Environmental Impact Assessment: Main Report

Project No. 48289-002
April 2017

PAK: Peshawar Sustainable Bus Rapid Transit Corridor Project

Prepared by Peshawar Development Authority (PDA), provincial Government of Khyber Pakhtunkhwa (GoKP) for the Asian Development Bank (ADB).

CURRENCY EQUIVALENTS

As of 9th April 2017 Currency Unit – Pak Rupees (Pak Rs.)
Pak Rs 1.00 = $ 0.0093 US$1.00 = Pak Rs. 107

Acronyms

ADB	Asian Development Bank
SPS	Safeguard Policy Statement
SIA	Social Impact Assessment
DoF	Department of Forests
EA	Environmental Assessment
EARF	Environment Assessment Review Framework
EAAC	Environmental Assessment Advisory Committee
EPA	Environmental Protection Agency
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
PPDD	Punjab Planning and Development Department
EA	Executing Agency
IA	Implementing Agency
PDA	Peshawar Development Authority
PMU	Project Management Unit
SC	Steering Committee
AS	Assistant Secretary
GoKPK	Government of Khyber Pakhtunkhwa
GOP	Government of Pakistan
IEE	Initial Environmental Examination
km	Kilometer
tpd	Tonnes per day
LAA	Land Acquisition Act (of 1984)
LARP	Land Acquisition and Resettlement Plan
Leq	Equivalent sound pressure level
NEQS	National Environmental Quality Standards
NGO	Non Governmental Organization
O&M	Operation & Maintenance
PC	Public consultation
PAP	Project Affected Person
BRT	Bus Rapid Transit
PEPAct	Pakistan Environment Protection Act 1997
RP	Resettlement Plan
PFS	Pre-Feasibility Study

Content Amendment Details

S/No.	Version	Date	Summary of Revisions made
1	Revision Number 1	09-04-17	▪ Executive Summary has been re-written. ▪ Chapter 2 (Policy and Legal Framework) has been updated. ▪ Chapter 5 (Analysis of Alternatives) has been further elaborated and comparison of diesel with a wider range of fuel options has been added. ▪ Chapter 6 (Potential Environmental Impacts and Mitigation Measures) has been updated and Section 6.5, 'Cumulative Impacts' has been elaborated. ▪ Section on Community Safety, Section 6.2.13 has been updated. ▪ Chapter 7 (EMP) has been updated and costs for monitoring and implementation of mitigation measures have been revised. ▪ Chapter 10 (Conclusions and Recommendations) has been updated. ▪ Annexure P: ToRs for 'Bala Hisar Fort Structural Assessment' has been revised. ▪ Annexures Q and R have been added.

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EXECUTIVE SUMMARY

Project Overview

1. The proposed project consists of the development of a bus rapid transit (BRT) corridor with a total length of 30.8 km to be constructed on a phase wise basis in Peshawar city, Pakistan. The first phase will involve construction of 25.8 km of the BRT corridor while 5 km will be constructed in the second phase. The BRT corridor will consist of a total of 31 stations and will run from Chamkani to Hayatabad. A map of the project area is provided as **Figure ES-1**.

Project Need

2. The project is of high significance considering the urgent need for improving the urban transport landscape of Peshawar city. This project is expected to contribute towards the economic and social development of the region and pave the way for uplift of this entire region through generation of economic opportunities and increased investor interest in Peshawar.

3. The BRT project can be used as an opportunity to restructure the entire public transport industry, from Minibus and Bedford bus, Wagon and Suzuki up to Qingqi. With the BRT implemented, the government will have more bargaining power to reform the public transport in Peshawar. BRT could be used as an opportunity to bring professional bus operating companies to run in Peshawar and show the best practice model to the existing operators.

4. Many positive impacts on the environment are expected from the proposed BRT project due to the use of a cleaner and more fuel efficient fleet being used in the BRT as well as reduction in vehicular exhaust emissions due to reduction in kilometers travelled by private vehicles.

5. There are also a number of economic benefits associated with the proposed BRT project due to the time savings of both the public transport and private vehicle passengers. Also, since there is no formal bus industry as yet in the city, the BRT will open up more formal employment associated with the BRT such as security guards, bus drivers, mechanics etc.

6. In comparison to rail based mass transit system, BRT offers flexibility and is easy to expand. Dedicated BRT lanes can increase bus travel speed significantly. But most importantly, with BRT, buses can operate inside and outside the BRT corridor, allowing rapid citywide coverage.

Study Methodology

7. Existing primary and secondary data on ambient noise levels and air quality, water resources, flora, fauna and information from the preliminary feasibility study conducted for this and other projects of similar nature were collected, reviewed, and analyzed. Extensive field visits to the project area were undertaken and key

receptors and stakeholders within the project area (100 meters on either side of the project corridor) were identified and consulted.

8. Detailed ambient air and noise monitoring at different key receptor points along the project corridor were conducted. Apart from PM_{10}, all other pollutants are within acceptable NEQS limits. The ambient noise levels are generally high at both day and night times and are exceeding the NEQS limits.

9. The significance of impacts from the proposed project were then assessed and for those impacts requiring mitigation, suitable measures were proposed to reduce impacts to within acceptable limits as per local and international applicable regulations. A detailed environmental management and monitoring plan was developed to ensure compliance to the proposed measures during the project development.

Public Consultation Process

10. A total of over 600 different stakeholders were consulted as a part of the consultation process with traders and business owners in the project area, residents along the project corridor, affected persons, senior management staff of health care and educational institutions, visitors to the project corridor on a daily basis as well as public sector representatives from different line departments. It was ensured that consultations with different women groups were also conducted which consisted of women from Affected Households, teachers and other working women as well as daily commuters along the proposed BRT corridor.

Analysis of Alternatives

11. The 'No Project' alternative was considered which is not a viable option since over two million people residing in Peshawar city would not benefit from a sustainable, more efficient, more economical and safer transport system and would continue to suffer congestion and traffic accident risks in the city.

12. A number of different route options were considered keeping in view a mix of technical, economical and environmental aspects to ensure the finalized route of the project would be the most favorable amongst the possible route alignment options. Six mass transit corridors were identified in Peshawar but the corridor 2, from Chamkani to Karkhano was selected as the recommended option to be built in the first stage as a BRT. Also, four alignment options were considered for the city center area and the 'At-Grade via Hospital road' was selected.

13. Other options considered were the different fuel alternatives compared to diesel such as compressed natural gas (CNG), natural gas, diesel-electric hybrid, alternative fuels (bio-diesel, bio-methane/CNG and hydrogen) and fully electric. The selection of diesel-based buses for the proposed BRT buses is the most suitable option considering all techno-economic aspects for the project.

14. The ‘At Grade’ versus ‘Elevated’ sections option along the BRT corridor was also considered and the pros and cons weighed with elevated sections constructed along the corridor, wherever felt necessary. The ‘At Grade’ option was assessed to be the most convenient from a techno-economic perspective.

15. A number of locations for development of the bus depots were also considered and the two selected sites were at Chamkani and Hayatabad, which are the two tail ends of the BRT corridor and thus will ensure that all environmental and social impacts are minimized, compared to developing these depots within the highly urbanized and congested urban areas of Peshawar city.

Potential Major Impacts

Traffic Management

16. A traffic management plan is presently under preparation by experts specifically engaged for this task by ADB. The finalized plan shall be provided to the Contractor for implementation prior to commencement of the project construction activity. The main objectives of the plan shall be to maximize the safety of the workforce and the travelling public while keeping the traffic flowing as freely as possible.

Disruption to Utilities

17. The project will require demolishing and relocating some of the structures within the ROW such as water supply pipes, drainage structures, electric and communication cables. Temporary suspension of services (planned or accidental) can affect the economy, industries, businesses and residents’ daily lives.

18. The project infrastructure shall pass through the median of the existing roads along the proposed corridor, with minimal utility infrastructure, if any, located under these roads. All required mitigation measures shall be implemented such as planning of activities through coordination with relevant line departments to minimize impact on utilities at work sites along corridor, advance notices to communities to enable them to prepare for utility outages etc.

Historical/Archaeological sites

19. There is only one historical site within the project area i.e. the Bala Hisar fort. While conducting the excavation activity next to the fort, a staff member from the department of Museum and Archaeology shall be present at all times. If evidence of any archaeological remains is found during the construction activities, the excavation work will be stopped immediately and necessary next steps taken to identify the archaeological discovery based on the ‘Chance Find’ procedures.

20. The vibration levels from the use of the construction equipment and vehicles will be closely monitored to ensure typical peak particle velocities remain within allowable limits and do not exceed the 5 in/sec limit, in which case major structural damage such as cracking or shifting of foundations or bearing walls can take place.

Air Quality

21. The potential impacts on air quality have been assessed for both the construction and operation phases of the project. The major impacts expected during the construction phase of the project are due to dust emissions resulting from vehicular movement, emissions from construction machinery, use of generators and construction vehicles. These impacts will be mitigated through employing of best practices such as water sprinkling, tuning and maintenance of construction equipment and vehicles, covering of materials susceptible to dust formation during transportation etc.

22. In order to assess the air quality impacts during the operation phase of the project, the BREEZE Roads model has been used to simulate the possible increment in ambient CO and PM pollutant concentrations in the project area. It has been observed that the maximum concentration of CO was 204.016 ug/m^3 (0.204 mg/m^3) and 104.13 ug/m^3 (0.104 mg/m^3) for 1 hour and 8 hourly averaged respectively. The model estimated that the mean concentrations of 23.89 ug/m^3 and 13.176 ug/m^3 for 1 hour and 8 hourly are well within the limits of NEQS for CO.

23. In the case of PM, the predicted 1 hour and 24 hourly averaged concentrations of PM are 6.272 ug/m^3 and 2.109 ug/m^3. There was an insignificant increase of PM concentrations in the atmosphere from the proposed project. However, since the ambient concentration of PM_{10} is already exceeding the NEQS limits of 150 ug/m^3 for the 24 hourly average, thus the cumulative concentration is also exceeding the NEQS limits.

Noise impacts

24. The potential noise impacts resulting from the construction and operation phases of the proposed project were assessed using a standard noise propagation model.

25. In the construction phase, three different scenarios involving various combinations of construction equipment were analyzed to assess the resulting noise levels at all key receptors all along the project corridor with noise contours developed to clearly display the respective noise levels. Based on the nature of the sensitive receptors, the applicable noise zones were also clearly marked to ensure any exceedances could be identified and necessary noise mitigation measures such as placing of noise barriers could be planned. A number of additional mitigation measures have also been proposed such as preventing blowing of horns, tuning of equipment and vehicles to minimize noise levels etc.

26. In the operation phase, the noise propagation model was used to simulate the operation of buses along the project corridor and the resulting noise levels and all key receptors. It was assessed that maximum resultant noise levels at the BRT bus stops are expected to be around 80 dB(A) which is a conservative estimate since the new engines of the BRT buses will produce low noise levels and will be quite efficient. Also, the drivers of the BRT buses will not be blowing the horns and these

buses will not be calling out loudly to attract customers to board the buses, which is a common practice for public transport in the city.

Land Acquisition & Resettlement

27. The project will have significant resettlement impacts on 535 households due to acquisition of 117 Kanal (14.6 acres/5.9 hectares) of private arable land, demolition of permanent structures of 2 underpass markets having 84 shops, 4 commercial toilets, 3 kiosks and 12 stores, a horizontal structure of 14 shops, one store room of a business, and two mosques (built in the ROW).

28. It will also impact the livelihood of 8 non-titleholder of agriculture land, 86 formal businesses/shopkeepers among them is a female headed household whose business is run by her brother; 235 non-titleholder vendors operating road side micro enterprises in the ROW, among them are 2 disabled, 99 employees of formal businesses and their 49 salaried relatives of formal businesses, having separate households; 4 security guards of underpass markets, and one khateeb (prayer leader) of a mosque.

29. All formal and micro businesses need relocation of their businesses to alternative sites. The leaseholders of 79 shops and owners of 14 shops will lose income from monthly rent of the commercial structures. Among 535 AHs, 349 are vulnerable with 246 severely affected that need additional resettlement and rehabilitation assistance.

30. Displaced Persons (DPs') and stakeholder concerns and suggestions have been incorporated in the LARP, Environment Management Plan (EMP) and Gender Action Plan (GAP). Consultation with DPs and other stakeholders will be continued during project implementation.

Climate Change Impacts

31. The BRT project will play a key role in reduction of CO_2 emissions from vehicular movement in Peshawar city with almost 31,000 tons of reduction in CO_2 emissions expected in the first year of operation and 62,000 tons of reduction in CO_2 emissions expected by the year 2026.

Site Specific Impact Assessment

32. A comprehensive 'site specific' impact assessment has also been conducted for Bus Depots, Elevated Sections and Tunnels and Underground sections and their corresponding EMPs have been developed for implementation during the construction phase for these respective sections of the BRT.

Cumulative Impacts

33. The only infrastructure project to be developed in the project area is a second tier flyover planned over the Pir Zakori bridge with a length of approximately 900 meters. The construction of this flyover bridge is expected to commence in April 2017 and will be completed in six months. Considering the location and scope of the proposed

flyover, it is not expected to pose any interruption or interference to the construction work for the BRT project. Also, this particular project will be almost complete by the time the proposed BRT project construction would be commencing and only a minor overlap is expected.

Indirect and Induced Impacts

34. The potential impact of development in Peshawar city has been examined, which indicated that the existing and planned infrastructure such as water supply, wastewater collection and treatment, municipal solid waste collection and disposal would be adequate to accommodate the population intake as a result of the proposed project development. Impacts on the environment from air emissions, traffic and community noise, and treated effluent discharge have also been assessed and have found to be acceptable and within the carrying capacities of the environmental media. Thus, negative indirect and induced impacts from this project are not expected.

Institutional Arrangements

35. During the construction phase, the overall responsibility for the implementation and monitoring of the EMP rests with the Project Director (PD). The PD through assistance from the Supervision Consultant's Environmental staff and the Environment team of PDA, will supervise the implementation of the proposed mitigation measures and monitor the implementation progress in the field. Monthly environmental monitoring data/reports will be incorporated in the project implementation progress reports to be shared with ADB and such monthly reports will be consolidated into bi-annual monitoring reports and submitted to ADB for review and clearance. Upon clearance, all such reports will be uploaded on the PDA and ADB websites.

Conclusion & Recommendations

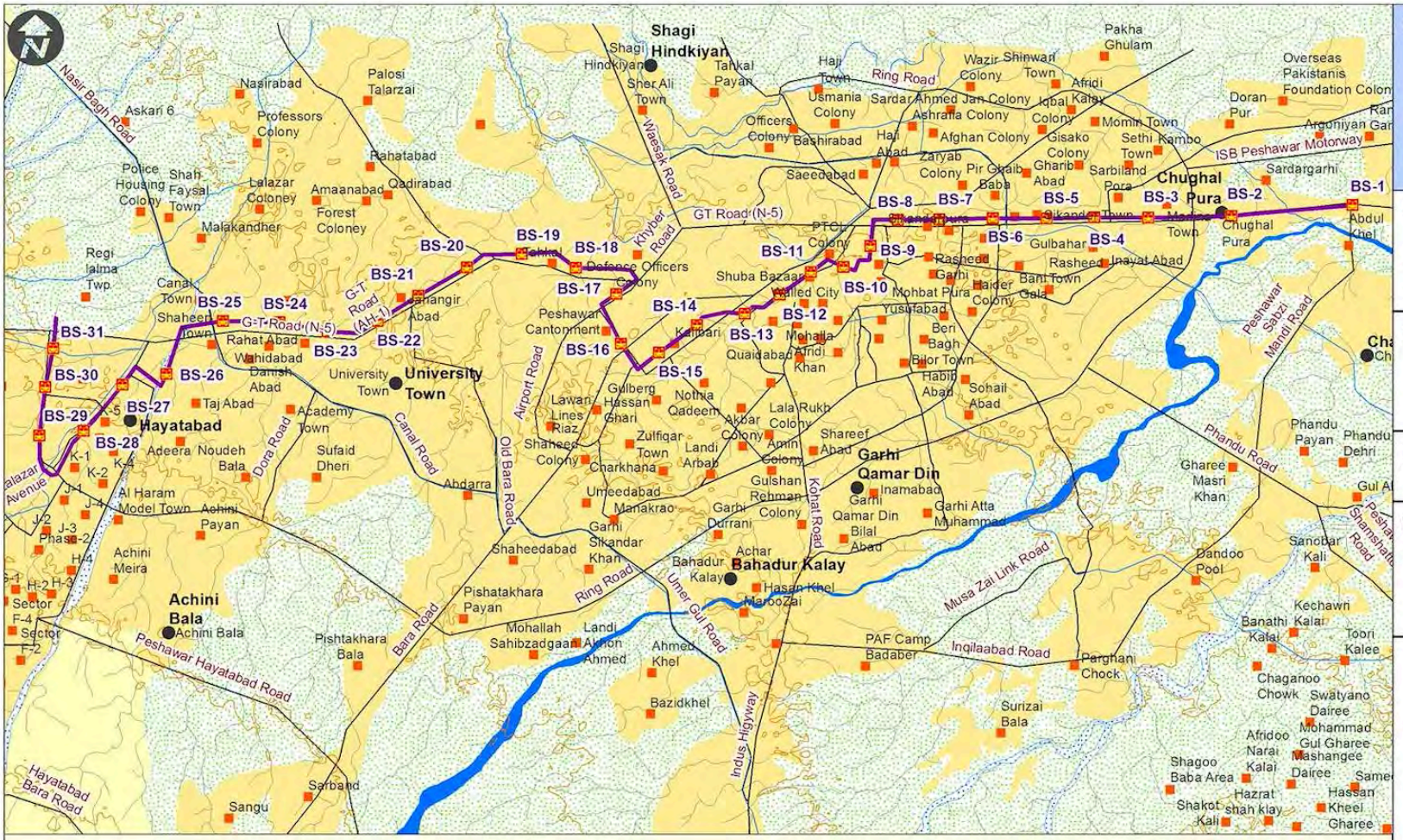
36. An action plan with clear roles and responsibilities of stakeholders has been provided in the report. The PDA, Contractors and the Construction Supervision Consultant are the major stakeholders responsible for the action plan. The action plan must be implemented prior to commencement of construction work.

37. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures in the EMP are implemented and to determine whether the environment is protected as intended. This will include observations on and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported. The engaging of external environmental monitoring consultants for ensuring efficient and effective implementation of the mitigation measures is also under consideration.

38. Therefore, the proposed BRT development is likely to cause certain significant adverse impacts, mostly during the construction phase, that shall be mitigated through necessary measures. The potential adverse impacts that are associated with design, construction, and operation can be mitigated to standard levels without

difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures. Based on the findings of this EIA study, the classification of the Project as Category 'A' is confirmed. It is concluded that the proposed project should proceed, with appropriate mitigation measures and monitoring programs identified in the EIA.

39. As a result of this EIA study, it has been determined that any adverse or harmful impacts shall be effectively mitigated through implementation of necessary measures and through regular monitoring. The project falls under the Category 'A' of ADB's Guidelines and thus an EIA has been prepared for the proposed project.



Preferred Option Route

Stop Number	Name	Stop Number	Name	Stop Number	Name
BS-01	Chamkani Chowk	BS-12	Dabgari Gardens	BS-23	KTH University of Peshawar
BS-02	Chughal Pura	BS-13	Railway Station	BS-24	Islamia College
BS-03	Dr. Zareef Memorial School	BS-14	State Bank of Pakistan	BS-25	Board Bazar Rogi
BS-04	Sethi Town	BS-15	Saddar Bazar	BS-26	Taj Abad
BS-05	Sikandar Town	BS-16	Mall Road	BS-27	Hayatabad Model School
BS-06	Gulbahar Square	BS-17	Khyber Road Airport	BS-28	Hayatabad Phase 3
BS-07	Hashnagri	BS-18	Gora Qabristan-Christian Cemetery	BS-29	Tatara Park
BS-08	Qila Balahisar	BS-19	Tehkal	BS-30	PDA Hayatabad
BS-09	Hospital Road	BS-20	Tambuwaan - Tents	BS-31	Cancer Hospital
BS-10	Khyber Bazar	BS-21	Abdara Road		
BS-11	Soekarno Square Secretariat	BS-22	University Town		

Project:

Peshawar Bus Rapid Transit Corridor Project

Drawing Title:

Project Area Map of Entire Project Corridor

Drawing Number:

Figure ES-1

Drawing Date: November-2016

Drawing Source:

Field Data Collection
Google Earth
DEM (Digital Elevation Model)

Legend

- Proposed Metro Stations
- Proposed Route Preferred Option
- Proposed Route Option 2
- Main Town / City
- Town / Sector
- Main Road Network
- Stream Network
- Nullah
- River
- Nullah_Network
- Contour

1 Introduction

1.1 Project Background

40. In 2013, the provincial government of Khyber Pakhtunkhwa (GoKP) requested the City Development Initiative for Asia (CDIA) to help improve Peshawar's urban transport system and provide technical and financial support to implement mass-transit solutions and strengthen institutions and organizations managing the urban transport sector.

    In response to this request, CDIA undertook an Urban Transport Pre-Feasibility Study (PFS). Completed in May 2014, this technical assistance developed a 20-year urban transport strategy with a 10-year action plan. The PFS also conducted a basic travel demand survey, identifying the east-west and north-south priority axis to be developed as mass-transit corridors and analyzed cost-efficiency of different mass-transit modes on those corridors. Based on available data and generic estimates, the PFS finally recommended the development of Bus Rapid Transit (BRT) on corridor 2 (GT Road from Chamkani to Karkhano) as the most viable option and priority investment under the action plan.

41. On the basis of the PFS, GoKP requested the Asian Development Bank (ADB) to provide a PPTA to undertake a feasibility study for the recommended BRT corridor. Pursuant to this request, ADB approved a $1.5 million PPTA grant and the PPTA consultants presented the project concept and different options for the BRT corridor alignment. The BRT on corridor 2 was agreed to preferably be left at-grade as much as possible to ensure better integration and flexibility with other future BRT corridors, limit the capital investment cost, and promote universal accessibility.

    The ADB Project will restructure the entire BRT corridor, from façade-to-façade, with the objective to address parking and encroachment issues, improve the surrounding walking environment, share public space equitably between pedestrians, public transport and private modes, and provide a more pleasant and beautiful urban environment.

42. This Environmental Impact Assessment (EIA) report presents the screening of potential environmental impacts of the proposed project and contains the mitigation measures in order to eliminate or reduce the negative impacts to an acceptable level, describes the institutional requirements and provides an environmental management plan.

    The key map of the proposed project is provided as **Figure 1.1** below.

1.2 Environmental Category of the Project

43. According to ADB's Safeguard Policy Statement (SPS) 2009, a Rapid Environmental Assessment (REA) Checklist was prepared (Annexure-I). The Pakistan Environmental Protection Agency's "Guidelines for the Preparation and Review of

Environmental Reports (2000)" were also consulted. Based on the initial findings, it was ascertained that certain adverse environmental impacts are expected due to development of the proposed bus rapid transit corridor project, and thus the subject project is considered environmentally "A" category. Therefore, an EIA has been conducted.

1.3 Methodology of EIA Study

The following methodology was employed for this EIA:

44. Existing secondary data such as baseline information on water resources, flora, fauna and information from the pre-feasibility study conducted for this and other projects of similar nature were collected, reviewed, and analyzed.

45. Field visits were undertaken consisting of preliminary scoping through survey and assessment activities to establish the potential impacts and categorization of activities and the Rapid Environmental Assessment (REA) was completed. The key receptors and stakeholders within the project area (100 meters on either side of the project alignment) were identified.

46. Primary data collection such as ambient noise levels and ambient air quality at the key receptor locations within 100 meters on either side of the project alignment was conducted.

47. Public consultations (PC) were carried out with all key stakeholders, particularly local businesses, management of hospitals and educational institutions residing in the project area, local communities, government and local government bodies in line with ADB's "Safeguard Policy Statement (SPS) – June 2009"/ Environmental Assessment Guidelines. Under ADB requirements, the environmental assessment process must also include meaningful public consultations during the completion of the study. In this EIA, the Public Consultation process included verbal disclosure regarding the project development as a vehicle for discussion.

48. The significance of impacts from the proposed project were then assessed and for those impacts requiring mitigation, suitable measures were proposed to reduce impacts to within acceptable limits as per local and international applicable regulations.

49. A detailed environmental management and monitoring plan was developed to ensure compliance to the proposed measures during the project development.

Project:

Peshawar Bus Rapid Transit Corridor Project

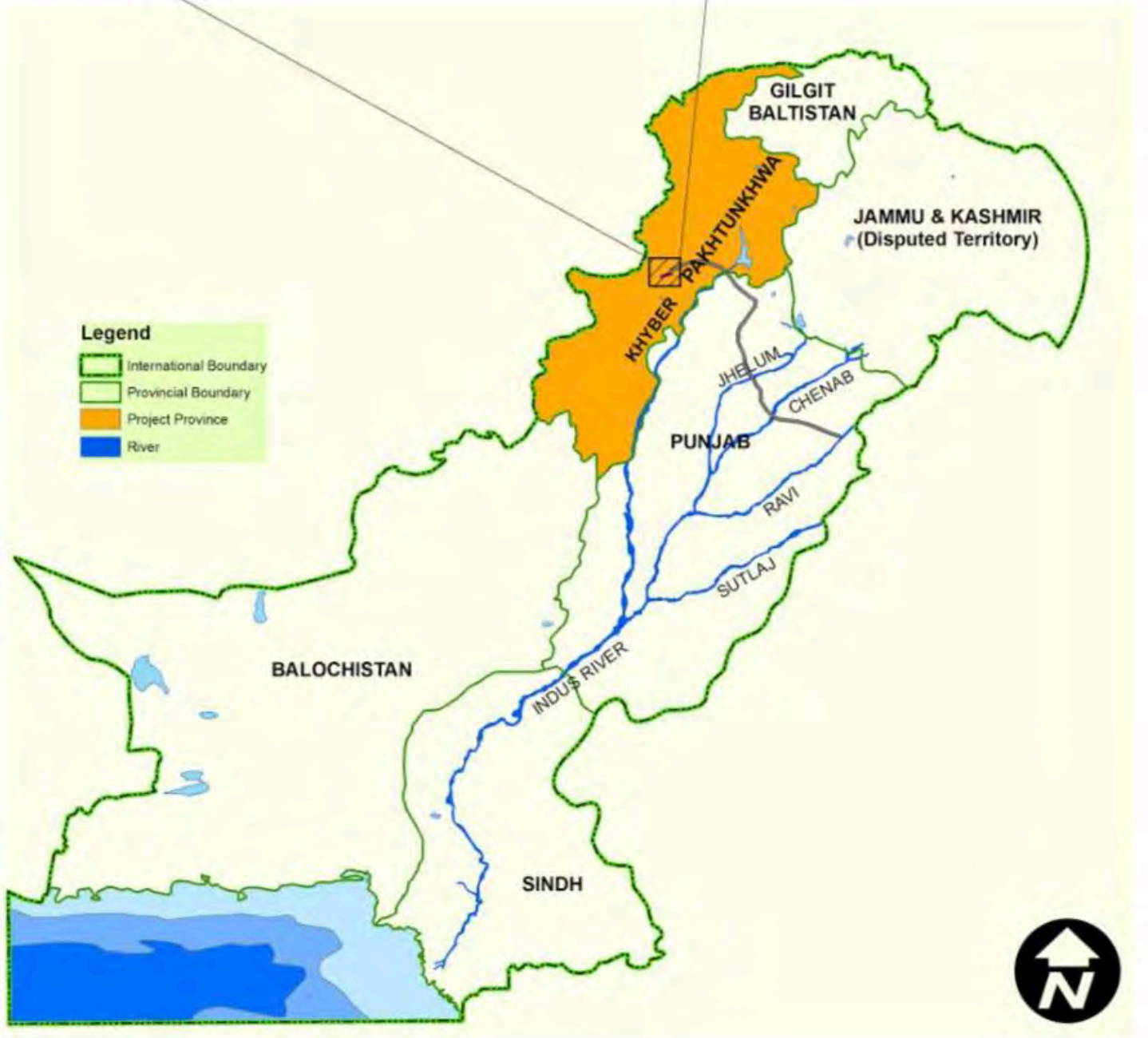
Drawing Title:

Key Map

Drawing Number:

Figure 1.1

Drawing Date: November-2016



2 Policy and Legal Framework

2.1 General

50. This section provides an overview of the policy framework and national legislation that applies to the proposed project. The project is expected to comply with all national legislation relating to the environment in Pakistan, and to obtain all the regulatory clearances required.

2.2 National Policy and Legal Framework

51. The Pakistan National Conservation Strategy (NCS) that was approved by the federal cabinet in March 1992 is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the proposed project are pollution prevention and abatement and increasing energy efficiency while conserving biodiversity.

52. Prior to the adoption of the 18th Constitutional Amendment, the Pakistan Environmental Protection Act (PEPA) 1997 was the governing law for environmental conservation in the country. Under PEPA 1997, the Pakistan Environmental Protection Council (PEPC) and Pak EPA were primarily responsible for administering PEPA 1997. Post the adoption of the 18th Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation. Subsequently, the Punjab government amended PEPA 1997 as Punjab Environmental Protection (Amendment) Act 2012, and Punjab EPA (PEPA) is responsible for ensuring the implementation of provisions of the Act in Punjab’s territorial jurisdiction. PEPA is also required to ensure compliance with the NEQS and establish monitoring and evaluation systems.

2.3 Regulations for Environmental Assessment, Pakistan EPA

53. Under Section 12 (and subsequent amendment) of the PEPA (1997), a project falling under any category specified in Schedule I of the IEE/EIA Regulations (SRO 339 (I0/2000), requires the proponent of the project to file an IEE with the concerned provincial EPA. Projects falling under any category specified in Schedule II require the proponent to file an EIA with the provincial agency, which is responsible for its review and accordance of approval or request any additional information deemed necessary.

2.4 Regulatory Clearances, KPK EPA

54. In accordance with provincial regulatory requirements, an IEE/EIA satisfying the requirements of the KPK Environmental Protection Act (2014) is to be submitted to

KP environmental protection agency (KP-EPA) for review and approval, and subsequent issuance of NOC before the commencement of construction.

2.5 Guidelines for Environmental Assessment, Pakistan EPA

55. The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. The guidelines that are relevant to the proposed project are listed below:

- Guidelines for the Preparation and Review of Environmental Reports, Pakistan, EPA1997;
- Guidelines for Public Consultations; Pakistan EPA May 1997;

2.6 National Environmental Quality Standards (NEQS) 2000

56. The National Environmental Quality Standards (NEQS), 2000, specify the following standards:

- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea (three separate sets of numbers);
- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources;
- Maximum allowable concentration of pollutants (two parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles;
- Maximum allowable noise levels from vehicles;

57. These standards apply to the gaseous emissions and liquid effluents discharged by batching plants, campsites and construction machinery. The standards for vehicles will apply during the construction as well as operation phase of the project. Standards for ambient air quality have also been prescribed.

2.7 ADB's Safeguard Policy Statement (SPS), 2009

58. The Asian Development Bank's Safeguard Policy Statement (SPS) 2009 requires that environmental considerations be incorporated into ADB's funded project to ensure that the project will have minimal environmental impacts and be environmentally sound. Occupational health & safety of the local population should also be addressed as well as the project workers as stated in SPS. A Grievance Redress Mechanism (GRM) to receive application and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance is also established and provided in Chapter 8.

59. All loans and investments are subject to categorization to determine environmental assessment requirements. Categorization is to be undertaken using Rapid Environmental Assessment (REA) checklists, consisting of questions relating to (i) the sensitivity and vulnerability of environmental resources in project area, and (ii) the

potential for the project to cause significant adverse environmental impacts. Projects are classified into one of the following environmental categories:

Category A: A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse or unprecedented. These impacts may affect an area lager than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required.

Category B: A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.

Category C: A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

Category FI: A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary (FI).

60. As a result of the completion of the REA checklist, provided as **Annexure A**, the project has been classified as Category ‘‘A’’ and thus a detailed and comprehensive EIA study has been prepared including the EMP.

2.8 ADB’s Public Communication Policy 2011

61. The PCP aims to enhance stakeholders’ trust in and ability to engage with ADB, and thereby increase the development impact of ADB operations. The policy promotes transparency, accountability, and participatory development. It establishes the disclosure requirements for documents ADB produces or requires to be produced.

2.9 ADB’s Accountability Mechanism Policy 2012

62. The objectives of the Accountability Mechanism is providing an independent and effective forum for people adversely affected by ADB-assisted projects to voice their concerns and seek solutions to their problems, and to request compliance review of the alleged noncompliance by ADB with its operational policies and procedures that may have caused, or is likely to cause, them direct and material harm. The Accountability Mechanism a “last resort” mechanism.

2.10 Interaction with Other Agencies

63. The Peshawar Development Authority (PDA), GoKPK is responsible for ensuring that the project complies with the laws and regulations controlling the environmental concerns of the bus rapid transit (BRT) construction and operation and that all

preconstruction requisites, such as permits and clearances are met. This section describes the nature of the relationship between the PDA and concerned departments.

2.11 Provincial EPAs

64. PDA will be responsible for providing the complete environmental documentation required by the KP-EPA and remain committed to the approved project design. No deviation is permitted during project implementation without prior and explicit permission of the KP-EPA.

2.12 Provincial Departments of Forests and Wildlife

65. No uprooting or clearing of trees is expected for the proposed project. However, any removed trees or vegetation under private ownership will be compensated as per provision that in case of disruption to vegetation or trees, the project contractor will be responsible for acquiring a 'No-Objection Certificate' (NOC) from the concerned forest department. The application for an NOC will need to be endorsed by the PDA.

2.13 Provincial Governments

66. The PDA and its contractors must ensure that the project meets the criteria of provincial/district governments as related to the establishment of construction camps and plants, and the safe disposal of wastewater, solid waste, and toxic materials. PDA will coordinate and monitor environment related issues.

2.14 Other Environment Related Legislations

67. **Table 2.1** provides a summary of other legislations, guidelines, conventions and corporate requirements.

Table 2.1: Environmental Guidelines and Legislations

Legislation/Guideline	Description
National Environmental Policy (2005) (NEP)	NEP is the primary policy of Government of Pakistan addressing environmental issues. The broad Goal of NEP is, “to protect, conserve and restore Pakistan’s environment in order to improve the quality of life of the citizens through sustainable development”. The NEP identifies a set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development. It also suggests various policy instruments to overcome the environmental problems throughout the country.
Land Acquisition Act, 1894 Including Later Amendments	The Land Acquisition Act, 1894, is a “law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be paid on account of such acquisition”. The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by judicial pronouncements made from time to time, reflect the anxiety of the law-giver to compensate those who have been deprived of property, adequately. No land acquisition is expected for the proposed project. However, in case any land acquisition does become necessary, the

Legislation/Guideline	Description
	land needed for the construction of the project will be acquired under normal conditions based on prevailing market prices or negotiated prices between PDA and owners of the land. Section 17(4) of the LAA will not be used in the absence of an emergency. Instead, the land will be purchased under willing-seller willing-buyer deal at agreed upon market rates and the seller will have the option not to sell the land, in case an acceptable deal for both the parties is not reached.
The Forest Act (1927)	The Act empowers the provincial forest departments to declare any forest area as reserved or protected. It empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees, branches in reserved and protected forests. The proposed project is urban in nature and thus no protected forest is situated in the Project area.
Khyber Pakhtunkhwa Wildlife and Biodiversity Act, 2015	It empowers the government to declare certain areas reserved for the protection of wildlife and control activities within in these areas. It also provides protection to endangered species of wildlife. As no activities are planned in these areas, no provision of this law is applicable to the proposed project.
The KPK Antiquities Act (2016)	It ensures the protection, preservation, development and maintenance of antiquities in the province of KPK. The Act defines “antiquities” as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the GoKPK to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, GoKPK, any archaeological discovery made during the course of the project.
Pakistan Penal Code (1860)	It authorizes fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to make them less fit for ordinary use.
NATIONAL ENVIRONMENTAL AND CONSERVATION STRATEGIES	
National Conservation Strategy	Before the approval of NEP, the National Conservation Strategy (NCS) was considered as the Government’s primary policy document on national environmental issues. At the moment, this strategy just exists as a national conservation program. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage and recommends immediate attention to these core areas.
Biodiversity Action Plan	The plan recognizes IEE/EIA as an effective tool for identifying and assessing the effects of a proposed operation on biodiversity.
Environment and Conservation	There is a well-established framework for environmental management in Pakistan. The Ministry of Environment deals with environment and biological resources. Within the ministry, the NCS unit established in 1992 is responsible for overseeing the implementation of the strategy. Two organizations, the Pakistan Environmental Protection Council (PEPC) and the Pak EPA are

Legislation/Guideline	Description
	primarily responsible for administering the provisions of the PEPA, 1997. The PEPC oversees the functioning of the Pak EPA. Its members include representatives of the government, industry, non-governmental organizations and the private sector. The Pak EPA is required to ensure compliance with the NEQS, establish monitoring and evaluation systems, and both identify the need to and institution of legislations whenever necessary. It is thus the primary implementing agency in the hierarchy. The respective provinces have formed the Provincial Environmental Protection Agencies.
INTERNATIONAL CONVENTIONS	
The Convention on Conservation of Migratory Species of Wild Animals (1981.21)	The Convention requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or cooperate with other countries in matters of research on migratory species. The proposed project is being developed in a completely urban landscape and thus there are no endangered species of plant life or animal life in the vicinity of the Project.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)	The convention requires Pakistan to impose strict regulation (including penalization, confiscation of the specimen) regarding trade of all species threatened with extinction or that may become so, in order not to endanger their survival further.
International Union for Conservation of Nature and Natural Resources Red List (2000)	Lists wildlife species experiencing various levels of threats internationally. Some of the species indicated in the IUCN red list are also present in the wetlands of Pakistan.
INTERNATIONAL ENVIRONMENTAL GUIDELINES	
ADB's Safeguard Policy Statement (SPS), 2009	ADB's Safeguard Policy Statement (SPS), 2009 provides guidelines for environmental assessments of development projects. These guidelines help prospective projects identify impacts they will have on various environmental receptors. The guidelines call for carrying out EIAs or IEEs of projects based on severity of their impacts.

2.15 Comparison of International and Local Environmental Legislations

68. The ADB SPS requires application of pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards. The SPS states that when host country regulations differ from these standards, the EA will achieve whichever is more stringent.

69. In order to select the most stringent standards applicable, a mix of local (NEQS) and international (IFC/WHO) regulations have been selected. Considering the high baseline noise levels along the project corridor, it shall be ensured that the increment in noise levels is minimized as far as possible. Also, at no location along the project corridor will the 3 dB (A) increment be allowed to exceed. Furthermore, it shall be

ensured that all necessary noise mitigation measures are implemented to minimize the noise levels in the project area.

70. A comparison of applicable local and international guidelines for ambient air quality has been provided in **Table 2.4** below. In the case of most pollutants, the NEQS standards for ambient air quality are more stringent in comparison to USEPA and WHO/IFC standards. The applicable and most stringent parameters for each respective pollutant are highlighted in green.

71. Similar to the standards for air quality, the comparison of noise standards provided in **Table 2.5** clearly shows that NEQS standards for noise are more stringent in comparison to the WHO/IFC standards. The only exception is the daytime noise level standard for Industrial areas where the World Bank/IFC standard is more stringent (70 dB(A)) in comparison to NEQS (75 dB(A)) and so for this particular parameter, the WHO/IFC standard will be used. Apart from this one exception, the NEQS standards have been used for the proposed BRT project.

72. As far as regulations regarding other environmental parameters are concerned such as acceptable effluent disposal parameters, the local regulations i.e. NEQS take precedence over any other international regulations such as WHO/IFC.

2.16 Implications of national policies and regulations on proposed project

73. The Pak-EPA formulated regulations in 2000 for 'Review of IEE and EIA' which categorise development projects under three schedules-Schedules I, II and III. Projects are classified on the basis of expected degree and magnitude of environmental impacts and the level of environmental assessment required is determined from the schedule under which the project is categorised.

74. The projects listed in Schedule-I include those where the range of environmental issues is comparatively narrow and the issues can be understood and managed through less extensive analysis. Schedule-I projects require an IEE to be conducted, rather than a full-fledged EIA, provided that the project is not located in an environmentally sensitive area.

75. The projects listed in Schedule-II are generally major projects and have the potential to affect a large number of people in addition to significant adverse environmental impacts. The impacts of projects included in Schedule-II may be irreversible and could lead to significant changes in land use and the social, physical and biological environments. The proposed BRT project has been categorized as Schedule II and requires an EIA.

76. The Peshawar Development Authority (PDA), being the Executing Agency for the Project is responsible for management of project impacts, and have to undertake the commitments and mitigation measures proposed in this environmental report and in the subsequent review and approval conditions.

77. According to the regulations, no construction, preliminary or otherwise, relating to the project shall be undertaken until and unless approval of the Environmental Impact Assessment Report has been issued by the KP EPA.

78. The PDA will submit the EIA Report on a prescribed application along with the processing fee to KP EPA. After submission of the EIA report, a thirty (30) day period for public comments will be provided. The assessment will be completed within a period of ninety (90) days from receipt of the complete documents, and earlier than this wherever practicable. Following the completion of public hearing, if required, and the provision of any further data from the proponent, the decision shall be made and conveyed after thirty days thereafter.

79. The EIA approval process as per environmental legislation applicable in Pakistan is summarized in **Figure 2.1** below.

2.17 Implications of ADB policies on proposed project

80. The objectives of ADB's safeguards are to:

- avoid adverse impacts of projects on the environment and affected people, where possible;
- minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- help borrowers/clients to strengthen their safeguard systems.

81. ADB's SPS sets out the policy objectives, scope and triggers, and principles for three key safeguard areas:

- environmental safeguards,
- involuntary resettlement safeguards, and
- Indigenous Peoples safeguards.

82. The objective of the environmental safeguards is to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. ADB's policy principles are summarized in **Table 2.2** below.

83. The overview of the ADB environmental assessment and review process for Category 'A' projects is provided in **Figure 2.1** below. Category 'A' projects have the most stringent requirements and need the highest level of effort and resources.

Figure 2.1: EIA Review and Approval Process of Pakistan EPAs

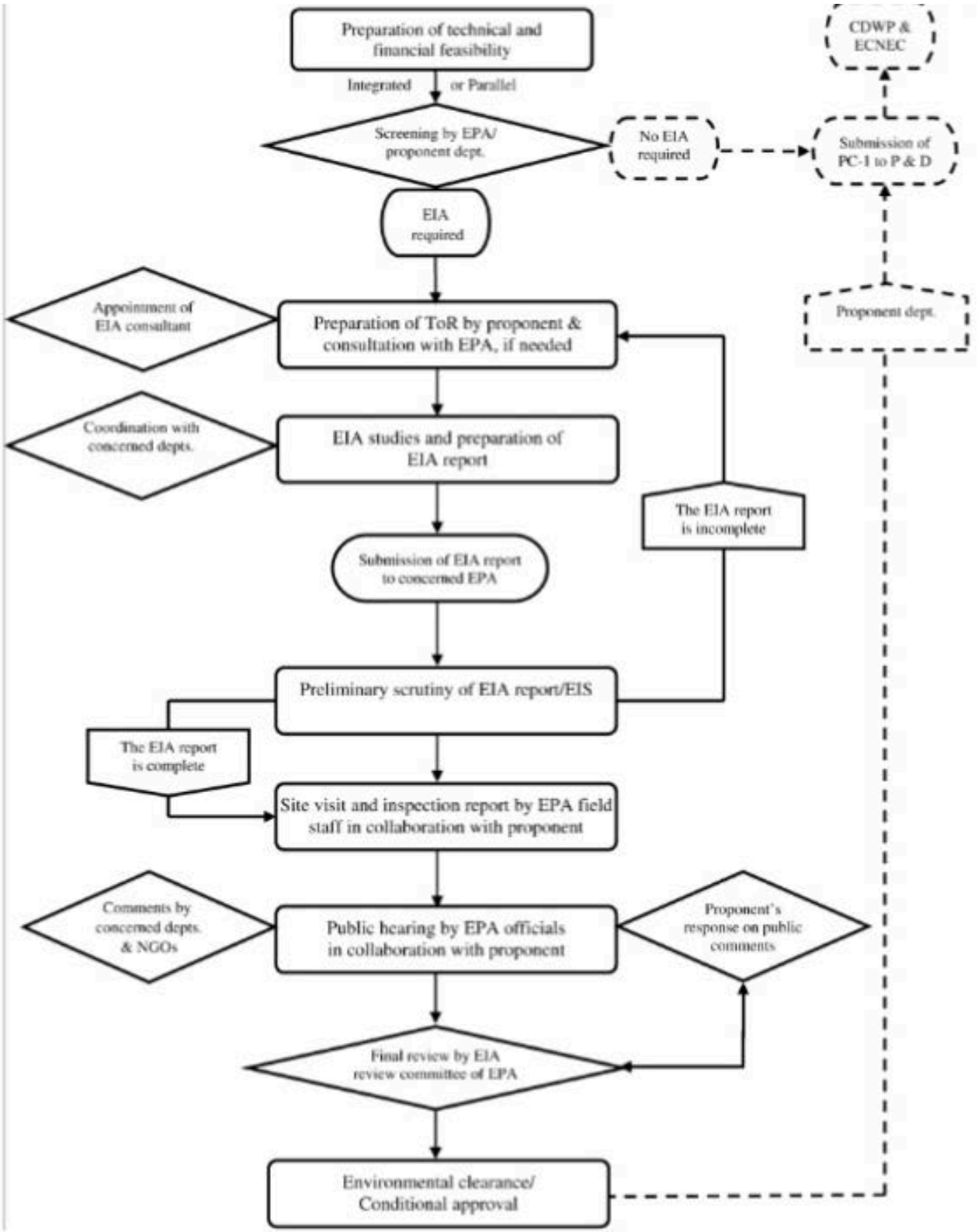


Table 2.2: ADB Policy Principles

	Policy principle	Summary
1	Screening and categorization	Screening process initiated early to determine the appropriate extent and type of environmental assessment.
2	Environmental assessment	Conduct an environmental assessment to identify potential impacts and risks in the context of the project's area of influence.
3	Alternatives	Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts, including no project alternative.
4	Impact minigation	Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts. Prepare an environmental management plan (EMP).
5	Public consultations	Carry out meaningful consultation with affected people and facilitate their informed participation. Involve stakeholders early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation. Establish a grievance redress mechanism.
6	Disclosure of environmental assessment	Disclose a draft environmental assessment in a timely manner, in an accessible place and in a form and language(s) understandable to stakeholders. Disclose the final environmental assessment to stakeholders.
7	Environmental management plan	Implement the EMP and monitor its effectiveness. Document monitoring results, and disclose monitoring reports.
8	Biodiversity	Do not implement project activities in areas of critical habitats.

9	Pollution prevention	Apply pollution prevention and control technologies and practices consistent with international good practices. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges. Avoid the use of hazardous materials subject to international bans or phase outs.
10	Occupational health and safety Community safety.	Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities
11	Physical cultural resources	Conserve physical cultural resources and avoid destroying or damaging them. Provide for the use of "chance find" procedures.

84. The basic environmental assessment requirements for Category 'A' projects are provided in **Table 2.3** below.

Table 2.3: ADB Environmental Assessment Requirements for Category 'A' projects

Aspect	Environmental Assessment & Management Requirements
Project processing	
Reporting	▪ Prepare full-scale environmental impact assessment (EIA)
Public consultations	▪ Conduct consultations at the early stage of EIA field work and when the draft EIA report is available during project preparation, and before project appraisal by ADB.
Disclosure of environmental assessment report	▪ Disclose draft environmental impact assessment reports at least 120 days before Board consideration.
Project implementation	
Reporting	Submit semiannual reports during project construction, and annual reports during project operation to ADB for disclosure.

Table 2.4: Comparison of International and local Air Quality Standards*

Pollutants	USEPA		WHO/IFC		Pak. NEQS	
	Avg. Time	Standard	Avg. Time	Standard	Avg. Time	Standard
SO_2	3 hrs 1 hr	0.5 ppm 75 ppb	24 hr 10 min	20 ug/m^3 500 ug/m^3	Annual Mean 24 hrs	80 ug/m^3 120 ug/m^3
CO	8 hrs 1 hr	9 ppm (11 mg/m^3) 35 ppm (43 mg/m^3)	-	-	8 hrs 1 hr	5 mg/m^3 10 mg/m^3
NO_2	Annual Mean 1 hr	100 ug/m^3 (53 ppb) 100 ppb	1 yr 1 hr	40 ug/m^3 200 ug/m^3	Annual Mean 24 hrs	40 ug/m^3 80 ug/m^3
O_3	8 hrs	0.07ppm (148 ug/m^3)	8 hrs	100 ug/m^3	1 hr	130 ug/m^3
TSP	-	-	-	-	Annual Mean 24 hrs	360 ug/m^3 500 ug/m^3
PM_{10}	24 hrs	150 ug/m^3	1 yr	20 ug/m^3	Annual Mean	120 ug/m^3

			24 hr	50 ug/m^3	24 hrs	150 ug/m^3
$PM_{2.5}$	Annual Mean 24 hrs	15 ug/m^3 35 ug/m^3	1 yr 24 hr	10 ug/m^3 25 ug/m^3	Annual Average 24 hrs 1 hr	15 ug/m^3 35 ug/m^3 15 ug/m^3

*: The standards highlighted in green for each respective pollutant are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed project.

Table 2.5: Comparison of International and Local Noise Standards

Category of Area/Zone	Limit in dB(A) Leq			
	NEQS		WHO/IFC	
	Day Time	Night Time	Day Time	Night Time
Residential area (A)	55	45	55	45
Commercial area (B)	65	55	70	70
Industrial area (C)	75	65	70	70
Silence zone (D)	50	45	55	45

*: The standards highlighted in green for each respective Area/Zone are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed project.

3 Description of the Project

3.1 Justification and Need for Project

85. Peshawar city is greatly in need of a good quality mass transit system for its residents, which face many logistical difficulties on a daily basis. The major issues in the Peshawar public transport sector are as follows:

    - Passengers are exposed to serious accidents due to poor driving behavior, particularly during the boarding and alighting of passengers from vehicles
    - Buses are poorly maintained and lead to high consumption of fuel
    - Bus stops are non-existent and buses stop randomly whenever a passenger is standing on the route
    - Buses are overcrowded, and at times passengers are hanging on the bus railings
    - Conductors are rude and offensive
    - Drivers and conductors are at times under substance abuse while on duty

86. Although there are many reasons to justify the need for BRT in Peshawar, however the main objective of implementing the proposed project is passenger time savings. BRT lanes can increase the bus travel speed and it should be built on a corridor where many public transport users travel and endure delays.

87. The proposed BRT project is expected to mitigate congestion for car users, especially in areas where buses block entire roads to pick up passengers, which can occur practically anywhere in Peshawar. A BRT system generally gives priority to public transport passengers, but can also greatly improve conditions for mixed traffic by solving the congestion problem caused by stopping buses.

88. BRT is an effective way to use space to move people in the city. One BRT lane of 3.5 meters can move up to 10,000 passengers per hour in one direction, whereas 3 car lanes of 10 meters width can only move a total of 4,500 to 6,000 people per hour in one direction.

89. The BRT project can be used as an opportunity to restructure the entire public transport industry, from Minibus and Bedford bus, Wagon and Suzuki upto Qingqi. With the BRT implemented, the government will have more bargaining power to reform the public transport in Peshawar. BRT could be used as an opportunity to bring professional bus operating companies to run in Peshawar and show the best practice model to the existing operators.

90. A positive impact on the environment is expected from the proposed BRT project due to the use of a cleaner and more fuel efficient fleet being used in the BRT as well as

reduction in vehicular exhaust emissions due to reduction in kilometers travelled by private vehicles.

91. There are also a number of economic benefits associated with the proposed BRT project due to the time savings of both the public transport and private vehicle passengers. Also, since there is no formal bus industry as yet in the city, the BRT will open up more formal employment associated with the BRT such as security guards, bus drivers, mechanics etc.

92. In comparison to rail based mass transit system, BRT offers flexibility and is easy to expand. Dedicated BRT lanes can increase bus travel speed significantly. But most importantly, with BRT, buses can operate inside and outside the BRT corridor, allowing rapid citywide coverage.

3.2 Objectives of Project

93. The objective of this project is the development of a sustainable bus rapid transit corridor to help improve Peshawar's urban transport system and facilitate the residents of Peshawar city by resolving the logistical difficulties faced by them on a daily basis.

3.3 Proposed Project Activities

94. Construction of a total of 31 BRT stations with 3 stations built as elevated BRT stations based on the BRT alignment provided in **Figure 3.1** below.

95. Operation and maintenance of the BRT to ensure project sustainability and logistical facilitation of the residents of Peshawar city.

3.4 Design of BRT

3.4.1 BRT Route

96. The station center co-ordinates, dimensions, access type as well as the expected peak hour bus frequency data per station is provided in **Table 3.1** below. At the city center stations, the maximum peak hour frequency is 107 buses/hour/direction and offset stations will be required due to limited space on Saddar road.

97. Although the average distance between stations is 922 meters, but there are a few stations that are only less than 700 meters apart, while on the other hand, several stations are also quite far from each other e.g. more than 1000 meters with the physical condition of the site and a low demand profile near the stations being the determining factor.

Figure 3.1: Proposed BRT Alignment

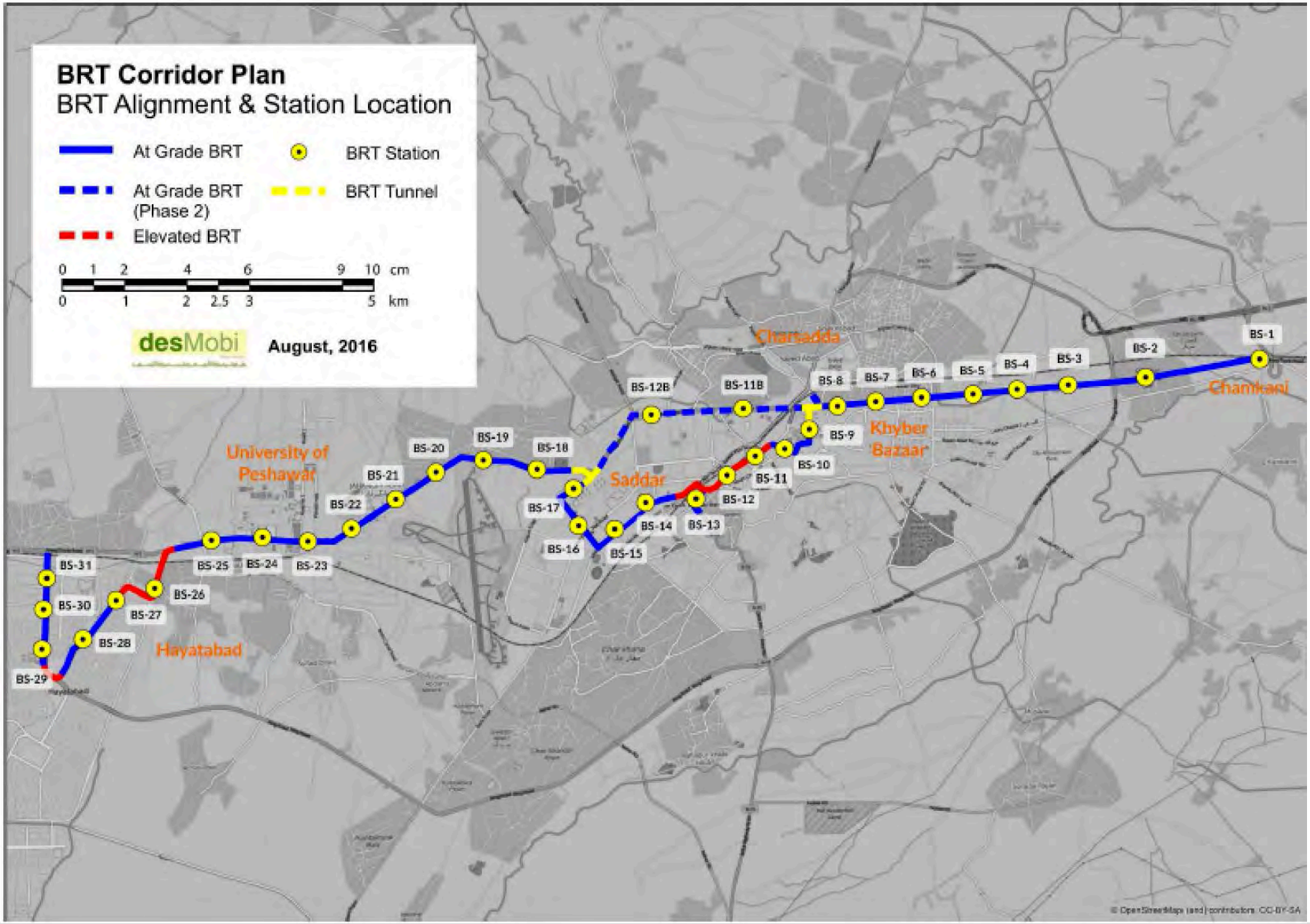


Table 3.1: Proposed BRT Station Information

Peshawar BRT Station Design – Preferred Option						
No.	**Station Name**	**Bus Stop ID**	**Distance to Next Station**	**Access**		**Station Dimension (Length x Width)**
				West/South	**East/North**	
1	Chamkani Chowk	BS-01	1620 m	Bridge	Bridge	70m x 8m
2	Chughal Pura	BS-02	1400 m	Bridge	Bridge	70m x 8m
3	Dr Zareef Memorial School	BS-03	655 m	Bridge	Bridge	110m x 6m
4	Sethi Town	BS-04	660 m	Bridge	Bridge	110m x 6m
5	Sikandar Town	BS-05	915 m	Bridge	Bridge	110m x 6m
6	Gulbahar Square	BS-06	790 m	Bridge & PedCross	Bridge & PedCross	110m x 5m
7	Hashnagri	BS-07	530 m	Bridge	Bridge	110m x 5m
8	Qila Balahisar	BS-08	700 m	Bridge	Bridge	110m x 5m
9	Hospital Road	BS-09	590 m	At Grade Ped Cross	At Grade Ped Cross	2 x (55m x 5m)
10	Khyber Bazaar	BS-10	550 m	At Grade Ped Cross	At Grade Ped Cross	110m x 5m
11	Soekarno Square Secretariat	BS-11	640 m	-	Bridge	90m x 5m
12	Dabgari Gardens	BS-12	550 m	-	Bridge	90m x 5m

13	Railway Station	BS-13	1050 m	-	Bridge	55m x 6m
14	State Bank of Pakistan	BS-14	620 m	At Grade Ped Cross	At Grade Ped Cross	195m x 4m
15	Saddar Bazar	BS-15	840 m	At Grade Ped Cross	At Grade Ped Cross	125m x 5m
16	Mall Road	BS-16	690 m	At Grade Ped Cross	At Grade Ped Cross	110m x 5m
17	Khyber Road Airport	BS-17	1270 m	Bridge	Bridge	205m x 5m
18	Gora Qabristan	BS-18	780 m	Bridge	Bridge	205m x 4m
19	Tehkal	BS-19	780 m	Bridge	Bridge	205m x 4m
20	Tambuwaan	BS-20	800 m	Bridge	Bridge	110m x 5m
21	Abdara Road	BS-21	790 m	Bridge	Bridge	110m x 5m
22	University Town	BS-22	760 m	Bridge	Bridge	110m x 5m
23	KTH University of Peshawar	BS-23	850 m	Tunnel	Bridge	110m x 6m
24	Islamia College	BS-24	730 m	Bridge	Bridge	110m x 5m
25	Board Bazar Regi	BS-25	1250 m	Tunnel	Bridge	110m x 6m
26	Taj Abad	BS-26	920 m	Bridge	Bridge	110m x 5m
27	Hayatabad Model School	BS-27	670 m	At Grade PedCross	At Grade PedCross	55m x 5m
28	Hayatabad Phase 3	BS-28	1450 m	At Grade PedCross	At Grade PedCross	55m x 6m
29	Tatara Park	BS-29	630 m	At Grade PedCross	At Grade PedCross	55m x 6m
30	PDA Hayatabad	BS-30	680 m	At Grade PedCross	At Grade PedCross	55m x 6m
31	Cancer Hospital	BS-31	-	At Grade PedCross	At Grade PedCross	55m x 6m

98. The BRT full alignment option starts from Chamkani, near the Chamkani train station. It goes along the GT Road at-grade until the junction with Ashraf road where it will enter into a tunnel connecting both approaches of GT Road, Malik Saad Shaheed road and Cinema road. After the tunnel, the main BRT route follows Cinema Road at-grade where it goes elevated to bypass the junction with Hospital road. It stays elevated on Khyber Bazaar road and Railway road, and passes the Soekarno and Suba Chowk, the two most congested intersections in the Khyber Bazaar area. After the railway road, the elevated BRT section turns right at Anwar Saeed medical center to cross the railway station, where a BRT-only bridge will be constructed. After crossing the railway station, the BRT goes at-grade again and join Saddar road just after Peshawar Press Club.

    On the preferred alignment, the BRT stays at-grade on Saddar Road, turns right to Khadim Hussein Road and Sir Sayed Road to go to Amman Chowk, where the BRT goes on BRT-only tunnel to cross Amman Chowk. The corridor continues through GT Road and Jamrud Road where it goes into an elevated BRT only corridor above a dried up river bank before the Bab-e-Peshawar Marco Polo Bridge until it joins the Habib Jalib Road towards Tatara Park and joins the Ring Road.

    In this alignment option, total length of BRT is 30.8 km, in which 25.8 km will be built in Phase 1, and 5 km in Phase 2. Out of the 30 km, there are some segments that will be built elevated, which is 4.1 km long, and tunnel with 3.5 km long. This will leave the at-grade BRT segment at 23.3 km long for both phases.

3.4.2 Off-Corridor Bus Stops

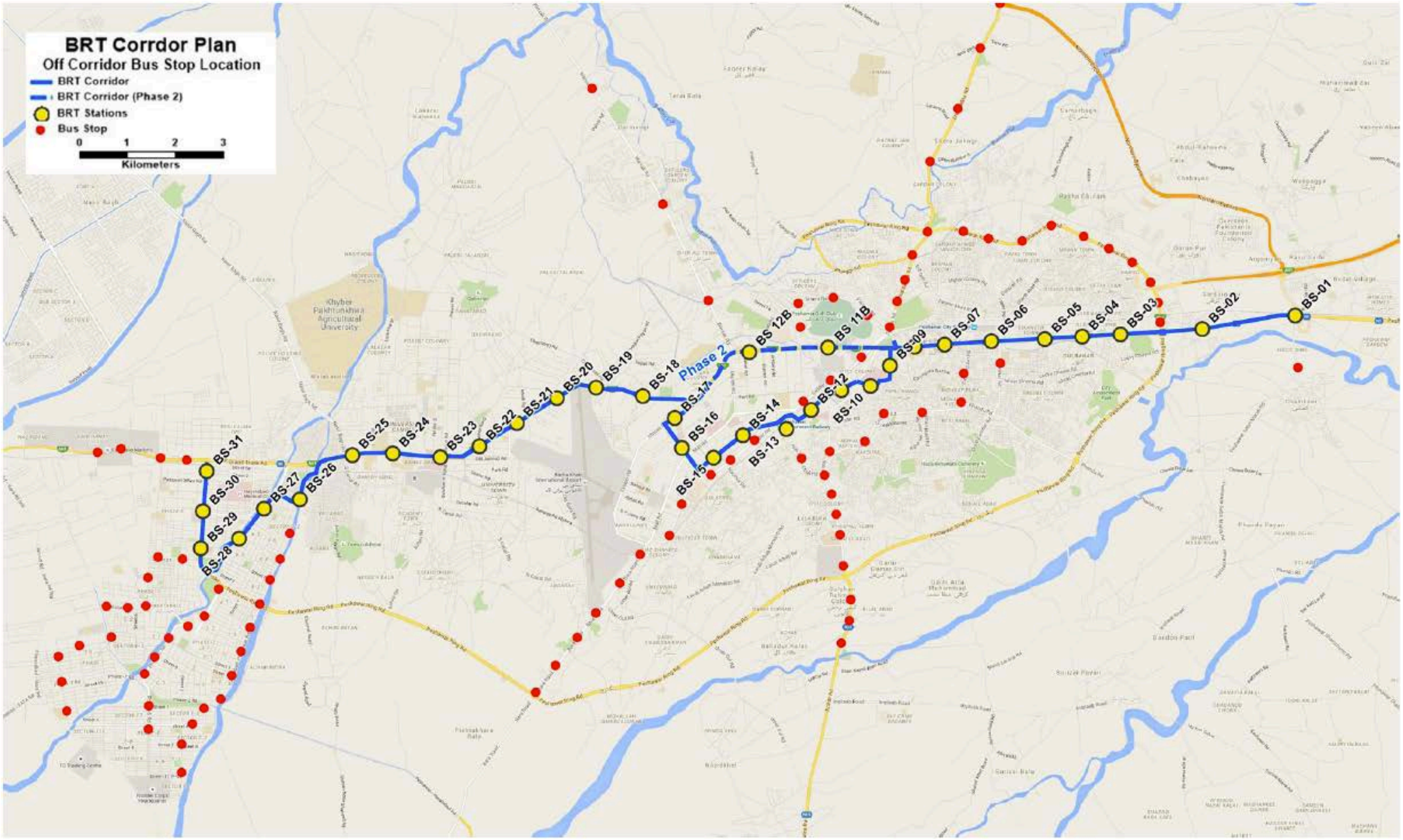
99. Off-corridor bus stops are required outside the BRT corridor segments, so that the BRT buses can pick up passengers. For the 8 direct-service routes, 100 off-corridor bus stops are proposed. Since practically no existing bus stops are adequate to be used as proper bus stop, new bus stops will be constructed with consideration of three main principles; location and placement of bus stops, type of bus stops, and their physical dimensions. The proposed off-corridor bus stop locations are provided in **Figure 3.2** below.

100. Bus stops will be developed wherever there is land availability and will be located along the 8 proposed direct-service routes for off-corridor segments with an average distance of 300 to 500 meters. These stops will be located where there is currently high demand from public transport (current public transport passengers boarding and alighting stations), these are generally residential or office areas or in front of markets. If there are two boarding and alighting spots nearby, the location with the higher number has been chosen as the bus stop location.

    The minimum distance for a bus stop to be located from an intersection is 50 meters or 100 meters from a busier intersection with the bus stops positioned curbside and placed on the sidewalk.

101. Shelters will be used on the side mainly used for boarding and shall be 2 meters wide and 9 meters long. Generally, this is the side of the road leading towards the city

Figure 3.2: Off-Corridor Bus Stop Locations



center in the morning peak period. Passengers would have to wait for buses on this side so shelters will be required to protect them from weather exposure.

102. Also, bus poles will be used on the opposing side of shelters. On this side, many passengers alight from the buses during evening peak period and will immediately walk towards their final destination and thus will not require waiting spaces in the bus stops.

The bus shelter designs for the off-corridor bus stops are provided as **Figure 3.3** below.

3.4.3 BRT Station design & Configuration

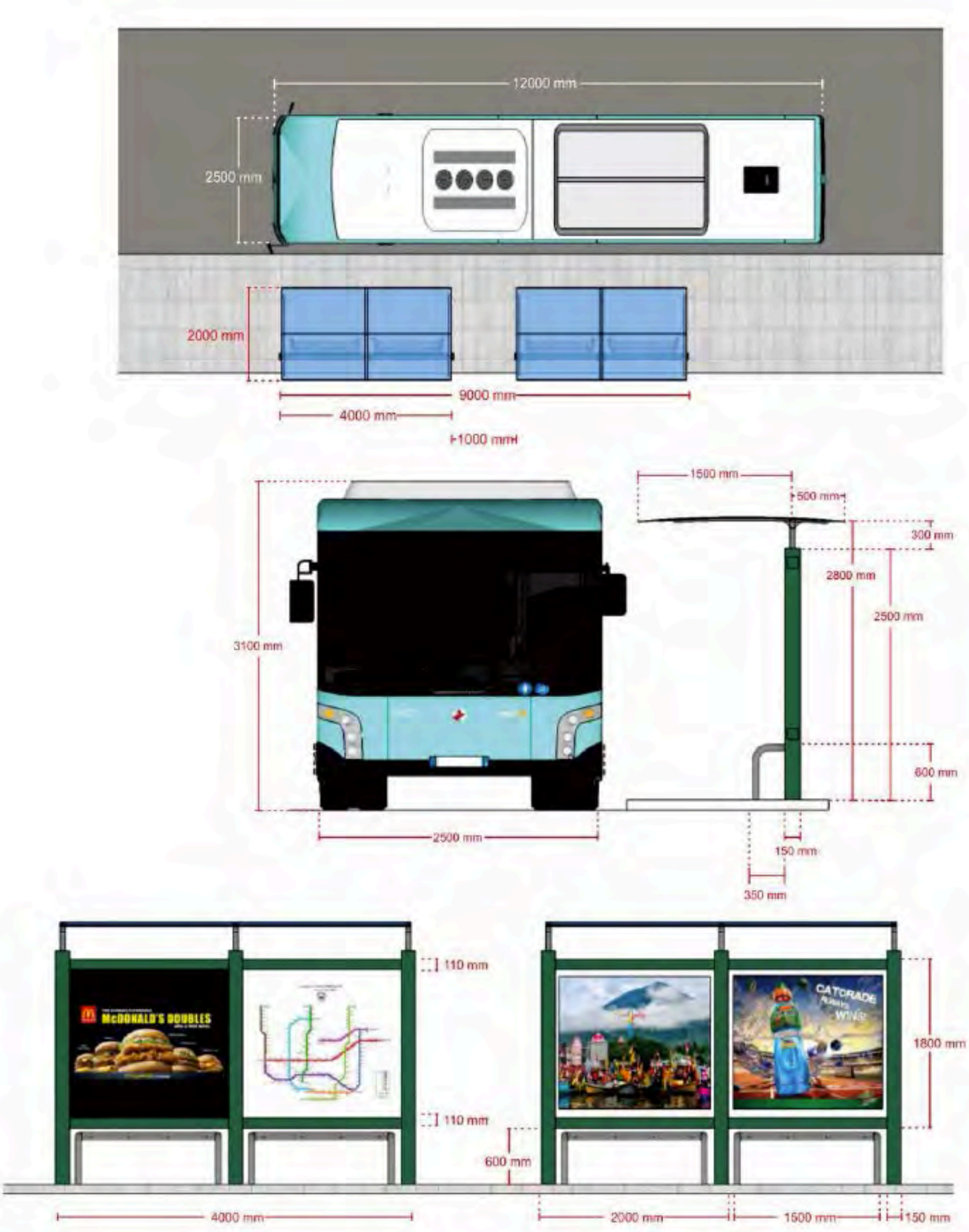
103. In designing the BRT station for Peshawar, the following key design features are proposed:

- High capacity stations
- Wide and comfortable stations
- Safe and weather protected stations
- Universally accessible
- Good passenger circulation
- Modern and create new branding image for public transport

104. The features mentioned above are important to make the proposed project successful and meet its goal to become the reliable mass transit of the city, as well as reaching the Gold Standard BRT. The proposed station design features includes the following components:

- Wide station platform (5 to 6 meter wide) and open air to allow good air circulation
- Multiple stopping bays (up to 4 buses can stop at the same time)
- Passing Lane to allow overtaking at stations
- Space for overtaking at stations with minimum length of 13 meters to allow 18-meter bus to overtake in the future
- Fast and universal access to BRT station with all kinds of access provided (stairs, elevator, escalator) and special gate to allow wheelchair to enter station
- Tactile ground surface indicator/paving for visually impaired users
- Lane separator with guard-rail

Figure 3.3: Bus Shelter dimensions for Off-Corridor Bus Stop



- Cycle lane along the corridor, complete with secured cycle parking at station and guiding rail on stairs to carry bicycle
- Real time passenger information system

The BRT key design components are shown in **Figure 3.5** below.

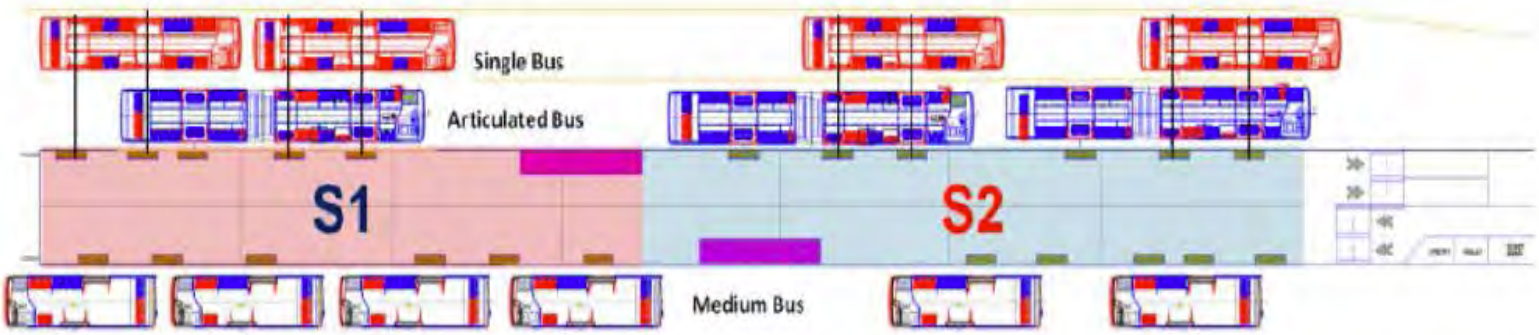
3.4.4 Sub-Stop Concept

105. BRT stations are designed in different sizes to reflect different demands. Station saturation determines the required station size, which is represented by the number of sub-stops required. The sub-stop calculation is determined by the number of boarding and alighting passengers, bus frequency per hour per direction as well as the type of bus and number of doors used per bus. If two or more sub-stops are chosen for any station, a passing lane will be required. Each sub-stop works independently and buses stopping at the second sub-stop do not have to wait for the buses stopping on the first sub-stop to be able to move.

106. For Peshawar, 5 types of stations will be designed, with one sub-stop, two sub-stops and three modifications of two sub-stops configuration.

The illustration of the concept of a sub-stop is provided as **Figure 3.4** below.

Figure 3.4: Illustration of a Sub-Stop



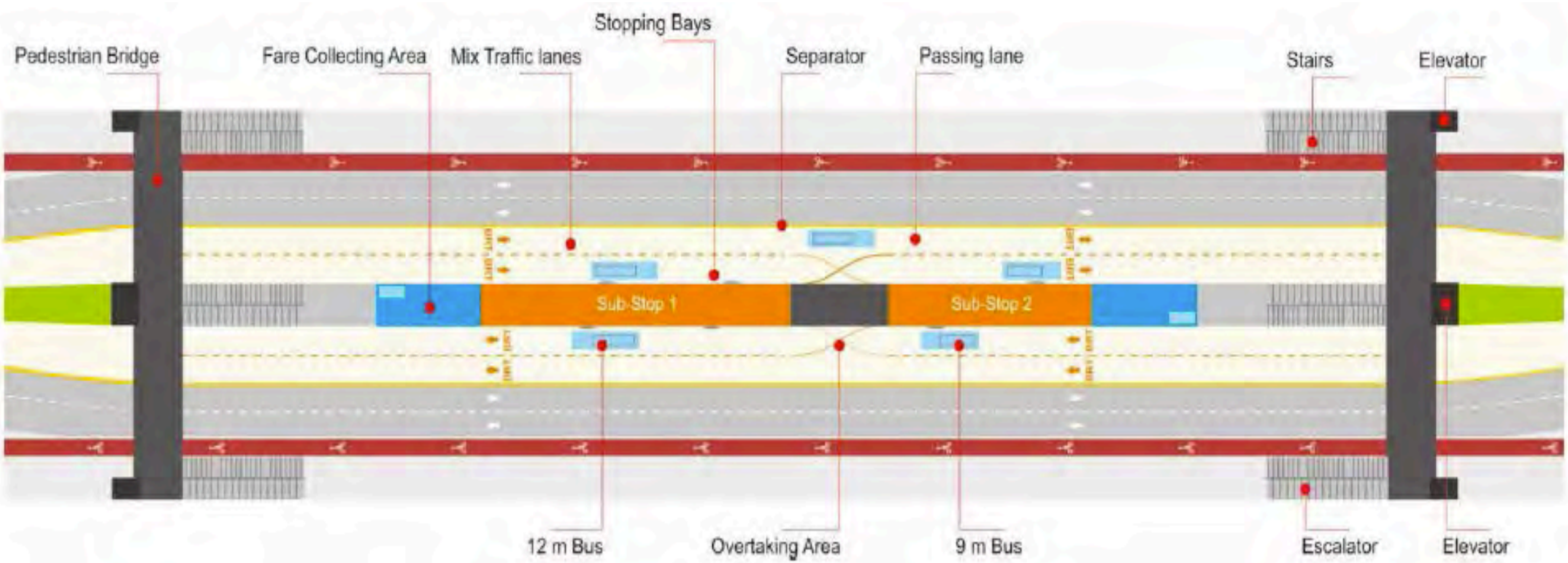
3.4.5 BRT Station Types

Type 1: One Sub-Stop (55 meters)

107. The station is designed in modular, with a 20-meter-long module, i.e. distance between columns is 20 meters. In station Type 1 with 1-subtop, the station length is 55 meters, with a 5-meter width. It has two construction modules for the sub-stop and a 15-meter long ticketing area.

