Initial Environmental Examination

July 2017

PAK: Multitranche Financing Facility Central Asia Regional Economic Cooperation Corridor Development Investment Program

Section 1 to 6 (Main Report)

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CURRENCY EQUIVALENTS

(as of 20 June 2017)

Currency Unit	Pakistan Rupee/s (PRs)
PRs 1.00	USD $0.00954
USD $1.00	PRs 104.8

ABBREVIATIONS

ADB	Asian Development Bank
ADF	Asian Development Fund
ACW	Additional Carriage Way
CAPE	Country Assessment Program Evaluation
CAREC	Central Asia Regional Economic Cooperation
CBE	Construction Business Expenses
CPEC	China-Pakistan Economic Corridor
DFID	Department for International Development
EA	Executing Agency
ECW	Existing Carriageway
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
FFA	Framework Financing Agreement
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GoP	Government of Pakistan
IA	Implementing Agency
HDM	Highway Development & Management
IEE	Initial Environmental Examination
IP	Indigenous People
IPP	Indigenous People Plan
IRR	Internal Rate of Return
IRI	International Roughness Index
JBIC	Japan Bank for International Cooperation
LARP	Land Acquisition and Resettlement Plan
LARF	Land Acquisition and Resettlement Framework
LIBOR	London Interbank Offered Rate
MFF	Multi-tranche Financing Facility
MTDF	Medium-Term Development Framework
NHA	National Highway Authority
NHDSIP	National Highway Development Sector Investment Program
NPV	Net Present Value
NTC	National Trade Corridor
NTCHIP	National Trade Corridor Highway Investment Program
NTCIP	National Trade Corridor Improvement Program
NWFP	North-West Frontier Province
OCR	Ordinary Capital Resources

O-D	Origin - Destination
PAK	Islamic Republic of Pakistan
PC-1	Planning Commission Pro-Forma Report 1
PEC	Pakistan Engineering Council
PPRA	Pakistan Public Procurement Regulations Authority
PFR	Periodic Financing Request
PIU	Project Implementation Unit
PMU	Project Management Unit
PPP	Public-Private Partnerships
PPTA	Project Preparatory Technical Assistance
PRC	People's Republic of China
PSA	Poverty and Social Assessment
PSDP	Federal Public Sector Development Program
ROW	Right of Way
RSDF	Road Sector Development Framework
RSL	Remaining Service Life
SAPE	Sector Assessment Program Evaluation
SATURN	Simulation and Assignment of Traffic to Urban Road Network
SPRSS	Summary Poverty Reduction and Social Strategy
TA	Technical Assistance
TOR	Terms of Reference

NOTES

- The fiscal year (FY) of the Government of Pakistan and its agencies ends on 30 June of the following year. FY before a calendar year denotes the year in which the fiscal year ends; e.g. FY2016 ends on 30 June 2016.
- In this report, "$" refers to United States dollars.

1. INTRODUCTION

1.1 The Project

1. Pakistan is one of the most rapidly urbanizing countries in South Asia. It will be vital how the country manages its urban growth for the quality of life of its people and the role that Pakistan government can make to influence the country's economic growth and poverty alleviation by developing the transport network. Pakistan is the world's sixth most populous country. The current population of Pakistan is estimated to be 191,527,753 people as of March 2016, based on the latest United Nations estimates, while 38.6%of the population is urban (74,986,621 people in 2016).

2. The government's Vision 2025 includes transport and connectivity as one of the priorities to achieve high, sustained and inclusive growth. The government is currently updating its Medium Term Development Framework (MTDF), which includes the transport sector. Previously, the government's transport sector plan envisaged rehabilitation and upgrading of the existing network, selective investment in new roads to facilitate regional trade, enhanced private sector participation, and control of overloading.

3. Pakistan has been looking forward to overcoming the physical and non-physical barriers by joining the CAREC program in order to grow and set in place Central Asia as the heart of trade and commerce in global markets since 2011. The CAREC Transport and Trade Facilitation Strategy (TTFS) 2020 included an expanded CAREC transport network, with CAREC Corridors 5 and 6 which are north-south national corridors on the west side of the Indus River running through Pakistan. Based on TTFS 2020, this TA project will assist the Pakistan Government in improving the CAREC corridors in Pakistan, and will develop and design a multi tranche financing facility (MFF), which will enhance regional connectivity and trade via the CAREC Corridors 5 and 6.

4. With Pakistan's accession to the CAREC Program, it is now possible to improve and extend the corridor to the neighboring countries. These Corridors within Pakistan will interconnect surrounding countries acting as a regional hub in order to promote regional integration and intra- and inter- regional trade.

5. The Project Preparatory Technical Assistance (PPTA) will prepare an MFF to assist the Government of Pakistan (GOP) in improving the CAREC corridors to serve the needs of surrounding countries to be interconnected through Pakistan and thereby acting as a regional hub to promote regional integration and intra- and inter-regional trade. The PPTA Consultant has carried out MFF packaging and identified the road sections for Tranche 1. Feasibility studies have also been carried out including preliminary engineering designs, cost estimating, technical, financial, economic, and socioeconomic analysis and environmental and social impact assessment.

6. In consultation with the National Highway Authority (NHA) the Consultant has identified the candidate road sections to be considered in the MFF packaging. The locations and lengths of the road sections of Tranche 1 of the MFF are as following;

    - Section-1: Petaro-Sehwan – 66.4 km
    - Section-2: Ratodero –Shikarpur – 43.2 km
    - Section -3: Dara Adamkhel-Peshawar – 34 km

7. These road sections were identified through preliminary field surveys, desk studies and in consultation with NHA.

1.2 Environmental Category

8. As per the criteria of Pak EPA of Pakistan, the Federal or Provincial highways or major roads (except in cases of maintenance, rebuilding or reconstruction of existing roads) and widening of existing three roads falls under Shedule-1 and requires an Initial Environmental Examination (IEE) to be conducted.

9. Regarding SPS 2009, an initial screening of the project roads was undertaken to assess the potential impacts and risks. It was concluded that there will be limited, generally site-specific and reversible impacts that can be addressed through mitigation measures. This project is therefore categorized as B and this IEE has been prepared consistent with ADB requirements.

1.3 Purpose of the IEE Report

10. The purpose of this IEE is to identify potential impacts during all stages of the road reconstruction and expansion project, list actions that will prevent or at least mitigate any negative effects of the work and specify a monitoring programme for implementation. This IEE has been prepared to comply with the requirements of the Pakistan Environmental Protection Act (PEPA), 1997, the Sindh Environmental Protection Act, 2014, the Khyber Pakhtunkhwa Environmental Protection Act, 2014, and ADB's Safeguard Policy Statement (SPS), 2009.

1.4 Methodology for the Environmental Assessment

11. This environment assessment report is based on primary and secondary data, information collected through field investigation and data obtained from the project authority. The activities carried out include the following:

- In-house discussion with consultants of different disciplines with a view to obtain details of the route and components of the work.

- Collection and review of relevant documents: The Environment Specialist collected and reviewed project details, primary and secondary data including technical information and design specification provided by engineering team.

- Reconnaissance: The physical review was carried out in two steps. Firstly, reconnaissance of all the options was done through the site visit and secondly meetings were held with the project proponent.

- Field investigation: Based on the reconnaissance visit, important issues and parameters to be investigated were identified and checklists were prepared. In subsequent visits by the Environment Specialist, various data were collected using simple tools like checklists, questionnaires, discussion with local people etc.

- Public consultation: Public consultations have been carried out during the months of October and November, 2016 to obtain the views of local people, project affected persons and local administrative representatives. The findings and recommendations are given Chapter 8, Stakeholder Consultation.

12. Based on the collected data and information, potential adverse environmental impacts have been identified and examined using ADB's Rapid Environmental Assessment (REA) Checklist (Appendix-1). Thereafter, possible mitigation measures have been

proposed on the basis of the findings of impact appraisal. Discussions were undertaken with the executive agency and technical team of the consultant for integrating environmental management measures into the project.

1.4 Boundary Selection

13. All three road sections of Tranche 1 namely Dara-Adamkhel, Ratodero-Shikarpur and Petaro-Sehwan boundaries will comply more or less with the general NHA legal boundaries established for the project, which would be the 50m and 100m RoW limits (centered over the existing ROW) for road construction respectively. RoW at water crossings will be 50m on either side of the road alignment.

1.5 Project Location

14. As stated previously, the aim of the Central Asia Regional Economic Cooperation Corridor (CAREC) Development Investment Project is to rehabilitate/reconstruct/upgrade the heavily damaged road infrastructure towards re-establishment of the road network in different parts of the country. The subprojects identified for Tranche 1 are as follows:

- Section-1: Patero–Sehwan is 66.4 km in length and is situated in the Jamshoro District of Sindh Province.
- Section-2: Ratodero–Shikarpur is 43.2 km in length and is situated in the Shikarpur District of Sindh Province.
- Section-3: Dara Ademkhel–Peshawar is 34 km in length and is situated in the Peshawar District of the Province of Khyber Pakhtunkhwa.

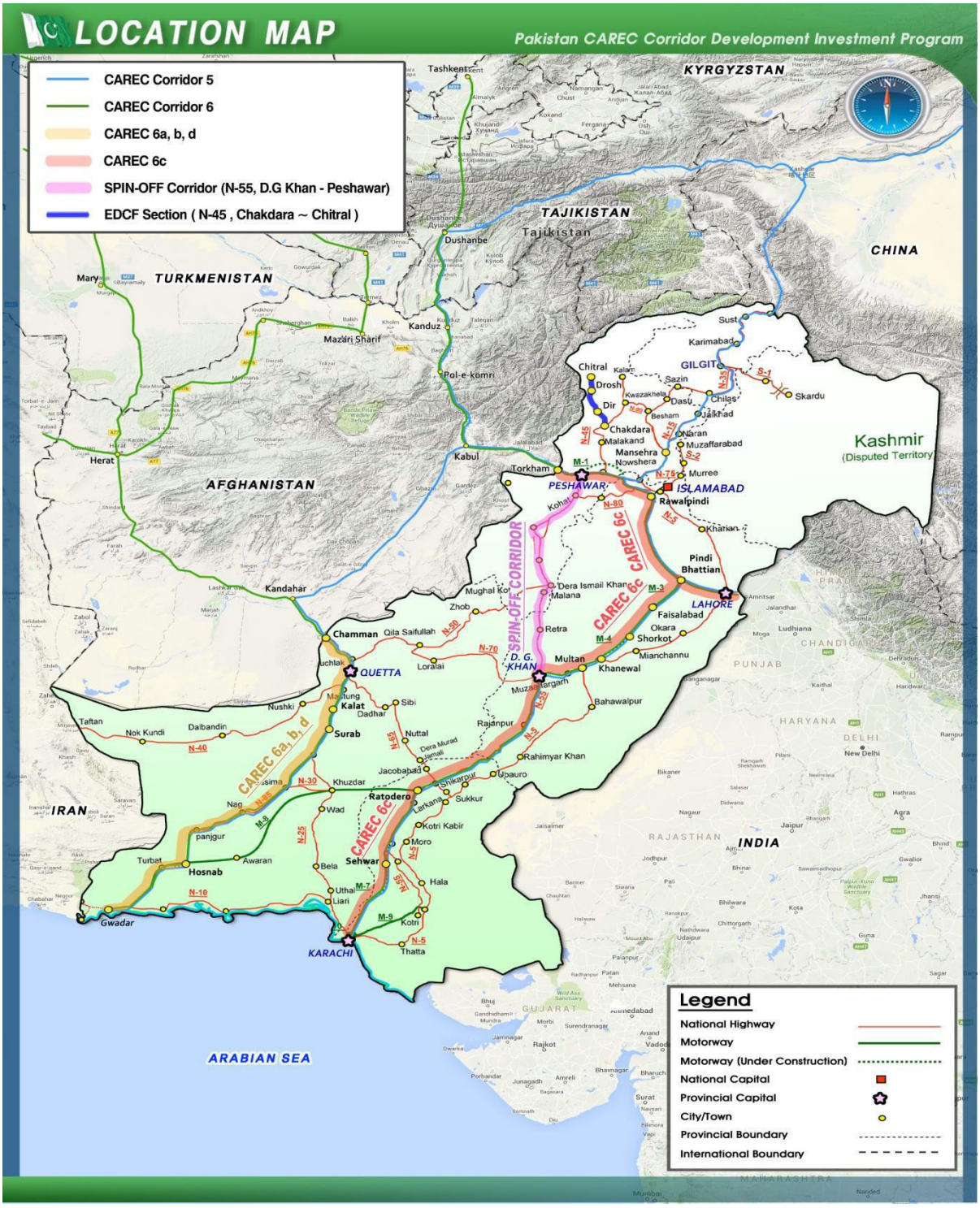


Figure 1.1: Location Map of Tranche 1 Subprojects

1.6 Content of the IEE study

15. The contents of the IEE report of this project are as follows:

Chapter 1 - Introduction: This chapter provides a brief overview of the assignment, purpose of the report, identification of the project and its proponent, brief description of the nature, size, and location of the project and its importance to the country.

Chapter 2 – Policy, Legal and Administrative Framework: Chapter 2 describes the policy, legal and administrative framework of Pakistan with respect to the environment. It also details the environmental safeguard policies and procedures of the lending agency i.e. the Asian Development Bank (ADB).

Chapter 3 - Description of the Project: Chapter 3 explains the type of project, need for the project, location, size or magnitude of operation, proposed schedule for approval and implementation, and a description of the project.

