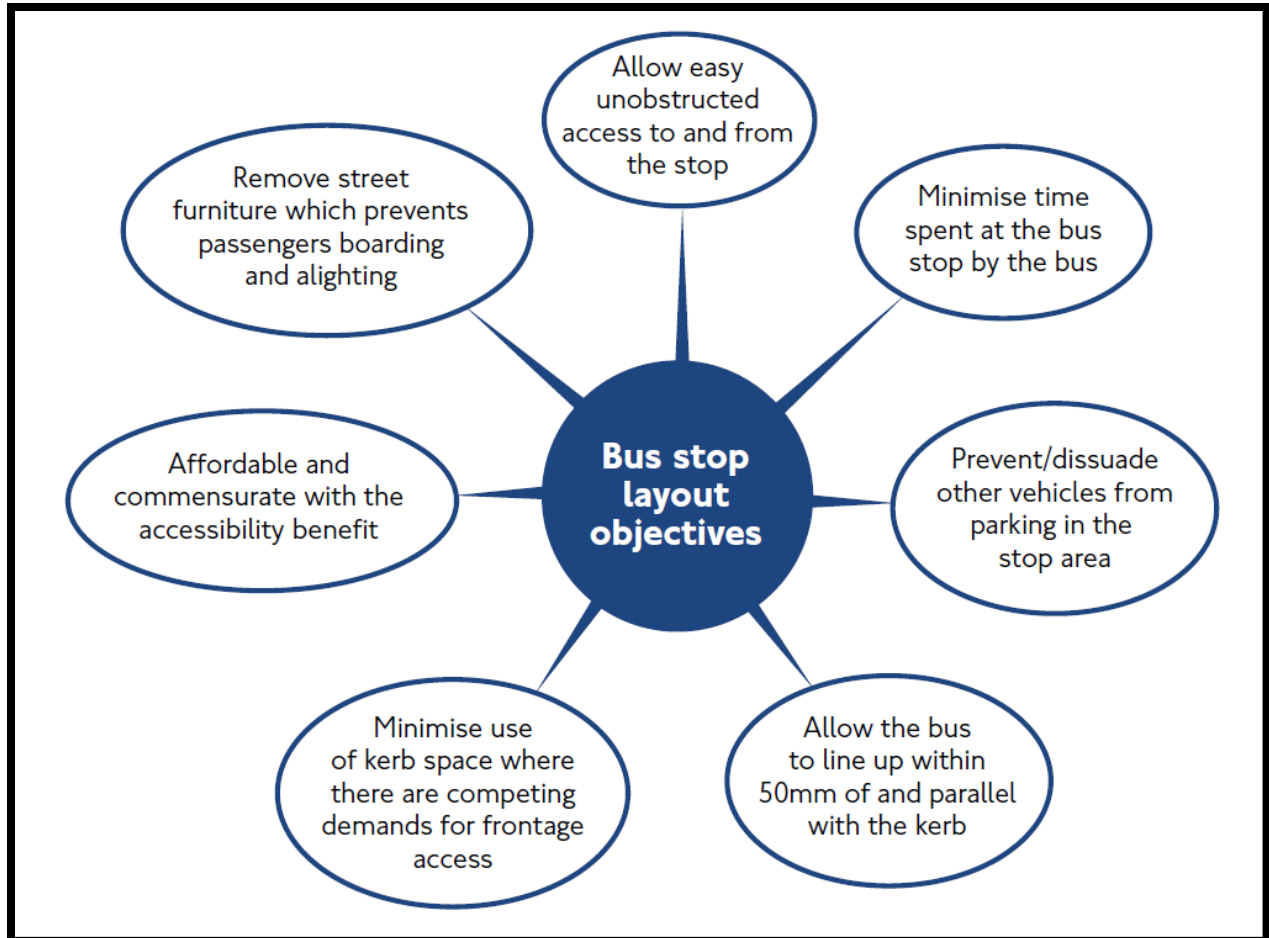


Figure 4-15: Bus Stop Layout Objectives

The bus should stop parallel to and as close to the kerb as possible to allow the effective use of the bus facilities. The critical dimensions (see Figure 4-16) to consider are the vertical gap, or step height from the kerb to the bus floor and the horizontal gap from kerb edge to the side of the bus. A well designed bus stop will provide features which coordinate with the facilities of low floor bus and minimize these two distances.