In this station type, for each direction, 2 buses can stop in two stopping bays adjacent to each other. At the beginning, only 9-meter and 12-meter buses can stop at this station type, but at the later stage, once the demand grows, 18- meter bus will be able to stop at this station, where additional station doors will be provided at reserved area at the back of the 12- meter and 9-meter doors. In this sub-stop, no

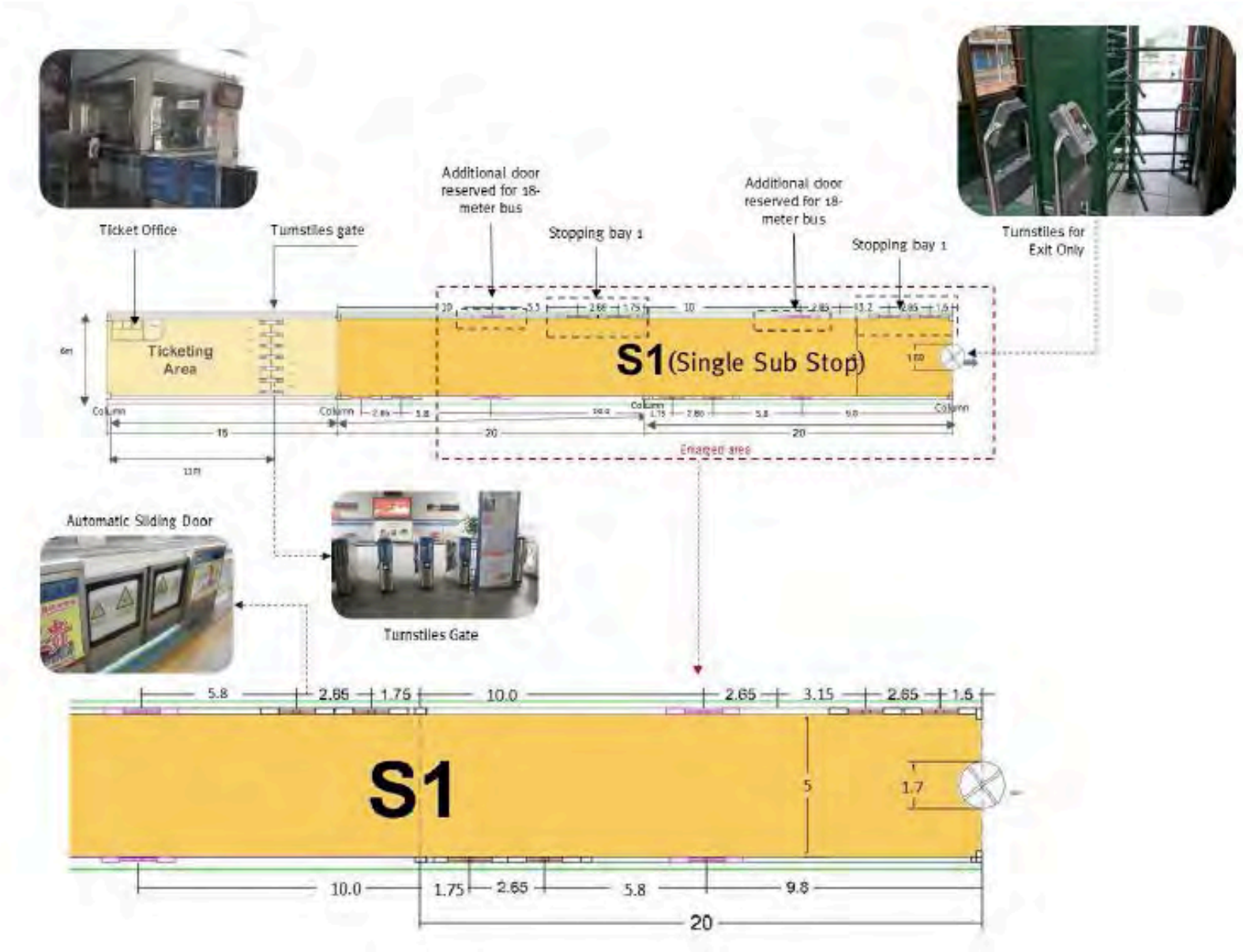
Figure 3.5: BRT Station Key Design Components



buses can overtake the bus standing in front, despite having enough distance to overtake, and buses going into the station will go on first-come-first-serve basis for stopping bays. i.e. the first bus coming to station should use the first bus, regardless of the bus route.

Although this station type only has 1 ticketing area, both sides of stations can be used for exit, with extra rotating door provided at the other end of the station to allow exit, as shown in the **Figure 3.6** below.

Figure 3.6: One Sub-Stop Station Configuration

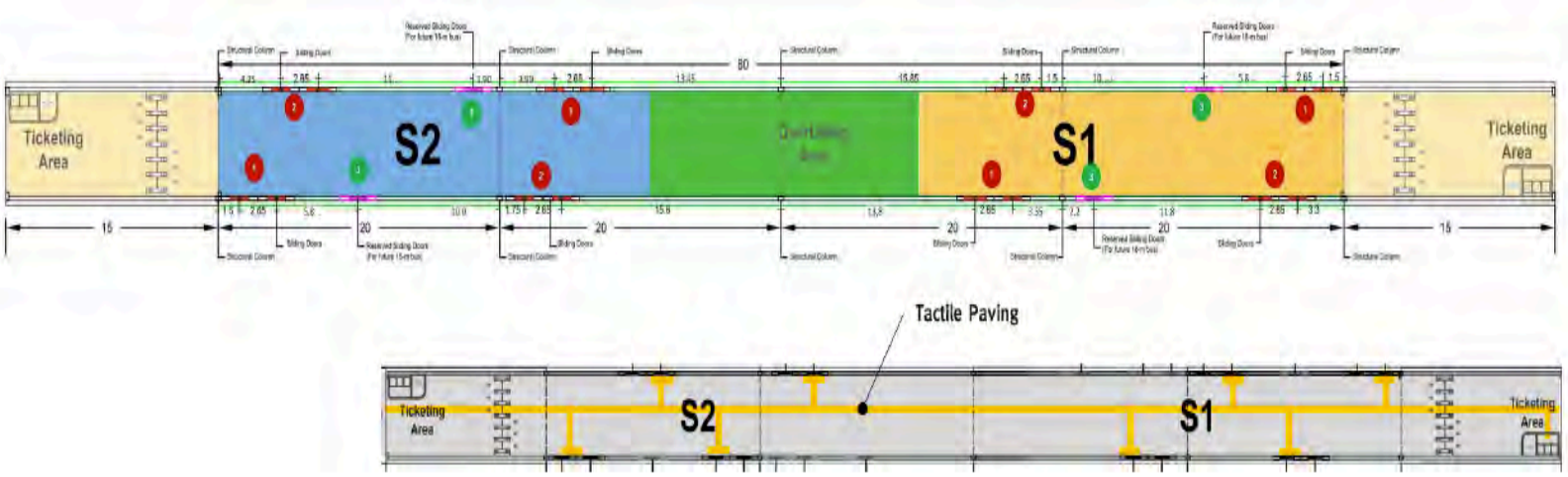


Type 2: Two Sub-Stops (110 meters)

108. The first type of station with two sub-stops has dimension of 110 meters long and 6 meters wide. In both sub-stops, all 3 types of buses are allowed to stop. The ticketing area is provided at both end of station, with a length of 15-meter each.

The overtaking area provided between the first and second sub-stops is used for buses to overtake. The minimum distance of the overtaking area, i.e. the area marked in green between S1 and S2 will provide a minimum of 20 to 34 meters distance between buses on different sub-stop to overtake, which will still enable the buses to dock properly on the stopping bays as shown in the **Figure 3.7** below.

Figure 3.7: Two Sub-Stop Station Configuration

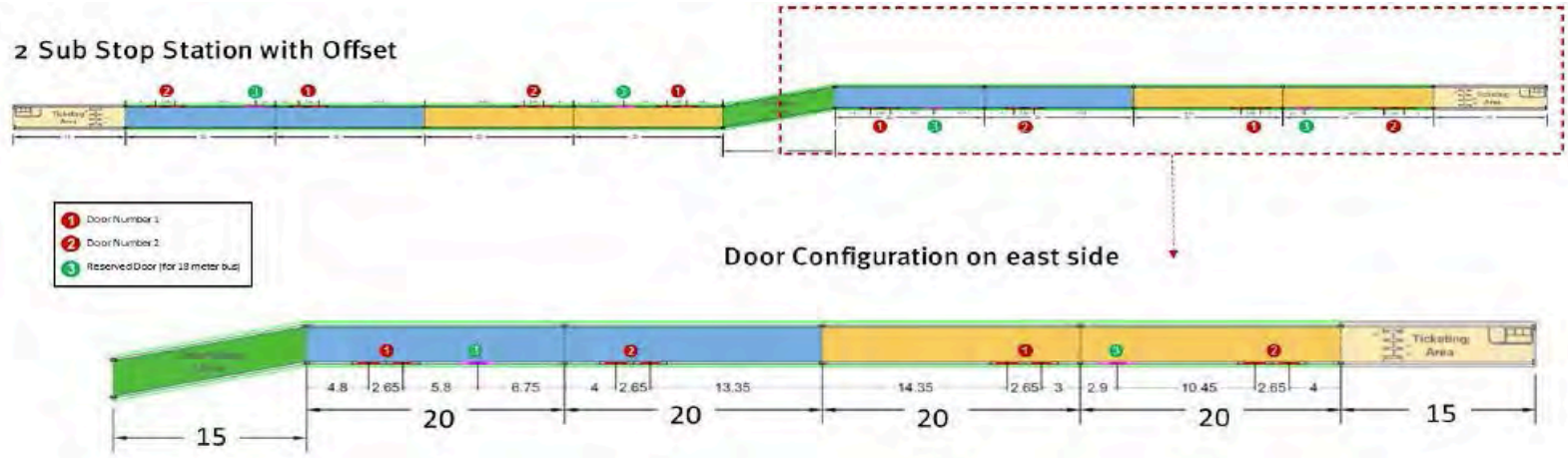


Type 3: Two Sub-Stops with offset configuration (205 meters)

109. An Offset station will only be placed on the locations where space might be an issue, such as on Saddar Road. With offset configuration, space required for station area will be less in width than normal station configuration, but increases in length. In offset configuration, buses on different directions will stop at different stopping locations, or in other words, each direction will have 2 sub-stops located separately. Thus, adding the total sub-stop required for this station type to 4 sub-stops in total for both directions.

110. Due to the station length, offset station is not preferable, as it increases walking time for passengers inside the station. However, a total of only 2 stations are designed with offset configuration with this type of configuration illustrated in **Figure 3.8** below.

Figure 3.8: Two Sub-Stops Station Configuration with offset module



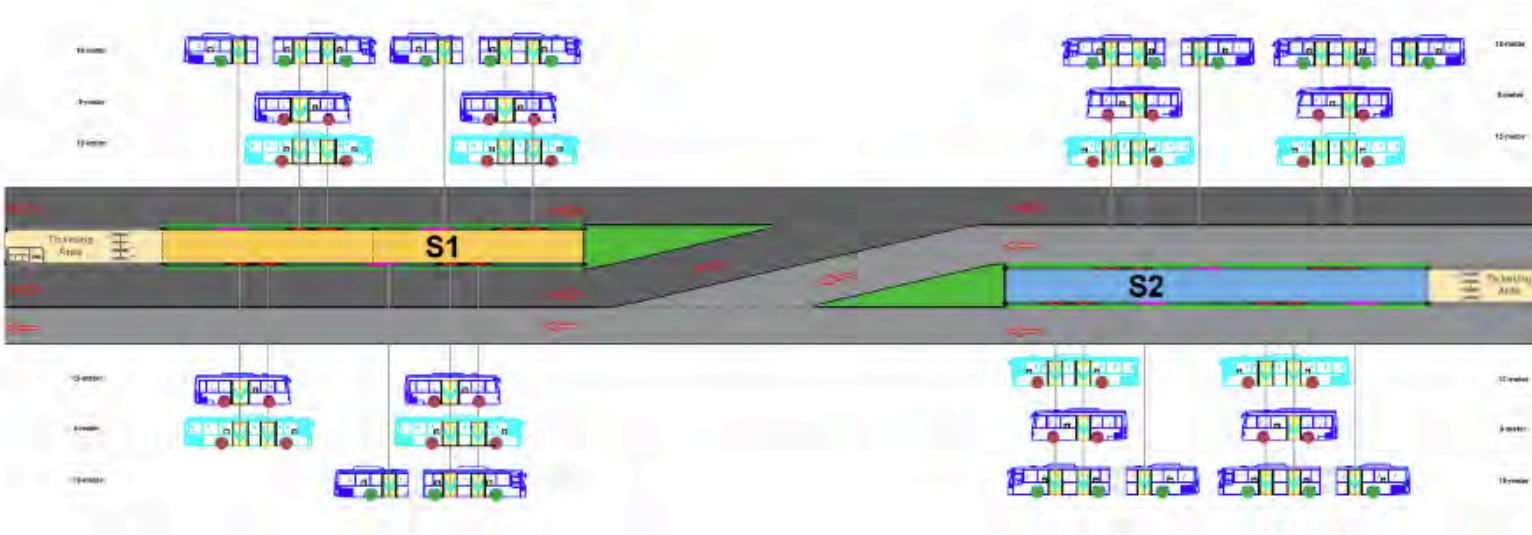
Type 4: Two Sub-Stops with split configuration (150 meters)

111. Where the road is neither wide enough for standard station nor long enough for offset station, split configuration will be used. With the split configuration, the space required for station area will be less in length than offset configuration, but this innovation will include a novel movement set up for buses, which would require clear signage to avoid any confusion.

In this configuration, all passengers going into one direction will use one sub-stop and the other sub-stop will be used for passengers going towards the other direction. This could potentially lead to two problems, overcrowding in each station during each peak period and difficulties in transferring between the two directions as shown in **Figure 3.9** below.

Only 1 station is designed with split configuration, the Hospital Road station.

Figure 3.9: Two Sub-Stops Station Configuration with split Module



3.4.6 Conceptual Design of BRT Stations

112. The conceptual design of the stations is provided as **Figure 3.10** below and the detailed station area is provided as **Figure 3.11** below.

113. The station dimensions are shown in **Figure 3.12** below. The access to the station will be provided from both sides and for some locations where pedestrian tunnel already exists, the BRT station will be connected to the nearest pedestrian tunnel for access. Also, each station will be equipped with escalators to go up, stairs and escalator for wheelchair and passengers with limited ability.

114. The station design for elevated BRT is provided as **Figure 3.13** below. The elevated BRT will have two levels of platform.

Figure 3.10: Conceptual design of BRT stations

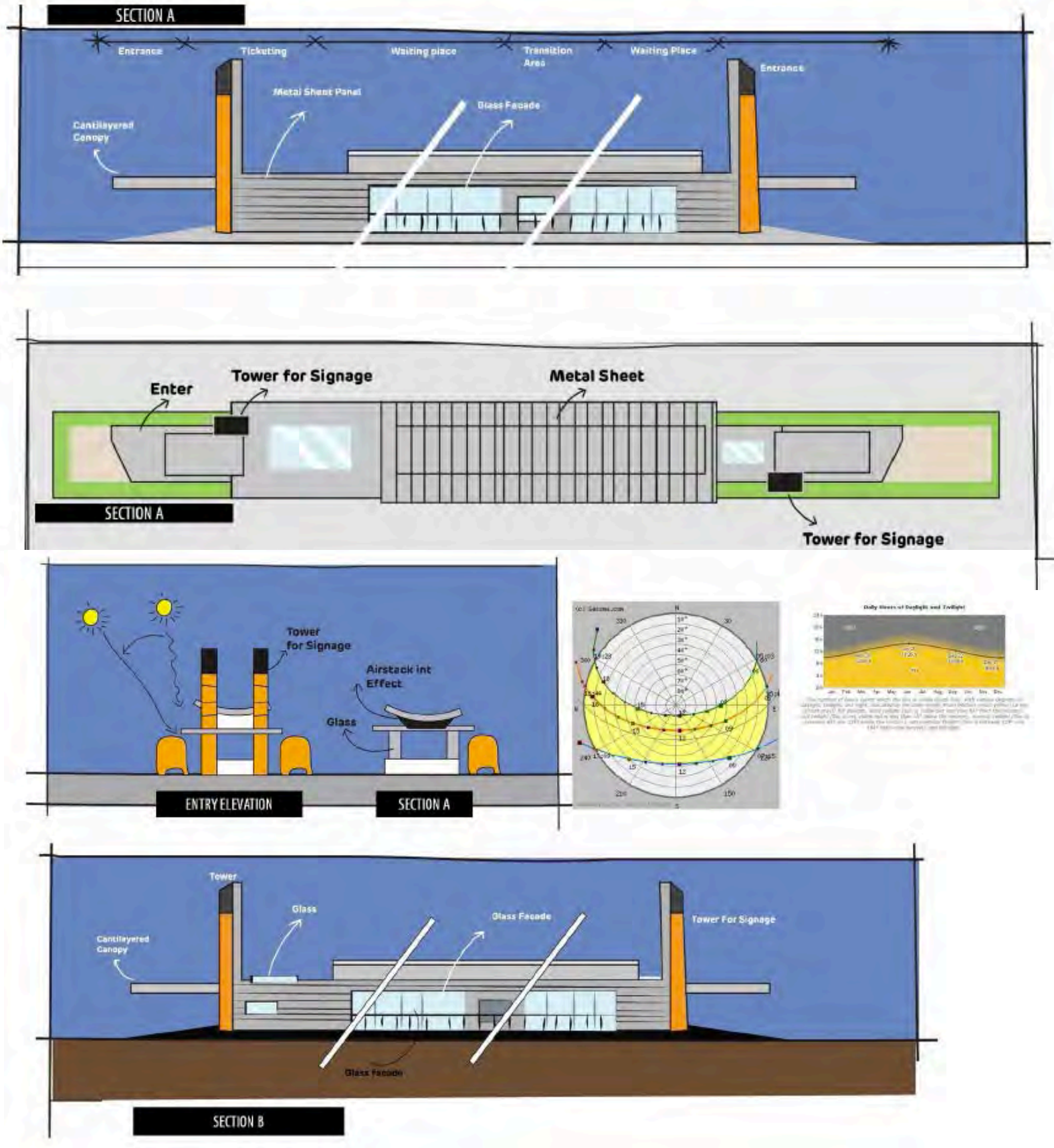
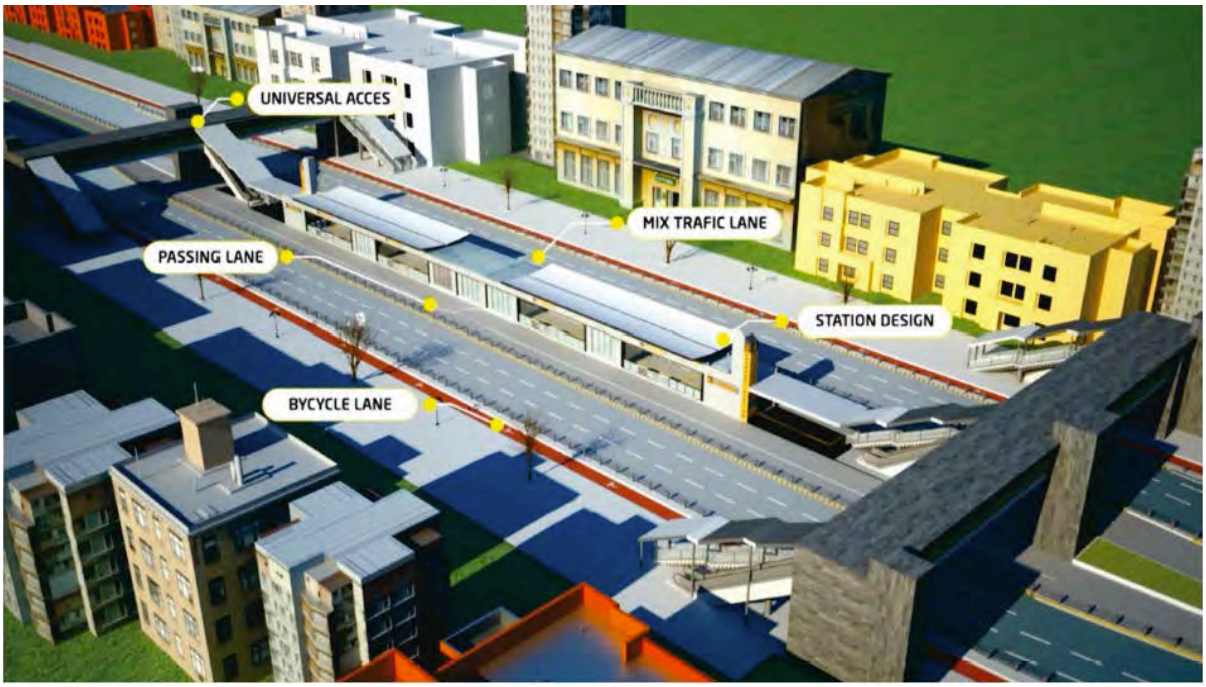


Figure 3.11: Detailed Station Area



115. The first level, which is on the same level with the pedestrian bridge will be used for the ticket office and for access to the station. The station platform will be located on the second level, where the turnstile and security check will take place. On the first level, a continuous walkway and cycle lane will be built to connect pedestrians along the corridor, underneath the elevated BRT section.

116. This will be the first BRT design in Pakistan which will accommodate cycling and walking facility along the elevated BRT section, a significant improvement from Lahore and Islamabad BRT systems.

Figure 3.12: Station Dimensions for at-grade station

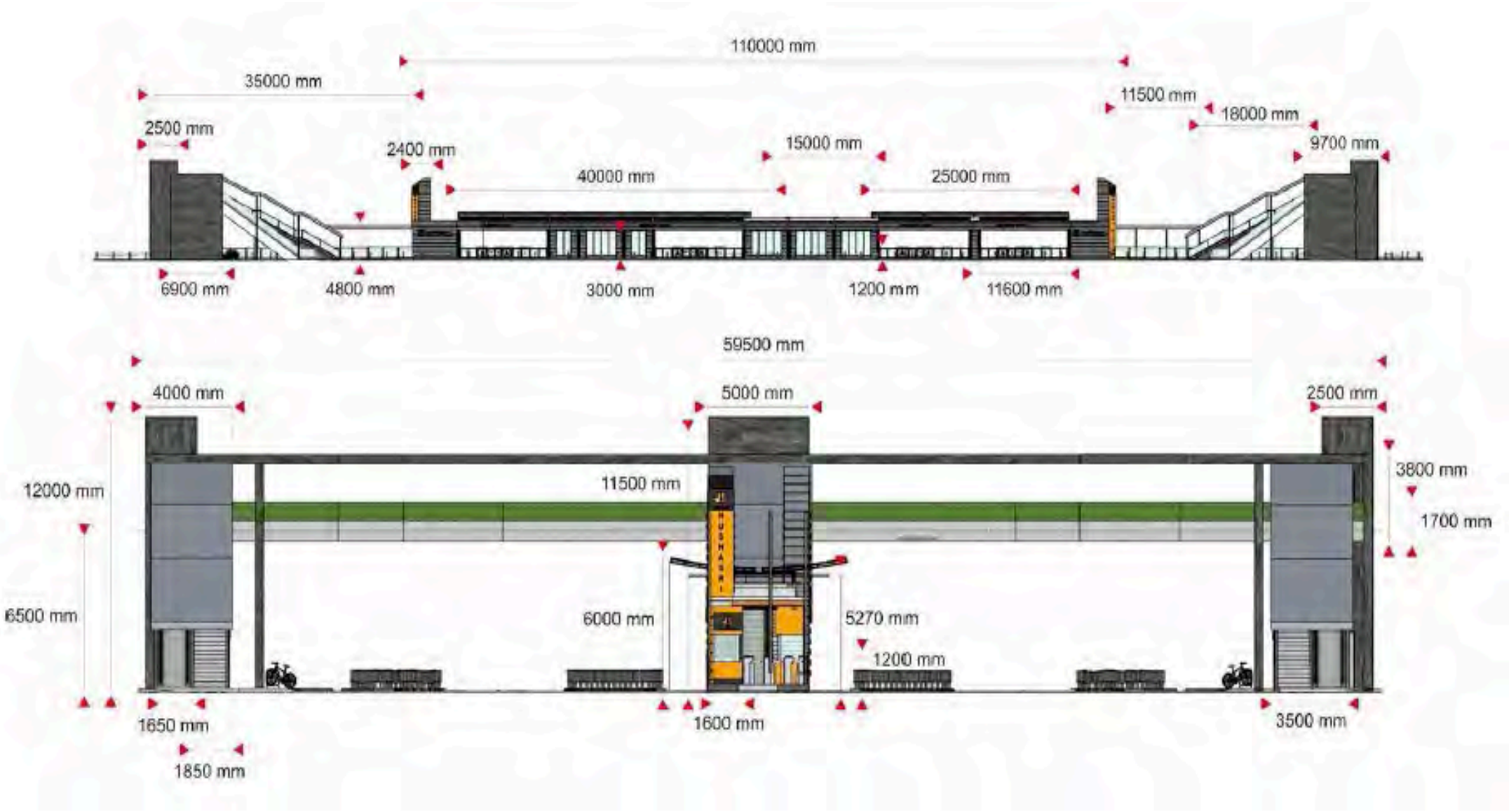
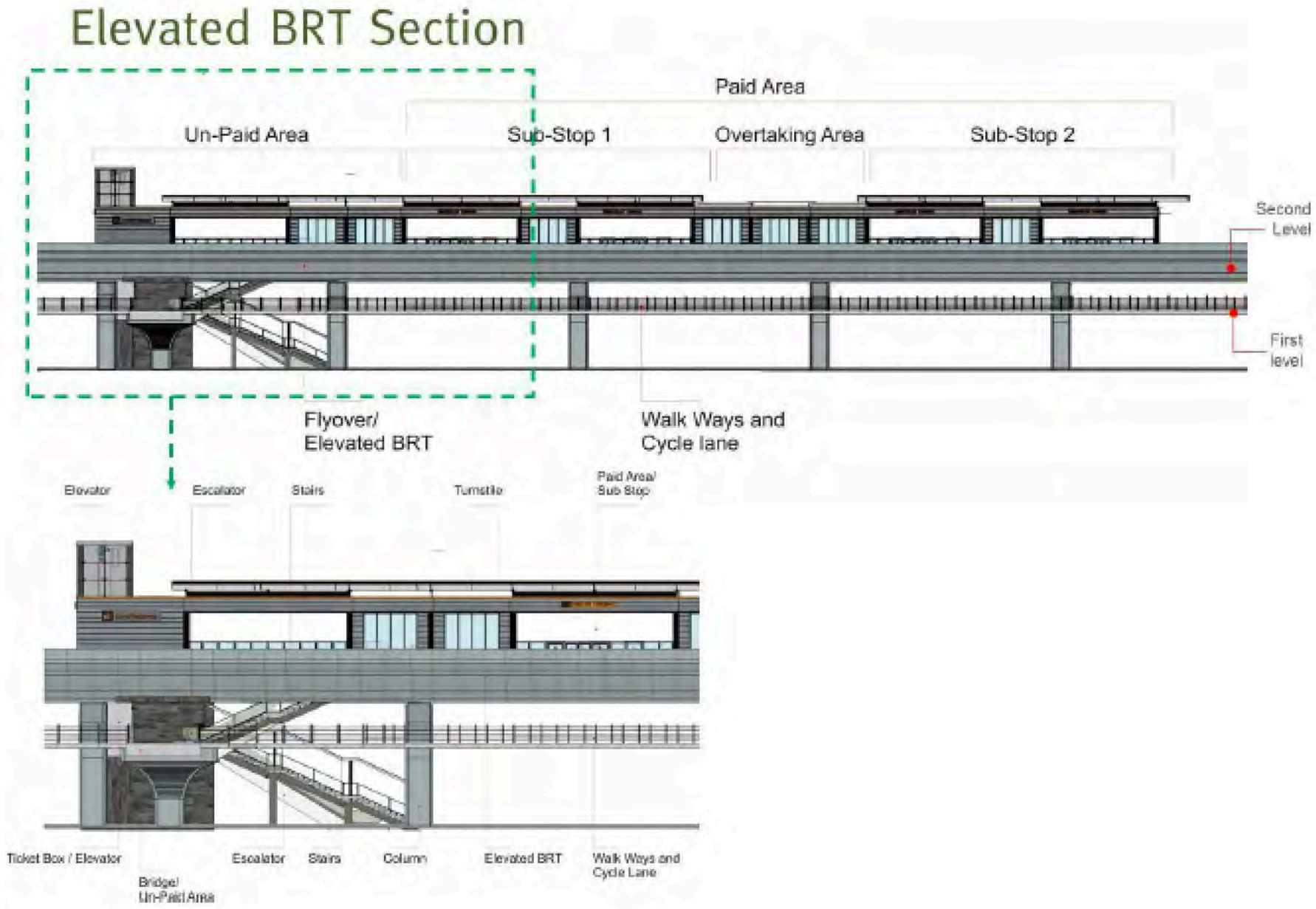


Figure 3.13: Station Dimensions for Elevated BRT



3.4.7 Vehicle design and Configuration

117. Two types of buses will be introduced for Peshawar BRT: 9-meter buses and 12-meter buses. With direct-service BRT operation, the BRT buses will be plying on the smaller road outside the corridor, such as Kohat Road, Bara Road, and residential roads at Hayatabad, where 9-meter buses with 2.2-2.5-meter width would be ideal to operate. Due to the seat configuration, the 9-meter bus is proposed to have engine placed at the front. The bus configurations for the 9 meter and 12 meter buses are provided as **Figures 3.14** and **3.15** respectively.

The 12-meter bus type will be used on routes with high proportion of the route passing the corridor on GT Road, with engine preferably at the rear.

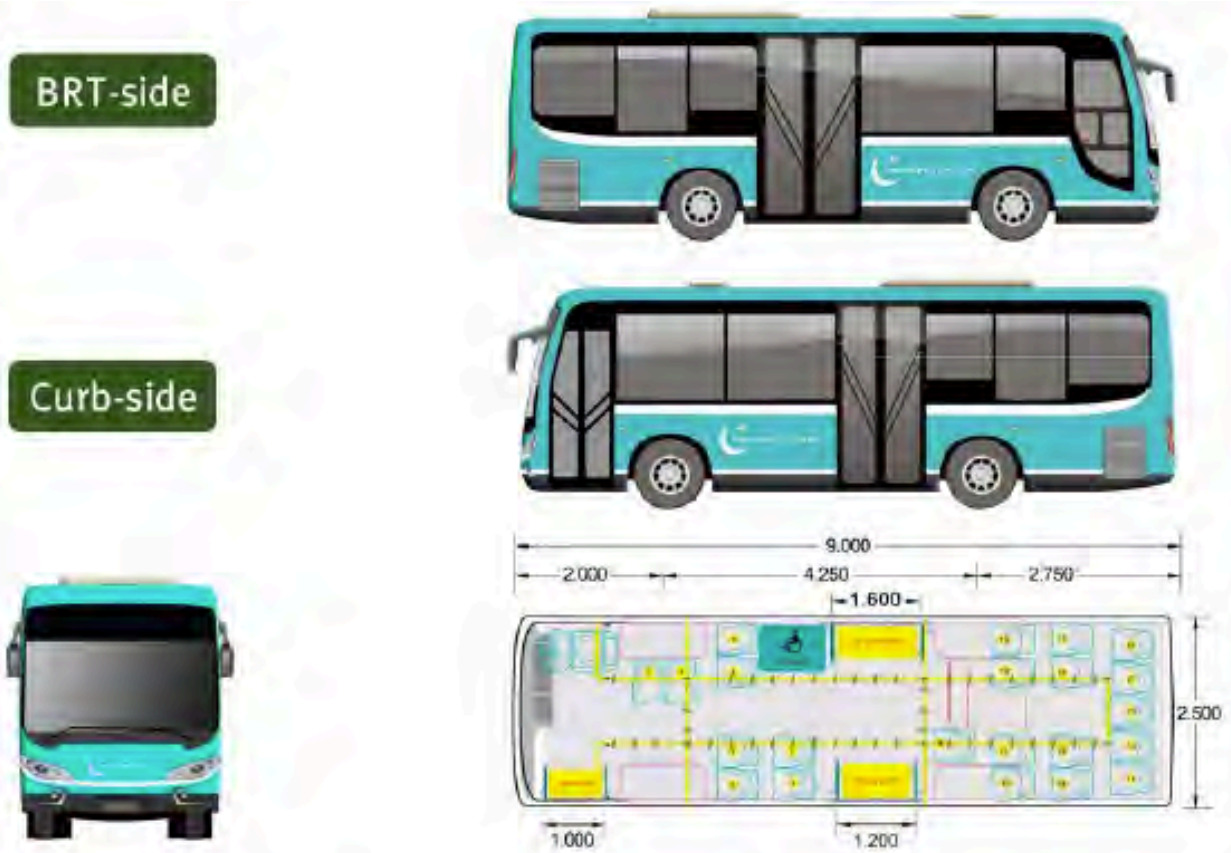
118. 18-meter buses will only be proposed for Peshawar BRT for future growth at a later stage, when the demand starts to grow. The current station design already accommodates the use of 18-meter buses. This is mainly due to narrow streets and tight turning radius that most of the road along off-corridor segment.

119. All buses are proposed to use diesel-fuel engine. Although CNG supply is not scarce in Peshawar, the use of CNG buses could increase the bus price as well as the Operating and Maintenance costs. From an operational point of view, CNG poses big problems with limited tank size, which requires buses to refill every 120-150 kilometers, and the possibility of installing new CNG station close to stations will depend on the CNG pipe availability, unlike the diesel fuel where it only requires storage tank at the refueling stations.

120. With direct-service buses serving both the BRT corridor and off-corridor (feeder), they need to have doors on both sides, and low-floor entrance (30-35 cm) to ensure easy access from the roadside onto the bus.

Such buses are available from both European manufacturers and Chinese manufacturer, and the manufacturers are more flexible to adjust the specification according to client's requirement.

Figure 3.14: Bus Configuration (9 meters)



Dimension

Length	: 9000 mm
Width	: Max 2500 mm
Height	: Max 3500 mm (with A/C unit)
Entrance	: 350 (fully loaded) to 380 mm
Door width	: 1000 mm (left-front) 1200 mm (remaining 3 doors)
Engine Location	: Front Engine

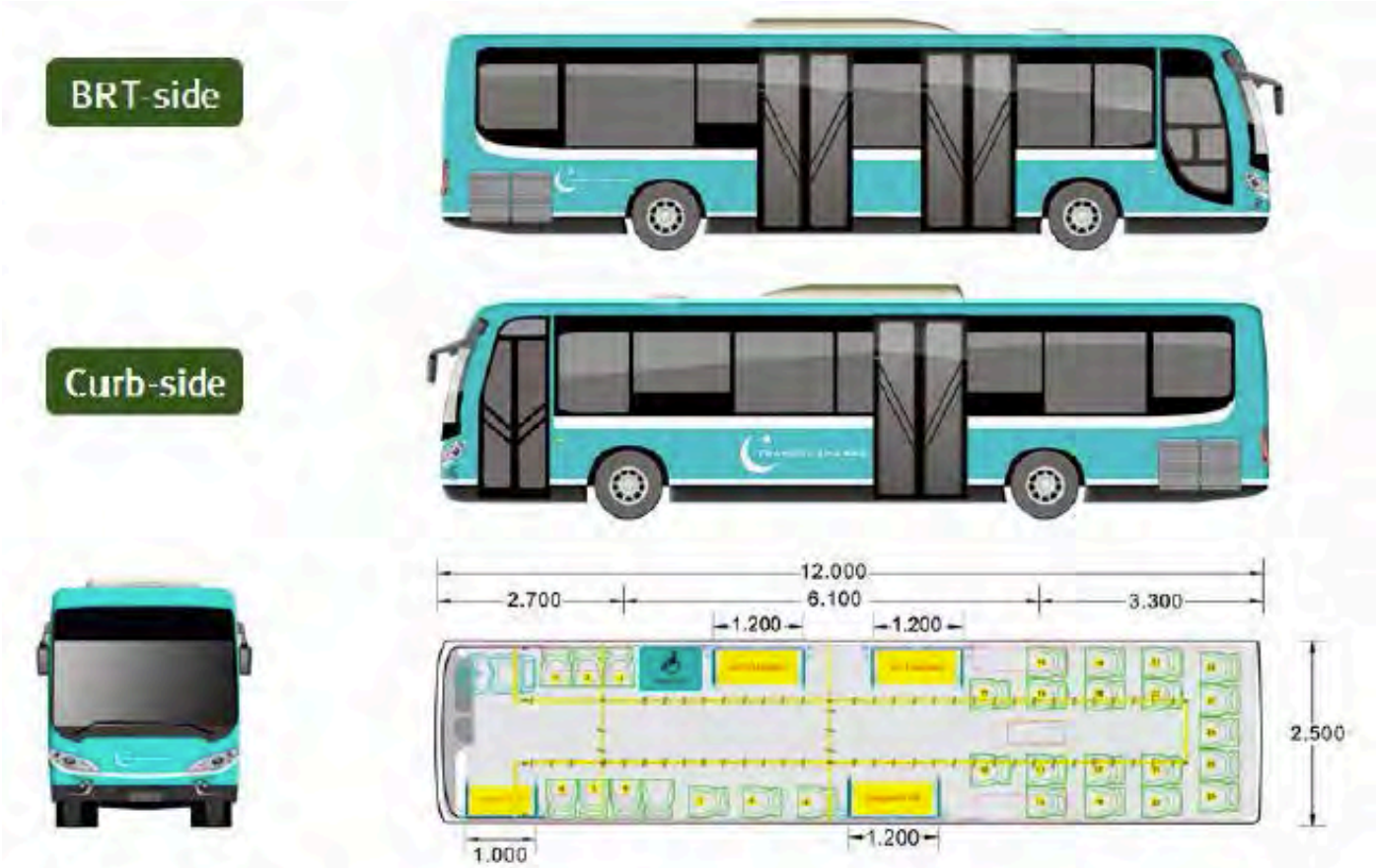
Capacity

Seating	: 22 seats
Wheelchair	: 1 Wheelchair
Standing	: Max 25 passengers (No Wheelchair)

Price

European OEM	: USD 100,000 – USD 150,000
Chinese OEM	: USD 75,000 – USD 90,000

Figure 3.15: Bus Configuration (12 meters)



Dimension

Length	: 12000 mm
Width	: Max 2500 mm
Height	: Max 3800 mm (with A/C unit)
Entrance	: 300 mm
Door width	: 1000 mm (front left) 1200 mm (remaining 3 doors)
Engine location	: Rear (preferred) or Front

Capacity

Seating	: 28 seats
Wheelchair	: 1 Wheelchair
Standing	: Max 55 passengers (No Wheelchair)

Price

Chinese EOM	: USD 160,000
European EOM	: USD 250,000

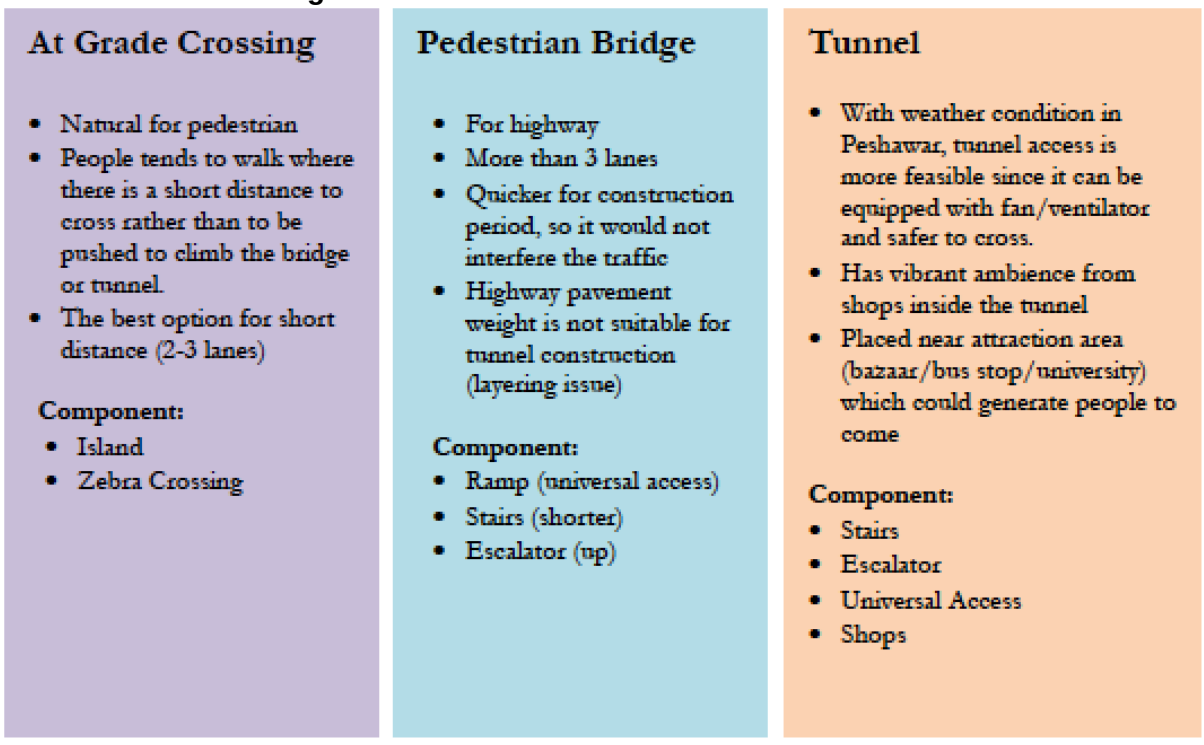
3.4.8 Station Access and Pedestrian Facility

121. Access to station is very important to improve the connectivity from the BRT station to the surrounding area. On most stations, access is provided at both ends of the station, except at few elevated stations, where space might be limited. Universal access is also promoted in Peshawar BRT, where all type of access, such as stairs, escalator and elevators are provided for all users with different abilities. On some stations, stairs from the sidewalk are also provided with guiding rails for bicycles, to allow bicycles to use the stairs to cross the road via bridge, mainly on the GT road.

122. To access the station, passengers are provided an overpass bridge, pedestrian tunnel or an at-grade crossing with a pedestrian signal with a combination between any of those options also available in certain locations. An an example, at Board Bazar Regi Station (BS-25), at one end, a pedestrian bridge will be provided, and at the other end, an existing tunnel will be improved for access to the station. The decision of choosing different types of access is determined with the site's space availability, as well as the road width. Most of the access to the at-grade section of the city center part (Saddar Road) will use at-grade crossing with pedestrian signals, since the width of road to cross is less than 30 meters wide.

The different types of BRT station access points are provided as **Figure 3.16** below.

Figure 3.16: Different BRT Access Points



123. In the proposed pedestrian crossing facilities, three pedestrian tunnels need to be demolished, mainly due to BRT-only tunnel that will be built on those locations. Since these pedestrian tunnels/market currently have many shop owners renting the space and needs to be relocated/compensated, we propose to shift them to the

nearest pedestrian bridge accessing the BRT station. The tunnels that need to be relocated are as follows:

- Pedestrian tunnel demolition of Hushnagri Underpass Market near BS-7. There are 36 shops owned or on rent by private investors. The existing shops will be moved to new pedestrian tunnel on east (accommodate 18 shops) and west (accommodate 20 shops) of BRT station.

- Pedestrian tunnel demolition of Firdous Cinema Underpass Market near BS-8. This will close 32 shops. The existing shops will be moved to new pedestrian tunnel on the east (able to accommodate 15 shops) and the west (able to accommodate 14 shops) of the BRT station.

- Pedestrian tunnel demolition near BS-22. Pedestrian bridges on BS-22 can accommodate 15 shops on west and 13 shops on east of BRT station.

This relocation is illustrated in **Figures 3.17** to **3.19** below.

Figure 3.17: Hashtnagri Underpass Market

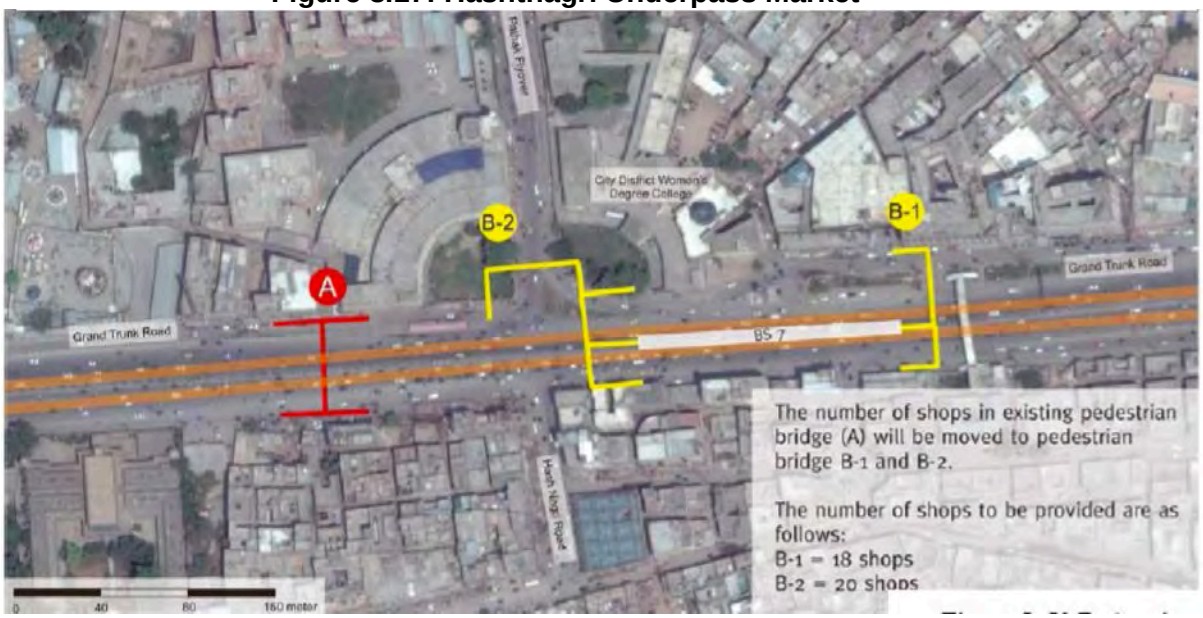


Figure 3.18: Firdous Cinema Underpass

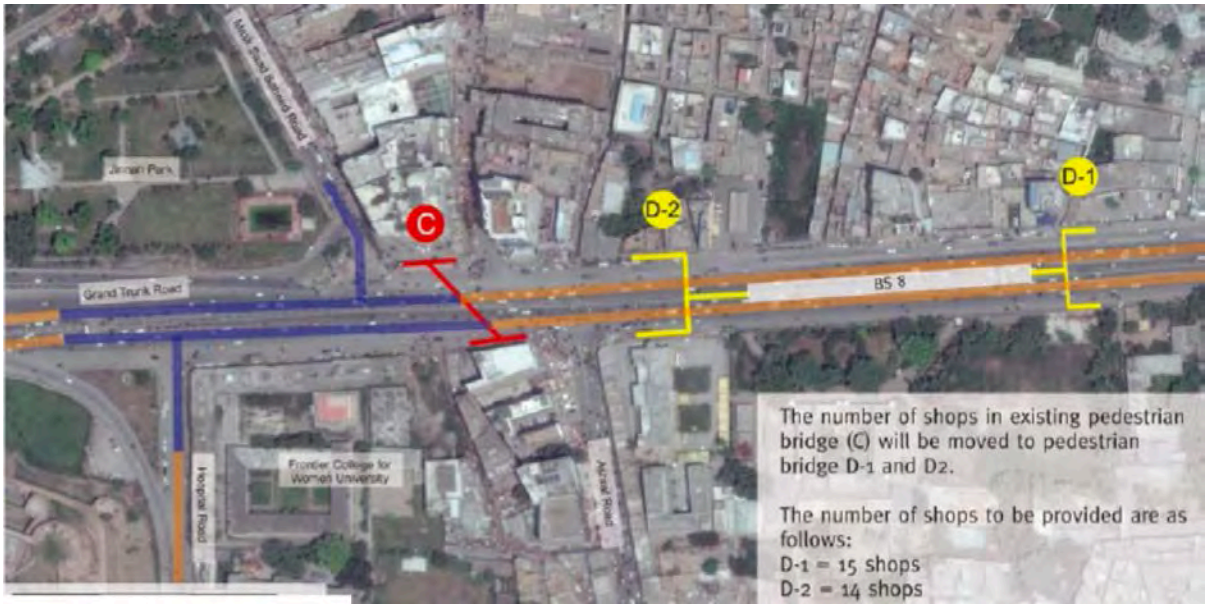
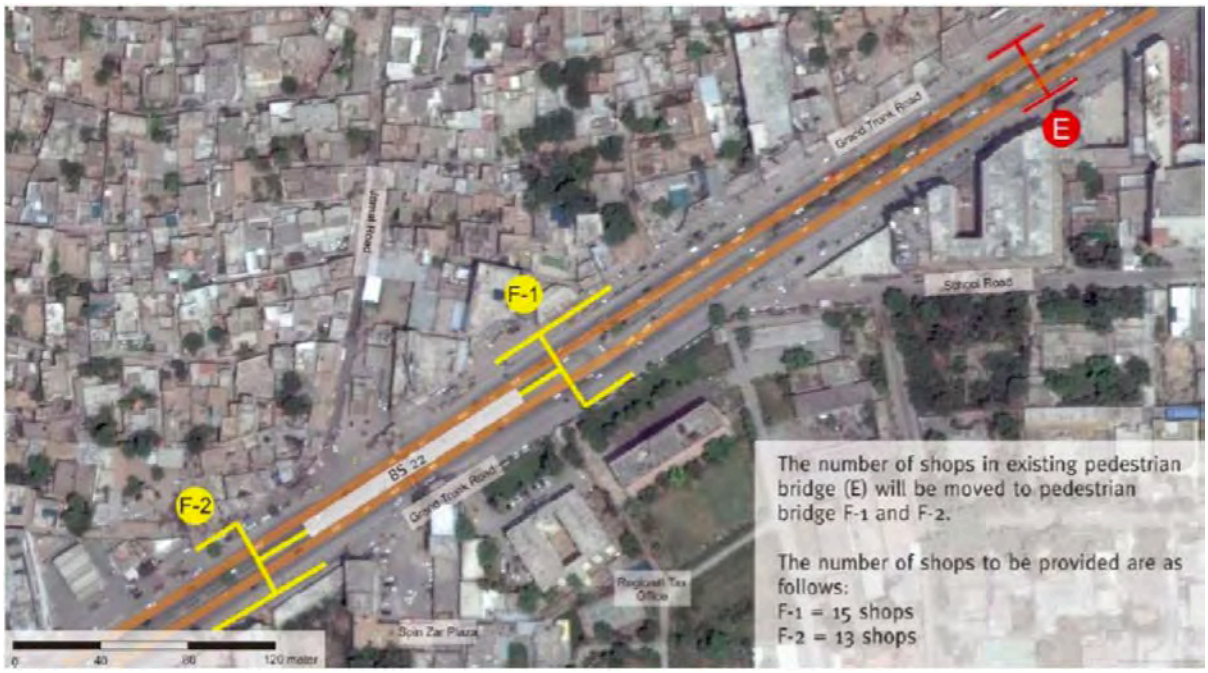


Figure 3.19: Pedestrian Tunnel near Jahangeer Abad Road



124. The proposed pedestrian bridges would be 8-meter wide (3 meter for shops, 5 meter for pedestrian movement). The shops on the new pedestrian bridges will have 2.5 m x 3 m (80 sqft) per shops. A total of 95 shops will be provided at the BRT station pedestrian bridge, with total area dedicated for shops are 637.5 Sqm, or 6861 sqft.

3.5 Associated BRT Infrastructure

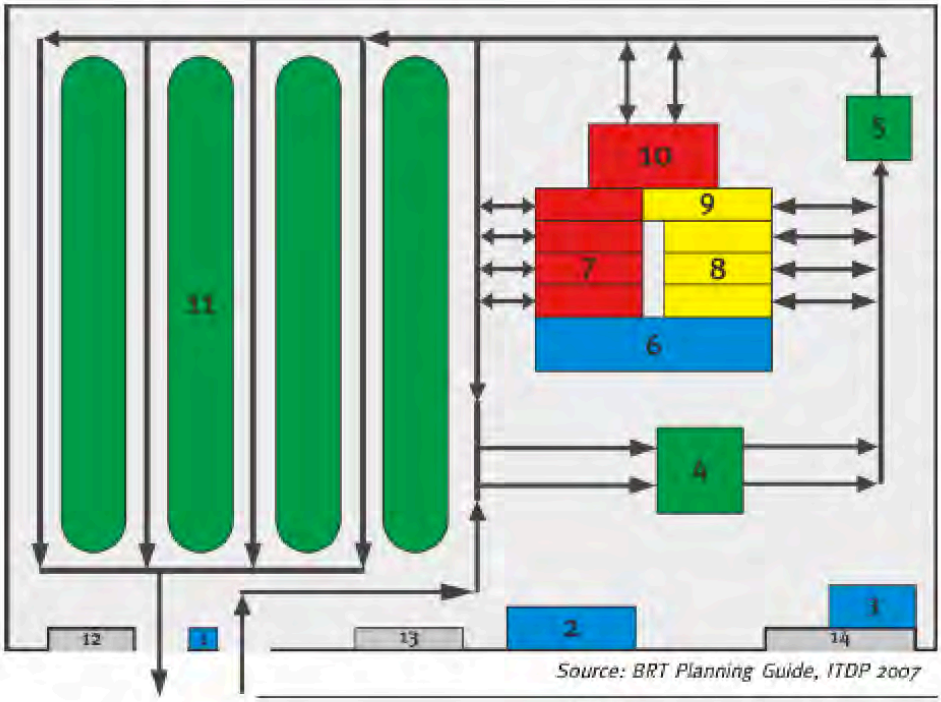
3.5.1 Bus Depot

125. A large number of buses for the Peshawar BRT operation will require a bus depot facility to enable operational efficiency in the BRT system. Such depots have indirect effects of improving passenger convenience and increasing the overall performance of the BRT. In order to serve the system well, bus depots should have at least the following facilities:

- A large area for parking buses
- Good pavement quality
- Sufficient space for bus marking and maneuver area
- Re-fueling facility, cleaning and washing system
- Maintenance and repair area (workshop)
- Administrative office for operators, and employee facilities.

The standard depot layout is provided in **Figure 3.20** below.

Figure 3.20: Standard Depot Layout



Source: BRT Planning Guide, ITDP 2007

LEGEND			
1	Gate and visual inspection area	7, 10	Major repairs
2, 3, 6	Administrative offices for concessioned operators	8, 9	Minor repairs and maintenance
4	Refueling area	11	BRT vehicle parking
5	Vehicle washing and cleaning area	12, 13, 14	Private vehicle parking
Green	Operational vehicles		
Yellow	Vehicles requiring minor or routine maintenance		
Red	Vehicles requiring major repairs		

126. In order to match the requirement for BRT depot in Peshawar, an available space measuring approximately 5.73 hectares on the Grand Trunk road and 4.1 hectares on the Peshawar Ring road are the ideal locations for the depot as they are close to the corridor.

127. Two depot locations are proposed near both ends of the corridors to ensure equal sizing of the fleet. Each depot will be designed to accommodate up to 250 buses with different types of buses (9 meter, 12 meter and 18 meter).

The possible locations of these depots are shown in the **Figure 3.21** below. The proposed designs of the Hayatabad and Chamkani depots are provided in **Figures 3.22** and **3.23** below.

128. The Hayatabad depot is located near the Peshawar Ring road across Al Haram Model town, with an area of approximately 2.5 hectares and can accommodate upto 131 buses, including parking space for 85 buses of 12 meter

length and 46 buses of 9 meter length. There is also a parking space for 18 buses standby as substitute for a bus which requires major maintenance.

129. A park and ride facility with an area of 0.5 hectares is located next to the Hayatabad depot and can facilitate upto 90 cars and has connection with BS 26.

130. The Chamkani depot which is located on the east side of the corridor, on Rano Gari road near the GT road, is roughly 3.5 hectares and contains parking space to accommodate up to 194 buses including 130 buses of 12 meter length and 64 buses of 18 meter length. There is also a parking space for 16 buses standby as a substitute for a bus which requires major maintenance.

131. A park and ride facility with an area of 0.5 hectares will be located opposite the proposed depot site and can facilitate upto 72 cars.

132. The location of the TransPeshawar office may be placed next to the depot over an area of 1 hectare or in Dabgari as an alternative.

3.5.2 Staging Facility

133. In addition to the depot. a staging facility needs to be provided in the middle of the corridor. This facility will be used during off-peak hour, when some portion of the fleet will be put off-service on a stand-by mode, ready to be deployed during the evening peak hour. This facility will be located in Dabgari Garden, along with the TransPeshawar office and Park and Ride facility. A multi-storey building will be constructed on the 20-kanal land, with bus parking located on the ground floor (road level), park and ride will be on the second floor and the TransPeshawar office will be located on the third floor. The map of the staging facility is provided as **Figure 3.24** below.

The layout of the proposed Staging facility at Dabgari is provided as **Figure 3.25** below.

134. The building structure of the Staging facility over 1 hectare (20 kanals) is proposed in Dabgari and the structure consists of three levels:

- Level 1 (at-grade): staging facility
- Level 2 (+ 5.5): park and ride
- Level 3 (+11.0): TransPeshawar office

Figure 3.21: Proposed BRT Depot Locations

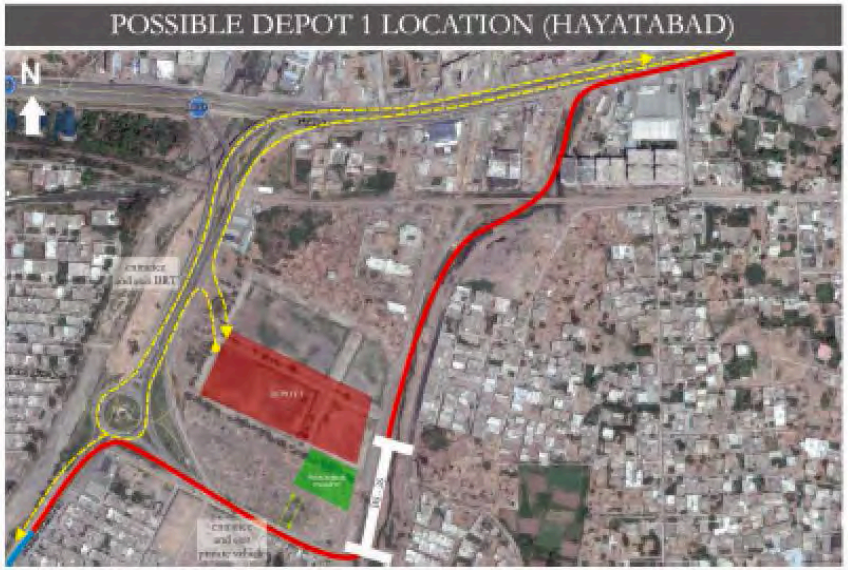


Figure 3.22: Layout of Depot 1 at Hayatabad

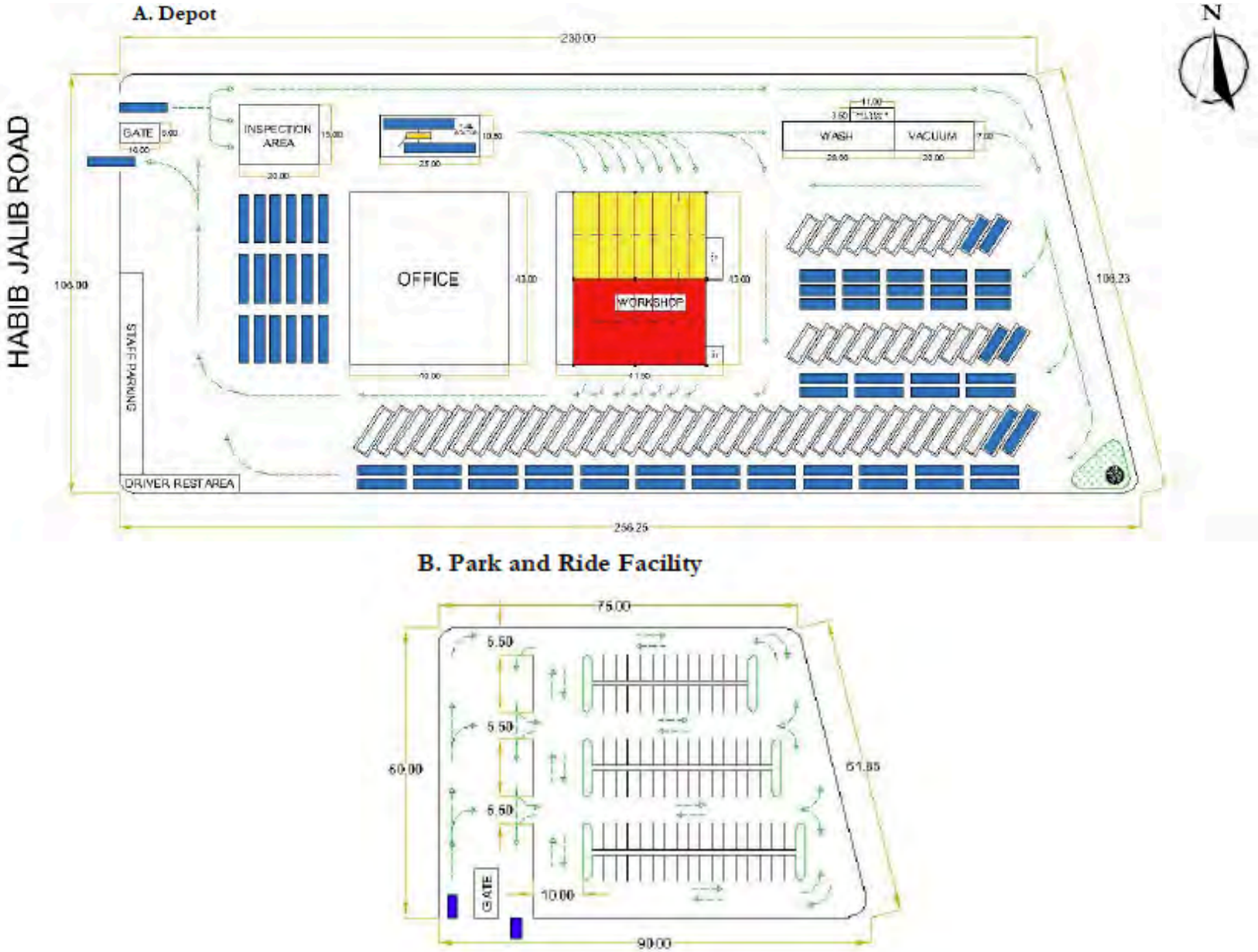


Figure 3.23: Layout of Depot 2 at Chamkani

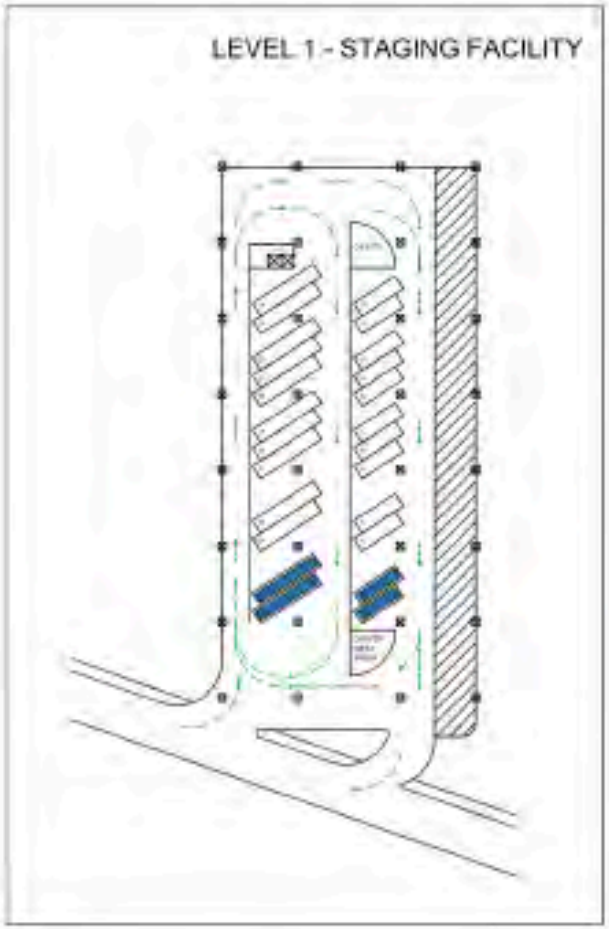
135. The Staging facility will be used as the bus parking facility during the off-peak period. With this facility, some of the buses that are not operated during the off-peak hours can stay for a few hours, before they go into operation at the evening peak. Based on the proposed design, the facility will be able to accommodate up to 36 buses (12 meter and 18 meter buses) and a small bus dispatching office as well as a driver rest area will be built in this facility.

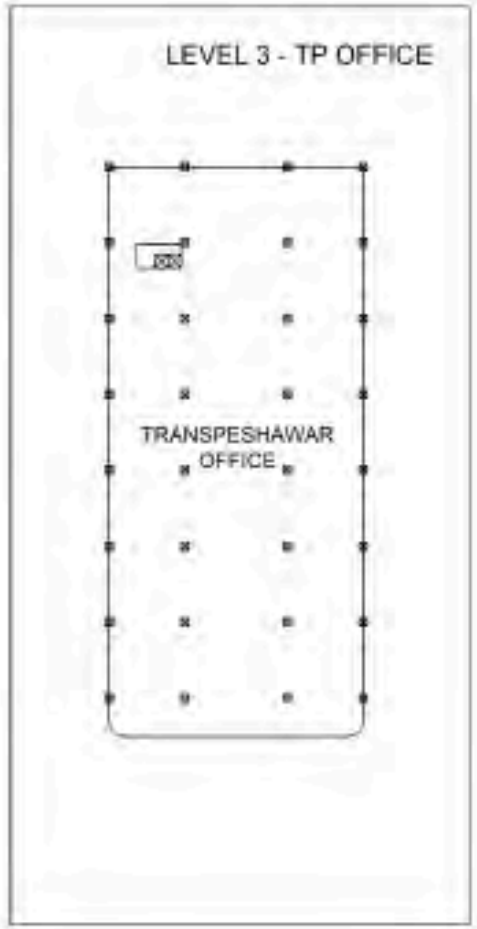
It should be noted that this facility will not be treated as a depot, as no maintenance facility will be provided at the site and any major maintenance shall be performed at the workshop located at the depot.

136. A park and ride facility will be located on the second level and can accommodate upto 100 cars with ramps provided for access by cars and this facility will be integrated with BS 12.

Figure 3.24: Location of Staging Facility

Figure 3.25: Layout of Staging Facility at Dabgari





3.5.3 Workshop Layout

137. The proposed workshop layout is provided as **Figure 3.26** below and will consist of the following features:

On First Floor

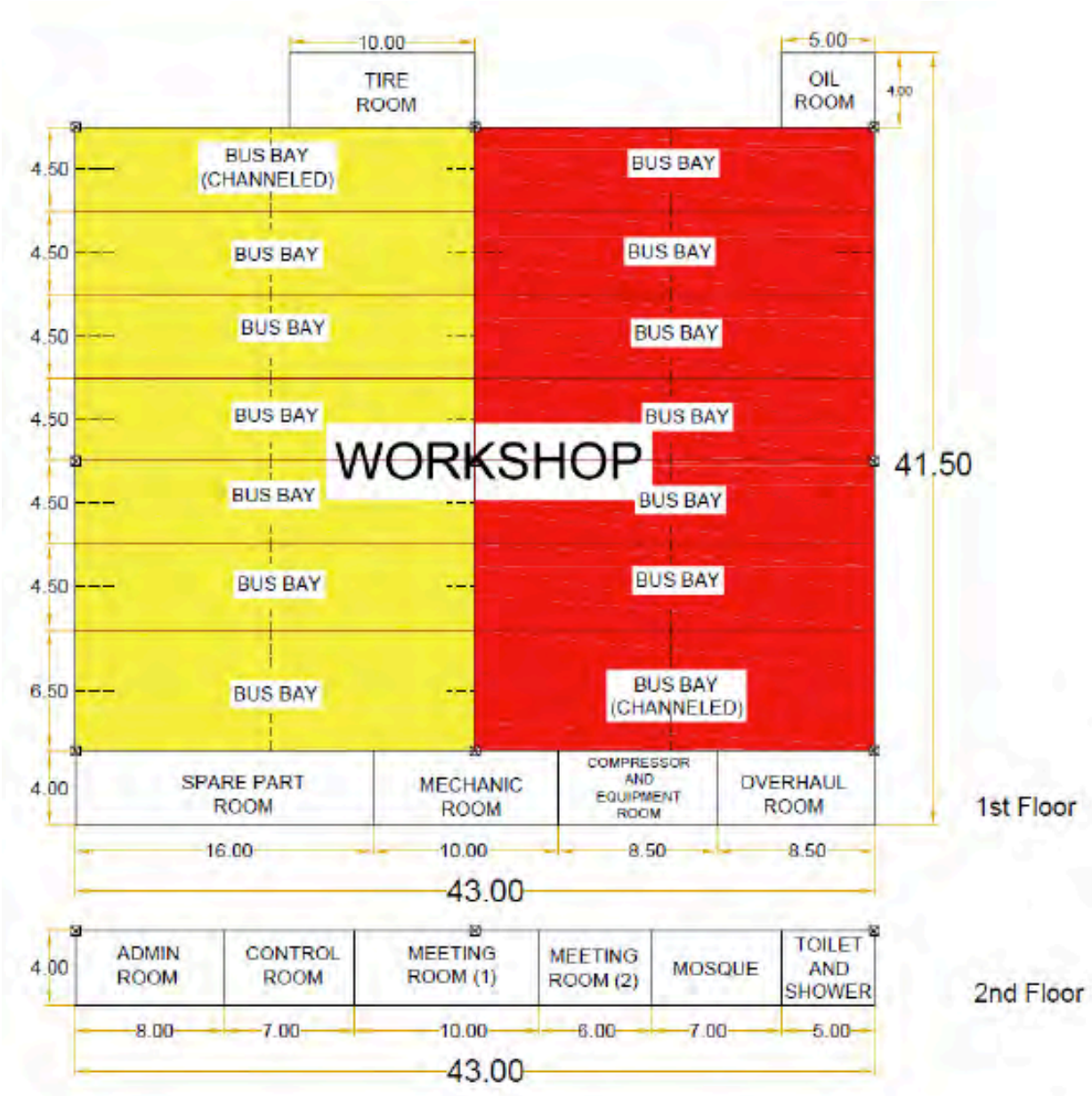
- Spare parts room: to store the spare parts stocks
- Mechanic room: for mechanics to gather or have a meeting
- Oil warehouse: to store oil to be used for periodic maintenance
- Tire room: to store tires and things related to tire changing
- Compressor room and equipment warehouse: to place the compressor as the center of air distribution and to store supporting equipment
- Overhaul room: to perform major repairs, such as engine dismount, transmission change, and other bus parts which require more than 1-day to complete
- Air and water installation: to be located in certain places in the workshop to support the maintenance process.

On Second Floor

- Admin room: to store documents, files and all related to administration
- Control room: for foreman or mechanics to receive orders according to the system applied
- Meeting room: for use by the management
- Mosque: for prayer
- Toilet and shower.

138. The proposed workshop design will be able to accommodate up to 14 buses at the same time and there will be two channeled work space at the underground level to allow mechanics to easily access the vehicle chassis for inspection and maintenance under the bus.

Figure 3.26: Workshop Layout



3.5.4 TransPeshawar Office

139. As part of the project, an office building for TransPeshawar will be built. This office building will also host the control center for BRT operation, as well as managing the operation and administration part of BRT. At the time of writing, no detail information has been provided on the exact staffing required for this office, but based on the staff size information provided by the institutional expert, the required space for TransPeshawar office is around 10,000 sqm. However, the cost calculation estimated for TransPeshawar office does not include the land acquisition cost, as it is assumed this cost will be borne by the KPK government.

Some facilities that will be provided in the TransPeshawar office are as follows:

- Office space for staff
- Control center, complete with staff from bus operator and traffic police
- Meeting room facilities
- Auditorium for staff training
- Prayer room
- Employee and guest parking space

3.6 Operational Mode of BRT

3.6.1 'Direct-Service' Operational Model

140. A 'Direct-service' operational model is proposed for this project, where BRT buses can run along the BRT corridor and beyond the corridor. This will enable passengers to access the BRT from outside the corridor, without the need to transfer to other buses once they are in the BRT system. Many BRT systems using a separate trunk and feeder system require passengers to transfer from feeder service to BRT trunk service. Although this transfer might be free, the time and the walking distance required to change buses and wait for the connecting service might discourage people to use the BRT.

The benefits of having a direct service BRT are as follows:

- Minimize transfer between trunk and feeder
- Reduce passenger whole end-to-end journey time
- Avoid the need to have big transfer terminal at the end of corridor
- Ability to increase coverage of the BRT service, without the need to build the physical infrastructure widely
- Flexibility in operation.

141. In order to enable the BRT routes to enter and exit the corridor, access needs to be provided at certain locations near the BRT stations. Bus entrance to the BRT corridor will be provided before the station, where the BRT separator will be removed, and chevron will be provided to guide the bus to enter the BRT lane. To exit the corridor, an opening will be provided for the bus to leave the BRT lane and join the mixed-traffic lane. The location of these openings for BRT direct service routes will only be provided on certain locations. The access for direct service on each station is illustrated in **Figure 3.27** below.

3.6.2 Operational Plan and Fleet

142. The 8 specified BRT lines will travel in and outside the corridor, and depending on their routes, will use 9 meter or 12 meter buses. The selection of the bus type, as well as the daily ridership, determines the necessary bus frequency for passengers to be picked up without long waiting times. The proposed route length and detail is provided in **Table 3.2** and **Figure 3.28** below.

143. With an average portion of 57% inside the corridor, the routes are obviously expected to travel faster in traffic-less lanes. Nonetheless, travelling outside the corridor will also be crucial in order to pick up passengers. In a matter of efficiency and comfort, the maximal peak hour headway is fixed to 5 minutes for all BRT routes.

144. At the beginning, with mixed of 9-meter and 12-meter fleet, the carrying capacity of the system will be between 5,800 passengers per hour per direction (pphpd) up to 8,500 pphpd. However, if later on 18-meter buses are introduced, it could even carry up to 15,000 pphpd, or even bigger, since express services are also possible to run with the current infrastructure design.

145. The total BRT fleet strength is planned to be 383 buses consisting of 131 buses of 9-meter length and 252 buses of 12-meter length.

3.7 Implementation Arrangement

3.7.1 Implementation Management and Execution

146. Physical implementation of the construction of the BRT infrastructure will be undertaken through a Contractor selected by the PDA. The Contractor shall conduct the construction activity on the basis of the detailed designs provided to him.

147. The Contractor will take broad responsibility for all elements of the construction and procurement and shall be responsible for ensuring compliance of the activities being conducted with the applicable environmental and social safeguards.