Chapter 4 - Description of the Environment: This chapter describes the baseline conditions of the area with respect to the physical, biological and socio-economic environments.

Chapter 5 – Option Analysis: Chapter 5 explores and analyses different route options for the project roads and explains the rationale for the selection of the finalized option.

Chapter 6 - Screening of Potential Environmental Impacts and Mitigation Measures: The chapter identifies the potential environmental impacts that may be caused by the project, and describes mitigation measures that may be adopted to minimize these impacts.

Chapter 7 - Institutional Requirements and Environmental Management and Monitoring Program: This section describes the institutional mechanisms that are required to satisfactorily implement the Environmental Management Plan (EMP) developed for the project. It further includes a monitoring plan designed to track the implementation of the EMP.

Chapter 8 - Public Consultation and Disclosure: The public consultation carried out as part of the IEE study is discussed in this chapter. Further, a Grievance Redressal Mechanism to address the environment related complaints arising from the project is also discussed.

Chapter 9, Findings and Recommendations: This chapter summarizes the findings, conclusion, and recommendations of the IEE study.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 General

16. This section provides an overview of the policy framework and national legislation that applies to the proposed subprojects under Tranche 1. The project is expected to comply with all national legislation relating to environment in Pakistan, and to obtain all the regulatory clearances required.

2.2 National Policy and Legal Framework

17. 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 sub-projects are pollution prevention and abatement and increasing energy efficiency while conserving biodiversity.

18. 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 Sindh government amended PEPA 1997 as Sindh Environmental Protection Act 2014, and the Sindh EPA (SEPA) is responsible for ensuring the implementation of provisions of the Act in Sindh's territorial jurisdiction. The province of Khyber Pakhtunkhwa (KP) also legislated the Khyber Pakhtunkhwa Environmental Protection Act 2014, and the KP EPA is the provincial institution responsible for its implementation.

2.2.1 Regulations for Environmental Assessment, Pakistan EPA

19. 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.

2.2.2 Guidelines for Environmental Assessment, Pakistan EPA

20. 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 sub-project are listed below:

1. Guidelines for the Preparation and Review of Environmental Reports, Pakistan, EPA1997;

2. Guidelines for Public Consultations; Pakistan EPA May 1997;

2.2.3 National Environmental Quality Standards (NEQS) 2000

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

1. 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);

2. Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources;

3. Maximum allowable concentration of pollutants (two parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles;

4. Maximum allowable noise levels from vehicles;

These standards apply to the gaseous emissions and liquid effluents discharged by construction machinery.

2.3 Provincial Environmental Legislation

2.3.1 Sindh Environmental Legislation

Sindh Environment Protection Act, 2014

21. The Sindh Environmental Protection Act 2014 is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a broad range of issues and extends to air, water, industrial liquid effluent, marine, and noise pollution, as well as to the handling of hazardous wastes. The sections of Sindh Act 2014 that have a direct bearing on the proposed Project are listed below. The details are discussed in the following sections.

    - Section 11 that deals with the Sindh Environmental Quality Standards (SEQS) and its application.
    - Section 13 that deals with hazardous substances.
    - Section 14 that prohibits various acts detrimental to the environment.
    - Section 15 that relates to vehicular pollution.
    - Section 17 that establishes the requirement for environmental impact assessment.

22. Under Section 2 (xxxl), the Act defines "pollution" as the contamination of air, land or water by the discharge or emission of effluent or wastes or air pollutants or noise or other matter which either directly or indirectly or in combination with other discharges or substances alters unfavorably the chemical, physical, biological, radiation, thermal or radiological or aesthetic properties of the air, land or water or which may, or is likely to make the air, land or water unclean, noxious or impure or injurious, disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to biodiversity.

23. The Act, under Section 17, empowers the EPA Sindh to acquire from the proponent an EIA/IEE assessment document from the proponent of any project prior to commencement of any construction or operations activity. Section 19, empowers the EPA Sindh to acquire from the proponent an EMP of any project or activity so as to acquire comprehensive appraisal of the environmental aspects of that project or activity SEPA Act 2014 is attached for ready reference and further guidance.

The Sindh EPA Review of IEE and EIA Regulations 2014

24. In exercise of the powers conferred by Section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government of Sindh has notified the 'Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2014' vide notification No. EPA/TECH/739/2014 dated 16th December 2014.

25. This regulation describes the procedure for conducting environmental assessments and their approval process. Categories for projects requiring IEE, EIA or Environmental Checklists are mentioned in the regulation. The environmental assessment includes preparation of an Environmental Management Plan (EMP). SEPA Review of IEE/EIA regulations 2014 is attached for ready reference and further guidance.

Self-Monitoring and Reporting

26. In exercise of the powers conferred by section 36 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Government has notified the "Self Monitoring and Reporting by Industry Rules, 2014" vide notification No. EPA/TECH/739/2014 dated 16th December 2014.

27. In 2014, the Government of Sindh has taken various concrete steps to attain control over industrial pollution in the Sindh Province. The most significant measure was the enactment of the Sindh Environmental Protection Act 2014, which makes it an obligation upon industrial facilities to restrict their air emissions and effluents to the limits specified in the Environmental Quality Standards (EQS).

The Sindh Irrigation Act 1879

28. This Act empowers the GoS to use the natural sources of water such as lakes, rivers, and streams, for supply of water for irrigation and other purposes. It allows the government to develop the required infrastructure, for example, canals, channels, pipelines, for the supply of water. It also allows the government to charge fee for the supply of water and regulate the water supply. The Irrigation Department of the Government of Sindh is the concerned department to which the project proponents have to apply to seek permit to obtain water from Indus River. The irrigation department will also charge fee as per the prevalent rates.

Sindh Wildlife Protection Ordinance, 1972

29. The Sindh Wildlife Protection Ordinance was approved in pursuance of the Martial Law Proclamation of 25th March, 1969. Under this Ordinance, three types of protected areas viz. National Park, Wildlife Sanctuary and Game Reserve have been notified for protection, conservation, preservation and management of wildlife.

30. This law declares any such area and its wildlife the sole property of the Government, making it accessible only to public for recreation, education and research. No hunting, shooting, trapping or killing is allowed without obtaining a special permit to do so within specific conditions and time limitations.

The Sindh Cultural Heritage (Preservation) Act, 1994

31. This provincial Act empowers the Government of Sindh (GoS) to preserve and protect any premises or objects of archaeological, architectural, historical, cultural, or national interest in Sindh by declaring them protected.

32. Among various provisions of this act some are, formation of an Advisory Committee to government to overlook and subsequent right of Acquisition of a protected heritage of architectural, historical, archaeological or national value, custodian/guardianship rights for preservation and declaration of protected heritage, evaluation of ownership rights, take legal action against any offender who attempts to damage, destroy, remove, deface, alter or imperil the protected heritage or to build on or near the site. It also details the purchase, maintenance and repair works of a protected heritage under the government's jurisdiction. The advisory committee may also receive voluntary donations towards the cost of maintenance of a protected heritage site. The act also establishes the right of access to certain protected heritage sites, penalties for violators, formulation of rules and provides protection to the persons working under this Act.

Sindh Local Government Ordinances, 2001

33. These ordinances issued following the devolution process, establish regulations for land use, the conservation of natural vegetation, air, water, and land pollution, the disposal of solid waste and wastewater effluents as well as matters related to public health and safety.

2.3.2 Khyber Pakhtunkhwa Environmental Legislation

Khyber Pakhtunkhwa Environment Protection Act, 2014

34. The KP Environmental Protection Act, 2014 is the basic legislative tool empowering the provincial government to frame regulations for the protection of the environment. The Act is applicable to almost all environmental parameters pertaining to air, water, soil and noise pollution, and handling of hazardous wastes, as well as to the social and socioeconomic aspects.

35. The Act provides the framework for: protection and conservation of species, wildlife habitats and biodiversity; conservation of renewable resources; establishment of provincial standards for the quality of the ambient air, water and land; establishment of Environmental Tribunals; appointment of Environmental Magistrates; and IEE and EIA approval. Penalties have been prescribed for those who contravene the Act. The key features of the Act have a direct bearing on the proposed project requirement for an IEE and EIA for development projects. The following are the key features of the Act that have a direct bearing on the area:

36. Section 12 (Prohibition of Certain Discharges or Emissions) states that "Subject to the provisions of this Act and the rules and regulations made there under, no person shall discharge or emit, or allow the discharge or emission of, any effluent or waste or air pollutant or noise in an amount, concentration or level which is in excess of the NEQS".

37. NEQS have been established for gaseous emission, liquid effluent, ambient air quality, noise, and drinking water. The proposed project needs to comply with all applicable standards.

38. Section 13 (Review of IEE and EIA). The Agency shall review the IEE/EIA report and accord its approval subject to such conditions as it may deem fit to impose, or require

that the IEE be re-submitted after such modifications as may be stipulated or rejected, the project as being contrary to environmental objectives.

39. The EIA of the proposed Project will be submitted to the Khyber Pakhtunkhwa–EPA (KP-EPA) for approval.

40. Section 15 (Handling of Hazardous Substances) requires that "Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle, or import any hazardous substance except;

41. Under a license issued by the Agency and in such manner as may be prescribed; or in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement, or other instrument to which Pakistan is a party." Enforcement of this clause requires the EPA to issue regulations regarding licensing procedures and to define 'hazardous substance.'

42. As per Article 15(1), the requirements of Article 15 are applicable in such manner as may be prescribed'. KP EPA defines that prescribed to mean as prescribed under the rules made under the Act. Hazardous Substances Rules were drafted in 2003 but were never notified.

Sarhad Provincial Conservation Strategy (SPCS), 1996

43. The Sarhad Provincial Conservation Strategy (SPCS) is a Sustainable Development Action Plan for Pakistan's North West Frontier Province and represents a significant milestone in the effort to implement Pakistan's National Conservation Strategy. Action plans are needed at the provincial level to guide government departments, non-governmental organizations, the private sector, and individual citizens. The SPCS is the first such provincial effort. It was approved by the NWFP Cabinet in June 1996, and implementation is underway.

2.4 ADB Policies

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

44. 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 9 of this report.

45. 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:

46. 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 larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required.

47. 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.

48. 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.

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

50. As a result of the completion of the REA checklist, the proposed sub-project has been classified as Category ‘‘B’’ and thus a detailed and comprehensive IEE study has been prepared including the EMP.

2.4.2 ADB’s Public Communication Policy 2011

51. 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.

2.4.3 ADB’s Accountability Mechanism Policy 2012

52. 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.

2.5 Other Environment Related Legislations

53. The **Table 2.1** provides a summary of all 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

Legislation/Guideline	Description
	goal of sustainable development. It also suggests various policy instruments to overcome the environmental problems throughout the country.
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. No protected forest is situated in the sub-project area.
Punjab Wildlife Protection Ordinance, 1972	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 Antiquities Act (1975)	It ensures the protection of Pakistan's cultural resources. 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 GOP 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, GOP, 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	
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 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 Provincial Environmental Protection Agencies are formed by the respective provinces.
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

Legislation/Guideline	Description
	cooperate with other countries in matters of research on migratory species. There are no endangered species of plant life or animal life in the vicinity of the proposed sub-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.

2.6 Comparison of International and Local Environmental Legislations

54. 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.

55. A comparison of applicable local and international guidelines for ambient air quality has been provided in **Table 2.3** 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.

56. Similar to the standards for air quality, the comparison of noise standards provided in **Table 2.4** 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 this sub-project.

57. 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 since these specific IFC standards only cover a limited number of parameters relating to effluent disposal etc and the NEQS are generally more stringent.

2.7 Implications of national policies and regulations on proposed project

58. 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.

59. 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.

60. The proposed sub-project has been categorized as Schedule-I and thus an IEE study has been conducted.

2.8 Implications of ADB's safeguard policies on proposed project

61. 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.

62. 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.

63. 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.

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 mitigation	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.

Table 2.3: 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	360 ug/m^3

					24 hrs	500 ug/m^3
PM_{10}	24 hrs	150 ug/m^3	1 yr 24 hr	20 ug/m^3 50 ug/m^3	Annual Mean 24 hrs	120 ug/m^3 150 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 2.4: 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.

2.9 Administrative Framework

2.9.1 Khyber Pakhtunkhwa Environmental Protection Agency (KP EPA)

64. For implementation of Khyber Pakhtunkhwa Environmental Protection Act Khyber Pakhtunkhwa EPA has powers for review, approval and monitoring of environmental assessment of project, in present case Section-3 of Trench-1 , Dara Adem Khel – Peshawar road segment shall fall in its territory. For Section-3 of trench -1, the KP-EPA will be responsible for reviewing the IEE report, issuing environmental approval and post approval monitoring of the proposed project activities to ensure compliance with the Environmental Management Plan (EMP) and any other condition of the environmental approval.

2.9.2 Khyber Pakhtunkhwa Forest Department:

65. The Project implementation will involve clearing of vegetation and trees within the Right of Way (ROW). The Project proponent will be responsible for acquiring a 'No-Objection Certificate' (NOC) from the Khyber Pakhtunkhwa Forest Department on the basis of the approved IEE. The application for an NOC will need to be endorsed by the implementing agency. Tree avenue plantation will be carried out by the NHA itself or through work awarded to Khyber Pakhtunkhwa Forest Department. NHA will also be responsible for liaising with Khyber Pakhtunkhwa Forest Department on the types of trees to be planted and other matters concerning plantation layout as an environmental mitigation measure.