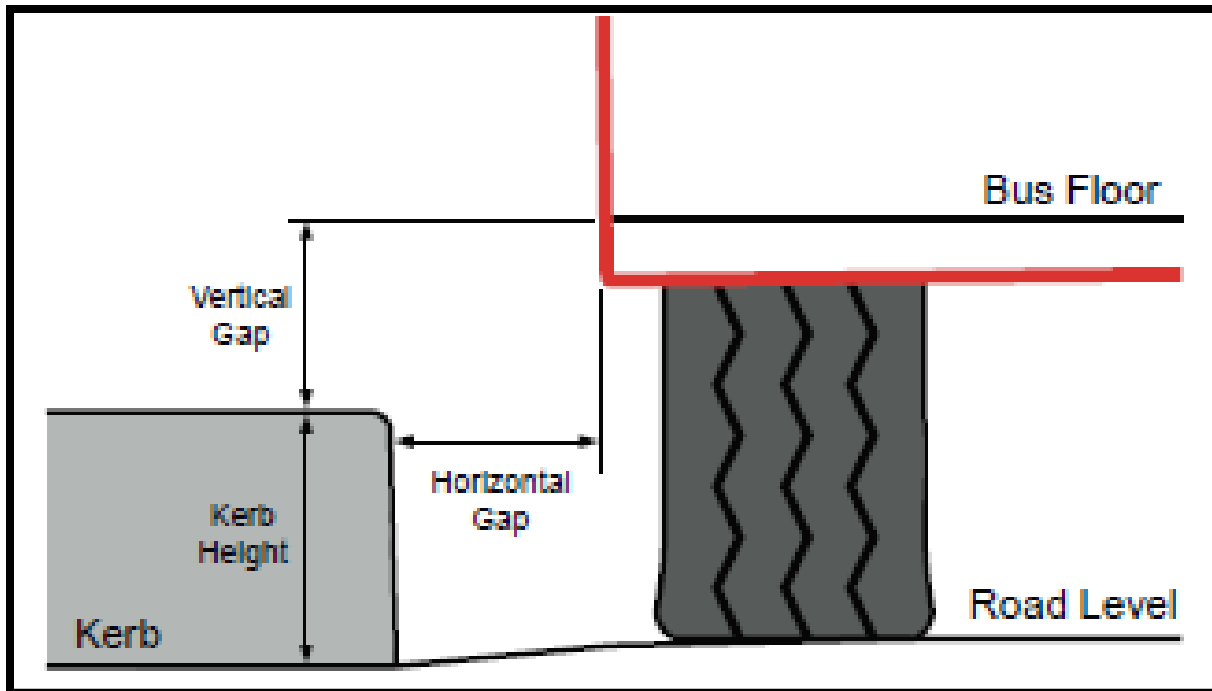


Figure 4-16: Critical Dimensions

The size of the vertical gap between the kerb and floor of the bus will affect the gradient of the ramp when it is deployed (see Figure 4-17). If this gradient is too severe, some users especially wheelchair users may be unable to enter or exit safely from the bus. Global Regulations under the Disability Discrimination Acts require new buses to be capable of deploying a ramp, giving a 1:8 or 12 percent (7 degree gradient), onto a kerb of at least 125mm in height. This regulation, therefore, assumes a standard kerb height of 125mm, which, although not the case universally, is the height that vehicle manufacturers are guided to apply in bus design.