Figure 3.27: Access for Direct Service at BRT Station

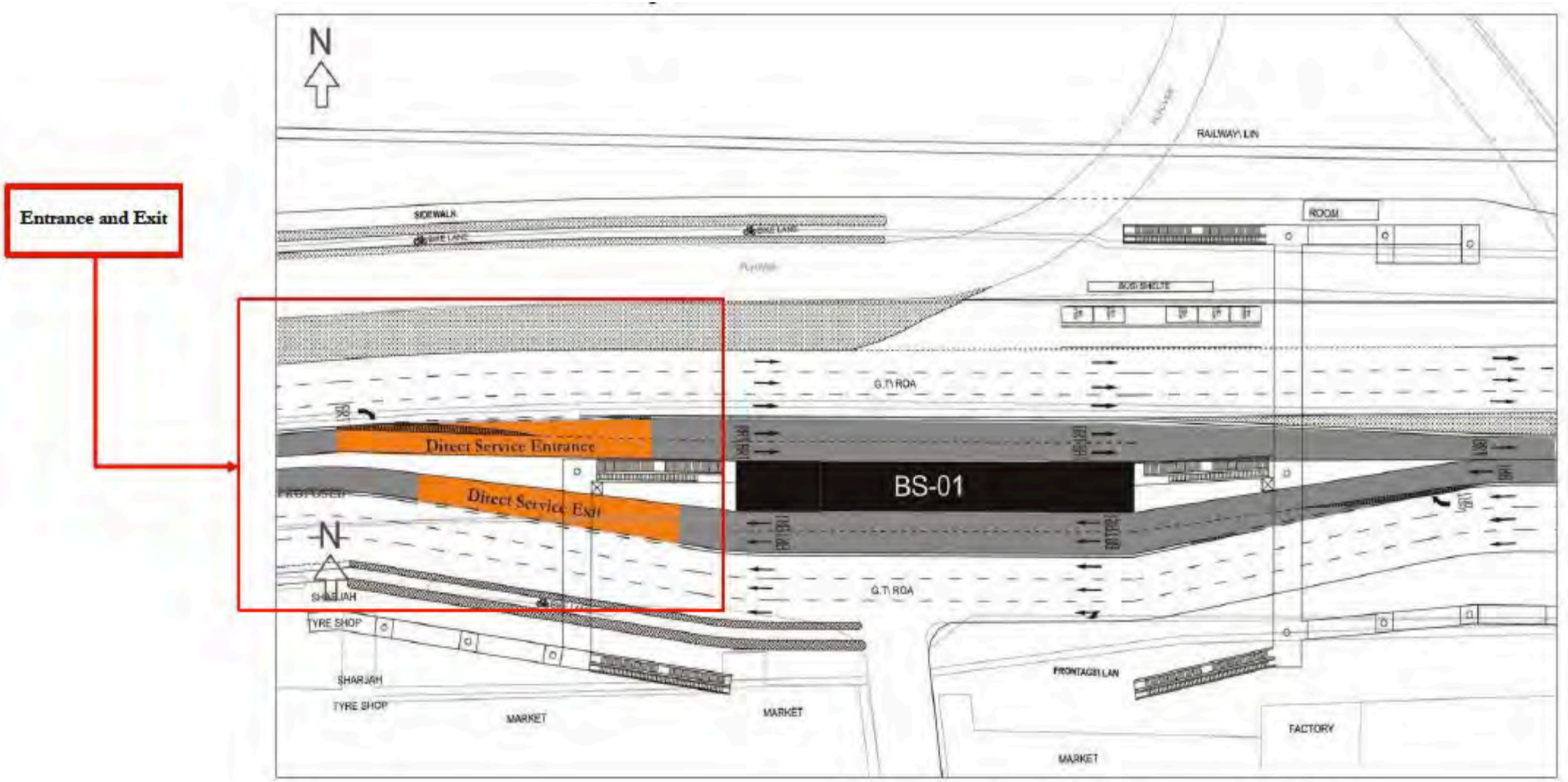
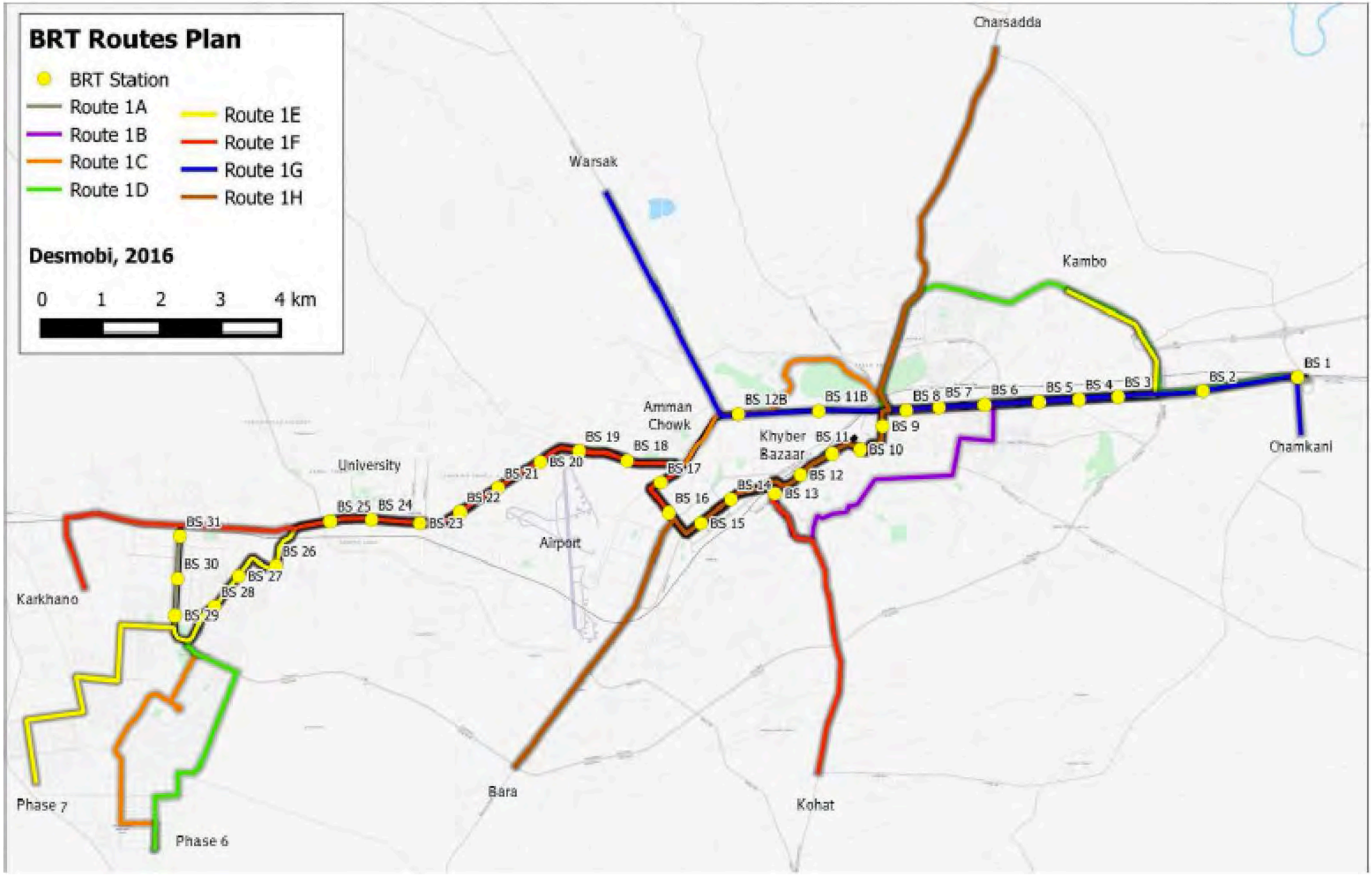


Table 3.2: Proposed BRT Route length and details

BRT	Route Length (km)	Length in Corridor (km)		Length off Corridor (km)		One way time (min)	Bus type (m)
1A	27.5	27.5	100%	0	0%	61	12
1B	12.9	6.2	48%	6.7	52%	41	9
1C	25.8	14.98	58%	10.82	42%	77	12
1D	29.3	15.88	54%	13.42	46%	89	12
1E	28.4	20.4	72%	8.0	28%	77	12
1F	20.5	10.2	50%	10.3	50%	64	9
1G	14.8	7.3	49%	7.5	51%	46	9
1H	15.8	4.5	28%	11.3	72%	55	9
Average	**21.9 km**		**57%**		**43%**	**64 min**	

Figure 3.28: BRT Route Plan



3.7.2 Project Construction Schedule

148. The project construction phase is expected to last for a total of 18 months with the activity expected to commence in the first quarter of 2017 and completed by the second quarter of 2018.

3.8 Construction Camps and Work Force

149. The construction activity has to span over approximately eighteen months. There shall be a number of contracts for a variety of works. The selected Contractor shall have the option to select suitable site(s) located near the project sites to establish his labor camps. If private land is selected, the contractor shall enter into contract with the private owner.

150. Since the work is quite scattered in nature with a large number of sites along the project corridor, the project construction will be divided into many sections. The work bases shall be setup by the contractor in consultation with the engineering teams. Essential for the work bases is easy approach, availability of a suitable place for temporary storage of material and availability of water for construction in the vicinity. Presence of shade from trees close to the work bases can add to the comfort of the labor while taking rest during the hot season.

151. The location of storage materials and camps will be critical. Since the project contractor(s) will be responsible for identifying the suitable locations for storage and labor camps from the private sector, thus there will need to be clear guidelines for this process, which will need to be closely monitored by the implementing agency. As far as possible, the project design team shall be assigned the task to identify the suitable location(s) for storage of materials since inappropriate storage of materials may result disruption of the traffic movement.

3.9 Machinery Requirement

152. For storing materials, stocking equipment and parking machinery and vehicles, the Contractor shall require open and accessible sites close to the labor camps. The Contractor, at his own expense, but keeping in view his contractual obligations to honor the NEQS regarding level of pollution, shall make the arrangements.

153. The expected machinery to be employed for the construction activity along with the respective noise ratings is provided in **Table 3.3** below.

Table 3.3: Construction Equipment Noise Ranges dB(A)

Equipment	Peak Noise Range at 15.2 m	Typical Peak Sound Level in a Work Cycle[a]	Typical 'Quieted Equipment' Sound Level[b]	Construction Phase		
				Earthworks	Structures	Installation
Batching plant	82-86	84	81		Y	
Concrete mixers	76-92	85	82		Y	
Cranes	70-94	83	80		Y	Y
Excavators	74-92	85	82	Y		
Tractors and trolleys	77-94	88	85	Y	Y	Y
Water bowsers	85-93	88	85	Y	Y	Y
Graders	72-92	85	82	Y		
Bulldozers	65-95	80	75	Y		
Paver	87-89	88	80	Y		
Pumps	68-72	76	75	Y	Y	Y
Diesel generators	72-82	78	75	Y	Y	Y
Vibrators	68-82	76	75	Y	Y	
Drilling machines	82-98	90	87		Y	Y
Compressors	74-88	81	71		Y	
Dumpers	77-96	88	83	Y	Y	Y
Road rollers	73-77	75	72	Y		

Sources: Bolt, Beranek, and Newman, Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. USEPA, 1971; http://www.waterrights.ca.gov/EIRD/text/Ch11-Noise.pdf; http://www.lacsd.org/LWRP%202020%20Facilities%20Plan%20DEIR/4_6_Noise.pdf; http://newyorkbiz.com/DSEIS/CH18Construction.pdf

Notes:

a. Where typical value is not cited in literature, mean of the peak noise range is assumed

b. Quieted equipment can be designed with enclosures, mufflers, or other noise-reducing features. Where data is not available, a 3 dB reduction is assumed

4 Description of Environment

4.1 General

154. Peshawar, the capital of Khyber Pakhtunkhwa province, is a metropolitan city and is located at the north-west end of Pakistan, about 160 km west of federal capital Islamabad. It is bounded by tribal agencies on its three borders.

155. Peshawar is a City district with a total population of 1.75 million people and contains four towns with each town consisting of union councils with a total of 92 union councils in Peshawar. There is only one tehsil in the district i.e. Peshawar tehsil and the total area of the district is 1,257 km^2.

156. The description of various features of the project area environment including the physical, ecological, cultural and socio-economic environmental aspects are presented in the following sub-sections.

4.2 Physical Resources

4.2.1 Topography

157. Peshawar is situated near the eastern end of the Khyber Pass and sits mainly on the Iranian plateau along with the rest of the Khyber-Pakhtunkhwa.

The Vale of Peshawar is covered with consolidated deposits of silt, sands and gravel of recent geological times. The areas between the Kabul River and Budni Nala consist of flood Plains/Zones. The meander flood plain extends from Warsak in the Northwest towards Southeast in the upper Northern half of the district. The Kabul river enters the district in the Northwest.

On entering the Peshawar Plain, the Kabul river is divided into several channels. Its two main channels are the Adizai River Eastward flows along the boundary with Charsadda District. Another channel branching from the right bank of the Naguman River is the Shah Alam, which again merges with Naguman River further in the East. In general, the sub-soil strata is composed of gravels, boulders, and sands overlain by silts and clays. Sand, gravel and boulders are important aquifers that extend to a depth of about 200 feet (61 m) and further confined water bearing aquifers occur at depths greater than 400 feet (120 m).

158. The proposed project corridor is located within Peshawar city, which is a completely urban environment. The terrain consists of completely flat land will the only vegetation cover consisting of plants and trees scattered across the project corridor for landscaping and beautification of the city.

4.2.2 Climate

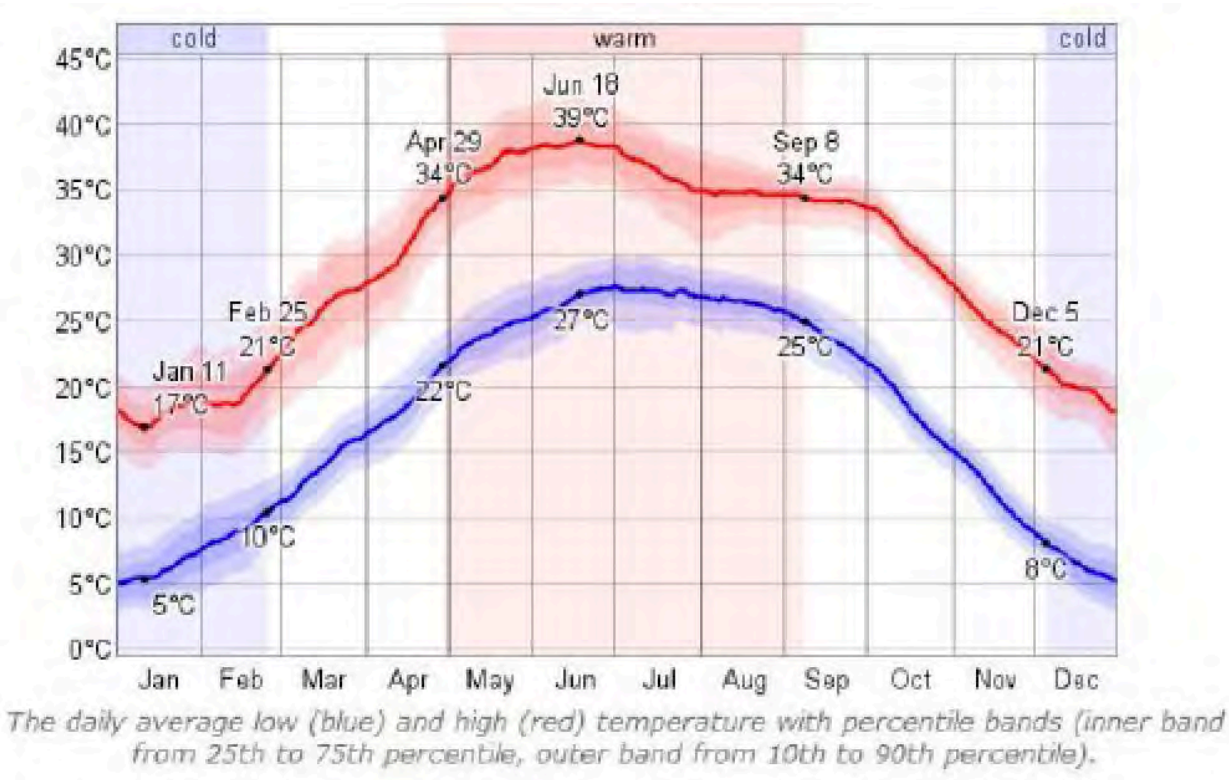
159. Peshawar has a hot semi-arid steppe climate, which is very dry with little rainfall. It can rain at any time of the year but the rain does not last long. As well as

being arid, the climate is extremely hot in the summer but slightly cooler in the winter months. There is no monsoon period. Throughout the year, temperatures fall dramatically at night, sometimes by as much as 20°C.

160. The warm season lasts from the 29th of April to the 8th of September with an average daily high temperature of above 34C. The hottest day of the year is the 18th of June, with an average high of 39C and a low of 27C.

161. The cold season lasts from the 5th of December to the 25th of February with an average daily high temperature below 21C. The coldest day of the year is the 2nd of January with an average low of 5C and a high of 18C. The temperature profile for Peshawar is shown in **Figure 4.1** below.

Figure 4.1: Year round Temperature Profile of Peshawar City

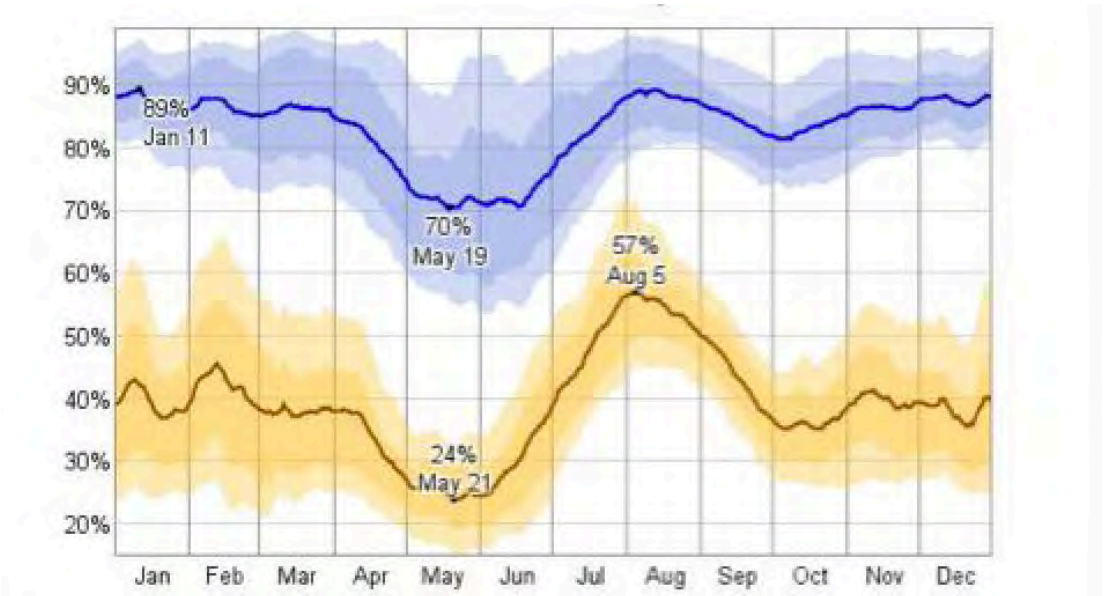


The daily average low (blue) and high (red) temperature with percentile bands (inner band from 25th to 75th percentile, outer band from 10th to 90th percentile).

162. The relative humidity typically ranges from 24% (dry) to 89% (very humid) over the course of the year, rarely dropping below 15% (dry) and reaching as high as 99% (very humid) as can be seen in **Figure 4.2** below.

The air is driest around the 21st of May, at which time the relative humidity drops below 29% (dry) three days out of four; it is most humid around the 11th of January, exceeding 85% (humid) three days out of four.

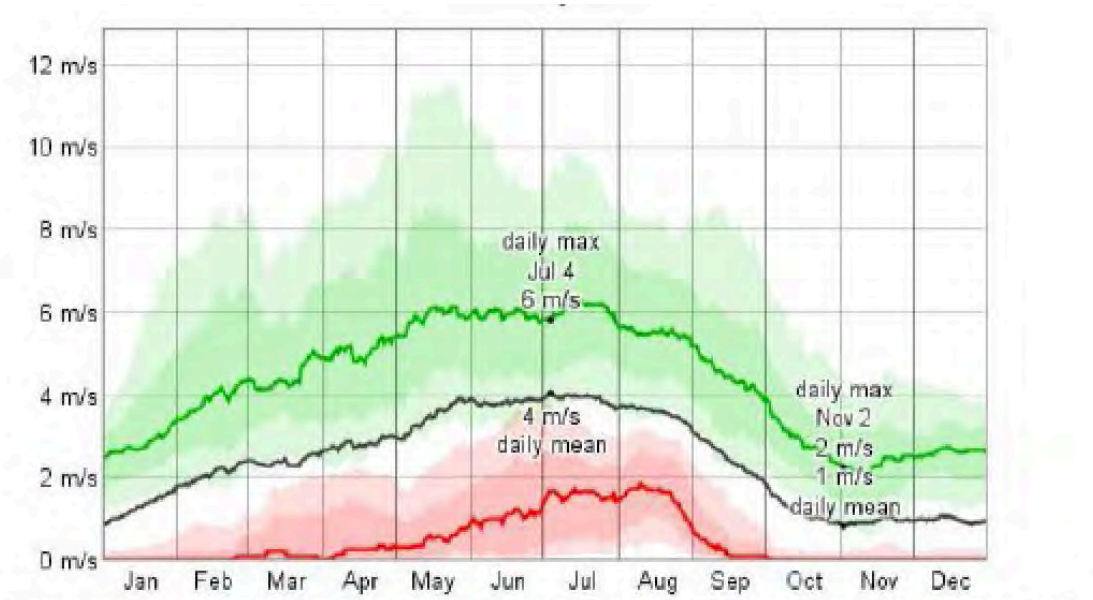
Figure 4.2: Humidity Profile of Peshawar City



The average daily high (blue) and low (brown) relative humidity with percentile bands (inner bands from 25th to 75th percentile, outer bands from 10th to 90th percentile).

163. Over the course of the year, the typical wind speeds vary between 0 m/s and 6 m/s (calm to moderate breeze), rarely exceeding 12m/s (strong breeze) as can be seen in **Figure 4.3** below.

Figure 4.3: Wind Speed Profile of Peshawar City

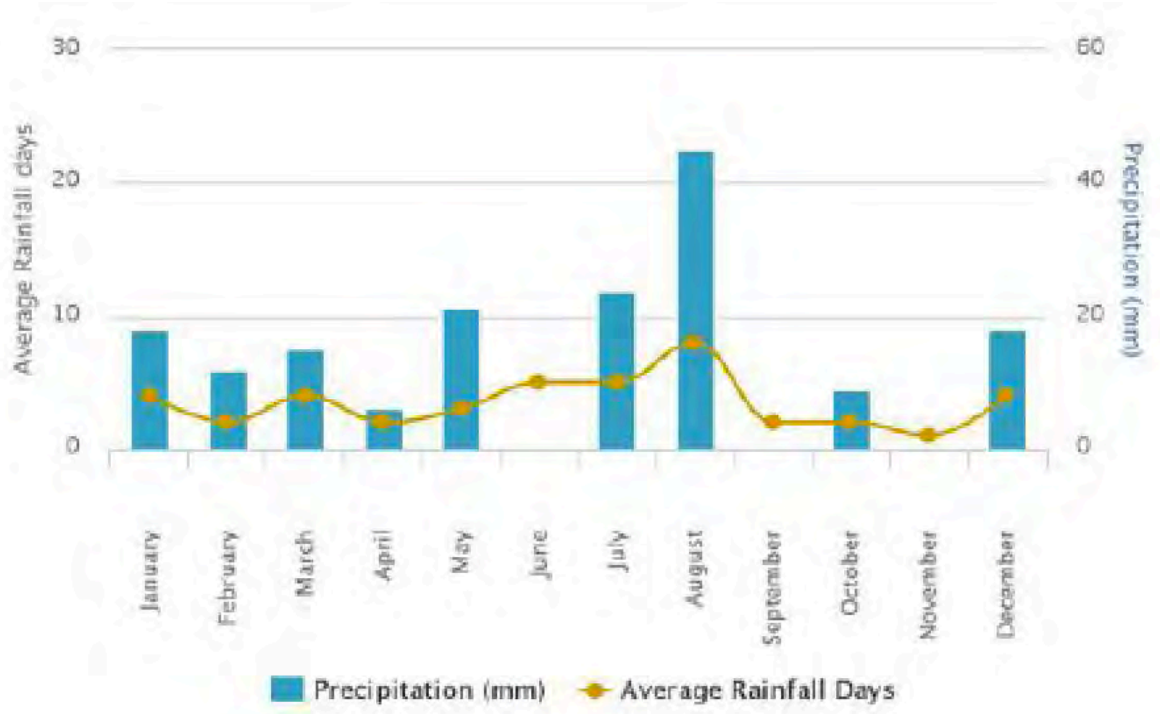


The average daily minimum (red), maximum (green), and average (black) wind speed with percentile bands (inner band from 25th to 75th percentile, outer band from 10th to 90th percentile).

164. The average rainfall profile for Peshawar is provided as **Figure 4.4** below. The physical work is planned to start from the 1st quarter of 2017 and to be completed by second quarter of 2018. Since there are over 20 days of rainfall during the month of August each year, thus potential issues related to drainage and water

logging can be expected at those project sites along the project corridor where excavation work will be conducted. In order to overcome any potential issues with drainage, necessary mitigation measures shall be implemented whenever required, provided in detail in Section 6.4.37 'Flooding'. All required measures such as installation of pumps for removing any water collecting within the excavated sites along with installation of retaining walls around the boundary of the excavated site to prevent filling up of water are some of the measures that shall be implemented, if required.

Figure 4.4: Average Rainfall Profile of Peshawar City

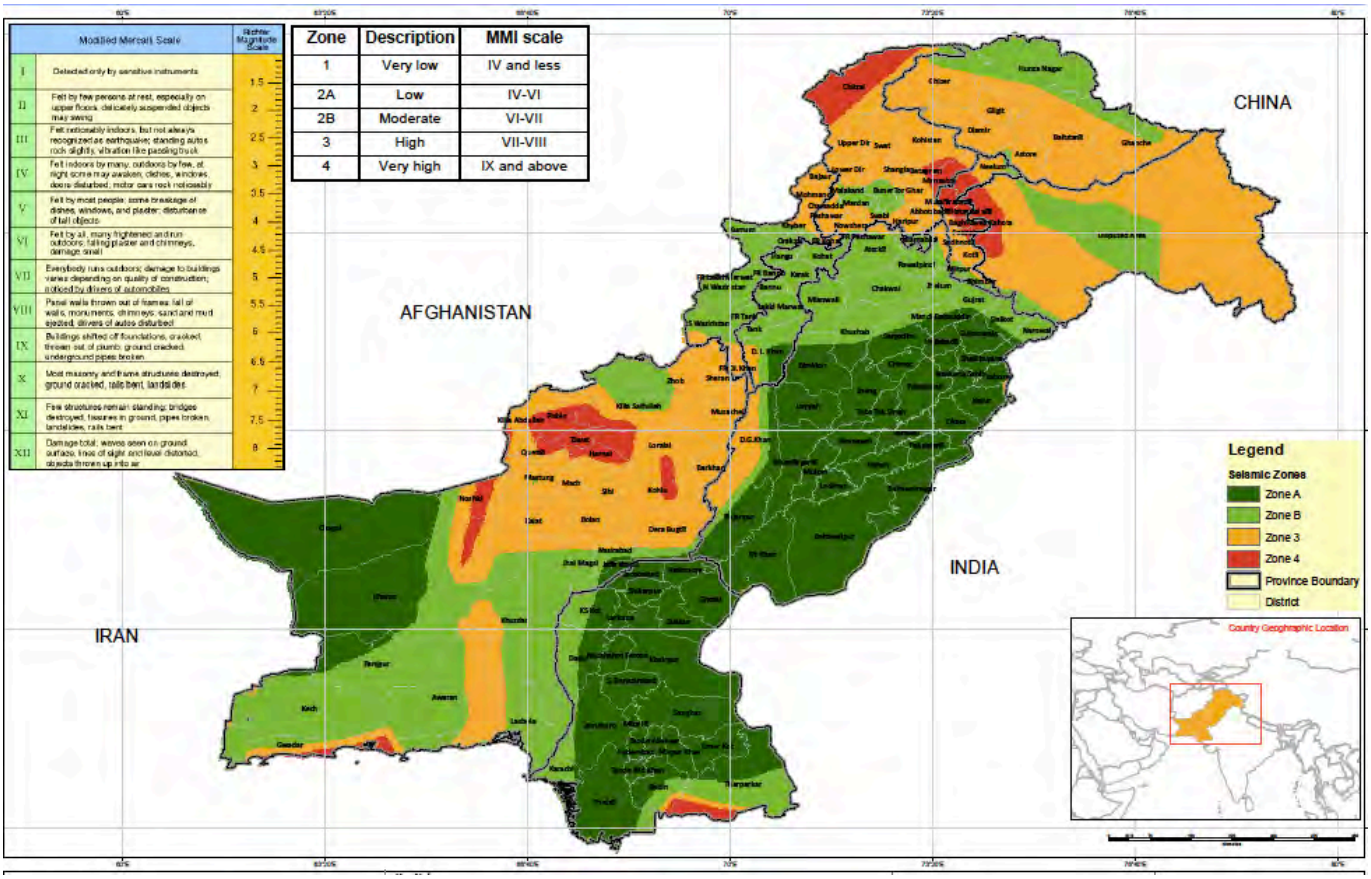


4.2.3 Seismology

165. The seismic hazard in Peshawar is aggravated by increasing vulnerability due to populated growth and expansion in infrastructure due to its political and regional importance. It is located in the western Himalayan region characterized by high seismicity rates due to its vicinity to the active plate boundary between the Indian and Eurasian plates. The seismic zone map of Pakistan is shown in **Figure 4.5** below.

166. According to MOHW-PEC-NEPAK (2007), Peshawar is placed in Zone 2B. The Zone 2B has Peak Ground Acceleration (PGA) in the range of 0.16g to 0.24g for a return period of 475 years and is considered to be at 'Moderate' risk of a major earthquake event.

Figure 4.5: Seismic Zones of Pakistan



4.2.4 Surface and Groundwater

167. Khyber Pakhtunkhwa province lies between river Indus and the Sulaiman hills that form the western barrier of Pakistan. Its canals are insignificant as compared with the great irrigation works of the Punjab. The only ones of any importance are in the Peshawar valley. These draw their supplies from the Kabul, Bara, and Swat rivers, but the first two rivers irrigate small portion of cultivated area of the district.

168. There is heavy dependence on the Kabul, Bara and Swat rivers to obtain water for every day use for the residents of Peshawar. Boring of tube wells to obtain underground water is a standard practice being implemented by the residents of Peshawar to ensure a continuous supply of water, which has lead to a reduction in the water table of 130 feet over the past decade.

169. The Government authorities are planning a Peshawar Greater Water Supply Scheme, which will allow approximately 200 million gallons per day (MGD) to be pumped in from different rivers to meet the growing requirements of Peshawar.

170. Agriculture in Peshawar is largely dependent on Canals. Moreover, tube wells irrigation is also available in some places. The irrigated land in district Peshawar constitutes a large percentage as compared to other districts of Khyber

Pakhtunkhwa. 73% of the rural mouzas are irrigated by canals while 15-20 % are irrigated by other sources including river, Tube-wells, ravine, and spring stream etc.

4.3 Ecological Resources

4.3.1 Flora

171. The city of Peshawar consists of a completely urban landscape with patches of plants and trees present across the city for the purpose of beautification and landscaping.

172. In the Peshawar valley, subsistence agriculture is widely practiced with wheat, barley, millet, corn, cotton, pepper and sugarcane being the primary crops. The annual cycle is divided into two planting and harvesting periods, one for wheat and barley in winter and another for corn in summers. Planting and harvesting of sugarcane overlaps both the periods. These crops are supplemented with a variety of vegetables and with clover, which is used in conjunction with millet as a fodder.

173. In many villages in the Peshawar valley, there are extensive pear, peach and apricot orchards and grape vineyards. Tobacco is also an important crop near the town of Nowshera. Wheat, cotton, pepper and particularly Tobacco and sugarcane are grown for the market as well as for local consumption.

174. The present flora of the irrigated areas is exotic. The common trees are mesquite, ber, different species of acacia and jand. The most common shrubs are tarmariax, articulata, spands, akk, small red poppy, spera, pueghambrigul, drab grass, spera, eamelthorl and pohli chaulai etc.

4.3.2 Fauna (Regional)

175. There is a variety of fauna present in Peshawar valley with the details provided in Table 4.1 below.

Table 4.1: Existing Fauna in Peshawar Valley

Mammals			
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Leopard	Panthera pardus	**Hare/Siah**	Lepus nigricolus
Mongoose/Neola	Herpestes anropunctatus	**Ludhar/Other**	Lutra persipiciliata
Gheese/House Shrew	Suncus marinus	**Black Bear**	Ursus thibetanus
Bat/Changadar	Pipistralius terwis	**Jackal/Gidder**	Canis auries
Black Rat	Ratus ratus	**Fox/Loori**	Vulpe bengalensis
House Rat	Mus musculus	**Hedge Hog**	Hemiechinus Sp.
Mole Rat	Bandicota bengalensis	**Porcupine/She**	Hystrise indirca

Squirrel/Gulehri	Fumbulus penanti		
Birds			
Dove/Common Dove	Streptophelia senegalusis	**Indian Sand Martuis**	Riparia paludicola
Dove/Common Dove	Streptophelia tranquefabria	**Indian River Term**	Sterna auranlia
Larks	Mirfa erythroptra	**Black Partridge**	Francolinus francolinus
Larks	Erimopterix grisea	**Common Babler/Bagla/Chakkira**	Turdoides candatus
Larks	Calaendrella cristata	**Neel Kanth**	Gracius garrulous
Weaver Bird	Ploceus phillipinus	**Grey Partridge**	Pyeronotus xythopygos
Jungle Pigeon	Teron walia	**Shrieks/Lali/Myna**	Passeriformes Sp.
Crow	Corcives abyssinica	**Owl**	Bubo africanus
Sparrow	Passer Sp.	**Black Rock Pigeon**	Columbia livia
Reptiles			
Indian Cobra	Naja naja		

4.4 Human and Economic Development

4.4.1 Culture

176. Peshawar is one of the most ancient cities of this region and for centuries has been a center of trade between Afghanistan, South Asia, and Central Asia as well as the Middle East. It is a conservative Islamic city with a rich history. Peshawar's inhabitants consist mainly of Pashtun and Hindkowans. In addition, many Punjabis, Chitralis, Tajiks, Uzbeks and Hazaras can be found in the city.

4.4.2 Languages

177. Though Pashto followed by Hindko is the main language spoken in the district, other languages such as Urdu, Persian, Saraiki and Punjabi are also spoken by some of the residents of the district.

4.4.3 Religion

178. Over 99% of the city's population is Sunni Muslim, along with some Shias and Ahmedis.

Despite overwhelmingly Islamic nature of modern Peshawar, it was previously home to other smaller communities such as Afghan Jews, Zorastrian, Hindus and Sikhs. Its famous markets such as the Qissa Khawani Bazaar (market of story tellers) are emblematic of this mixture of culture and offer a variety of goods including gold and silver ornaments, traditional carpets, pottery, and clothing to artwork in wood, brass

and precious stones. Even today, Peshawar is the commercial, economic, political and cultural capital of the Pashtuns as well as a major center of Hindko culture in Pakistan.

4.4.4 Administrative Setup

179. Under the latest revision of Pakistan's administrative structure, promulgated in 2001, Peshawar was given the status of a City district and divided into four towns. Each town in turn consists of a group of Union Councils (UCs).

180. The administrative towns are know as Peshawar Town I, Peshawar Town II, Peshawar Town III and Peshawar Town IV.

4.4.5 Main Sources of Livelihood/Income

181. According to the official statistics, in 2007, there were 432,506 employed people in the district. Agriculture sector is the highest employer with 26.6 percent of the total employment followed by wholesale and retail businesses 8.9%, transport and communications 5.8% and manufacturing 5.5%.

182. Reported statistics also indicate that people of Peshawar have mostly focused on their personal business and services, i.e. 41% of the employed population earn their livelihood through personal services. Women participation in employment is low as only 12% of the female population is employed.

4.4.6 Transport

183. There are 4 types of vehicles operating as public transport vehicles in Peshawar. The biggest capacity is Minibus, which also has two sub-types: Mazda minibus and Bedford buses. Both sub-types have similar size of approximately 8 meters long with capacity of 41 passengers inside the bus. Passengers also often sit on the roof, despite posing great danger to their life and others. At most, 11 passengers can sit on the roof.

184. The second vehicle type is the Ford wagon, with a capacity of 15 passengers. The seat configuration of the wagon makes passengers difficult to get in and get out of the vehicles, thus most of the passengers on wagon are typically an end-to-end passengers riding the entire route.

185. In addition to the above, the Suzuki vans have started to gain some public transport market shares, with at least 14 routes plying on Peshawar road. Suzuki vehicles are derived from pick-up minivans, modified with fragile roofs to provide cover for passengers. Despite their small size, the Suzuki can carry up to 18 passengers in total (inside and outside). Accident rates are not available, but it would not be surprising if they were listed as the most dangerous public transport option of Peshawar.

186. Small people carrier called Qingqi – named after the Pak-Chinese based motorcycle brand used as the vehicle, are also operating in Peshawar and relatively

popular for short distance trips. This vehicle, a modified 3-wheeler with extra cabin at the back for passengers, has a capacity of 6 to 8 passengers.

187. In Peshawar, no public route map exists, although many routes operate in the city. The official data obtained from the Government only listed the minibuses, rocket bus and wagon. Suzuki and Qingqi are operating illegally so no official data is available. Based on the surveys conducted for this project, 7 minibus routes, 2 wagon routes, 13 Suzuki routes and 6 Qingqi routes have been identified.

188. Based on the 16 road segments surveyed, only 3 road segments have peak passenger volumes under 1,000 passengers per hour per direction, and there are 5 locations with peak passenger volumes above 3,000 passengers per hour per direction. Most of these locations are located along the BRT corridor on GT road, which indicates a clear need to implement a BRT corridor on these roads. This passenger volume throughput is higher than some of the BRT systems in the world and Pakistan, where the peak passenger throughout in Islamabad BRT is only 2,100 passengers per hour per direction (December 2015).

4.4.7 Industry

189. Peshawar district is comparatively developed area in the province of Khyber Pakhtunkhwa. Khazana sugar mill and a number of small industrial units in the industrial estates located at Kohat road and Jamrud road are functioning, which are manufacturing hosiery, small arms, leather and foot wear, garments, ghee, soap, etc. Match factories, flour mills and steel re-rolling units are also operating in the district.

190. There are a total of 550 Industrial Units in district Peshawar that provide employment to 14,471 people and the total Investment of all these industries amounts to Rs. 5009.902 million.

4.4.8 Health Care

191. Presently, in district Peshawar, health services are provided by both Public and private institutions. There are 12 public hospitals - out of these 3 are teaching hospitals, 72 private hospitals, 3 RHC, 37 civil dispensaries, 4 MCH centers, 49 BHUs and 4 TB clinics in district Peshawar. The total beds strength of government teaching hospital is about 3460 beds. Also, there are 1,046 doctors, 176 dispensers, 708 nurses, 60 Lady Health Workers (LHW) and 1,888 other paramedical staff posted by the government in the district.

4.4.9 Literacy Rate

192. The literacy rate for population 10 years and above (2010-2011) was 54 percent (Males: 68%, Females: 38%).35 which increased to 59% in 2013. For the urban rural comparison, the urban literacy rate is higher than the rural, which is 62 percent. Among urban community, literacy ratio for male is 75 and for female it is 47; whereas the rural literacy ratio is 45 percent, and in rural community, literacy ratio for male is 61 and for female it is 29. Adult literacy rate (> 15 years) is 51 percent. Gross

Enrollment Rate (GER), at the primary level, is 93% (Male: 101%, Female: 85%). Net Enrollment Rate (NER), at the primary level, is 56% (Male: 59%, Female: 52%).

4.4.10 Education

193. The total enrollment in district Peshawar is 354.674 (Boys: 207,941, Girls: 146,733). Out of a total of 9,652 teachers 5,522 are male and 3,796 are female teachers. This illustrates that, on an average, one teacher is teaching 37 students. Total educational facilities are 1,376; out of which 836 are boys and 540 are girls. This means that, on an average, every facility has a teaching staff of around 7.

194. Primary: The total number of primary level schools, that are reported, are 1,063 (Male: 652, Female: 411). The total enrollment, at the primary level is 239,320 (Boys 136,615, Girls 102,705). Total number of teachers, at the primary level, is 5,554, out of which 3,379 are male and 2,175 are female teachers. Thus on, an average, each primary school has an enrolment of 225 students with a teaching staff of 5.

195. Middle: There are a total of 150 middle schools reported. The total enrollment at the middle level is 64,077, of which 38,726 are boys and 25,351 are girls. The total number of teachers at the middle level is 954, out of which 522 are male teachers, while 432 are female teachers. Thus, on an average, each middle school has an enrolment of 427 students with a teaching staff of 6.

196. Matric: There are a total of 118 secondary schools in the district. The total enrollment at the secondary level is 24,766, of which 14,880 are boys and 9,886 are girls. The total number of teachers at the secondary level is 1,521, out of which male teachers are 996 and female teachers are 525. Thus, on an average each, the Secondary level schools have an enrolment of 210 students with a teaching staff of 13.

197. There are a total of 52 higher secondary schools in the district. Total enrollment, at the higher secondary level, is 3,326 (Boys: 1,422, Girls: 1,922). The total number of teachers at the higher secondary level is 823, out of which 567 are male teachers and 256 female teachers. Thus, on an average, each higher secondary school has an enrolment of 133 students with a teaching staff of 33.

4.4.11 Archaeological and Cultural Heritage

198. The Bala Hisar Fort is the only major site of cultural importance that is located at a distance of 83 meters from the project corridor. However, it is predicted that there will be no direct impact on this historical landmark since the project corridor alignment passes next to the fort and the vibration effects resulting from the construction activity are not expected to be so significant as to cause any damage to the Fort.

However, during the detailed design phase of the project, expected to commence by March 2017, a detailed investigation by a team of civil engineers will be conducted

prior to commencement of the project activity to assess the existing structural strength of the fort as well as any possible impact(s) of the expected vibration levels resulting from the project construction activity on the fort. The assessment of the expected vibration levels shall be conducted based on the vibration thresholds provided in **Table 4.2** below. The tentative scope of work for this structural assessment is provided as **Annexure O**.

199. An NOC has already been issued by the Directorate of Archaeology and Museums (please refer to Annexure K) and only requiring that a staff member from the Directorate be present at the respective project site(s) to ensure no adverse impacts take place during the construction activity.

200. Apart from the Bala Hisar Fort, no other sites of archaeological or cultural heritage have been observed during the survey. However, if at any stage any archaeological or physical heritage is discovered, it shall be managed as per established protocol from the department of Museum and Archaeology, GOP.

Table 4.2: Damage Thresholds from Construction related Vibration Effects[1]

Conditions Observed	Typical Peak Particle Velocity (in/sec)*
Threshold damage (hairline cracking in plaster, opening of old cracks etc.)	2-3 Never at <0.5
Minor damage (hairline cracking in masonry, breaking of windows)	4-5 Never at <1.0
Major structural damage (cracking or shifting of foundations or bearing walls)	>5

Note: *: Based on Standard USBM RI 8507

4.4.12 Energy Supplies

201. The residents of Peshawar city are reliant on electricity available from the grid through PESCO (Peshawar Electric Supply Company) although they face between six to eight hours of load shedding on a daily basis. Certain residents and businesses in the city, based on affordability, operate diesel generator sets as a back up. Also, there is an increasing trend of installing solar PV systems in both residences and businesses in order to ensure energy reliability.

4.4.13 Communication

202. Majority of the community members possess cellular phones, although PTCL line is present in the city but it is mostly used in Public offices and in Public Call offices (PCOs). Most youth is IT literate and use both desktop and laptop computers and have access to the internet. Postal service is available throughout the city. Majority of the residents of Peshawar city have access to a television as well as satellite channels.

[1] http://www.apti.org/clientuploads/publications/2015/Johnson-HannenHiRes_SampleArt_46.2-3.pdf

4.4.14 Project Area Communities

203. The inhabitants in the area fall into socioeconomic strata varying from poor to rich. The specific areas lying in the project area are shown in **Figures 4.6** to **4.9** below.

204. The area in Peshawar urban district is dominated by both residential and commercial activities. Along the GT Road, commercial and business areas are found on the main road, whereas on the secondary roads, or 500 meters from the main GT Road, highly populated residential areas are found. Commercial activities and offices dominate the cantonment-controlled area, such as in Khyber Bazaar and Saddar, and a significant portion of the area south of Khyber road is dominated by government and military offices.

205. On the west part of the corridor, major residential area in Hayatabad dominates the area while some proportion of industry is located south of Karkhano. This makes the BRT corridor surrounded by high commuting activities, which makes it ideal. The density of the urban area, where the BRT will run, is much higher than the density outside the urban district. Currently, 11,714 people per square km live in the urban district, whereas the density outside is only a tenth of the urban area's density.

206. Based on the detailed surveys conducted, the key receptors along the BRT project corridor were identified and are shown in **Figures 4.10** to **4.23** below.

207. The average distance of any residences from the proposed BRT route is 60 meters while the maximum distance is greater than 200 meters. In addition, at a number of locations along the BRT corridor, the first row of buildings consists of commercial plazas with the residential buildings located behind these plazas. Thus, at these locations, the residences are being 'shielded' by the commercial buildings with regards to exposure to any potential impacts such as noise, dust and exhaust emissions. Thus, at these locations, the first row of commercial plazas along the corridor are acting as a 'noise barrier' due to attenuation and will cause considerable reduction in the noise levels and level of air emissions reaching the residences.

Thus, the construction activity or operation of the BRT is not expected to pose any disturbance to the residences lying at these locations near the proposed BRT route.

4.5 Noise

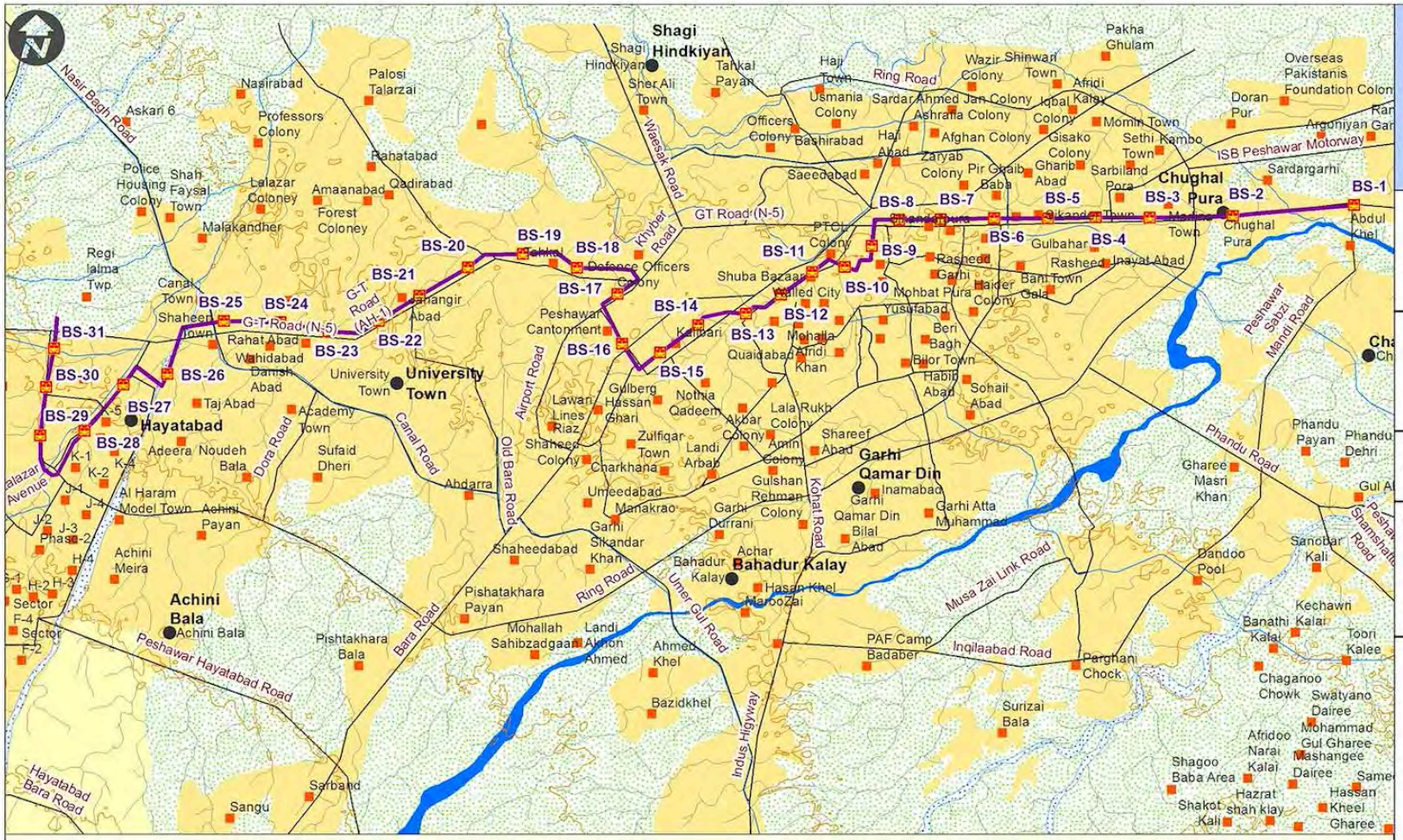
208. As the first step, the selection of locations for the 24-hourly monitoring of ambient noise levels at sensitive receptors along the BRT route was conducted. In order to select the five most representative locations for monitoring of the ambient noise levels over a period of 24 hours, a Type 2 portable sound meter was used and instantaneous noise levels were recorded at ten different locations. A strict protocol was followed by ensuring the sound meter was calibrated and each measurement was obtained by holding the meter at an arm's length until the reading stabilized.

Also, during the measurements, the wind speeds were observed and readings taken during high wind speeds were discarded.

These ten locations were as follows:

- Chamkani Chowk
- Sethi Town
- Hashnagri
- Soekarno Square
- Saddar Bazaar
- Christian Cemetery
- Abdara Road
- KTH University of Peshawar
- Board Bazar Regi
- Cancer Hospital

The map showing the ten locations and their respective instantaneous ambient noise readings are provided as **Figure 4.24** below.



Preferred Option Route

Stop Number	Name	Stop Number	Name	Stop Number	Name
BS-01	Chamkani Chowk	BS-12	Dabgari Gardens	BS-23	KTH University of Peshawar
BS-02	Chughal Pura	BS-13	Railway Station	BS-24	Islamia College
BS-03	Dr. Zareef Memorial School	BS-14	State Bank of Pakistan	BS-25	Board Bazar Rogi
BS-04	Sethi Town	BS-15	Saddar Bazar	BS-26	Taj Abad
BS-05	Sikandar Town	BS-16	Mall Road	BS-27	Hayatabad Model School
BS-06	Gulbahar Square	BS-17	Khyber Road Airport	BS-28	Hayatabad Phase 3
BS-07	Hashnagri	BS-18	Gora Qabristan-Christian Cemetery	BS-29	Tatara Park
BS-08	Qila Balahisar	BS-19	Tehkal	BS-30	PDA Hayatabad
BS-09	Hospital Road	BS-20	Tambuwaan - Tents	BS-31	Cancer Hospital
BS-10	Khyber Bazar	BS-21	Abdara Road		
BS-11	Soekarno Square Secretariat	BS-22	University Town		

Project:

Peshawar Bus Rapid Transit Corridor Project

Drawing Title:

Project Area Map of Entire Project Corridor

Drawing Number:

Figure 4.6

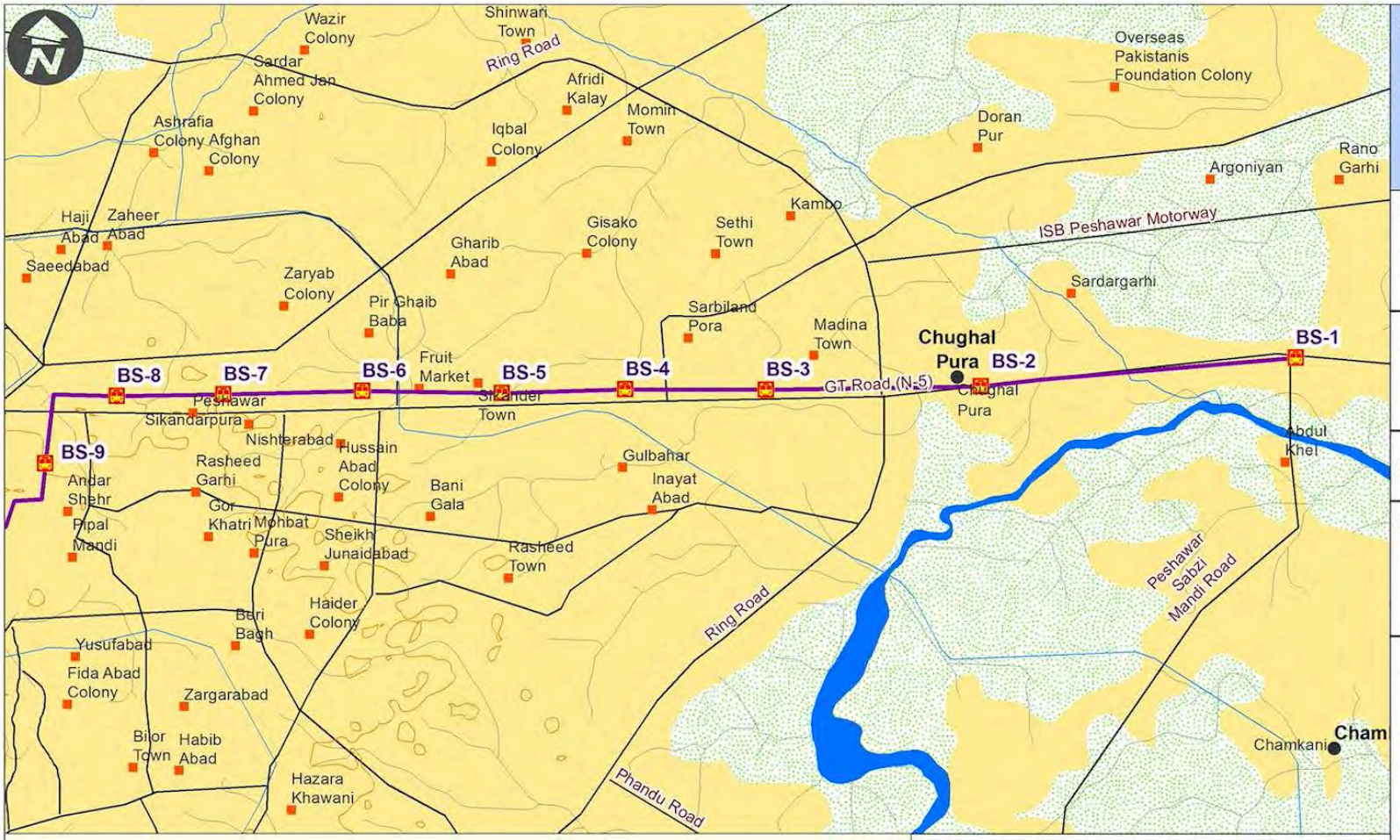
Drawing Date: November-2016

Drawing Source:

Field Data Collection
Google Earth
DEM (Digital Elevation Model)

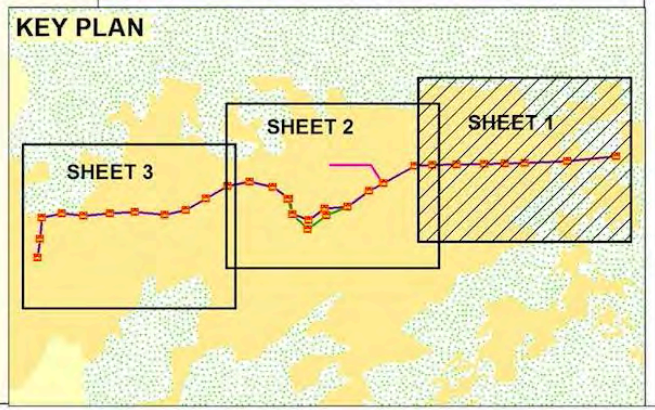
Legend

- Proposed Metro Stations
- Proposed Route Preferred Option
- Proposed Route Option 2
- Main Town / City
- Town / Sector
- Main Road Network
- Stream Network
- Nullah
- River
- Nullah_Network
- Contour



Preferred Option Route

Stop Number	Name
BS-01	Chamkani Chowk
BS-02	Chughal Pura
BS-03	Dr. Zareef Memorial School
BS-04	Sethi Town
BS-05	Sikandar Town
BS-06	Gulbahar Square
BS-07	Hashnagri
BS-08	Qila Balahisar
BS-09	Hospital Road



Project:

Peshawar Bus Rapid Transit Corridor Project

Drawing Title:

Project Area Map (BS-1 to BS-9)

Drawing Number:

Figure 4.7
Sheet 1 of 3

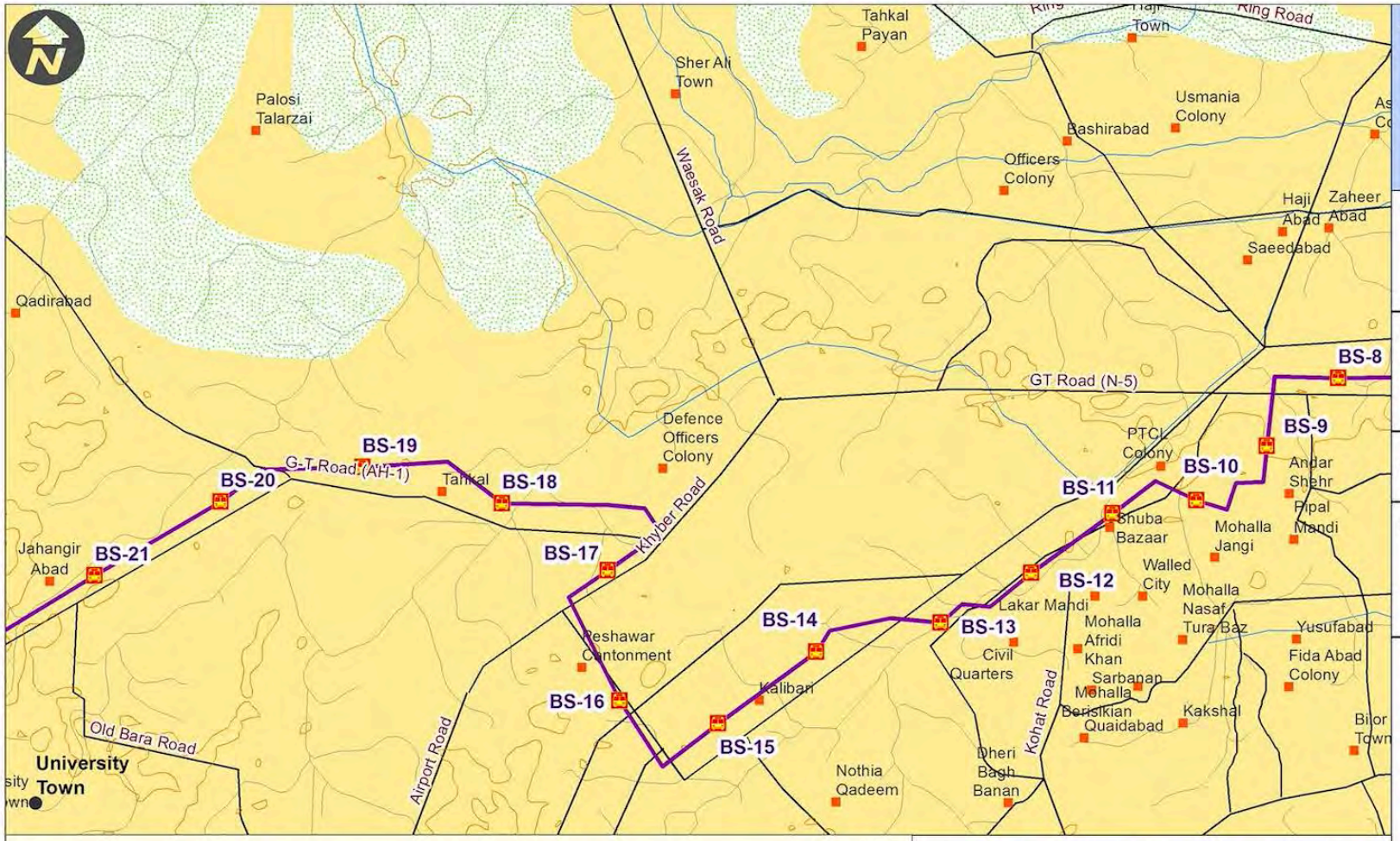
Drawing Date: November-2016

Drawing Source:

Field Data Collection
Google Earth
DEM (Digital Elevation Model)

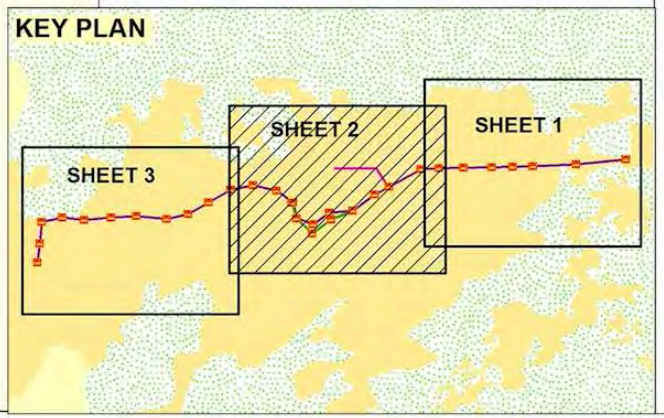
Legend

- Proposed Metro Stations
- Proposed Route Preferred Option
- Proposed Route Option 2
- Main Town / City
- Town / Sector
- Main Road Network
- Stream Network
- Nullah
- River
- Nullah_Network
- Contour



Preferred Option Route

Stop Number	Name	Stop Number	Name
BS-08	Qila Balahisar	BS-19	Tehkal
BS-09	Hospital Road	BS-20	Tambuwaan - Tents
BS-10	Khyber Bazar	BS-21	Abdara Road
BS-11	Soekarno Square Secretariat	BS-22	University Town
BS-12	Dabgari Gardens		
BS-13	Railway Station		
BS-14	State Bank of Pakistan		
BS-15	Saddar Bazar		
BS-16	Mall Road		
BS-17	Khyber Road Airport		
BS-18	Gora Qabristan-Christian Cemetery		



Project:

Peshawar Bus Rapid Transit Corridor Project

Drawing Title:

Project Area Map (BS-8 to BS-21)

Drawing Number:

Figure 4.8
Sheet 2 of 3

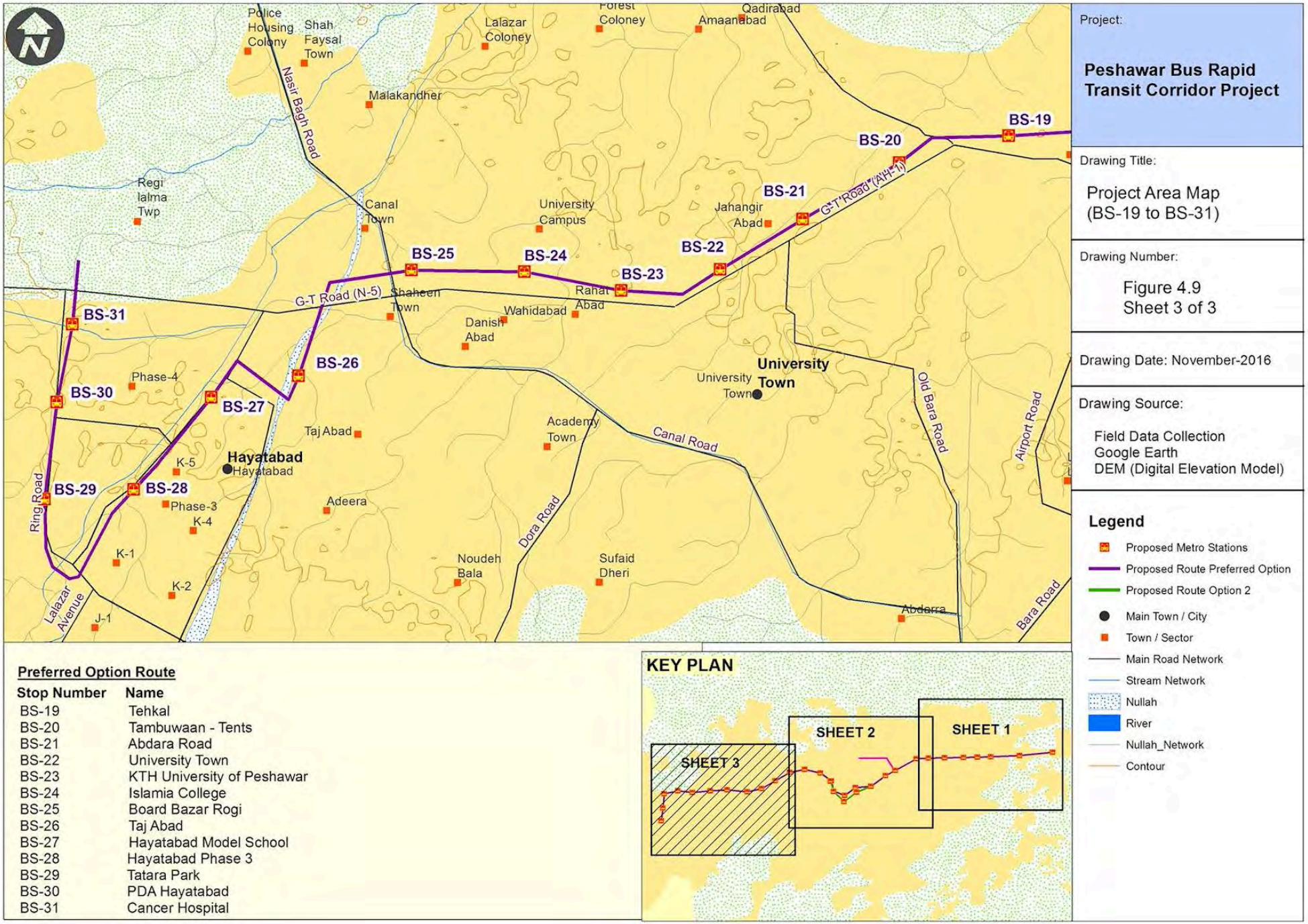
Drawing Date: November-2016

Drawing Source:

Field Data Collection
Google Earth
DEM (Digital Elevation Model)

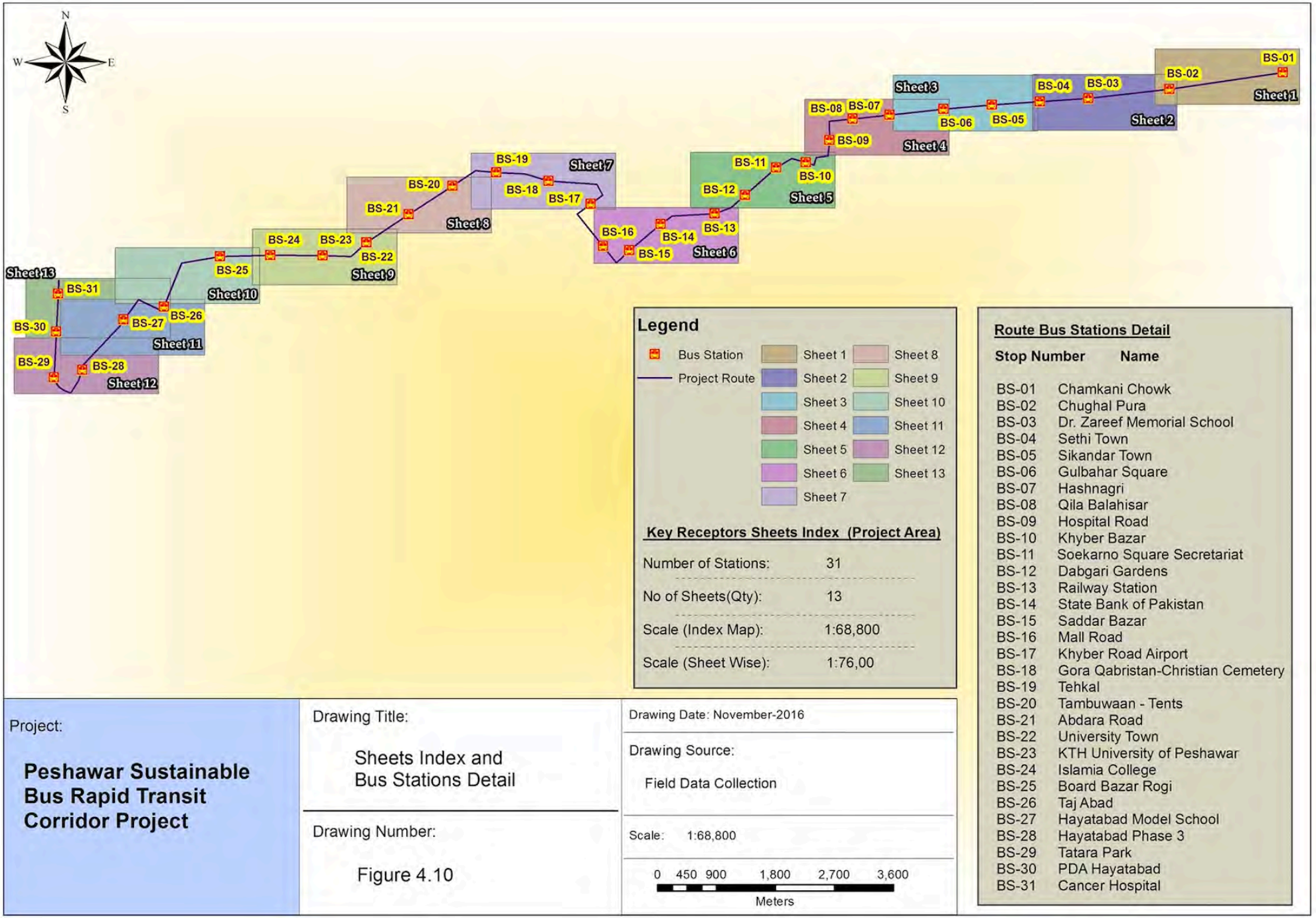
Legend

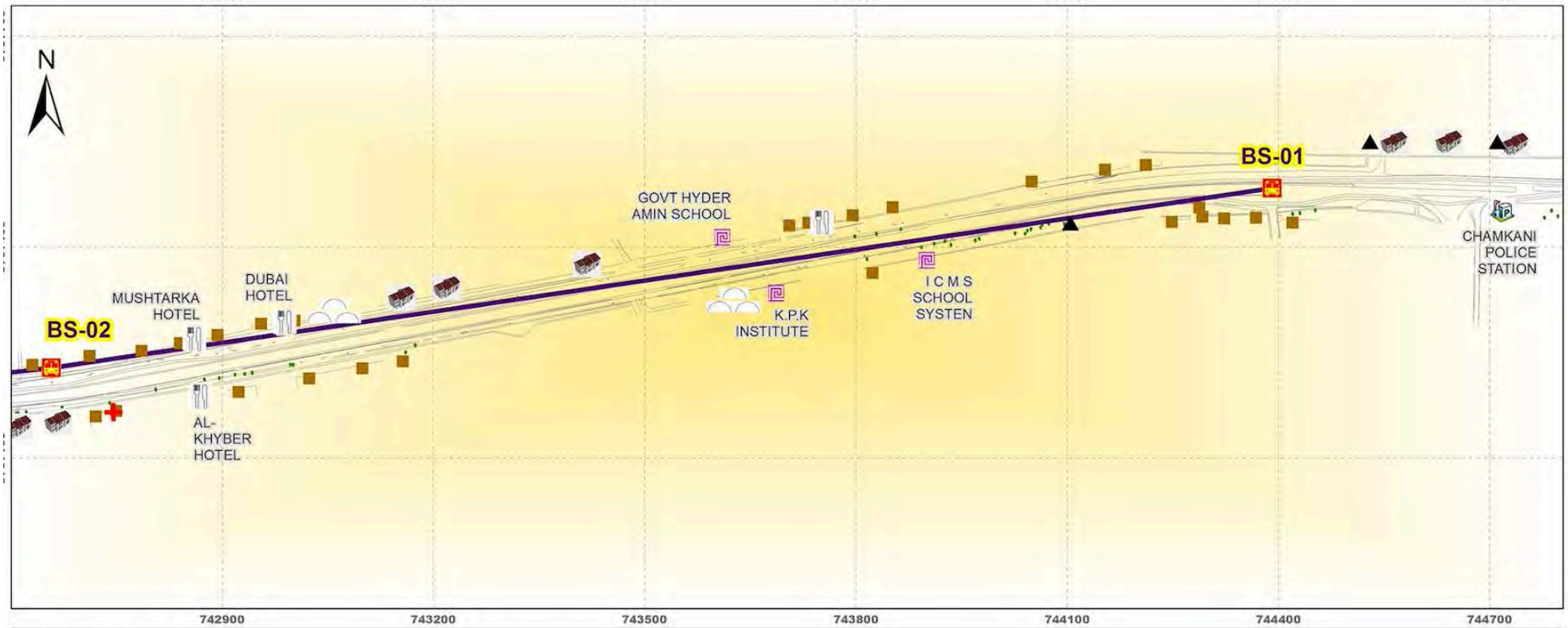
- Proposed Metro Stations
- Proposed Route Preferred Option
- Proposed Route Option 2
- Main Town / City
- Town / Sector
- Main Road Network
- Stream Network
- Nullah
- River
- Nullah_Network
- Contour



Preferred Option Route

Stop Number	Name
BS-19	Tehkal
BS-20	Tambuwaan - Tents
BS-21	Abdara Road
BS-22	University Town
BS-23	KTH University of Peshawar
BS-24	Islamia College
BS-25	Board Bazar Rogi
BS-26	Taj Abad
BS-27	Hayatabad Model School
BS-28	Hayatabad Phase 3
BS-29	Tatara Park
BS-30	PDA Hayatabad
BS-31	Cancer Hospital

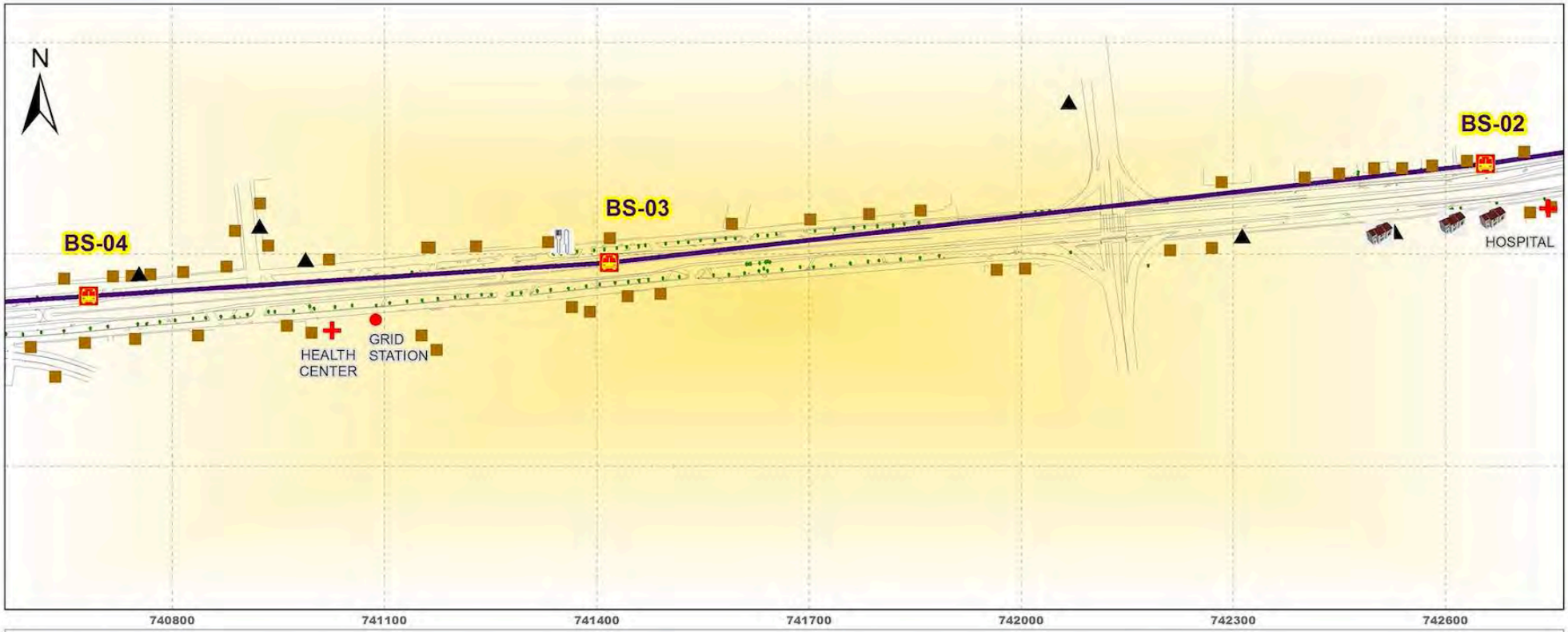

N
W
E
S
Sheet 1
Sheet 2
Sheet 3
Sheet 4
Sheet 5
Sheet 6
Sheet 7
Sheet 8
Sheet 9
Sheet 10
Sheet 11
Sheet 12
Sheet 13
BS-01
BS-02
BS-03
BS-04
BS-05
BS-06
BS-07
BS-08
BS-09
BS-10
BS-11
BS-12
BS-13
BS-14
BS-15
BS-16
BS-17
BS-18
BS-19
BS-20
BS-21
BS-22
BS-23
BS-24
BS-25
BS-26
BS-27
BS-28
BS-29
BS-30
BS-31
Legend
Bus Station
Project Route
Sheet 1
Sheet 2
Sheet 3
Sheet 4
Sheet 5
Sheet 6
Sheet 7
Sheet 8
Sheet 9
Sheet 10
Sheet 11
Sheet 12
Sheet 13
Key Receptors Sheets Index (Project Area)
Number of Stations: 31
No of Sheets(Qty): 13
Scale (Index Map): 1:68,800
Scale (Sheet Wise): 1:76,00
Route Bus Stations Detail
Stop Number Name
BS-01 Chamkani Chowk
BS-02 Chughal Pura
BS-03 Dr. Zareef Memorial School
BS-04 Sethi Town
BS-05 Sikandar Town
BS-06 Gulbahar Square
BS-07 Hashnagri
BS-08 Qila Balahisar
BS-09 Hospital Road
BS-10 Khyber Bazar
BS-11 Soekarno Square Secretariat
BS-12 Dabgari Gardens
BS-13 Railway Station
BS-14 State Bank of Pakistan
BS-15 Saddar Bazar
BS-16 Mall Road
BS-17 Khyber Road Airport
BS-18 Gora Qabristan-Christian Cemetery
BS-19 Tehkal
BS-20 Tambuwaan - Tents
BS-21 Abdara Road
BS-22 University Town
BS-23 KTH University of Peshawar
BS-24 Islamia College
BS-25 Board Bazar Rogi
BS-26 Taj Abad
BS-27 Hayatabad Model School
BS-28 Hayatabad Phase 3
BS-29 Tatara Park
BS-30 PDA Hayatabad
BS-31 Cancer Hospital
Project:
Peshawar Sustainable Bus Rapid Transit Corridor Project
Drawing Title:
Sheets Index and Bus Stations Detail
Drawing Number:
Figure 4.10
Drawing Date: November-2016
Drawing Source:
Field Data Collection
Scale: 1:68,800
0 450 900 1,800 2,700 3,600
Meters