2.9.3 Khyber Pakhtunkhwa Wildlife Department:

66. Khyber Pakhtunkhwa Wildlife Department controls the district wildlife through District Officers Wildlife DO (W). According to wildlife department setup, this project comes under the jurisdiction of DO (W) of Peshawar.

67. There is no wildlife sanctuary/ Game Reserve present in the project area. Wildlife related issues if arised during any stage of the Project, the contractor/proponent will resolve it with the consultation of respective nearest wildlife office.

2.9.4 District Environment Offices

68. Environment Protection Department in Khyber-Pakhtunkhwa has been developed with the promulgation of Khyber Pakhtunkhwa Local Government Ordinance, 2001. Under this ordinance, District Environment Offices have also been established to perform the following functions:

- To regulate motor vehicles subject to the provisions of the KP-Environmental Protection Act, 2014 and the rules and regulations to be made there-under;
- To ensure, guidance and assistance to the proponents of new Projects in submission of Initial Environmental Examination (IEE)/ Environmental Impact Assessment (EIA) to the Director General, EPA for approval;
- To ensure implementation of environmental protection and preservation measures in all development Projects at the district level and to sensitize government agencies on environmental issues;
- To identify the needs for legislation in various sectors of the environmental matters.
- To provide information and guidance to the public on environment;

- To encourage the formation and working of Non-Governmental Organizations (NGOs), to prevent and combat pollution and promote sustainable development; and
- To undertake regular monitoring of Projects and to submit progress reports to the DG, EPA for publication in the Annual Report.

2.9.5 Sindh Environmental Protection Agency (SEPA)

69. For implementation of Sindh Environmental Protection Act, Sindh EPA has powers for review, approval and monitoring of environmental assessment of project, in present case Sections 1, and 2, of tranche 1, Petaro-Shewan and Ratodero-Shikarpur road segment fall in its territory. For Section 1 and 2of trench -1, the Sindh EPA will be responsible for reviewing the IEE report, issuing environmental approval and post approval monitoring of the proposed project activities to ensure compliance with the Environmental Management Plan (EMP) and any other condition of the environmental approval.

2.9.6 Sindh Forest Department

70. The Project implementation will involve clearing of vegetation and trees within the Right of Way (ROW). The Project contractors will be responsible for acquiring a 'No-Objection Certificate' (NOC) from the Sindh Forest Department on the basis of the approved IEE. The application for an NOC will need to be endorsed by the NHA. Tree avenue plantation will be carried out by the NHA itself or through work awarded to Sindh Forest Department. NHA will also be responsible for liaising with Sindh Forest Department on the types of trees to be planted and other matters concerning plantation layout as an environmental mitigation measure.

2.9.7 Sindh Wildlife Department

71. Sindh Wildlife Department controls the district wildlife through District Officers Wildlife DO (W). According to wildlife department setup, this project comes under the jurisdiction of DO (W) of Jamshoro.

72. There is no wildlife sanctuary/ Game Reserve present in the project area. If wildlife related issues arise during any stage of the Project, the contractor/proponent will resolve them with the consultation of respective nearest wildlife office.

2.9.8 District Environment Offices

73. Environment Protection Department in Sindh has been developed with the promulgation of Sindh Local Government Ordinance, 2001. Under this ordinance, District Environment Offices have also been established to perform the following functions:

- To regulate motor vehicles subject to the provisions of the Sindh Environmental Protection Act 2014 and the rules and regulations to be made there-under;
- To ensure, guidance and assistance to the proponents of new Projects in submission of Initial Environmental Examination (IEE)/ Environmental Impact Assessment (EIA) to the Director General, EPA for approval;
- To ensure implementation of environmental protection and preservation measures in all development Projects at the district level and to sensitize government agencies on environmental issues;
- To identify the needs for legislation in various sectors of the environmental matters;

- To provide information and guidance to the public on environment;
- To encourage the formation and working of Non-Governmental Organizations (NGOs), to prevent and combat pollution and promote sustainable development; and
- To undertake regular monitoring of Projects and to submit progress reports to the DG, EPA for publication in the Annual Report.

2.9.9 Non –Governmental Organization (NGOs)

74. NGOs play pivotal role in mobilizing and enlisting public participation in development projects. The local/ Civil Society Based Organizations namely Sarhad Rural Support Programme (SRSP), Pakistan Poverty Alleviation Fund (PPAF), Forest Conservation Committee (FCC), etc. are already working in project areas in different sectors. These organizations can be instrumental in advocating the proposed project, organizing the community, negotiating the compensation packages, imparting skills training etc., at different stages of the proposed Project.

3. DESCRIPTION OF THE PROJECT

3.1 Introduction

75. The road network in Pakistan is expanding rapidly and the pace of this development is gradually accelerating. The Government of Pakistan places major emphasis on improving the existing roads and building new motorways and expressways to enhance and expand the country's road network. Notwithstanding the efforts of the Government, roads outside major cities have deteriorated with the passage of time. Highways and motorways constructed over the last two decades have brought much needed improvements to the sector but major highways have also been impacted by heavy traffic flows, climatic impacts and natural wear and tear compounded by poor repair and maintenance. These issues have resulted in frequent traffic jams, blockages and road accidents. The N55 Indus Highway, sections of which are considered for development under the current MFF, too, has degraded significantly over its two decades of existence.

76. Pakistan has been looking forward to overcoming the physical and non-physical barriers by joining the CAREC program in order to grow and participate in trade and commerce with Central Asia, and through this with global markets. The CAREC Transport and Trade Facilitation Strategy (TTFS) 2020 included an expanded CAREC transport network, with CAREC Corridors 5 and 6, which are north-south national corridors on the west side of the Indus River running through Pakistan. Based on TTFS 2020, the current TA project will assist the Government of Pakistan (GoP) in improving the CAREC corridors in Pakistan, and will develop and design a Multi-Tranche Financing Facility (MFF) to enhance regional connectivity and trade via the CAREC Corridors 5 and 6.

77. The PPTA will prepare an MFF to assist the Government of Pakistan (GoP) in improving the CAREC corridors to serve the needs of surrounding countries to be interconnected through Pakistan, and thereby acting as a regional hub to promote regional integration and intra- and inter-regional trade. The PPTA Consultant has carried out MFF packaging, identified the road sections of Tranche 1, and carried out Feasibility Studies including preliminary engineering designs, cost estimating, technical, financial, economic, and socioeconomic analysis, and environmental and social impact assessment.

78. The road sections included in Tranche 1 of the MFF are located on the national highway N-55, also known as the Indus Highway. The Indus Highway starts from Kotri / Jamshoro at the junction of M-9 (Karachi-Hyderabad Motorway). The road originates from Kotri and passes through the intersection constructed on the M-9. The following three sections have been finalized as subprojects for Tranche 1, and are depicted in Figure 3.1.

<u>Section-1 Petaro-Sehwan: RD 64+000 to 130+400 km (66.4 km)</u>

79. This section is located in Jamshoro district in Sindh, from km 64+000 to km 130+400 of N-55 or the Indus Highway. It starts from Petaro near Jamshoro (start point of M-9 motorway) and terminates near Sehwan. Most of the area is flat while some reaches are rolling. No major agriculture activity was found in this section. Hyderabad, Kotri and Jamshoro are three adjoining cities, which have expanded and form an urban agglomerate and center of trade, commerce and industry. Jamshoro is known as an educational city due to the location of the University of Sindh. Sehwan is an old, small and historical town famous for the Shrine of Hazrat Shaikh Usman Marvandi, commonly known as Hazrat Lal Shahbaz Qalandar. Thousands of devotees visit the

Shrine every year, and three-day period of the annual Urs or death anniversary. Besides, there is Mancher lake nearby which is a tourist attraction. The land is rugged and water is scarce. Population density is low. Some coal mines are also located at the start of this section. Major towns in this section are Petaro, Manjand, Sann, Amri, Lakhi Shah Saddar and Tirath Laki. There are not sensitive or ecologically important sites in the area.

80. The existing road alignment starts at km 64+000 (Amri) in Manjhand Taluka of the Jamshoro District, and terminates at km 130+400 near Sehwan. The total length of the proposed additional carriageway will be 66.400 km, with right of way (ROW) between 40 to 50m (132 to 165 ft.). The existing road is a 7.3m wide single carriageway with earthen shoulders and formation width of 13.3m. Under the subproject, an additional 7.3 meters carriageway with treated shoulders will be constructed along the existing carriageway except in urban sections where both sides of the existing road will be widened in order to upgrade it into dual carriageway with 4 lanes. In sections with steep curves, a new dual carriageway with improved curve geometry will be constructed.

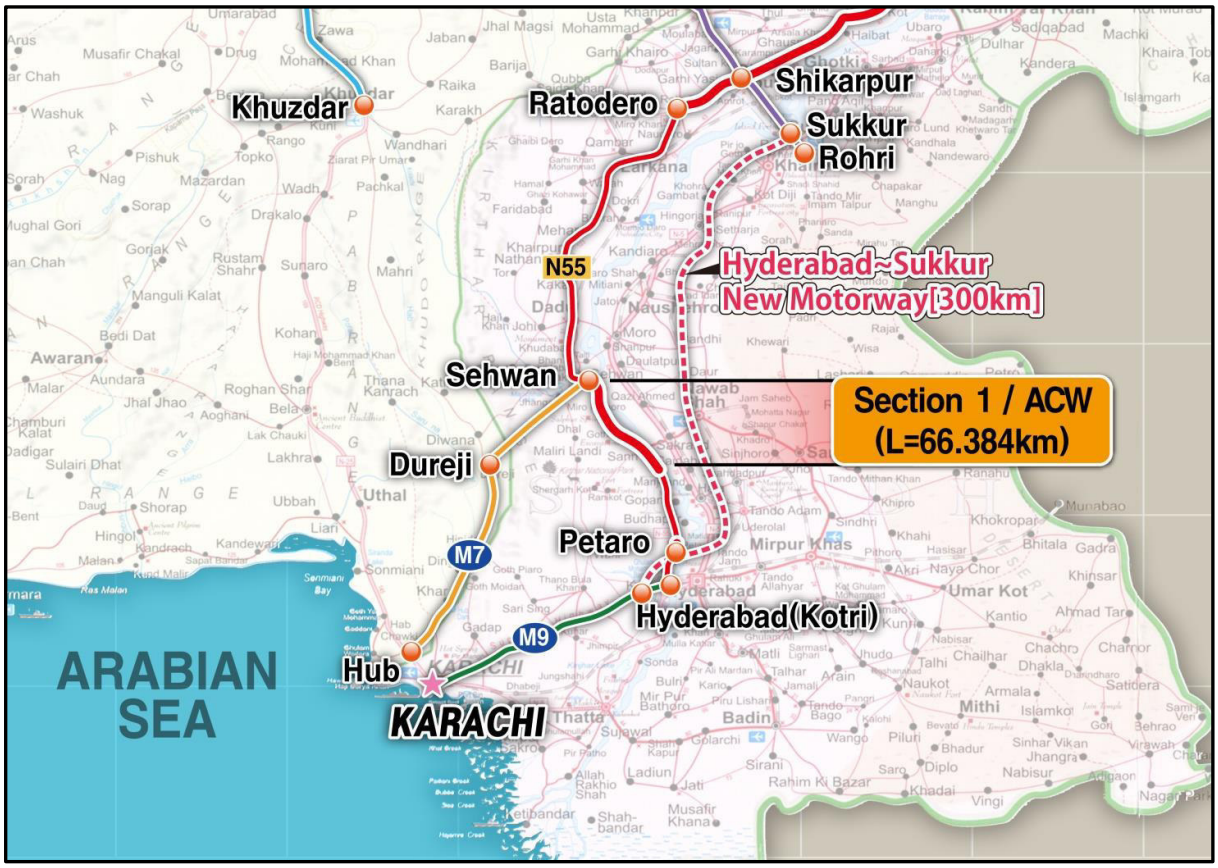
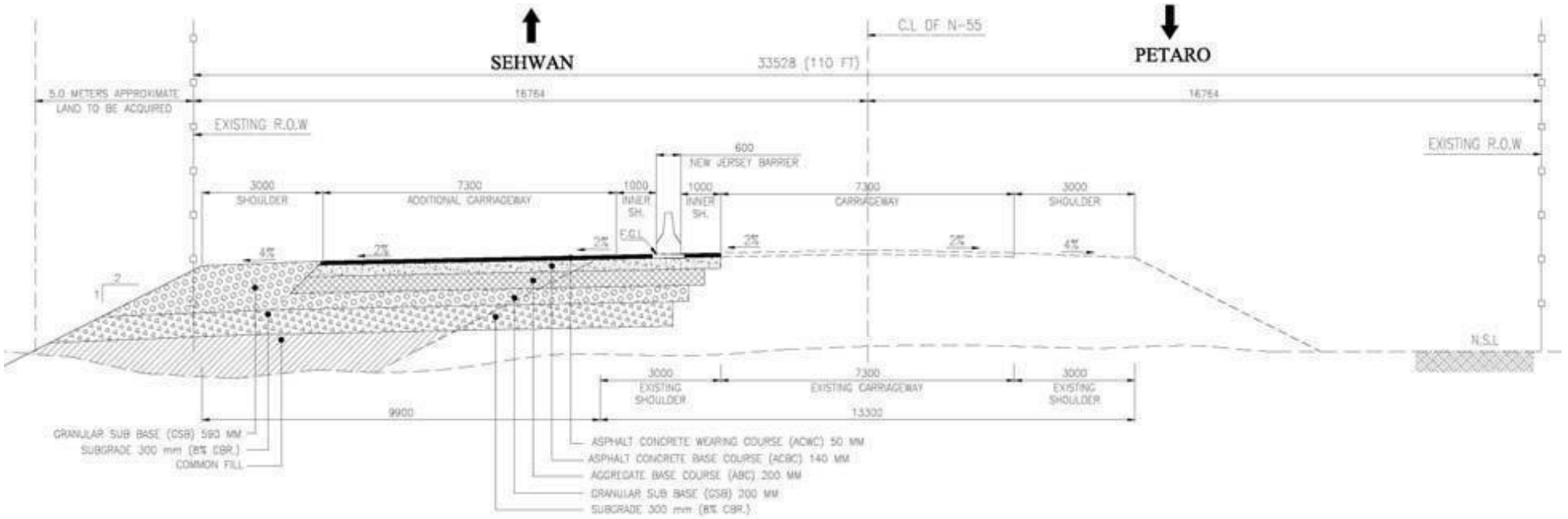


Figure 3.1: Location Map of Section 1 – Petaro to Sehwan



TYPICAL X-SECTION FOR ADDITIONAL CARRIAGEWAY ON LEFT SIDE

Figure 3.2: Typical X-section for Additional Carriageway on Left Side

Section-2 Ratodero –Shikarpur: RD 338 to 382 km (43.2 km)

81. Section 2 starts from Ratodero (start point of M-8 motorway) and terminates at Shikarpur. The subproject will rehabilitate 43.2 km and construct an additional 2-lane carriageway between Ratodero and Shikarpur section of N-55, including a bypass at Dakkan town at km 10+450 to km 12+750.