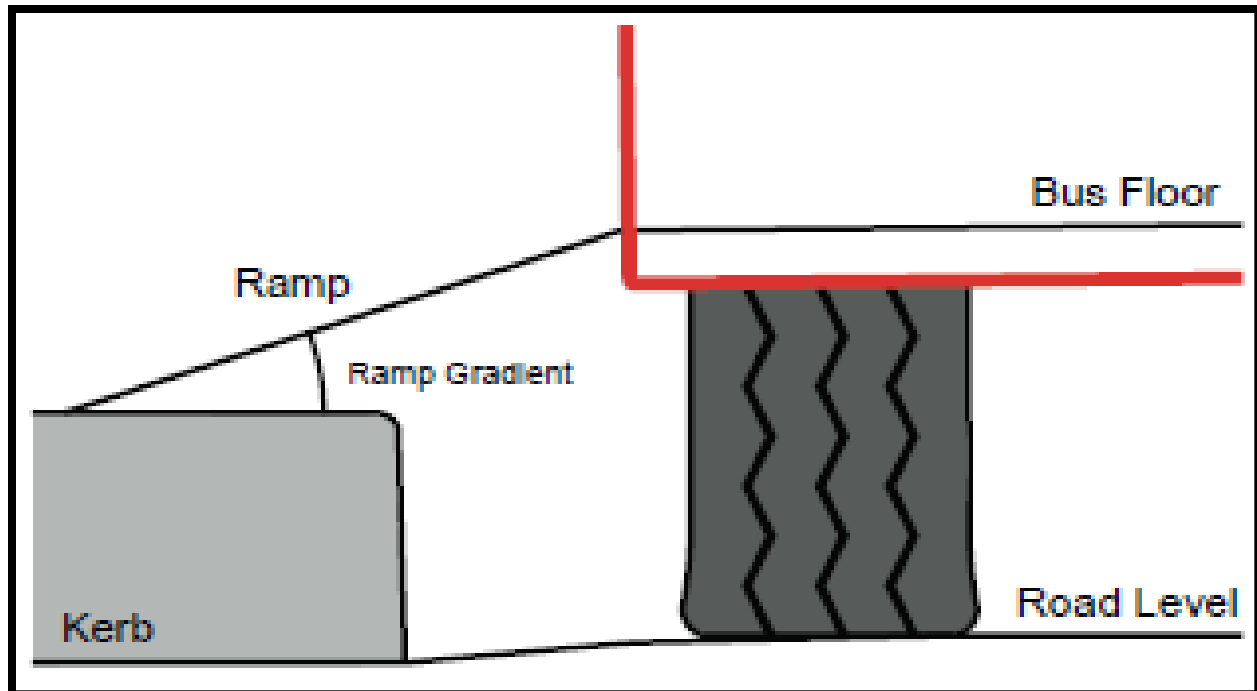


Figure 4-17: Ramp Gradient

It is important to recognize that, even when deployed on a 125mm high kerb, the gradient of the ramp may vary. The major determinants include:

- Type of ramp
- Ramp length
- Carriageway and footway cross falls;
- Distance of the bus from the kerb;

Maximum kerb height or higher 'special' kerbs should be preferred as they result in lower ramp gradients.

4.8.1.3 Types of Bus Stop Layout

Determining the proper location of bus stops involves choosing among far-side, near-side, and mid-lock stops as shown in Figure 58. The following factors should be considered when selecting the type of bus stop:

- Adjacent land use and activities

- Bus route (for example, is bus turning at the intersection)
- Bus signal priority (e.g., extended green suggests far side placement)
- Impact on intersection operations
- Intersecting transit routes
- Intersection geometry
- Parking restrictions and requirements
- Passenger origins and destinations
- Pedestrian access, including accessibility for handicap/wheelchair patrons
- Physical roadside constraints (trees, poles, driveways, etc.)
- Potential patronage
- Presence of bus bypass lane
- Traffic control devices

4.8.1.4 Stop Spacing

The determination of bus stop spacing is primarily based on goals that are frequently subdivided by development type, such as residential area, commercial, and/or a central business district (CBD). Another generally accepted procedure is placing stops at major trip generators. An ideal spacing for bus stops is approximately 400 to 700 meter, although a closer spacing in town centers and residential areas may be necessary to meet passenger requirements. Consideration should be given to improving spacing, and reviewing locations, particularly where interchange is an issue. Bus journey times are affected by the number of stops on a route and therefore a careful balance must be achieved. If it is proposed to relocate or remove a stop, an assessment of resulting benefits/impacts should be undertaken alongside consultation with stakeholders.