Legend

- Bus Station
- Project Route
- Built Area
- Graveyard
- Hospital-Clinic
- Hotel
- House
- Mosque
- Police Station
- Educational Institutions

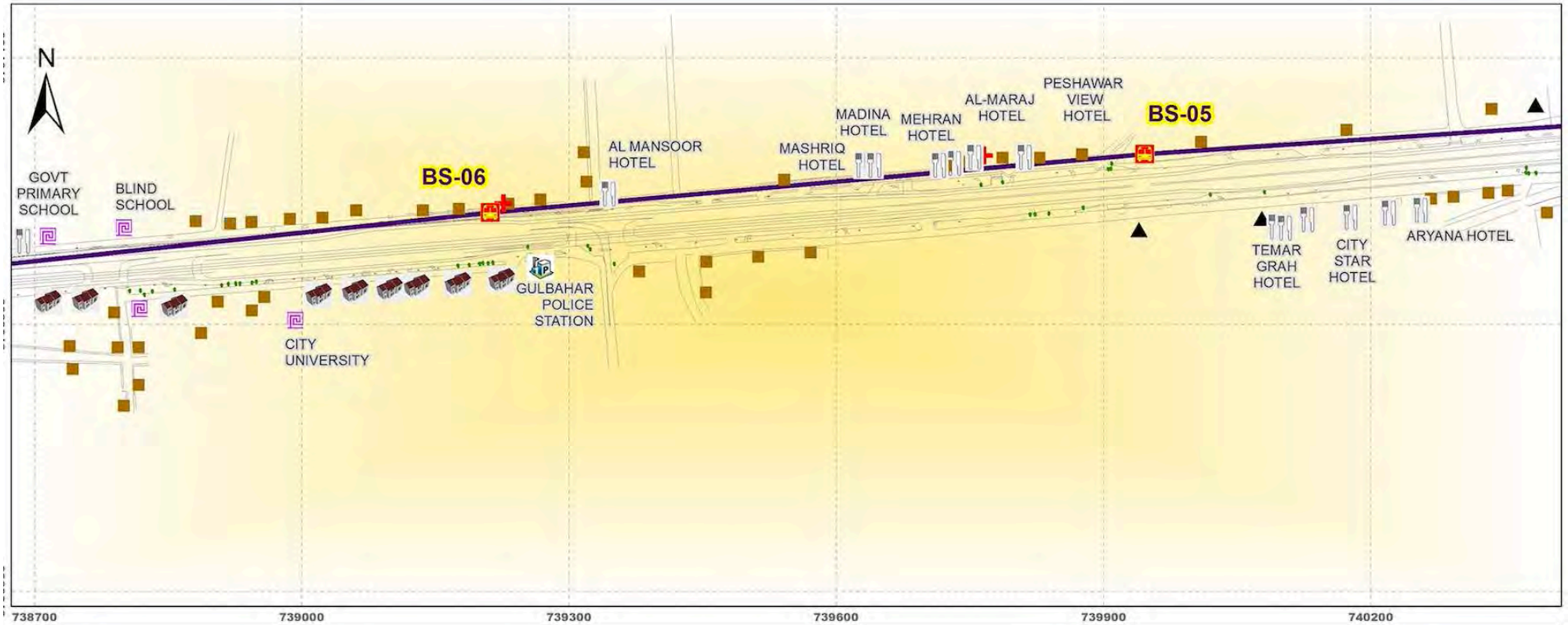
Project: **Peshawar Sustainable Bus Rapid Transit Corridor Project**	Drawing Title: Key Receptors in Project Area	Drawing Date: November-2016 Drawing Source: Field Data Collection, Google Earth Scale: 1:7,600 0 50 100 200 300 400 Meters	KEY PLAN (SHEET 1)
	Drawing Number: Figure 4.11 Sheet 01 of 13		



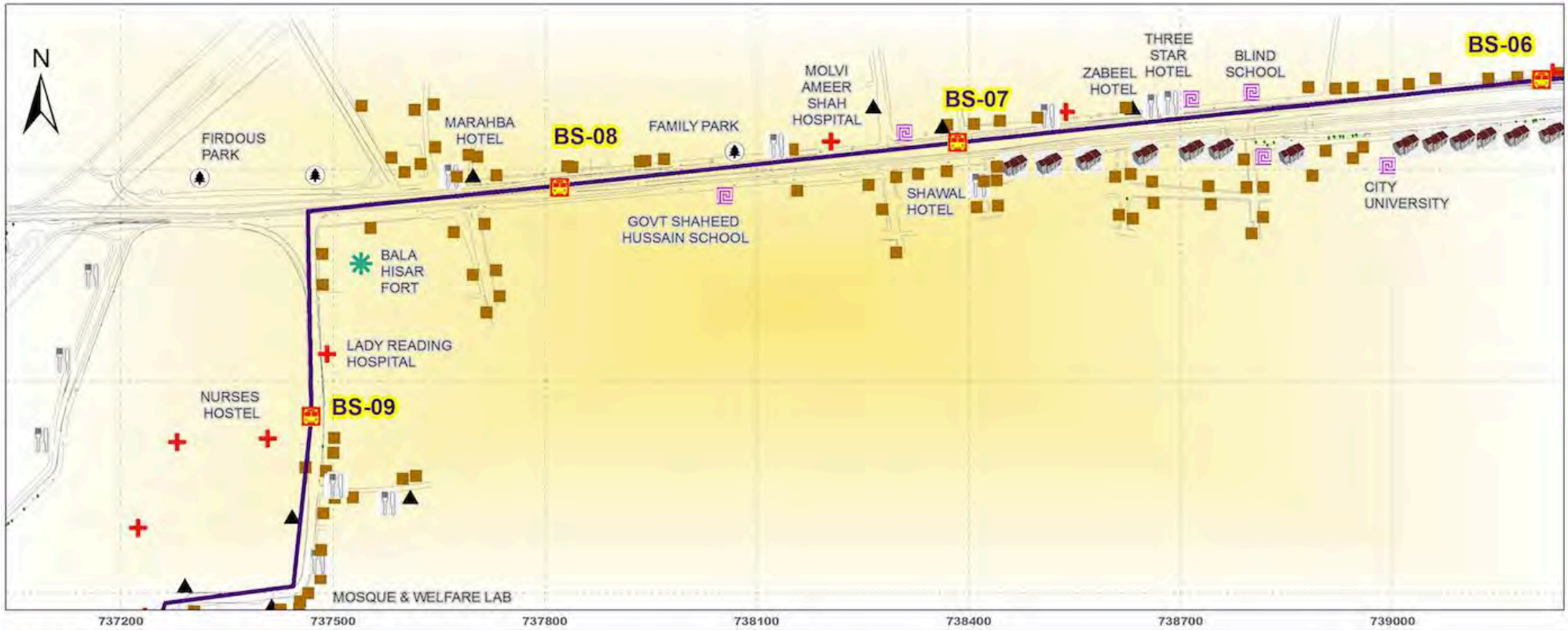
Legend

Bus Station
Project Route
Built Area
Grid Station
Hospital-Clinic
Hotel
House
Mosque
Post Office
Railway Station

Project: **Peshawar Sustainable Bus Rapid Transit Corridor Project**	Drawing Title: Key Receptors in Project Area	Drawing Date: November-2016 Drawing Source: Field Data Collection, Google Earth	KEY PLAN: SHEET 2
	Drawing Number: Figure 4.12 Sheet 02 of 13	Scale: 1:7,600 0 50 100 200 300 400 Meters	



Project: **Peshawar Sustainable Bus Rapid Transit Corridor Project**	Drawing Title: Key Receptors in Project Area	Drawing Date: November-2016	KEY PLAN
		Drawing Source: Field Data Collection, Google Earth	SHEET 3
	Drawing Number: Figure 4.13 Sheet 03 of 13	Scale: 1:6,000	
		0 40 80 160 240 320 Meters	

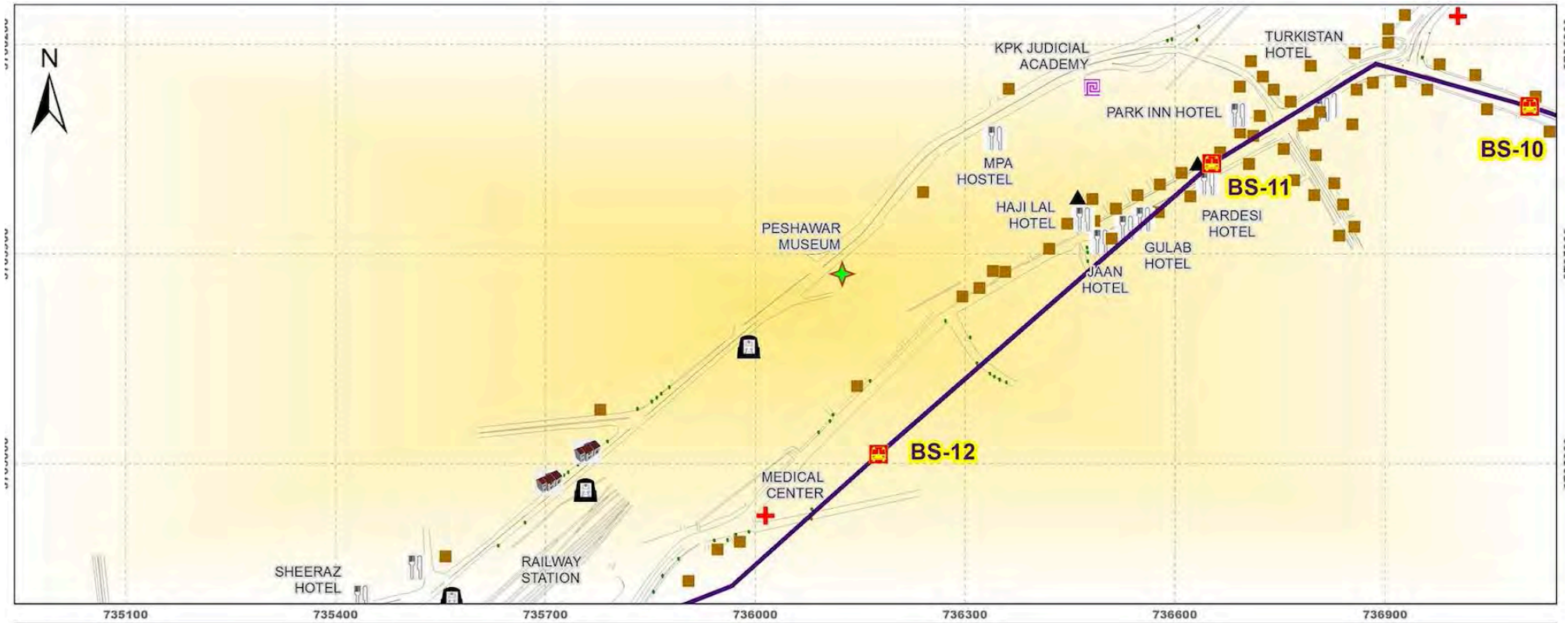


Legend

- Bus Station
- Project Route
- Bala Hisar Fort
- Built Area
- Hospital-Clinic
- Hotel
- House
- Mosque
- Park
- Educational Institutions

Project: **Peshawar Sustainable Bus Rapid Transit Corridor Project**	Drawing Title: Key Receptors in Project Area	Drawing Date: November-2016
		Drawing Source: Field Data Collection, Google Earth
	Drawing Number: Figure 4.14 Sheet 04 of 13	Scale: 1:7,600
		0 50 100 200 300 400 Meters

KEY PLAN



Project:

Peshawar Sustainable Bus Rapid Transit Corridor Project

Drawing Title:

Key Receptors in Project Area

Drawing Number:

Figure 4.15
Sheet 05 of 13

Drawing Date: November-2016

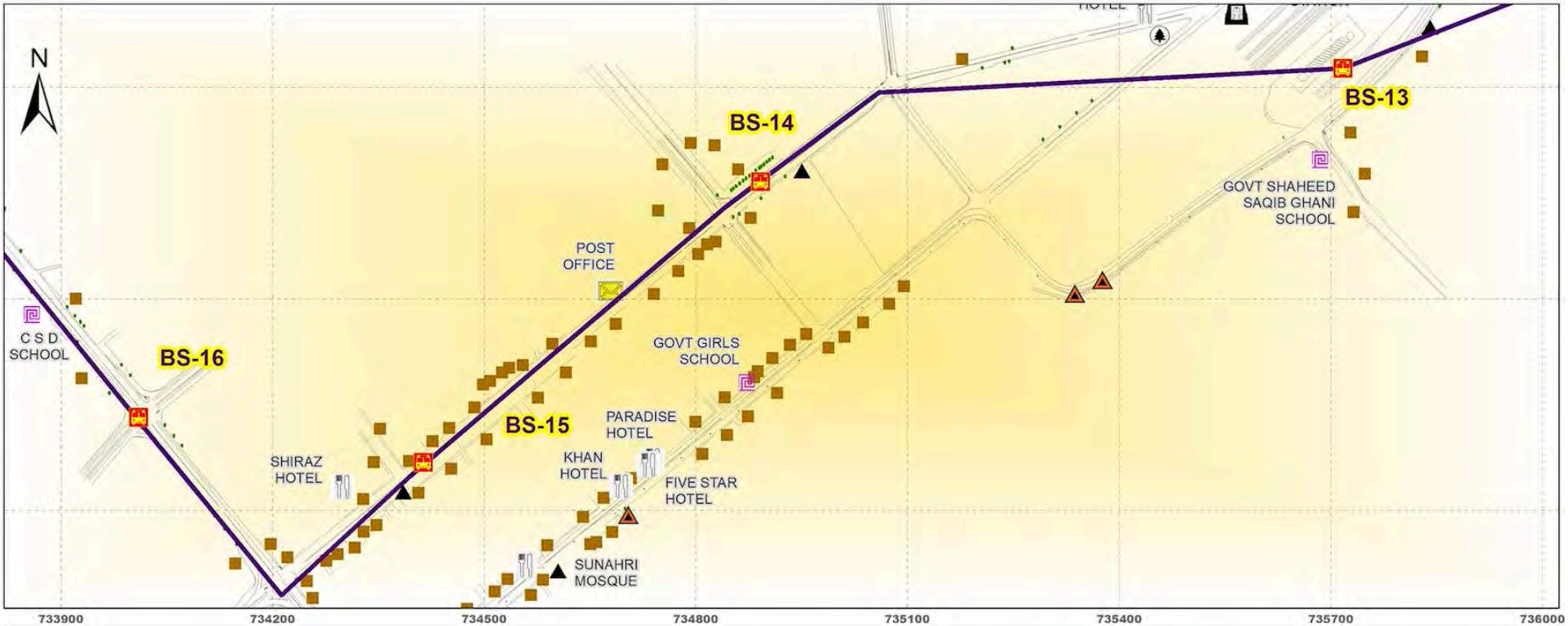
Drawing Source:

Field Data Collection
Google Earth

Scale: 1:7,600

0 50 100 200 300 400
Meters

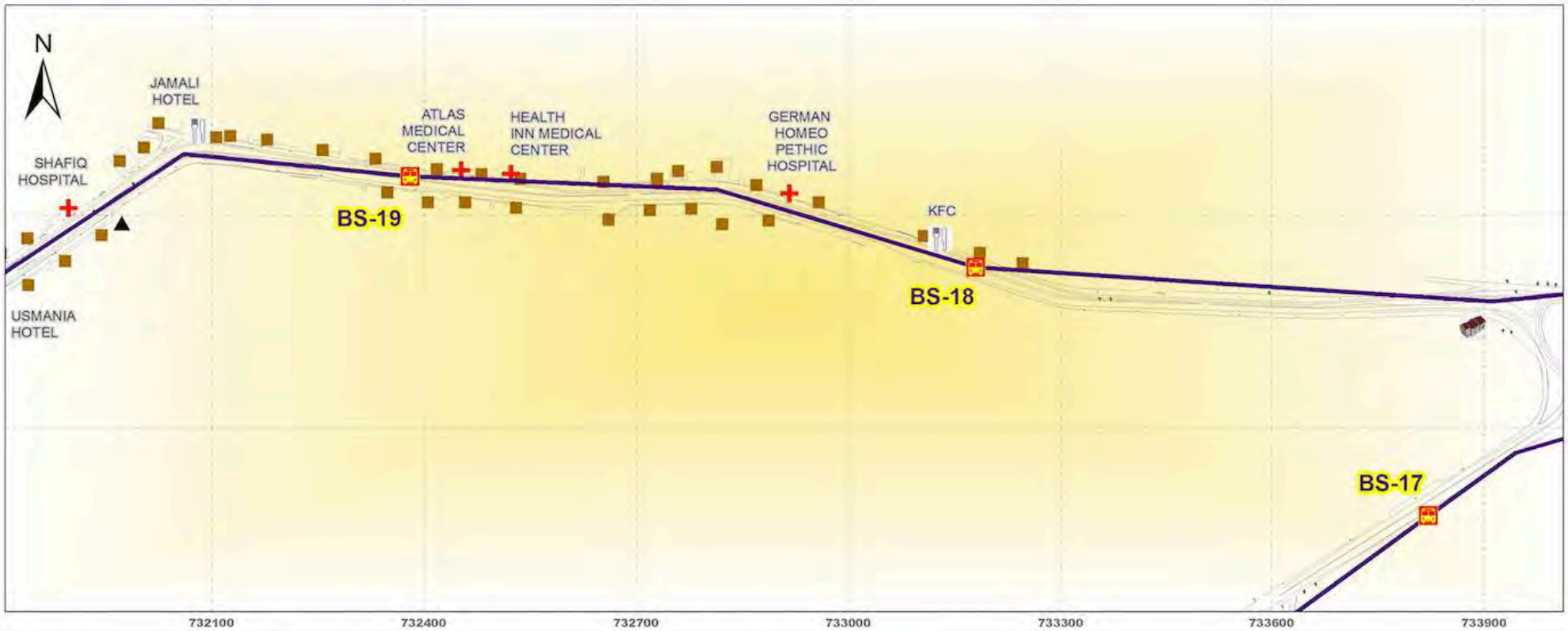
KEY PLAN



Legend

Bus Station
Project Route
Built Area
Check Post
Hospital-Clinic
Hotel
House
Mosque
Park
Post Office
Railway Station
Educational Institutions

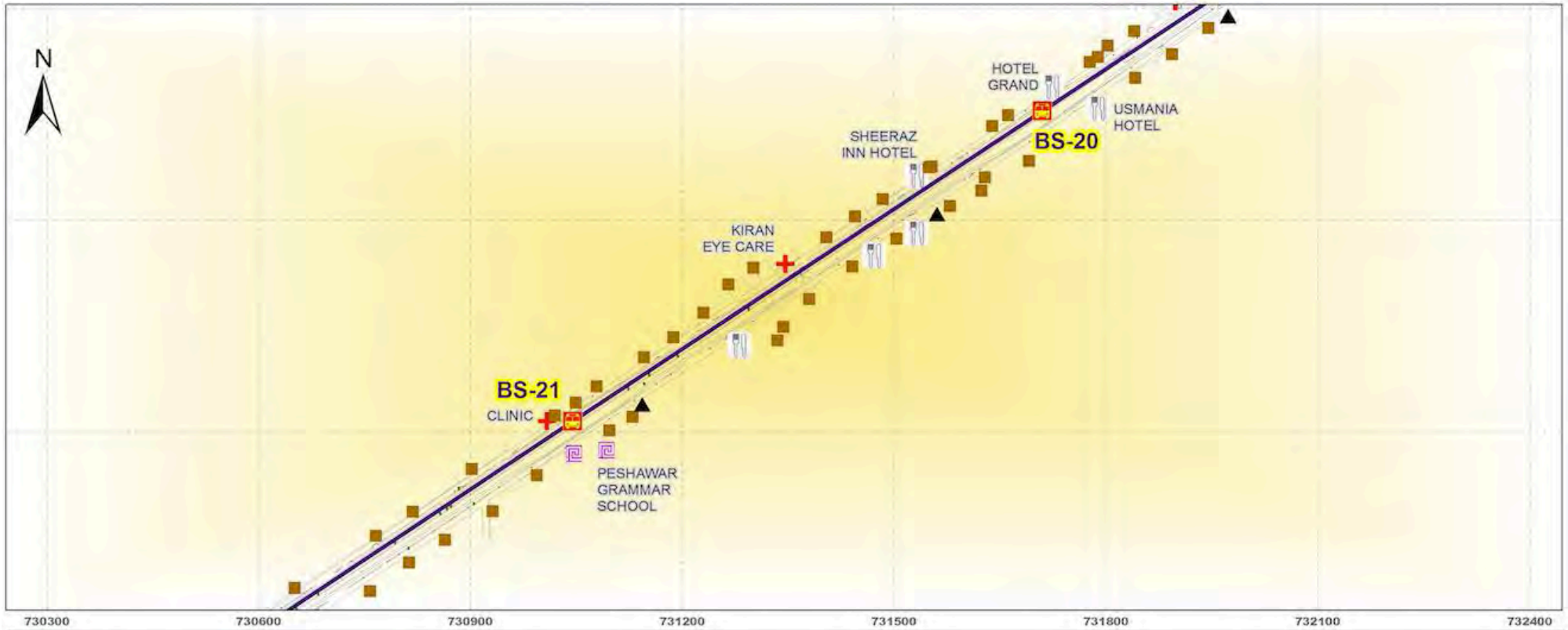
Project: **Peshawar Sustainable Bus Rapid Transit Corridor Project**	Drawing Title: Key Receptors in Project Area	Drawing Date: November-2016 Drawing Source: Field Data Collection, Google Earth	KEY PLAN: SHEET 6
	Drawing Number: Figure 4.16 Sheet 06 of 13	Scale: 1:7,600 0 50 100 200 300 400 Meters	



Legend

Bus Station | Built Area | Hotel | Mosque
Project Route | Hospital-Clinic | House

Project: **Peshawar Sustainable Bus Rapid Transit Corridor Project**	Drawing Title: Key Receptors in Project Area	Drawing Date: November-2016 Drawing Source: Field Data Collection, Google Earth	KEY PLAN: SHEET 7
	Drawing Number: Figure 4.17 Sheet 07 of 13	Scale: 1:7,600 0 50 100 200 300 400 Meters	



Legend

- Bus Station
- Project Route
- Built Area
- Hospital-Clinic
- Hotel
- Mosque
- Educational Institutions

Project:

Peshawar Sustainable Bus Rapid Transit Corridor Project

Drawing Title:

Key Receptors in Project Area

Drawing Number:

Figure 4.18
Sheet 08 of 13

Drawing Date: November-2016

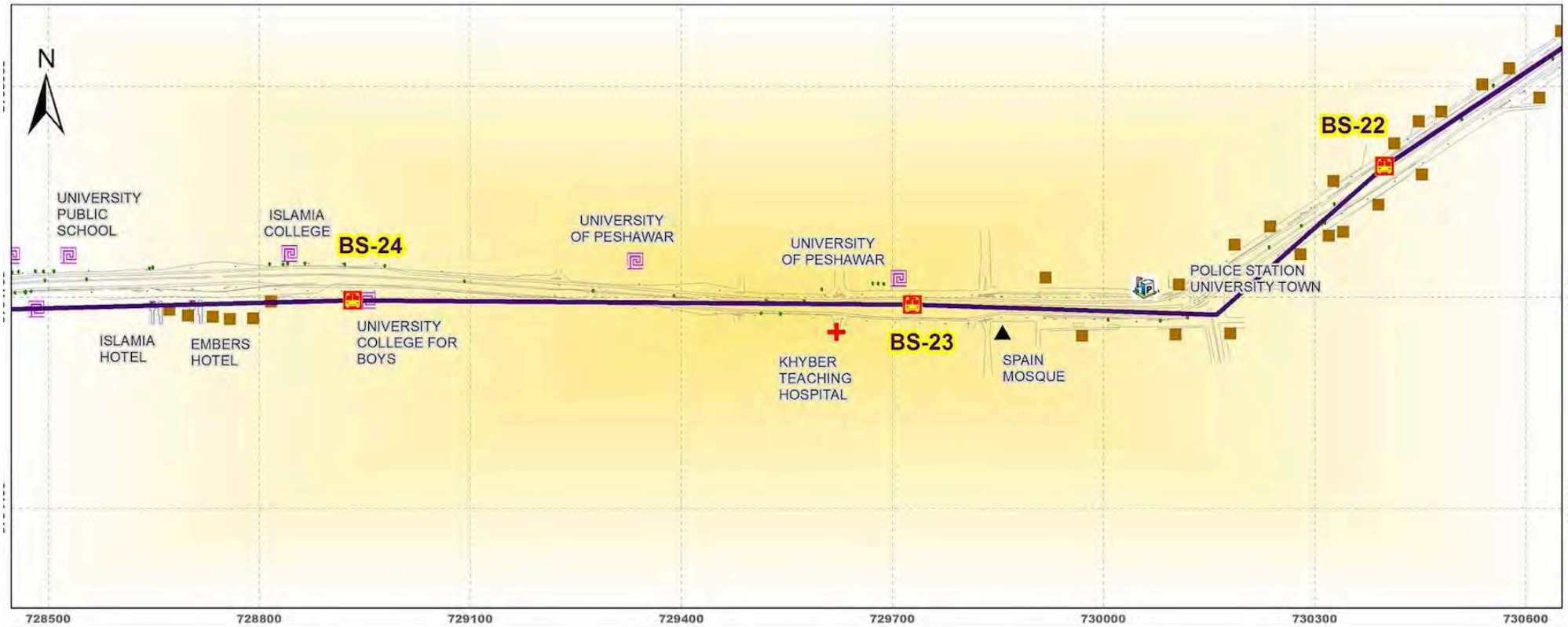
Drawing Source:

Field Data Collection
Google Earth

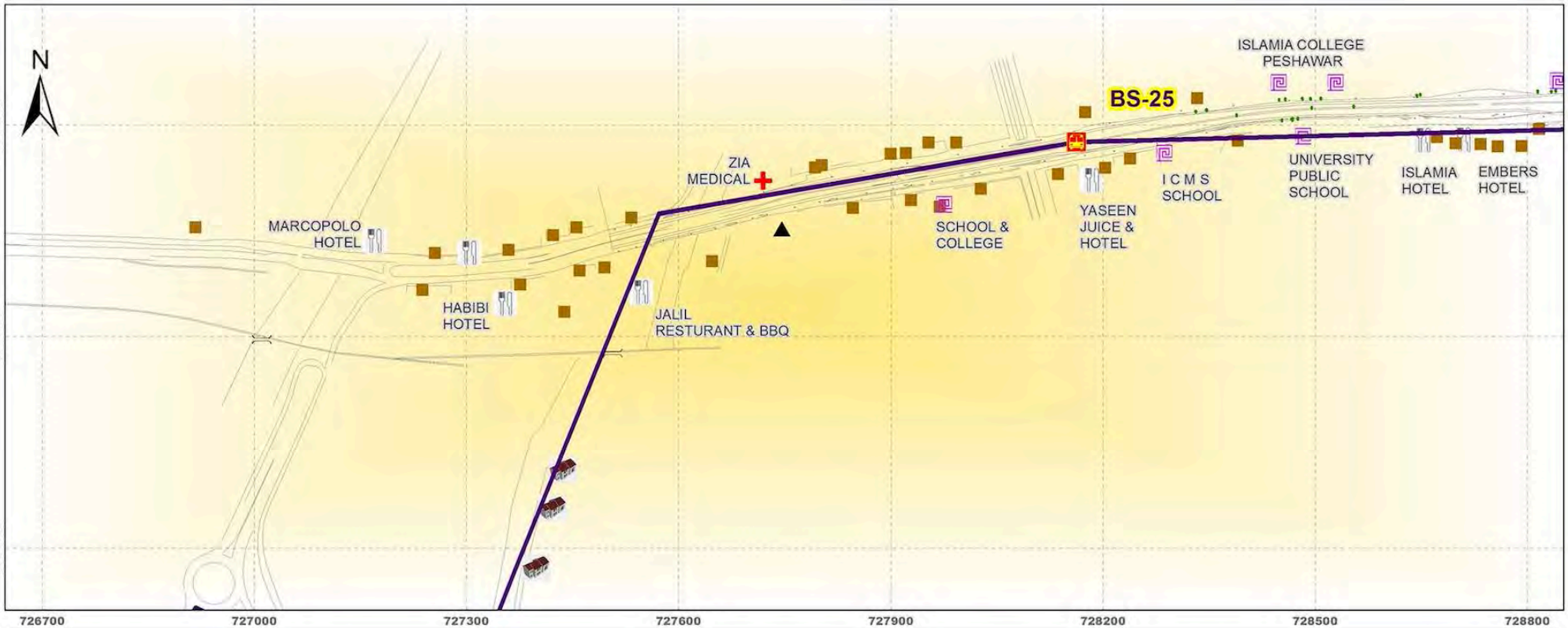
Scale: 1:7,600

0 50 100 200 300 400
Meters

KEY PLAN



Project: **Peshawar Sustainable Bus Rapid Transit Corridor Project**	Drawing Title: Key Receptors in Project Area	Drawing Date: November-2016 Drawing Source: Field Data Collection, Google Earth Scale: 1:7,600 0 50 100 200 300 400 Meters	KEY PLAN SHEET 9
	Drawing Number: Figure 4.19 Sheet 09 of 13		

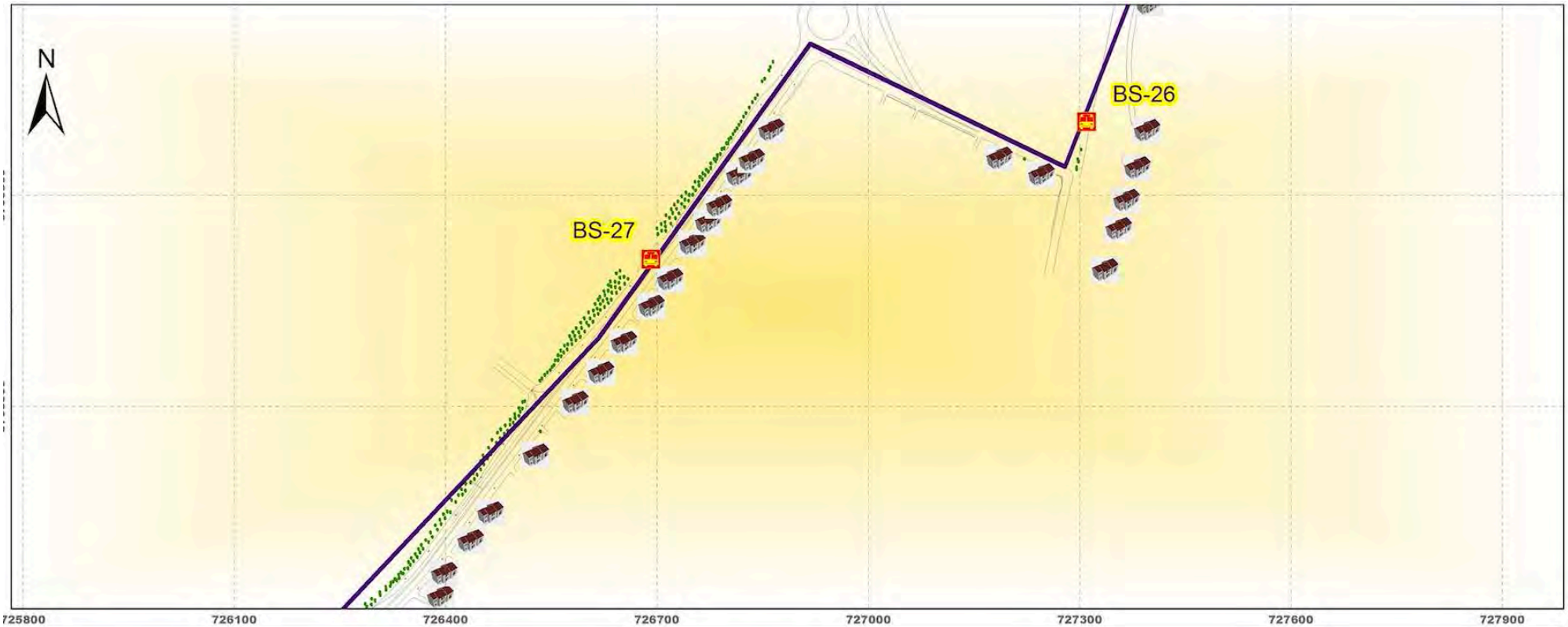


Legend

- Bus Station
- Project Route
- Bridge
- Built Area
- Hospital-Clinic
- Hotel
- House
- Mosque
- Police Station
- Educational Institutions

Project: **Peshawar Sustainable Bus Rapid Transit Corridor Project**	Drawing Title: Key Receptors in Project Area	Drawing Date: November-2016
		Drawing Source: Field Data Collection Google Earth
	Drawing Number: Figure 4.20 Sheet 10 of 13	Scale: 1:7,600
		0 50 100 200 300 400 Meters

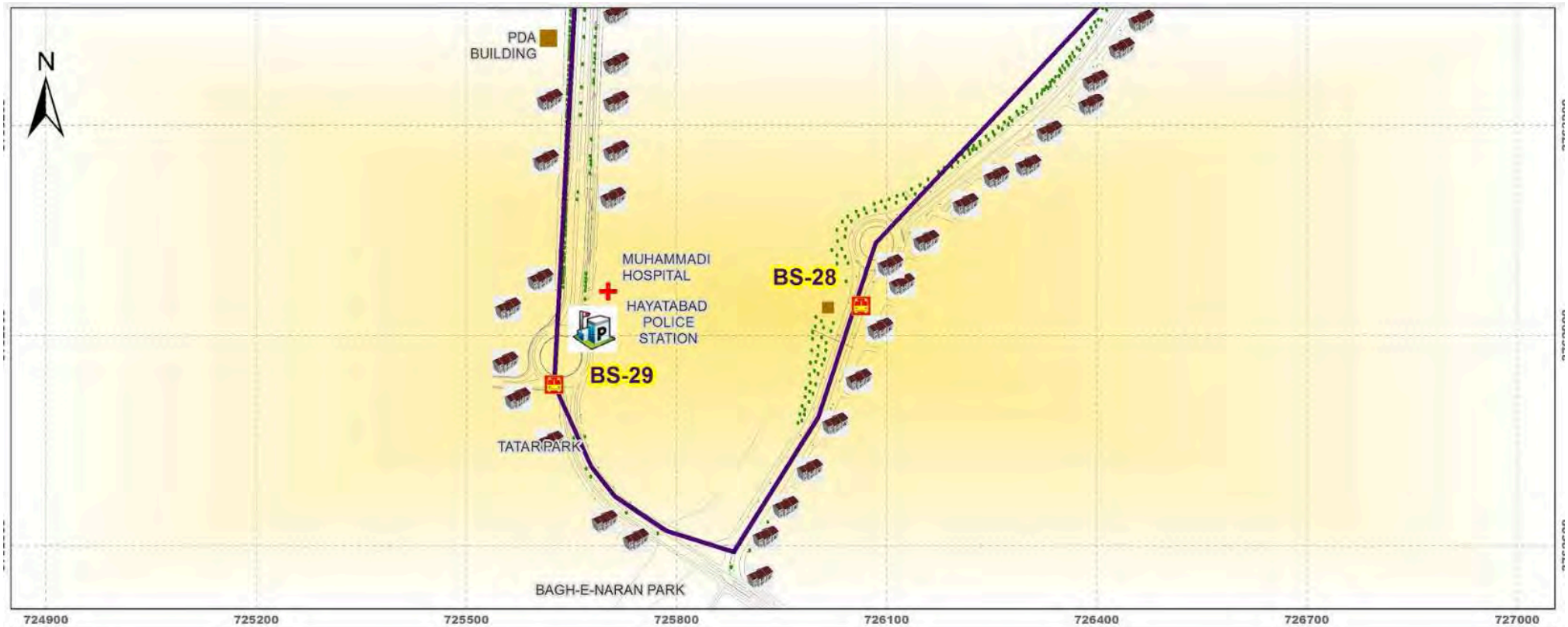
KEY PLAN



Legend

Bus Station
Project Route
Built Area
House

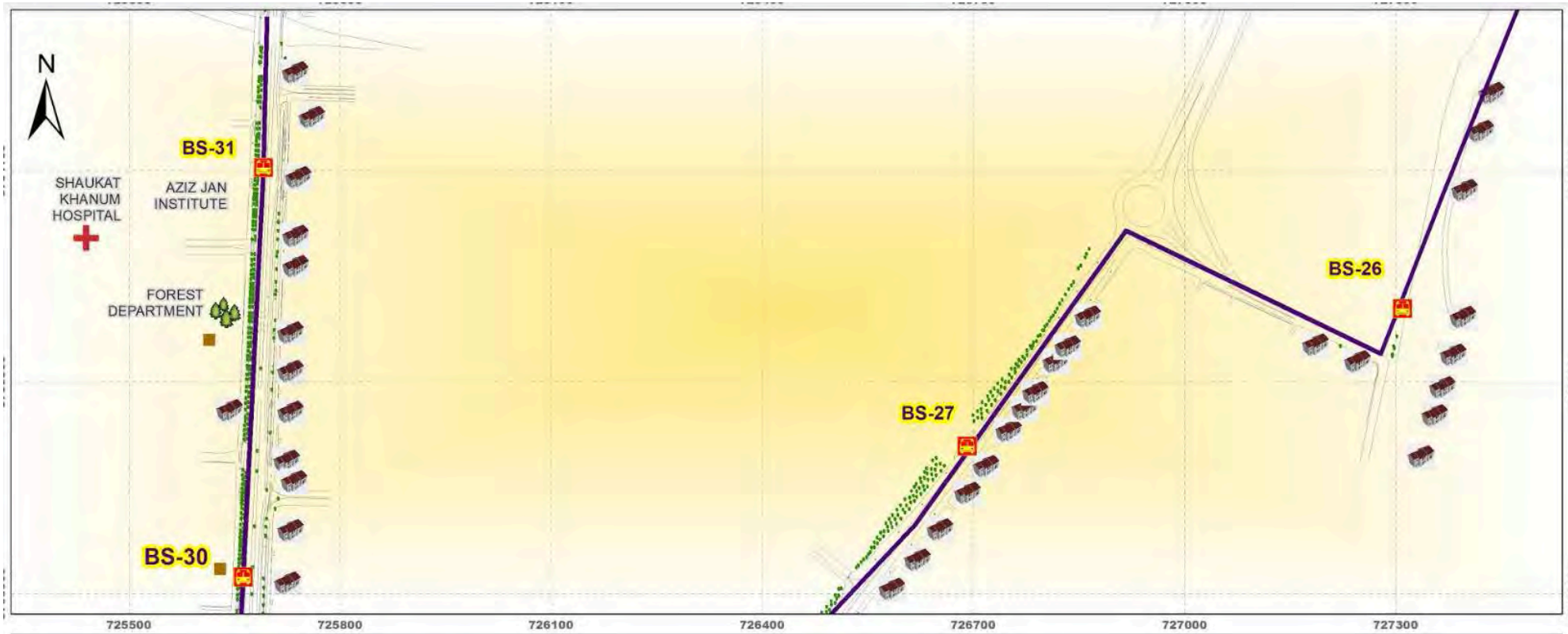
Project: **Peshawar Sustainable Bus Rapid Transit Corridor Project**	Drawing Title: Key Receptors in Project Area	Drawing Date: November-2016 Drawing Source: Field Data Collection, Google Earth Scale: 1:7,600 0 50 100 200 300 400 Meters	KEY PLAN SHEET 11
	Drawing Number: Figure 4.21 Sheet 11 of 13		



Legend

Bus Station
Project Route
Built Area
Hospital-Clinic
House
Police Station

Project: **Peshawar Sustainable Bus Rapid Transit Corridor Project**	Drawing Title: Key Receptors in Project Area	Drawing Date: November-2016 Drawing Source: Field Data Collection, Google Earth	KEY PLAN
	Drawing Number: Figure 4.22 Sheet 12 of 13	Scale: 1:7,600 0 50 100 200 300 400 Meters	SHEET 12



Legend

Bus Station
Project Route
Built Area
Forest Department
Hospital-Clinic
House

Project:

Peshawar Sustainable Bus Rapid Transit Corridor Project

Drawing Title:

Key Receptors in Project Area

Drawing Number:

Figure 4.23
Sheet 13 of 13

Drawing Date: November-2016

Drawing Source:

Field Data Collection
Google Earth

Scale: 1:7,600

0 50 100 200 300 400
Meters

KEY PLAN

Preferred Option Route

Stop Number	Name	Stop Number	Name	Stop Number	Name
BS-01	Chamkani Chowk	BS-12	Dabgari Gardens	BS-23	KTH University of Peshawar
BS-02	Chughal Pura	BS-13	Railway Station	BS-24	Islamia College
BS-03	Dr. Zareef Memorial School	BS-14	State Bank of Pakistan	BS-25	Board Bazar Rogi
BS-04	Sethi Town	BS-15	Saddar Bazar	BS-26	Taj Abad
BS-05	Sikandar Town	BS-16	Mall Road	BS-27	Hayatabad Model School
BS-06	Gulbahar Square	BS-17	Khyber Road Airport	BS-28	Hayatabad Phase 3
BS-07	Hashnagri	BS-18	Gora Qabristan-Christian Cemetery	BS-29	Tatara Park
BS-08	Qila Balahisar	BS-19	Tehkal	BS-30	PDA Hayatabad
BS-09	Hospital Road	BS-20	Tambuwaan - Tents	BS-31	Cancer Hospital
BS-10	Khyber Bazar	BS-21	Abdara Road		
BS-11	Soekarno Square Secretariat	BS-22	University Town		

Project:

Peshawar Bus Rapid Transit Corridor Project

Drawing Title:

Selection of Sampling Locations for Ambient Noise Monitoring

Drawing Number:

Figure 4.24

Drawing Date: November-2016

Drawing Source:

Field Data Collection

Legend

- Proposed Metro Stations
- Proposed Route Preferred Option
- Ambient Sampling Location Point
- Main Town / City
- Main Road Network
- Nullah
- River

209. During the day time, high instantaneous noise levels at all ten locations were recorded due to heavy traffic volumes with the frequent honking of horns being a standard practice. The noise levels were observed to be generally in the mid 80 dB(A) range while even higher noise levels of 90 dB(A) and above were observed at BS-11 (Soekarno Square) and BS-15 (Saddar Bazaar).

210. The five locations that were selected for 24 hourly ambient monitoring since they were considered to be the most representative out of the ten initial points were as follows:

- Chamkani Chowk
- Soekarno Square
- Saddar Bazaar
- KTH University of Peshawar
- Cancer Hospital

These five locations were selected since they were observed to be the most important in terms of having the most sensitive receptors in their vicinity with receptors such as the Lady Reading Hospital, KTH and Shaukat Khanum Hospital as well as educational institutions such as Islamia College. In addition, the Soekarno Square and Saddar Bazaar are hubs of commercial activity and thus were selected due to the high traffic volumes and movement of general public at these two locations. It should be mentioned that at each selected monitoring location, the monitoring equipment was placed nearest to the most sensitive receptor present at that location in order to accurately record the ambient noise levels at the receptor.

The receptor map showing the five selected noise locations and their respective 24 hourly ambient noise readings are provided as **Figure 4.25** below.

211. As can be observed, the average ambient noise levels vary between 68 dB(A) and 74 dB(A) with the nighttime noise levels at all locations being very similar at approximately 65 dB(A). In comparison, there is reasonable variation in the day time noise levels, which vary between 71.8 dB(A) and 76.4 dB(A).

This variation between the day and night time noise levels is due to the reduction in the traffic and commercial activity in the late evening hours, primarily after 11 pm.

It can be observed that the proposed BRT project corridor is a disturbed high noise environment with the existing ambient noise levels already exceeding applicable NEQS limits for the different categories of areas/zones i.e. Residential, Commercial etc.

4.6 Air Quality

212. The five locations where 24 hourly ambient air quality monitoring was conducted since they were considered to be the most representative were as follows:

- Chamkani Chowk
- Soekarno Square
- Saddar Bazaar
- KTH University of Peshawar
- Cancer Hospital

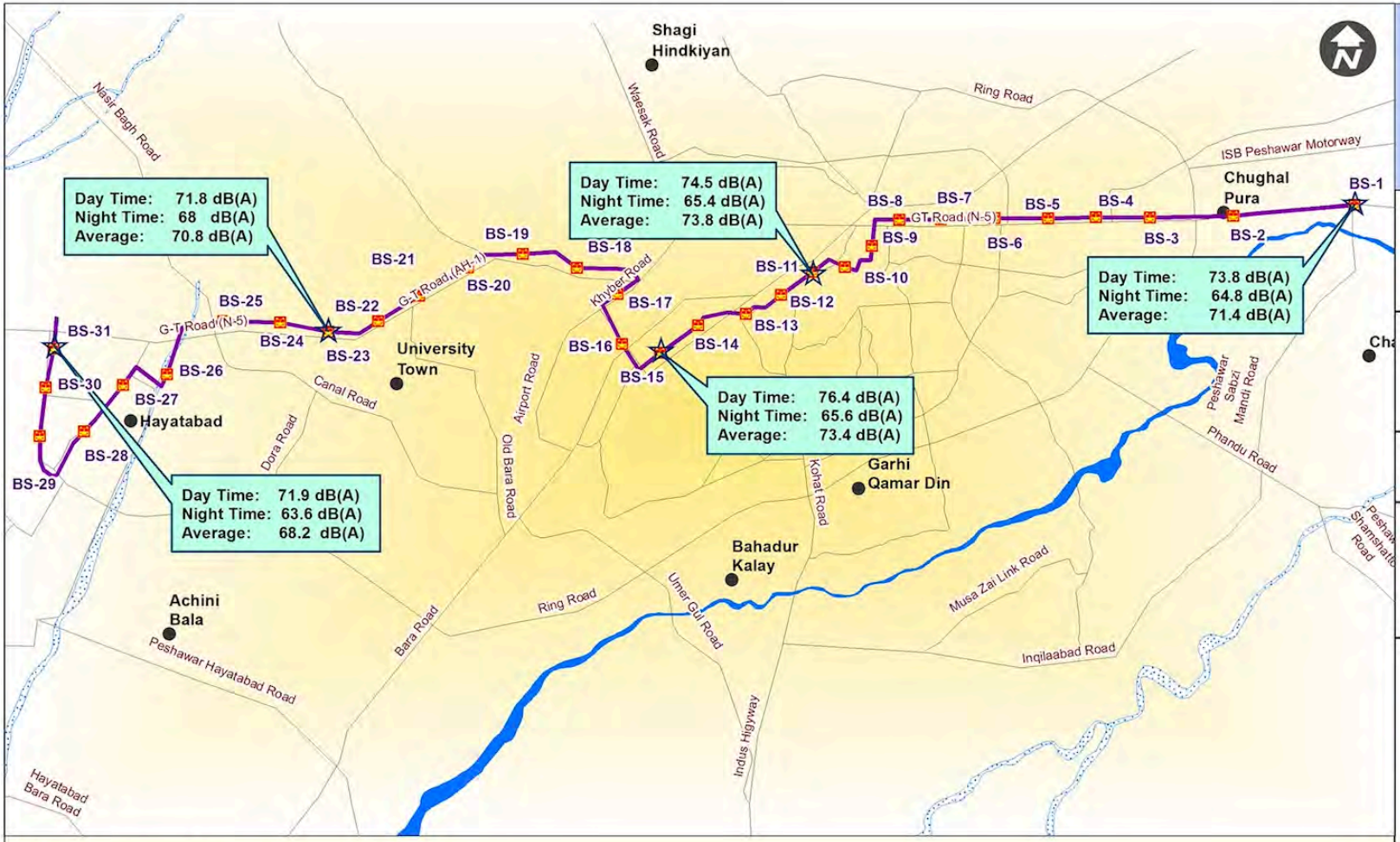
213. It is important to mention that the selected five air quality monitoring locations are adjacent to the affected road links at the locations of highest risk from traffic using the affected roads. The map showing the five selected air quality monitoring locations and their respective 24 hourly ambient air quality readings are provided as **Figure 4.26** below.

214. As can be observed, in general the ambient air quality is within the acceptable NEQS guidelines with PM_{10} being the only pollutant that is exceeding the guidelines at two of the five monitoring locations.

4.7 Climate Vulnerability of Project

215. The project is expected to have a positive impact from a climate change perspective since the proposed BRT project will result in the operation of a fleet of new buses on a designated corridor and thus will emit fewer emissions and will be undergoing maintenance on a regular basis. The construction phase of the project will expected to last for approximately 18 months and the only sources of emissions to the environment will be during the construction phase from construction related vehicle movement and equipment use. No toxic or ozone depleting gases shall be emitted into the environment.

216. Once the project is operational, the overall traffic volumes in Peshawar will be reduced since the commuters will prefer to travel on the BRT since it will be a more reliable, convenient and economical option. Thus, it is estimated that 30,988 tons of CO_2 emission reductions will take place in the first year of the project operation while these reductions will more than double by the year 2026 to 62,145 tons of CO_2 and reach over 77,000 tons of CO_2 by the year 2036.



Preferred Option Route

Stop Number	Name	Stop Number	Name	Stop Number	Name
BS-01	Chamkani Chowk	BS-12	Dabgari Gardens	BS-23	KTH University of Peshawar
BS-02	Chughal Pura	BS-13	Railway Station	BS-24	Islamia College
BS-03	Dr. Zareef Memorial School	BS-14	State Bank of Pakistan	BS-25	Board Bazar Rogi
BS-04	Sethi Town	BS-15	Saddar Bazar	BS-26	Taj Abad
BS-05	Sikandar Town	BS-16	Mall Road	BS-27	Hayatabad Model School
BS-06	Gulbahar Square	BS-17	Khyber Road Airport	BS-28	Hayatabad Phase 3
BS-07	Hashnagri	BS-18	Gora Qabristan-Christian Cemetery	BS-29	Tatara Park
BS-08	Qila Balahisar	BS-19	Tehkal	BS-30	PDA Hayatabad
BS-09	Hospital Road	BS-20	Tambuwaan - Tents	BS-31	Cancer Hospital
BS-10	Khyber Bazar	BS-21	Abdara Road		
BS-11	Soekarno Square Secretariat	BS-22	University Town		

Project:

Peshawar Bus Rapid Transit Corridor Project

Drawing Title:

24 Hourly Ambient Noise Quality Results

Drawing Number:

Figure 4.25

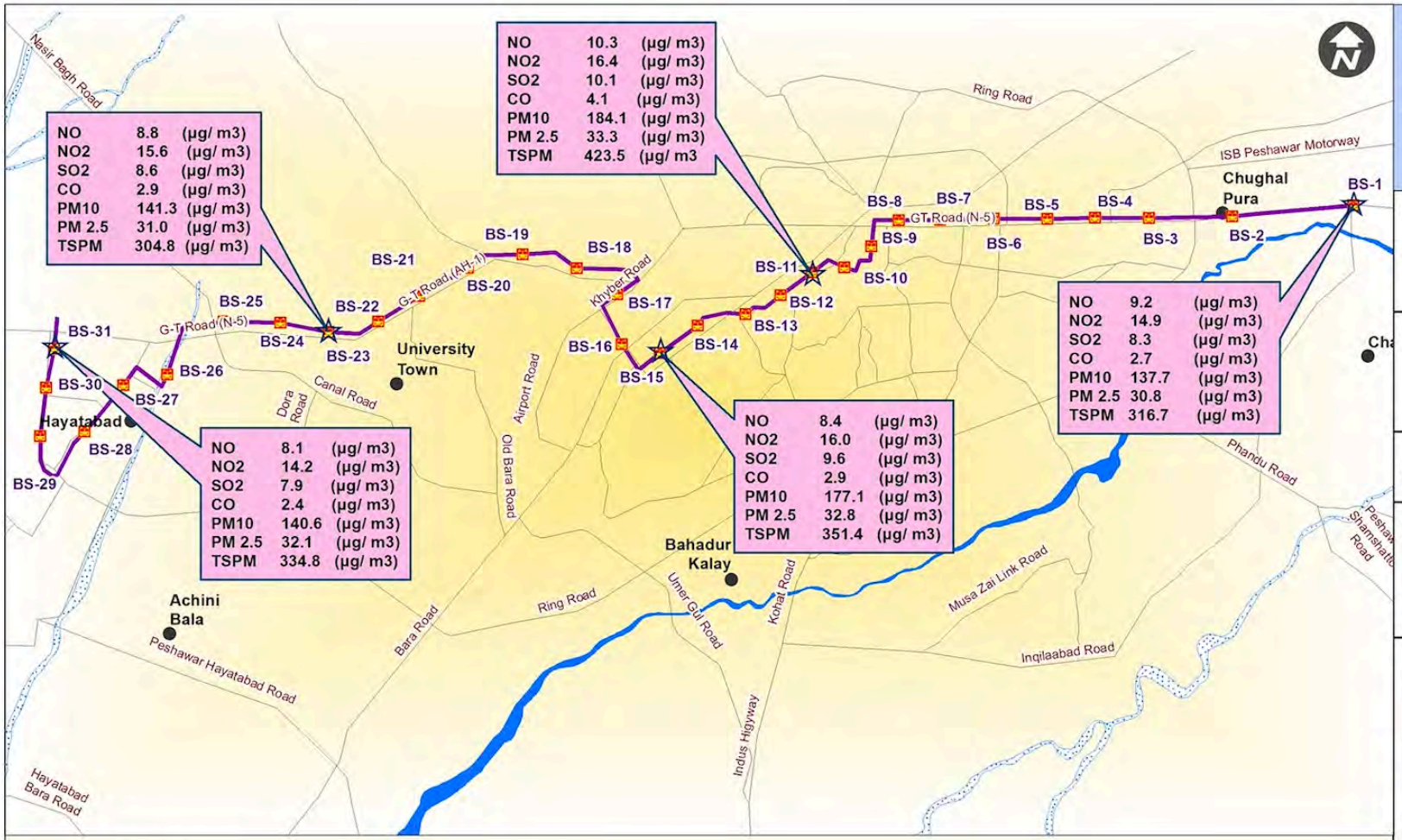
Drawing Date: November-2016

Drawing Source:

Field Data Collection

Legend

- Proposed Metro Stations
- Proposed Route Preferred Option
- Ambient Sampling Location Point
- Main Town / City
- Main Road Network
- Nullah
- River



Preferred Option Route

Stop Number	Name	Stop Number	Name	Stop Number	Name
BS-01	Chamkani Chowk	BS-12	Dabgari Gardens	BS-23	KTH University of Peshawar
BS-02	Chughal Pura	BS-13	Railway Station	BS-24	Islamia College
BS-03	Dr. Zareef Memorial School	BS-14	State Bank of Pakistan	BS-25	Board Bazar Rogi
BS-04	Sethi Town	BS-15	Saddar Bazar	BS-26	Taj Abad
BS-05	Sikandar Town	BS-16	Mall Road	BS-27	Hayatabad Model School
BS-06	Gulbahar Square	BS-17	Khyber Road Airport	BS-28	Hayatabad Phase 3
BS-07	Hashnagri	BS-18	Gora Qabristan-Christian Cemetery	BS-29	Tatara Park
BS-08	Qila Balahisar	BS-19	Tehkal	BS-30	PDA Hayatabad
BS-09	Hospital Road	BS-20	Tambuwaan - Tents	BS-31	Cancer Hospital
BS-10	Khyber Bazar	BS-21	Abdara Road		
BS-11	Soekarno Square Secretariat	BS-22	University Town		

Project:

Peshawar Bus Rapid Transit Corridor Project

Drawing Title:

24 Hourly Ambient Air Quality Results

Drawing Number:

Figure 4.26

Drawing Date: November-2016

Drawing Source:

Field Data Collection

Legend

- Proposed Metro Stations
- Proposed Route Preferred Option
- Ambient Sampling Location Point
- Main Town / City
- Main Road Network
- Nullah
- River

5 Analysis of Alternatives

5.1 No Project Alternative

217. Without this project, the population of almost two million people residing in the Peshawar city would not benefit from a sustainable, more efficient and safer transport system and would continue to suffer congestion and traffic accident risks in the city. Peshawar would not have an efficient public transport system that reduces the costs of transport, serve the central urban area or facilitate intermodal interchange, or provide better accessibility to employment and services in the city. Peshawar would also lose the benefits of behavioral change with respect to road safety and traffic management.

218. The BRT system would streamline the public transport operation making bus services more efficient with dedicated lanes and stops. Without the BRT corridor, public buses would continue to fight for lanes with other motor vehicles when getting in and out of stops in congested traffic, resulting in road safety risks and slower travel time for the passengers.

219. Without the BRT system, carbon emissions in Peshawar city from road traffic would continue to increase and the expected CO_2 emission reductions from the BRT project of 62,145 tons by year 2026 would not take place.

220. In case the BRT system is not developing, considering the inefficient and highly congested road network within Peshawar city, future developments could be delayed due to incomplete road network and lack of connectivity between roads. Future residents would also lack public open space without any locations of scenic, aesthetic and recreational value. All these could affect the socio-economic development in the city, employment opportunities for residents and quality of living conditions and environment.

221. Delay in developing the city through the BRT corridor would also affect the urbanization of Peshawar city, putting pressure on the old central urban area of Peshawar city to accommodate new migrants.

5.2 Alternatives Considered

The different alternatives considered for development of the proposed BRT project are presented below.

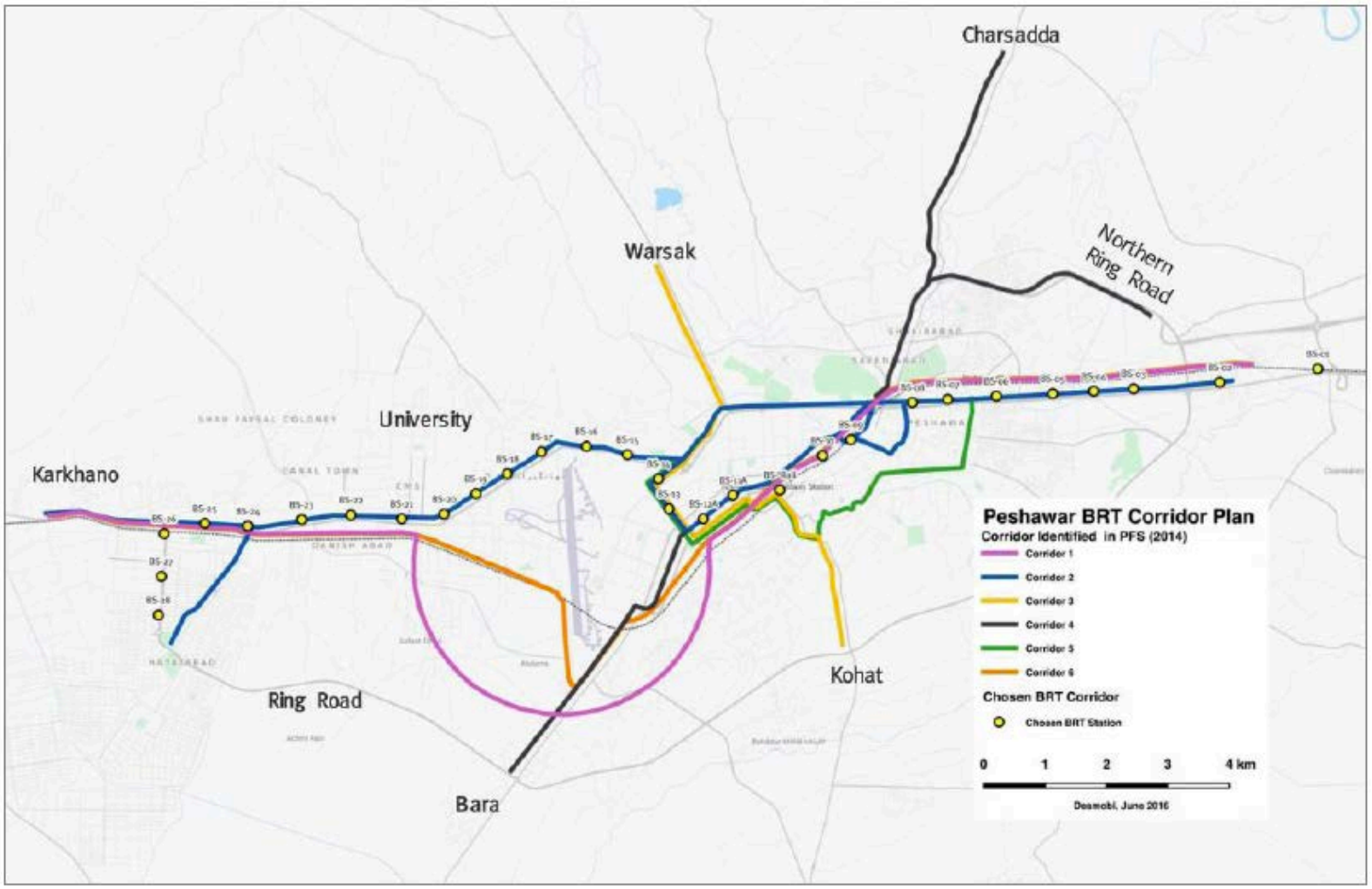
5.2.1 Alternative route options

222. The selection of the possible alignment of the BRT was conducted keeping in view a mix of technical, economical as well as environmental aspects to ensure the finalized route of the project would be the most favorable amongst the possible route alignment options in all regards. The impact on the area from the environmental and social aspects was given significant weightage during the assessment of the different alignment options. Other aspects that were considered were the right of way (RoW)

along the project corridor, demand coverage of the corridor, practicality of construction as well as option offering the shortest duration to complete the project construction.

223. As a result of the CDIA pre-feasibility study (PFS) conducted in 2014, six mass transit corridors were identified in Peshawar but the corridor 2, from Chamkani to Karkhano was selected as the recommended option to be built in the first stage as a BRT. The PFS also identified five other corridors, but some of them were not too feasible to be built as a mass transit corridor during the first stage. The mass transit corridors identified in the PFS are shown in **Figure 5.1** below.

Figure 5.1: Mass Transit Corridors identified in PFS



224. The Corridor '1' was not selected as the proposed alignment for the BRT since it runs alongside the railway track and some of the sections do not have the necessary minimum clearance required from the railway track and could possibly create considerable issues from health, safety and environment perspectives.

225. Other corridors identified on the PFS will also pose great difficulties with regards to land acquisition to construct the required mass transit infrastructure. In addition, the proximity of the key receptors to the other corridor options are also expected to create much greater environmental impacts that would be much more

difficult to mitigate in comparison to the limited number of impacts resulting from the chosen corridor for the proposed project.

226. As a part of the comprehensive assessment for identifying the preferred BRT corridor, four different alignment options were considered for the city center area are as follows:

- At-grade via Jail road
- Elevated via Soekarno road
- Elevated via Hospital road
- At-grade via Hospital road

The assessment of these four options is provided in **Table 5.1** below.

Table 5.1: City Center Alignment Assessment Summary

Alignment Option	Features	Results
Option 1: At-Grade via Jail Road	++Faster construction time ++Goes to non-congested road - Skip high demand area - Need to remove parking - Pass through Government sensitive area	This was assessed to be the third bet option after options # 2 and 4, due to minimum investment required and faster construction time
Option 2: Elevated via Soekarno road and Shuba Chowk	++Capture high demand area ++Avoid conflict with general traffic at Khyber bazar ++Minimize impact for resettlement and acquisition -Higher construction cost -Might degrade the area underneath elevated section -Might pose security threat to Bala Hisar fort -Pylon for elevated section are too close to Bala Hisar fort	This option could have been feasible. However, due to concern on the pylon for elevated BRT being too close to the Bala Hisar fort structure, this option has not been selected.
Option 3: Elevated at Hospital road	++Capture high demand area -Highest construction cost out of all options -Narrow section on hospital road makes it difficult -Might degrade the area underneath the elevated section	This option was only possible if the elevated section is made for a 1-direction BRT, which will further increase the project cost. Thus, it is considered as the last option.
Option 4: At-Grade via Hospital road	++Capture high demand area ++Traffic re-direction also helps to ease the congestion ++Will change the overall street realm	**Preferred option**

Alignment Option	Features	Results
	along BRT corridor -Pose emergency risk with one-way traffic for ambulance	

227. During the initial discussions between the project consultants and the Government staff for identification of the most feasible BRT alignment, the option 2 was initially considered the preferred option. However, later it was decided that due to the high construction cost and security and livability aspects, the advantages of the second option could not outweigh its disadvantages. This referred the discussions to option 4 with the issue of ensuring uninterrupted access for emergency vehicles to the Lady Reading hospital being resolved by dedicating a portion of BRT for 'ambulance only' access along the south part of Cinema road and the east part of Khyber bazar road.

5.2.2 CNG versus Diesel buses

228. The option to purchase either CNG or diesel buses for the BRT project was assessed by considering the pros and cons of both options in terms of technical as well as economic viability.

229. Firstly, a reliable and uninterrupted supply of CNG is difficult to guarantee in Pakistan in comparison to the supply chain of diesel, which is much more streamlined and reliable.

230. In terms of economic viability, CNG buses currently cost, on average, approximately 70,000 USD more to purchase than equivalent diesel buses. In addition, in order to ensure a reliable and uninterrupted supply of CNG, fueling stations will need to be constructed which will cost approximately 26,000 USD per bus. Based on experience globally, it has been observed that the payback period on the incremental purchase cost of CNG buses and fueling infrastructure, compared to diesel buses, is between five to eight years. [2]

231. The emissions from new diesel buses and new CNG buses are comparable with both type of buses emitting low levels of NOx, PM and HC. It is important to mention that a new diesel bus in comparison to an old diesel bus emits 94 percent less NOx per mile, 98 percent less PM and 89 percent less HC. In comparison, a CNG bus emits 80 percent less NOx, 99 percent less PM and 100 percent less HC in comparison to an old diesel bus. Thus, there is a minimal difference in emission levels between new diesel and new CNG buses.

[2] http://www.catf.us/resources/publications/files/20120227-Diesel_vs_CNG_FINAL_MJBA.pdf

232. The wells to wheels[3] emissions from new diesel buses total 3,840 g CO2-e per mile, a 9 percent reduction compared to older buses. In the case of new CNG buses, the wells to wheels emissions from CNG buses total 3,655 g CO2-e per mile, 5 percent less GHG emissions than compared to new diesel buses.

233. There is a high variation in the quality of CNG available in the country with different gas stations offering a large variation in the composition of the CNG being sold, despite offering the CNG at a uniform price. This itself is a major concern since the life of buses would be significantly reduced and their downtime would steadily increase with time if high quality CNG of a uniform composition is not available throughout the year.

234. There is a minimal difference in emissions and resulting impact on air quality from both diesel and CNG buses. However, in terms of economic viability, there is a considerable difference in the cost of procuring CNG buses in comparison to diesel buses.

Life Cycle Cost Comparison of Diesel versus CNG buses

235. The net present value of total incremental life cycle costs for conversion of a typical 200-bus depot to clean fuel operations with either CNG or filter-equipped diesel buses are summarized below in Table 5.2.

The following assumptions were used for this life cycle cost analysis:

- The discount rate is 6%
- The time frame for the analysis is 30 years, assuming that the capital investments for facility modifications and incremental bus purchase costs are made in year 1 and the incremental operating costs are expended every year. As discussed below, since the facility investments have a longer life cycle than the bus investments, the incremental bus purchase costs are repeated during the 30-year time frame.
- Facility investments (ie for diesel fuel or CNG infrastructure) have an effective life of 30 years. These investments are only made once during the analysis time frame, in year 1.
- Transit buses have an effective life of 15 years, so that incremental purchase costs for CNG buses will have to be made in year 1 and year 15.
- Diesel particulate filters (DPFs) have an effective life of 7 1⁄2 years, so that the purchase of DPFs will have to be made in year 1, year 8, year 15, and year 22.
- It is typical for transit agencies to invest in “overhauls” of transit buses throughout their life, including an overhaul or replacement of the engine some time between

[3] Wells to wheels emissions take into account the production and distribution of the fuel. It is a type of analyis that allows emissions to be compared over the entire lifecycle of a vehicle.

the 7th and 10th years of life. These investments were excluded from the analysis since they apply equally to CNG and diesel buses, and would generally be offsetting. This is a conservative assumption, since based on current experience the overhaul or replacement of a CNG engine would be expected to be more expensive that the overhaul or replacement of a diesel engine.

Table 5.2: Comparison of NPV of Total Incremental Costs: CNG versus Diesel

Alignment Option	CNG	Diesel
NPV of Incremental Capital Costs	$ 33,653,806	$ 3,448,862
NPV of Incremental Operating Costs	$ 33,651,891	$ 6,732,158
NPV of Total Incremental Costs	$ 70,305,697	$ 10,181,020
Annualized NPV of Total Incremental Costs	$ 2,343,523	$ 339,367

As shown, over 30 years of operation (the life of the original facility investments required for CNG operation) the use of filter-equipped diesel buses at one 200-bus depot will cost $10.2 million in net present value terms more than the cost of operating today's "baseline" diesel buses, or $339,000 more per year. Alternately, the use of CNG buses at the same depot would cost $70.3 million more in net present value terms, or $2.3 million more per year than the cost of operating today's "baseline" diesel buses.

The cost of operating 200 CNG buses for 30 years would be $60.1 million more than the cost of operating 200 filter-equipped buses, or $2 million more per year. The above analysis includes a one-time investment of $20 million to upgrade a 200-bus depot.

Keeping in view all these aspects, it was decided to procure new diesel buses for the proposed BRT project instead of CNG buses.

5.2.3 Diesel versus other fuel options

236. The majority of BRT buses being manufactured globally are based on diesel, CNG or natural gas, since they are the most competitive in terms of both pollutant emissions as well as economic viability from both operation and maintenance perspectives. Other fuel options being offered by BRT bus manufacturers consist of diesel-electric hybrid, alternative fuels (bio-diesel, bio-methane/CNG and hydrogen) and fully electric.

237. Bus manufacturers do not generally offer the use of gasoline in BRT buses since globally there is increasing popularity of procuring buses based on cleaner,

cheaper and more efficient fuel options mentioned above. In addition, the use of low Sulphur diesel based BRT buses is also an increasingly popular fuel option.

238. In the context of the proposed BRT buses for this project, the technical expertise required for maintenance and repair of hybrid-based buses is presently not available in the country. In addition, the use of fully electric buses is also not possible keeping in view the continuous power outages and unpredictable supply of power in the country along with the lack of required infrastructure such as charging stations for recharging the electric buses. The use of gasoline-based buses cannot be considered since the bus manufacturers are not offering such buses at present.

239. There have been marked improvements in the environmental performance of diesel engines as a result of progressive tightening in the environmental performance of diesel engines due to stricter regulations, with the latest Euro VI standards delivering ultra low PM and NOx emissions.

240. Thus, the selection of diesel-based buses for the proposed BRT buses is the most suitable option considering all techno-economic aspects for the project.

5.2.4 'At Grade' versus 'Elevated' Sections

241. The development of elevated sections along the BRT corridor has been minimized as far as possible to reduce costs and to ensure only those sections shall be 'elevated' where high level of impacts would take place if the 'At Grade' option was implemented. Although a direct comparison between these two options might make the 'At Grade' option seem preferable, however the 'Elevated' option has a high number of benefits, both from the environment and social perspectives, in certain specific locations where high traffic congestion exists and a high level of sensitive receptors are present. A comparison from an environmental perspective of these two options has been provided below as **Table 5.3**.

Table 5.3: Comparison of 'At Grade' versus 'Elevated' Sections

Item	At Grade	Elevated
Aesthetic View and Landscape	Good	Not good since the view will be limited by high elevation of the road
Working Conditions	Low risk of accidents for the worker and surrounding areas due to work at ground level	High risk of accidents for the worker and surrounding areas due to work at high elevation
Air Pollution	**Construction phase:** Medium impacts since dust concentration caused during the demolition activities, material transportation,	**Construction phase:** Major impacts since dust concentration during the piling, transportation of construction material etc.

Item	At Grade	Elevated
	earth works etc.	
Noise Pollution	Increase in noise levels during transportation of construction material	Increasing of noise levels during piling and transportation of construction material
Vibration	Less impact due to construction activities will be at ground level	High vibration levels due to use of boring and excavation equipment
Risk to Historical/Heritage sites	Minimal risk due to the project development taking place at the median of the existing roads.	Higher level of risk due to piling and excavation required which can lead to damage of historical sites at close proximity to the project site.
Damage to Utilities	Minimal risk since no deep excavation or piling will be required.	Higher level of damage can be caused due to excavation and piling required.

5.2.5 Location of Bus Depots

242. The two bus depots to be developed for the proposed project will be located at sites identified at Chamkani and Hayatabad. These two sites are located at the tail ends of the BRT corridor and thus will ensure that all environmental and social impacts are minimized compared to developing these depots within the highly urbanized and congested urban areas of Peshawar city.

243. The two identified bus depot locations are located in comparatively thinly populated areas which contain large open spaces in comparison to the remaining BRT corridor. As a result, all possible environmental and social impacts will be minimized such as impacts on air quality, hazardous waste disposal, traffic congestion, effluent and solid waste disposal. Traffic congestion will also be avoided from high volumes of buses traveling to and from the bus depots since these two locations contain lower traffic volumes compared to the inner Peshawar city.

6 Potential Environmental Impacts and Mitigation Measures

244. This chapter presents the potential environmental impacts related to design, construction and operation phases of the proposed Project. Following is a description of the environmental impacts and the proposed mitigation measures to minimize the negative impacts, if any.

6.1 Design/Pre-Construction Phase

6.1.1 Cultural Heritage, Religious Sites, Social Infrastructure

Impacts

245. The location of cultural and other heritage sites with respect to the proposed project has been reviewed in Chapter 4. Bala Hisar fort is the only site of historical significance next to the project route. No temples or religious sites are in close proximity to the project site to cause a concern with regards to a possible impact during the project construction and operation. There will be a sufficient buffer distance between the works and the Bala Hisar fort that no significant impact would be expected from the works.

Mitigation measures

246. During the excavation works next to the Bala Hisar fort, a representative of the Department of Archaeology shall be present to document any archaeological discovery and take the necessary steps to extract it without any damage being caused to it.

247. The vibration levels from the use of the construction equipment and vehicles will be closely monitored to ensure typical peak particle velocities remain within allowable limits and do not exceed the 5 in/sec limit, in which case major structural damage such as cracking or shifting of foundations or bearing walls can take place.[4]

6.1.2 Land Acquisition and Resettlement

Impacts

248. The LARP has been prepared based on a census (conducted from 9 Nov to 29 Dec 2016) of 100% potentially Displaced Persons (DPs) that are known at preliminary design stage; a socio-economic survey of 25% project Affected Households (AHs) conducted from 21 Dec 2016 to 5 Jan 2017; and consultations with DPs and other stakeholders. This LARP will be updated during the detailed design stage.

[4] http://www.apti.org/clientuploads/publications/2015/Johnson-HannenHiRes_SampleArt_46.2-3.pdf

249. The clearing of the right-of-way (ROW) and initiation of civil works on the BRT sites will be contingent to the following conditions (a) preparation of an updated LARP, including a detailed Livelihood Restoration Plan (LRP), following the detailed design (b) endorsement and allocation of the required funds for the updated LARP by TMTD-GoKPK, and (c) approval of the updated LARP by ADB and disclosure to the public.

250. Commencement of civil works on sections/civil works packages with resettlement impacts, to be confirmed and/or determined during detailed design, is conditional to the full payment of compensation, resettlement and rehabilitation cash assistance and allowances, and provision of temporary alternative vending sites to displaced vendors. Livelihood Restoration Plan will be implemented during the construction phase.

251. The preliminary design would cause heavy resettlement impacts. Adjustments were made in the BRT design to avoid and minimize displacement and resettlement to the maximum possible extent.

252. The project will have significant resettlement impacts on 535 households due to acquisition of 117 Kanal (14.6 acres/5.9 hectares) of private arable land, demolition of permanent structures of 2 underpass markets having 84 shops, 4 commercial toilets, 3 kiosks and 12 stores, a horizontal structure of 14 shops, one store room of a business, and two mosques (built in the ROW).