82. N-55 passes through Larkana and Shikarpur district headquarters, which are 70.5 km apart. Ratodero is located on the road connecting the two cities at a distance of 26 km from Larkana. The portion of the road from Larkana to Ratodero has already been improved. Hence the section from Ratodero to Shikarpur is included in Tranche 1 program.

83. Ratodero is a sub-division (Taluka/Tehsil) of Larkana district and a small town. Shikarpur is the headquarter of a district of the same. The national highways N-55 and N-65 intersect here. The area is fertile, canal irrigated, densely populated and connected by road in all directions. Shikarpur is also a center of industry and commerce in the area and commands traffic to and from Balochistan.

84. The existing road is 7.3 meters wide single carriageway with a formation width of 13.30 meters. The total length of this section is 43.2 km. An additional carriageway is designed to convert the existing single lane carriageway into 4 lanes dual carriageway. The additional carriageway runs along the existing alignment of the road and most part of the new alignment is located on the left side of the existing road except in urban areas where both sides will be widened to make a dual carriageway. A bypass road is proposed at Dakkan town (km 10+450 to km 12+750).

85. The construction of additional carriageway will mostly follow the available ROW width (110 feet to 165 feet) except for the new bypass road where land will be acquired. To achieve vertical and horizontal geometric improvements in some sections, additional strip of land will be acquired along the existing ROW.

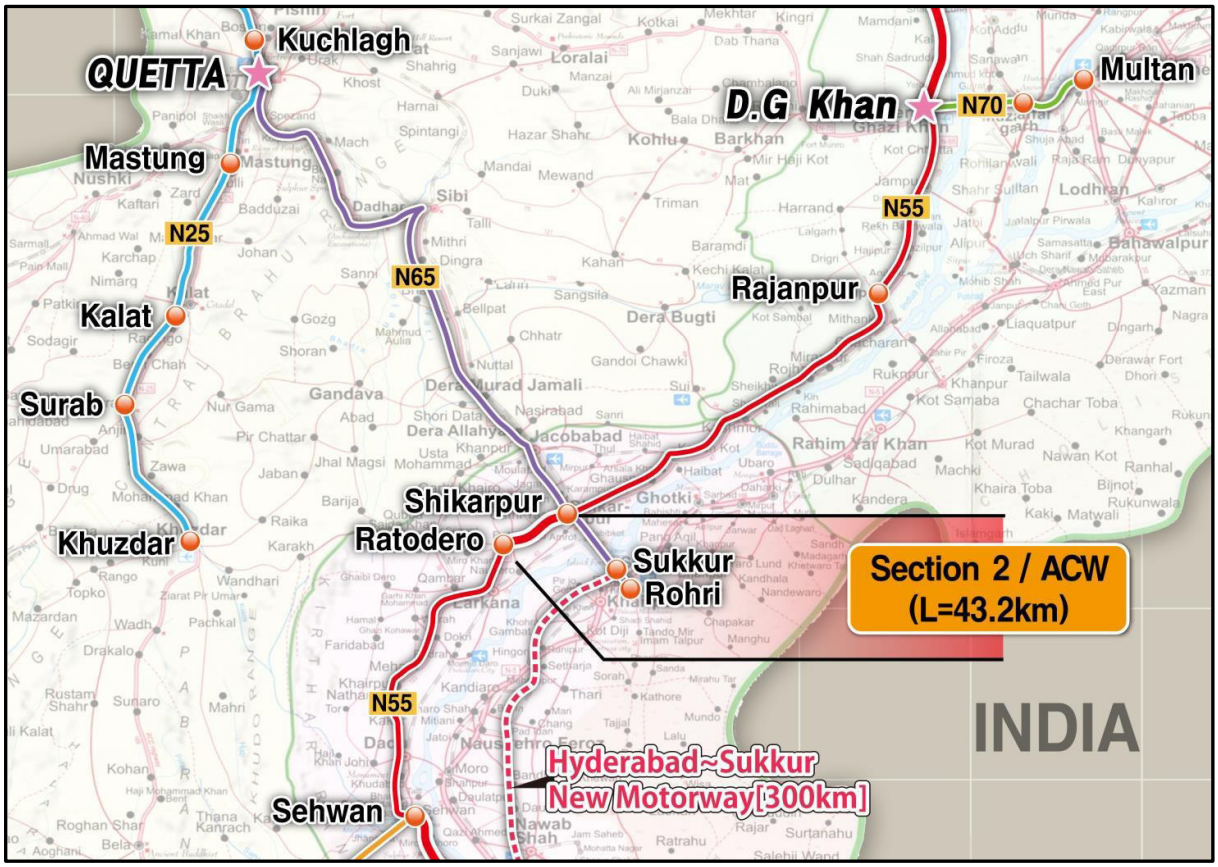


Figure 3.3: Location Map of Section 2 – Ratodero to Shikarpur

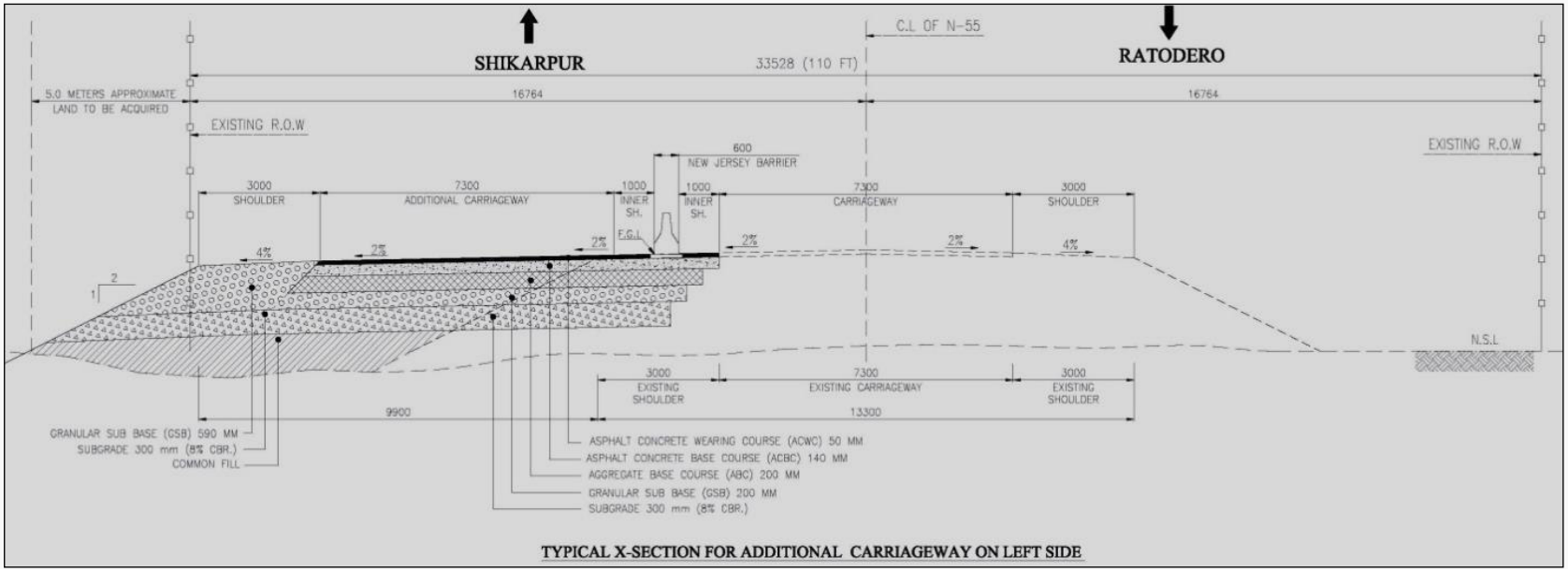


Figure 3.4: Typical X-section for Showing Both Sides Widening

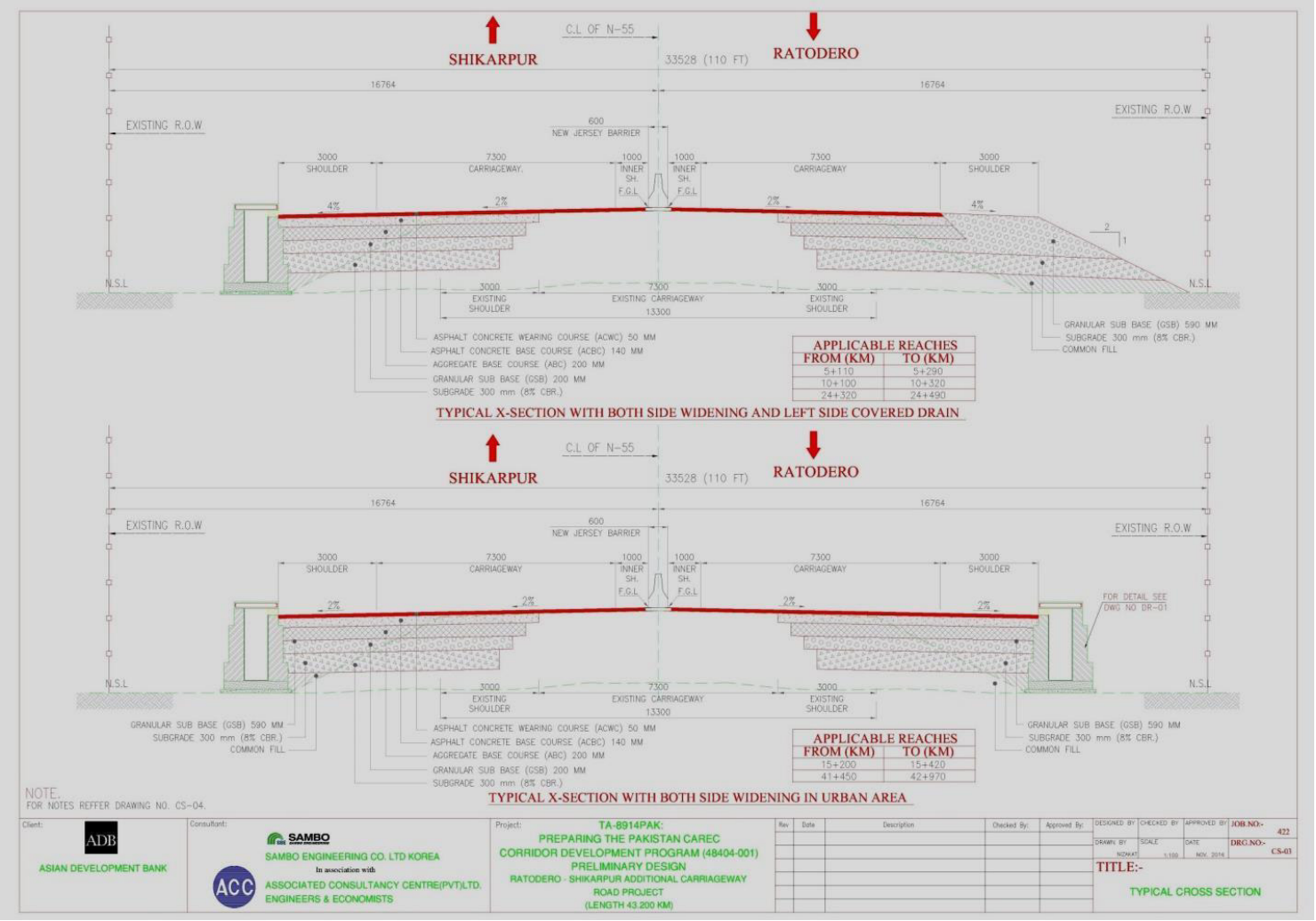


Figure 3.5: Typical X-section for Showing Both Sides Widening

Section -3 Dara Adamkhel-Peshawar: RD 1192 to 1228 km (34.5 km)

86. This section is the northern end of the N-55 national highway. It starts from Peshawar (first bridge located at Kohat Road, 1.5 km away from the Ring Road, Peshawar) and terminates at Dara Adam Khel where the existing dual carriageway ends. The road section is passing through flat and rolling terrain. The total length of this section is 34.5 km and the existing alignment has been followed with overlay and minor improvements in the geometry.