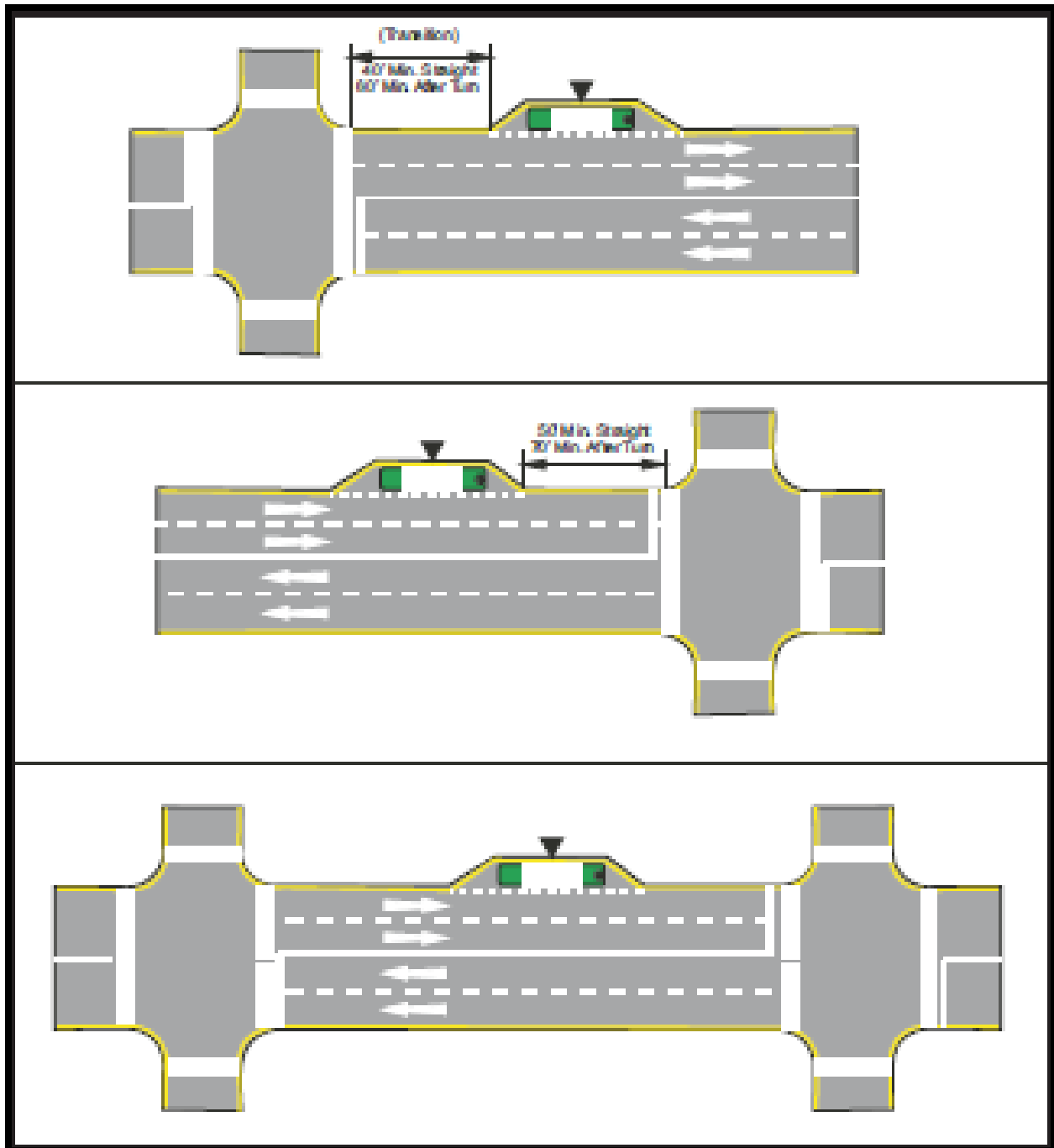


Figure 4-18: Types of Bus Stop Layout

4.8.1.5 Layout of Bus Stop

Typical Bus Stop Lay Out recommended for the Gujranwala city are shown below in Figure 4-19, 4-20, 4-21, 4-22 and 4-23 below.