It will also impact the livelihood of 8 non-titleholder of agriculture land, 86 formal businesses/shopkeepers among them is a female headed household whose business is run by her brother; 235 non-titleholder vendors operating road side micro enterprises in the ROW, among them are 2 disabled, 99 employees of formal businesses and their 49 salaried relatives of formal businesses, having separate households; 4 security guards of underpass markets, and one khateeb (prayer leader) of a mosque.

All formal and micro businesses need relocation of their businesses to alternative sites. The leaseholders of 79 shops and owners of 14 shops will lose income from monthly rent of the commercial structures. Among 535 AHs, 349 are vulnerable with 246 severely affected that need additional resettlement and rehabilitation assistance.

253. The project will have an impact on a number of public utilities including relocation of electricity pylons and poles with transmission lines, transformers, water supply stations, drainage systems, and telecommunications infrastructure. There will be temporary impacts on mobility and access of general public due to PBRT construction.

254. A long process of consultation and negotiation was carried out from 21 Dec 2016 to 5 Jan 2017 to address complex resettlement issues and to resolve them amicably with DPs. Consultations were also conducted with a number of other stakeholders. The potentially displaced shopkeepers of underpass markets are keen

in getting alternative shops at pedestrian bridges. The displaced vendors are keen in getting formal business spaces at BRT related infrastructure, which have been planned to be established in commercial areas of BRT related infrastructure.

Under PBRT, it is planned to build spaces for about 1100 shops in 4 pedestrian underpasses, 38 access bridges and 24 pedestrian bridges and/or new bus stations on a rental agreement basis with TransPeshawar Company, giving vendors security of business and opportunities for growth.

Mitigation measures

255. DPs' and stakeholders' concerns and suggestions have been incorporated in the LARP, Environment Management Plan (EMP) and Gender Action Plan (GAP). Consultation with DPs and other stakeholders will be continued during project implementation.

6.1.3 Identification of Locations for Labor Camps and ancillary facilities

Impacts

256. The duration of the construction activity for the proposed project is expected to be 18 months and a considerable amount of work force will be engaged. As a result, worker camps will need to be developed and ancillary facilities will need to be provided such as electricity, washrooms for labor with suitable effluent and sewage disposal facilities as well as water for their everyday use for drinking and bathing etc.

Mitigation measures

257. In order to prevent a nuisance, specific locations shall be designated along the proposed project corridor for development of the labor camps. All necessary facilities and amenities shall be provided in these camps such as electricity, sufficient supply of water, solid and liquid effluent waste disposal facilities etc.

258. The use of proper planning while identifying locations for the labor camps will ensure there is minimal disturbance to all key receptors along the project corridor and the traffic is not disrupted by labor camps being set up road side next to the construction site.

6.1.4 Development of Traffic Management Plan

Impacts

259. The proposed BRT corridor will be constructed on existing traffic routes. Construction activities along these routes are likely to cause hindrance in traffic flow if not mitigated properly.

Mitigation measures

260. A traffic management plan is presently under preparation by experts specifically engaged for this task by ADB. The finalized plan shall be provided to the Contractor for implementation prior to commencement of the project construction activity. The main objectives of the plan shall be to maximize the safety of the workforce and the travelling public while keeping the traffic flowing as freely as possible.

261. The detailed traffic plan shall ensure that traffic is diverted to alternate routes wherever possible and will minimize traffic jams and bottlenecks along the project corridor and also minimize the chances of traffic related accidents.

262. The plan will include consideration of the following:

- Lane availability and minimization of traffic flows past the works site
- Establishment of acceptable working hours and constraints
- Agreement on time scale for works and establishment of traffic flow/delay requirements
- Acceptability of diversion routes where necessary
- Need for road closures and necessary orders
- Co-ordination with other planned road and street works
- Establishment of incident management system for duration of the works

The plan shall be approved by PDA and necessary resources will be provided to implement the plan with the involvement of the traffic police.

6.2 Construction Phase

263. The summary of potential impacts during the Construction phase are provided in **Table 6.1** below.

Table 6.1: Summary of Possible Impacts during Construction Phase

S/No.	Environmental Aspect	Potential Issue from Environmental Aspect	Potential of Impact	Mitigation Measures
1	Ambient Air Quality	Dust emissions from site preparation, excavation, material handling & other construction activities at site.	Dust emissions expected at work site and at closest key receptors. However, minor and short-term impact expected which will be temporary in	Regular water sprinkling on the exposed surfaces to reduce dust emissions and proper maintenance of all equipment at regular intervals to minimize impact of

			nature.	exhaust emissions
2	Noise	Noise generated from construction activities, operation of construction machinery, equipment and their movement.	Noise levels expected to vary during activity based upon the nature of work being conducted. Higher noise levels expected at site but minor impact expected at key receptors. Impact expected to be short term in nature.	Necessary control equipment and techniques to be applied to control noise levels and limit their nuisance effects
3	Water Quality	Surface runoff from project site of Oil/fuel and waste spills as well as improper disposal of debris and discharge of sewage from labor camp.	Minor negative impact expected.	Construction methods and techniques and mechanism for disposal of effluent to be designed for proper drainage and control of discharge
4	Solid Waste	Disposal of excavated soil, construction debris and other waste including domestic waste, which can cause soil contamination and other health and safety issues.	Minor negative impact expected.	Proper solid waste management programme to be designed and implemented
5	Land Use	Demolition/excavation on the BRT route requiring rehabilitation	Minor negative impact expected	Demolition/excavation and rehabilitation to be conducted as per EMP.
6	Soils	Construction and excavation activity leading to topsoil removal and erosion.	Minor negative impact expected	Necessary measures to be taken to replace removed soil as per EMP.
7	Ecology Flora & Fauna	Habitat disturbance during construction activity.	Project is being developed in a highly urban environment with scarce flora and fauna present in project area. Minor and short term impact expected	Necessary steps to be taken to minimize ecological disturbance wherever applicable, particularly the prohibition of hunting and killing of animals.
8	Socio-economy	Increase in job opportunities expected for residents of Peshawar	Overall positive impact	Fair and transparent hiring policy must be

		and neighboring areas. Industry related to provision of raw materials expected to boom. The proposed project is expected to increase the urban aesthetic and landscape profile of Peshawar.	expected	maintained for the project. Project sustainability must be ensured through regular and proper maintenance of infrastructure.
9	Traffic pattern	Vehicle movement and possibility of traffic congestion on the road.	Minor negative impact	Traffic management plan to be prepared and implemented one month before commencement of construction work

6.2.1 Air Quality

Impacts

264. The ambient air quality levels at five different points of the project corridor have already been presented and discussed in **Section 4.26** below. As can be observed, in general the ambient air quality is within the acceptable NEQS guidelines with PM_{10} being the only pollutant that is exceeding the guidelines at two of the five monitoring locations.

265. Since almost all ambient air quality parameters are within the acceptable NEQS guidelines, thus any additional emissions expected to arise during the construction phase due to the use of construction equipment shall be insignificant. Additional sources of dust from construction of the proposed BRT project and from general handling of materials are likely to create significant additional impacts, particularly where the works are close to sensitive receptors such as residences, hospitals and schools.

The worst effects are likely to take place in the most constricted and congested commercial areas where construction will take place such as Saddar bazar, Soekarno square etc.

266. Potential sources of particulate matter emission during construction activities include earthworks (dirt or debris pushing and grading), exposed surfaces, exposed storage piles, truck dumping, hauling, vehicle movement on unpaved roads, combustion of liquid fuel in equipment and vehicles, land excavation, and concrete mixing and batching.

267. Vehicles carrying construction material are expected to result in increased SPM levels near the haul roads. This can be of potential importance if the vehicles pass through the areas with a high concentration of sensitive receptors such as residences, hospitals and educational institutions.

268. At the construction yard, the dust levels are also expected to increase due to unloading of construction materials. It shall be ensured that most of the excavated material will be used within the project, with minimal cut and fill material to come from outside the site.

269. The pavement works will also generate gas and odor from the asphalt works and vibration from the compaction of the new BRT road pavement. Emissions from powered mechanical equipment will be superimposed on the already high traffic pollution but is expected to disperse rapidly.

270. The quantity of dust that will be generated on a particular day will depend on the magnitude and nature of activity and the atmospheric conditions prevailing on the day. Due to the uncertainty in values of these parameters, it is not possible to calculate the quantity from a 'bottom-up' approach, that is, from adding PM_{10} emissions from every activity on the construction site separately. Typical and worst-case PM_{10} emissions from construction sites have been estimated[5] as 0.27 megagram per hectare per month of activity (Mg/ha-month) and 1.04 Mg/ha-month, respectively.

Fugitive Dust Control

271. The source wise fugitive control measures are provided in **Table 6.2** below.

Table 6.2: Control measures for Fugitive Dust emissions

Source	Control Measures
Earth Moving	For any earth moving that is to take place in the immediate vicinity from the site boundary, watering must be conducted as required to prevent visible dust emissions
Disturbed Surface Areas	Apply dust suppression measures (clear vegetation only from areas where work is to commence, plant or mulch areas that will not receive traffic, construct artificial wind breaks or wind screens) frequently to maintain a stabilized surface. Areas that cannot be stabilized, such as wind driven dust, must have an application of water at least twice a day
Inactive Disturbed Surface Areas	Apply dust suppressants (clear vegetation only from areas where work is to commence, plant or mulch areas that will not receive traffic, construct artificial wind breaks or wind screens) in sufficient quantity and frequency to maintain a stabilized surface
Unpaved Roads	Water all roads used for any vehicular traffic at least twice per day during active operations and restrict vehicle speed to 20 kmph.
Open Storage Piles	Apply water to at least 80 percent of the surface areas of all open storage piles on a daily basis when there is evidence of wind driven fugitive dust or install an enclosure

[5] Gaffney, G. and Shimp, D. 1997. *Improving PM_{10} Fugitive Dust Emission Inventories*. Sacramento, CA. California Air Resource Board. <www.arb.ca.gov/emisinv/pubs/pm10tmp.pdf>

	all along the storage piles
Track-out Control	Wash down of construction vehicles (particularly tyres) prior to departure from site.

Mitigation measures

272. A wide variety of options exist to control emissions from construction sites. The most effective means of reducing the dust emission is wet suppression. Watering exposed surfaces and soil with adequate frequency to keep soil moist at all times can reduce the total dust emission from the project by as much as 75%.[6] This measure alone can bring down the dust level to less than 100 µg/m^3.

Water can be sprinkled by handheld sprays or with the help of automatic sprinkler systems as required.

273. In case surplus water is not available to suppress dust at certain locations, it is recommended that if works are within 10 meters of any sensitive receptors, the contractor shall install segregation between the works at the edge of the median at the road edge nearest the center to provide a barrier to protect the sensitive receptors and passing traffic. The segregation should be easily erectable 2.5 meter high hoarding /fiber boards and/or steel sheets to make protection fences around the construction site (at each station location and depot site during the construction) within which all construction works can take place. They can be moved from site to site along the BRT route as the work proceeds.

274. The need for large stockpiles shall be minimized by careful planning of the supply of materials from controlled sources. Stockpiles should not be located within 50 m of schools, hospitals or other public amenities and shall be covered with tarpaulins when not in use and at the end of the working day to enclose dust. If large stockpiles (>25m^3) of crushed materials are necessary they should be enclosed with side barriers and also covered when not in use.

275. Construction materials that are susceptible to dust formation will be transported only in securely covered trucks to prevent dust emission during transportation.

276. Aggregate material will be delivered to the batching plant in a damp condition, and water sprays will be applied, if needed, to reduce dust emissions.

277. A minimum distance of 300 meters will be ensured between the batching plant(s) and the nearest community.

[6] El Dorado County Air Pollution Control District. 2002. Guide to Air Quality Assessment: Determining Significance of Air Quality Impacts Under the California Environmental Quality Act. First Edition. <http://co.el-dorado.ca.us/emd/apcd>

Vehicular & Equipment Emissions

278. It shall be ensured that the following measures are taken to control emissions from vehicles being used in the construction activity:

- Periodically check and conduct maintenance of the construction machinery and haul vehicles.
- Regularly change the engine oil and use new engines/machinery/equipment having good efficiency and fuel burning characteristics.
- Use of catalytic converters and low Sulphur fuels.
- The stack height of generators will be at least 3 meters above the ground.
- Training of the technicians and operators of the construction machinery and drivers of the vehicles.
- Air quality monitoring at the project site during the construction phase.

6.2.2 Noise

Impacts

279. The assessment of the impacts of noise on the sensitive receptors at each site of the project corridor depend upon:

- Characteristics of noise source (instantaneous, intermittent or continuous in nature)
- Time of day at which noise occurs, and
- Location of noise source

280. Due to the various construction activities, there will be temporary noise impacts in the immediate vicinity of the project corridor.

281. The construction activities will include the excavation for foundations and grading of the site and the construction of structures and facilities. Powered mechanical equipment such as generators, excavators, bulldozers, piling rigs, stabilizers, drills, stone crushers, graders, vibratory rollers, concrete mixing plants and screening plants can generate significant noise.

Since various modern machines are acoustically designed to generate low noise levels, any high noise levels that might be generated will only be for a short duration during the construction phase.

282. Depending on the construction equipment used and its distance from the receptors, the community and the workers may typically be exposed to intermittent and variable noise levels. During the day, such noise results in general annoyance and can interfere with sleep during the night. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is

clearly noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level.

283. Due to the various construction activities, there will be temporary noise impacts in the immediate vicinity of the project corridor. The construction activities will include the excavation for foundations and grading of the site and the construction of structures and facilities. Crushing plant, asphalt production plants, movement of heavy vehicles, loading, transportation and unloading of construction materials produces significant noise during the construction stage. However, these increased noise levels will prevail only for a short duration during the construction phase.

284. The assumptions made while conducting the noise level projections are as follows:

- No noise abatement at source
- Minimal attenuation
- Different construction equipment operation scenarios were explored
- All the noise-generating sources from the site act as one source
- Standard internationally accepted equipment noise levels have been assumed (see Table 3.2).

285. The analysis presented in this section is based on the approach recommended by Federal Highway Administration of the US Department of Transportation for assessment of construction noise.[7]

The modeling of noise levels as a result of the proposed construction activities has been conducted using a Mathematic model for Sound Wave propagation that has been developed specifically for this purpose. In order to estimate the noise dispersion, it has been assumed that all the noise-generating sources from the site act as one source. Thus, the total noise generated from all equipment will be confined to about 108 dB(A) which as mentioned above is a highly conservative scenario and the actual noise levels at the construction sites are expected to be lower than the estimates provided here.

286. The model is based on the standard acoustical equations with the sound pressure level generated by noise sources decreasing with increasing distance from the source due to wave divergence. An additional decrease in sound pressure level with distance from the source is expected due to atmospheric effects or its interaction with objects in the transmission path.

287. Three different scenarios for assessment of noise levels generated from operation of different types of construction equipment for the proposed project were examined and are presented in **Table 6.3** below.

[7] Reagan, J. A. and C. A. Grant. *Highway Construction Noise: Measurement, Prediction, and Mitigation. Special Report.* US. Department of Transportation, Federal Highway Administration. Available from <http://www.fhwa.dot.gov/environment/noise/highway/index.htm>

288. As can be observed, the highest noise level generated was 90 dB(A) from Scenario 'B. The other two scenarios i.e. 'A' and 'C' also each produced very comparative noise levels of 89 dB(A).

Table 6.3: Noise Level Scenarios from Construction Machinery

Scenario	Loudest Equipment	Leq@15m (dBA)	Noise Level (dBA) at 15m
A	Truck	88	89
	Grader	83	
	Backhoe	88	
B	Truck	88	90
	Backhoe	88	
	Concrete Mixer	92	
C	Front End Loader	85	89
	Grader	83	
	Pneumatic Tools	88	

289. The input to the model has been taken as the cumulative noise of all the noise generating sources, unique for each specific scenario. The coordinates X and Y are taken as the input to the model, which is correlated with the grid size and scale (1:100 m). Thus, the center of the project area is defined as 0,0 coordinates.

290. The isopleths and noise levels obtained through this model are provided as **Figure 6.1** below. It is observed from the isopleths (contours) that high noise levels will be confined to the work zone areas only. It can be observed that the noise levels get attenuated rapidly with the distance. Also, the contours showing the noise levels at the receptors around each BRT station during the construction phase are provided in **Annexure E** as **Figures E-1 to E-31**.

291. It should be noted that the predicted noise levels indicate noise contours of 50 dB(A) along the BRT project corridor at a distance of about 180 meters from the center of the source which is within the NEQS day time limits for noise for both residential and commercial areas. Thus, there will not be any significant increase in the existing ambient noise levels for receptors located at this distance.

292. The sensitive receptors lying within the project area of the BRT corridor have been clearly marked and classified in the noise maps into specific 'to clearly present the specific noise zone applicable to them. Thus, all receptors have been categorized based on whether they lie in the 'Silence zone', 'Commercial zone', 'Industrial zone' or 'Residential zone' since the permissible day and night noise level thresholds vary for each zone.

293. Also, since noise barriers shall be installed at different locations along the proposed project corridor, an attenuation of approximately 7 dB(A) is expected, resulting in a further decrease in the noise levels reaching the sensitive receptors as

a result of the construction activity. The resulting noise levels at the different sensitive receptors are illustrated through noise maps provided in **Annexure F**.

294. Thus, in reality maximum noise levels at any receptor after incorporating the attenuation factor due to the noise barriers is expected to be only 83 dB(A). Also, keeping in view the existing high baseline noise levels in the project area of up to 91 dB(A) as shown in **Figure 4.24**, the increment in noise levels due to the project construction activity shall be less than 1 dB(A). As a result, the noise levels generated from the project construction activity shall remain within the 3 dB(A) increment limit, applicable for high noise environments.

Mitigation measures

295. It shall be further ensured through periodic monitoring to ensure that any increase in noise levels resulting from the construction activity is not greater than 3 dB(A) since the project area is already a high noise disturbed environment.

296. Before site works commence, a Noise Control Plan shall be prepared by the contractor and shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimize impacts to sensitive receptors (residential areas, etc.) due to construction works, sourcing and transport of construction materials, and other project-related activities.

297. Use only vehicles and equipment that are registered and have necessary permits.

298. It shall be ensured that equipment noise is reduced at source by proper design, maintenance and repair of construction machinery and equipment. Also, noise from vehicles and power generators will be minimized by use of proper silencers and mufflers.

299. Equipment emitting excessive noise in comparison with other similar equipment will not be allowed to operate and will be checked to determine if it can be improved, and replaced with less noisy equipment as soon as practicable.

300. Acoustic insulation shall be installed or portable noise barriers or hoardings shall be installed where practicable to limit noise to protect sensitive areas such as educational institutions, hospitals, residential areas etc.

301. Blowing of horns by the construction vehicles will be prohibited on the access road to the project site and at the site.

302. Stationary noise sources such as batching plants will be kept at least 300 meters away from the nearest community.

303. Construction work will only be carried out during daytime and occasionally in the evening up to 9 pm. If construction works continues overnight, care will be taken to keep noise within the night time limit of NEQS at the nearest receptor.

304. Noise levels will be monitored on bi-monthly basis at the key receptors in the project area in order to take timely corrective measures, if needed.

305. Impose speed limits on construction vehicles to minimize noise emission along areas where sensitive receptors are located (houses, etc.).

306. Provide temporary noise barriers (3-5 meter high barrier can reduce 5-10 dB(A), as necessary, since works near sensitive receptors will generate high noise levels that could cause disturbance.

307. As much as possible, use quiet equipment and working method.

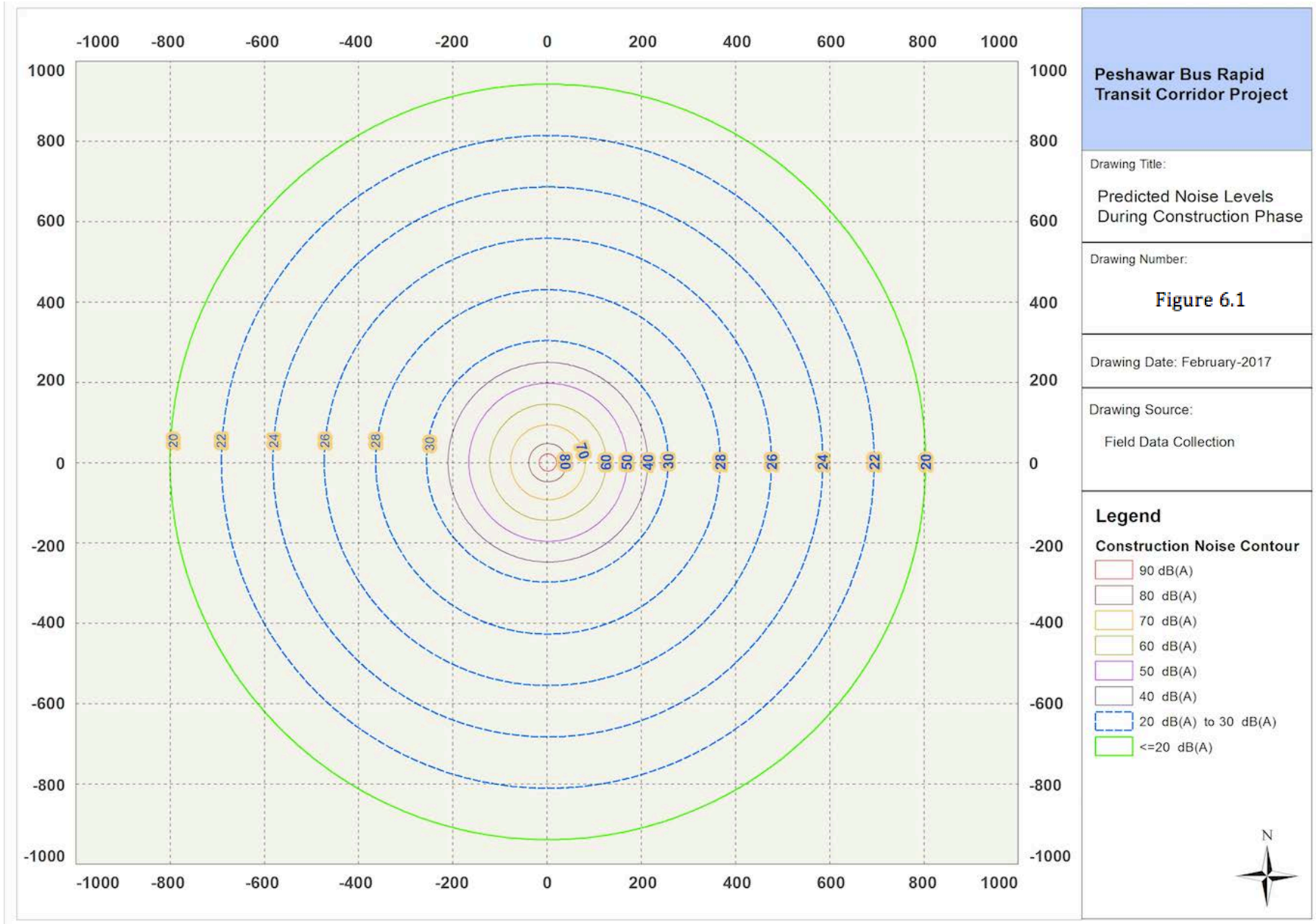
308. Whenever possible, completely enclose noisy equipment which can reduce noise level by 15-25 dB(A), restrict use of noisy equipment (e.g.15 min for every consecutive 30 min period) and undertake sequential operation of equipment with objective to reduce noise generated;

309. Provide prior notification to the community on schedule of construction activities.

310. Implement community complaints hotline.

311. Prior to commencement of construction activity, consultations will be organized with the key sensitive receptors along the BRT corridor such as hospitals, schools and hotels. Also, it shall be ensured as far as possible that construction activity near schools is conducted during their vacation period.

Figure 6.1: Predicted Noise levels during Construction Phase



6.2.3 Management of Traffic

Impacts

312. The project corridor is quite congested in certain segments where a high level of traffic volumes and commercial activity takes place, particularly the segments such as Hospital Road, Khyber Bazaar, Soekarno Square and Saddar Bazaar etc.

313. The efficient management of traffic once the construction activity commences will be critical in order to minimize the risk of possible road accidents and construction related hazards.

Mitigation measures

314. Traffic signs and warning instructions shall be displayed at the sites and along the proposed routes being used by the construction traffic for the information of other road traffic as well.

315. Public awareness campaigns through radio and newspaper advertisements shall be conducted to educate the public and sensitize them to cooperate with the construction staff and project focal staff in order to try and avoid the areas under construction as far as possible, particularly during the peak times when traffic volumes and pedestrian movement is the highest.

316. The potential risks of accidents to pedestrians and commuters while in the immediate vicinity of construction sites shall be conveyed to them in order to educate them and gain their cooperation and minimize the risk of accidents.

317. Employ flag persons to control traffic at the work sites for safety reasons when construction equipment is entering or leaving the work area.

318. Lanes shall be created through the work site using rope or flagging to minimize risks and injuries from falling objects.

319. As much as possible, lifting and placing of the pre-cast sections will be done at night to minimize traffic congestion.

320. Post traffic advisory signs (to minimize traffic build-up) in coordination with local authorities.

321. Provide road signs indicating the lane is closed 500 m before the worksite.

322. Use traffic cones to direct traffic to move to the open lane.

323. Provide sufficient lighting at night within and in the vicinity of construction sites.

324. Regularly monitor traffic conditions along access roads to ensure that project vehicles are not causing congestion.

325. Define and observe schedules for different types of construction traffic trips (e.g., transport of pre-cast sections, haulage of spoils, delivery of construction materials, etc.).

326. As much as possible, schedule delivery of construction materials and equipment as well as transport of spoils during non-peak hours.

327. Avoid movements of noisy vehicles during night time in vicinity of sensitive receivers.

328. Implement suitable safety measures to minimize risk of adverse interactions between construction works and traffic flows through provision of temporary signals or flag controls, adequate lighting, fencing, signage and road diversions.

329. Ensure relocation of any affected public transport infrastructure (but stops, shelters etc.) prior to commencement of works.

330. Provide advance notification to the community regarding changes to public transport facilities or routes.

331. Schedule construction works to minimize extent of activity along linear construction site at any one time.

332. Comply with traffic regulations and avoid, where possible, roads with the highest traffic volumes, high density of sensitive receivers or capacity constraints are not used as access to and from the construction areas and spoil disposal sites.

333. Install temporary accesses to properties affected by disruption to their permanent accesses.

334. Reinstate good quality permanent accesses following completion of construction.

6.2.4 Water Resources

Impacts

335. Water shall be used during the project construction in the labor camps for the everyday use of the laborers for cooking, drinking and bathing etc. Also, water shall be used at the sites along the project corridor for sprinkling to suppress dust emissions. In addition, water shall also be used during the construction activity itself for mixing of gravel in the batching plant etc.

336. Water is available in sufficient quantities along the entire project corridor and will be sourced either through pipes taken from the nearest municipal connection or through bowzers that shall be brought to the specific sites along the corridor. If felt necessary, temporary bore wells will be dug and will be restored to their original condition once the construction activity has been completed.

337. Even though there is no issue with water availability and the project construction will only be requiring limited quantities of water that will be easily manageable, however it shall be ensured through monitoring that wastage of water is prevented both at the project sites as well as at the labor camps.

Mitigation measures

No measures required.

6.2.5 Safety precautions during Construction work

Impacts

338. The project construction activity will be conducted in a thickly populated area with high volumes of pedestrians and vehicular traffic. The risk of accidents taking place will be high, particularly from falling objects during work being conducted on elevated structures, falling of beams and metal rods as well as the potential of accidents of vehicles with construction machinery.

339. The general track record of Contractors in the country with regards to following safety protocols during construction work is not very impressive with safety precautions mostly felt to be an impediment to fast pace of work.

Mitigation measures

340. Keeping in view the significant risk posed by the construction work to the surrounding commuters and pedestrians, it shall be ensured that the Contractor provides his staff with a provided detailed orientation on the safety protocols to be followed at all times during the construction work to minimize the risk of accidents.

341. The Contractor shall provide bi-monthly refresher sessions to his staff on the safety precautions to be followed during the construction activity.

342. The Contractor will closely monitor his staff at all times and will take strict action against any non-compliance with these protocols and will ensure at all times that the safety of the commuters and traffic in the vicinity of the project site are kept a priority.

6.2.6 Camp effluent

Impacts

343. The staff and labor camps for the construction of the proposed BRT will be a source of wastewater generated from the toilets, washrooms and the kitchen. The wastewater will not meet the national environmental standards and will therefore need treatment prior to disposal.

344. The project sites along the project corridor where construction is being conducted must not be treated by the project staff and/or labor as a public toilet or for disposal of camp effluent.

Mitigation measures

345. It will be ensured that no untreated effluent is released to the environment.

346. A closed sewage treatment system will treat the effluent, which will then be disposed of in a soak pit or will be used for plantation. The sewage treatment plants will be installed at each respective labor camp based on the number of laborers residing at the respective camp. The detailed design study for the proposed project will develop and propose suitable sewage treatment plants for installation by the Contractor at each of the respective labor camp sites.

6.2.7 Soil Erosion and Sedimentation

Impacts

347. The majority of the road works proposed are designed to be within the existing median of major roads on paved surfaces and therefore soil erosion and sedimentation should not be a significant impact.

Mitigation measures

348. Any drainage structures, cross road tunnels, culverts or pipes crossing the BRT corridor may need to be modified or protected and the detailed designs must make provisions to protect or re-provision all infrastructure that may be affected by the construction works.

6.2.8 Soil Contamination

Impacts

349. During the project construction, spills of fuel, lubricants and chemicals can take place while transferring from one container to another or during refueling. Also, during maintenance of equipment and vehicles, through leakages from equipment and containers and as a result of traffic accidents.

350. Depending on the nature of the material, location of spill and quantity of spill, the soil can get contaminated.

Mitigation measures

351. It will be ensured that spill prevention trays are provided and used during refueling stations. Also, on-site maintenance of construction vehicles and equipment will be avoided as far as possible. In case on-site maintenance is unavoidable, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil.

352. Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities.

353. Fuels, lubricants and chemicals will be stored in covered bounded areas, underlain with impervious lining. Appropriate arrangements, including shovels, plastic bags and absorbent materials will be available near fuel and oil storage areas.

6.2.9 Drainage and Storm Water Run-off

Impacts

354. The storm water run-off from the construction site could carry oil and grease if the soil is contaminated or the potentially contaminated areas (oil and grease storage areas, maintenance areas and workshops) are in hydrological contact with the surrounding areas. Any risk may be eliminated by taking measures to avoid spillages and taking immediate remedial measures in case of accidental spillage of oil.

Mitigation measures

355. All unpaved exposed areas at the project sites will be compacted to minimize water erosion and all areas containing potentially hazardous materials will be hydrologically isolated from the remaining site.

356. It shall be ensured that natural drainage is not hampered or blocked in any way at any of the sites.

6.2.10 Hazardous and Non-Hazardous Waste Management

Impacts

357. In the absence of national or domestic regulations and a waste management system in the project area, waste disposal can potentially become a serious environmental issue, particularly with the local contractors. To avoid any potential issue, the project proponent will have to impose adequate internal controls.

Mitigation measures

358. A waste management plan will be developed prior to the start of construction. This plan will cater to sorting of hazardous and non-hazardous materials prior to disposal, placing of waste bins at the sites along the project corridor for waste disposal and an onsite hazardous waste storage facility.

359. Periodic on-site audits of waste management will be undertaken along with auditing of waste disposal contractors and disposal facilities on regular basis to check that procedures are being followed.

360. Records of all waste generated during the construction period will be maintained. Quantities of waste disposed, recycled or reused will be logged on a Waste Tracking Register.

361. Licensed waste contractors will be engaged to dispose off all non-hazardous waste material that cannot be recycled or reused.

362. Training will be provided to personnel for identification, segregation and management of waste.

6.2.11 Historical/Archaeological Sites

Impacts

363. There is only one historical site within the project area i.e. the Bala Hisar fort. While conducting the excavation activity next to the fort, a staff member from the department of Museum and Archaeology shall be present at all times.

Mitigation measures

364. If evidence of any archaeological remains is found during the construction activities, the excavation work will be stopped immediately and necessary next steps taken to identify the archaeological discovery based on the 'Chance Find' procedures provided as **Annexure O**.

6.2.12 Vegetation and Wildlife Loss

Impacts

365. The project consists of an urban built environment with minimal vegetation cover. However, during construction, any vegetation present on the median lane will be removed. All trees will be retained along the project corridor wherever possible since the removal of trees will result in the local ecosystem being changed.

366. The impact of project activities on the wildlife in the area is likely to be insignificant as the area has a long area of human occupation, to which most of the animal species have adapted over time.

Mitigation measures

367. Wherever trees have to be felled, mitigation will be required in the form of reinstatement and compensatory planting. Soft landscaping shall be installed in the median under the elevated sections to improve the appearance of the completed works.

368. In case existing trees and topsoil (down to 0.5 meters) is removed, the top soil shall be retained for elsewhere in the project. The wood that would be cut will not be burnt on site. All stumps and surplus vegetation shall be disposed of at landfills via routes or other destinations as designated and instructed by PDA focal points.

369. It will be ensured that willful killing; trapping and trade of faunal species will be strictly prohibited.

370. Tree plantation will be undertaken at the project site to compensate for the vegetation lost during construction in the minimum ratio of 3:1 i.e. 3 saplings to be planted for every tree felled given the possible difficulties with establishing trees and low survival rates of young trees.

371. Burning of vegetation as fuel will be prohibited.

6.2.13 Community Safety

Impacts

372. The proposed project will involve the use of considerable heavy machinery as well as excavation and erection of civil structures such as overhead bridges in congested environments of the project corridor. The risk to community will be significant in certain instances and thus a number of precautionary measures will be necessary to minimize the risk of a possible accident.

Mitigation measures

373. Buffer strips or other methods of physical separation around the project sites shall be ensured to protect the public from major hazards associated with hazardous materials incidents or failure of the structure being constructed. In addition, nuisance issues related to noise, odors or other emissions would also be avoided as a result.

374. Siting and safety engineering criteria shall be incorporated to prevent failures due to natural risks posed by earthquakes, wind, flooding, landslides and fire. To prevent such issues, project structures shall be designed in accordance with engineering and design criteria mandated by site specific risks, included but not limited to seismic activity, slope stability, wind loading etc.

375. Inventories of hazardous materials shall be reduced through inventory management to greatly reduce or eliminate the potential off-site consequences of a release.

376. Process or storage conditions shall be modified to reduce the potential consequences of an accidental off-site release.

377. Improving of shut down and secondary containment to reduce the amount of material escaping from containment and to reduce the release duration.

378. Reduce the probability that releases will occur through improved site operations and control, and through improvements in maintenance and inspection.

379. Reduce off-site impacts of releases through measures intended to contain explosions and fires, alert the public, provide for evacuation of surrounding areas,

establish safety zones around each work site, and ensure the provision of emergency medical services to the public.

380. Work areas outside the project site, especially where machinery is involved will be roped off and will be constantly monitored to ensure that local residents, particularly children stay away. Also, no machinery will be left unattended, particularly in running condition.

381. Community will be briefed on traffic safety, especially women who are the main care providers to children.

382. Speed limit of 20 km/hr will be maintained by all project related vehicles on the section of the roads and passages adjacent to the houses near the project boundary and nighttime driving of project vehicles will be limited where possible.

6.2.14 Employment Conflicts

Impacts

383. The proposed project is not likely to create any significant permanent job opportunities. Even unskilled and semi-skilled employment opportunities that are likely to be created will be for a short period while the project is constructed. As persons with relevant skills may be available locally within Peshawar, people from the project area are likely to fill a significant number of the semi-skilled and skilled jobs.

384. This issue of provision of jobs can become particularly problematic if it is perceived by the local population that a significant number of construction-related jobs opportunities are not given to people from the local community. This can result in friction between local residents and construction workers from outside of the community.

385. The understanding of 'local' needs to be clear as being residents of the project area (i.e. city of Peshawar and its suburbs). These Project Affected Persons (PAPs) will be given priority for construction jobs as long as they possess the minimum skills for such a job.

Mitigation measures

386. The Construction Contractor will adopt a transparent hiring policy. Prior to the commencement of the construction activity, the local communities in the project area will be informed of the employment policy in place and number of people that can be employed for this project.

387. It will be ensured that maximum number of unskilled and semi-skilled jobs will be provided to the residents of Peshawar and its suburbs.

388. PDA will ensure a balanced process of employment of the communities in the project area with preference given to those most directly affected by the project.

6.2.15 Communicable Diseases

Impacts

389. Communicable diseases such as HIV may be introduced due to the immigration of workers associated with the project.

Mitigation measures

390. A communicable diseases prevention program will be prepared for construction workers or residents near the construction sites.

6.2.16 Land Use and Aesthetics

Impacts

391. The proposed project will build on the existing road with a minor change in the land use pattern of the area. Aesthetic and visual impacts during the construction phase will be visible along the corridor and particularly in areas that are congested. However, the construction of the BRT stations will have a positive impact on the urban aesthetics and architectural beauty they will bring to the city's real estate line. The construction of BRT related infrastructure will add structural beauty and value to the city.

392. However, the erection of barrier walls along the track will have some displeasing effect on the overall aesthetics, which is unavoidable keeping in view safety requirements.

Mitigation measures

No mitigation measures required.

6.2.17 Utilities provision interruption

Impacts

393. The project will require demolishing and relocating some of the structures within the ROW such as water supply pipes, drainage structures, electric and communication cables. Temporary suspension of services (planned or accidental) can affect the economy, industries, businesses and residents' daily lives.

394. Based on the initial surveys conducted along the BRT corridor, there are approximately 197 electric poles within a 10-meter buffer on either side of the project corridor and approximately 78 telephone poles within this buffer.

395. The project infrastructure shall pass through the median of the existing roads along the proposed corridor, with minimal utility infrastructure, if any, located under these roads. Thus, minimal or no utility infrastructure shall be affected.

Mitigation measures

396. PDA, as the implementing agency, will be responsible for ensuring all permits and clearances are obtained prior to commencement of work at each section of the project corridor. In addition, PDA will ensure that detailed contingency plans are prepared prior to commencement of construction activities at specific areas of the corridor to mitigate any potential impacts resulting from outage of utilities.

397. Contractors will assess construction locations in advance for potential disruption to services and identify risks prior to starting construction. Any damage or hindrance/disadvantage to local businesses caused by the premature removal or insufficient replacement of public utilities is subject to full compensation, at the full liability of the contractor who caused the problem.

398. If temporary disruption is unavoidable, the contractor will, in collaboration with relevant local authorities such as power company, water supply company and communication company, develop a plan to minimize the disruption and communicate the dates and duration in advance to the affected persons.

399. Communities shall be informed in advance regarding storage of water when their utilities are about to be relocated to pave the way for road works. Also, water pipes located/crossing in the right of way (road reserve) may be moved slightly away from the road or provision of service duct may be considered.

400. Construction billboards, which include construction contents, schedule, responsible person and complaint phone number, will be erected at each construction site.

401. Also, for any specific sections along the corridor where either tunnels or elevated sections are to be developed and piling work will be involved, prior to construction at any such section(s), the relevant utility master plans shall be reviewed and the construction activity planned accordingly to ensure disturbance to existing utilities is minimized. Once the project enters the detailed design stage, these master plans shall be obtained from the concerned utility departments in order to plan the construction activity accordingly.

6.2.18 Natural and Man made Hazards

Impacts

402. Natural disasters include windstorms, floods, earthquakes which may be experienced during the construction phase. However, the likelihood of such events is quite low and the effect on the project in the case of an occurrence of such a natural calamity on the health and safety of the workers and affected population can be minimized by adopting appropriate and adequate mitigation measures.

403. Fire accidents and terrorist/sabotage activities are something that cannot be predicted or foreseen but can be prepared for by taking precautionary measures such as training of staff and acquiring extra safety and security measures.

Mitigation measures

No mitigation measures required.

6.3 Operation Phase

404. The introduction of modern BRT buses with low emissions coupled with removal of older buses from the traffic fleet is expected to deliver some reductions in ambient levels of noise and air pollution.

405. The impacts in the operation phase are critically important since the impacts in the operation phase of the project are 'long term'.

406. The summary of potential impacts during the Operation phase are provided in Table 6.4 below.

Table 6.4: Summary of Possible Impacts during Operation Phase

S/No.	Environmental Aspect	Potential Issue from Environmental Aspect	Potential of Impact	Mitigation Measures
1	Ambient Air Quality	Particulate and gaseous emissions from buses	No significant impacts with project related increment to baseline ambient quality within acceptable limits	No negative impacts. However, vehicle maintenance and emission controls to be conducted in the long term to protect air quality
2	Noise & Vibration	Noise resulting from movement of buses	No significant impact at the sensitive receptors along the project corridor. New generation of vehicles will generate less noise.	No negative impacts.
3	Water Quality	Oil/fuel and waste spills. Discharge of sewage. Discharge of contaminated storm water.	No significant adverse impacts expected. No wastewater discharge outside the premises to the nearby water source.	Wastewater treatment at depots will be installed to mitigate the impact.
4	Land contamination	Accidental fuel and material spills	No negative impact expected.	Proper waste management plan and spill response plan to be implemented
5	Ecology, Flora	Land use Change	No negative impact	-

	and Fauna			
8	Socio-economy	Increased job opportunities Improvement of infrastructure facilities Wider economic growth Reduced health risk and accidental hazards	Overall positive impact expected and socio-economic conditions of region can improve	Project sustainability must be ensured through regular and proper maintenance of infrastructure.
9	Traffic pattern	Improved roads without any obstruction	Positive impact	-

6.3.1 Air Quality

Impacts

407. There is strong evidence from different BRT projects implemented across the world to suggest that a significant improvement in air quality in the project area can be expected once the proposed project is operational. The concentrations of key pollutants such as CO, NOx, PM_{10} and $PM_{2.5}$ have been observed to be reduced significantly. This is attributed to a number of reasons such as reduced traffic congestion on the roads with a larger number of persons using the BRT and the avoidance of traffic jams ensuring the idling times for vehicles is significantly reduced. In addition, the replacing of new BRT buses with efficient engines replacing to some extent old and inefficient public and private vehicles is expected to be another major factor in improvement of the air quality in Peshawar once the project is operational.[8]

408. The project operation phase input parameters and assumptions used to develop the air emission simulation are provided in **Table 6.5** below.

409. The impact of operation of the BRT buses along the project corridor on the ambient air quality of the project area up to 1 km from the project route has been modeled using the internationally accepted simulation software 'BREEZE ROADS' which is a complete air dispersion modeling suite that includes CALINE4, CAL3QHC and CAL3QHCR models. These air dispersion models are used within the software program to predict air quality impacts of Carbon monoxide (CO), particulate matter (PM) and other inert pollutant concentrations from moving and idle motor vehicles at or alongside roadways and roadway intersections.

[8] Germa Bel and Maximilian Holst, 2015. 'Evaluation of the Impact of Bus Rapid Transit on Air Pollution'. Research Institute of Applied Economics.

Robert Cervero, 2013. 'BRT: An Efficient and Competitive Mode of Public Transport'. Institute of Urban and Regional Development.

410. BREEZE ROADS is used in conjunction with emissions data from MOBILE or other emission models to demonstrate compliance with NEQS and modeling for highway site and design selection.

411. It was assumed that the background concentrations and emission rate of each of the pollutants remained constant throughout the gridding domain (Northeast X 8246.42 m, Northeast Y; 4094.14 m) of the image map of the project site.

412. The model predicted the output on 1 hourly and 8 hourly-averaged concentrations of CO and 1 hourly and 24 hourly averaged concentrations for PM emissions. As part of the model input, the BRT segments that are 'at grade' were defined separately from the segments that are elevated.

413. The predicted concentrations output by the model are the 'Incremental Concentrations' from the project activities of the BRT operation. The 'Cumulative' concentrations are obtained by adding the ambient pollutant levels to the respective incremental levels (predicted by the model simulation as a result of the proposed BRT operation) for each pollutant.

The hourly surface meteorological data for 2015 obtained from the Peshawar International Airport was used in the modeling and the dominant wind was South-West and North East during the year.

414. The maximum concentration of CO was 204.016 ug/m^3 (0.204 mg/m^3) and 104.13 ug/m^3 (0.104 mg/m^3) for 1 hour and 8 hourly averaged respectively. The model estimated that the mean concentrations of 23.89 ug/m^3 and 13.176 ug/m^3 for 1 hour and 8 hourly are well within the limits of NEQS for CO. The isopleths (contour) plot for the concentrations for CO for 1 hour and 8 hourly basis are provided in **Figures 6.2** and **6.3** respectively.

415. The predicted 1 hour and 24 hourly averaged concentrations of PM were 6.272 ug/m^3 and 2.109 ug/m^3. There is an insignificant increase of PM concentrations in the atmosphere from the proposed project. However, since the ambient concentration of PM_{10} is already exceeding the NEQS limits of 150 ug/m^3 for the 24 hourly average, thus the cumulative concentration is also exceeding the NEQS limits. The isopleths for the concentrations for PM for 1 hour and 24 hourly basis are provided in **Figures 6.4** and **6.5** respectively.

416. The results of the model simulation are presented in **Tables 6.6** and **6.7** below. The sample model input file is provided as **Annexure H**.

Table 6.5: BREEZE Model Input Parameters & Assumptions

Model Input Parameters	Model Assumptions
Total corridor length: 30.8 km Elevated Section: 4 km Tunnel Section: 3.5 km Average distance between stations: 922 meters All buses will run on diesel fuel Each bus will stop at each station for approx. 120 seconds Buses will operate for 365 days a year Average bus speed will be 25 km/hr Wide station platform dimensions: 5 to 6 meters wide Multiple stopping bays (up to 4 buses can stop at same time) 107 buses per hour per direction Station exterior dimensions: 6500 mm Station interior dimensions: 5000 mm	Min. Wind Speed is at least 1 m/s

Table 6.6: Minimum and Maximum Predicted Concentrations of CO and PM

Pollutant Name	Predicted Incremental Concentration (ug/m^3)			
	1 hourly		24 hourly for PM and 8 hourly for CO	
	Minimum	Maximum	Minimum	Maximum
CO	6.652	204.016	3.518	104.13
PM_{10}	1.712	53.56	0.38	14.13

Table 6.7: Averaged Predicted Concentrations of CO and PM

Pollutants	Averaging Time	Predicted Concentration	Background* Concentration	Predicted Ambient Concentration	NEQS
CO (mg/m^3)	**1-hr**	0.024	-	-	10
	8-hrs	0.013	3.33	3.343	5
PM (ug/m^3)	**1-hr**	6.272	-	-	-
	24-hrs	2.109	167.6	169.709	150

* Ambient data collected through 24 hourly monitoring by M/s SGS

Mitigation measures

417. Regular maintenance of BRT buses shall be conducted and optimal engine efficiency shall be ensured through use of high quality fuel.

418. Regular monitoring will be conducted of the PM levels. Any sections along the BRT corridor where PM levels are found to be increasing shall be closely examined and potential sources of PM shall be identified and customized mitigation measures developed to reduce PM levels at that particular section of the BRT corridor.

419. Buses and all mechanical equipment such as generators shall undergo regular maintenance and shall be tuned to maintain engine efficiency and minimize emissions in compliance of NEQS limits.

420. Stack height of generators (if any) will be at least 3 meters above the ground.

Figure 6.2: Isopleths of CO (1st Highest) for 1 hourly averaged Concentrations

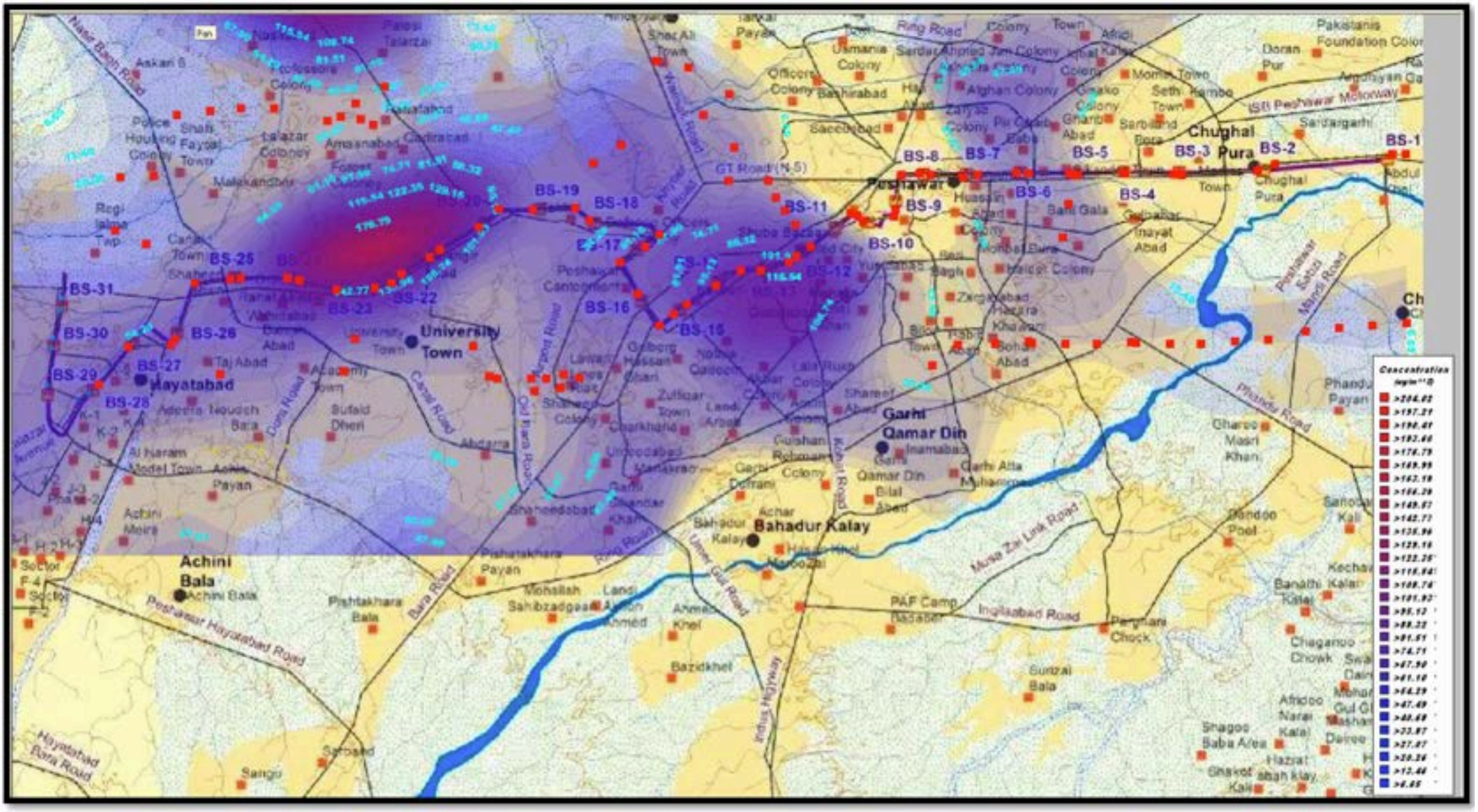


Figure 6.3: Isopleths of CO (1st Highest) for 8 hourly averaged Concentrations

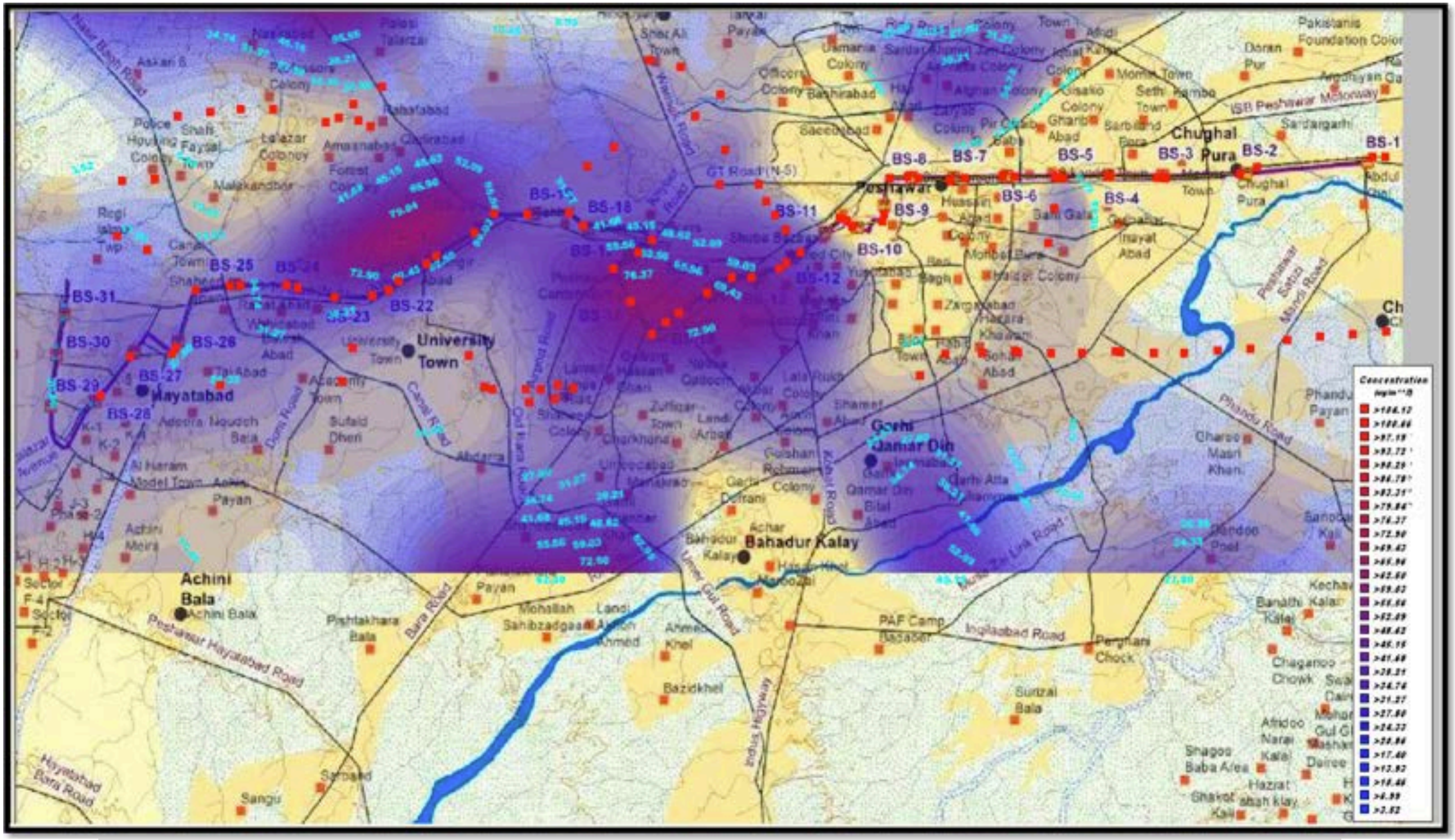


Figure 6.4: Isopleths of PM (1st Highest) for 1 hourly averaged Concentrations

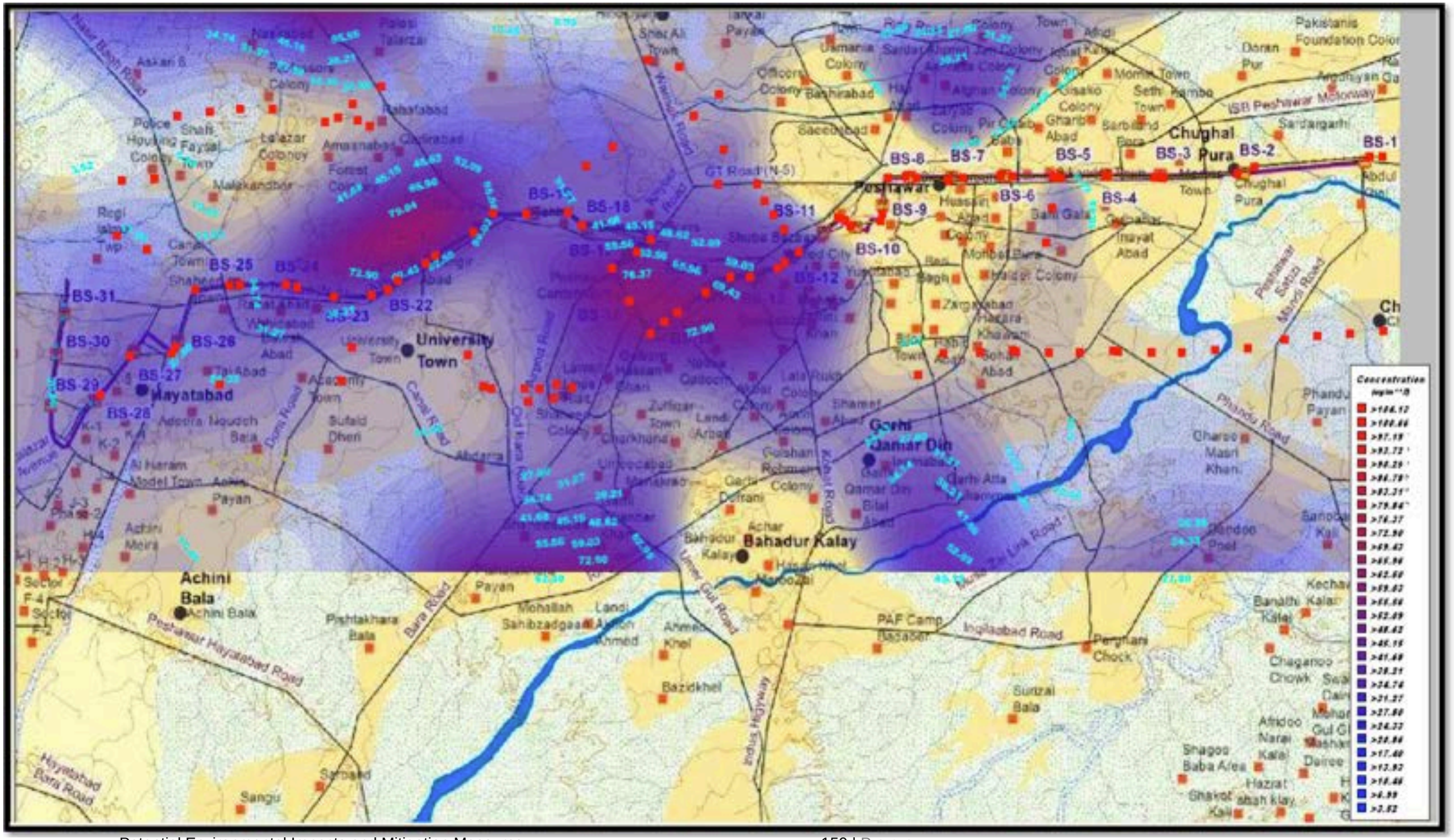
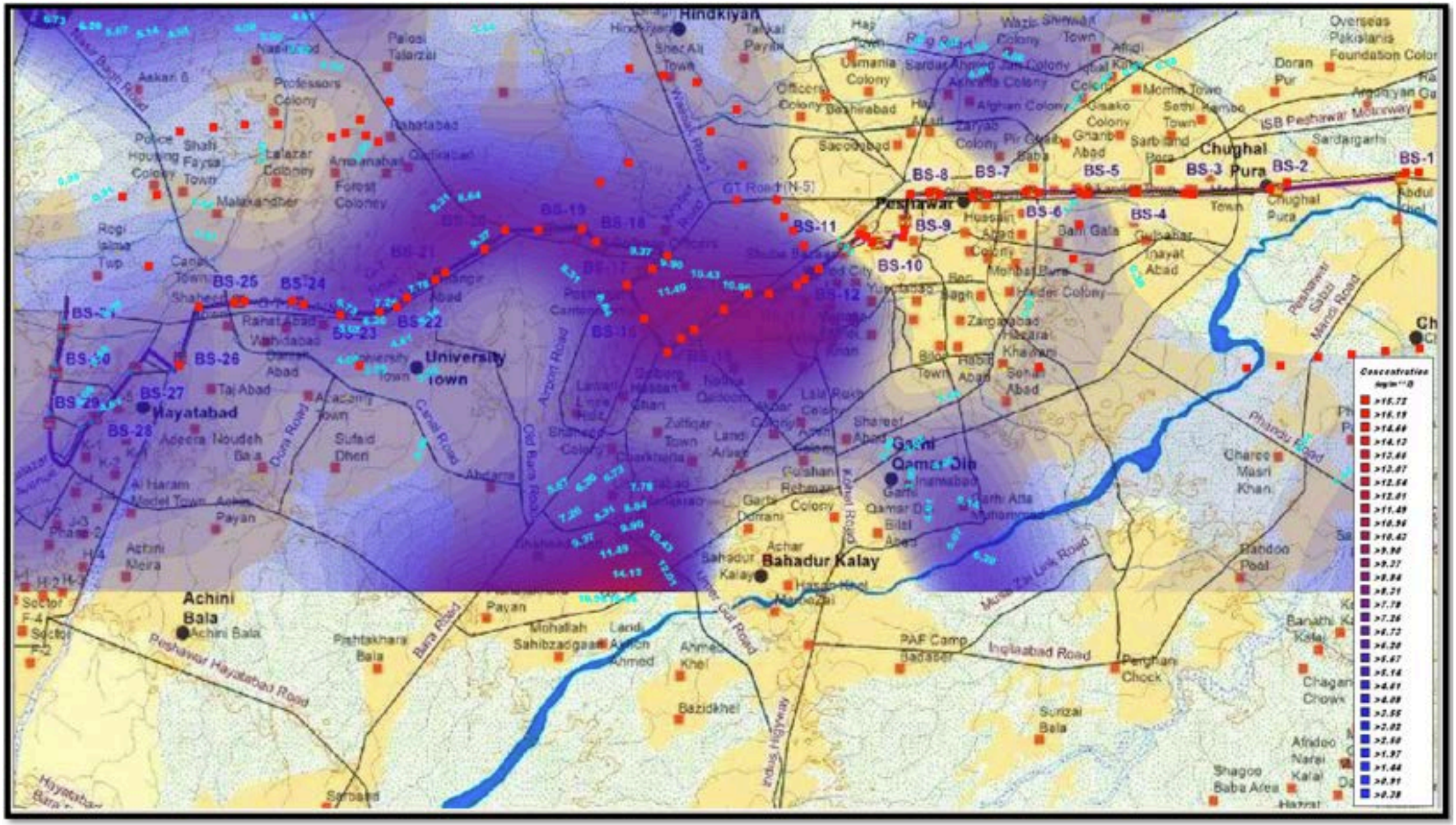


Figure 6.5: Isopleths of PM (1st Highest) for 24 hourly averaged Concentrations



6.3.2 Noise

Impacts

421. The proposed BRT project will result in a reduction in the overall traffic related noise levels since the total traffic volume is expected to decrease as the residents of Peshawar will prefer the BRT, which will offer a reliable and convenient commuting option.

422. The BRT buses will be new vehicles that shall be properly maintained and will follow strict operational protocols such as avoiding honking unless necessary and driving within a certain speed limit, which in turn will reduce the noise levels resulting from traffic movement.

423. Since the BRT buses will travel on a dedicated corridor, thus traffic congestion will be prevented and the noise resulting from honking that is experienced during traffic jams will also be prevented, which can particularly be an issue in the vicinity of sensitive receptors such as hospitals and schools.

424. The expected noise levels as a result of operation of the BRT buses has been calculated using the same model that has been used for predicting the noise levels during the construction phase of the proposed project.

425. The assumptions made while conducting the noise level projections are as follows:

- No noise abatement at source
- Minimal attenuation
- Each noise-generating source i.e. BRT bus, along the project corridor acts as one source
- Typical internationally accepted noise ratings for diesel public buses assumed

426. During the operational phase of the project, the maximum resultant noise levels at the BRT bus stops are expected to be around 80 dB(A) which is a conservative estimate since the new engines of the BRT buses will produce low noise levels and will be quite efficient. Also, the drivers of the BRT buses will not be blowing the horns and these buses will not be calling out loudly to attract customers to board the buses, which is a common practice for public transport in the city.

As a result, the actual noise levels will in fact be lower than the estimated 80 dB(A). The estimation of noise dispersion has been calculated using a standard mathematical model for sound wave propagation. These projected operational noise levels have been further corroborated based on multiple references of different international research and analytical studies to assess the noise levels generated from diesel based buses used in urban transport[9].

[9] FROST, M.W. and ISON, S.G., 2007. Comparison of noise impacts from urban transport. Proceedings of the Institution of Civil Engineers, Transport, 160(4),165-172.

427. The noise levels have been predicted from the center of the corridor up to 150 meters on either side of the project route. The isopleths (contours) of the noise levels obtained by modeling at the BRT bus stops are provided in **Figure 5.6** below. Also, the contours showing the noise levels at the receptors around each BRT station during the operation phase are provided in **Annexure D** as **Figures D-1 to D-31**.

428. It is observed from the isopleths that moderate noise levels (55 dB(A)) will be confined up to 50 meters from the center of the corridor. The noise levels at 115 meters from the center of the BRT corridor will be around 45 dB(A).

429. The sensitive receptors lying within the project area of the BRT corridor have been clearly marked and classified in the noise maps into specific 'to clearly present the specific noise zone applicable to them. Thus, all receptors have been categorized based on whether they lie in the 'Silence zone', 'Commercial zone', 'Industrial zone' or 'Residential zone' since the permissible day and night noise level thresholds vary for each zone.

430. Based on these noise maps, which contain the noise zones applicable for each sensitive receptor, any exceedances of noise levels from the permissible limits are clearly displayed. In any cases where such exceedances have been observed, it has been assessed that the utilization of measures such as placing of noise barriers at key receptor locations will result in noise attenuation and a resulting loss in noise levels by approximately 10 dB(A). As a result, the noise levels at all receptors shall be within the acceptable noise limits for each noise zone.

431. Since the noise levels get attenuated rapidly with the distance, thus the impact during the BRT operation phase will not be felt at the sensitive receptors along the project corridor.

Mitigation measures

432. In order to ensure attenuation of noise levels, noise barriers shall be provided at all flyovers or on elevated roads that pass through congested localities.

433. Also, BRT buses and all mechanical equipment shall be regularly maintained to ensure compliance with NEQS limits for noise.

434. Strict protocols for driving on the BRT corridor shall be followed and honking shall not be allowed and pre-set speed limits shall be followed.

6.3.3 Impacts on Water Resources

Wastewater Generation and Discharge

Impacts

Jason C.Ross and Harris Miller, 2007. A comparison of green and conventional diesel bus noise levels. NOISE-CON 2007, Reno, Nevada, USA., 4-5.

435. The operation of the BRT will not directly involve any discharge of effluents into the surrounding environment. However, wastewater will be generated from each depot and workshop area. The runoff from the depot may affect the water quality of the surface and ground water, if the drainage and collection system is not properly designed and fails to function.

436. Although the specific amount of water to be consumed is not known as yet, however the quality of the waste water is expected to be contaminated mostly with oil and grease and thus it is proposed that a proper wastewater collection and treatment facility should be set up at the depot.

Accidental Spill

437. The contamination of surface and ground water may be possible due to accidental spillage of oil, grease and diesel from the vehicles during the operation phase of the project. An efficient storm water drainage network along the BRT route will minimize the waterlogging.

Mitigation measures

438. Wastewater collection, conveyance and disposal system shall be installed at the depot and treatment will be carried out prior to disposal. Monitoring shall be carried out at specific locations for any possible incident of contamination and non-compliance to the NEQS.

439. Most of the storm water produced along the BRT route shall be channeled to a well laid out storm water network designed along both sides of the corridor and it will recharge the ground water 'recharge pit' through a sand filter.

440. Rainwater harvesting can help utilize the rainwater and prevent wastage by capturing the run-off.

6.3.4 Solid Waste disposal

Impacts

441. The operation of the BRT buses will result in domestic garbage being generated from stations and buses as well as from the depots and workshops consisting of dinner boxes, aluminium cans, plastic bottles, tissue paper/paper, newspapers, nutshells and food waste.

Mitigation measures

442. A proper solid waste management plan will be prepared and implemented to ensure waste containment, collection, transfer and disposal. Also, monitoring will be conducted at specific locations along the corridor and at the depots/workshops to ensure strict compliance with the EMMP in implementing the measures for solid waste management.

6.3.5 Biological Environment

Impacts

443. No significant impacts are expected to the biological environment from the operational phase of the project.

Mitigation measures

444. Since most of the existing green belts shall be demolished to develop the BRT corridor, thus extensive plantation and landscaping shall be conducted to mitigate any impacts.

445. Also, selection of the plant species shall be done on the basis of their adaptability to the existing geographical conditions and the vegetation composition of the region. Also, during the development of the green belt within the project corridor, emphasis shall be laid on selection of plant species such as nitrogen fixing species, species of very fast growth etc.

6.3.6 Adaptability of General Public to Driving Conditions

Impacts

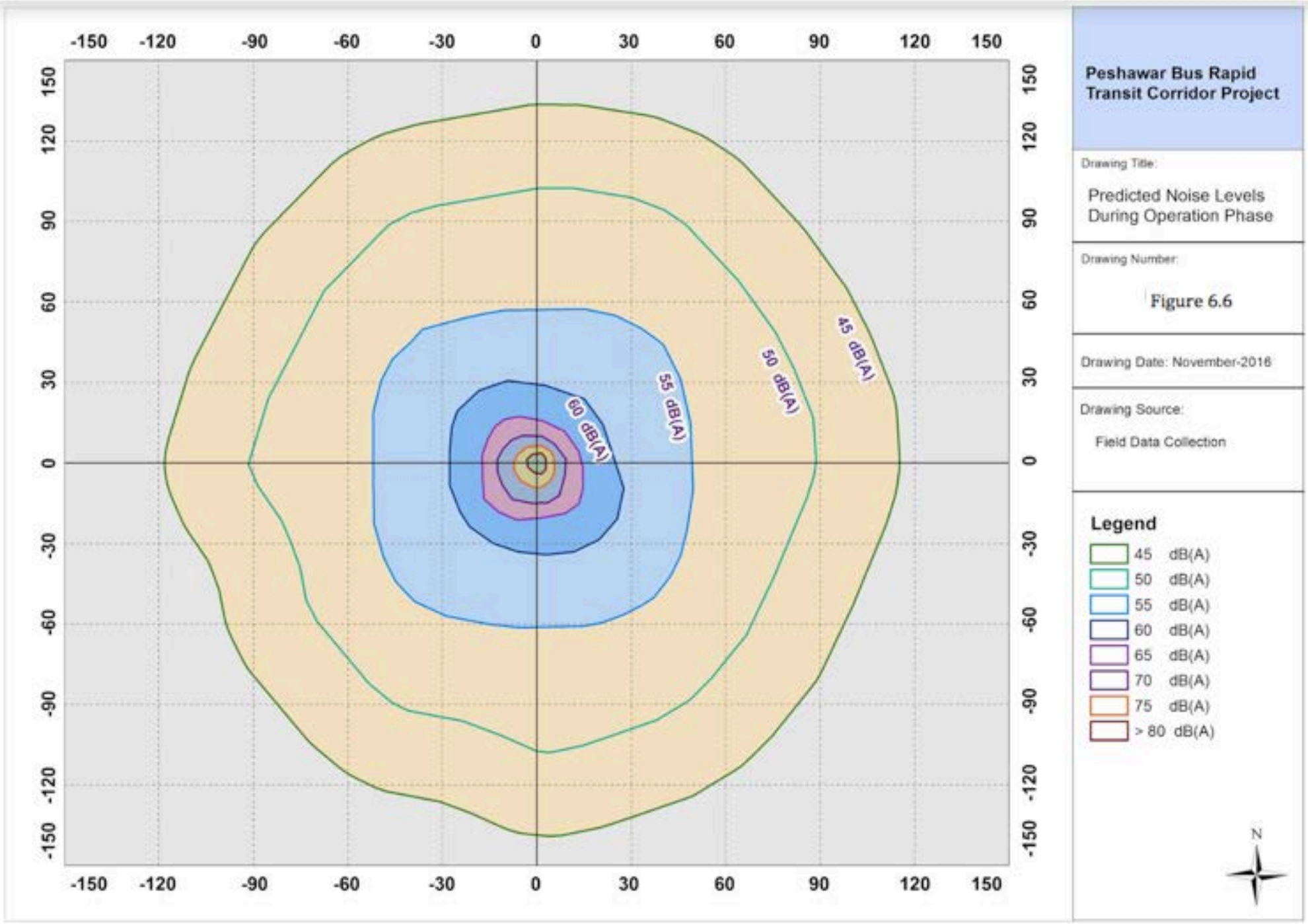
446. In general, the proposed BRT project will play a key role in reducing traffic volumes and resulting traffic congestion and basically improve the overall traffic landscape and make it safer and more efficient.

447. However, the road traffic carriageways will become narrower due to the space required for the BRT and the pillars to be constructed for the elevated sections of the BRT will pose a potential risk for collision of vehicles in instances where unfamiliar drivers would over speed.

Mitigation measures

448. Provisions will need to be made in the detailed designs for road conditions at the major intersections and the overall visibility at the intersections will need to meet the local design standards and will need to be acceptable under all the foreseeable conditions.

449. Improvements to sighting angles and improved junction warning signage and road markings may require inclusion at the detailed design stages. Flourescent signboards shall be used for the major junctions.


-150 -120 -90 -60 -30 0 30 60 90 120 150
150 120 90 60 30 0 -30 -60 -90 -120 -150
45 dB(A)
50 dB(A)
55 dB(A)
60 dB(A)
Peshawar Bus Rapid Transit Corridor Project
Drawing Title:
Predicted Noise Levels During Operation Phase
Drawing Number:
Figure 6.6
Drawing Date: November-2016
Drawing Source:
Field Data Collection
Legend
45 dB(A)
50 dB(A)
55 dB(A)
60 dB(A)
65 dB(A)
70 dB(A)
75 dB(A)
> 80 dB(A)
N

6.3.7 Accessibility for disabled people

Impacts

450. The proposed BRT project has been designed while paying particular attention to ensure the special needs of disabled persons are incorporated into the project design. In this regard, the following key aspects of the project design features shall cater to the special needs of disabled people that shall be using the BRT:

- Wide station platform (5 to 6 meter wide) and open air to allow good air circulation
- Fast and universal access to BRT station with all kind of access provided (stairs, elevator, escalator) and special gate to allow wheel chair to enter station
- Tactile ground surface indicator/paving for visually impaired users. For these passengers, the tile will guide them to the front door of each stopping bay. This is to make the driver aware if there are any visually impaired passengers boarding the bus, so that drivers can allow additional dwelling time for safety reasons.
- Lane separator with guard rail

451. The above mentioned project design features shall ensure that all disabled people with special needs will be able to use the proposed BRT project with complete ease, safety and peace of mind.

Mitigation measures

No mitigation measures required.

6.3.8 Socioeconomic

Impacts

452. The operational phase of the BRT project will contribute to the local economy by providing job opportunities to the residents of Peshawar. These benefits will increase the socio-economic status of the region and the overall impact will bring about a positive change.

Improvement of Infrastructure Facilities

453. The development of the proposed project will also create and improve the amenities/ services such as power, road infrastructure, communication etc. and thus improve the overall living conditions for the residents of Peshawar.

Economic Growth

454. The proposed project will increase the economic activities around the area, creating avenues for direct/indirect employment in the post project period.

455. A wider economic impact is expected in terms of generating opportunities for other businesses linked to the proposed project such as marketing, repair and maintenance tasks etc.

Improved Road Transportation

456. The existing roads will undergo lesser wear and tear since a considerable reduction in traffic volume will take place since commuters will prefer to travel on the BRT buses. As a result, the air quality, noise levels and general environmental conditions associated with vehicular traffic will improve and thus bring about positive change.

Reduced Health Risk and Accidental Hazards

457. The risk of accidental hazards will be minimized due to the reduced traffic volumes. The separate BRT lane will greatly reduce the accidents associated with movement across the roads. Health risks due to vehicular/exhaust emissions experienced in congested traffic conditions are likely to be avoided by the commuters traveling on the BRT.

Mitigation measures

No mitigation measures required.

6.3.9 Impact on Livelihood of existing transport workers

Impacts

458. The potential impact of the project development on the livelihoods of the existing transport workers has been an aspect of continuous focus for ADB and the TMTD and PDA. As a part of the preliminary design prepared for this project, this aspect was highlighted and a number of different possible scenarios were discussed to ensure there is minimal impact on the livelihoods of the existing transport workers.

Mitigation measures

459. The TMTD and PDA are presently in negotiation with the existing transport service providers to find a mutually agreeable modality that shall ensure the existing personnel engaged in the transport industry are absorbed in different capacities into the BRT project and their employment is not put at risk.

460. A comprehensive livelihood assessment study is presently being prepared and shall cover all aspects of the livelihood restoration plan for all project affected persons, including the existing transport workers to ensure their livelihood is not affected.

6.3.10 Labor Camps Operation and Location

Impacts

461. The location and operation of the labor camps can potentially have a significant impact on the receptors in the project area by causing nuisances such as disposal of untreated solid waste and liquid effluent, untreated sewerage as well as wastage of water and disruption to the privacy of the residents in the project area.