87. At Peshawar, N-55 joins National Highway N-5 and Motorway M-1. N-5 connects the Pak-Afghan border at Torkham in the north and rest of the country in the south. Peshawar is the capital of Khyber Pakhtunkhwa province, the provincial center of industry, trade and commerce, and the gateway to Afghanistan and Central Asian states. Dara Adamkhel is a small town in Khyber Agency, an autonomous federally administered territory. It is famous for the manufacture of illegal arms of all types in small shops and factories. It is the largest market of illegal arms in the country. As the name implies, it is a mountain pass between Peshawar and Kohat. In 1999-2003, a 10 feet wide and 1.9 km long tunnel was built here with the financial and technical assistance of Japan. The tunnel reduced distance between Peshawar and Kohat by 20 km and made travel easier.

88. The start of the subproject (km 0+000) as per design drawing is at RD 1228+000: Bara Bridge and the end of the subproject (km 34+350 as per design drawing) is at RD 1197+650: Abbas Chowk. The total length of the road section is 34+350 km. The road section, which mainly traverses built up areas (Bazaars) of Peshawar and sub-urban area has varying ROW in different stretches of the road. There are two underpasses at RD 17+741 and 19+222. No new facility has been proposed, and works are confined to repairs, road rehabilitation and upgrading work by resurfacing or strengthening the pavement structures.

89. The proposed rehabilitation includes relaying of road pavement, strengthening of shoulders, construction of drain and replacing the curbstones. The existing carriageway is 7.3 meters wide with minimum formation width of 19.2m, but is but variable as the width of the existing median varies. The width of a lane is 3.65 m, outer shoulder is 2m and inner shoulder is 1m (except in urban area: km 0+000 - 6+770). The width of drain is 0.75 m. The total number of cross drainage structures designed for this road section is 66, out of which, 17 are pipe culverts, 10 slab culverts, 7 bridges, 2 pedestrian underpasses and 30 box culverts. Dismantling of 23 cross drainage structures has been proposed with provision of new box culverts as well as 4 structures shall be extended. Further, repair work has been proposed for various cross drainage structure at damaged/cracked locations.

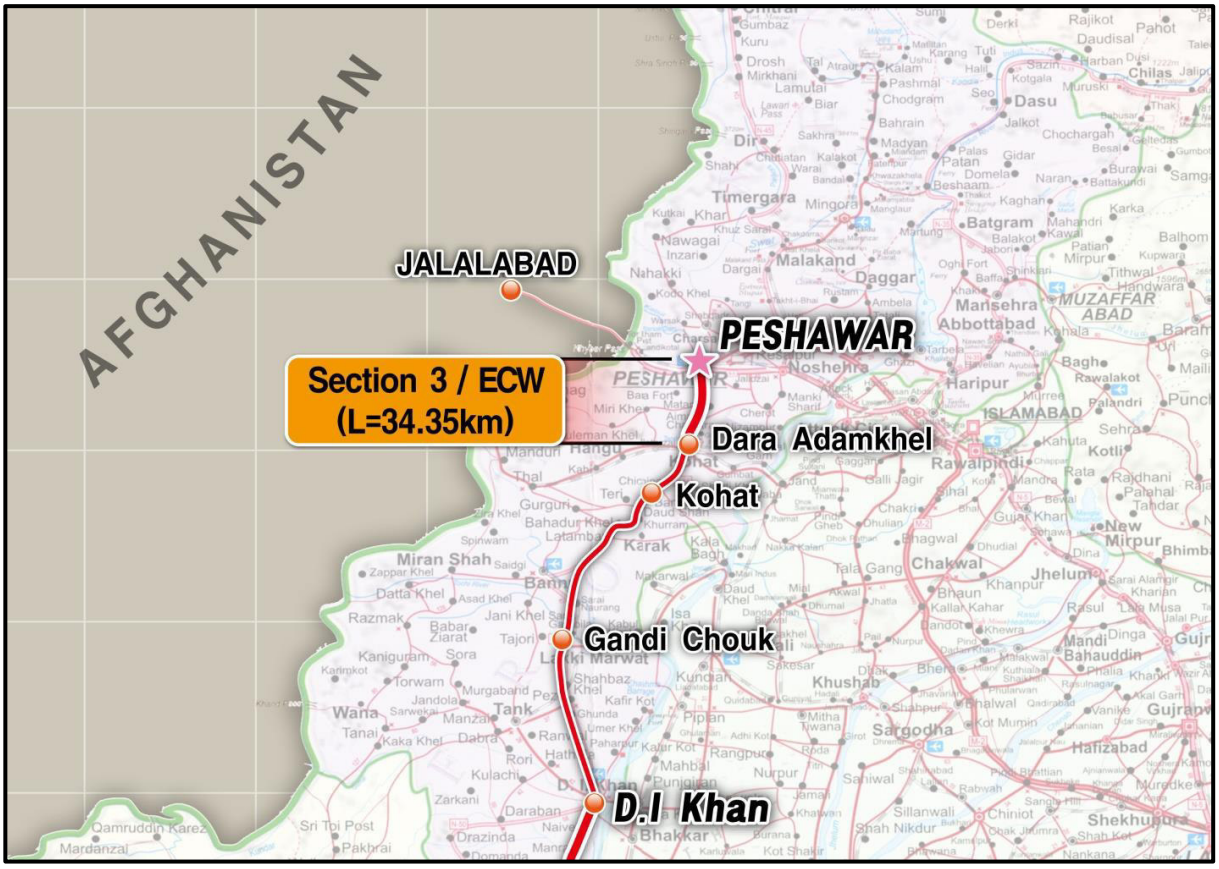


Figure 3.6: Location Map of Section 3 – Dara Adam Khel to Peshawar

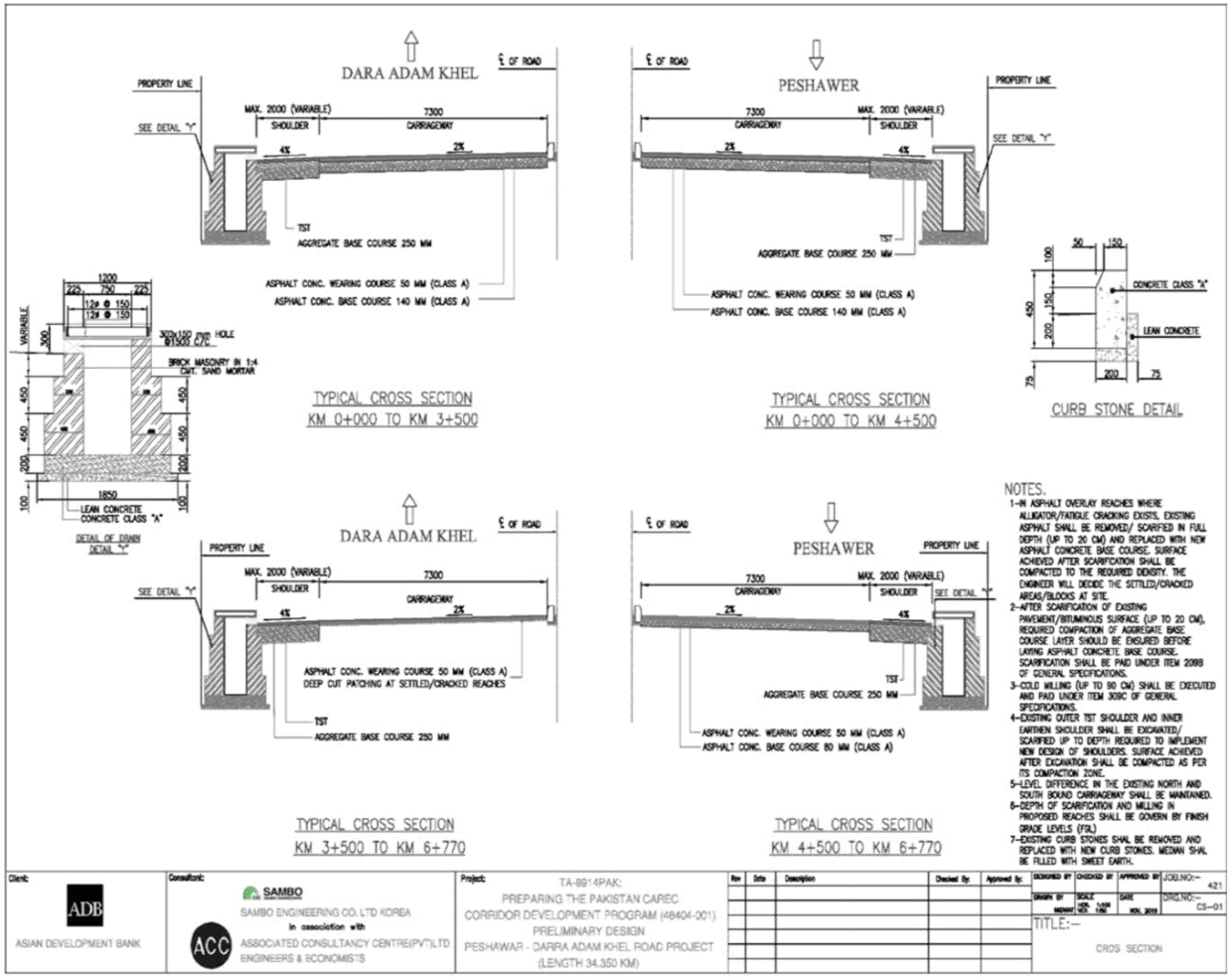


Figure 3.7: Typical cross section of the road between km 0+000 to 4+500 and km 4+500 to 6+770

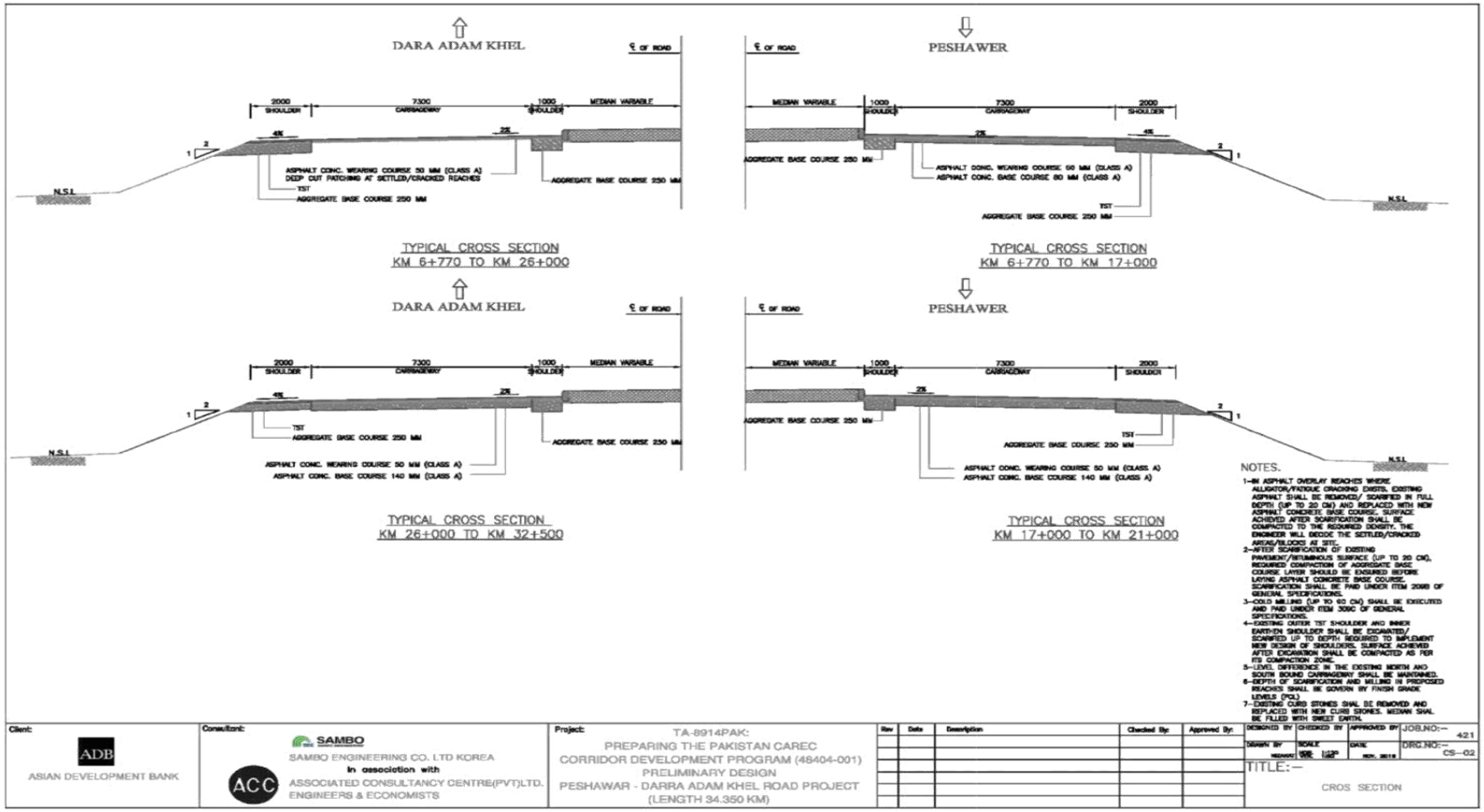


Figure 3.8: Typical Cross-section of the Road between km 21+000 to 26+000

3.2 Components of Works

90. The project works involve reconstruction/widening of candidate roads. The major components of work involved are the following:

- Survey and route fixing.
- Earth filling (embankment) to raise the road level.
- Transportation of materials to the site.
- Storage of materials and equipment.
- Construction of contractors' camps.
- Construction of the road.
- Construction of adequate drainage and culverts along the right-of-way for smooth passage of rain and water.
- Construction of adequate number of underpasses for local communities and their livestock.
- Clearing of Row

- Survey and route fixing

91. In order to minimize land acquisition for the alignment of road, the consultant's team in consultation with NHA has selected routes that avoid major geological features and human habitations.