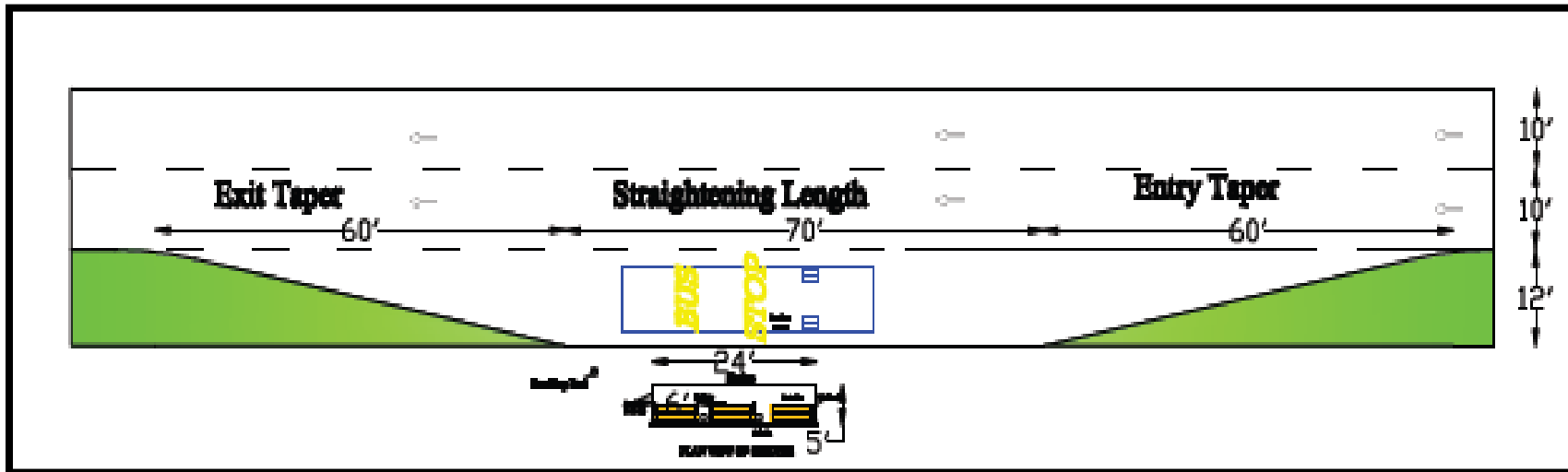


Figure 4-19: Plan View of Bus Stop

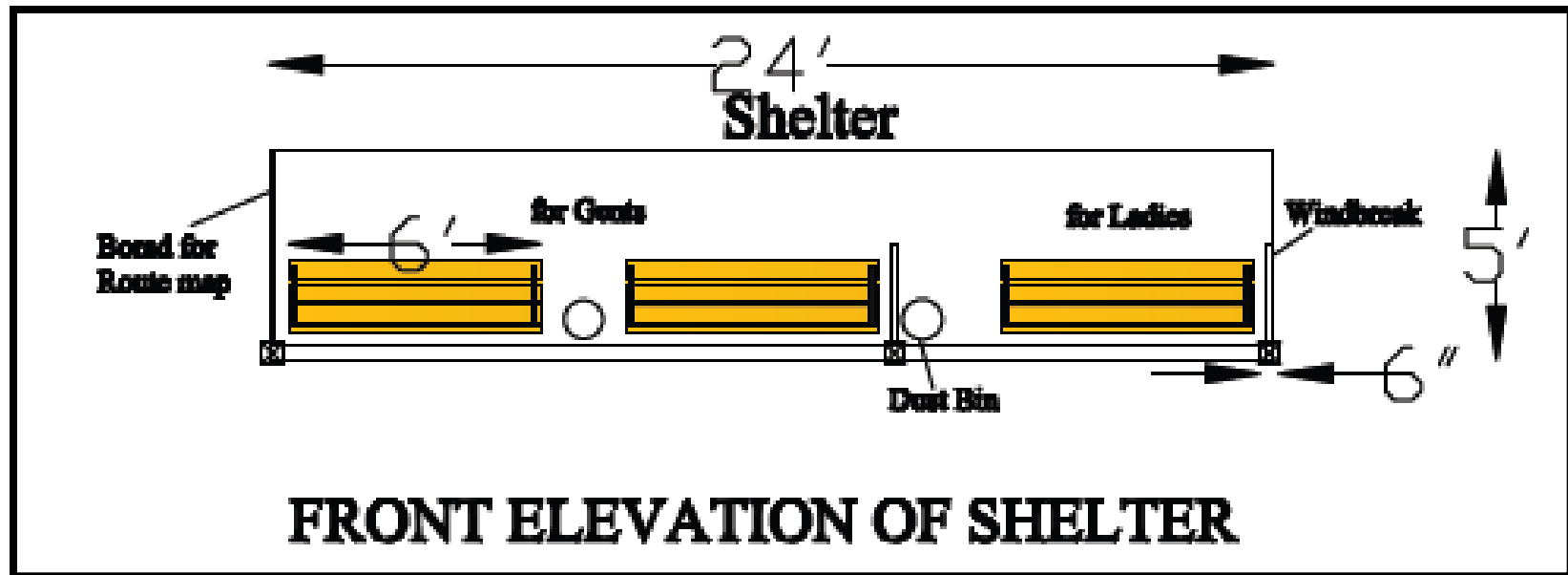


Figure 4-20: Plan View of Bus Stop Shelter

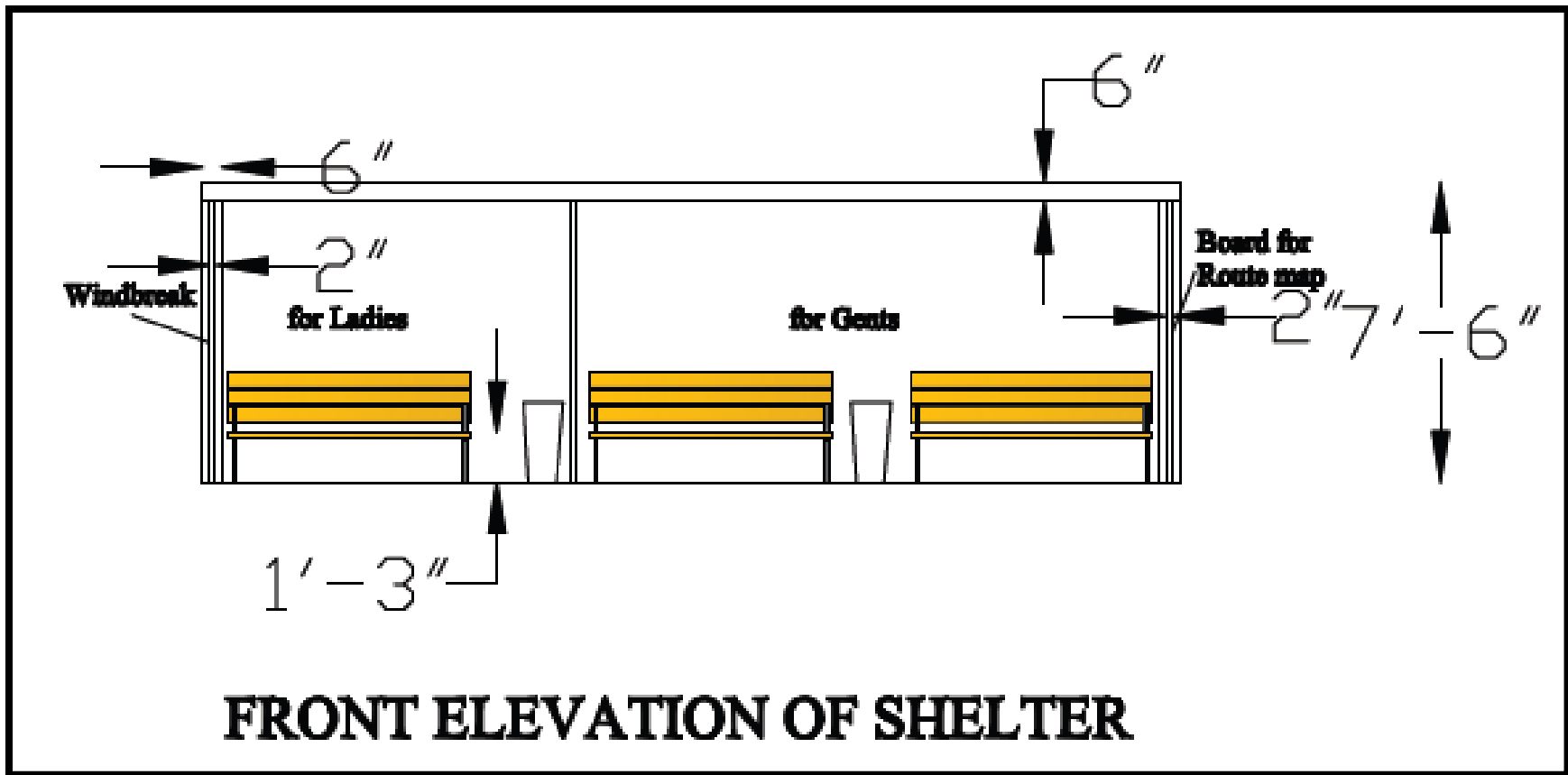


Figure 4-21: Front Elevation of Bus Stop Shelter

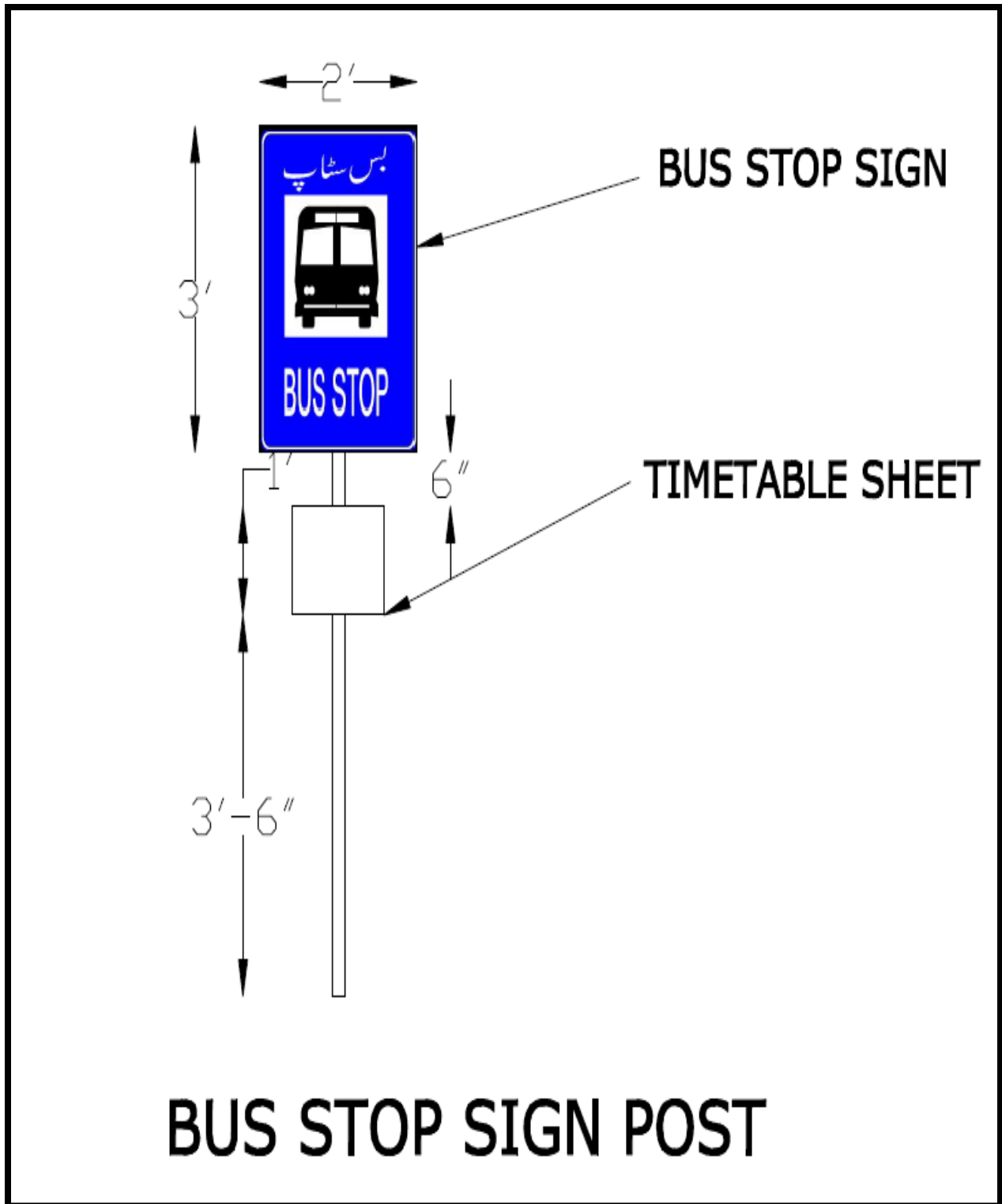