Mitigation measures

The following mitigation measures will be implemented:

(i) Identify location of work camps in consultation with local authorities. The location shall be subject to approval by the PDA. If possible, camps shall not be located near settlements or near drinking water supply intakes.

(ii) Cutting of trees shall be avoided and removal of vegetation shall be minimized.

(iii) Water and sanitary facilities (at least pit latrines) shall be provided for employees. Worker camp and latrine sites to be backfilled and marked upon vacation of the sites.

(iv) Solid waste and sewage shall be managed according to the national and local regulations. As a rule, solid waste must not be dumped, buried or burned at or near the project site, but shall be disposed off to the nearest sanitary landfill or site having complied with the necessary permission of local authority permission.

(v) The Contractor shall organize and maintain a waste separation, collection and transport system.

(vi) The Contractor shall document that all liquid and solid hazardous and non-hazardous waste are separated, collected and disposed of according to the given requirements and regulations.

(vii) At the conclusion of the project, all debris and waste shall be removed. All temporary structures, including office buildings, shelters and toilets shall be removed.

(viii) Exposed areas shall be planted with suitable vegetation.

(ix) PDA and Supervising Engineer shall inspect and report that the camp has been vacated and restored to pre-project conditions.

6.3.11 Disposal of Old buses

Impacts

462. The Peshawar public transport sector consists mostly of individual owners of vehicles i.e. one vehicle per owner, but there are a number of individuals who own several vehicles, while some vehicles have as many as three or four owners. The current fleet, although required by law to be no more than 10 years old, comprises almost exclusively of models from the 1980s and 1990s.

463. The TMTD and PDA are presently in negotiation with the existing transport service providers to find a mutually agreeable modality that shall ensure the existing personnel engaged in the transport industry are absorbed in different capacities into the BRT project and their employment is not put at risk.

464. Once the BRT project commences operation, a shifting of the existing dynamic of the public transport sector in Peshawar shall take place as follows:

- A certain proportion of the existing public transport service providers shall be employed by the BRT project and thus will sell their existing buses to any willing customers.

- Those service providers opting to continue with their transport businesses and not join the BRT project shall continue to operate their existing buses.

  The possibility exists that this latter group of transporters might choose to procure these buses that shall be up for sale in order to scale up their businesses. Otherwise, these buses will be sold to any willing customers, either in Peshawar or from other parts of the country.

465. Keeping in view the lack of financial support in terms of subsidies or other financial incentive schemes from the Government of Pakistan to the public transport sector, the general norm in the country is to continue using old buses as long as possible, irrespective of their age or the risk they might pose being on the roads.

466. It is expected that unless the TMTD and PDA launch a scheme for purchase of old buses from the public service providers once the BRT project comes into operation, majority of these old buses will continue to be used either in Peshawar or in other parts of the country. Thus, while the logistical landscape within the city of Peshawar and its outskirts is expected to considerably improve, however the decommissioning of the existing old buses will only be made possible through the introduction of a robust scheme aimed at decommissioning of old buses.

Mitigation measures

No mitigation measures required.

6.3.12 Climate Change Impacts

Impacts

467. The BRT buses for this project will run on diesel but will be new and will be properly maintained and thus will be highly fuel efficient and will produce much lower CO_2 emissions in comparison to the status quo of old and inefficient vehicles being used in the public transport sector. The existing vehicles produce a high level of CO_2 emissions and pollute the environment and adversely contribute towards climate change.

468. The GHG emissions have been computed by considering the existing vehicular landscape and corresponding CO_2 emissions based on the respective fuels being used and kilometers being driven by each category of vehicles, which forms the baseline for CO_2 emissions in Peshawar. The expected emissions from the new fleet of BRT buses have been computed based on emission factors for new vehicles and the difference between this fleet and the baseline landscape leads to the emission reductions in a particular year.

469. Since the ridership will increase over the next two decades, thus the CO_2 reductions are also expected to increase and will result in an overall positive impact. This is primarily due to a reduction in the overall traffic volume due to the availing of the efficient and economical BRT option for commuting on a daily basis.

470. The expected reductions in CO_2 emissions over the next two decades as a result of the proposed project are shown in **Table 6.8** below.

471. The CO_2 emission reductions are expected to double by the year 2026 in comparison to 2017 and the CO_2 reductions will have increased by over 2.5 times in the year 2036 in comparison to 2017.

472. Thus, the propose project is expected to have a significantly positive impact in contributing towards slowing down the effects of climate change and global warming.

Mitigation measures

No mitigation measures required.

Table 6.8: Greenhouse Gas (GHG) Emission Reductions from BRT Project Operation

Parameters	Base Year		
	2017	**2026**	**2036**
Ridership ('000)/day	472,911	627,910	860,389
Ton CO_2/km	1,486.54	1,486.54	1,486.54
Ton CO_2/daily passenger	0.13	0.13	0.13
CO_2 Reductions (tons)	**30,988**	**63,907**	**79,140**

6.4 'Site Specific' Impact Analysis

473. The impact analysis presented earlier in this Chapter covers potential construction and operation related impacts resulting from the proposed BRT project. This analysis is essentially the 'Environmental Code of Practice (ECoP)' in order to

address standard construction and operation related impacts, irrespective of any specific infrastructure development along the BRT corridor.

474. Keeping in view that certain environmentally critical infrastructure will be developed along the project corridor, a 'site' specific impact analysis has also been prepared to cover the different categories of major physical infrastructure as far as possible at this initial stage of the project development. This approach has been adopted since the different infrastructure components of the proposed project will results in construction and operation related impacts of varying severity.

Bus Depot

475. Please refer to **Section 3.5.1** of this report for details regarding the design and locations of the two depot locations identified for the proposed BRT project.

Construction Related Impacts

6.4.1 Soil Contamination/Hazardous Substances

Impacts

476. Potential contamination of groundwater may occur due to spills of fuel and other hazardous substances.

Mitigation measures

477. These impacts can be addressed through implementation of the following measures by the contractors:

(i) Before site works commence, a Spill Management Plan shall be prepared by the contractor and shall be approved by construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of procedures, responsibilities, resources, documentation and reporting requirements, training provisions for relevant staff, etc. to avoid spills of hazardous substances and to effectively respond to such incidents, in case these occur.

(ii) Store fuel and hazardous substances in paved areas with embankment. If spills or leaks do occur, undertake immediate clean up.

(iii) Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored and used.

(iv) Train relevant construction personnel in handling of fuels and spill control procedures.

(v) Ensure all storage containers are in good condition with proper labeling.

(vi) Regularly check containers for leakage and undertake necessary repair or replacement.

(vii) Store hazardous materials above flood level.

(viii) Equipment maintenance areas shall be provided with drainage leading to an oil water separator that will be regularly skimmed of oil and maintained to ensure efficiency. Discharge of oil contaminated water shall be prohibited.

(ix) Store waste oil, used lubricant and other hazardous wastes in tightly sealed containers to avoid contamination of soil and water resources. Transport and off-site disposal of such wastes shall be consistent with national and local regulations.

6.4.2 Surface Water

Impacts

478. There are no anticipated adverse impacts on surface water during construction of the depot(s) since there are no water bodies in close proximity to the proposed depot locations. Furthermore, the depot(s) will be equipped with a wastewater treatment facility to ensure that effluent discharge complies with applicable national standards.

Mitigation measures

No mitigation measures required.

6.4.3 Wastewater

Impacts

479. The construction of the Depot will require operation of a concrete batch plant/s (CBP).

Mitigation measures

480. To ensure that untreated wastewater from the CBP will not be discharged to the environment, the contractor will implement similar measures identified for the tunnel component.

6.4.4 Drainage

Impacts

481. Earthworks and other construction activities at the depot may cause alteration to drainage patterns in the area and could cause localized flooding.

Mitigation measures

482. The contractor shall implement the following mitigation measures to address such impacts:

(i) Avoid placement of construction materials, waste storage areas or equipment in or near drainage channels surrounding the Depot.

(ii) Prohibit disposal of waste materials to drainage channels.

(iii) In case existing drainage ditch is filled-up as required for the construction works, provide alternative drainage for rainwater.

(iv) Regularly inspect and maintain all drainage channels to keep these free of obstructions.

6.4.5 Air Quality

Impacts

483. Emissions from construction equipment and dust generation are short-term impacts that will be generated during construction of depot facilities. Emissions are not expected to create any significant concerns because of the size and openness of the proposed site(s). However, dust generation will result from transport of construction materials, grading the track area, construction of the internal road system and parking areas.

Mitigation measures

484. To reduce gaseous and dust emission during construction, the contractor shall implement the following measures:

(i) Before site works commence, a Dust Control Plan shall be prepared by the contractor and shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimize impacts to sensitive receptors (residential areas etc.) due to construction works; operation of concrete batch plants; sourcing, storage and transport of construction materials, and other project-related activities.

(ii) Wherever possible, use electrically powered equipment rather than gas or diesel-powered equipment.

(iii) Position any stationary emission sources (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors;

(iv) Use only vehicles and equipment that are registered and have necessary permits.

(v) Burning of wastes generated at the construction sites, work camps and other project-related activities shall be strictly prohibited.

(vi) Construction equipment and vehicles shall be well-maintained and shall meet NEQS emission standards.

(vii) Specify the use of clean fuels such as ultra-low sulphur diesel in dump trucks and other heavy-duty diesel vehicles and/or equipment, in conjunction with the use of particulate trap control devices, as well as catalytic converters, to avoid excessive diesel emissions.

(viii) Keep stockpiles moist and cover vehicles with tarpaulin sheets or other suitable materials to minimize dust emission and prevent spillage of materials (e.g., soil, cement, stone, sand, aggregates, etc.).

(ix) Provide temporary covers (e.g., tarpaulins, grass, etc.) on long term materials stockpiles.

(x) Concrete mixing areas at the Depot site shall be located at least 300 m from the nearest residential area.

(xi) Clean road surfaces of debris/spills from construction equipment and vehicles.

(xii) Install temporary fencing or barriers around particularly dusty activities in vicinity of sensitive receivers.

(xiii) Ensure availability of water trucks on site and if the works surface and access roads near sensitive receptors (i.e., residential areas, roadside tea and food stalls, and other sensitive receptors) are dry and dusty, spray water on the exposed surfaces to reduce dust emission.

(xiv) All construction equipment and machinery shall be fitted with emission control equipment in full compliance with the national regulations.

(xv) Fuel-efficient and well-maintained haulage trucks will be used to minimize exhaust emissions. Smoke belching vehicles and equipment shall not be allowed and shall be removed from the project.

(xvi) Impose speed limits on construction vehicles to minimize road dust in areas where sensitive receptors are located.

(xvii) Locations for stockpiling material at the depot area will be at least 100 m from the nearest residential sensitive receivers.

(xviii) Undertake immediate repairs of any malfunctioning construction vehicles and equipment.

(xix) Discourage idling of engines.

(xx) Provide prior notification to the community on schedule of construction activities.

(xxi) Implement community complaints hotline.

(xxii) Avoid site run-off of water or mud

(xxiii) Minimize drop heights

(xxiv) Use enclosed chutes and conveyors, and covered skips

(xxv) Use dust suppression for cutting and grinding operations

(xxvi) Handling procedures for bulk cement and other potentially dusty materials

6.4.6 Noise

Impacts

485. Permanent noise barriers are not required at the Depot. Once construction has ceased, the activities within the depot should result in ambient noise levels at existing community noise levels.

Mitigation measures

486. Mitigation measures to be implemented by contractors to reduce noise levels from construction works are listed below:

(i) Before site works commence, a Noise Control Plan shall be prepared by the contractor and shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimize impacts to sensitive receptors (residential areas, etc.) due to construction works, sourcing and transport of construction materials, and other project-related activities.

(ii) All construction equipment and vehicles shall be well maintained, regularly inspected for noise emissions, and shall be fitted with appropriate noise suppression equipment consistent with applicable national and local regulations.

(iii) Use only vehicles and equipment that are registered and have necessary permits.

(iv) No noisy construction-related activities near sensitive receptors (such as residential areas, etc.) will be carried out during the night. Such activities shall be restricted to daylight hours.

(v) Truck drivers and equipment operators shall minimize the use of horns.

(vi) Impose speed limits on construction vehicles to minimize noise emission along areas where sensitive receptors are located (houses, etc.).

(vii) Provide temporary noise barriers (3-5 meter high barrier can reduce 5-10 dB(A), as necessary, if depot works will generate high noise levels that could disturb nearby households and other sensitive receptors.

(viii) As much as possible, use quiet equipment and working method.

(ix) Whenever possible, completely enclose noisy equipment which can reduce noise level by 15-25 dB(A), restrict use of noisy equipment (e.g.15 min for every consecutive 30 min period) and undertake sequential operation of equipment with objective to reduce noise generated;

(x) Provide prior notification to the community on schedule of construction activities.

(xi) Implement community complaints hotline.

6.4.7 Solid Waste

Impacts

487. If not properly handled and disposed of, solid wastes poses health and safety hazards and are likely to cause nuisance to surrounding communities and the workforce.

Mitigation measures

488. In order to avoid such impacts, the contractor shall implement the following:

(i) Provide garbage bins and facilities within the project site for temporary storage of construction waste and domestic solid waste.

(ii) Separate solid waste into hazardous, non-hazardous and reusable waste streams and store temporarily on site in secure facilities with weatherproof flooring and roofing, security fencing and access control and drainage/ wastewater collection systems.

(iii) Ensure that wastes are not haphazardly dumped within the project site and adjacent areas.

(iv) Undertake regular collection and disposal of wastes to sites approved by local authorities.

6.4.8 Damage to Community Facilities

Impacts

489. Transport of materials, operation of construction equipment and various construction activities may damage community utilities.

Mitigation measures

490. The contractor shall implement the following measures to address this impact:

(i) The contractor shall immediately repair any damage caused by the Project to properties (e.g., houses, other types of structures, etc.), community facilities such as water supply, power supply, communication facilities etc.

(ii) Access roads damaged during transport of construction materials and other project-related activities shall be reinstated upon completion of construction works.

6.4.9 Traffic Concerns

Impacts

491. Construction activities may cause traffic congestion along access roads due to transport of materials and operation of other project-related vehicles.

Mitigation measures

492. In order to minimize traffic disturbance, the contractor shall undertake the following:

(i) Before site works commence, a Traffic Management Plan for the construction phase shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall be designed to ensure that traffic congestion due to construction activities and movement of construction vehicles, haulage trucks, and equipment is minimized. The plan shall be prepared in consultation with local traffic officials and people's committees at the district and commune levels. The plan shall identify traffic diversion and management, transport mode for spoils disposal (e.g., truck, truck and barge, etc.), traffic schedules, traffic arrangements showing all detours, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas.

(ii) Post traffic advisory signs (to minimize traffic build-up) in coordination with local authorities

(iii) As much as possible, schedule delivery of construction materials and equipment during non-peak hours.

(iv) Regularly monitor traffic conditions along access roads to ensure that project vehicles are not causing congestion.

6.4.10 Health and Safety of Workers and the Public

Impacts

493. The scope of activities for the proposed project consist of use of heavy machinery and civil structures being constructed at elevated heights along the proposed corridor in a highly urbanized and congested environment. The construction activities could result in a significant impact on the health and safety of the workers and public.

Mitigation measures

494. In order to` ensure health and safety of workers, the following measures shall be implemented by the Contractor:

(i) Prior to commencement of site works, the following plans, which have already been prepared and are appended in this report, shall be implemented by the contractor:

- **Occupational and Community Health and Safety Plan (refer to Annexure L)**. This Plan addresses health and safety hazards associated with construction activities (e.g., excavations, working at heights, electrocution, etc.), establishment and operation of construction/worker's camps, use of heavy equipment, transport of materials and other hazards associated with various construction activities.

- **Emergency Response Plan (refer to Annexure M)** to prevent, mitigate, respond to and recover from emergency events that could occur due to project activities such as accidents, spills of hazardous substances, fire, extreme weather events, and other crises.

(ii) Appoint an environment, health and safety manager to look after implementation of required environmental mitigation measures, and to ensure that health and safety precautions are strictly implemented for the protection of workers and the general public in the vicinity of construction areas.

(iii) Conduct orientation for construction workers regarding health and safety measures, emergency response in case of accidents, fire, etc., and prevention of HIV/AIDS and other related diseases.

(iv) Provide first aid facilities that are readily accessible by workers.

(v) Provide fire-fighting equipment at the work areas, as appropriate, and at construction camps.

(vi) Provide adequate drainage in workers camps to prevent water logging/accumulation of stagnant water and formation of breeding sites for mosquitoes.

(vii) Provide adequate housing for all workers at the construction camps.

(viii) Provide reliable supply of potable water.

(ix) Provide separate hygienic sanitation facilities/toilets and bathing areas with sufficient water supply for male and female workers.

(x) Ensure that all wastewater emanating from worker camps, construction camps and other project-related activities and facilities are treated consistent with national regulations.

(xi) Establish clean canteen/rest area.

(xii) Ensure proper collection and disposal of solid wastes within the construction camps consistent with local regulations.

(xiii) Provide fencing on all areas of excavation greater than 2 m deep.

(xiv) Provide appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, breathing mask, goggles, and ear protection.

(xv) Ensure reversing signals are installed on all construction vehicles.

(xvi) Implement precautions to ensure that objects (e.g., equipment, tool, debris, precast sections, etc.) do not fall onto or hit construction workers.

(xvii) Implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery or through an opening in a work surface. Based on a case specific basis, fall prevention/protection measures may include installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area, proper use of ladders and scaffolds by trained employees, use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard, fall protection devices such as full body harnesses, etc.

589. The following mitigation measures to ensure public safety shall be implemented by the contractor:

(i) Implement precautions to ensure that objects (e.g., equipment, tool, debris, precast sections, etc.) do not fall onto or hit people, vehicles and properties in adjoining areas.

(ii) Fencing of construction sites and regular patrols to restrict public access.

(iii) Prior to excavation work, provide fencing on all sides of areas to be excavated.

(iv) Provide warning signs at the periphery of the construction site.

(v) Strictly impose speed limits along residential areas and where other sensitive receptors are located.

(vi) Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances and other construction materials during transport.

6.4.11 Social Conflicts

Impacts

495. The presence of construction camps may cause conflict with the surrounding communities.

Mitigation measures

496. Any potential issues arising from social conflicts will be addressed by implementing the following mitigation measures:

(i) Consider the location of construction camps away from communities in order to avoid social conflict in using resources and basic amenities such as water supply.

(ii) Maximize number of local people employed in construction works.

(iii) Maximize goods and services sourced from local commercial enterprises.

6.4.12 Long Term Residual Effects

497. There are no long-term residual negative impacts predicted for the Depot site. There are only positive socio-economic benefits to the local community from the project.

Operation Related Impacts

6.4.13 Soil Contamination/Hazardous Substances

Impacts

498. A wastewater treatment should be constructed at the depot to ensure that relevant NEQS standards and requirements are met prior to recycling and discharge to the city drainage network. The treatment plant should be designed to remove pollution, debris and reuse of the water. Improper handling of hazardous substances at substations and other depot facilities are likely to cause adverse impacts.

Mitigation measures

499. The mitigation measures to be implemented to address potential impacts on water resources are as follows:

(i) Wastewater shall be treated at the depot's treatment plant to ensure that relevant NEQS standards and requirements are met.

(ii) In the vehicle washing, maintenance area and wheel lathe pits, drains shall be linked to the water treatment plant.

(iii) Drainage emanating from the depot workshops will be equipped with oil interceptors. Oil-drip pans shall be used where appropriate to avoid contamination of the environment.

(iv) Office buildings shall be provided with toilets and septic tanks or drain to sewers to handle domestic sewage.

(v) The sewer system will be designed to prevent leakage or overflow of waste water that could contaminate the surrounding areas.

(vi) All hazardous and potentially contaminating materials (chemicals, fuels, oils, etc.) and equipment that contain hazardous substances shall be stored in facilities with weatherproof flooring and roofing, security fencing and access control and drainage/wastewater collection systems.

(vii) PCB-containing equipment shall not be used.

(viii) Leaks shall be repaired immediately and waste oil shall be stored and disposed of consistent with applicable laws and regulations.

(ix) Diesel generators shall be placed on concrete floors with embankment.

(x) There shall be provisions for concrete-lined transformer bays as well as drainage and oil-water separator to handle spills, leaks and oily water run-off that could emanate from the transformers.

(xi) Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored and used.

(xii) A groundwater quality monitoring program shall be implemented to ensure that groundwater for domestic purposes are adequately treated to meet applicable NEQS standards (based on the monitoring results).

6.4.14 Air Quality

Impacts

500. To minimize odor generation, wastewater treatment facilities shall be properly maintained and solid wastes regularly removed from the depot area to disposal sites approved by local authorities.

Mitigation measures

501. Burning of waste materials shall be prohibited

502. Idling of vehicles will be minimized.

503. Back-up diesel generators will be used during power interruptions and shall be maintained regularly to ensure emissions comply with NEQS standards.

6.4.15 Noise

Impacts

504. Noise mitigation measures (e.g., enclosure) shall be provided for the back-up diesel generator(s) to ensure that high noise levels will not impact on surrounding sensitive receptors. While the noise levels are not expected to cause nuisance to the local community, noise monitoring will continue during the operation to determine and

provide noise abatement measures, if necessary. Noise sampling shall also be conducted in response to complaints.

Mitigation measures

No measures required.

6.4.16 Solid Waste

Impacts

505. The maintenance works as well as workers/employees at the Depot offices will generate solid wastes.

Mitigation measures

506. The proposed mitigation measures are as follows:

(i) Offices, workshops and other areas within the depot shall be provided with waste collection bins or receptacles.

(ii) Solid wastes shall be segregated into hazardous, non-hazardous and reusable waste streams and stored temporarily on site in secure facilities with weatherproof flooring and roofing, security fencing and access control and drainage/wastewater collection systems.

(iii) Garbage shall be regularly collected and shall be disposed consistent with local regulations.

(iv) Wastes shall only be disposed of in approved sites by local authorities.

6.4.17 Health and Safety of Workers and the Public

Mitigation measures

507. In order to protect the health and safety of workers and general public during depot operations, the following measures shall be implemented:

(i) Prior to operation of the depot, PDA shall ensure that the following plans have been developed and adequately resourced. PDA shall ensure that plan provisions are strictly implemented throughout operation phase:

- Occupational Health and Safety Plan for all components of depot operation and train staff in the implementation of such plan.
- Emergency Response Plan (e.g., in case of fire, extreme weather events, floods, power outage, equipment breakdown, accidents, spills of hazardous substances, etc.) covering all components of depot operation and train staff in the implementation of such plan.

(ii) The depot site will be fenced and access will be restricted to authorized personnel to avoid safety risks to the public.

Elevated Sections

508. The elevated sections of the BRT will be a total of 4.1 km long and will be located between BS-10 to BS-14, BS-25 to BS-27 and between BS-28 and BS-29. The BRT elevated section will commence at Cinema road where it shall become elevated to bypass the junction with Hospital road. It shall stay elevated on Khyber Bazaar road and Railway road, and pass the Soekarno and Suba Chowk, the two most congested intersections in the Khyber Bazaar area. After the railway road, the elevated BRT section will turn right at Anwar Saeed medical center to cross the railway station, where a BRT only bridge will be constructed. After crossing the railway station, the BRT shall become at-grade again and join Saddar road.

The corridor shall again become elevated at Jamrud road while passing above a dried up river bank before the Bab-e-Peshawar Marco Polo bridge until it joins the Habib Jalib road towards Tatara Park and joins the Ring road.

Construction Related Impacts

6.4.18 Disruption to Community Utilities

Impacts

509. Utility relocation on this section poses only a limited or short-term concern to residents in the area.

Mitigation measures

510. In order to minimize any potential impacts, the contractor shall implement the following measures:

i) Water supply pipelines, power supply, communication lines and other utilities shall be re-provisioned before construction works commence.

ii) Provisions shall be made to preserve the operation of current facilities in sufficient quantity and in agreement with the local community.

iii) Re-provisioning shall be undertaken in coordination with the utility company.

iv) Affected households and establishments shall be notified well in advance of such disruption.

6.4.19 Spoils Generation

Impacts

511. Construction of the pillars will require removing at least 5 m x 5 m area of the median and asphalt in the roadway. At each pillar site, soil removal to -2 m depth

within the 5 m x 5 m area will be required to carry out pile driving and construction of the pillar footing/cap. Although the quantity of soil removal for the pillar section is small, the contractor should ensure the measures provided below.

Mitigation measures

(i) Meet the same measures as prescribed for the underground/ tunnel spoils under the Spoils Disposal Plan.

(ii) All asphalt and sidewalk materials removed should be separated and recycled.

(iii) Spoil disposal will only be to pre-approved areas.

(iv) The capacity of disposal sites shall be adequate to accept the quantity of spoils without alienating areas outside the site boundaries.

(v) Disposal of contaminated spoils shall only be to disposal sites equipped and licensed to handle such wastes.

(vi) Trucks transporting spoils shall be tightly covered with tarpaulin or other suitable materials to minimize dust emission and spills.

(vii) Load-out areas shall be cleaned and watered to ensure no accumulated dust originates that could be dispersed to surrounding areas.

(viii) Wheel washing shall be undertaken to remove mud so as to ensure that access roads are kept clean.

(ix) Road surfaces shall be regularly cleaned of spilled spoils;

(x) Spoil disposal shall not cause sedimentation and obstruction of flow of watercourses, damage to agricultural land and densely vegetated areas.

6.4.20 Wastewater

512. Wastewater will be generated from operation of concrete batch plant/s (CBP) for the pillar construction. To ensure that untreated wastewater from the CBP will not be discharged to the environment, the contractor will implement similar measures identified for the tunnel and station components.

6.4.21 Drainage/Flooding

Impacts

513. Earthworks along the elevated sections may cause clogging of drainage and result in localized flooding.

Mitigation measures

514. The contractor shall implement the following mitigation measures to address these impacts:

(i) Placement of construction materials, excavated spoils and equipment shall not block flow of rainwater into canals/drainage structures.

(ii) Prohibit disposal of waste materials to drainage channels.

(iii) Regularly inspect and maintain all drainage channels in the vicinity of construction sites to keep these free from obstructions.

6.4.22 Air Quality

Impacts

515. During the construction phase, the potential exists for short-term negative air quality impacts along the corridor. The two major sources of emissions from construction are: dust emissions from non-combustion sources and exhaust emissions from construction vehicles and stationary combustion sources. Although the potential for localized air quality impacts of these activities may be significant, it is important to note that they will be temporary and localized.

516. On the pillars section, there should be minimum dust generated. Only construction of the pile-cap for the pillars will involve the removal of approximately 5 m x 5 m of soil = 50 m^3. This can be carried in one to ten truck loads and the dust should be contained.

517. It will be the cranes lifting the pre-cast sections of the pier and the viaduct that will cause emissions. Obviously these emissions will add cumulatively to the existing high levels of TSP, SO_2 and NOx.

Mitigation measures

518. Best management practices shall be adopted during construction to minimize dust and combustion exhaust emissions are the same as those that apply for the underground project corridor construction.

6.4.23 Noise

Impacts

519. Pile driving for the pillar piles will be carried out using a churn-drill. This is a much quieter machine than a diesel hammer driver and should significantly reduce noise levels to receivers in the community. Also, one column can be erected in one day, thereby reducing any prolonged noise at sensitive receivers along the alignment.

520. Construction activity and operation of cranes during construction of elevated stations will create an increase in noise levels to receivers in the area, combined with

existing traffic noise; the levels may be extreme, well over 80 dBA for short periods of construction.

521. Every opportunity should be taken to make use of natural features on the edge of the right-of-way or at the property line of the affected property to reduce noise impacts. Use of dedicated noise barriers such as barrier fences, or retaining walls should be considered during the detailed design stage, where warranted.

Mitigation measures

522. The following measures to attenuate noise shall be implemented by the contractor:

(i) Before site works commence, a Noise Control Plan shall be prepared by the contractor and shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimize impacts to sensitive receptors (residential areas, etc.) due to construction works, sourcing and transport of construction materials, and other project-related activities.

(ii) Unobtrusive noise barriers near sensitive areas such as residential areas, etc. can also be placed on the edge of the right-of-way should construction monitoring indicate an impact to sensitive receivers. Temporary noise barriers (3-5 meter high) can reduce noise level by 5-10 dB(A).

(iii) Diesel hammer piling shall be limited in favor of drill piling.

(iv) Truck drivers and equipment operators shall minimize the use of horns.

(v) Position any stationary equipment that produce high noise levels (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors;

(vi) All construction equipment and vehicles shall be well maintained, regularly inspected for noise emissions, and shall be fitted with appropriate noise suppression equipment consistent with applicable national and local regulations.

(vii) Use only vehicles and equipment that are registered and have necessary permits.

(viii) No noisy construction-related activities will be carried out during the night near sensitive receptors (e.g., residential areas). Such activities shall be restricted to daylight hours.

(ix) Impose speed limits on construction vehicles to minimize noise emission along areas where sensitive receptors are located (residential areas, etc.).

(x) As much as possible, use quiet equipment and working method.

(xi) Whenever possible, completely enclose noisy equipment which can reduce noise level by 15-25 dB(A), restrict use of noisy equipment (e.g.15 min for every consecutive 30 min period) and undertake sequential operation of equipment with objective to reduce noise generated;

(xii) Provide prior notification to the community on schedule of construction activities.

(xiii) Implement community complaints hotline.

6.4.24 Vibration

Impacts

523. Vibration generated during construction and operation has the potential to cause amenity and physical (structural) impacts at receivers. Installation of the pillar columns will generate intermittent vibration, which is defined as interrupted periods of impulsive vibration (e.g. pile driving, excavation).

524. Equipment working on the viaduct will be cranes and pile drivers. At each column site, four 1000 mm piles of +50m are required to anchor the columns. Piles can either be driven or churned drilled. Driving H piles with a diesel hammer is exceedingly noisy and creates significant levels of vibration to the surrounding area. However, churned drilled piles are significantly quieter and causes lower vibrations. Tracked cranes will be used to lift pre-cast sections of the columns and will cause some vibration.

Mitigation measures

525. The selection of a churned drill pile method will significantly reduce noise and vibration to the community along the route.

526. Since construction will be staggered, so at different stages of erection, noise and vibration will be intermittent and therefore less of an annoyance to residents along the route. Equipment will also not be operating at night and monitoring at sensitive receiver sites will be carried out.

6.4.25 Use of Hazardous Substances

Impacts

527. Potential contamination of surrounding areas and groundwater may occur due to spills of fuel and other hazardous substances.

Mitigation measures

528. Any potential impacts will be addressed through implementation of the following measures by the contractors:

(i) Before site works commence, a Spill Management Plan shall be prepared by the contractor and shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of procedures, responsibilities, resources, documentation and reporting requirements, training provisions for relevant staff, etc. to avoid spills of hazardous substances and to effectively respond to such incidents, in case these occur.

(ii) Store fuel and hazardous substances in paved areas with embankment. If spills or leaks do occur, undertake immediate clean up.

(iii) Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored and used.

(iv) Train relevant construction personnel in handling of fuels and spill control procedures.

(v) Ensure all storage containers are in good condition with proper labeling.

(vi) Regularly check containers for leakage and undertake necessary repair or replacement.

(vii) Store hazardous materials above flood level.

(viii) Equipment maintenance areas shall be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency. Discharge of oil contaminated water shall be prohibited.

(ix) Store waste oil, used lubricant and other hazardous wastes in tightly sealed containers to avoid contamination of soil and water resources. Transport and off-site disposal of such wastes shall be consistent with national and local regulations.

6.4.26 Solid Waste

529. Please refer to Section 6.4.7.

6.4.27 Damage to Community Facilities

530. Please refer to Section 6.4.8.

6.4.28 Health and Safety of Workers and the Public

531. Please refer to Section 6.4.10.

6.4.29 Traffic Concerns

Impacts

532. The pillar construction will occur in the median of the existing roads along the BRT corridor. Excavation and cranes will require a working easement that will

reduce the current lanes of traffic. This will cause traffic jams and time delays to the road users.

533. The duration of this impact, however, will be short. It will likely take about 5-7 days to excavate, pile and pour the pile cap. This operation will be the most intensive activity and occurring at different sections along the alignment. The erection of the pillars is expected to take one day per section. In order to avoid traffic congestion and problems, the erection will occur at night. The movement of equipment along the alignment will reduce the length and degree of disturbance and annoyance to local residents.

Mitigation measures

534. The following measures shall be implemented by the contractor to address impacts to traffic flows and access to properties:

(i) Before site works commence, a Traffic Management Plan for the construction phase shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall be designed to ensure that traffic congestion due to construction activities and movement of construction vehicles, haulage trucks, and equipment is minimized.

The plan shall be prepared in consultation with local traffic officials and people's committees at the district and commune levels. The plan shall identify traffic diversion and management, transport mode for spoils disposal (e.g., trucks etc.), define routes for construction traffic from materials storage/parking areas to construction site and from construction site to waste disposal locations, traffic schedules, traffic arrangements showing all detours/lane diversions, modifications to signaling at intersections, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas.

(ii) Provide signs advising road users that construction is in progress and that the road narrows to one lane using cones.

(iii) Employ flag persons to control traffic at the work sites for safety reasons when construction equipment is entering or leaving the work area.

(iv) Lanes shall be created through the work site using rope or flagging to minimize risks and injuries from falling objects.

(v) As much as possible, lifting and placing of the pre-cast pillar sections will be done at night to minimize traffic congestion.

(vi) Post traffic advisory signs (to minimize traffic build-up) in coordination with local authorities.

(vii) Provide road signs indicating the lane is closed 500 m before the worksite.

(viii) Use traffic cones to direct traffic to move to the open lane.

(ix) Provide sufficient lighting at night within and in the vicinity of construction sites.

(x) Regularly monitor traffic conditions along access roads to ensure that project vehicles are not causing congestion.

(xi) Define and observe schedules for different types of construction traffic trips (e.g., transport of pre-cast sections, haulage of spoils, delivery of construction materials, etc.).

(xii) As much as possible, schedule delivery of construction materials and equipment as well as transport of spoils during non-peak hours.

(xiii) Avoid movements of noisy vehicles during night time in vicinity of sensitive receivers.

(xiv) Implement suitable safety measures to minimize risk of adverse interactions between construction works and traffic flows through provision of temporary signals or flag controls, adequate lighting, fencing, signage and road diversions.

(xv) Ensure relocation of any affected public transport infrastructure (but stops, shelters etc.) prior to commencement of works

(xvi) Provide advance notification to the community regarding changes to public transport facilities or routes.

(xvii) Schedule construction works to minimize extent of activity along linear construction site at any one time.

(xviii) Comply with traffic regulations and avoid, where possible, roads with the highest traffic volumes, high density of sensitive receivers or capacity constraints are not used as access to and from the construction areas and spoils disposal sites.

(xix) Install temporary accesses to properties affected by disruption to their permanent accesses.

(xx) Reinstate good quality permanent accesses following completion of construction.

6.4.30 Social Conflicts

535. Please refer to Section 6.4.11.

Operation Related Impacts

6.4.31 Wastewater

536. There are no expected impacts due to project design. Drainage from the pillars will be carried through pipes and drain internally to the city storm water system. The

elevated station shall be provided with toilets and septic tanks to handle sewage generated by workers and passengers.

6.4.32 Health and Safety of Workers and the Public

537. Please refer to Section 6.4.17.

6.4.33 Solid Waste

Impacts

538. The operation of elevated stations will generate solid wastes from workers/employees and passengers.

Mitigation measures

539. The proposed mitigation measures are as follows:

(i) Waste collection bins or receptacles shall be provided in various areas at the elevated stations, such as offices and areas accessed by passengers.

(ii) Garbage shall be regularly collected and shall be disposed consistent with local regulations.

Tunnels & Underground Sections

540. Based on the preliminary design for the proposed project, there will be two tunnels/underground sections along the project corridor with a total length of 3.5 km, namely between BS-8 and BS-9 and between BS-17 and BS-18. The first tunnel connects both approaches of the GT road, Malik Saad Shaheed road and Cinema road. The second tunnel will be 'BRT only' and will cross Amman Chowk.

Construction Related Impacts

6.4.34 Disruption to Community Utilities

541. Please refer to Section 6.4.19.

6.4.35 Spoils Generation

Mitigation measures

542. The following measures shall be implemented by the contractor to minimize impacts due to spoils generation:

(i) Before site works commence, a Spoils Disposal Plan (SDP) shall be prepared by the contractor. The plan shall be reviewed by CSC and forwarded to ADB for approval. The plan shall present off-site re-use (if suitable) of excavation spoils and corresponding volume, identification of suitable temporary and final disposal location/facility and corresponding capacity, designation of suitable transport routes

and schedule for spoil truck movements to minimize traffic disruption/congestion, and environmental mitigation measures to address impacts due to transport and disposal of spoils.

The SDP shall include maps and layout plan of the disposal site(s) identifying where protection measures are required such as slope stabilization measures, silt fencing, ditching, dust control, cross drains, measures to avoid flooding in surrounding areas, etc. The SDP shall specify spoils dewatering procedures (and facilities), as necessary, and shall describe in detail the mitigation measures to be implemented to ensure that resulting wastewater from spoils dewatering is adequately treated and disposed of to meet applicable NEQS standards and requirements.

Provisions for random testing of spoils shall be specified in the SDP to determine contamination levels (e.g., hydrocarbons, heavy metals) based on NEQS standards and corresponding treatment measures to meet standards and avoid pollution.

(ii) All asphalt and sidewalk materials removed should be separated and recycled.

(iii) Spoil disposal will only be to PDA approved areas.

(iv) The capacity of disposal sites shall be adequate to accept the quantity of spoils without alienating areas outside the site boundaries.

(v) Undertake random sampling of spoils from underground station excavations and tunneling to determine presence of contaminants. If levels of contaminants exceed standards, excavation spoils shall be considered as hazardous wastes consistent with applicable standards/guidelines and shall be treated and disposed of as such.

(vi) Disposal of contaminated/hazardous spoils shall only be to disposal sites equipped and licensed to handle such wastes.

(vii) Determine water content of spoils to ascertain if spoils dewatering is necessary.

(viii) Undertake necessary spoils dewatering and provide adequate treatment facilities to ensure that resulting wastewater meets NEQS standards. Adequate treatment should also be undertaken for groundwater drained from the excavated areas to ensure compliance with NEQS standards.

(ix) Stockpiling of spoils shall not be undertaken due to the limited footprint of the construction site. Spoils shall be trucked away immediately to approved temporary or final disposal sites.

(x) Should any small stockpiles be developed, these shall be covered by plastic sheeting.

(xi) Trucks transporting spoils shall be tightly covered with tarpaulin or other suitable materials to minimize dust emission and spills. Wet spoils shall be transported using covered water-tight trucks to avoid spillage and drips onto access roads.

(xii) Load-out areas shall be cleaned and watered to ensure no accumulated dust originates that could be dispersed to surrounding areas.

(xiii) Wheel washing shall be undertaken to remove mud so as to ensure that access roads are kept clean.

(xiv) Road surfaces shall be regularly cleaned of spilled spoils.

(xv) Spoil disposal shall not cause sedimentation and obstruction of flow to agricultural land, properties, and densely vegetated areas.

6.4.36 Land Subsidence/Geotechnical Hazards

Impacts

543. Land subsidence along the underground section will have a direct impact on the construction site. Settlement caused by tunneling, deep excavation, and dewatering will occur during the construction stage, even with mitigation measures.

Mitigation measures

544. To avoid excessive settlement that could damage the nearby buildings, the following measures will be implemented by the contractor:

(i) Undertake detailed geological investigation to determine geotechnical hazards along the Project's impact zone. Implement suitable precautionary and protection measures to avoid or minimize hazards.

(ii) Select the best construction methods for retaining wall to ensure the stability of the deep excavation.

(i) Implement a survey program to monitor the background subsidence rate along the project alignment. The monitoring data shall be used to assess potential damage that the observed subsidence may cause to buildings under or alongside the tunnels and to estimate the cumulative amount of regional subsidence during the construction stage.

(ii) As part of the survey program, take photographs of each individual structure within the possible affected zone before the construction starts, to be used for assessing potential damage due to subsidence.

(iii) Conduct careful monitoring of the groundwater level, amount of settlement, tilt of buildings, and any building damages.

(iv) Depending on the results of subsidence monitoring program, develop and implement suitable mitigation measures to avoid or minimize damage to properties.

(v) Establish an emergency action plan for geotechnical hazards including a set of criteria for issuing warnings for such hazards.

(vi) If necessary; carefully design, implement and monitor an appropriate dewatering program.

(vii) Perform probe drilling ahead of the TBM cutting surface at places where abrupt change of geological properties occur since such areas tend to have a higher risk of failure. Based on the results of probe drilling, implement appropriate precautionary measures.

(viii) Undertake ground treatment underneath the deep excavation site if required.

(ix) Although there are no internationally adopted standards for settlement, the parameters below are based on normal practice. The tunnel boring machine (TBM) contractor shall be required to operate within the following settlement parameters:

- Standard building: maximum settlement: 25 mm, maximum differential settlement: 11500 (this indicator is more important for damage), maximum upheaval: 10 mm
- Particularly sensitive building to be identified: maximum settlement: 20 mm; maximum differential settlement: 11600, maximum upheaval: 10 mm
- Street and pavement: maximum settlement: 30 mm, maximum differential settlement: 11400, maximum upheaval: 10 mm. Select the best tunneling methods to minimize possible settlement during construction.

6.4.37 Flooding

Impacts

545. The contractor will be required to prepare a spoils disposal plan, which will include, among others, installation of adequate drainage facilities and flood prevention measures.

546. To prevent flush of soil into the channel during flood events, a retaining wall along the boundary is recommended.

Mitigation measures

547. During construction, the following measures shall be implemented by the contractor to avoid clogging of drainage and creating localized flooding:

(i) Placement of construction materials, excavated spoils, equipment shall not block flow of rainwater into canals/drainage structures.

(ii) Prohibit disposal of waste materials to drainage channels.

(iii) Regularly inspect and maintain all drainage channels in the vicinity of construction sites to keep these free from obstructions.

(iv) Construct retaining walls along the spoils disposal boundary bordering the channels to prevent spoils from being flushed into the water courses during heavy rains and flood events.

(v) At the disposal site, avoid formation of steep slopes to avoid soil materials from being eroded/washed out during rains and floods.

6.4.38 Surface water

Impacts

548. No surface water bodies occur within the tunnel section. No impacts are anticipated.

Mitigation measures

No mitigation measures required.

6.4.39 Wastewater

Impacts

549. Considerable volume of wastewater will be generated from operation of concrete batch plant/s (CBP) for the tunnel and station construction.

Mitigation measures

550. In order to ensure that untreated wastewater from the CBP will not be discharged to the environment, the contractor will:

(i) Prior to operation of CBP, construct settling/retention ponds with sufficient specifications/capacity for treatment of wastewater (e.g., from washing of equipment such as mixer drums, trucks and chutes; contact storm water, etc.).

(ii) Properly operate and maintain settling/retention ponds to ensure effluent quality meets applicable NEQS limits.

6.4.40 Air Quality

Impacts

551. Dust and vehicle emissions will be created by construction of the cut and cover and tunneling works. Dust emissions generally consist of large particles that settle out relatively close to the source, whereas exhaust emissions generally consist of fine particles that can drift further away from the source. The potential for dust emissions will occur wherever any of these activities are taking place; the most likely areas where such impacts could occur include openings to tunnel boring sections, at underground station sites using cut-and-cover excavation, fugitive dust from dump trucks, and locations where excavation spoils are transferred from dump trucks to spoil receiving site(s).

552. Combustion emission sources typically associated with this type of project include: (i) diesel exhaust emissions from mobile sources, including earth-moving equipment, and dump trucks; (ii) exhaust from stationary combustion sources, including generators, heaters, and possibly off-site construction and fabrication (including concrete-casting facilities); and (iii) exhaust from tunnel boring machines, either directly, in the case of diesel-powered tunnel boring machines, or indirectly, in the case of electric tunnel boring machines powered by diesel generators at the surface.

553. It is unclear whether a diesel powered TBM or an electric powered TBM will be used. Without having details on the level of activity for each of these types of combustion emission sources, it is not possible to provide a quantitative estimate of the total emissions that will be generated. Although the potential air quality impacts from these activities can be significant, it is important to note that they will be temporary and localized.

554. There are no major sources of contaminant in the spoil, neither the natural geological materials nor the common additives (bentonite and cement) for construction are expected to react to the air to produce toxic/harmful fumes. It is possible that some organic rich layers may be encountered during excavation works. Although these materials may generate some unpleasant odor, once exposed to the air these will be oxidized and the odor is not expected to last long such that it will not cause any long term impact to the atmosphere and the residents.

Mitigation measures

555. Mitigation measures to be implemented by the contractor to minimize impacts on air quality are listed below:

(i) Before site works commence, a Dust Control Plan shall be prepared by the contractor and shall reviewed by the construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimize impacts to sensitive receptors (residential areas, schools, hospitals, etc.) due to construction works; operation of concrete batch plants; sourcing, storage and transport of construction materials, spoils disposal and other project-related activities.

(ii) Wherever possible, use grid rather than generator set electrical power for construction equipment such as the tunnel boring machine and equipment to be used during cut-and-cover tunnel excavations.

(iii) Position any stationary emission sources (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors;

(iv) Use only vehicles and equipment that are registered and have necessary permits.

(v) Burning of wastes generated at the construction sites, work camps and other project-related activities shall be strictly prohibited.

(vi) Construction equipment and vehicles shall be well-maintained and shall meet national NEQS emission standards.

(vii) Trucks to be used for transporting excavation spoils shall be tightly covered

(viii) Specify the use of clean fuels such as ultra-low sulphur diesel in dump trucks and other heavy-duty diesel vehicles and/or equipment, in conjunction with the use of particulate trap control devices, as well as catalytic converters, to avoid excessive diesel emissions.

(ix) Keep stockpiles moist and tightly cover vehicles with tarpaulin sheets or other suitable materials to minimize dust emission and prevent spillage of materials (e.g., soil, cement, stone, sand, aggregates, excavation spoils, etc.).

(x) Provide temporary covers (e.g., tarpaulins, grass, etc.) on long term materials stockpiles.

(xi) Store excavated materials outside road reserve, but where there is no area; spoils shall be loaded and transported immediately.

(xii) Provide truck-washing facilities to prevent truck-out of mud and dust onto city streets.

(xiii) As much as possible, the casting yard for the Project will make use of already established and licensed site(s) for concrete forming activities where all the pre-cast sections will be fabricated.

(xiv) Ensure that necessary environmental approvals are obtained for the establishment and operation of concrete batching plants and casting yards. A minimum distance of 300 meters will be ensured between the batching plant(s) and the nearest community.

(xv) Daily cleaning of road surfaces of debris/spills from construction equipment, haulage trucks and vehicles,

(xvi) Install temporary fencing or barriers around particularly dusty activities in vicinity of sensitive receivers

(xvii) Ensure availability of water trucks or other dust suppressants and appropriate equipment for applying the suppressant (e.g., a tank tuck with spray bars) on site and if the works surface and access roads near sensitive receptors (i.e., residential areas, roadside tea and food stalls, schools, hospitals and other sensitive receptors) are dry and dusty, spray water on the exposed surfaces to reduce dust emissions.

(xviii) All construction equipment and machinery shall be fitted with emission control equipment in full compliance with the national (NEQS) and local regulations.

(xix) Fuel-efficient and well-maintained haulage trucks will be used to minimize exhaust emissions. Smoke belching vehicles and equipment shall not be allowed and shall be removed from the project.

(xx) Impose speed limits on construction vehicles to minimize road dust in areas where sensitive receptors are located.

(xxi) Undertake immediate repairs of any malfunctioning construction vehicles and equipment.

(xxii) Daily visual inspections to identify and address potential areas of dust and odor emissions.

(xxiii) Discourage idling of engines.

(xxiv) Provide prior notification to the community on schedule of construction activities.

(xxv) Implement community complaints hotline.

(xxvi) Soil testing for heavy metals shall be conducted by Contractor at different points along the BRT corridor.

6.4.41 Noise

Impacts

556. Noise impacts to the community will occur due to operation of heavy equipment. Sensitive receptors such as commercial and residential areas are found at different locations along the alignment, some of these are right along the edge of the road where cut and cover works for station construction will be undertaken and will experience construction noise levels exceeding 80 dB(A).

Mitigation measures

557. Specific measures to be implemented by contractors to attenuate noise are as follows:

(i) Before site works commence, a Noise Control Plan shall be prepared by the contractor and shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimize impacts to sensitive receptors (residential areas, schools, hospitals, etc.) due to construction works, sourcing and transport of construction materials, and other project-related activities.

(ii) Erection of temporary walls around all underground station excavation sites and tunnel portals. Temporary noise barriers (3-5 meter high) can reduce noise level by 5-10 dB(A).

(iii) Truck drivers and equipment operators shall minimize the use of horns.

(iv) Position any stationary equipment that produce high noise levels (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors;

(v) All construction equipment and vehicles shall be well maintained, regularly inspected for noise emissions, and shall be fitted with appropriate noise suppression equipment consistent with applicable national and local regulations.

(vi) Use only vehicles and equipment that are registered and have necessary permits.

(vii) No noisy construction-related activities will be carried out during the night. Such activities shall be restricted to daylight hours.

(viii) Impose speed limits on construction vehicles to minimize noise emission along areas where sensitive receptors are located (houses, schools, hospitals, etc.).

(ix) As much as possible, use quiet equipment and working method.

(x) Whenever possible, completely enclose noisy equipment which can reduce noise level by 15-25 dB(A), restrict use of noisy equipment (e.g.15 min for every consecutive 30 min period) and undertake sequential operation of equipment with objective to reduce noise generated;

(xi) Construction work shall respect the hospital areas as a “quiet zone” in the evening, nighttime and early morning hours. Work activities should be kept to daytime hours only.

(xii) No noisy construction activities in the vicinity of schools during examination periods. The contractor will closely coordinate with the school/university administration on construction schedules to ensure that noise from site works will not be disruptive during such periods.

(xiii) Avoid noisy construction activities in vicinity of sensitive receivers (e.g., residential areas) during night time or other sensitive periods (e.g. during school hours). Suitable noise reduction measures (e.g., noise barriers or equipment enclosures) shall be installed by the contractor if construction activities will be disruptive during normal school hours.

(xiv) Provide prior notification to the community on schedule of construction activities.

(xv) Implement community complaints hotline.

6.4.42 Vibration

Impacts

558. Excavation equipment and a steady movement of heavily loaded dump trucks will likely be the cause of any vibration effects that may exceed ambient standards.

559. Vibration effects may be high during excavation at grade or down to a depth of 5 meters, particularly for loaded dump trucks moving slowly up a ramp and then accelerating away from the excavation site. The TBMs will be operating at a depth of -15m+ and experience elsewhere in the world on tunnel projects has indicated that no significant vibration impacts are expected for businesses or residences on the surface. Once the cut and cover tunnel area and the stations are excavated below 5 meters, noise and vibration impacts should diminish.

Mitigation measures

560. Using best management practices cited to alleviate air and noise pollution will also reduce vibration effects. These are:

(i) Erection of temporary walls around the underground station excavation sites and tunnel portal. Temporary noise barriers (3-5 meter high) can reduce noise level by 5-10 dB(A), using daytime work schedules only,

(ii) All construction equipment and vehicles shall be well maintained,

(iii) Diesel hammer piling shall be limited in favor of churn drill piling.

6.4.43 Use of Hazardous substances

561. Please refer to Section 6.4.26.

6.4.44 Solid Waste

Impacts

562. If not properly handled and disposed of, solid wastes pose health and safety hazards and are likely to cause nuisance to the surrounding communities and the workforce.

Mitigation measures

563. To avoid such impacts, the contractor shall implement the following at the construction sites as well as the spoils disposal site:

(i) Provide garbage bins and facilities within the project site for temporary storage of construction waste and domestic solid waste.

(ii) Separate solid waste into hazardous, non-hazardous and reusable waste streams and store temporarily on site in secure facilities with weatherproof flooring and roofing, security fencing and access control and drainage/ wastewater collection systems.

(iii) Ensure that wastes are not haphazardly dumped within the project site and adjacent areas.

(iv) Undertake regular collection and disposal of wastes to sites approved by local authorities.

6.4.45 Damage to Community Utilities

564. Please refer to Section 6.4.19.

6.4.46 Health and Safety of Workers and the Public

Mitigation measures

565. To ensure health and safety of workers, the following measures shall be implemented by the contractor:

(i) Prior to commencement of site works, the following plans that have been prepared and are appended wit this report shall be implemented by the contractor:

- **Occupational and Community Health and Safety Plan** consistent with international standards (e.g., the World Bank Group's Environment, Health and Safety Guidelines of 2007). The Plan shall address health and safety hazards associated with tunneling (working in confined space and compressed air, etc.), working at heights, electrocution, excavations, establishment and operation of construction/worker's camps, use of heavy equipment, transport of materials and other hazards associated with various construction activities.

- **Emergency Response Plan** to prevent, mitigate, respond to and recover from emergency events that could occur due to project activities such as accidents during tunneling (e.g., tunnel collapse, electrocution, etc.), release of toxic gas during tunneling, spills of hazardous substances, fire, floods, and other crises.

(ii) Appoint an environment, health and safety manager to look after implementation of required environmental mitigation measures, and to ensure that health and safety precautions are strictly implemented for the protection of workers and the general public in the vicinity of construction areas.

(iii) Conduct workshop for all workers on health, safety and environmental measures.

(iv) Provide first aid facilities that are readily accessible by workers.

(v) Provide fire-fighting equipment at the work areas, where appropriate, and at construction camps.

(vi) Provide adequate drainage in workers camps to prevent water logging and formation of breeding sites for mosquitoes.

(vii) Provide potable water, hygienic sanitation facilities/toilets with sufficient water supply

(viii) Ensure that all wastewater emanating from workers camps, construction camps and other project-related activities and facilities are treated consistent with national regulations.

(ix) Establish clean canteen/rest area.

(x) Provide fencing on all areas of excavation greater than 2 m deep.

(xi) Provide appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, breathing mask, goggles, and ear protection.

(xii) Implement precautions to ensure that objects (e.g., equipment, tool, debris, precast sections, etc.) do not fall onto or hit construction workers.

(xiii) Implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery or through an opening in a work surface. Based on a case specific basis, fall prevention/protection measures may include installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area, proper use of ladders and scaffolds by trained employees, use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard, fall protection devices such as full body harnesses, etc.

(xiv) Provide sufficient lighting such as in the tunnel areas, underground station excavation sites as well as in other construction areas, as appropriate, to enable safe equipment operation. Provide emergency lighting system of adequate intensity that is automatically activated upon failure of the principal artificial light source to ensure safe equipment operation, safe shut-down, evacuation, etc.

(xv) Ensure that sufficient fresh air is supplied at confined work spaces such as the tunnel and underground station excavation sites. Re-circulation of contaminated air is not acceptable. Air inlet filters shall be kept clean and free of dust and microorganisms; and,

(xvi) Confined spaces (e.g., tunnel) shall be provided with safety measures for venting, monitoring, and rescue operations, to the extent possible.

493. The following mitigation measures to ensure public safety shall be implemented by the contractor:

(i) Implement precautions to ensure that objects (e.g., equipment, tool, debris, precast sections, etc.) do not fall onto or hit people, vehicle, and properties in adjoining areas.

(ii) Fencing of construction sites and excavation sites and guarding such areas to restrict public access.

(iii) Provide warning signs at the periphery of the construction site.

(iv) Strictly impose speed limits on construction vehicles along residential areas and where other sensitive receptors such as schools, hospitals, and other populated areas are located.

(v) Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances and other construction materials during transport.

6.4.47 Traffic Concerns

Impacts

566. The work areas shall be isolated and shielded to minimize road encroachment, contain dust and noise, and provide protection for pedestrians.

Mitigation measures

567. The following measures shall be implemented by the contractor to address impacts to traffic flows and access to properties:

(i) Before site works commence, a Traffic Management Plan for the construction phase shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall be designed to ensure that traffic congestion due to construction activities and movement of construction vehicles, haulage trucks, and equipment is minimized.

The plan shall be prepared in consultation with local traffic officials and people's committees at the district and commune levels. The plan shall identify traffic diversion and management, transport mode for spoils disposal (e.g., trucks etc.), define routes for construction traffic from materials storage/parking areas to construction site and from construction site to waste disposal locations, traffic schedules, traffic arrangements showing all detours/lane diversions, modifications to signaling at intersections, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas.

(ii) Provide signs advising road users that construction is in progress and that the road narrows to one lane using cones.

(iii) Employ flag persons to control traffic at the work sites for safety reasons when construction equipment is entering or leaving the work area.

(iv) Lanes shall be created through the work site using rope or flagging to minimize risks and injuries from falling objects.

(v) As much as possible, lifting and placing of the pre-cast pillar sections will be done at night to minimize traffic congestion.

(vi) Post traffic advisory signs (to minimize traffic build-up) in coordination with local authorities.

(vii) Provide road signs indicating the lane is closed 500 m before the worksite.

(viii) Use traffic cones to direct traffic to move to the open lane.

(ix) Provide sufficient lighting at night within and in the vicinity of construction sites.

(x) Regularly monitor traffic conditions along access roads to ensure that project vehicles are not causing congestion.

(xi) Define and observe schedules for different types of construction traffic trips (e.g., transport of pre-cast sections, haulage of spoils, delivery of construction materials, etc.).

(xii) As much as possible, schedule delivery of construction materials and equipment as well as transport of spoils during non-peak hours.

(xiii) Avoid movements of noisy vehicles during night time in vicinity of sensitive receivers.

(xiv) Implement suitable safety measures to minimize risk of adverse interactions between construction works and traffic flows through provision of temporary signals or flag controls, adequate lighting, fencing, signage and road diversions.

(xv) Ensure relocation of any affected public transport infrastructure (but stops, shelters etc.) prior to commencement of works

(xvi) Provide advance notification to the community regarding changes to public transport facilities or routes.

(xvii) Schedule construction works to minimize extent of activity along linear construction site at any one time.

(xviii) Comply with traffic regulations and avoid, where possible, roads with the highest traffic volumes, high density of sensitive receivers or capacity constraints are not used as access to and from the construction areas and spoils disposal sites.

(xix) Install temporary accesses to properties affected by disruption to their permanent accesses.

(xx) Reinstate good quality permanent accesses following completion of construction.

6.4.48 Cultural and Heritage Resources

Impacts

568. The possibility of discovering archaeological relics is remote but still does exist.

Mitigation measures

569. In the scenario of making a discovery of any cultural or archaeological significance, the 'Chance Find' procedures provided in **Annexure O** of this report shall be followed.

Operation Related Impacts

6.4.49 Flooding

Impacts

570. The project area is subject to minor, temporary flood events after heavy rain.

Mitigation measures

571. The underground tunnel sections will be provided with pumps to pump storm water.

572. Flood waters could enter the tunnel section if it is not adequately protected. A sill designed to meet annual and maximum flood height shall be constructed to protect the tunnel entrance from flood.

6.4.50 Noise

Mitigation measures

573. The following mitigation measures shall be implemented during operation phase:

(i) Tunnel ventilation systems shall have suitable noise control measures incorporated into their design to reduce mechanical noise to acceptable levels in the surrounding community.

(ii) Depending on the results of monitoring, installation of acoustical treatment to the first few meters (i.e., <15 m) of the tunnel portal could be implemented, if necessary.

6.4.51 Health and Safety of Workers and the Public

Mitigation measures

574. A system will be installed to ensure circulation of fresh air to meet both normal and emergency requirements.

575. Pumps will be installed in the tunnels to pump storm water and wastewater.

6.5 Cumulative Impacts

576. Cumulative impacts would mainly be from other projects particularly road projects and buildings being constructed concurrently with the construction stage of this project. The BRT corridor is in the central urban area of Peshawar city where there might be other building construction or road construction works that might overlap with the construction stage of this project.

577. The only infrastructure project to be developed in the project area is a second tier flyover planned over the Pir Zakori bridge with a length of approximately 900 meters. The construction of this flyover bridge is expected to commence in April 2017 and will be completed in six months. Considering the location and scope of the proposed flyover, it is not expected to pose any interruption or interference to the construction work for the BRT project. Also, this particular project will be almost complete by the time the proposed BRT project construction would be commencing and only a minor overlap is expected.

578. Apart from the flyover over the Pir Zakori bridge, no other projects are in the pipeline in the project area. Thus, no cumulative impacts are expected as a result of the development of the proposed BRT project.

579. The severity of cumulative effects, if any, would be dependent upon:

- The type of works being undertaken;
- The duration of the works;
- The distance between the works and their respective proximity to the receptor;
- The sensitivity of the receptor; and
- The visible presence of the works.

580. Construction related cumulative impacts, if any, will be effectively minimized by adopting proper mitigation measures, including:

(i) Coordination between all project components and other projects in the area of influence in terms of construction schedule, possible access road and borrow/disposal sites sharing;

(ii) Contractors will develop material transport plan with consultation of PDA and traffic police and the local community;

(iii) Enforcement of good construction management to minimize dust, noise and waste generation;

(iv) Education of construction workers to minimize social disturbance and cultural conflict;

(v) Provision of temporary access to local traffic;

(vi) Proper maintenance of the access roads and timely restoration/strengthening upon completion.

581. Indirect cumulative effects as a result of construction can also occur. To avoid disruptions to traffic flow caused by construction works, drivers sometimes choose to travel on surrounding roads, known as 'rat-running'. This can affect traffic flows on roads not directly affected by the construction works. Rat-running can result in reduced air quality, increased noise, reduced amenity etc. Rat-running is a common concern at a local level although by, for example, effective traffic management or night-time working then it may be possible to reduce the risk of rat-running.

582. The development of the proposed project will eventually have an affect on the key receptors in close proximity to the project corridor. Urbanization will result in changes to livelihoods; however, impact to the existing population will mostly be positive, with improved urban environmental quality and better socio-economic opportunities.

583. With effective implementation of good construction management measures, any of these common construction-related cumulative impacts can be adequately mitigated to acceptable levels.

6.6 Indirect and Induced Impacts

584. The construction of the BRT corridor through development of overhead bridges where none existed before has the potential to influence land use development patterns, traffic volumes and consequent developments on adjacent roads. The proposed BRT corridor infrastructure as well as future traffic volumes on these roads have been examined in the context of the preliminary design study.

585. The proposed project infrastructure will induce developments throughout the city and will provide transport linkage to the suburbs of Peshawar such as Bara road, Gulshan Rehman Colony, Peshawar Ring road and Charsadda road. The BRT corridor will improve transport among these surburban parts and the central urban area of Peshawar city. Their individual contributions to, and influence on the district and neighborhood traffic flows, have therefore been assessed within the context of the relevant plans and are considered appropriate.

586. The potential impact of development in Peshawar city have been examined, which indicated that the existing and planned infrastructure such as water supply, wastewater collection and treatment, municipal solid waste collection and disposal would be adequate to accommodate the population intake as a result of the proposed project development. Impacts on the environment from air emissions, traffic and community noise, and treated effluent discharge have also been assessed and have found to be acceptable and within the carrying capacities of the environmental media.

587. Negative indirect and induced impacts from this project are not expected.

7 Environmental Management and Monitoring Plan

7.1 Introduction

588. The Environmental Management and Monitoring Plan (EMP) is developed to eliminate and/or mitigate the impacts envisaged at the design, construction and operation stages and provide specific guidelines for long term monitoring by identifying the roles and responsibilities of PDA, Supervision Consultant and Contractor(s).

589. The detailed EMP provided in this section provided as **Table 7.1** ensures that the Project has no detrimental effect on the surrounding environment. The Plan shall act as a guideline for incorporating environmental measures to be carried out by the contractors engaged by PDA, as well as for other parties concerned for mitigating possible impacts associated with the Project and will form part of the Contract documents to be considered alongside the specifications. This Plan shall act as the Environmental Monitoring Plan during construction and operational phases of the Project, and will allow for prompt implementation of effective corrective measures.

7.2 Environmental Management Plan (EMP)

590. The EMP attached with this report ensures the following:

- Delivery of the prescribed environmental outcomes during all phases of the Project;
- Formulating a system for compliance with applicable legislative and non-legislative requirements and obligations and commitments for the Project;
- Ensure that project design process incorporates best practice environmental design and sustainability principles to minimize potential impacts of construction and operation on the environment and community.
- Ensure that the construction work procedures minimize potential impacts on the environment and community.
- Develop, implement and monitor measures that minimize pollution and optimize resource use.

7.3 Objectives of EMP

591. The EMP provides a delivery mechanism to address potential impacts of the project activities, to enhance project benefits and to outline standardized good practice to be adopted for all project works. The EMP has been prepared with the objectives of:

- Defining the roles and responsibilities of the project proponent for the implementation of EMP and identifying areas where these roles and responsibilities can be shared with other parties involved in the execution and monitoring of the project;
- Outlining mitigation measures required for avoiding or minimizing potential negative impacts assessed by environmental study;

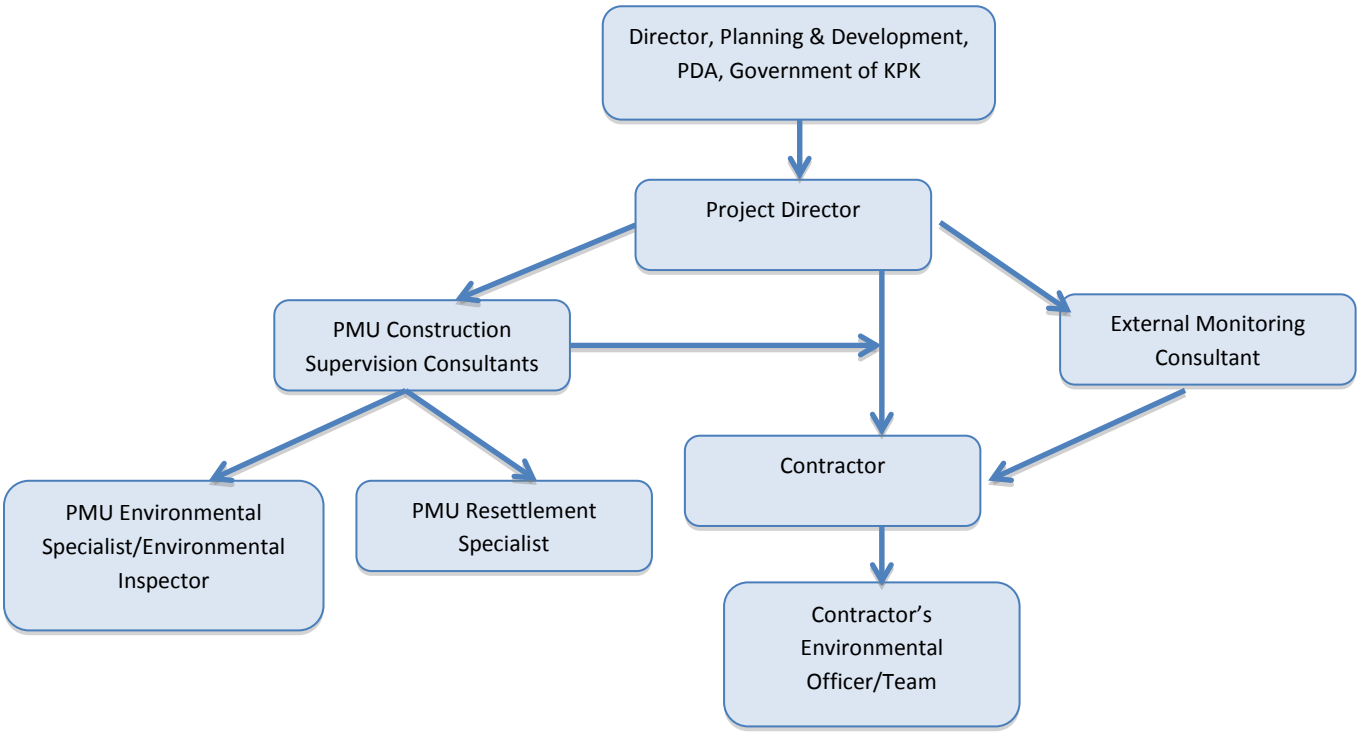
- Developing a monitoring mechanism and identifying requisite monitoring parameters to confirm effectiveness of the mitigation measures recommended in the study;
- Defining the requirements for communication, documentation, training, monitoring, management and implementation of the mitigation measures.

7.4 Environmental Management/Monitoring and Reporting

592. During the construction phase, the overall responsibility for the implementation and monitoring of the EMP rests with the Project Director (PD). The PD through assistance from the Supervision Consultant's Environmental staff and the Environment team of PDA, will supervise the implementation of the proposed mitigation measures and monitor the implementation progress in the field. Monthly environmental monitoring data/reports will be incorporated in the project implementation progress reports to be shared with ADB and such monthly reports will be consolidated into quarterly monitoring reports and submitted to ADB for review and clearance. Upon clearance, all such reports will be uploaded on the PDA and ADB websites.

593. The organizational structure for the Environmental Management/Monitoring implementation is shown in **Figure 7.1** below. The specific roles and responsibilities for environmental management are provided in **Tables 7.9** and **7.10** below.

Figure 7.1: Organization Chart for Environment Management/Monitoring implementation



594. Keeping in view the sensitive nature of the project in terms of the highly congested and urban environment in which the project will be developed, it is proposed that external monitoring of the EMP shall be conducted to ensure all proposed mitigation measures are being implemented in their true spirit.

7.5 Institutional Arrangements

595. The proposed project environmental management plan will require involvement of the following organizations for its implementation:

- The Project Management Unit (PMU), which will be established at the PDA, this PMU will be the project proponent and owners of the EMP;
- Project Contractors as executors of the EMP;
- Project Environment Officer (PEO) as environmental monitor of the execution of the EMP.

7.5.1 Role of PDA

596. As the proponent of the project, PDA will be responsible for implementation of the EMP. The PDA will be responsible for ensuring the implementation of the EMP and for overall environmental performance during construction operations and also for ensuring implementation of the EMP by the project contractors.

7.5.2 Role of Project Director

597. The key responsibilities of the PD will be as follows:

- Liaise closely with the environmental agency (KP-EPA) and all concerned Government departments e.g. Forest and Wildlife Department, Department of Archaeology and Museums etc.
- Obtaining approval of the EIA study;
- Ensuring the EMP is properly implemented;
- Responsible for all environmental coordination and reporting;
- Provide technical support for compliance and monitoring of EMP;
- Responsible for resettlement plan;

7.5.3 Role of Project Contractor

598. The project contractor will be responsible for following items:

- Implementation of, or adherence to, all provisions of the EIA and EMP;
- Contractor's environmental performance will rest with the person holding the highest management position within the contractor's organization. Reporting to their management, the contractor's site managers will be responsible for the effective implementation of the EMP.

7.5.4 Role of Police

599. The local Peshawar traffic police force is expected to play a key role in the implementation of the traffic management plan and thus ensure that accidents are avoided and traffic hazards are prevented. In addition, the local police force will also play a pivotal role in maintaining law and order, both during the construction phase of the project as well as once the project becomes operational.

7.6 Environmental Performance Indicators

600. Environmental performance indicators will be chosen to quantify that whether the targets of environmental policy safeguards are met as desired in the EMP within the specified time period. The quantitative data against following attributes as performance indicators will be collected and reported in the quarterly environmental monitoring reports.

- **Air Quality**

The following quantifiable indicators shall be used to assess impact on air quality:

- Frequency of complaints during construction activity
- Measurement of PM10 and dust fall levels during construction
- Measurement of NO2 and PM10 levels during operation compared to pre-operational baseline levels and compared to levels recorded at a reference location in the city.

- **Water Quality and related issues**

Indicator of water quality must quantify water contamination or pollution and any changes in the water composition and chemistry whether surface or ground water in terms of water quality parameters and their pattern of existence.

- **Air and Noise pollution**

Magnitude of air and noise quality changes due to project activities.

- **Flora and Fauna**

Any quantifiable changes in the population of flora and fauna and in their habitat patterns will be recorded.

- **Traffic and transportation**

Management of traffic during construction and adequate planning for operation phase.

- **Socio-economic**

Impact on the local/regional economy

Changes in cultural pattern

Dislocation of population

- **Health and Safety**

New disease pathways

Number of injuries or casualties

7.7 Monitoring Parameters

601. The key environmental parameters such as ambient air quality, noise levels, waste disposal etc. will be monitored at key receptor locations.

602. A monitoring plan for the pre-construction, construction and operation phases of the project, indicating environmental parameters, frequency, locations and applicable standards is provided as **Tables 7.1, 7.2** and **7.3** below. Standards set under the NEQS guidelines for the key receptors are also provided as Annexure B.

7.8 Environmental Training

7.8.1 Capacity Building and Training

603. Capacity building and training programs are necessary for PDA staff in order to control the negative impacts resulting from the project construction and during its operation phase. They will also require trainings on monitoring and inspecting of such a project for environmental impacts and for implementation of mitigation measures.

604. The details of this capacity building and training program are presented in the **Table 7.4** below.

Table 7.1: Pre-Construction Monitoring Requirements

Project Activity and Potential Impact	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Demolition and re-allocation of shops for small business owners located near BRT route	To ensure the affected small business owners are provided shops of equal plot size and value	Process of re-allocation of shops	To ensure shop owners are allocated alternate shops at new locations to their satisfaction near BRT corridor	-	-	Contractor's Environmental officer, PDA
Relocation of infrastructure (water pipelines, gas pipelines, electric cables etc.)	To ensure no interruption of these services takes place once construction activity commences	Process of relocation of services	Completion of relocation of services to alternate pathways	Along project corridor wherever relocation of services is necessary	-	PDA
Ambient Air Quality	To establish baseline air quality levels	CO,NO_x & PM_{10} (particulate matter smaller than 10 microns) concentration at receptor level	1-hr and 24-hr concentration levels	At five key receptor locations along the project corridor	Twice in total (Once on a weekday and once on a weekend)	PDA
Ambient Noise	To establish baseline noise levels	Ambient noise level near key receptors along project corridor	A-weighted noise levels – 24 hours, readings taken at 15 s intervals over 15 min. every hour, and then averaged	At five key receptor locations along the project corridor	Twice in total (Once on a weekday and once on a weekend)	PDA

Table 7.2: Construction Phase Monitoring Requirements

Project Activity and Potential Impact	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Noise Disturbance due to noise from construction activity	To determine the effectiveness of noise abatement measures on sound pressure levels	Ambient noise level near key receptors along project corridor	A-weighted noise levels – 24 hours, readings taken at 15 s intervals over 15 min. every hour, and then averaged	At five key receptor locations along the project corridor	Once weekly	Contractor's Environmental officer, PDA
Air Quality Dust emissions from construction vehicles and equipment	To determine the effectiveness of dust control program on dust at receptor level	CO,NO_x & PM_{10} (particulate matter smaller than 10 microns) concentration at receptor level	1-hr and 24-hr concentration levels	At five key receptor locations along the project corridor	Once weekly	Contractor's Environmental officer, PDA
		Visible dust	Visual observation of size of dust clouds, their dispersion and the direction of dispersion	Construction sites	Once daily	Contractor's Environmental officer, PDA
		Dust Fall	Amount of dust deposition shall be measured	Construction sites	Once daily	Contractor's Environmental officer, PDA
Water Resources Wastage of water leading to depletion in water resources	To prevent wastage of water during the construction works	Volume of water being used versus its utilization	Visual observations of water being used at project sites and at labor camps	Construction sites and labor camps	Once daily	Contractor's Environmental officer, PDA
Landscape scarring at borrow sites	To ensure landscape does not lose its aesthetic value	-	Visual inspection	Borrow sites	Weekly	Contractor's Environmental officer, PDA
Soil erosion	To ensure soil erosion does not take place	-	Visual inspection	Borrow sites	Weekly	Contractor's Environmental officer, PDA

Project Activity and Potential Impact	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Increase in traffic accidents	To minimize risk of traffic accidents	Number of accidents taking place	Visual monitoring	Construction sites along BRT corridor	Once weekly	Contractor's Environmental officer, PDA
Delays in traffic management	To ensure traffic movement is efficiently managed	Number of traffic congestion events	Visual inspections	Construction sites along BRT corridor	Once weekly	Contractor's Environmental officer, PDA
Safety precautions by Safety workers	To prevent accidents for workers and general public	Number of near miss events and accidents taking place	Visual inspections	Construction sites along BRT corridor	Once weekly	Contractor's Environmental officer, PDA
Soil Contamination	To prevent contamination of soil from oil and toxic chemical spills and leakages	Incidents of oil and toxic chemical spills	Visual inspections	At construction sites and at vehicle and machinery refuelling & maintenance areas	Once a month	Contractor's Environmental officer, PDA
Solid Waste & Effluent disposal Insufficient procedures for waste collection, storage, transportation and disposal	To check the availability of waste management system and implementation	Inspection of solid and liquid effluent generation, collection, segregation, storage, recycling and disposal will be undertaken at labor camps and at all work sites along project corridor	Visual inspections	At labor camps and at work sites along project corridor	Once daily. Liquid effluent to be tested on quarterly basis	Contractor's Environmental officer, PDA
Protection of Heritage Sites Destruction of relic or damage to heritage site	To ensure heritage sites are protected and any relic found is recovered without damage	Careful inspections during excavation work in case any relic is discovered	-	At work sites along project corridor, particularly near Bala Hisar fort	During excavation work	Contractor's Environmental officer, PDA

Table 7.3: Operation Phase Monitoring Requirements

Project Activity and Potential Impact	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Noise Disturbance due to noise from operational activity	To determine the effectiveness of noise abatement measures on sound pressure levels	Ambient noise level near receptors along BRT corridor	A-weighted noise levels – 24 hours, readings taken at 15 s intervals over 15 min. every hour, and then averaged	At five key receptor locations along the project corridor	Once every month	O&M Contractor's Environmental officer, PDA
Air Quality Air pollutants can adversely affect the ambient air quality and impact human health	To ensure air pollutants are not present above the permissible guidelines	Ambient air quality i.e. concentration of pollutant gases in air such as CO, NO_X and PM_{10}	Concentration levels of the pollutant gases	At five key receptor locations along the project corridor	Once every month	O&M Contractor's Environmental officer, PDA
Wastewater generation and Discharge Effluent discharge from depots and workshop areas can affect water resources of project area	To ensure water resources of city are not affected by effluent from depots and workshop areas	Characterisitics of wastewater	Chemical analysis of the wastewater Operational efficiency of the wastewater treatment plant and other units	Depots and Workshop areas (at point of discharge of the effluent)	Once every six months	O&M Contractor's Environmental officer, PDA
Hazardous material Hazardous chemicals such as oils, paints can harm human health and contaminate soil	To ensure proper disposal of hazardous material (if any)	Quantity of hazardous waste generated and its disposal procedure	Complete record of purchase, storage, use, and disposal of hazardous material will be maintained	At point of generation of hazardous material	Daily records to be maintained	O&M Contractor's Environmental officer, PDA

Solid Waste Management Domestic garbage from stations and buses as well as from depots and workshops	To ensure solid waste is disposed off in an environmentally friendly manner	Amount of solid waste generated and its disposal method	Records of waste generated On-site audits of waste management Audits of the waste disposal contractors and waste disposal facilities	BRT stations, buses, depots and workshops	Daily records of waste generated to be maintained. Audits to be conducted monthly.	O&M Contractor's Environmental officer, PDA
Adaptability of General Public to Driving Conditions	To minimize risk of accidents and facilitate adaptability to new infrastructure of BRT project by educating general public	Number of accidents taking place	Accidents per week	Along entire BRT corridor where BRT infrastructure has changed driving conditions	Monthly review	O&M Contractor's Environmental officer, PDA

Table 7.4: Capacity Development and Training Programme

Provided by	Organized by	Contents	No. of training events	Duration	Cost (PKR)
Pre-construction Phase Monitoring Consultants/Organizations offering specialized services in environmental management and monitoring	Project Director	Short seminars and courses on: Environmental Management Plan and Environmental Monitoring Plan	Two seminars for Contractor management staff and PDA project staff	3 days each	200,000
Construction Phase Monitoring Consultants/Organizations offering specialized services in social management and monitoring	Project Director	Short seminars on Environmental risks associated with construction phase. Development of Environmental Performance Indicators Occupational Health and Safety (OHS) issues	Two seminars for Contractor management staff and PDA project staff dealing in environment and social issues	3 days each	200,000
Operational Phase Monitoring Consultants/Organizations offering specialized services in Occupational Health and Safety (OHS) Issues	Project Director	Short seminars relating to monitoring of environmental and social parameters during operational phase	Two seminars for O&M Contractor and PDA staff	3 days each	200,000
Total			**600,000 (PKR 0.6 million)**		

7.9 Environmental Management Costs

605. The **Table 7.5** below provides cost estimates for 'Pre-Construction phase' monitoring while **Table 7.6** provides cost estimates for 'Construction phase' monitoring and **Table 7.7** provides the cost estimates for the 'Operation phase' monitoring of key environmental parameters.