- Earth Filling and Compaction:

92. Earth for the reconstruction and widening of the road is expected to be borrowed from adjacent barren land by dredging equipment. The spreading of the fill materials is to be made in layers conforming to standard engineering practices, so that appropriate compaction is attained. Earth filling will be done mechanically. Compaction will be done with the uses of vibrating heavy rollers suitable for the type of soil used for the roadwork. The soil should be brought to optimum moisture content to give the desired level of compaction (i.e. 85% compaction). This will also prevent harmful dust pollution.

- Transportation of Materials to the Site:

93. Materials to be used for reconstruction and widening of all three sections of road include: fill materials (sandy soil), bricks, sand, stone chips, cement, bitumen, drainage pipes, etc. These are likely to be carried by trucks and stored locally at designated places along the three road sections. Fill materials will be taken from the borrow/barren areas and transported to the site by the trucks.

- Storage of Materials:

94. It is suggested that construction materials may be stored at the proposed roadside locations beside the existing highway at Ghandy Khail, Landi Khail Village, Rahim

Abad Village, Dokhan Market Area near the roundabout of Shikarpur, Ghari Yasin and Ratodero Bypass area of Ratodero-Shikarpur subproject, and Ghot Khassai Village, Manzorabad Village and at Kaleri Slop (Sunkari) Village of Petaro-Shewan subproject. The storage will be temporarily used for a short duration, and will be cleared immediately after the completion of the construction.

3.3 Construction of Contractors' Camps

95. The construction of the Dara Adam Khel-Peshawar, Ratodero-Shikarpur and Petaro-Shewan road, culverts etc. requires a great workforce, the workforce is especially high during the construction work by use of heavy equipment. The work will be a continuous process for which some of the workforce will be recruited from outside the project area, and in view of the traveling distances involved, the establishment of some local accommodation for workers is deemed feasible. A field base camp in the vicinity at Dara Adam Khel-Peshawar, Ratodero-Shikarpur and Petaro-Shewan project area in the 1.- Dara Adam Khel to Peshawar , At the chainage -1196, in Zarghan Khel area; 2- Ratodero-Shikarpur Route (Subproject-2): At the Ch-370 in Gari Yaseen City, 3 - Petaro-Shewan Route (Subproject-3)-44km: At the ch-50, in Goht Anabkhosa near the construction site will be established by the contractor.

96. The following should be considered for the selection of the site:

- Easy access to the site from the camp;
- Well drained soils;
- Easy access to excellent drinking water supply;
- Ease of rehabilitation of the site; and
- Potential reuse of the site, buildings and infrastructure.

3.4 Construction camp management measures:

97. The construction camp manager (will be appointed by contractor) would responsible for making sure that the Provincial Environmental Regulations are followed adequately. He will consult with the environmental specialist of supervision consultant and implementing agency as regards the local standards, laws, and regulations, and will make sure that pertinent environmental information is distributed and understood by the employees. When the construction camp is eventually closed down, the camp manager will see to a proper cleanup and rehabilitation of the area in accordance with environmental rules and regulations of Province. The rules governing earthworks, deforestation, construction equipment maintenance, drainage control, erosion control, and other activities must be followed throughout site preparation of the three project like Dara Adam Khel-Peshawar, Ratodero-Shikarpur and Petaro-Shewan project area.

98. Buildings should be aesthetically appealing, blending harmoniously with the surrounding natural environment. Suitable planting stock should be placed around buildings to promote the natural blending effect, shade buildings, and improve the general appearance of the compound. Buildings should be designed with good ventilation, effective energy saving lighting, ready access to facilities such as bathroom and kitchen, and incorporate a communal recreational area. The bathroom should be located adjacent to the main building with a covered walkway to allow for easy all weather access. In addition, all openings to the outside should be screened for insects.

3.5 Construction camp waste disposal system:

99. The objective is to create an environmentally safe and workable system for waste disposal by creating different categories for solid wastes and effluents and treating each differently according to their capacity to make negative environmental impacts.

100. There will be different sources of waste production within the construction camp; the main sources are:

- domestic waste (biodegradable and non-biodegradable)
- kitchen (biodegradable and non biodegradable)
- bathroom and laundry waste water (grey water)
- human waste

101. In addition, waste from all other construction sites will be collected and brought to the construction camp, making it act as a center for storage and sorting out to the municipality waste disposal area or bean.

3.6 General protection measures:

102. The following general rules will be applied for the construction camp waste disposal procedures:

- The three road sections reconstruction and widening works wastes like biodegradable waste must be removed from the construction camp and transported to an approved waste disposal site.
- Bathrooms must be outfitted with shower stalls (cubicles) with a common drainage system leading to the outside of the building, and from there to temporary storage in tanks or excavated sedimentation ponds for settling.

3.7 Contractors responsibilities:

103. The responsibilities of the contractor for access road construction and maintenance are as follows:

- Manage the workers camp used for the construction and maintenance of access roads in order to follow mitigation measures presented in the IEE, the camp manager must inform all the employees about the measures to protect the environment and their applications. The camp manager must consult with an environmental specialist of supervision consultant regarding standards, laws, regulations and recommendations to be enforced.
- Implement a proper signal system complying with local regulations to reduce the risk of accidents during project implementation, If required, a surveillance system will be set and check points established to enforce safe use of the road network.
- The contractor crews will be responsible to place caution signs along the three roads working sections during works. All working vehicles and equipment must be properly marked and equipped with warning devices.

3.8 Rehabilitation of the construction area:

104. The rehabilitation of the construction area implies restoring damaged areas to the original condition and rendering the site compatible with its eventual intended

utilization. Natural draining must be preserved during rehabilitation, and if necessary, ditches should be dug to facilitate the flow of water. If and when temporary drainage structures are no longer useful, they must all be removed.

105. Removed topsoil must be preserved and every attempt must be made not to create ruts or mix the topsoil with subsoil for restoration of the land in rehabilitation areas. Topsoil in the work areas located within the camp can be transported outside the base camp and used for rehabilitation.

106. On completion of the work, all equipment, materials, temporary installations, wastes, debris, and excavated material must be removed from the construction site area of all road sections under consideration.

107. Access may be cut off and appropriate signs or fences must be put up to prevent the area from being disturbed and to protect rehabilitated sites.

108. The construction works activities of road and its associated structures etc. will be done as per specification and standard with environment friendly equipments.

3.9 Clearing of Row:

109. After completion of the work the RoW will be cleared of all materials and debris. Line marker posts, Km posts, aerial markers, intermediate aerial markers, warning signs and proper road Signs, etc. shall be cleared as per specification and recommendations.

3.10 Construction of Bridges and Culverts:

110. The fabrication of the different structure culverts, bridges components will take into account the local materials and local resources as much as possible. Local participation is an important component to the local economy. The construction process and the material procurement will comprise various activities such as Fabrication of Steel Members, Steelwork, Welding, Bolting, Erection of Steel Span, Manufacture of Concrete Elements, Execution Lines and Grades, Formwork and False work, Placing Concrete, Concrete Reinforcement, Fabrication of Bearings, Earthworks etc. works is to be done as per standard procedure of works during the construction of bridge and culverts along the project roads.

4. DESCRIPTION OF ENVIRONMENT

4.1 General

111. This section summarizes available baseline data on the physical, biological and socioeconomic environment of the project area. Reconnaissance visits and field surveys were carried out, and the findings were validated through cross-referencing data from the government departments and other agencies, namely Irrigation Department, Meteorological Department, Forest Department etc. Satellite imagery, where available, and published literature were also consulted.

112. The baseline environmental data has been compiled to cover the following areas:

- Physical Environment
- Biological Environment
- Socioeconomic conditions

4.2 Project area

113. The project envisages the widening of various sections of the national highway N-55. The three subprojects for which this IEE is prepared are located in two provinces of Pakistan i.e. Sindh and Khyber Pakhtunkhwa. Therefore, a description of the areas of two provinces within which the subprojects are located has been given in the IEE report. Sections 1 and 2 roads, namely Petaro-Sehwan and Ratodero-Shikarpur of Tranche 1 fall in the jurisdiction of the province of Sindh, in districts Jamshoro and Shikarpur respectively, while section 3, Dara Adam Khel-Peshawar lies in the province of Khyber Pakhtunkhwa.

4.2.1 Province of Sindh – District Jamshoro (Section 1: Petaro-Sehwan)

PHYSICAL ENVIRONMENT

Geography

114. Jamshoro district is bound on the north by Dadu district, on the east by River Indus, on the south by Thatta district, on southwest by Karachi district and on the west by the Kirthar Range, which is the natural border between the Sindh and Balochistan provinces. The district takes its name from Jamshoro City, which is its headquarters.

115. Jamshoro district has four Talukas: Sehwan (area 2,830 km^2, population about 170,589), Kotri (area 1, 845 km^2, population about 215,966), Thana Bula Khan (area 4,799.31 km^2, population about 179,527), and Manjhand (area 1,630 km^2, population about 100,135). Further, the district has 28 union councils and 174 mouzas (revenue village). Out of these mouzas, 139 are rural, 6 are urban, 11 are partly urban and 13 are un-populated mouzas. View of the proposed site is shown in Figure 4.6.

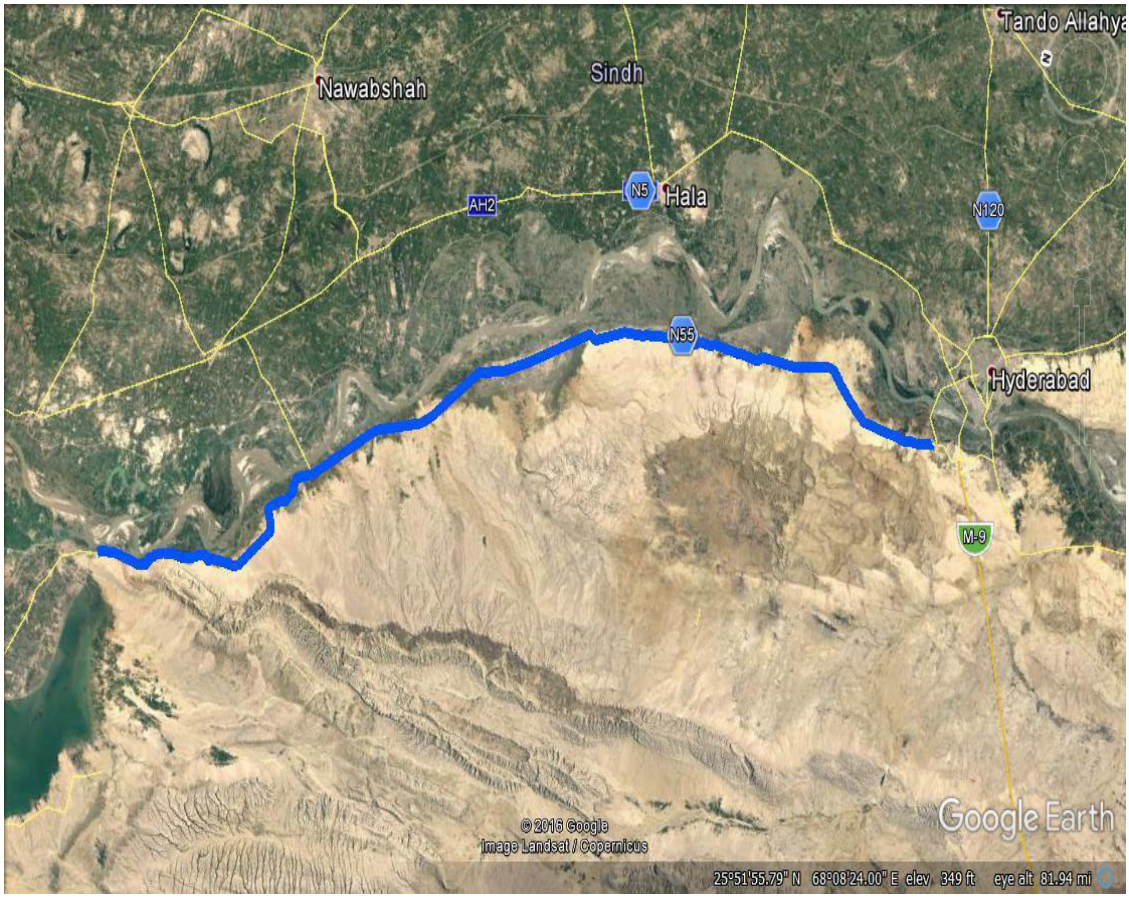


Figure 4.6: View of Proposed Site (Petaro – Sehwan)

Topography and Geomorphology

116. The N-55 highway stretch between Petaro and Sehwan is about 130 km. It is situated in southern Pakistan in central Sindh province. The road extends in N-NW direction and at elevation of about 30-140m above average mean sea level. The relief along the alignment is about 110m whereas elevation of the Petaro town is about 60m, which increases southward to a maximum of 140m after which rolling ground starts having very low relief.