Figure 4-22: Bus Stop Sign Post

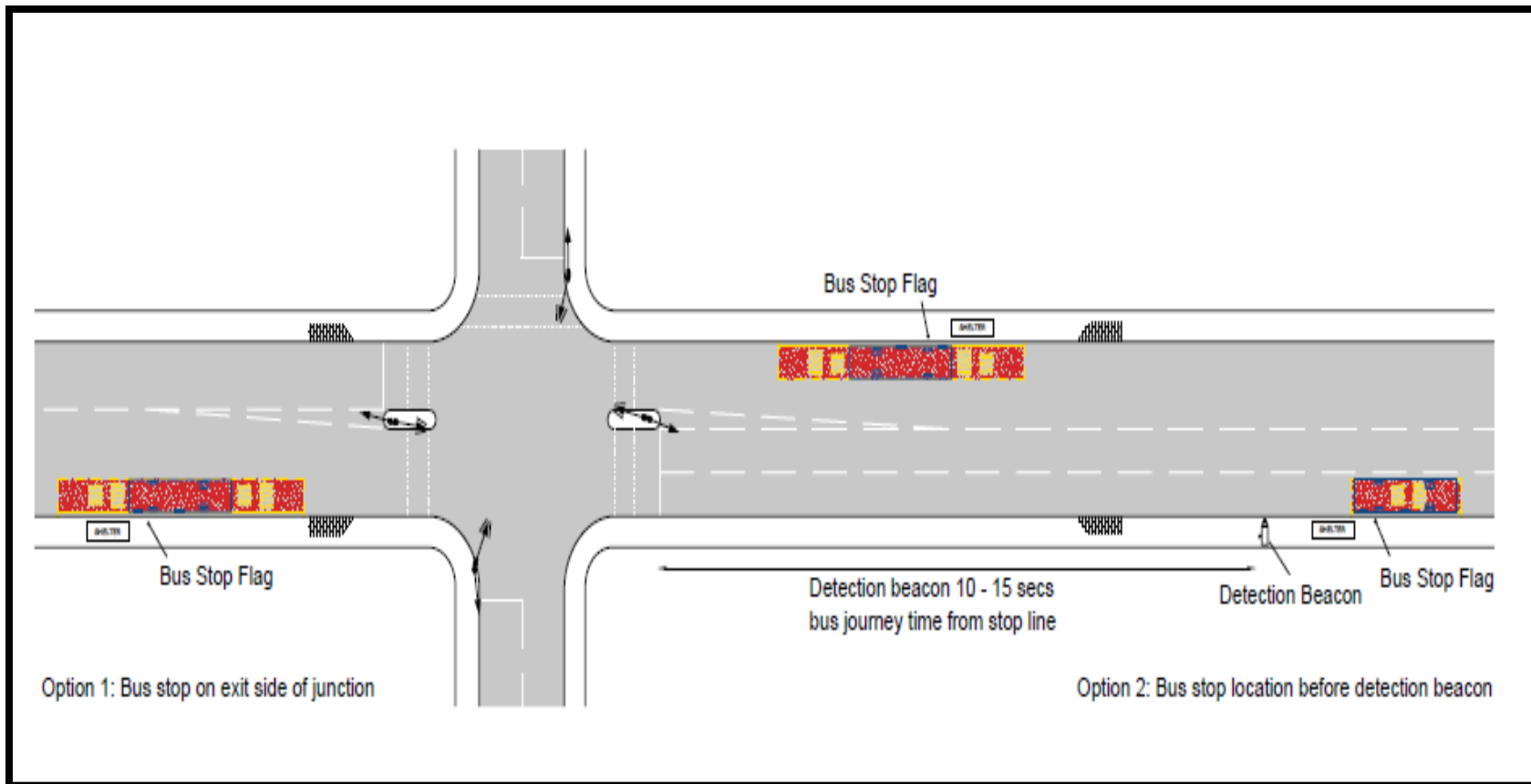


Figure 4-23: Bus Stop Location in vicinity of Traffic Signals

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Annexure-A

Survey Forms

ILLEGAL PUBLIC TRANSPORT SURVEY

Name of Surveyor: _____

Date: _____

Location: _____

Sheet # : _____

Direction: From _____ to _____

Sr. No	Vehicle Type	Registration No.	Boarding Passengers	Time
1	Q A H S			
2	Q A H S			
3	Q A H S			
4	Q A H S			
5	Q A H S			
6	Q A H S			
7	Q A H S			
8	Q A H S			
9	Q A H S			
10	Q A H S			
11	Q A H S			
12	Q A H S			
13	Q A H S			
14	Q A H S			
15	Q A H S			
16	Q A H S			
17	Q A H S			
18	Q A H S			
19	Q A H S			
20	Q A H S			
21	Q A H S			
22	Q A H S			
23	Q A H S			
24	Q A H S			
25	Q A H S			
26	Q A H S			
27	Q A H S			
28	Q A H S			
29	Q A H S			
30	Q A H S			
31	Q A H S			
32	Q A H S			
33	Q A H S			
34	Q A H S			
35	Q A H S			
CODES	Q = QINGQI	A = AUTO RIKSHAW	H = HIACE/TOYTA	S = SUZUKI