606. The costs associated with implementation of the EMP and the necessary mitigation measures are provided as **Table 7.8** below. The **Table 7.9** below provides the Environmental management and monitoring plan for the proposed project.

Table 7.5: Annual Cost Estimates for 'Pre-Construction Phase' Environmental Monitoring

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Air Quality	CO, NOx, PM_{10}	10 (Twice only at 5 locations)	600,000	10 readings @ PKR 60,000 per sample
Noise Levels	dB(A)	10 (Twice only at 5 locations)	600,000	10 readings @ PKR 60,000 per reading
Contingencies			60,000	5% of monitoring cost
Total (PKR)			**660,000**	

Table 7.6: Annual Cost Estimates for 'Construction Phase' Environmental Monitoring

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Air Quality	CO, NOx, PM_{10}	240 (Weekly basis at 5 locations)	24,00,000	240 readings @ PKR 10,000 per sample
Noise Levels	dB(A)	240 (Weekly basis at 5 locations)	24,00,000	240 readings @ PKR 10,000 per reading
Liquid Effluents				
Effluent produced from labor camp and construction sites	As per NEQS	20 (Quarterly basis at 5 sites)	400,000	20 samples @ PKR 20,000 per sample
Contingencies			260,000	5% of monitoring cost
Total (PKR)			**54,60,000**	

Table 7.7: Annual Cost Estimates for 'Operation Phase' Environmental Monitoring

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Air Quality	CO, NOx, PM_{10}	60 (Once a month at 5 locations)	600,000	60 readings @ PKR 10,000 per sample
Noise Levels	dB(A)	60 (Once a month at 5 locations)	600,000	60 readings @ PKR 10,000 per reading
Liquid Effluents				
Effluent produced from depots and workshop areas	As per NEQS	8 (twice a year at 4 locations)	160,000	8 readings @ PKR 20,000 per reading
Contingencies			68,000	5% of monitoring cost
Total (PKR)			**1,428,000**	

Table 7.8: Estimated Costs for EMP Implementation

Item	Sub-Item	Estimated Total Cost (PKR)
Staff, audit and monitoring cost[1]	6 persons for 18 months (@ 50,000 per month per staff member)	54,00,000
Monitoring Activities	Provided separately in Tables 6.5 to 6.7.	-
Mitigation Measures	As prescribed under EMP and EIA.	15,000,000
(i) Noise barriers[2]	Specific locations for installation of noise barriers to be assessed. Presently, a total of 800 meters of noise barriers are estimated to be installed around sensitive receptors.	80,00,000
(ii) Water sprinkling	To suppress dust emissions	25,00,000
(iii) Wastewater collection & Treatment	From labor camps and construction sites (based on initial estimates)	25,00,000
(iv) Solid waste collection & disposal	From labor camps and construction sites (based on initial estimates)	20,00,000
Contingencies	5% of EMP implementation cost	1,020,000
Total Estimated Cost (PKR)		**21,420,000**

1: To cover staff cost and expenses of Contractor

2: Approx. 10,000 PKR per meter

3: Approx. 5000 PKR per m^2

Table 7.9: Environmental Management and Monitoring Plan

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
Design/Pre-Construction Stage						
Historical Heritage sites	To protect any historical sites present within BRT corridor.	1. To stop excavation work immediately if any artifact of historical importance is discovered. 2. Structural assessment to be conducted to ensure no damage is expected from vibration effects. Necessary measures to be implemented based on survey findings.	At BRT route design stage and once excavation work commences	Along project corridor wherever excavation will be conducted	PDA	Department of Archaeology, GoP
Land Acquisition & Resettlement	To ensure smooth transition in shifting of shop and house owners to new locations	1. Detailed dialogue with affected parties to ensure all concerns are addressed. 2. The new shops and houses allocated to affected parties must be based on a fair and transparent criterion. 3. All affected persons must be offered fair compensation based on market rates.	Prior to commencement of construction and demolition activity	Along project corridor wherever shifting of shops and/or houses needs to be conducted	PDA	ADB Resettlement Specialist

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
Locations for Labor Camps	To ensure the labor camps do not pose any adverse impacts on the project area	1. Specific locations will be strategically selected for development of labor camps that contain all necessary facilities. 2. Camp locations will ensure minimal disturbance to key receptors in project area	Prior to commencement of construction activity	Most suitable locations for labor camps nearest to the BRT corridor must be identified	PDA	-
Traffic Management Plan	To minimize possibility of accidents and traffic congestion once construction commences and thus minimize possible nuisance for residents of Peshawar	Development of a comprehensive plan that shall contain traffic diversion onto alternate routes and management traffic flows to minimize congestion and possibility of accidents.	Prior to commencement of construction activity	At all construction sites along project corridor	PDA	-
Construction Stage						
Air Quality	To minimize air emissions effectively and avoid complaints due to the airborne particulate matter released to the atmosphere.	1. Water will be sprinkled daily at all construction sites to suppress dust emissions. 2. All heavy equipment and machinery shall be fitted in full compliance with the national and local	All construction sites within 100 m of sensitive receivers.	A list of locations to be included in contract and other sensitive areas identified by the CSC in project area.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		regulations. (Relevant regulations are in the Motor vehicles fitness rules and Highway Act). 3. Stockpiled soil and sand shall be slightly wetted before loading, particularly in windy conditions. 4. Fuel-efficient and well-maintained haulage trucks shall be employed to minimize exhaust emissions. 5. Vehicles transporting soil, sand and other construction materials shall be covered with tarpaulin. 6. Limitations to speeds of such vehicles necessary. Transport through densely populated area should be avoided. 7. Concrete plants to be controlled in line with statutory requirements and shall not be close to sensitive receptors. 8.Stack height of generators will be at least				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		3 meters above the ground. 9. Project traffic will maintain maximum speed limit of 20 km/hr on all unsealed roads within project area. 10. A minimum distance of 300 meters will be ensured between batching plant(s) and the nearest community.				
Noise	To minimize noise level increases during construction activities.	1. Equipment noise will be reduced at source by proper design, maintenance and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by use of proper silencers and mufflers. 2. Excessive noise emitting equipment will not be allowed to operate and will be replaced. 3. Blowing of horns will be prohibited on access roads	All construction sites within 100 m of sensitive receivers.	A list of locations to be included in contract and other sensitive areas identified by the CSC in project area.	Contractor should maintain the acceptable standards CSC to supervise relevant activities.	PDA / CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		to site. 4. As a rule, the operation of heavy equipment shall be conducted in daylight hours. 5. Hammer- type percussive pile driving operations shall be not be allowed at night time. 6. Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise. 7. Well-maintained haulage trucks will be used with speed controls. 8. Contractor shall take adequate measures to minimize noise nuisance in the vicinity of construction site by way of adopting available acoustic methods to remain within NEQS limits. 9. Noise levels at sensitive receptors along corridor will be frequently monitored.				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		10. It shall be ensured that construction activity does not result in increment in noise levels greater than 3 dB(A). 11. Stationary noise sources such as batching plants will be kept at least 300 meters away from nearest community. 12. Acoustic insulation or portable noise barriers or hoardings shall be installed to protect sensitive receptors along corridor. 13. Provide prior notification to community on schedule of construction activities. 14. Implement community complaints hotline. 15. All efforts will be made to conduct construction activity near schools during vacation period to minimize disruption.				
Traffic Management	Minimize disturbance of vehicular traffic	Detailed traffic management plan to be	Prior to and throughout the	The most important locations to be identified	Contractor and Engineer	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
	and pedestrians during haulage of construction materials, spoil and equipment and machinery, blocking access roads during works Damage / maintenance problems for roads and bridges used by the haulage trucks, dust nuisance to school and hospitals.	implemented in true letter and spirit. As part of this plan, following measures will be implemented: 1.Submit temporary haul and access routes plan one month prior to start of works. 2. Formulate and implementation of a plan of alternate routes for heavy vehicles. 3. Public awareness campaigns through radio and newspaper ads to educate public and sensitize them to cooperate with project staff and to make them aware of potential risks of accidents and necessary precautions. 4. Installation of traffic warning signs, and enforcing traffic regulations during transportation of materials and equipment and machinery. Conditions of roads and bridges to be considered.	construction.	and listed. Relevant plans of the Contractor on traffic arrangements to be prepared and available.		

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		5. Employing of flag persons to control traffic at work sites for safety reasons when construction equipment is entering or leaving work areas. 6.Lanes shall be created through work site using rope or flagging to minimize risks and injuries from falling objects. 7. As far as possible, lifting and placing of pre-cast sections will be done at night to minimize traffic congestion. 8. Provide road signs indicating lane is closed 500 meters before work site. 9. Use traffic cones to direct traffic to move to open lane. 10. Provide sufficient lighting at night within and in vicinity of construction sites. 11. Regular monitoring of traffic conditions along access roads to ensure				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		that project vehicles are not causing congestion. 12. Define and observe schedules for different types of construction traffic trips. 13. Install temporary accesses to properties affected by disruption to their permanent accesses. 14. Reinstate good quality permanent accesses following completion of construction.				
Labor Camp Effluent	Prevent untreated effluent from being released into the environment.	1. No untreated effluent will be released into the environment. 2. Closed sewage treatment system will treat the effluent, which will then be disposed of in a soak pit or will be used for plantation.	During Construction	At labor camps	Contractor	PDA/ CSC
Community Safety	To ensure the residents and visitors to the project area are kept safe during the construction activity at the	1. Buffer strips or other methods of physical separation around project sites shall be ensured to protect public from major hazards.	During construction activity	Project area	Contractor and the CSC	PDA/ CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
	different work sites.	2. Siting and safety engineering criteria shall be incorporated to prevent failures due to natural risks posed by earthquakes, floods, fire, wind etc. 3. Inventories of hazardous materials shall be reduced through inventory management. 4. Process or storage conditions shall be modified to reduce potential consequences of an accidental off-site release. 5. Improving of shut down and secondary containment to reduce amount of material escaping from containment and to reduce release of duration. 6. Reduce probability that releases will occur through improved site operations and control and through improvements in maintenance and				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		inspection. 7. Reduce off-site impacts of releases through measures intended to contain explosions and fires such as alerting public, provision for evacuation of surrounding areas, establish safety zones around each work site and ensure provision of emergency medical services to the public. 8. Work areas outside project area, particularly where machinery is involved will be roped off and constantly monitored to ensure local residents and children in particular stay away. 9. No machinery will be left unattended, particularly in running condition. 10. Community will be briefed on traffic safety, especially women who are the main care providers to children.				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		11. Speed limit of 20 km/hr will be maintained by all project related vehicles on section of roads and passages adjacent to houses along project corridor. 12. Night time driving of vehicles will be limited as far as possible.				
Historical/Archaeological Sites	To protect any historical/archaeological sites along project corridor	If evidence of any historical remains/artifacts are found at Bala Hisar fort or any other historical site, the excavation work will be immediately stopped and necessary steps as per 'Chance Find' procedures will be followed.	During construction activity	Project area	Contractor and the CSC	PDA/ CSC
Construction Waste Disposal	Minimize the impacts from the disposal of construction waste.	1. Waste management plan to be submitted to the CSC and approved one month prior to starting works. 2. Estimating the amounts and types of construction waste to be generated by the project. 3. Investigating whether	Update monthly	A list of temporary stockpiling areas and more permanent dumping areas to be prepared at the contract stage for agreement.	Contractor and CSC should supervise and take action to complete contractor's relevant activities according to EIA/IEE/ EMP	PDA/ CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		the waste can be reused in the project or by other interested parties. 4. Identifying potential safe disposal sites close to the project or those designated sites in the contract. 5. Investigating the environmental conditions of the disposal sites and recommendation of most suitable and safest sites. 6. Piling up of loose material should be done in segregated areas to arrest washing out of soil. Debris shall not be left where it may be carried by water to downstream flood plains, dams, lagoons etc. 7. Used oil and lubricants shall be recovered and reused or removed from the site in full compliance with the national and local regulations. 8. Oily wastes must not be burned. Disposal location to be agreed with local authorities/EPA.			requirement & environmental standards.	

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		9. Machinery should be properly maintained to minimize oil spill during the construction. 10. Solid waste should be disposed at an approved solid waste facility, open burning is illegal and contrary to good environmental practice.				
Orientation for Contractors, and Workers	To ensure that the CSC, contractor and workers understand and have the capacity to ensure the environmental requirements and implementation of mitigation measures.	1. PDA to engage environmental specialist in the PMU to monitor and progress all environmental statutory and recommended obligations. 2. Conduct special briefing for managers and / or on-site training for the contractors and workers on the environmental requirement of the project. Record attendance and achievement test. 3. Agreement on critical areas to be considered and necessary mitigation measures, among all parties who are involved in	Induction of all relevant staff required for implementation of EMP. At early stages of construction for all construction employees as far as reasonably practicable.	All staff members in all categories. Monthly induction and six month refresher course as necessary until contractor complies.	Contractor and the CSC and record details	PDA & CSC to observe and record success

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		project activities. 4. Continuous progress review and refresher sessions to be followed.				
Labor Camp(s) Operation and Location	To ensure that the operation of work camps does not adversely affect the surrounding environment and residents in the area.	1. Identify location of work camps in consultation with local authorities. The location shall be subject to approval by the PDA. If possible, camps shall not be located near settlements or near drinking water supply intakes. 2. Cutting of trees shall be avoided and removal of vegetation shall be minimized. 3. Water and sanitary facilities (at least pit latrines) shall be provided for employees. Worker camp and latrine sites to be backfilled and marked upon vacation of the sites. 4. Solid waste and sewage shall be managed according to the national and local regulations. As a	Update once a month	Location Map to be prepared by the Contractor.	Contractor	PDA/ CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		rule, solid waste must not be dumped, buried or burned at or near the project site, but shall be disposed off to the nearest sanitary landfill or site having complied with the necessary permission of local authority permission. 5. The Contractor shall organize and maintain a waste separation, collection and transport system. 6. The Contractor shall document that all liquid and solid hazardous and non-hazardous waste are separated, collected and disposed of according to the given requirements and regulations. 7. At the conclusion of the project, all debris and waste shall be removed. All temporary structures, including office buildings, shelters and toilets shall be removed. 8. Exposed areas shall be planted with suitable vegetation.				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		9. PDA and Supervising Engineer shall inspect and report that the camp has been vacated and restored to pre-project conditions.				
Loss of Trees and Vegetation Cover for Temporary Work-space and Wildlife Loss	To avoid several negative impacts due to removing of landmark, sentinel and specimen trees as well as green vegetation and surface cover and wildlife loss.	1. The contractor's staff and labor will be strictly directed not to damage any vegetation such as trees or bushes. 2. Clearing of green surface cover for construction, for borrow of for development, cutting trees and other important vegetation during construction shall be minimized. 3. Landscaping and road verges to be re-installed on completion. 4. Compensatory planting of trees/shrubs/ornamental plants (at a rate of 3:1) to contribute to the aesthetic value of the area and compensate for the lost capability of the area to absorb carbon dioxide in	Site identification during design stage and other matters during construction of relevant activities	A list of locations with a Map to be compiled by the design consultant during detailed design and CSC to update as necessary.	Design consultant, Contractor and CSC	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		line with best international practice. 7. At completion all debris and waste shall be removed. 8. All temporary structures, including office buildings, shelters and toilets shall be removed. 9. Willful killing trapping and trade of faunal species will be strictly prohibited. 10. Cutting of trees and burning of wood will be strictly prohibited.				
Safety Precautions for the Workers	To ensure safety of workers	1. Providing adequate warning signs. 2. Providing workers with skull guard or hard hat. 3. Contractor shall instruct his workers in health and safety matters, and require the workers to use the provided safety equipment.	Prior to commencement and during construction	Location to be identified by the CSC with contractor.	Contractor and CSC	PDA/ CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		4. Establish all relevant safety measures as required by law and good engineering practices. 5. Contractor will closely monitor staff at all times and will take strict action against any non-compliance of established protocols.				
Soil Contamination	To ensure contamination of soil along project corridor is prevented.	1. Spill prevention trays will be provided and used at refueling stations. 2. On site maintenance of vehicles shall be avoided as far as possible. If unavoidable, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil. 3. Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities.	During construction activity	Project area	Contractor and the CSC	PDA/ CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		4. Fuels, lubricants and chemicals will be stored in covered bounded areas, underlain with impervious lining. 5. Appropriate arrangements, including shovels, plastic bags and absorbent materials will be available near fuel and storage areas.				
Water Quality	To prevent adverse water quality impacts due to negligence and ensure unavoidable impacts are managed effectively. Ensure adverse impacts on water quality caused by construction activities are minimized.	1. Compile temporary drainage management plan one month before commencement of works. 2. Proper installation of Temporary Drainage (TD) and Erosion Control (EC) before works within 50 m of water bodies. 3. Proper construction of TD and EC measures, maintenance and management including training of operators and other workers to avoid pollution of water bodies by the considerate	Prior to construction, 50 m from water bodies. Timing will depend on the construction timetable.	Relevant locations to be determined in the detailed project design	1.Contractor CSC to enforce 2. Contractor has to check water quality and report to PDA. 3. CSC supervises monitoring activities.	PDA to review results

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		operation of construction machinery and equipment. 4. Storage of lubricants, fuels and other hydrocarbons in self-contained dedicated enclosures >50m away from water bodies. 5. Proper disposal of solid waste from construction activities and labor camps. 6. Cover the construction material and spoil stockpiles with a suitable material to reduce material loss and sedimentation and avoid stockpiling near to water bodies. 7. Topsoil stripped material shall not be stored where natural drainage will be disrupted. 8. Borrow sites (if required) should not be close to sources of drinking water.				
Hydrology and Drainage	To ensure the hydrological and	1. Consideration of weather conditions when	1. Prepare a thorough plan to be	1. Location of construction activities to	CSC or PDA to actively	PDA

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
Aspects	drainage aspects are considered during construction activity.	particular construction activities are undertaken. 2. Limitations on excavation depths in use of recharge areas for material exploitation or spoil disposal. 3. Use of landscaping as an integrated component of construction activity as an erosion control measure. 4. Minimizing the removal of vegetative cover as much as possible and providing for its restoration where construction sites have been cleared of such areas. 5.All unpaved exposed surfaces at project sites will be compacted to minimize water erosion and all areas containing potentially hazardous materials will be hydrologically isolated from remaining site. 6. It shall be ensured that natural drainage is not hampered or blocked in any way at any of the sites.	approved by CSC one month prior to commencement of construction. 2. Proper timetable prepared in consideration with the climatic conditions of each area, the different construction activities mentioned here to be guided.	be listed by the engineer. 2. A list of locations of drains to be compiled by the contractor.	supervise and enforce	

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
Soil Erosion/ Surface Run-off	Prevent adverse water quality impacts due to negligence and ensure unavoidable impacts are managed effectively. To minimize soil erosion due to the construction activities and creation of access tracks for project vehicles.	1. Back-fill should be compacted properly in accordance with design standards and graded to original contours where possible. 2. Stockpiles should not be formed within such distances behind excavated or natural slopes that would reduce the stability of the slopes. 3. In the short-term, either temporary or permanent drainage works shall protect all areas susceptible to erosion. 11. Clearing of green surface cover to be minimized during site preparation. 12. Replanting of trees to be done before the site is vacated and handed back to PDA with appropriate trees (other vegetation cover as appropriate) to ensure interception of rainwater and the deceleration of surface run-off.	Because the area can be subject to un seasonal heavy rain plan before and during construction (cut and fill, land reclamation etc.) while considering the climatic conditions.	1. Locations based on history of flooding problems. 2. A list of sensitive areas during construction to be prepared by the detail design consultant in consideration with the cut and fill, land reclamation, borrow areas etc. 3. Locations of all culverts, irrigation channels, road and highway.	Contractor and CSC	PDA/ CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
Utilities provision interruption	To ensure the sensitive receptors in the project area are not affected by the relocation/ disruption of any utilities such as water supply, electricity, telecommunicatio n, gas supply etc.	1. Contractor(s) will assess construction locations in advance for potential disruption to services and identify risks prior to starting construction. Any damage or hindrance/disadvantage to local businesses caused by the premature removal or insufficient replacement of public utilities is subject to full compensation, at the full liability of the contractor who caused the problem. 2. If temporary disruption is unavoidable, the contractor will, in collaboration with relevant local authorities such as power company, water supply company and communication company, develop a plan to minimize the disruption and communicate the dates and duration in advance to the affected persons. 3. Communities shall be	1. Prepare a thorough plan to be approved by CSC one month prior to commencement of construction. 2. Implement measures during construction activity	Along entire BRT corridor at each location where construction work is being conducted.	Contractor and the CSC	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		informed in advance regarding storage of water when their utilities are about to be relocated to pave the way for road works. Also, water pipes located/crossing in the right of way (road reserve) may be moved slightly away from the road or provision of service duct may be considered. 4. Construction billboards, which include construction contents, schedule, responsible person and complaint phone number, will be erected at each construction site.				
Employment Conflicts	To prevent conflicts of the project work force with the residents in the project area	6. A transparent hiring policy shall be adopted and local communities in project area will be informed of this policy. 7. It shall be ensured that maximum number of unskilled and semi-skilled jobs will be provided to residents of Peshawar and its suburbs.	During construction activity	Project area	Contractor and the CSC	PDA/ CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		8. PDA will ensure a balanced process of employment for communities in project area.				
Social Impacts	To ensure minimum impacts from construction labor force. To ensure minimum impacts on public health. To ensure minimum effects of indirect impacts of constructions to the people who are living close to the boundary of project site; Dust, Noise effects etc. To minimize access problems for local population during construction.	1. Potential for spread of vector borne and communicable diseases from labor camps shall be avoided (worker awareness orientation and appropriate sanitation should be maintained). 2. Claims/complaints of the people on construction nuisance/damages close to project site to be considered and responded to promptly by the Contractor. 3. Contractor shall organize temporary means of access and make alternative arrangements to avoid local community impacts and to avoid such short-term negative impacts.	Complaints of APs to be solved as soon as possible. Necessary evacuations to be done as when necessary if construction impacts are of significant duration and close to APs.	Project area.	Contractor and the CSC	PDA/ CSC
Operational Stage						
Air Quality	To ensure operational	1. Buses and all mechanical equipment	Once BRT operation	Along BRT corridor and at associated facilities	O&M Contractor	PDA

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
	phase of BRT project does not have adverse impact on air quality of project area	such as generators shall undergo regular maintenance and shall be tuned to maintain engine efficiency and minimize emissions in compliance of NEQS limits. 2.Stack height of generators (if any) will be at least 3 meters above the ground. 3. Regular maintenance of BRT buses shall be conducted and optimal engine efficiency shall be ensured through use of high quality fuel. 4. Regular monitoring of PM levels will be conducted. Any sections along BRT corridor where PM levels are increasing shall be closely examined and potential PM sources will be identified and customized mitigation measures developed and implemented to reduce PM levels at that particular section of	commences.	such as depots, workshops etc.		

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		the BRT corridor.				
Noise Levels	To ensure noise levels remain within acceptable NEQS limits during BRT project operation	1. Tuning and maintenance of buses and mechanical equipment such as buses on regular basis to minimize noise levels and comply with NEQS limits. 2. Strict driving protocols shall be followed such as no honking etc. 3. Permanent Noise barriers shall be placed at all flyovers and on elevated roads that pass through congested facilities.	Once BRT operation commences.	Along BRT corridor and at associated facilities such as depots, workshops etc.	O&M Contractor	PDA
Water Resources	To ensure any wastewater being discharged from BRT facilities complies with NEQS limits.	1. Proper wastewater collection and treatment facility must be developed at depots. 2. Efficient storm water drainage network along BRT route must be developed.	Once BRT operation commences.	At BRT depots and workshop areas	O&M Contractor	PDA
Solid Waste Disposal	To prevent contamination of the areas along the project	1. Proper waste management plan will be prepared and implemented to ensure waste collection,	Once BRT operation commences.	At BRT stations, depots and workshop areas	O&M Contractor	PDA

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
	corridor due to improper solid waste disposal.	transfer and disposal.				
Biological Environment	To replant any vegetation such as trees, plants uprooted due to project development	Plantation and landscaping shall be conducted along BRT corridor wherever vegetation has been removed. This will ensure the existing aesthetic value of the project area is protected.	As soon as BRT construction is complete.	Along BRT corridor wherever vegetation has been removed.	O&M Contractor	PDA
Impact on Livelihood of existing transport workers	To ensure no significant impacts take place on the livelihood of the existing transport workers	A comprehensive livelihood assessment study has been conducted and its findings shall be implemented in true letter and spirit.	Once BRT operation commences.	Along BRT corridor	O&M Contractor	PDA
Adaptability of general public to driving conditions	To ensure general public adapts to the new BRT infrastructure and changed driving conditions.	1. Provisions will be made in detailed designs for road conditions at major intersections to meet local design standards. 2. Flourescent signboards shall be used for the major junctions.	Prior to commencement and once BRT operation commences.	Along BRT corridor	O&M Contractor	PDA

PDA Peshawar Development Authority

PD Project Director

CSC Construction Supervision Consultant

O&M Operation & Maintenance

Table 7.10: 'Site Specific' Environmental Management and Monitoring Plan

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
BUS DEPOT						
Construction Stage						
Soil Contamination/ Hazardous Substances	To prevent contamination of soil from toxic and hazardous substances	(i) Before site works commence, a Spill Management Plan shall be prepared by the contractor and shall be approved by construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of procedures, responsibilities, resources, documentation and reporting requirements, training provisions for relevant staff, etc. to avoid spills of hazardous substances and to effectively respond to such incidents, in case these occur. (ii) Store fuel and	During Construction	At each location for development of the Bus Depot	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		hazardous substances in paved areas with embankment. If spills or leaks do occur, undertake immediate clean up. (iii) Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored and used. (iv) Train relevant construction personnel in handling of fuels and spill control procedures. (v) Ensure all storage containers are in good condition with proper labeling. (vi) Regularly check containers for leakage and				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		undertake necessary repair or replacement. (vii) Store hazardous materials above flood level. (viii) Equipment maintenance areas shall be provided with drainage leading to an oil water separator that will be regularly skimmed of oil and maintained to ensure efficiency. Discharge of oil contaminated water shall be prohibited. (ix) Store waste oil, used lubricant and other hazardous wastes in tightly sealed containers to avoid contamination of soil and water resources. Transport and off-site disposal of such wastes shall be consistent with national and local				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		regulations.				
Wastewater	To ensure only wastewater meeting the NEQS standards is discharged into the environment.	The depot(s) will be equipped with a wastewater treatment facility to ensure that effluent discharge complies with applicable national standards.	During Construction	At each location for development of the Bus Depot.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC
Drainage	To ensure the construction activity does not affect the natural drainage patterns in the project area.	(i) Avoid placement of construction materials, waste storage areas or equipment in or near drainage channels surrounding the Depot. (ii) Prohibit disposal of waste materials to drainage channels. (iii) In case existing drainage ditch is filled-up as required for the construction works, provide alternative drainage for rainwater.	During Construction	At each location for development of the Bus Depot.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		(iv) Regularly inspect and maintain all drainage channels to keep these free of obstructions.				
Air Quality	To minimize air emissions effectively and avoid complaints due to the airborne particulate matter released to the atmosphere	(i) Before site works commence, a Dust Control Plan shall be prepared by the contractor and shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimize impacts to sensitive receptors (residential areas etc.) due to construction works; operation of concrete batch plants; sourcing, storage and transport of construction materials, and	During Construction	At each location for development of the Bus Depot.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		other project-related activities. (ii) Wherever possible, use electrically powered equipment rather than gas or diesel-powered equipment. (iii) Position any stationary emission sources (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors; (iv) Use only vehicles and equipment that are registered and have necessary permits. (v) Burning of wastes generated at the construction sites, work camps and other project-related activities shall be strictly prohibited.				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		(vi) Construction equipment and vehicles shall be well-maintained and shall meet NEQS emission standards. (vii) Specify the use of clean fuels such as ultra-low sulphur diesel in dump trucks and other heavy-duty diesel vehicles and/or equipment, in conjunction with the use of particulate trap control devices, as well as catalytic converters, to avoid excessive diesel emissions. (viii) Keep stockpiles moist and cover vehicles with tarpaulin sheets or other suitable materials to minimize dust emission and prevent spillage of materials (e.g., soil, cement, stone, sand,				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		aggregates, etc.). (ix) Provide temporary covers (e.g., tarpaulins, grass, etc.) on long term materials stockpiles. (x) Concrete mixing areas at the Depot site shall be located at least 300 m from the nearest residential area. (xi) Clean road surfaces of debris/spills from construction equipment and vehicles. (xii) Install temporary fencing or barriers around particularly dusty activities in vicinity of sensitive receivers. (xiii) Ensure availability of water trucks on site and if the works surface and access roads near				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		sensitive receptors (i.e., residential areas, roadside tea and food stalls, and other sensitive receptors) are dry and dusty, spray water on the exposed surfaces to reduce dust emission. (xiv) All construction equipment and machinery shall be fitted with emission control equipment in full compliance with the national regulations. (xv) Fuel-efficient and well-maintained haulage trucks will be used to minimize exhaust emissions. Smoke belching vehicles and equipment shall not be allowed and shall be removed from the project. (xvi) Impose speed limits on construction vehicles to				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		minimize road dust in areas where sensitive receptors are located. (xvii) Locations for stockpiling material at the depot area will be at least 100 m from the nearest residential sensitive receivers. (xviii) Undertake immediate repairs of any malfunctioning construction vehicles and equipment. (xix) Discourage idling of engines. (xx) Provide prior notification to the community on schedule of construction activities. (xxi) Implement community complaints hotline.				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
Noise	To ensure noise levels do not exceed permissible NEQS/IFC limits and do not create a nuisance for sensitive receptors in project area.	(i) Before site works commence, a Noise Control Plan shall be prepared by the contractor and shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimize impacts to sensitive receptors (residential areas, etc.) due to construction works, sourcing and transport of construction materials, and other project-related activities. (ii) All construction equipment and vehicles shall be well maintained, regularly inspected for	During Construction	At each location for development of the Bus Depot.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		noise emissions, and shall be fitted with appropriate noise suppression equipment consistent with applicable national and local regulations. (iii) Use only vehicles and equipment that are registered and have necessary permits. (iv) No noisy construction-related activities near sensitive receptors (such as residential areas, etc.) will be carried out during the night. Such activities shall be restricted to daylight hours. (v) Truck drivers and equipment operators shall minimize the use of horns. (vi) Impose speed limits on construction vehicles to minimize noise emission				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		along areas where sensitive receptors are located (houses, etc.). (vii) Provide temporary noise barriers (3-5 meter high barrier can reduce 5-10 dB(A), as necessary, if depot works will generate high noise levels that could disturb nearby households and other sensitive receptors. (viii) As much as possible, use quiet equipment and working method. (ix) Whenever possible, completely enclose noisy equipment which can reduce noise level by 15-25 dB(A), restrict use of noisy equipment (e.g.15 min for every consecutive 30 min period) and undertake sequential operation of equipment				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		with objective to reduce noise generated; (x) Provide prior notification to the community on schedule of construction activities. (xi) Implement community complaints hotline.				
Solid Waste	To ensure all solid waste generated during construction activity is disposed of in accordance with applicable local/international best practices.	(i) Provide garbage bins and facilities within the project site for temporary storage of construction waste and domestic solid waste. (ii) Separate solid waste into hazardous, non-hazardous and reusable waste streams and store temporarily on site in secure facilities with weatherproof flooring and roofing, security fencing and access control and drainage/ wastewater	During Construction	At each location for development of the Bus Depot.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		collection systems. (iii) Ensure that wastes are not haphazardly dumped within the project site and adjacent areas. (iv) Undertake regular collection and disposal of wastes to sites approved by local authorities.				
Damage to Community Facilities	To ensure the construction activity does not affect the community facilities in the project area.	(i) The contractor shall immediately repair any damage caused by the Project to properties (e.g., houses, other types of structures, etc.), community facilities such as water supply, power supply, communication facilities etc. (ii) Access roads damaged during transport of construction materials and other project-related activities shall be	During Construction	At each location for development of the Bus Depot.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		reinstated upon completion of construction works.				
Traffic Concerns	To ensure the traffic is managed efficiently and does not create issues for the receptors in the project area.	(i) Before site works commence, a Traffic Management Plan for the construction phase shall be reviewed by construction supervision consultant (CSC) prior to approval by ADB. The plan shall be designed to ensure that traffic congestion due to construction activities and movement of construction vehicles, haulage trucks, and equipment is minimized. The plan shall be prepared in consultation with local traffic officials and people's committees at the district and commune levels. The plan shall identify traffic diversion	During Construction	At each location for development of the Bus Depot.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		and management, transport mode for spoils disposal (e.g., truck, truck and barge, etc.), traffic schedules, traffic arrangements showing all detours, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas. (ii) Post traffic advisory signs (to minimize traffic build-up) in coordination with local authorities (iii) As much as possible, schedule delivery of construction materials and equipment during non-peak hours. (iv) Regularly monitor				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		traffic conditions along access roads to ensure that project vehicles are not causing congestion.				
Health and Safety of Workers and Public	To ensure the project construction does not adversely impact on the health and safety of workers and public.	(i) Prior to commencement of site works, the Occupational and Community Health and Safety Plan and Emergency Response Plan must be implemented when required. (ii) Appoint an environment, health and safety manager to look after implementation of required environmental mitigation measures, and to ensure that health and safety precautions are strictly implemented for the protection of workers	During Construction	At each location for development of the Bus Depot.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		and the general public in the vicinity of construction areas. (iii) Conduct orientation for construction workers regarding health and safety measures, emergency response in case of accidents, fire, etc., and prevention of HIV/AIDS and other related diseases. (iv) Provide first aid facilities that are readily accessible by workers. (v) Provide fire-fighting equipment at the work areas, as appropriate, and at construction camps. (vi) Provide adequate drainage in workers				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		camps to prevent water logging/accumulation of stagnant water and formation of breeding sites for mosquitoes. (vii) Provide adequate housing for all workers at the construction camps. (viii) Provide reliable supply of potable water. (ix) Provide separate hygienic sanitation facilities/toilets and bathing areas with sufficient water supply for male and female workers. (x) Ensure that all wastewater emanating from worker camps, construction camps				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		and other project-related activities and facilities are treated consistent with national regulations. (xi) Establish clean canteen/rest area. (xii) Ensure proper collection and disposal of solid wastes within the construction camps consistent with local regulations. (xiii) Provide fencing on all areas of excavation greater than 2 m deep. (xiv) Provide appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, breathing mask, goggles, and				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		ear protection. (xv) Ensure reversing signals are installed on all construction vehicles. (xvi) Implement precautions to ensure that objects (e.g., equipment, tool, debris, precast sections, etc.) do not fall onto or hit construction workers. (xvii) Implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery or through an opening in a work surface. Based on a case specific basis, fall				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		prevention/protection measures may include installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area, proper use of ladders and scaffolds by trained employees, use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard, fall protection devices such as full body harnesses, etc. To ensure public safety: (i) Implement precautions to ensure that objects (e.g., equipment, tool, debris, precast sections, etc.) do not fall onto or hit people,				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		vehicles and properties in adjoining areas. (ii) Fencing of construction sites and regular patrols to restrict public access. (iii) Prior to excavation work, provide fencing on all sides of areas to be excavated. (iv) Provide warning signs at the periphery of the construction site. (v) Strictly impose speed limits along residential areas and where other sensitive receptors are located. (vi) Educate drivers on safe driving practices to minimize accidents and to prevent spill of				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		hazardous substances and other construction materials during transport.				
Social Conflicts	To ensure social conflicts are prevented from arising due to project construction.	(i) Consider the location of construction camps away from communities in order to avoid social conflict in using resources and basic amenities such as water supply. (ii) Maximize number of local people employed in construction works. (iii) Maximize goods and services sourced from local commercial enterprises.	During Construction	At each location for development of the Bus Depot.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC
Operation Stage						
Soil Contamination/ Hazardous	To ensure soil contamination does not take place due to the	(i) Wastewater shall be treated at the depot's treatment plant to	During BRT Operation	At each location for development of the Bus Depot.	O&M Contractor	PDA

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
Substances	project construction activity.	ensure that relevant NEQS standards and requirements are met. (ii) In the vehicle washing, maintenance area and wheel lathe pits, drains shall be linked to the water treatment plant. (iii) Drainage emanating from the depot workshops will be equipped with oil interceptors. Oil-drip pans shall be used where appropriate to avoid contamination of the environment. (iv) Office buildings shall be provided with toilets and septic tanks or drain to sewers to handle domestic sewage. (v) The sewer system will					

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		be designed to prevent leakage or overflow of waste water that could contaminate the surrounding areas. (vi) All hazardous and potentially contaminating materials (chemicals, fuels, oils, etc.) and equipment that contain hazardous substances shall be stored in facilities with weatherproof flooring and roofing, security fencing and access control and drainage/wastewater collection systems. (vii) PCB-containing equipment shall not be used. (viii) Leaks shall be repaired immediately				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		and waste oil shall be stored and disposed of consistent with applicable laws and regulations. (ix) Diesel generators shall be placed on concrete floors with embankment. (x) There shall be provisions for concrete-lined transformer bays as well as drainage and oil-water separator to handle spills, leaks and oily water run-off that could emanate from the transformers. (xi) Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		hazardous substances where such materials are being stored and used. (xii) A groundwater quality monitoring program shall be implemented to ensure that groundwater for domestic purposes are adequately treated to meet applicable NEQS standards (based on the monitoring results).				
Air Quality	To minimize air emissions effectively and avoid complaints due to the airborne particulate matter released to the atmosphere	1. To minimize odor generation, wastewater treatment facilities shall be properly maintained and solid wastes regularly removed from the depot area to disposal sites approved by local authorities. 2. Burning of waste materials shall be	During BRT Operation	At each location for development of the Bus Depot.	O&M Contractor	PDA

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		prohibited. 3. Idling of vehicles minimized. 4. Back-up diesel generators to be used during power interruptions and shall be maintained regularly to ensure emissions comply with NEQS standards.				
Noise	To ensure noise levels do not exceed permissible NEQS/IFC limits and do not create a nuisance for sensitive receptors in project area.	1. Noise mitigation measures (e.g., enclosure) shall be provided for the back-up diesel generator(s) to ensure that high noise levels will not impact on surrounding sensitive receptors. While the noise levels are not expected to cause nuisance to the local community, noise monitoring will continue	During BRT Operation	At each location for development of the Bus Depot.	O&M Contractor	PDA

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		during the operation to determine and provide noise abatement measures, if necessary. Noise sampling shall also be conducted in response to complaints.				
Solid Waste	To ensure all solid waste generated during BRT operation is disposed of in accordance with applicable local/international best practices.	(i) Offices, workshops and other areas within the depot shall be provided with waste collection bins or receptacles. (ii) Solid wastes shall be segregated into hazardous, non-hazardous and reusable waste streams and stored temporarily on site in secure facilities with weatherproof flooring and roofing, security fencing and access control and drainage/wastewater	During BRT Operation	At each location for development of the Bus Depot.	O&M Contractor	PDA

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		collection systems. (iii) Garbage shall be regularly collected and shall be disposed consistent with local regulations. (iv) Wastes shall only be disposed of in approved sites by local authorities.				
Health and Safety of Workers and Public	To ensure the project construction does not adversely impact on the health and safety of workers and public.	(i) Prior to operation of the depot, PDA shall ensure that the following plans have been developed and adequately resourced. PDA shall ensure that plan provisions are strictly implemented throughout operation phase: ▪ Occupational Health and Safety Plan	During BRT Operation	At each location for development of the Bus Depot.	O&M Contractor	PDA

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		▪ Emergency Response Plan (ii) The depot site will be fenced and access will be restricted to authorized personnel to avoid safety risks to the public.				
ELEVATED SECTIONS						
Construction Stage						
Disruption to Community Utilities	To ensure the community utilities in the project area are not disrupted due to the project construction activity.	i) Water supply pipelines, power supply, communication lines and other utilities shall be re-provisioned before construction works commence. ii) Provisions shall be made to preserve the operation of current facilities in sufficient quantity and in agreement with the local	During Construction	At each elevated section location project site.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		community. iii) Re-provisioning shall be undertaken in coordination with the utility company. iv) Affected households and establishments shall be notified well in advance of such disruption.				
Spoils Generation	To ensure spoils generated during the construction activity is disposed off in accordance with applicable local and international legislation.	(i) Meet the same measures as prescribed for the underground/ tunnel spoils under the Spoils Disposal Plan. (ii) All asphalt and sidewalk materials removed should be separated and recycled. (iii) Spoil disposal will only be to pre-approved areas.	During Construction	At each elevated section location project site.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		(iv) The capacity of disposal sites shall be adequate to accept the quantity of spoils without alienating areas outside the site boundaries. (v) Disposal of contaminated spoils shall only be to disposal sites equipped and licensed to handle such wastes. (vi) Trucks transporting spoils shall be tightly covered with tarpaulin or other suitable materials to minimize dust emission and spills. (vii) Load-out areas shall be cleaned and watered to ensure no accumulated dust originates that could be				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		dispersed to surrounding areas. (viii) Wheel washing shall be undertaken to remove mud so as to ensure that access roads are kept clean. (ix) Road surfaces shall be regularly cleaned of spilled spoils; (x) Spoil disposal shall not cause sedimentation and obstruction of flow of watercourses, damage to agricultural land and densely vegetated areas.				
Drainage/Flooding	To ensure the occurrence of flooding does not affect the project construction activity.	(i) Placement of construction materials, excavated spoils and equipment shall not block flow of rainwater into canals/drainage	During Construction	At each elevated section location project site.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		structures. (ii) Prohibit disposal of waste materials to drainage channels. (iii) Regularly inspect and maintain all drainage channels in the vicinity of construction sites to keep these free from obstructions.				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
Air Quality	To minimize air emissions effectively and avoid complaints due to the airborne particulate matter released to the atmosphere	Best management practices shall be adopted during construction to minimize dust and combustion exhaust emissions consisting of: (i) Burning of waste materials shall be prohibited. (ii) Idling of vehicles minimized. (iii) Back-up diesel generators to be used during power interruptions and shall be maintained regularly to ensure emissions comply with NEQS standards.	During Construction	At each elevated section location project site.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC
Noise	To ensure noise levels do not exceed permissible NEQS/IFC limits and do not create a nuisance for	(i) Noise Control Plan shall be prepared by the contractor and implemented.	During Construction	At each elevated section location project site.	Contractor shall maintain acceptable standards. CSC to supervise	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
	sensitive receptors in project area.	(ii) Unobtrusive noise barriers near sensitive areas such as residential areas, etc. can also be placed on the edge of the right-of-way should construction monitoring indicate an impact to sensitive receivers. Temporary noise barriers (3-5 meter high) can reduce noise level by 5-10 dB(A). (iii) Diesel hammer piling shall be limited in favor of drill piling. (iv) Truck drivers and equipment operators shall minimize the use of horns. (v) Position any stationary equipment that produce high noise levels (e.g., portable diesel			activities.	

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		generators, compressors, etc.) as far as is practical from sensitive receptors; (vi) All construction equipment and vehicles shall be well maintained, regularly inspected for noise emissions, and shall be fitted with appropriate noise suppression equipment consistent with applicable national and local regulations. (vii) Use only vehicles and equipment that are registered and have necessary permits. (viii) No noisy construction-related activities will be carried out during the night near sensitive receptors (e.g., residential areas).				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		Such activities shall be restricted to daylight hours. (ix) Impose speed limits on construction vehicles to minimize noise emission along areas where sensitive receptors are located (residential areas, etc.). (x) As much as possible, use quiet equipment and working method. (xi) Whenever possible, completely enclose noisy equipment which can reduce noise level by 15-25 dB(A), restrict use of noisy equipment (e.g.15 min for every consecutive 30 min period) and undertake sequential operation of equipment with objective to reduce				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		noise generated; (xii) Provide prior notification to the community on schedule of construction activities. (xiii) Implement community complaints hotline.				
Vibration	To ensure vibration effects resulting from use of construction equipment does not cause damage to infrastructure in project area.	(i) Tracked cranes will be used to lift pre-cast sections of the columns. (ii) Equipment will also not be operating at night (iii) Monitoring at sensitive receiver sites will be carried out.	During Construction	At each elevated section location project site.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC
Use of hazardous substances	To ensure hazardous and toxic substances are disposed off in accordance with applicable local and	(i) Before site works commence, a Spill Management Plan shall be prepared by the contractor and	During Construction	At each elevated section location project site.	Contractor shall maintain acceptable standards. CSC to supervise	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
	international regulations.	implemented, if required. (ii) Store fuel and hazardous substances in paved areas with embankment. If spills or leaks do occur, undertake immediate clean up. (iii) Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored and used. (iv) Train relevant construction personnel in handling of fuels and spill control procedures. (v) Ensure all storage			activities.	

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		containers are in good condition with proper labeling. (vi) Regularly check containers for leakage and undertake necessary repair or replacement. (vii) Store hazardous materials above flood level. (viii) Equipment maintenance areas shall be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency. Discharge of oil contaminated water shall be prohibited. (ix) Store waste oil, used lubricant and other				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		hazardous wastes in tightly sealed containers to avoid contamination of soil and water resources. Transport and off-site disposal of such wastes shall be consistent with national and local regulations.				
Solid Waste	To ensure all solid waste generated during BRT construction is disposed of in accordance with applicable local/international best practices.	(i) Waste collection bins or receptacles shall be provided in various areas at the elevated stations, such as offices and areas accessed by passengers. (ii) Garbage shall be regularly collected and shall be disposed consistent with local regulations.	During Construction	At each elevated section location project site.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC
Damage to Community Facilities	To ensure the construction activity does not affect the	(i) The contractor shall immediately repair any damage caused by the	During Construction	At each elevated section location project site.	Contractor shall maintain acceptable	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
	community facilities in the project area.	Project to properties (e.g., houses, other types of structures, etc.), community facilities such as water supply, power supply, communication facilities etc. (ii) Access roads damaged during transport of construction materials and other project-related activities shall be reinstated upon completion of construction works.			standards. CSC to supervise activities.	
Traffic Concerns	To ensure the traffic is managed efficiently and does not create issues for the receptors in the project area.	(i) Before site works commence, a Traffic Management Plan for the construction phase shall be reviewed and implemented when required. (ii) Provide signs advising road users that construction is in	During Construction	At each elevated section location project site.	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		progress and that the road narrows to one lane using cones. (iii) Employ flag persons to control traffic at the work sites for safety reasons when construction equipment is entering or leaving the work area. (iv) Lanes shall be created through the work site using rope or flagging to minimize risks and injuries from falling objects. (v) As much as possible, lifting and placing of the pre-cast pillar sections will be done at night to minimize traffic congestion. (vi) Post traffic advisory signs (to minimize traffic build-up) in coordination				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		with local authorities. (vii) Provide road signs indicating the lane is closed 500 m before the worksite. (viii) Use traffic cones to direct traffic to move to the open lane. (ix) Provide sufficient lighting at night within and in the vicinity of construction sites. (x) Regularly monitor traffic conditions along access roads to ensure that project vehicles are not causing congestion. (xi) Define and observe schedules for different types of construction traffic trips (e.g., transport of pre-cast sections, haulage of				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		spoils, delivery of construction materials, etc.). (xii) As much as possible, schedule delivery of construction materials and equipment as well as transport of spoils during non-peak hours. (xiii) Avoid movements of noisy vehicles during night time in vicinity of sensitive receivers. (xiv) Implement suitable safety measures to minimize risk of adverse interactions between construction works and traffic flows through provision of temporary signals or flag controls, adequate lighting, fencing, signage and road diversions.				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		(xv) Ensure relocation of any affected public transport infrastructure (but stops, shelters etc.) prior to commencement of works (xvi) Provide advance notification to the community regarding changes to public transport facilities or routes. (xvii) Schedule construction works to minimize extent of activity along linear construction site at any one time. (xviii) Comply with traffic regulations and avoid, where possible, roads with the highest traffic volumes, high density of sensitive receivers or capacity constraints are				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		not used as access to and from the construction areas and spoils disposal sites. (xix) Install temporary accesses to properties affected by disruption to their permanent accesses. (xx) Reinstate good quality permanent accesses following completion of construction.				
Operation Related Impacts						
Wastewater	To ensure only wastewater meeting the NEQS standards is discharged into the environment.	Drainage from the pillars will be carried through pipes and drain internally to the city storm water system. The elevated station shall be provided with toilets and septic tanks to handle sewage generated by workers and passengers.	During BRT Operation	At each elevated section of BRT.	O&M Contractor	PDA

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
Solid Waste	To ensure all solid waste generated during BRT operation is disposed of in accordance with applicable local/international best practices.	(i) Waste collection bins or receptacles shall be provided in various areas at the elevated stations, such as offices and areas accessed by passengers. (ii) Garbage shall be regularly collected and shall be disposed consistent with local regulations.	During BRT Operation	At each elevated section of BRT.	O&M Contractor	PDA
Tunnels & Underground Sections						
Construction Phase						
Disruption to Community Utilities	To ensure the construction activity does not affect the community utilities in the project area.	i) Water supply pipelines, power supply, communication lines and other utilities shall be re-provisioned before construction works commence. ii) Provisions shall be made to preserve the operation of current	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		facilities in sufficient quantity and in agreement with the local community. iii) Re-provisioning shall be undertaken in coordination with the utility company. iv) Affected households and establishments shall be notified well in advance of such disruption.				
Spoils Generation	To ensure spoils generated during the construction activity is disposed off in accordance with applicable local and international legislation.	(i) Before site works commence, a Spoils Disposal Plan (SDP) shall be prepared by the contractor. (ii) All asphalt and sidewalk materials removed should be separated and recycled.	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		(iii) Spoil disposal will only be to PDA approved areas. (iv) The capacity of disposal sites shall be adequate to accept the quantity of spoils without alienating areas outside the site boundaries. (v) Undertake random sampling of spoils from underground station excavations and tunneling to determine presence of contaminants. If levels of contaminants exceed standards, excavation spoils shall be considered as hazardous wastes consistent with applicable standards/guidelines and shall be treated				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		and disposed of as such. (vi) Disposal of contaminated/hazardous spoils shall only be to disposal sites equipped and licensed to handle such wastes. (vii) Determine water content of spoils to ascertain if spoils dewatering is necessary. (viii) Undertake necessary spoils dewatering and provide adequate treatment facilities to ensure that resulting wastewater meets NEQS standards. Adequate treatment should also be undertaken for groundwater drained from the excavated				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		areas to ensure compliance with NEQS standards. (ix) Stockpiling of spoils shall not be undertaken due to the limited footprint of the construction site. Spoils shall be trucked away immediately to approved temporary or final disposal sites. (x) Should any small stockpiles be developed, these shall be covered by plastic sheeting. (xi) Trucks transporting spoils shall be tightly covered with tarpaulin or other suitable materials to minimize dust emission and spills. Wet spoils shall be transported using				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		covered water-tight trucks to avoid spillage and drips onto access roads. (xii) Load-out areas shall be cleaned and watered to ensure no accumulated dust originates that could be dispersed to surrounding areas. (xiii) Wheel washing shall be undertaken to remove mud so as to ensure that access roads are kept clean. (xiv) Road surfaces shall be regularly cleaned of spilled spoils. (xv) Spoil disposal shall not cause sedimentation and obstruction of flow to agricultural land,				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		properties, and densely vegetated areas.				
Land Subsidence/ Geotechnical hazards	To ensure geotechnical stability at project sites is ensured prior to commencement of construction activity.	(i) Undertake detailed geological investigation to determine geotechnical hazards along the Project's impact zone. Implement suitable precautionary and protection measures to avoid or minimize hazards. (ii) Select the best construction methods for retaining wall to ensure the stability of the deep excavation. (iii) Implement survey program to monitor the background subsidence rate along the project alignment. (iv) Conduct careful monitoring of the	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		groundwater level, amount of settlement, tilt of buildings, and any building damages. (v) Depending on the results of subsidence monitoring program, develop and implement suitable mitigation measures to avoid or minimize damage to properties. (vi) Establish an emergency action plan for geotechnical hazards including a set of criteria for issuing warnings for such hazards. (vii) If necessary; carefully design, implement and monitor an appropriate dewatering program. (viii) Perform probe drilling ahead of the TBM cutting				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		surface at places where abrupt change of geological properties occur since such areas tend to have a higher risk of failure. Based on the results of probe drilling, implement appropriate precautionary measures. (ix) Undertake ground treatment underneath the deep excavation site if required. (x) The tunnel boring machine (TBM) contractor shall be required to operate within the following settlement parameters: Standard building: maximum settlement: 25 mm, maximum differential settlement: 11500 (this indicator is more important for damage), maximum				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		upheaval: 10 mm Particularly sensitive building to be identified: maximum settlement: 20 mm; maximum differential settlement: 11600, maximum upheaval: 10 mm Street and pavement: maximum settlement: 30 mm, maximum differential settlement: 11400, maximum upheaval: 10 mm. Select the best tunneling methods to minimize possible settlement during construction.				
Flooding	To ensure the occurrence of flooding does not affect the project construction activity.	1. The contractor will be required to prepare a spoils disposal plan, which will include, among others, installation of adequate drainage facilities and flood	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		prevention measures. 2. To prevent flush of soil into the channel during flood events, a retaining wall along the boundary is recommended. 3. To avoid clogging of drainage and creating localized flooding: (i) Placement of construction materials, excavated spoils and equipment shall not block flow of rainwater into canals/drainage structures. (ii) Prohibit disposal of waste materials to drainage channels. (iii) Regularly inspect and maintain all drainage channels in the vicinity of construction sites to				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		keep these free from obstructions. (iv) Construct retaining walls along the spoils disposal boundary bordering the channels to prevent spoils from being flushed into the water courses during heavy rains and flood events. (v) At the disposal site, avoid formation of steep slopes to avoid soil materials from being eroded/washed out during rains and floods.				
Air Quality	To minimize air emissions effectively and avoid complaints due to the airborne particulate matter released to the atmosphere	(i) Before site works commence, a Dust Control Plan shall be prepared by the contractor and implemented when required.	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		(ii) Wherever possible, use grid rather than generator set electrical power for construction equipment such as the tunnel boring machine and equipment to be used during cut-and-cover tunnel excavations. (iii) Position any stationary emission sources (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors; (iv) Use only vehicles and equipment that are registered and have necessary permits. (v) Burning of wastes generated at the construction sites, work camps and other project-				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		related activities shall be strictly prohibited. (vi) Construction equipment and vehicles shall be well-maintained and shall meet national NEQS emission standards. (vii) Trucks to be used for transporting excavation spoils shall be tightly covered (viii) Specify the use of clean fuels such as ultra-low sulphur diesel in dump trucks and other heavy-duty diesel vehicles and/or equipment, in conjunction with the use of particulate trap control devices, as well as catalytic converters, to avoid excessive diesel				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		emissions. (ix) Keep stockpiles moist and tightly cover vehicles with tarpaulin sheets or other suitable materials to minimize dust emission and prevent spillage of materials (e.g., soil, cement, stone, sand, aggregates, excavation spoils, etc.). (x) Provide temporary covers (e.g., tarpaulins, grass, etc.) on long term materials stockpiles. (xi) Store excavated materials outside road reserve, but where there is no area; spoils shall be loaded and transported immediately. (xii) Provide truck-washing facilities to prevent truck-				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		out of mud and dust onto city streets. (xiii) As much as possible, the casting yard for the Project will make use of already established and licensed site(s) for concrete forming activities where all the pre-cast sections will be fabricated. (xiv) Ensure that necessary environmental approvals are obtained for the establishment and operation of concrete batching plants and casting yards, A minimum distance of 300 meters will be ensured between batching plants and the nearest community. (xv) Daily cleaning of road surfaces of debris/spills				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		from construction equipment, haulage trucks and vehicles, (xvi) Install temporary fencing or barriers around particularly dusty activities in vicinity of sensitive receivers (xvii) Ensure availability of water trucks or other dust suppressants and appropriate equipment for applying the suppressant (e.g., a tank tuck with spray bars) on site and if the works surface and access roads near sensitive receptors (i.e., residential areas, roadside tea and food stalls, schools, hospitals and other sensitive receptors) are dry and dusty, spray water on the exposed surfaces to				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		reduce dust emissions. (xviii) All construction equipment and machinery shall be fitted with emission control equipment in full compliance with the national (NEQS) and local regulations. (xix) Fuel-efficient and well-maintained haulage trucks will be used to minimize exhaust emissions. Smoke belching vehicles and equipment shall not be allowed and shall be removed from the project. (xx) Impose speed limits on construction vehicles to minimize road dust in areas where sensitive receptors are located.				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		(xxi) Undertake immediate repairs of any malfunctioning construction vehicles and equipment. (xxii) Daily visual inspections to identify and address potential areas of dust and odor emissions. (xxiii) Discourage idling of engines. (xxiv) Provide prior notification to the community on schedule of construction activities. (xxv) Implement community complaints hotline.				
Vibration	To ensure vibration effects resulting from use of construction	(i) Erection of temporary walls around the underground station excavation sites and	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
	equipment does not cause damage to infrastructure in project area.	tunnel portal. Temporary noise barriers (3-5 meter high) can reduce noise level by 5-10 dB(A), using daytime work schedules only, (ii) All construction equipment and vehicles shall be well maintained, (iii) Diesel hammer piling shall be limited in favor of churn drill piling.			CSC to supervise activities.	
Solid Waste	To ensure solid waste is disposed in accordance with local and international applicable best practices.	(i) Provide garbage bins and facilities within the project site for temporary storage of construction waste and domestic solid waste. (ii) Separate solid waste into hazardous, non-hazardous and reusable waste streams and store temporarily on site in secure	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		facilities with weatherproof flooring and roofing, security fencing and access control and drainage/ wastewater collection systems. (iii) Ensure that wastes are not haphazardly dumped within the project site and adjacent areas. (iv) Undertake regular collection and disposal of wastes to sites approved by local authorities.				
Damage to Community Utilities	To ensure the construction activity does not affect the community facilities in the project area.	(i) The contractor shall immediately repair any damage caused by the Project to properties (e.g., houses, other types of structures, etc.), community facilities such as water supply, power	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		supply, communication facilities etc. (ii) Access roads damaged during transport of construction materials and other project-related activities shall be reinstated upon completion of construction works.				
Health and Safety of Workers and Public	To ensure the project construction does not adversely impact on the health and safety of workers and public.	i. 'Occupational and Community Health and Safety Plan' and 'Emergency Response Plan' to be implemented when required. ii. Appoint an environment, health and safety manager to look after implementation of required environmental mitigation measures.	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		iii. Conduct workshop for all workers on health, safety and environmental measures. iv. Provide first aid facilities that are readily accessible by workers. v. Provide fire-fighting equipment at the work areas, where appropriate, and at construction camps. vi. Provide adequate drainage in workers camps to prevent water logging and formation of breeding sites for mosquitoes. vii. Provide potable water, hygienic sanitation facilities/toilets with sufficient water supply				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		viii. Ensure that all wastewater emanating from workers camps, construction camps and other project-related activities and facilities are treated consistent with national regulations. (ix) Establish clean canteen/rest area. (x) Provide fencing on all areas of excavation greater than 2 m deep. (xi) Provide appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, breathing mask, goggles, and ear protection. (xii) Implement precautions to ensure that objects				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		(e.g., equipment, tool, debris, precast sections, etc.) do not fall onto or hit construction workers.				
Traffic Concerns	To ensure smooth and uninterrupted flow of traffic and to ensure safety during traffic movement in project area.	i. Traffic management plan for implementation when required. (ii) Provide signs advising road users that construction is in progress and that the road narrows to one lane using cones. (iii) Employ flag persons to control traffic at the work sites for safety reasons when construction equipment is entering or leaving the work area. (iv) Lanes shall be created through the work site using rope or flagging	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		to minimize risks and injuries from falling objects. (v) As much as possible, lifting and placing of the pre-cast pillar sections will be done at night to minimize traffic congestion. (vi) Post traffic advisory signs (to minimize traffic build-up) in coordination with local authorities. (vii) Provide road signs indicating the lane is closed 500 m before the worksite. (viii) Use traffic cones to direct traffic to move to the open lane. (ix) Provide sufficient lighting at night within				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		and in the vicinity of construction sites. (x) Regularly monitor traffic conditions along access roads to ensure that project vehicles are not causing congestion. (xi) Define and observe schedules for different types of construction traffic trips (e.g., transport of pre-cast sections, haulage of spoils, delivery of construction materials, etc.). (xii) As much as possible, schedule delivery of construction materials and equipment as well as transport of spoils during non-peak hours. (xiii) Avoid movements of noisy vehicles during				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		night time in vicinity of sensitive receivers. (xiv) Implement suitable safety measures to minimize risk of adverse interactions between construction works and traffic flows through provision of temporary signals or flag controls, adequate lighting, fencing, signage and road diversions. (xv) Ensure relocation of any affected public transport infrastructure (but stops, shelters etc.) prior to commencement of works (xvi) Provide advance notification to the community regarding changes to public transport facilities or				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		routes. (xvii) Schedule construction works to minimize extent of activity along linear construction site at any one time. (xviii) Comply with traffic regulations and avoid, where possible, roads with the highest traffic volumes, high density of sensitive receivers or capacity constraints are not used as access to and from the construction areas and spoils disposal sites. (xix) Install temporary accesses to properties affected by disruption to their permanent accesses. (xx) Reinstate good quality				

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
		permanent accesses following completion of construction.				
Cultural and Heritage Resources	To protect cultural and heritage resources in the project area.	'Chance Find' procedures shall be followed.	During Construction	At each tunnel & underground section project site	Contractor shall maintain acceptable standards. CSC to supervise activities.	PDA/CSC
Operation Related Impacts						
Flooding	To ensure the project operation is not affected due to flooding.	i. The underground tunnel sections will be provided with pumps to pump storm water. ii. A sill designed to meet annual and maximum flood height shall be constructed to protect the tunnel entrance from flood.	During BRT Operation	At each tunnel section of BRT.	O&M Contractor	PDA
Noise	To ensure noise levels do not exceed permissible NEQS/IFC limits and do not create a nuisance for	i. Tunnel ventilation systems shall have suitable noise control measures incorporated into their design to	During BRT Operation	At each tunnel section of BRT.	O&M Contractor	PDA

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
	sensitive receptors in project area.	reduce mechanical noise to acceptable levels in the surrounding community. ii. Depending on the results of monitoring, installation of acoustical treatment to the first few meters (i.e., <15 m) of the tunnel portal could be implemented, if necessary.				
Health and Safety of Workers and Public	To ensure the project construction does not adversely impact on the health and safety of workers and public.	i. A system will be installed to ensure circulation of fresh air to meet both normal and emergency requirements. ii. Pumps will be installed in the tunnels to pump storm water and wastewater.	During BRT Operation	At each tunnel section of BRT.	O&M Contractor	PDA

PDA Peshawar Development Authority

PD Project Director

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring

CSC Construction Supervision Consultant

O&M Operation & Maintenance

8 Public Consultation and Information Disclosure

8.1 Introduction

607. Public participation and community consultation has been taken up as an integral part of environmental and social assessment process of the project. The public consultations have been conducted from 1st August'16 up to 5th January'17 in the entire project area. Consultation was used as a tool to inform and educate stakeholders about the proposed action both before and after the development decisions were made. It assisted in identification of the problems associated with the project as well as the needs of the population likely to be impacted.

608. This participatory process helped in reducing the public resistance to change and enabled the participation of the local people in the decision making process. Initial public consultations have been carried out in the project area with the objectives of minimizing probable adverse impacts of the project and to achieve speedy implementation of the project through bringing in awareness among the key stakeholders on the benefits of the project.

609. Public participation and consultation are the major keys to any success in infrastructure development. The sustainability of any infrastructure development depends on the participatory planning in which public consultation plays a major role.

610. To ensure peoples' participation in the planning phase of this project and to treat public consultation and participation as a continuous two way process, a number of consultations were arranged.

611. Aiming at promotion of public understanding and discussion on the local needs and concerns of the various stakeholders i.e., affected business persons, government officials, local community members and daily visitors to the project area, consultations were conducted through focus group discussions, individual interviews and formal consultations.

612. The consultation process was meant to ensure that all key stakeholders are informed, consulted and allowed to participate actively in the development process. This shall continue to be done throughout the project, both during preparation, implementation and monitoring of project results and impacts.

613. The environmental assessment process under the Pakistan Environmental Protection Act 1997, requires the disclosure to the public after the statutory IEE / EIA has been accepted by the relevant EPA, to be in strict adherence to the rules. In this EIA, the consultation process was performed to satisfy the ADB requirements (Social Safeguard Policy 2009).

614. The Land Acquisition and Resettlement Plan (LARP) for PBRT has been prepared by Consultants following the final preliminary design under Project Preparatory Technical Assistance of Asian Development Bank (ADB). The RP is fully

endorsed by Transport and Mass Transit Department, Government of Khyber Pakhtunkhwa (GoKPK). It focuses on the key activities of the project, which would cause involuntary resettlement impacts; and is prepared in accordance with ADB's Safeguards Policy Statement (SPS) 2009.

615. The LARP has been prepared based on a census (conducted from 9 Nov to 29 Dec 2016) of 100% potentially Displaced Persons (DPs) that are known at preliminary design stage; a socio-economic survey of 25% project Affected Households (AHs) conducted from 21 Dec 2016 to 5 Jan 2017; and consultations with DPs and other stakeholders. This LARP will be updated during the detailed design stage.

8.2 Objective of Consultations

616. The basic objective of the consultations is as follows:

- Understand views of affected key stakeholders and generate ideas regarding the expected demands of the affected parties;
- Disseminate information to the affected persons about the project in terms of its activities and scope of work; and understand the views and perceptions of the people affected and local communities with reference to acquisition of land or loss of property and its due compensation.
- Identify and assess major economic and social information and characteristics of the project area to enable effective social and resettlement planning and its implementation.
- Resolve issues related to impacts on community property and their relocation.
- Examine PAPs' opinions on health safety issues during the construction period on garbage materials, waste materials and other pollution issues.
- Identify levels and extent of community participation in project implementation and monitoring.
- Establish an understanding for identification of overall developmental goals and benefits of the project.
- Disseminate information to and develop a thorough coordination with different government, non-government and public private sector stakeholder line agencies ensuring their participation and mobilization of support in the process for the successful planning and implementation of the project.
- Assess the local people's willingness to get involved with the project; and enumerate the measures to be taken during the implementation of the project.

8.3 Identification of Main Stakeholders

617. The primary stakeholders identified are the residents in the project area along with displaced persons, owners of small businesses/traders in close proximity to the project corridor, health care facilities (hospitals, clinics etc.), educational institutions near the BRT corridor and the general public that visit the project area frequently for different purposes. All these stakeholders have different types of stakes according to their interests and professions.

8.4 Approach for Public Consultation

618. The approach adopted towards public participation was to disseminate information, solicit inputs and develop consensus on issues and subsequently propose mitigation measures. This approach was put into practice through consultation and public meetings with relevant public sector authorities and other key sensitive receptors, namely the local communities residing in proximity to the project, management officials of hospitals and educational institutions in the project area as well as roadside consultations with pedestrians etc.

619. The project related information was shared with all key stakeholders by engaging local Pashto (the native language spoken in the project area) speaking personnel who explained the project scope to the different stakeholders. In addition, during these consultations, detailed maps of the proposed project showing the project alignment were also used as a visual aid apart from verbally explaining in detail the activities to be conducted during the construction phase of the proposed project. Thus, through these detailed briefings, it was ensured that complete clarity was provided to the stakeholders regarding the possible environment related issues to be faced by the key receptors in the project area.

620. It is important to emphasize that the public consultation is a continual process that shall be conducted throughout the project development phase with different national and international project stakeholders being consulted and their respective comments and concerns being addressed through dialogue and discussion. These consultations shall continue during the project detailed design phase and shall be completed prior to review of this report for separate approvals from ADB and KPK EPA, with the finalized consultation findings incorporated into the last version of this report.

8.5 Consultations

621. A total of over 600 different stakeholders were consulted as a part of the consultation process with traders and business owners in the project area, residents along the project corridor, affected persons, senior management staff of health care and educational institutions, visitors to the project corridor on a daily basis as well as public sector representatives from different line departments.

Consultations with Women

622. It was ensured that consultations with different women groups were also conducted. Several cultural and economic obstacles exist for women's participation in public consultations and decision making; this is compounded by constraints on mobility and limited interaction. There is not a single woman found operating business on the PBRT corridor.

623. To conduct effective consultations separately with women, 2 female surveyors were engaged. The women were keenly interested in consultations and provided good information. These included females of AHs, student's teachers and other

working women as well as the daily commuters. Most of them belonged to poor affected households while road side consultations were conducted with female of lower middle class and middle class families. The women unanimously supported the PBRT Project by GoKPK and highlighted the following key aspects:

- Most of the women from AHs demanded sufficient resettlement assistance and rehabilitation of MEs and restoration of household income/livelihood due to PBRT related road works.
- The loss of income of their household due to the relocation of affected business enterprises (of their spouses) will have a negative effect on their normal socio-economic living conditions.
- Risk to safety and security for their children will be increased due to construction works.
- Separate waiting spaces for women at PBRT stations and separate compartments for women in PBRT buses.
- Dedicated buses for female during rush hours.

624. The concerns and issues raised by women and other stakeholders have been adequately considered in the design of the project and resettlement assistance and rehabilitation packages for the DPs.

Consultations with NGOs

625. SABAWON (Social Action Bureau for Assistance in Welfare and Organizational Networking) and South Asia Partnership–Pakistan (SAP-PK), are two major Peshawar based NGOs working for the creation of a society based on principles of social justice and gender equality. Both strive to contribute towards development of the local communities, with a focus on providing enabling environment to the marginalized and deprived groups to access and utilize social sector services.

626. The NGOs are in favour of efficient public transport system. However, they demanded sufficient and timely payment of compensation, full mitigation of social and environmental impacts, effective consultations and participation of stakeholder particularly displaced persons in resettlement and environment related activities of the PBRT Project.

The summary of the public consultations is provided in Table 8.1 below.

8.6 Key Concerns

627. The key comments and concerns raised as a result of the consultations are as follows:

- There is an overall positive sentiment with regards to the project development with the stakeholders expressing an urgent need for development of the project considering the traffic congestion issues faced by the residents of the city on a daily basis. The benefits from this project as expressed by the stakeholders consisted of faster, reliable, safer and cleaner mode of public transport, quicker and easy connectivity, stress free travel and minimal risk of accidents.

- The stakeholders requested the concerned authorities to ensure the project was completed on a fast track basis and hoped it would not suffer any delays.

- The senior management staff of the major hospitals and health care institutions present in the project corridor expressed the need to ensure an uninterrupted path for their ambulances would remain available at all times during the project construction.

- The respondents urged the relevant authorities to award the contract for the project through a transparent process and keeping in view the scale of this activity, they requested that a contractor with very sound repute should be considered since local contractors tend to miss project deadlines and significantly delay project completion timelines.

- The need for efficient and detailed planning and development of a detailed traffic management plan prior to the commencement of the project construction was emphasized repeatedly since it was mentioned that the project route passes through certain highly congested areas.

- It was mentioned by different stakeholder groups that the Government focal agency needs to ensure high quality raw materials and techniques are employed in the project since the BRT route passes through the heart of Peshawar city and thus a high level of safety buffers need to be put in place in the design plans to prevent any civil structure failures, which could prove catastrophic.

- The stakeholders continued to stress the need for using all available measures to ensure the construction phase of the project would cause the least amount of difficulty to the everyday lives and routines of the sensitive receptors in the project area. Measures such as sprinkling of water for dust emission suppression, disallowing work at night times to control high noise levels and controlling speed of construction vehicles, particularly dumper trucks was requested.

- It was also mentioned that the relevant Government personnel must ensure the Contractor staff is cooperative with the general public and maintain the right attitude and try to facilitate them instead of being confrontational.

- The local traders and business owners in the project area mentioned that it must be ensured through efficient design of the BRT that their businesses are not affected and devaluation of the land on which their shops are constructed does not take place.

- The stakeholders also expressed the desire to receive regular updates on the project development from the relevant Government departments. In particular, the business owners and residents near the project area mentioned that they would appreciate some advance notice if any substantial activity was planned by the Contractor on a particular day that might cause an extraordinary disruption to their daily routines, thus enabling them to make necessary arrangements accordingly.

- The public sector representatives of the different line departments expressed their complete support and efforts towards the project development and mentioned the intent to ensure the project was completed at the earliest to the highest quality standards. In addition, these officials expressed the commitment to ensuring the Contractor selected for this project would adhere to all environmental and social compliance standards with no leniency in this regard to be expected from the relevant Government line departments.

- The public sector stakeholders also mentioned that this project was of high priority and its success needed to be ensured since it would prove a considerable opportunity to attract investors towards Peshawar and the KPK province.

- A number of visitors to the area mentioned that they are presently unemployed and are looking for employment and hoped a transparent hiring policy would be adopted for hiring of staff by the public sector line departments as well as by the Contractor.

- The residents of the project area requested that the line departments must ensure the Contractor works carefully during the construction activity to ensure minimal damage to the existing infrastructure. In case any damage does take place, such as bursting of water pipelines, damage to sewerage lines or damage to electricity transmission poles, repair work must be promptly conducted to minimize the nuisance resulting from the construction activity.

- The local traders as well as the residents in the project area also mentioned that the Contractor(s) must be urged to hire staff through proper background checks to minimize the chances of hiring staff with questionable character that might pose a threat of conducting indecent acts or engaging in criminal activities.