Geology and Seismology

117. The geological conditions are interpreted based on the geological Map of Sindh after Javed et al 2012, compiled and published by the Geological Survey of Pakistan (GSP). The road alignment has been overlaid on the geological map and presented in figure 4.7.

118. The road stretch extends in N-S direction runs parallel along the right bank of the Indus River. The terrain of the area is gentle and mostly consists of surficial deposits comprising mainly sand, silt and clay deposited by the river. Longitudinal sand dunes and playa deposits occupies the northern part of the area. Along the road towards west terrain is high which lies in Kirthar Range. Stratigraphic sequence in the Kirthar range varies in age from Jurassic to recent.

119. Along the road the following formations are exposed at places:

Formation	**Age**
Manchar Formation	Pliocene
Nari Formation	Oligocene
Laki Formation	Early Eocene
Kirthar Formation	Middle-Late Eocene

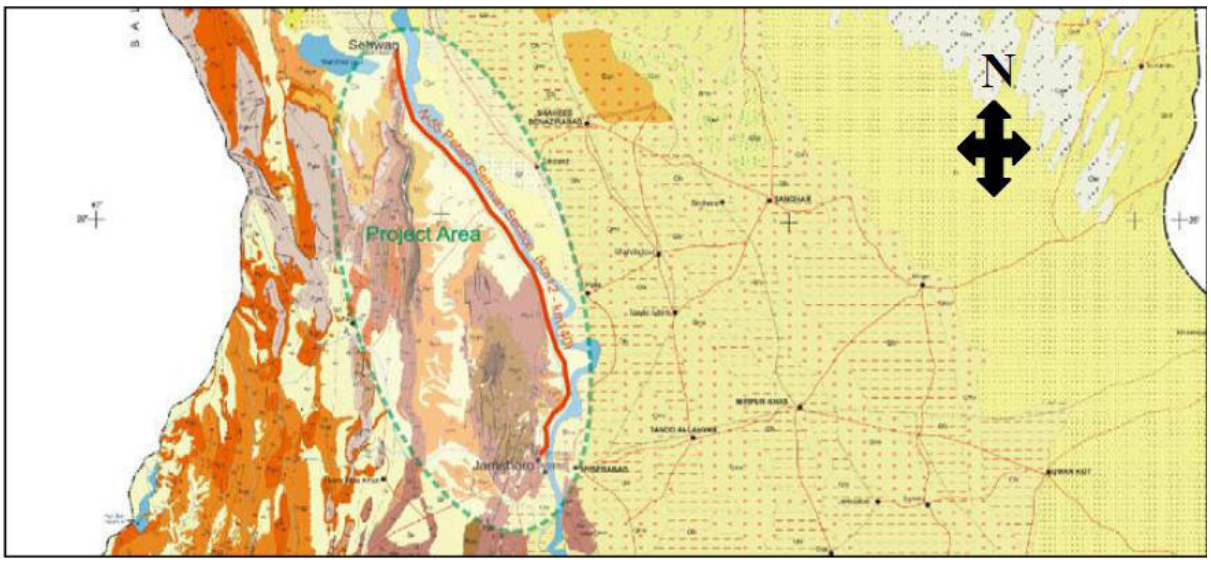


Figure- 4.7: Geological Map of the Project Area (Petaro – Sehwan Sharif)

120. **Kirthar Formation**. Kirthar Formation predominantly consists of limestone with some shale and marl. The thick-bedded limestone is light grey, and weathers to grey, brown and cream color. The shale is of olive, orange yellow to grey color, calcareous and soft.

121. **Laki Formation.** The formation mainly consists of cream colored to grey limestone, shale, and sandstone and lateritic clay. Limestone is yellowish brown, whitish, thin to thick-bedded, massive and nodular at places. Sandstone is variegated in colors and ferruginous exposed in lenticular beds. Shales are grey, greenish yellow and calcareous. Lateritic clay is ferruginous and variegated in colors. It lies in early Eocene age.

122. **Nari Formation**. Nari formation is exposed along the road, which lies in Oligocene age. It consists of sandstone inter-bedded with limestone and shales. Sandstone is greenish grey, red and brown in color, medium grained, friable, thinly bedded and intercalated with shale. Limestone is dull white to grey, brown or yellowish in color, thick bedded to massive. Shale is greenish grey, soft and thinly laminated.

123. **Manchhar Formation**. This formation is composed of sandstone, shales, clay inter-bedded with conglomerates. Sandstone is greenish grey in color, medium to fine grained. Shale and clay are brownish green to red in color containing pebbles of claystone and sandstone. The age of the formation is Pliocene.

124. The Seismic Risk evaluation of the project area is made based on the seismic map of Pakistan compiled on the basis of Probabilistic seismic hazard evaluation carried out in connection with updating of Building Code of Pakistan after destructive earthquake of 2005. The road stretch of the N55 has been marked on the Seismic zonation map of Pakistan and is provided in Figure 4.8.

Figure 4.8. Seismic Zonation Map of the Project Area (Petaro – Sehwan Sharif)

125. According to this map, the proposed road stretch falls in Seismic Zone 2A, which indicates that the ground motions associated with 10% probability of exceedance in 50 years (return period of 475 years) are in the range of 0.08-0.16g. It

is suggested that the proposed structures associated with the highway may be designed to withstand horizontal peak ground acceleration of >0.12g.

Soil

126. The dominant soil group in Project area is Calicisols, which are loamy soils with accumulation of secondary calcium carbonates. As part of the baseline, soil samples were collected from project area for analysis..

Climate

127. Climatically, Sindh lies between two monsoons, the southwest monsoon from the Indian Ocean and the northeast or retreating monsoon deflected towards it by the Himalayan Mountains, and thus escapes the influence of both. The average rainfall in Sindh is only 6-7 in (15-18 cm) per year. Almost 65 % of the rain is concentrated in the monsoon months of July and August. The region's scarcity of rainfall is compensated by the inundation of the Indus twice a year, caused by the spring and summer melting of Himalayan snow and by rainfall in the monsoon season. These natural patterns have however changed somewhat with the construction of dams and barrages on the Indus River. The project area receives approximately 178 mm of rain annually. The winters are mild with temperature dropping to 20ºC in January.

Water Resources

128. The major water body of the project area is the Indus River. Groundwater is not major source of drinking water due to high salinity. The region's water resources are briefly described below.

129. Surface Water: River Indus is the only surface water resource used throughout in Jamshoro district for diverse applications. The water is primarily consumed for drinking and sanitary applications in addition to limited agricultural and other activities. The river has an average width of about 500m during normal flow, which may exceed to several kilometers during high floods. The width of the river at Kotri Barrage is one kilometer. Kotri Barrage, built in 1955, is used to divert water to irrigation canals and for flood control purposes. The annual flow of Indus River at Kotri barrage is 1,787 cumec.

130. Groundwater: The water used for drinking and other applications comes mainly from the Indus River by tankers or through pipelines. Groundwater is very scarcely extracted throughout this section of Jamshoro District. However, there are plenty of groundwater resources in the southwestern section of Jamshoro district along both sides of Super Highway. In this section there is a large number of agricultural farms where water need is met through groundwater resources.

131. Flood / Drainage Water: On a broader scale, the project area lies in the flood plain of River Indus. The terrain is almost flat and is located at the bottom of Indus Basin. Surplus water of Indus River and its tributaries including rainwater during the monsoons has to pass through Sindh. Hill torrents, which emanate from Balochistan add to the pressure on both accounts, till its outfall in the Arabian Sea.

BIOLOGICAL ENVIRONMENT

Flora

132. A large variety of floral regimes exist in this section of Jamshoro despite the arid and barren nature of land. This section is deprived of large trees but shrub and bush flora are largely distributed in the project zone. All of these floral genera are capable to withstand penetrating heat during most of the year and survive mainly on atmospheric moisture.

133. The floral diversity of the area include *Aizoaceae, Amaranthaceae, Apoctnaceae, Asteracerae, Asclepiadaceae, Bigniniaceae, Boraginaceae, Caesalpiniaceae, Capparidaceae, Convolvulaceae, Cucurbitaceae, Euphorbiaceae, Labiatae, Malvaceae, Menispermaceae, Mimosaceae, Nyctaginaceae, Oleaceae, Papilionaceae, Rhamnaceae, Salvadoraceae, Sapindaceae, Scrophulariaceae, Solanaceae, Tamaricaceae, Tiliaceae, Umbelliferae, Verbenaceae, Urticaceae, Violaceae, Zygophyllaceae*, *Rhazyastricta* (*Apocynaceae*), *Withaniacoagulans* (*Solanaceae*), *Dodanea viscose,* (*Spindaceae*), *Fagoniaindica* (*Zygophyllaceae)*, *Grewiatenax and Grewiavillosa* (*Tiliaceae*).

134. *Prosopis juliflora, Cassia italica, Prosopisglandulosa, Salvadoraoleoides, Calotropisprocera, Rhaziastricta, Convolvulus spinosus* and *Cymbopogon jwarancusa* are common species.

Acacia Sanigal ***Prosopis cineraria***

Figure 4.9

Fauna

135. With the exception of humbler species like jackal, wildlife is almost non-existent. Hyenas and wolves are hardly ever seen although wild boar is still found in small numbers. Manchar Lake has a variety of migratory birds coming from Siberia. Among other birds partridge, both grey and black, is remarkable. The migrant species of birds only pass through the area in very few numbers and that too in winter. Common type of wild ducks and waterfowl can be seen during winter season.

136. River Indus and its associated tributaries provide an important habitat for both resident and migratory birds. Vegetation on both sides of the river and agricultural areas offer ample habitat and food for many bird species. Common resident bird species reported from the area include Indian Pond Heron *(Ardeolagrayii),* Common Moor hen *(Gallinulachloropus)*, Little Egret *(Egrettagarzetta)*, Black-shouldered Kite *(Elanuscaeruleus)*, Black Kite *(Milvus migrans)*, Red-wattled Lapwing

(Hoplopterusindicus), Eurasian collard dove *(Streptopeliadecaocto)*, White-throated Kingfisher *(Halcyon smyrnensis)*, Pied Kingfisher *(Cerylerudis)*, Common Kingfisher *(Alcedoatthis)*, Hoopoe *(Upupaepops)*, Striated Babbler *(Turdoidesearlei)*, Black Drongo or King Crow *(Dicrurusmacrocercus)*, House Crow *(Corvussplendens)*, Common Myna *(Acridotherestristis)*, Bank Myna *(Acridotheresginginianus)*. Among reptiles, only Black Rock Agama, Brilliant Agama, Bluetail Sand Lizard have been recorded. Saw-scale Viper has been reported from the area. No threatened species have been recorded from the area.

SOCIO-ECONOMIC ENVIRONMENT

History

137. After the independence of Pakistan in 1947, district Jamshoro remained a part of district Dadu. This area continued to be neglected by the authorities but the gradual process of development has changed this district significantly. In 2004, Jamshoro was made a separate district.

Demographic Profile

138. The population of the district according to a 2011 estimate was 1,176,969. The predominant first language is Sindhi, which as of 1998 was spoken by 84% of the total population in the talukas of Kotri, Sehwan and Thano Bula Khan. Urdu accounted for 6.3%, Punjabi for 4.2% and Pashto for 3%.

Culture (Ethnicity, Religion and Politics)

139. Jamshoro has a rich traditional Sindhi culture. Women usually wear Shalwar Qameez but quite often dress in the traditional attire, Ghaghra or Parro, as well. Traditionally, women wear bangles. Men usually wear a Shalwar Qameez distinguished by broader bottoms, and a traditional Sindhi style cap.

140. People of this district are predominantly Sindhi speaking but Urdu, Balochi and Brohi languages are also spoken in the district. Bhutto, Rind, Syed, Talpur, Chandio, Magsi, Soomro, Memon and Kalhoro are the major clans of this district. Islam is the religion of majority of the population, followed by a minority of Hindu community.

Economically Active Population

141. The economically active population in the district is 20.64% of its total population and 37.37% of the population aged 10 years and above. The percent of age of children below 10 years is 32.03 while 7.54% are students and 8.22% are all others.

Literacy Rate and Education Facilities

142. There are primary schools for boys, primary schools for girls, middle school, and madrassas in the villages for which information could be gathered at the focused group discussions at each village. All the schools are functional. As such the literacy rate among the youth is reasonably high. Male literacy ratio is about 50% and female literacy is less than 30%. Quite a few persons can speak Urdu, the national language and many more can read the Holy Quran. There are mosques in every village. Things

have started to change with the emergence of new leadership, which has started setting up mosques and madrassas in their area of influence.

Professional Affiliations

143. The people in the project area are engaged in low as well as high-level occupation, including mining, farming, and raising livestock. Two or three persons from each village assume the management responsibility and assign different roles to different members of the family and to the families in other villages, if necessary. The persons in the management hierarchy form about 5% of the population; they are responsible to the Sardar/wadera/rais (tribe leaders and/or landlords) of the area. The household chores are left to the female population.