- The daily visitors to the project area requested the need to ensure the design of each BRT station consisted of escalators and/or elevators to enable access to the handicapped and elderly in order to enable them to also avail the benefits and convenience to be offered from this project.

- All stakeholders urged the relevant Government authorities to ensure the sustainability of the project and to hire qualified and polite staff for the positions of drivers, ticket issuers etc. in order to make the public feel welcome and want to avail the convenience being offered through this project.

- The stakeholders also requested that the relevant authorities should consider keeping the fare for using the BRT as low as possible to make it affordable

for the general public. It was also requested that a special discounted fare should be offered to students for using the BRT.

Table 8.1: Summary of Public Consultations

Date	Location	Type of Stakeholder	Objective	Participants		Opinion/Concern/Suggestion/Recommendation	Results/Actions to Address
				Male	Female		
1 Aug	BRT route Chamkani to Aman Chowk (left side)	General public and vendors residing along the BRT corridor	Introduce BRT and feedback on the project and potential impacts	17	5	BRT is a much-needed service as shared by male and female respondents. Female respondents shared incidences of harassment in public transport. Vendors shared fears about potential impacts on their businesses during construction phase and their displacement due to vacation of ROW. The owners and tenants of business structures requested to avoid impact on the commercial structures and dedicated parking facilities along the BRT corridor.	Impacts on structures were avoided to the maximum possible level during the Preliminary Design. The Gender Action Plan was developed for gender sensitive BRT operations. Impacts on vendors will be mitigated and a relocation strategy proposed for permanent vending spaces. A parking policy is requested to be developed by KPUMA, and parking facilities will be developed along BRT corridor.
2 Aug	Aman Chowk-Hayataba d (left side)	General public and vendors residing along the BRT corridor	Introduce BRT and feedback on the project and potential impacts	23	11		
3 Aug	Chamkani -Aman Chowk (right side)	General public and vendors residing along the BRT corridor	Introduce BRT and feedback on the project and potential impacts	16	19		
4 Aug	Aman Chowk-Hayataba-d (right side)	General public and vendors residing along the BRT corridor	Introduce BRT and feedback on the project and potential impacts	9	11		
5 Aug	PDA Office	Project Implementing Department	Consultation on meetings with PDA staff of different sections regarding	5		It was agreed that PDA technical staff was to accompany resettlement consultants for their orientation of the ROW and a GIS specialist was also	PDA provided detail of width of ROW of BRT corridor and copies of ROW maps, and also conducted a joint field visit to BRT corridor and oriented

			the width of ROW, potential impacts of BRT due to encroachments, to get detail of ROW and request for orientation of resettlement team about BRT corridor			present for on-site guidance.	resettlement consultants.
6 Aug	Sardar Garhi, site proposed for Western Bus Depot	Sardar Garhi land owners/ housing owners, small farmers, tenants of agriculture land and big landlord.	Focus Group Discussion to conduct consultations with male and female of housing owners, small farmers, land of larger land pieces to assess impact of land acquisition on difference categories of people	28	8	The owners of housing structures showed serious concerns due to acquisition of their residential lands, and small farmers and tenants were found to be concerned about the loss of income due to their dependency on agriculture land for livelihood, fodder for animals and food for their families. Farmers/ tenants suggested that in case of land acquisition they should be properly compensated and jobs should be provided to their family members in the construction and operational phases BRT as an alternate source of income.	Local population became aware of BRT, its potential impacts. More consultations were conducted with small farmers, non-titleholder tenants and land titleholders and the resettlement consultants got an idea of the extent of impacts on certain groups.

7 Aug	Sardar Garhi, site proposed for Western Bus Depot	Focus Group Discussion	To take views/ opinions of the youth regarding BRT & depot site To know whether they are aware about the BRT project. To know where they will play in case of constructi on of BRT depot on their playing ground.	60		Local cricket players did not know about the BRT project. Local cricket players showed serious concern in case the playground taken for BRT depot site.	Resettlement consultants got familiarized with the large number of youth coming to Sardar Ghari & Hargoni land for playing cricket. Resettlement consultant briefed the local cricket players about the BRT project and also informed them about the land acquisition process.
8 Aug	Sardar Garhi, site proposed for Western Bus Depot	Small farmers, owners of agriculture land, owners of housing structures and residents of Sardar Garhi	Focus Group Discussio n and conduct village mapping of Sardar Garhi to assess land use of Sardar Garhi, to identify lands with minimum impacts and free to encumbra nces.	19	-	The residents of a settlement of Sardar Garhi named Gujjar Garhi were extremely concerned on the acquisition of their residential land and were not willing to relocate themselves as they had housing compounds for animals in open space of their houses.	Resettlement consultants got an orientation of Sardar Garhi land use, and identified possible parcels of land for acquisition, for PBRT bus depot.
			Briefed the vendors about BRT			The vendors shared their worries about dislocation. However,	Vendors willingly gave information

11 Aug	Saddar Bazar	Focus Group Discussion with Vendors of Sadar Bazar	project. Ma-de consultation with vendors regarding BRT project. Know the opinions of vendors & informed about census procedure.	30	0	due to proper briefing by the lead surveyor about compensation, the vendors assured cooperation to survey team.	required for long-listing like CNIC number and contact numbers. Assured full support during conduction of vendors-census.
19 Aug	Chungi Chowk (Food Godowns) at Kohat Road	Vendors of Chungi Chowk (Food Godown) at Kohat Road	Focus Group Discussion to Briefed the vendors about BRT project & about staging station propose at food godowns site. Made consultation with vendors regarding BRT project. Know the opinions of vendors & informed about census procedure.	6	0	The vendors showed their worries about dislocation however, due to proper briefing by the lead surveyor about compensation vendors assured cooperation to survey team.	Vendors willingly gave information required for long-listing like CNIC number and contact numbers. Assured full support during conduction of vendors-census.
			Focus Group Discussion with title & non-titleholder-s & local elders Briefed the FGD			Prepared social map of the site with the help of FGD participants.	Noted that both the title & non-titleholders were quite worried. Particularly the non-titleholders who are mostly doing

20 Aug	Sardar Ghari	Title & non-titleholder-s	participant-s about the BRT project. Briefed the participant-s about the social & resettlement study and its purpose/ objectives.	5		Identification of title & non-title-holders was made with the help of FGD participants.	subsistence farming and solely dependent on this land.
23 Aug	Govt; Food Departme nt	Staff of Govt Food Departmen t, Chungi-Kohat Road, Peshawar	Meeting with Food Inspector (Zafran) and mapping of land use surrounde d by godown.	3	-	Discussion over land proposed for BRT staging station. The team also took opinions about availability of space at godowns site, and the possible impacts the site would entail.	Found that land is free of encumbrances with no resettlement impacts
23 Aug	PDA	Several officers of PDA	Introducto ry meeting and consultati ons on the status of land proposed for staging station.	5	0	PDA endorsed the location for the staging station.	Food department stated that communication between Secretary Transport, other stakeholders and with higher officials from the Food Department was underway to agree upon the utilization of their land for staging station.
4 & 5 Oct	PDA	Director P&D, Assistant Director Roads and SDO Roads, Land Acquisition Collector, Tehsildar and Naib Tehsildar	Held meetings with relevant staff and PDA design consultant-s of General Bus Stand, to share	9	1	PDA staff was concerned that it was not possible for them to avoid impacts on housing units as the Section-IV and V had been issued for a parcel of land for the general bus stand, whilst all the resettlement consultants were of the view that the	Resettlement consultants decided not to propose the parcel of residential land of Gujjar Garhi for the construction of BRT bus depot and related infrastructure.

		PDA Director Engineering, PDA design consultants of General Bus Stand.	sensitivities of local people about potential impacts on housing structures and explored ways to minimize impacts on local population.			notification of the sections had been issued for a broader area and demarcation was to be done under Section-VI.	
6 Oct	PDA & Project Affected persons	Resident-s of Sardar Ghari and Hargooni	To conduct consultations with local population of potentially affected villages and develop a consensus on the options of land for PBRT bus depot, to minimize adverse impacts on socio-economic condition of affected population	44	0	AP did not agree on demolition of their houses, and agreed to the option of acquiring agriculture land for the construction of BRT bus depot.	Resettlement team was able to develop a consensus with the local population on acquisition of agriculture land for the bus depot.
7 Oct	Cantonment Board Office		Chief Executive Officer, Chief Engineer, Overseer and Draftsman	4	-	The cantonment board shared their concerns on the proposed initial design for the BRT in cantonment area. The team had to convey to them the	Completed initial assessment of the availability of ROW for the construction of BRT.

			of Cantonment Board for consultations on the use of roads in the cantonment area for the BRT route, detail of any encroachment on the BRT road lying in cantonment area, and to acquire detail of the ROW.			engineering design and the consultants agreed to provide ROW detail of the BRT alignment lying in cantonment area.	
13 Oct	Office of District Revenue Department	Additional Deputy Commissioner-Revenue-Land Acquisition, Land Acquisition Tehsidar, Tehsil, District Qanoong-o & relevant Girdawar	To enquire information about the nature of disputes and court cases on the land of Sardar Garhi and Hargoni Mouzas and take assistance of the Revenue Staff in case land is not disputed. Discussed and identified	8	-	The District Revenue Staff shared information about the proposed options of land to be acquired and agreed to pay joint visits to the proposed land.	It was mutually decided that both the teams were to jointly visit the site to verify physical location of the proposed parcels of land and issues related to each parcel/khasra number of land.

			three options for BRT station in the acquired land.				
15 Oct	Hashtnagri & Firdous underpasses	Shop-keepers	Focus Group Discussion to introduce BRT and feedback on the project and potential impacts	36		Resettlement consultants introduced the BRT route. Got the opinion of shopkeeper-s in case of disruption of their businesses temporarily. The shopkeepers were not ready for dislocation of their businesses as well as demolition of both the underpasses.	Informed the shopkeepers for next joint consultation meeting with the lease owner of underpasses and representatives of both the underpasses.
17 Oct	SW&WD Office Peshawar -FGDs	Government KP Social Welfare & Women Development Department Peshawar- Adeel Sb Additional Secretary KP SW&WD, Niaz Mihammed In charge Gender and Shguhfta Gender Specialist KP	Discussion on collecting sex & gender disaggregated data on women & transportation and women laborers and to understand the existing public transport for women & girls in Peshawar city.	5	3	Due to limited resources SW&WD department did not conduct any study on working women/women working laborers and transport. Not only women and girls are facing problems while traveling in local buses and wagons, men and boys were also faced with a number of issues due to slow speed of buses, attitude of bus drivers and conductors. As women labor force, has increased over time, they need	SW&WD KP department appreciated the PBRT project and cooperated with providing information.

		SW&WD Department & staff				to have safe, secure and respectful public bus service. Women separate compartment need to be allocated so that they can travel without any hesitation. In PBRT 50% potion need to be fixed for women because the women who are now traveling in rickshaw and taxi will ride PBRT after its operation as women in Peshawar have been waiting for such kind of public transport. In case of safe, secure, comfortable, respectful and air-conditioned public bus service operation definitely women and girls' traveler's number will have increased in double. Women need to be involved at the planning and execution phase. Besides PBRT there is need to start a public train system to fulfill the need of male, female, elderly & disabled travelers. As women spend more money on private transport, the PBRT operation they will save their money.	
7 Nov	At the residence	Land Owners of	Conducted	2	-	The land owners agreed to provide	The land owners agreed to provide

	of Fazeel Khan	Hargoni Land	consultations with major land holders of Hagoni Land, proposed for the acquisition on the rates proposed by PDA.			their lands for the construction of BRT bus depot, but not on the rates proposed by PDA, as the adjacent land of Sardar Garhi was calculated at 75% higher rate than Hargooni due to the average of last one year sale price, while the record of sale of Hargooni land is very old due to family disputes and court cases.	evidence of higher value of land, against a decision of the court regarding a case registered against the rates fixed for Hargoni land, under another project. Evidence of higher rates was later provided to the resettlement consultants
9 Nov	Chamkani Bus Stop	Vendor s of Chamkani Bus stop	Focus Group Discussion to introduce BRT and feedback on the project and potential impacts	5		The vendors shared their concern, said their business and their families would be affected. The resettlement consultant briefed about the compensation allowance upon which the vendors felt reassured. However, they had doubts about provision of compensation.	It was noted that although, the vendors were upset in view of their businesses dislocation, they felt satisfied with the compensation amount. However, they were not sure about receiving the compensation amount from the concerned department.
11 Nov	Her Residence Chatty Lal Kurti, Peshawar Cantt (KII)	House Wife, of Chatty Lal Kurti, Peshawar Cantt-KIIs	To find out reasons why women of the area needed to travel and use public transport as a mode of travelling and issues that they faced.		1	It was found that women majorly used public transport to visit schools, markets, hospitals and relatives. It was also found that although some women came from families that owned cars, they still travelled on local transport like auto-rickshaws and buses. Women stated that the existing public	

						transport facilities were both time consuming and crowded and as they had mixed gender spaces, they had to face harassment. It was thus found that the existing public transport was not safe for women. Women found mornings and early evenings the best time for traveling. Female correspondents stated that 20 rupees per stop was affordable fare.	
14 Nov	Noor Center and Gull Center of Hashtnagri and Firdous Underpass	Potential Displaced Persons (Shopkeeper/business operators)	To conduct initial consultations on the possibility of demolition of the underpasses	26	-	The potential displaced persons were informed and their strong demand to save the underpasses from demolition was noted.	The representatives of different categories of interest groups were identified, their concerns helped to develop next steps for resettlement planning.
14 Nov	Firdous Bus Stop, Peshawar - FGD	Potential Women PBRT Travelers Shumaila Zulfiqar, private school teacher, Gulbehar Colony Peshawar, Gul Bibi Afghan, housewife, Hayatabad	To ask about the problems women face while travelling on public transport (bus or wagon)		3	Women are stared at by the men waiting at the bus stops. Whilst getting on to the busses, men use the same door as female passengers, making the female passengers very uncomfortable. Men often sit on the seats that are allocated for women and refuse to vacate the seats so women have to stand and travel.	Initially the respondents were reluctant to respond but later gave information. As men standing at the bus stop were eavesdropping, the women initially were uncomfortable in engaging.

		& Razia from Chamkani housemaid in University Town (cleaning and washing clothes in 4 houses)				It was found that a majority of the public bus drivers did not like women getting onto their busses and therefore did not stop the busses for them at the stops or refused to let them on. Women travelling on public busses often face extortion as they are charged higher fares by bus conductors and this often results in arguments. Young girls avoid sitting with the elder women as they inquire about their personal life and family. Also, it was reported that burqa clad women were also known to pick pockets and therefore that was another reason girls were comfortable in sitting in busses. Therefore, they were forced to take local busses as taxis and rickshaws were expensive. They hoped that Peshawar would be able to provide a bus service like Rawalpindi. One woman had a reservation over higher transit bus fees. Female respondents hoped that the female portion in the busses and the fares would	

						be same as those of the Rawalpindi metro bus. They argued that after the PBRT, there would be no need to run separate female buses.	
14 Nov	Peshawar Chamber of Commerce (PCC) & Women Chamber of Commerce (WCC), Peshawar -FDG	Non-Government-Peshawar Iqbal Sb-President PCC, Haji Afzal – Chairman PCC, Additional Secretary General PCC & other members Shamama-Chairperson WCC, Shumela Secretary and staff	To understand the existing public transport services for women and to get information about women labor & women enterprise	5	4	As women face problems in travelling because of the existing public transport infrastructure, women labor force working in the industries prefer to work where they have facility of pick and drop. However, it was found that PBRT might not be able to benefit women working in industries but is expected to benefit women working in other public and private sector institutions, those running small businesses and those travelling to run errands and avail social services. It was recommended that the cheapest form of transport for Peshawar city would be the train system that previously operated in the city as it was expected to be affordable and would be able to cater to the needs of a larger group of people. It was also stated that	Cooperative and shared information

						female ticketing counters needed to be established and separate compartments for women needed to be ensured. The corridors were expected to cater to the needs of women, children, elders and disabled people. During construction, it was stated that there was a need to have a safe alternate traffic movement plan to avoid any problem. The government also needed to ensure an increased number of buses during the peak hours to cater to the increased demand.	
16 Nov 2016	AHAN (AJk Hunar AJk Nagar/one skill)-Consultation	Semi-Government Company, Project Director, Program officer, Market Officer	To get information about their skill development program, get their views about existing public transport facilities for male and female travelers perspective and to get their opinion about BRT and request	3		AHAB facilitate male & female craft persons, artisans and poor producer groups in accessing enterprise development services with focus on hand-crafted products. AHAN staff and female of their targeted communities appreciated BRT. They also demanded for the intra-city train as railway track is already available. Women demanded separate entrance, waiting areas and compartments (30 to 40 in buses) to avoid harassment they experienced public	Identification of potential company for livelihood program, and discussion helped in analysis of female travelling patterns, assessment of their travel needs, problems faced in existing public transport.

			for assistance organizing a Focus Group Discussion with female of AHAN targeted community			transport. They also proposed color coded compartments to assist people who cannot read. They also demanded connecting services to feeder roads and need for men and women security staff at bus stations. The need to employ women in BRT operations was also emphasized. Women stated that their access to education and employment would considerably increase. AHAN stated that although it had trained a number of women in different skills, they were unable to access to markets for raw materials and for marketing their products due to unfriendly transport services.	
16 Nov 2016	Center of Excellence for Resource Development-FGD	NGO (Project Coordinator and M&E Officer)	To get their views on existing public transport from the perspective of women travelers and take their opinion about PBRT	5		They shared how present public transport system impacted vulnerable groups and overall participation of women in social and economic development, restrictions on women mobility due to unsafe public transport, emphasized on the need of job opportunities for women in BRT operations, demanded women	Helped in gender analysis of public transport and women specific needs.

						specific facilities in BRT due to strict norms of Pakhtoon culture.	
17 Nov 2016	Office of UN Women, Peshawar -FGD	Staff of UN Agencies (UN Women, UNOPS, UNFPA) & Coffee International	To get their views on existing public transport from gender perspective and opinion about BRT	4	2	The staff members stated that the environment concerns such as dust, noise pollution, restriction to public to access spaces and utilities should be taken care of by the GoKPK. The old intra-city train system should also be rebuilt, which can be operationalised with less money. A traffic management plan should be developed and implemented effectively during construction period. The BRT should be linked with pink buses for women. The GoKPK should relocate the shopkeepers of underpass markets in a way that their livelihood would not be affected. Security of passengers should be a priority in BRT operations. Women specific facilities should be provided in all aspects of BRT operations. BRT should be equipped with modern facilities separately for men and women i.e. waiting areas elevators, escalators, rest rooms, clean	Actions laid down in the Gender Action Plan and Environment Management Plan, and LARP to address their suggestions.

						drinking water, and ramps for wheel chairs in buses.	
17 Nov 2016	Sarhad Rural Support Program Office-FGD	Manager Program Operations, 2 Program Officers	Gender analysis of existing public transport, women travelling pattern and women specific needs for public transport, and opinion about PBRT	2	2	The organization appreciated the PBRT project and stated it would provide safe and respectful transport to women and female students; enhance their access to educational institutions, health facilities, jobs and help in establishing their businesses. Shared issues faced by women in existing public transport facilities and its impact on women social and economic development. Recommended that 50% portion of buses should be specified for women travelers	Actions incorporated in Gender Action Plan against their suggestions.

						with separate compartments and entrances. In peak hours, number of buses should be sufficient to accommodate men and women travelers. Need to offer subsidized fare to students and old citizens.	
17 Nov 2016	Khwendo Kor, Hayatabad-Peshawar - Consultations	NGO (Senior Program Manager HR, Community Program Officer.	To get their opinion on PBRT and help in studying travelling pattern of women labor force (home based workers & house maids)	-	2	Shared issues faced by women in public transport i.e. harassment, personal safety, long waiting hours and travel time. A number of educated and skilled girls and women were unable to work due to insecure and inefficient public transport. Hence, it was proposed that women specific services should be provided that are to include separate access ways to bus stations, ticketing facility, entrance in buses, compartments etc. BRT is thus expected to impact on women access to education, health facilities, jobs and business opportunities. They also suggested 45% seats to be fixed for women. Emphasized on rehabilitation of rail track. Emphasized on the need for a good environment management plan to	Actions lay down in GAP and EMP to address their concerns.

						control dust, noise, traffic jams, and disruptions to public utilities and access. Special security arrangements should be made, a special security force to be hired and trained. A complaint mechanism should be developed and implemented to take public feedback on BRT operations and redressal problem face by women and other vulnerable groups. CCTV cameras to be installed at bus stations with emergency telephone facility. Women, young boys and girls face harassment from bus drivers, conductors and fellow male passengers. A substantial number of female housemaids, factory workers, home-based workers, living in old city and suburbs of Peshawar were found to face difficulties in accessing public transport. BRT will particularly benefit these women and professional women who do jobs in public and private sector offices, health and educational institutions. Jobs should be created for women in BRT operations and women should also	

						be trained as bus drivers. Women specific pink buses, funded by foreign grant, should also be operated by female drivers on BRT corridor.	
18 Nov	Office of Mohmand Construction Company, Peshawar	Lessee of Firdous & Hashtnagri underpass	To discuss the status of underpass lease and its terms and conditions.	4	-	Mirza Khan showed concerns about loss of business by MCC and shopkeepers due to demolition of underpass markets, and suggested that GoKPK should provide shops at alternative locations, and lease period should be extended to cover the period for the establishment of businesses at new locations. It was agreed that resettlement team was to closely work with MCC and shopkeepers to develop the resettlement policy for PBRT Project.	
18 Nov 2016	Shelton Guest House Peshawar -KII	Government- Police Department (Traffic)	To take opinion on security issues	1		Although the PBRT was appreciated, it was affirmed that rehabilitation of train system as part of BRT was of importance. Two Police stations needed to be established on BRT route with a facility of female staff to facilitate male and female passengers on security issues	Suggestion integrated in Gender Action Plan

						and criminal activities i.e. theft. Trained security personnel need to be deputed at PBRT bus stations.	
21 Nov	Office of Special Secretary Industries-KPK Industries Department	Special Secretary and Additional Secretary Industrial Department, Economic Development Specialist.	To get segregated data of labor force in Peshawar and get tier views on BRT	4		PBRT will change the travelling pattern in Peshawar especially for women. The number of women and girl passengers using public transport was expected to increase significantly. In BRT there should be women specific facilities, 30% seats should be fixed for women and strict security measures were needed for BRT i.e. CCTV cameras at bus stations and in buses.	Provided useful suggestions and reference to contact relevant officials in TEVT and Labor Department to get gender disaggregated data of labor force in Peshawar.
21 Nov	Labor Department-Stakeholders Consultation	Director, Director HR Labor, Deputy Director, Assistance Director and Labor Inspector	To take information about travelling pattern of women in the industrial workforce and get gender disaggregated data of labor force of industries in Peshawar.	4		It was stated that BRT was not only expected to significantly increase the number of female travelers but also the male passengers particularly the middle class, who currently avoid public transport. 30% portion of PBRT need to be fix for women. They disclosed that women labor force working in industries of Hayatabad were compelled to use the buses provided by the factories and charges ranged from	Provided required data

						3000 to 4000, as there is no direct public transport available and young women do not like to change buses, pay higher fares, waste time and face harassment from fellow male passengers and bus conductors. Women and girls also lost their precious belongings and money while traveling on the existing public transport. Recommended rest rooms, ticketing booth, entrance and compartments for women. Announcements were suggested to be announced in the buses to inform about bus stations. Need to install CCTV cameras and telephone at the bus stations. BRT should be extended to Karhaono Bazar.	
21 Nov 2016	Technical Education Vocational Training, Peshawar - Stakeholders Consultation	Director, HR Labor,	To get opinion about PBRT and get information about TEVT training program	3		It was said that the start of the PBRT operation would see an increase in the number of travelers. Women and men compartment should be segregated, with separate entrances. Due to PBRT more labor force of men and women would be able to work in the industries and run businesses with ease. More buses will be needed in peak hours especially at	Provided information about their training program.

						morning time, mid-day and afternoon (after 4:30 pm).	
22 Nov 2016	Cantt Secretariat Labor Department- Stakeholders Consultations	Secretary Labor, Joint Secretary and Director	To discuss social and gender impact of BRT	5		BRT will increase women mobility. Should be separate portion for women with separate entrance. There should be strict security arrangement at bus stations. Women participation in labor force would increase.	
22 Nov 2016	University Town, Peshawar -KII	Electronic media	To take views on BRT	1		It was found that currently women and the transgender community faced a lot of harassment in public transport. Given the government was to provide women specific facilities at bus stations and separate compartment; women would be confident in travelling independently and therefore female travelers would increase. 30% portion of buses needs to be allocated for women and special safety measures to be ensured at bus stops and in buses. Train system of public transport needs to be revived.	
23 Nov 2016	Gulbahar Police Station Peshawar - Stakeholder	Male and female DSPs and IT Manager	To understand security issues in public transport	2	1	Appreciated BRT system. The major concern was that majority of women do not like travelling from public transport, they face harassment	

	Consultations					from the fellow male passengers and bus conductors. Security arrangements for BRT system were deemed to be very important and a well-equipped and trained security force needed to be formed for BRT. A camera control room also needed be established for 24 hours monitoring. Women travelers were expected to increase and thereby 30% portion of buses needs to fix for women. Morning time, mid-day (after 12:30 pm) and afternoon (after 4:30) were said to be the peak hours more busses needed to be ensured on the corridor. Emphasized for development of a traffic management plan during construction of PBRT corridor.	
23 Nov 2016	Main Bus Stand, City Peshawar -FDG	Transporters, conductors & drivers of Peshawar Main Bus Stand	To understand existing public transporters perception about PBT To find and gauge the response of transport Unions and Owners etc.	20		Transporters expressed their anger against new traffic police system as they had been fined penalties of minimum of Rs 500 and maximum of Rs 1000. They stated that majorly poor women, female beggars, housemaids and women street vendors traveled on public buses whereas female students, women working for	Provided required information expressed they're not approving of the PBRT

			towards BRT and relevant results/repercussions. To get information about women mobility			public and private jobs, running small enterprise/business and from the lower middle classes preferred to travel on wagons, and only travel on busses when seats aren't available. Women from affluent families prefer to travel on rickshaw or taxi. Transgender individuals travel on rickshaw or taxis as they are harassed by the fellow male passengers and women do not allow them to sit in their part. Buses commuting to the old Bara route have last seats for women, whereas in other buses the front 10 seats behind the bus driver are allocated for women during the peak hours. Other than peak hours' men also travel on these seats. Women often get into fights with the conductors on fare so conductors discourage them to ride on the bus. Buses only for women travelers have not been successful as women do not prefer to travel in these busses as stated by the Social welfare minister	

						Sitara Ayaz. Upcoming PBRT will be not good news for the local bus drivers, conductors and owners as they will face losses as their buses will not be awarded any route. Therefore, it is expected that as soon as PBRT corridor's construction will start, the bus drivers will take steps to create hindrance in the PBRT implementation process (as one owner commented that we will take stay order from the court if PBRT will start). Minimum fare at stop is 10 Rs in the buses and wagons and maximum fare is 30 Rs. Women running household chores travel after 10 am to 4:30 pm whereas women laborers, house maids, students and doing jobs often travel from 6:30 am to 9:00 am in morning and then come back at 4:30 pm to 5:00 pm. Students timings are from 6:30 am to 8:00am and 12:30 pm to 3:00 pm. After evening, there are few women (with their families) and mostly no women travel	

						alone. According to them a lot of poor families will be affected due to closing of buses and wagons on PBRT route. They suggested alternates regarding provision of new vehicles (As Shahbaz Sharif did in Punjab), issuance of new permits, allocation of new routes where they can drive their bus as well as provision alternate jobs in PBRT for those affected.	
23 Nov 2016	Peshawar Press Club, Near Cantt. Railway Station, Peshawar -FGD	Mass Media/ Newspaper Journalist of Khabrain Ms. Iffat Siddiqui, Journalist of Mashriq Muhammad Owais , Peshawar Press Club, Daily Wahdat Habib Syed, Daily Ummat Iqbal Afridi, Journalist of Geo News Mr. Rizwan Sheikh, Iqbal SB Roznama Umat	To find their views on present public transport modes for women travelers To understand their opinion about PBRT project	6	1	Although female harassment is common in the existing public transport, men are also found to face harassment. Women seats are often occupied by men. Buses are in bad condition and not secure and are a threat to life. PBRT is always welcome but there is need to have separate women portion where no men would be allowed to enter. There is strong need to have effective security system on the corridor, at the bus station and in the buses.	Provided required information and were found to be welcoming & cooperative but expressed their reservation regarding completion of the PBRT project.

						PBRT will be very good for women and they will travel more as it would be safer as currently a large number of women avoid traveling on existing and available public transport in Peshawar city. PBRT will provide safe and secure public transport. Besides PBRT need to operate public train as did before also PBRT will not fulfill the requirement of all the travelers in Peshawar so better to restart the old GTS system that was the most successful.	
24 Nov	University of Peshawar -FGD	Government Chairman of Institute of development Studies-Agriculture University Peshawar Peshawar Agriculture University Mr. Inayatullah Jan PhD IDS & his colleges Dr. Gohar Ayub Assoc. Prof Mr. Sohail PhD student and fellow teaching	To find their opinions on BRT To understand their views about existing public transport	6		The existing public transport service is not friendly for women and students. PBRT project will provided better transport to women and students. It will encourage more women work and girls to get higher education. Women should have separate compartment and entrance in PBRT and special security steps need to be undertaken by the project implementers and his co-stakeholders. BRT will be good not only for students but	

		staff				for the employees of the Universities. Need to offer student subsidized fare and issue the cards as exercised before.	
24 Nov 2016	University Road, Peshawar -FGDs	Non-Government-Trader Union representatives Traders Leader SVP Tajjir Ittehad Mr. Noor Muhammad, Mohd Sohail, Dr Gafoor Ayub, University Town Traders Union. Head Dispute Resolution Council, Engr Riaz Mufti, Tariq	To get traders views on present transport issues in context of women travelers To understand their response on PBRT.	6		Existing public transport is not good for women as they have to face lot of problems. PBRT is good project especially for women and students. Women need to allocated separate compartment & entrance in the PBRT and there is a need provide necessary security system under PBRT project so that passengers feel comfortable. Ambulances need to be allowed to use the PBRT corridor in case of sever emergences. As it is a political decision following Punjab government so maybe there will be hindrance during construction of corridors as number of stakeholders have reservation like trader's fear that their businesses can be affected, venders fear that they may be forced to a place where they might not get customers. Transporters, rickshaw drivers and	They said BRT is welcome. Its route will raise many objections as businesses will be affected. Is good for public but route should not affect existing economy. Those affected be given good recompense.

						taxi owners fear that they will lose income as most people will use PBRT services.	
24 Nov	Western Bus depot site-FGD		Visited Western Side BRT Bus Depot site and **held on site meeting** with District Land Revenue Officer, concerned Girdawar and Patwaris of three different Mouzas.	10	1	Do not have & remember record of purpose of meeting, outputs, action points etc	
26 Nov	Peshawar City – Old Wall City-FGD	Sikh Community, Minorities Sikh Gurudwara, Pramjit Singh and Babaji Gurpal Sigh - Incharge KP FATA Lungi Malik, Sikh community, Men & women of Sikhs Community	To find their view on present transport issues related to women & minorities. To find what is their response on PBRT	6	5	It was found that the existing transport system was not good for women and girls whereas the men faced no problems while using it. Sikh women were found not to travel alone and if they did, they hired rickshaw or taxis. Sikh men were found to have a little trouble problem as they are easily identifiable but women did not face that problem. However, a lot of money had to be spent on taxis as they charged fares up to 400 rupees on a one-way trip.	Cooperative but reluctant to respond

						PBRT was found to be very welcome as it was expected to provide respectful and comfortable traveling to the people of Peshawar. The need to have separate women seats, compartment and entrance was advocated very strongly. As in Peshawar there is security related issues so need to provide special security to make the PBRT travelling safe for all. Female staff needed to be hired under PBRT project. The fare of be PBRT should be subsidized just as that being offered in Rawalpindi and Lahore especially to the students and regular male and female commuters.	
26 Nov	Canal Town, Peshawar -FGD	Christian Community -Minorities Salvation Army Church, Capton Nadeem, Capton. Hina, Tariq Masih, Faisal, Raeaq, Ieshad Tahira Tariq,	To get their view on present transport system especially in context of women & minorities. To find their response on PBRT.	4	4	It was found that a large number of Christian communities, both men and women, used public transport. They walked long distances to reach bus stops to save money. As women faced hardships and embarrassment while traveling in public transport, so they	

		Samina, Nasreen,				never took their young daughters when themselves whilst travel in buses. Separate women compartment with a separate entrance needed to be ensured. PBRT fare should be easily affordable. Women were found to be happy with the prospect of using PBRT to take their children, particularly girls, for outing.	
29 Nov	Kohati-FGD	Christian Community Shabnam Maqsood Samina Jamil, Anam Shahbaz, Sadia Shoukat, Uzma Ashfaq, Sonia Javid, Mursaleen Yousaf, Jamila Ashfaq, Shahmim, Humera Yaqoob	To inquire about their mode of travelling and related issues		10	It was found that public transport was mostly used for travelling to work, shopping, and dropping children to their schools, and attending ceremonies. Women preferred to travel in rickshaw whilst men traveled on public transport. As women were always pressed for time due to their household and employment responsibilities, they could not make time to walk 15-20 minutes to the bus stop and then wait another half an hour for the bus to show. Women were also found to feel insecure while traveling on public transport and even crossing the roads was sought of	Cooperative and shared information without hesitation

						as difficult o and therefore women tried to stay at home. They were also found to face bad behavior from the bus and wagon drivers and conductors and harassment from the fellow male passengers. Bus or wagon drivers were found not to stop to pick the women. The need for traffic signals, zebra crossings, separate women compartment and seats in the buses and wagons, separate women waiting places at bus stops was emphasized. Rawalpindi Metro bus system was cited as a good example for public transportation. PBRT was therefore expected need to have women separate places and seating (at 30% area), economical fare, women waiting area a bus stations, and easy access to the buses. CCTV cameras needed to be at bus station and in the bus to ensure security during travelling.	
29 Nov	Agriculture University Peshawar -FGD	Students of BSc Honors Agriculture Laiba	To discuss the existing commuting patterns in public		9	Men and women come out for jobs, education, hospitals, shopping and to visit relatives also to travel to villages.	Quite responsive and enthusiastic

		Najam Mah Rukh Maria Muneer Doha Ajmal Zainab Malik Sonya Bahadur Maliha Mahboob Kinza Mehak Sajid	transportation in Peshawar and related issues			Women were mostly found to prefer rickshaw and taxi especially when their children were with them. However, men were found to use all kind of transport (public & private). In main city, there is no issue to access the public transport but people living in outskirts and distant areas had issues in accessing public transport and thus they relied on Chin-chi, Tonga, Auto Rickshaw and taxi to reach the main road to get the public transport often they walk. It was told that women could not travel alone after sunset and had to do so with a male family member. As there were no zebra crossings on roads in Peshawar, it posed as a major problem for female pedestrians and posed as one of the major reasons for higher ratio of women being injured in road accidents. As in Peshawar there is dominating Pakhtoon Culture so women and girls are usually not allowed to travel alone without male family members. GoKP need to design gender friendly public transport system so	

						that everyone could avail it. As of now, the public transport drivers and conductor's behaviors were quoted to be very unprofessional therefore; there was a need to higher professional drivers and staff. As currently, there was no separate area for women to wait, they felt insecure. It was said that University Road, Hastnagri & Saddar, KTH & LRH were very safe for women travelers. In PBRT women were expected to have separate seating in separate allocated compartment with separate entrance. Women also feel uncomfortable due to pick pocketing so in PBRT special safety measures need to undertake to avoid such exercise. Fans, water cooler and bathrooms need to provide in bus station separately for men and women. Dust bins need to be provided in the waiting areas, maintain cleanliness at bus stations, in the bus and on the corridor. Need to provided elevators for old and disable persons. An ambulance service	

						needs to be provided on the PBRT corridor in case of an emergency. PBRT door need to be closed and its fare should be affordable for students and poor. If PBRT is like metro Rawalpindi than it will be beneficial for women travelers as it is speedy, safe, time saving, economical so that it encourages women to prefer to travel on PBRT. Also, need to have separate ticketing system for security need to install CCTV cameras. There is need to have more buses during peak hours. After PBRT there will more women and girls come out for job, business, work and education so there will be possibility to have more job opportunities.	
30 Nov	Girls Guide Associations Dubgri-FGD	Girls Guide Vocational Staff & Students Noreen, Mubashara, Kalsoom, Rimshah, Saba Kanwal, Rabi Jabbar, Sana & Rubeena	To know about existing PT, its use and related issues		9	Come out from home for getting vocational training, education, shopping and jobs etc. Women prefer to travel through rickshaw and taxi sometimes in buses and wagons whereas men can travel on all kind of PT. Women has less access to PT due to lack of money and	Cooperative and responsive.

						lack of proper PT. Due to rush and traffic jam women are unable to travel easily. Most of the road accidents occur due to overcrowded buses. Existing PT in Peshawar was found unsafe for women and therefore women do not leave their houses. In case of provision of save, secure, cheap, speedy and respectful PT services women will be encouraged to come out to be a part of social and economic activities. Misbehavior is common with women from the PT drivers, conductors and harassment from the fellow male passengers. Over speeding in the congested areas are in routine, and the respondents said that the bus drivers almost never stopped vehicle for women passengers. Regular women commuters feel insecure while traveling on taxi and rickshaw but they have no alternate. PBRT needed to have separate women compartment with separate doors,	

						separate waiting areas at bus stations and separate ticketing booths for women. There is need to have traffic signals, sign boards, zebra crossings, also need to conduct awareness sessions how to travel in PBRT.	
1 Dec	FRONTIER COLLEGE AND UNIVERSITY-FGD	Nimra Laiba Shanza Mah Noor Razia Batool Fatma Saba Wajeeha Munaza Laiba	To know students public transport use and related issues		10	Men and women use public transport to travel to work, to educational institutions, shopping, and hospitals and to visit their relatives. It was reiterated that although the existing public transport was not women friendly, women were compelled to use public transport as they could not afford to travel in auto rickshaw and taxi. The existing transport system was reported to be deeply flawed as it was time consuming, crowded, mixed gender, had limited seats for female which are mostly taken by male passengers and women and girls has to travel by standing in the bus. Buses and wagons are fast and rushed while driving, and they did not stop properly while picking & dropping the passengers, not even	All girl students were cooperative and welcomed the PBRT but they suggested extending the PBRT corridor to the link roads as Charsada road, Kohat road & Warsak road to facilitate the people living of those areas. PBRT needed to fulfill the female needs, providing them with safe, secure and affordable traveling so that women and girls could use it without any fear and therefore increase ratio of women travelers up to 100%. Group participants asked that whether PBRT corridor will construct in front of the college as already the road is narrow how it will be built here. In case of alleviated corridor, the building alongside the road

						for women and girls. Drivers and conductors were not skilled and their behavior was reported to be bad with women and girls and thus they continually felt harassed. While traveling on buses and wagons women and girls are most of the time accompanied by their male family member and some time they have to skip their visits or use auto rickshaw/ taxi. It was said that although the existing public transport was affordable and accessible to schools, education institutions, hospitals, market places, and public utilities, it could not be used by females. Major transport corridors used by women were Sadder bazar (shopping), hospitals (LRH, KTH, HMC and SKMH), university road (for education and shopping both), Hayatabad (NADRA office, passport office) PBRT should have separate compartment/ bus station/ waiting area/ separate ticketing line for females and also should have a separate space for	could be affected.

						luggage. PBRT should reserve 40 percent seats for female, with a separate exit/ entrance and should also have a separate door and space for disabled and elderly people. The stations needed to be kept clean with dustbins in waiting areas. CCTV cameras need to be installed on each bus station, waiting areas and in the buses and security guards need to be present to deal security issues. Fans, wash rooms and cool water coolers need to be installed at each bus station. PBRT fare needed to be affordable and the government was expected to offer concession to students, disable and old people. PBRT buses flow should be rapid during the peak hours of 7am to 9am during the morning time later from 12pm to 4pm in the afternoon. The busses needed to have an emergency exit and an ambulance service should be available to deal with emergencies. A proper and regular monitoring system	

						should be there to avoid any issues.	
1 Dec	Shaheed Benazir University- FGD	Girls Students Nirma Shanza Raziaa batool Saliha Munza Laiba Mah Noor Marwa Warda Javerria Sidra	To know about the existing public transport in Peshawar city, their public transport mode and related issues		12	The female students had to travel to universities on vans they paid for monthly as their parents worked or were busy running household errands. It was stated that the men the area could both travel on public transport for both educational and work purposes with trouble whilst the women in the city could not. It was found that students, both male and female, did not find taxis to be a safe alternative as they could be easily kidnapped for ransom. It was also due to the lack of zebra crossing on the road a number of accidents that involved women and children occurred. Moreover, as there were no specific bus stops in the area, the buses stopped randomly to pick up passengers and the bus drivers seldom stopped for female passengers. It was found that women usually went to Saddar Bazar for shopping, schools & universities were on University road, KTH and LRH for health issues & Gulbehar and Hayatabad &	Responsive and cooperative

						University Town for house maids. To overcome the women harassment public transport for women needed to have separate compartment with separate entrance, separate waiting areas at bus station and separate ticketing points. In PBRT special security system needed to be installed as CCTV cameras need to be there. There is need to have announcement system for arrival and departure timings of PBRT, prevent from pick pocketing and for announcement of name of station. The PBRT stations need to be properly maintained, cleaned and more buses need to be made available for rush hours. Female usually carry small shopping bags while traveling in public transport as conductors do not allow them to get on with heavy bags and charge extra fare. Need to have separate ticket lines for men and women. Separate exit and entrance door for	

						men and women. It was also proposed that PBRT should be designed like double Decker buses with the lower deck for men and the upper deck for females. It was also suggested that the portions be color coded for ease of understanding. If PBRT was to operate, more women and girls were expected to come out from their homes for work and education.	
1 Dec	LRH Peshawar - FGD	LRH (Leading Reading Hospital) Peshawar Staff Khadija Fatima, Hafza, (clinical psychologist) Shista (Head of Nurses) Adnan (clinical psychologist) Fida Jann – Social Medical Officer	To understand the exiting public transport system and its issues	2	4	It was stated that people only travelled on public transport to run errand or too work, hospitals and schools. Women had no time for recreational activities especially if they were working and therefore the majority users of public transport were men who could spare time in the evenings to socialize and travel within the city. Women felt unsafe using public transport due to lack of bus stations, bad traffic management, no traffic rules, no sign boards, no zebra crossing in Peshawar city. It was found that busses rarely stopped to pick up female passengers and in cases they did,	PBRT will be economical and affordable for every class. Participants were cooperative besides their busy schedule.

						they were often asked to pay higher fares, especially during late evenings. As local transport was found to be unsafe, time consuming and with frequent pickpocket incidents, most of women doctors, nurses and trained paramedical staff decided to not work and therefore PBTR is expected to be extremely useful to girl students and working women. PBRT was expected to have separate women portion and seats, proper and regular bus repair, professional driving staff, availability of the security guards and if possible also female security guards. As currently in public transport women harassment is common by the drivers, conductors and fellow male passengers so after PBRT it will be overcoming as by hiring professional staff. Exiting PT being time consuming, PBRT would be rapid so would attract more passengers. Moreover, travel for patients is almost impossible in the available PT system whereas after PBRT	

						operation it would be easier for patients to travel. Currently PT is overloaded, dirty and old whereas PBRT would have new clean buses, less overloaded due to frequent and rapid movement after 5-6 minutes' difference. In PBRT 40% portion of the bus was expected to be allocated to women. Provision of dustbins in buses and at bus stations and separate ticketing system were also expected to be a part of the design. It was pointed out that as PBRT would be passing through the LRH Peshawar, the narrow road would imply an alleviated corridor will be constructed which could affect the hospital and thus needed to be taken into consideration by the government.	
2 Dec	Postal Colony-FGD	House Wives & Working Women Farzana Anila Shazia Yasmin Nazia Jabbin Afsheen	To understand the mode of their public transport and related issues		6	Women majorly choose to travel on family owned cars, taxis or rickshaws in comparison to travelling on busses or wagons as the later forms of transport were thought of to be unsafe for women. It was stated that women only choose to use public transport only if it was	Women, children, elders, minorities, disable and other excluded sections of society can only be benefited when there will be public transport system overcome and fulfill their required needs.

		Shahid				absolutely necessary to run errands and almost never for leisurely activities, whereas men had the luxury to use public transport to indulge in leisure activities. For women, no proper seats were available in public transport and they had to walk 20-30 minutes to get the nearest bus stop. Women had no separate waiting areas that needed to be included in the PBRT to avoid harassment incidents. For illiterate men and women. It was proposed that announcements be made in both Urdu and Pashto. Need to have special security system as CCTV camera needed to be installed to minimize terrorism or any other security incidents. There is need to have separate space for luggage, water coolers, fans in the PBRT waiting areas for females. The buses need to be air-conditioned during summers and heated during winter so that passengers feel comfortable while travelling in PBRT. Women need to have secure, safe, respectful, time saving and affordable	

						public transportation that is currently not available. If such public transport was to be provided 50% passenger rate would increase, especially for females. As the current forms of public transport had no space to carry luggage, women carrying bags were forced to private rickshaws and taxis and therefore the PBRT design was strongly advised to keep space for luggage and provide an emergency ambulance service. It was also stated that the PBRT project needed to ensure jobs, especially for women and that the project needed to be regularly monitored and maintained. The government needed to run an awareness campaign on from where and how people could travel on PBRT. I was stressed that female issues needed to be considered and honored during designing, planning and implementation of PBRT.	
5 Dec	Afghan Commissioner flats	Nasira wife of Syed Noor Wali	To understand the	-	1	It was found that the respondent had never used public	Need to have safe, secure and comfortable

	Hayataba d-KII	Shah a Governme nt servant	existing public transport services for women and issues			transport as the busses and wagons were overcrowded, time consuming, had no proper stops, there were no designated seats for women and not easy to climb in along with children and therefore either travelled on a motorcycle with her husband or took a taxi which she stated was highly inefficient. She stated that the existing public transport was not deemed safe for women and only 7 am morning time was a good time for women to travel. The respondent suggested that the ticket prices for PBRT should be kept as low as possible that can easily affordable for poor travelers, students and people with disabilities.	transport for women travelers, students and disabled people.
6 Dec	Engineeri ng University Peshawar -FGD	Students Mamoona Safeer Sania Ajaz Wali Khan Sadaf Javid Sidra tul Muntaha	To understan d exiting PT (Public Transport) and their use and issues		5	The students responded that the majority of the public transport users were men as women preferred to use taxis and rickshaws due to fear of harassment, higher fares, limited availability of seats, crowded spaces, pick pocketing and waste of time. Moreover, it was stated that as bus drivers refused to completely stop busses, it was very difficult for women to	Cooperative About 50% to 60% women will become able to reap social and economic benefits after the provision of an efficient and safe PT system. It would be helpful in increasing female literacy rate and it would be needed to be ensured that there is no discrimination amongst the

						hop on to moving busses and therefore it discouraged female passengers. Therefore, PBRT needed to have 40% of the space allocated to a separate women compartment with a separate entrance, separate women waiting area at the bus station, arrangement of water cooler, tuck shop, women separate wash rooms and proper cleaning facilities at bus station and in the busses. Keep less height of the PBRT so that women, children, old and disable people can enter easily (need to be leveled at bus station platform). It was pointed out that there was a need to have proper maintenance of the PBRT and necessary security measure needed to undertake to avoid any problems. Female security guards, drivers and conductors needed to be hired.	passengers.
6 Dec	Khyber Medical College Peshawar - FGD	Students Sumaia Azmat, Ayesha Ahsaan, Anam	To	1	12	The students reiterated that women only used public transport if absolutely necessary and never for recreational and leisure purposes as	Cooperative and quite enthusiastic

		Delawar, Ruba Gul, Kinaat, Ayesha Yousaf, Maria Khan, Aqsa, Ulfat & Saad Manan				public transport is deemed as unsafe, unreliable, poorly managed and overcrowded. Females thus preferred taxis and rickshaws as their preferred mode of transport to work, markets, schools and colleges and hospitals. The students stated that not only did the bus drivers refuse to stop busses to take on female passengers, the harassment faced in the busses and at the bus stops included touching, whistling, and comments by fellow male passengers. It was also stated that due to the unprofessional attitudes of the bus drivers and their lack of training, they both drove terribly slow or extremely fast and were thus were extremely unreliable. Furthermore, the people on the main roads had direct access to public transport and crossing over from side roads was deemed as extremely dangerous as the roads had no proper traffic signals or zebra crossing. University road, Hayatabad and Sadder is for shopping, hospitals	

						and education institutions Hayatabad for hospital (Doctors, patients & nurses) and Warsak Road for schools. For PBRT, the government needed to install traffic signals, proper monitoring system, proper security, professional transport staff, and proper bus stops, clean and comfortable buses. PBRT should not be time consuming like the existing public transport. BRT platforms needed to be raised so that women, children, elders and disable could easily ascend in and descend out. At bus stops women, should have separate ticketing booths and CCTV cameras needed to be installed at bus stops, in the buses and on the PBRT corridor. Emergency telephones needed to be at bus stations and in the buses to avoid any emergency. Needed to have wash rooms both for women and men and separate waiting areas at bus stations.	
7 Dec	Social Work Department University	Female Students Sana	To understand the existing Public		5	It was found that both women and men used public transport to run errands and get to work, to study	Cooperative

	of Peshawar -FGD	Ahmed Kainaat Hassan Shahnaz Afridi Rida Iqbal Alina Ali	Transport system and women issues while traveling in public transport			or to get to social services. Women from rather affluent backgrounds were found to be using taxis and rickshaws and only those who faced financial constraints used public transportation systems. However, bad public transportation was reported to be a major deterrent for women in continuing their education or perusing career prospects. Women and girls faced extreme misbehavior from the bus drivers, conductors and fellow male passengers that they reported to have chosen to not travel at all. Overloaded, old, ripped seats and dirty busses had no designated times of arrival and departure and therefore were very unreliable and were not used by a large majority of female passengers. The culture of the city prevented women to mobile and therefore, women were mostly found to travel in pairs or were accompanied by family male member. The PBRT busses were thus expected to have separate seating spaces for women, with separate entrances and ticketing	

						counters. It was proposed that a map of the BRT route should be displayed at predominant spaces at the stations for the ease of passengers. PBRT is thus expected to resolve 80% of public transport related issues. It was stressed that the fares needed to be economical to ensure that everyone could afford to travel on the buses. The buses needed to be operated by trained drivers and other staff members and cleanliness needed to be ensured at the stations and in busses. Cameras needed to be installed at the bus stations and within the busses to ensure monitoring and for security purposes.	
7 Dec	Firdous & Hashtnagri underpasses-CM	Shopkeepers of Firdous & Hashtnagri underpasses Wajid Ali Nadeem, Zahir Shah, Islam Gul, Qari Hidayatullah (Shura Committee members of Firdous underpass) & Wajid Ali	Held consultation meetings (CM) with shop-keepers of Firdous & Hashtnagri underpasses. Discussed over census data collection of formal	30 in Firdous underpass & 27 in Hashtnagri underpass	0	In view of underpasses demolition, the shopkeepers suggested that the authorities should fulfill 4 demands on priority basis. All the shopkeepers of both the underpasses should be provided with shops at the same location in Bus stops at the same location. In the construction	The shopkeepers got ready for conduction of census of formal businesses after the consultation meetings. The survey team realized them that through census survey they could send their demands/ rights to the authorities. Meeting was fruitful because through formal consultation direct with survey team they realized

		Nadeem, Afsar Ali Khan	businesses and took their consent before start of data collection process.			phase, they should be provided alternate proper business place. Lease agreement of the shops should be extended. Proper compensation should be provided in place of their decoration or investment on the current shops.	the benefits of survey platform and got ready for conduction of census of formal businesses survey
07 Dec	University of Peshawar -FGD	University Students07 Dec 2016 Social Work Department University of Peshawar, Wahab Razaullah, Abdul Bais , M. Sohail , Abdur Rehman , Aqib Khan, Ikram Khan	FGD to introduce BRT and discuss their preferences/views regarding present public transport and BRT. Related issues and gender benefit.	6		The real problem for women is harassment free, fast and quality transport. Men tag along and they can also hang and bear discomfort. Men travel more than women. Women should travel in day time that is best time for them. University students here and elsewhere in Peshawar on BRT route will be very happy. If not us those (students) who are coming after us will enjoy the benefit of BRT. It should have come earlier.	
08 Dec	Hazar Khwani Peshawar -KII	PWD Habib Gul, PWD (Person with Disability) blind, Resident of Hazar Khwani, Peshawar	KII. Find travel pattern, restriction experienced due to transport and disability, harassment and preferred transport and views	1		Fares should be lower for poor women. Asked for care of disabled in PBRT	

			on fare.				
08 Dec	Board Bazar Peshawar -KII	PWD Muhammad Yusaf, unable to walk due to polio	KII. Find travel pattern, restriction experienced due to transport and disability, harassment and preferred transport and views on fare.	1		Bus should wait for disabled to board easily.	Provided information
08 Dec	University Town, Peshawar -KII	Poor Commuter Rahat, Domestic Servant	KII. Find travel pattern, restriction experienced due to transport, harassment and preferred transport and views on fare.		1	Women preferred time of travel is day time.	Hesitant
08 Dec	Kachi Muhallah, Lahore Gate Peshawar (KII)	Shazia Rouf Teacher Also Student of Quran (Blind Person)	To know the women travelling public transport mode & related issues		1	As the respondent, did not own a private vehicle, she had to rely on travelling on expensive taxis and rickshaws with her brother. She stated that she was unable to access public transport as they did not cater to her disability. According to her public transport is not safe for women because they have to face harassment issues but during the day time it became slightly safer for	Requested to make PBRT travel safe and useable for blind persons.

						women to travel. She stated that she had to allocate 150 rupees for daily commute and although that was extremely expensive, she did not have another option. According to her 10 rupees' ticket price per stop could be affordable while traveling from Hashtnagari to Saddar. PBRT needed to be friendly for the blind so she could travel on PBRT with ease.	
8 Dec	Bhana Mari, Kohat Road, -KII	Gulshan beautician	To understand about existing public transport travelling pattern & issues		1	She walks every day to the nearest bus station and takes bus. She also uses the public transport to go the market. Public transport is too slow, taking too much time to reach the destination whereas taxi and auto-rickshaw provides efficient service but expensive cannot be affordable on daily basis. She often travels in crowded mixed gender spaces although not pleasant for her. She faces harassment of staring and touching by men at bus stop and by the fellow male travelers. Public transport is not safe for women however morning and before evening are the safest time for	PBRT will be more useful for working women so need to offer subsidized rate for daily commuters.

						women travelers. For women, the safest areas to travel are Saddar, University Road and GT Road. The exiting public transport is affordable and for women the most acceptable fare should not be more than 15 rupees.	
8 Dec	Hayatabad Peshawar -KII	Naveeda Naz, lawyer	To know about women traveling through existing public transport & issues		1	The respondent reported that she had to walk a kilometer every day to nearest bus station to catch a bus to work. She stated that the public transport facilities were highly inefficient and slow and travelling in crowded, mixed gender spaces was an unpleasant experience as she routinely faced harassment as fellow male passengers leered and commented at her. She stated that days were relatively safer for women to travel in public transport the safest areas to commute were Saddar and University road. The exiting public transport was said to be affordable but not for poor people.	Need to have fixed fare of 20 rupees for women as offered in RMBRS (Rawalpindi Metro Rapid Bus Service) also need to offer subsidized package for the students, old citizens and people with disability. PBRT has to be women, children, elders and disable friendly.

8 Dec	Khadia khel Bakshi Pul Charsada Road Hayatabad-KII	Gazala daughter of Samin Jan-Blind person	To know what are the blind person's particularly blind women travelling mode, frequency and issues/problems		1	The respondent attends the school (blind Institute) to learn Braille and once a month and visits her sister house and the market place. Never having taken a bus because of them being overcrowded and difficult to get on; the respondent either uses a motorcycle to travel or a rickshaw. Usually preferred to travel most frequently in the morning and was always accompanied by family members. The respondent stated that public transport was not safe for women when they traveled alone. Morning time and day light is more secure for women traveling. For women and girls no route is safe in Peshawar while traveling in exiting public transport.	PBRT has to be friendly and comfortable for blind women and other disables. Special paths and elevators need to offer for the people of any kind of disabilities.
21 Dec	MCC Office, Arbab Road Peshawar	Leased owner of Firdous & Hashtnagri underpasses Mirza Khan, Owner & CEO of Mohmand Construction Company	Meeting with Mirza Khan & Shura members regarding commencement & purpose of structures/ shop-keepers socio-economic survey.	8	0	As the socio-economic survey was on sample basis that is why the shopkeepers were worried that why the survey team conducted survey from selective shopkeepers (were suspicious about purpose and did not know about the sample technique). Therefore, to explain the purpose of socio-economic survey, the shurra members	The shopkeepers and the lead person (Mirza Khan) realized the purpose of socio-economic survey and allowed the survey team for the particular survey exercise. Due to the meeting with shurra members, they allowed the survey team to conduct the socio-economic survey

						demanded that the survey team conduct a meeting with their lead person (Mirza Khan).	
26 Dec	PDA Office, Phase-V, Hayataba d	Project implementi ng Departmen t (Director & focal person for BRT)	Status of STP land ownership , discussion over resettleme nt cost for PC-1 and other study related matters.	3	0	He showed his concern over the availability of BRT proposed width at Zakori Bridge in Chughal Pura area & at Takhto Jummat (Sadar Bazar). He and DG PDA informed with confidence that STP land is the property of PDA.	Resettlement team decided to conduct visit to two mentioned sites for confirmation and clarification.
28 Jan	Shelton Guest House	DPs	To share salient features of LARP and take DPs views on proposed unit rates for compensa tion and resettleme nt assistance	28	0	DPs showed keen interest in the LARP features, and proposed unit rates, and provided suggestions to improve LARP and resettlement packages.	DPs suggestions are incorporated in the LARP to the extent possible.

8.7 Addressal of Stakeholder Concerns

628. The DPs and stakeholder concerns and suggestions have been incorporated in the Environment Management Plan, LARP and Gender Action Plan, and will be implemented as an integral part of the PBRT Project activities. The LARP has been prepared to compensate DPs sufficiently and promptly. The EPCM consultants and PMU Social, Gender and Resettlement staff will conduct consultations with potential DPs at the stage of detailed design and other relevant stakeholders during the process of updating this LARP, and develop mitigation measures against identified impacts to address concerns of DPs and other stakeholders. The summary of the concerns raised and their addressal is provided in Table 8.2 below.

Table 8.2: Summary of Concerns Raised by DPs / Stakeholder, and their Addressal

Concerns raised by the DPs / Recommendations	Actions incorporated in the RP/EMP (to address DPs Concerns / Recommendations)	Responsibility during Project and RP Implementation
• Prior to demolition of underpass markets, the alternative shops should be constructed and relocation of affected businesses should be completed • Compensation against damages to the fixtures and decoration of the shops should be fully and promptly paid.	• It is strongly recommended that demolition of underpass markets should be done after construction of alternative shops and relocation of businesses.	TMTD/TPC, Project Director and SPS of PMU, EPCM and civil works contractors
• Affected vendors should be provided alternative temporary business spaces to continue their business activities during the construction of BRT corridor.	• TMTD/TPC in coordination with other relevant departments will allow affected vendors to re-establish their businesses at temporary vending locations to enable them to continue their livelihood activities.	TMTD/TPC, Project Director of PMU, SPS and EPCM
• Permanent vending spaces to affected vendors at BRT related infrastructure to legally continue their business activities after construction of BRT corridor.	• TMTD/TPC in collaboration with other relevant departments will provide formal vending spaces to affected vendors at commercial areas of in proposed 4 pedestrian underpasses, 38 access bridges and 24 pedestrian bridges or around Bus Stations on a rental agreement with TransPeshawar Company through registration and issuance of legal licenses.	TMTD/TPC, Project Director of PMU, SPS and EPCM
• The businesses of the commercial markets shall not be affected due to project activities, except the DPs who should be fully compensated for income and structure losses.	• The GoKPK has adopted an approach to restrict the BRT works within the available width of ROW at built up areas and due to this approach damages to only few structures will occur. However, the people whose income will be affected will be sufficiently and promptly compensated.	TMTD/TPC, Project Director and SPS of PMU, SRS, EPCM and civil works contractors

Concerns raised by the DPs / Recommendations	Actions incorporated in the RP/EMP (to address DPs Concerns / Recommendations)	Responsibility during Project and RP Implementation
• Construction of road strictly within the available width of RoW.	• An approach adopted by GoKPK to restrict the road construction within the available space of ROW at built up areas to the extent possible.	TMTD, Project Director and SPS of PMU, EPCM and civil work contractors
• Avoid dismantling of commercial, residential or community structures.	• TMTD/TPC will ensure no damages to additional structures in built up areas other than those which are inevitable to demolish.	TMTD, Project Director and SPS of PMU, EPCM and civil work contractors
• The affected DPs, vendors and other vulnerable groups should be sufficiently and timely compensated against their income losses.	• The operators of affected business enterprises will be adequately and sufficiently compensated by following principles of ADB SPS.	TMTD/TPC, Project Director of PMU, SPS and EPCM
• Opportunities for skilled and unskilled labor should be provided to AHs during construction of BRT.	• The Contractor will be required to provide opportunities for skilled and unskilled employment to Project Affected Households, as well as on–the–job training to skilled labor of AHs to upgrade their skills in construction building. And TMTD and EPCM will closely monitor the contractors.	TMTD, Project Director and SPS of PMU, EPCM and civil work contractors
• Construction could also take place at night and on holidays to reduce disturbances.	• Construction may also take place at night to reduce impacts, such as relieving daytime traffic congestion, BRT road construction will be completed in minimum possible time i.e. 18 months.	TMTD, Project Director of PMU, EPCM and civil work contractors
• Safe mobility of commuters particularly women and children, and safety measures during construction activities	• Roadside furniture and traffic control devices, including information and cautionary signs, announcements at public places, signals, traffic diversion and flow markings, to ensure pedestrian safety during construction and operation stages.	TMTD, Project Director and SPS of PMU, EPCM and civil work contractors
• Proper facilities like sufficient number of bus stations and parking areas should be built at suitable locations.	• GoKPK (TMTD) will ensure provision of these facilities under the project	TMTD, Project Director and SPS of PMU, EPCM

Concerns raised by the DPs / Recommendations	Actions incorporated in the RP/EMP (to address DPs Concerns / Recommendations)	Responsibility during Project and RP Implementation
• Tree plantation should be done along the road.	• TMTD committed to retain existing median, in addition to this, a tree plantation program has been designed to compensate anticipated loss of trees during construction activities, and to help abate pollution caused by emissions and dust during BRT operations.	TMTD, Project Director and SPS of PMU, EPCM and civil work contractors
• Provide drainage along the road	• A drainage system has been designed along the road	TMTD, Project Director of PMU,EPCM and civil work contractors
• Stakeholder's consultation and participation should be an integral part of the resettlement and BRT construction and implementation process.	• TMTD/TPC will ensure effective stakeholders consultation and participation in the process of detail design, updating of LARP, implementation of LARP, constriction of BRT corridor and operations of BRT system.	TMTD, Project Director and SPS of PMU, EPCM, civil work contractors and service providers
• Mobility of local residents particularly women, children and elderly should not be restricted during construction activities;	• TMTD/TPC will ensure that project facilities like contractor camps will be located at a minimum distance of 500 m from residential areas in order to avoid restriction to mobility of local residents particularly women, children and elderly.	TMTD, Project Director and SPS of PMU, EPCM and civil work contractors
• Proper arrangements should be made for smooth and un–interrupted flow of traffic passing through the road during construction works.	• TMTD will ensure that Traffic Management Plan development and will be implemented	TMTD, Project Director and SPS of PMU, EPCM and civil work contractors
• The Control over–speed, management of traffic during construction	• A traffic management plan has been prepared for smooth flow of traffic during construction	TMTD, Project Director and SPS of PMU, EPCM, civil work contractors and other relevant departments of the city government and GoKPK

Concerns raised by the DPs / Recommendations	Actions incorporated in the RP/EMP (to address DPs Concerns / Recommendations)	Responsibility during Project and RP Implementation
• Provide access to first aid facilities in case of emergencies of road accidents.	• TMTD will ensure provision of first aid in case of emergencies through provision in the contractors' agreements.	TMTD, Project Director and SPS of PMU, EPCM and civil work contractors
• Proper arrangements for storage of construction material during construction.	TMTD will ensure it.	TMTD, Project Director and SPS of PMU, EPC, civil work contractors, service providers and relevant department of city government and GoKPK
• Regular removal of waste material from the ROW during construction.	TMTD will ensure it.	TMTD, Project Director and SPS of PMU, EPCM, civil work contractors city government and relevant department of GoKPK
• Improved road markings / signage and demarcation of accident–prone junctions in order to reduce conflicting movement during operation, particularly along inhabited stretches of road.	TMTD will ensure it	TMTD, Project Director and SPS of PMU, EPCM and civil work contractors
• Installation of speed breakers where required particularly in front of hospitals, education institutions and other sensitive receptors.	To be included in PBRT design at the stage of detailed design of BRT corridor.	TMTD, Project Director and SPS of PMU, EPCM and civil work contractors

9 Grievance Redress Mechanism

9.1 General

629. ADB Policy (SPS 2009) requires establishment of a local grievance redress mechanism to receive and facilitate resolution of the Displaced/Affected Persons concerns and grievances regarding the project's social, resettlement and environment performance. The measures have been identified to mitigate social and resettlement impacts to be caused due to implementation of PBRT Project works.

630. However, in spite of best efforts, there is every chance that the individuals / households affected by the project or other stakeholders are dissatisfied with measures adopted to address adverse social impacts of the project. To address, such situation an effective Grievance Redressal Mechanism (GRM) will be established to ensure timely and successful implementation of the project. It will also provide a public forum to the aggrieved to raise their objections and the GRM would address such issues adequately. It will receive, evaluate and facilitate the resolution of displaced persons' concerns, complaints and grievances about the social and environmental performance at the level of the Project.

631. The GRM will aim to investigate charges of irregularities and complaints receive from the Displaced Persons and provide a time-bound early, transparent and fair resolution to voice and resolve social and environmental concerns link to the project.

632. It is anticipated that the nature of such complaints will relate to compensation and resettlement assistance matters, damages, mobility and access issues of general public or disruptions of services during civil works related to the project functionaries. Some of the grievances that may arise are listed below:

- Name of a DP may be missing from the eligible DPs list
- Losses (such as damage to assets or loss of income) may not identified correctly during detailed design stage
- Improper distribution of compensation and/or resettlement assistance
- Problems in the relocation of DPs or their structures
- Delays in the payment of compensation and resettlement assistance,
- Any disruption by the civil works contractors
- Non-observance of project principles, by different parties, as laid down in the LARP
- Any other issue arising during the project implementation

633. The TMTD/TransPeshawar and PMU shall make the public aware of the GRM through public awareness campaigns particularly to DPs. The name of contact person and his/her phone number, PMU contact numbers and the TMTD/TransPeshawar, will serve as a hotline for complaints and shall be publicized through the media and placed on notice boards outside their offices, construction

camps of contractors, and at accessible and visible locations along the PBRT corridor, and also shared with the DPs representatives. The project information brochure will include information on the GRM and shall be widely disseminated throughout the PBRT corridor by the Social and Resettlement Specialist in TMTD/TransPeshawar and Social Team for Resettlement Plan Implementation (STRPI) under EPCM. Grievances can be filed in writing, via web-based provision or by phone with any member of the TMTD/TansPeshawar or PMU.

9.1.1 FIRST TIER OF GRM

634. The PMU is the first tier of GRM, which offers the fastest and most accessible mechanism for resolution of grievances. The Social and Resettlement Specialist (SRS), Environment Specialist (ES) and STRPI shall be designated as the key personnel for grievance redress. Resolution of complaints will be completed within ten (3) to fifteen (15) working days, depends on the nature of complaint. At this stage, the SRS will inform the TMTD/TransPeshawar PMU for additional support and guidance in grievance redress matters. Investigation of grievances will involve site visits and consultations with relevant parties (e.g. displaced persons, contractors, traffic police, general public, utilities companies etc.). Grievances will be documented and personal details (name, address, date of complaint, nature of complaint etc.) will be included unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:

- Initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
- Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures);
- Closure sheet, one copy of which will be handed to the complainant after s/he has agreed to the resolution and signed-off.

COMPLAINTS MANAGEMENT REGISTER (CMR)

635. The Social and Resettlement Specialist (SRS) will maintain a CMR to record grievances brought forward by displaced persons and general public, and ensure that these are appropriately addressed. The complaint register will provide for: the date and particulars of the complaint; description of the grievance; follow–up action required; name of person responsible for implementing the action; a target date for redressal and up-dated status/final action with date.

636. The SRS will be supported by the STPRI for this purpose. The actual measures taken to mitigate the concerns will also be recorded in the register. The complainant's views on the remedial action taken will also be documented in the Register. All complaints received verbally or in writing will be properly documented and recorded/written in the CMR. In addition to this an easy to access web based GRM will be designed on the same pattern, which will have updated status of each complaint to be used by complainants to get an update on their complaints.

637. The updated register of grievances and complaints will be available to the public at the PMU office, construction camps of contractors and other key public offices along the project corridor (offices of the city district government and district administration), and at accessible and visible places along the PBRT corridor. Should the grievance remain unresolved it will be escalated to the second tier.

9.1.2 SECOND TIER OF GRM

638. The SRS and ES in PMU will refer the unresolved issues (with written documentation) to the second tier of GRM, the GRC (Grievance Redress Committee). The GRC shall be established by TMTD/TansPeshawar during the detailed design stage prior to updating of LARP so that the DPs and other key stakeholders have recourse to refer their complaints.

639. The GRC will consist of the following persons: (i) representative of TMTD/Trans Peshawar as head of GRC; (ii) Project Director-PMU; (iii) representative of district administration; (iv) representative of PDA; (v) representative of relevant city district government offices; (vi) two representative of the displaced persons and (vii) representative of EPA-KPK (for environmental related grievances). The SRS and STPRI under EPCM shall organize a training of GRC to raise awareness about GRM and in handling grievances in an efficient and transparent manner as laid down in the LARP.

640. A hearing will be called with the GRC, if necessary, where the displaced person can present his/her concerns/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (7-15) working days, depends on the nature of complaint. The contractor(s) will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's administrative or judicial remedies.

641. The functions of the GRC are as follows: (i) resolve problems and provide support to displaced persons arising from various social, resettlement and environmental issues. Social and resettlement issues including land acquisition (temporary or permanent, as applicable); asset acquisition; eligibility for entitlements, compensation and resettlement assistance as well as environment issues including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public safety/utilities; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions maximum within 15 to 30 days; and (iii) report to the aggrieved parties about developments regarding their grievances and decision(s) of the GRC.

642. The TMTD/TransPeshawar (SRS or ES) will be responsible for processing and presenting all relevant documents, field enquires and evidences/proofs to the GRC, maintaining a database of complaints, recording decisions, issuing minutes of

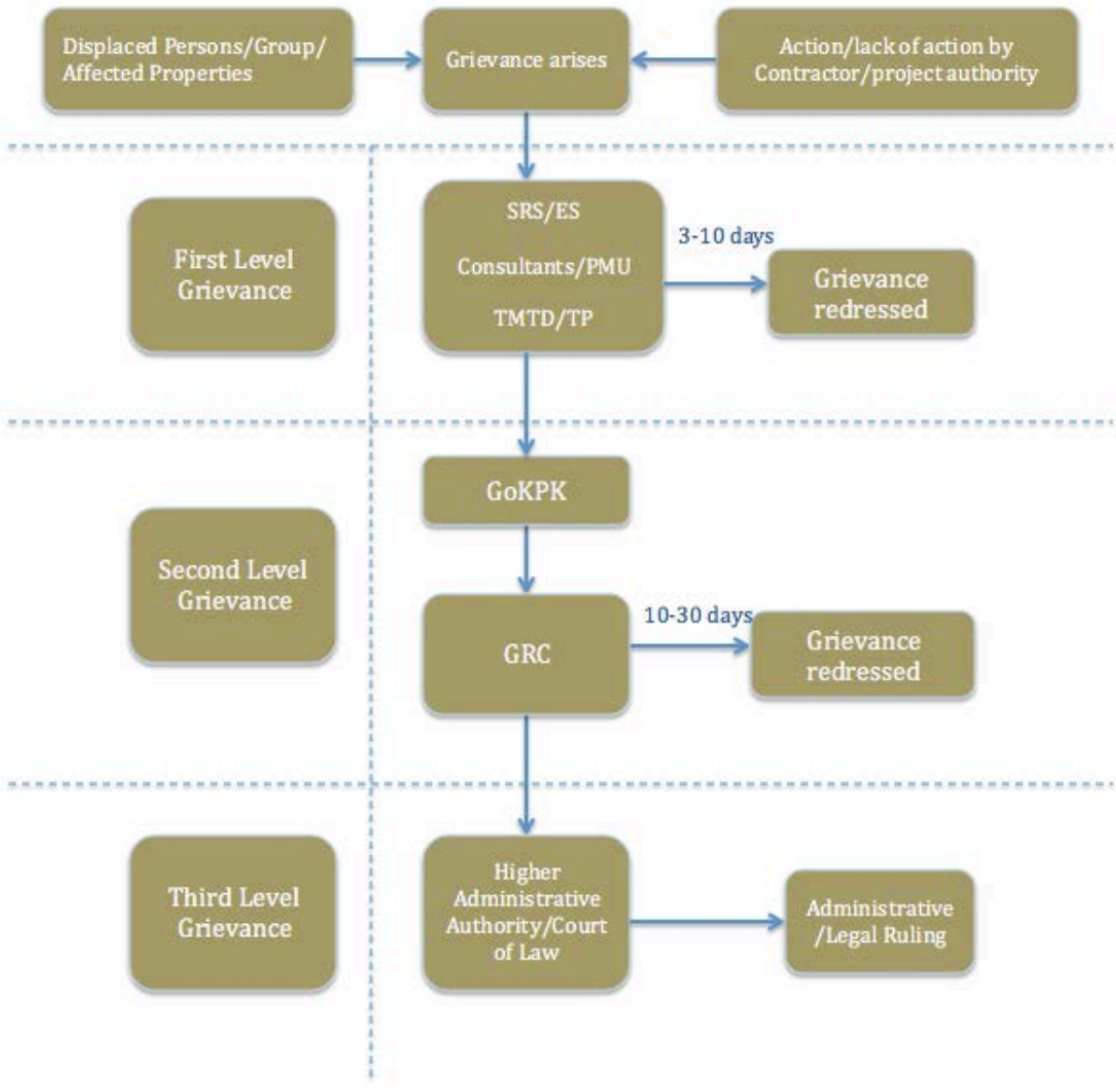
meetings and monitoring to see that formal orders are issued and to ensure that required actions against decisions are being carried out.

9.1.3 THIRD TIER OF GRM

643. In the event that a grievance cannot be resolved directly by the PMUs (first tier) or GRC (second tier), the displaced person can seek alternative redress through the district administration or city government, court of law or as appropriate. The PMU or GRC will be kept informed by the city district government or government administration, or any other authorities.

644. The grievance redress mechanism and procedures are depicted in **Figure 9.1**. The monitoring reports of the LARP and EMP implementation shall include the following aspects pertaining to progress on grievances: (i) Number of cases registered, level of jurisdiction (first, second and third tiers), number of hearings held, decisions made, status of pending cases; and (ii) lists of cases in process and already decided upon, may be prepared with details such as name with copy of NIC, complaint number, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, pending, closed).

Figure 9.1: Grievance Redress Mechanism



10 Conclusions and Recommendations

645. The development of the proposed BRT project in Peshawar is of high significance considering the urgent need for improving the urban transport landscape of Peshawar city. This project is expected to contribute towards the economic and social development of the region and pave the way for uplift of this entire region through generation of economic opportunities and increased investor interest in Peshawar.

646. Primary and secondary data has been collected and used to assess the environmental impacts of the Project. This EIA report highlights all potential environmental impacts associated with the Project and recommends mitigation measures. Any environmental impacts associated with the project need to be properly mitigated, through the existing institutional arrangements described in this report.

647. The majority of the environmental impacts are associated with the construction phase of the project such as high noise levels, deterioration of air quality, disturbance to existing utilities and resettlement impacts, to name a few.

648. The implementation of mitigation measures during this period will be the responsibility of the Contractor. Therefore, the required environmental mitigation measures will have to be clearly defined in the bidding and contract documents, and appropriately qualified environmental staff retained by the Consultant to supervise the implementation process. The EMP includes measures to minimize project impacts due to noise and air pollution, waste generation etc.

649. This project has been assigned environmental category ‘A’ in accordance with the ADB’s Safeguard Policy Statement (SPS) 2009 and Schedule II as per EPA, IEE and EIA Gazette Notification, 2000. Thus, a comprehensive EIA report has been prepared for the proposed project.

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