Source of Livelihood

144. The agricultural practices are limited to the areas beyond the Highway N-55 on the east of the area, where Livestock herding is commonly practiced. The Union Council has a high per capita ownership of the livestock of the order of at least 8 heads per household while agricultural practices are limited to subsistence farming. The entire population of the villages is in one way or the other engaged in mining. The male population is engaged in the mines as mining labor or is serving as driver, mechanic or electrician or as semi-skilled labor. The resident population does not have high-level manpower but its higher income group has their youngsters being educated at the nearby university at Jamshoro.

Physical Infrastructure

145. Kotri taluka being the hub of all economic, political, religious and district government activities of Jamshoro district, has relatively well developed infrastructure in comparison to the other four talukas of Jamshoro district. The communication network of the taluka is well developed. Kotri taluka has four railway stations namely Kotri, Jamshoro, Bulari and Petaro. The taluka has three post offices and two main telephone exchanges.

Agriculture

146. Agriculture is practiced in the flood plains along the River Indus in a belt extending to 2 to 3 km from the river bank. Irrigation is carried out mainly by water pumped from the river. Land holdings range from 7 to 10 acres[1] for smaller farms, to 20 to 30 acres for medium sized farms. Typically, each village has a landlord that owns most of the land around the village, which could be as much as 80 to 100 acres. These landlords tend to be influential and employ labor to work on the farms. Sharecropping is also prevalent, where the tenants provide all the labor and cash inputs, and are typically entitled to five to 10% of the produce. Principle crops in the project area are cotton and fodder in the summer, and wheat in the winter. Vegetables and fruits (mainly tomatoes and chilies, and melons) are also grown throughout the year. The yields for cotton and wheat are comparatively similar to the country average of 725 kg/hectare for cotton and 2750 kg/hectare for wheat. Agricultural land is prone to flooding, and loss of crops was extensive in the floods of 2010.

[1] 1 acre = 0.405 hectares

Figure 4.10: View of Agricultural Land of Proposed Site

4.2.2 Province of Sindh – District Shikarpur (Section 2: Ratodero-Shikarpur)

PHYSICAL ENVIRONMENT

Geography and Topography

147. The section of Ratodero-Shikarpur falls in District Shikarpur, which has an area of 2640 km^2 with an estimated population of 880,000. It is divided in four 'Talukas' (sub-unit of a district): Shikarpur, Lakhi Garhi Yasin and Khanpur. District Shikarpur is adjacent with the districts of Larkana, Jacobabad, Khairpur and Sukkur, and two national highways (N-65 and N-55) intersect in the city of Shikarpur.

148. The subproject road section extends in NE-SW direction (Figure 4.1). The project area is plain and flat with almost leveled alluvial plains formed by River Indus. The land slopes from the northwest to southeast. The elevation of the project area varies from 50 to 100m above sea level. Shikarpur town is 70m and Ratodero is about 50m above mean sea level.

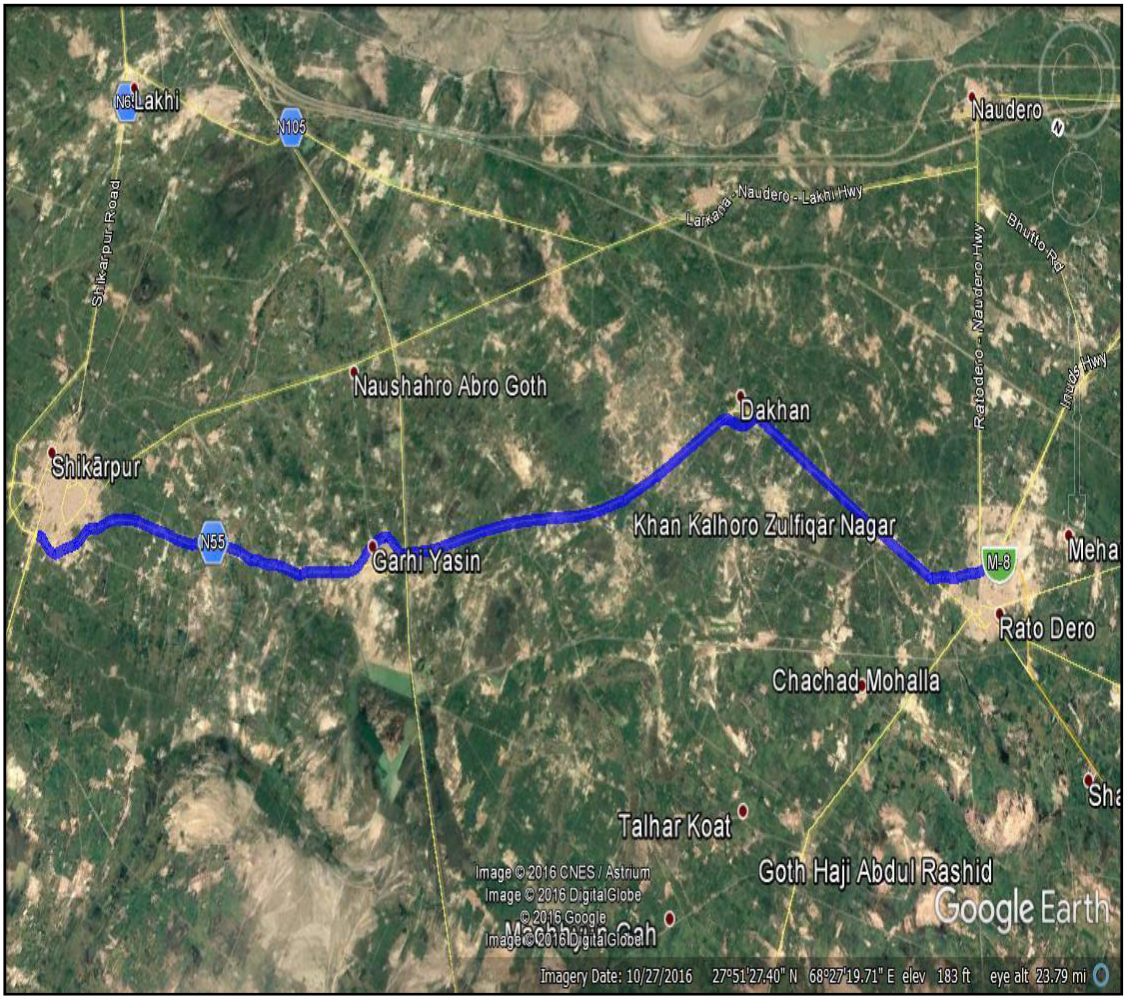


Figure - 4.1: An Aerial View of Ratodero-Shikarpur Section

Landforms and Soils

149. The soils in the area are calcareous alluvial loam fine to medium textured homogenized, and are well drained. They are highly fertile and productive, with high moisture content.

Geology and Seismology

150. The geological conditions are interpreted based on the geological Map of Sindh after Javed et al 2012, compiled and published by the Geological Survey of Pakistan (GSP). The road alignment has been overlaid on the geological map and presented in Figure 4.2. The map shows that the entire road stretch is aligned almost NE-SW along the right bank plains of the Indus River. The material exposed is mainly alluvium deposited by the extinct streams that were flowing in the Indus river bed, and their depths reach up to several thousand meters. The origin of the deposits ranges from the Pleistocene (50,000 years ago) to Recent (a few hundred years ago).

151. Rock outcrops are not exposed along the road in this area. Alluvial or flood plain deposits range in age from Pleistocene to Holocene. Alluvial deposit consists of greenish grey to grey, fine grained silt and clay with subordinate fine sand. It is interlayered with black clay having minor calcareous content. Calcareous soil is generally fine to medium grained.

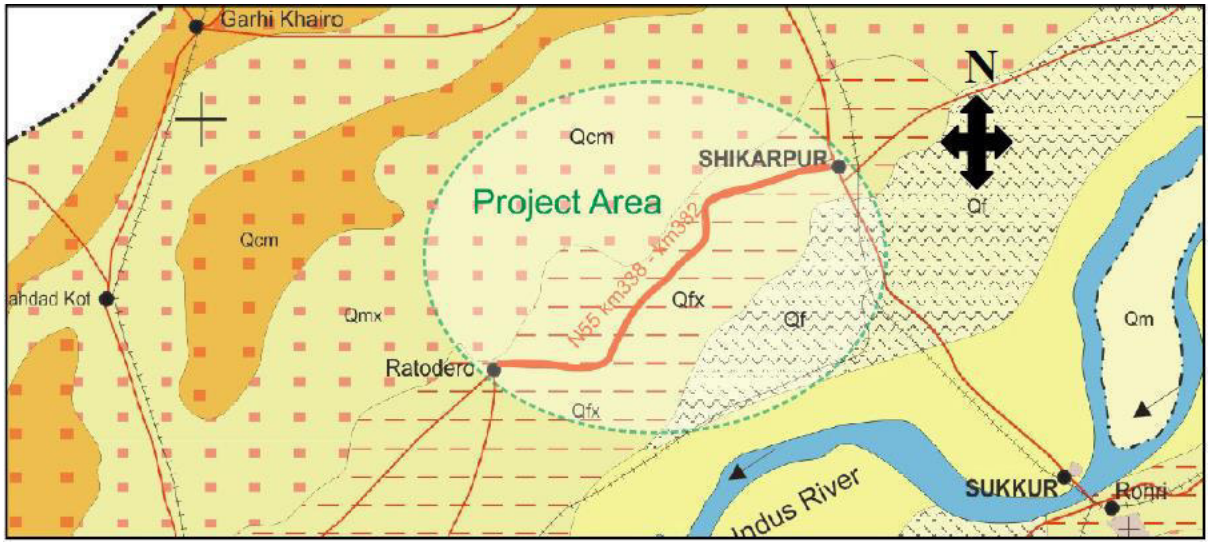


Figure- 4.2: Geological Map of the Project Area (Ratodero-Shikarpur)

152. The Seismic Risk evaluation of the project area was made based on the seismic map of Pakistan compiled based on the Probabilistic seismic hazard evaluation carried out in connection with updating of Building Code of Pakistan after the destructive earthquake of 2005. The road alignment of the N55 has been marked on the Seismic zonation map of Pakistan and is provided in Figure 4.3.

Figure - 4.3: Seismic Zonation of the Project Area

153. According to this map, the proposed road stretch falls in Seismic Zone 2A, which indicates that the ground motions associated with 10% probability of exceedance in 50 years (return period of 475 years) are in the range of 0.08-0.16g. It is suggested that the proposed structures associated with the highway may be designed to withstand horizontal peak ground acceleration of >0.12g.

Water Resources

154. The project area contains a network of canals and distributaries. Canal as well as tube well water is used for irrigation. The depth of the water table ranges from a few to 20m, and the content of salts in the water is generally high. The groundwater is mostly not fit for drinking purposes. Water is available for construction activities.

Fisheries

155. There are a few fishponds in the area. Inland Fisheries Statistics in Sindh and especially in Shikarpur are given in Table 3.1

Table - 4.1: Inland Fisheries Statistics in Sindh and in Shikarpur year (In Metric Tons)

Province/ District	Fish Production	No. of Fishermen			No. of Boats		
		Full time	Part Time	Total	Sail	Row	Total
Sindh	**85,047**	29,401	17,219	46,620	2,155	2,291	4,446
Shikarpur	**5,085**	1,498	575	2,073	189	33	222

Source: Directorate of Fisheries Sindh, Hyderabad, 2014

Climate

156. The project area falls in an arid subtropical climate zone and the district is subject to extremes of climate. Overall the climate is hot and dry in summer and cold and dry in winter. Summer months extend from April to October, whereas March and November are generally pleasant. Dust storms are frequent in summers and the average annual rainfall is around 100 mm.

Air Quality

157. Due to dry atmospheric conditions, suspended particulate matter is the major air pollutant in the project area. However, the air quality monitoring results (Appendix VII) reveal that ambient air in the subproject area is relatively less contaminated.

BIOLOGICAL ENVIRONMENT

Flora

158. The flora of the project area falls in the Scrub Dry Tropical Thorn Forest Zone, which is the natural vegetation of the Indus Basin. Such vegetation has the capacity to survive and grow in areas with extremely high temperatures and low precipitation.

159. The flora consists of thorny and hard wooded species, with Acacia species being the dominant one. The main tree species of the project area include *Acacia nilotica* (Keekar), *Eucalyptus camaldulensis* (Safaida), *Phoenix dactylifera* (Date Palm), *Dalbergiasissoo* (Shisham). *Azadirachta indica* (Neem), *Salvadora oleoides* (Peelu) and *Ficus religiosa* (Peepal). *Tamarix dioica* (Lai), *Calotropis procera* (Akk), *Aeruaja vanica* (Bui), *Salsola barysma* (Chotalona), *Zizyphus nummularia* (Mallah) and *Prosopis juliflora* (Mesquit) in bush form are abundant along the roadside. Among the grasses *Arislidadepressa* (Lumb), *Eleusinecompressa* (Chemmer), *lasiurussindicus* (Gorkha) and *Saccharumbengalensis* (Kana) are found in the project area.

160. The main fruit grown in the project area is date. Besides date, guava and grapefruits are also grown. Fields spreading over several acres were seen along the roadside where sunflower has also been cultivated. Turnips, oniongs, radish, potatoes, peas, spinach, carrot and ladyfinger are the commonly grown vegetables.

161. The common species of trees, shrubs and grasses found in the project area are given in Table 4.1**.**

Table 4.1: Common Trees, Shrubs and Grasses

Serial	Local Name	Botanical Name
1	Kikar	*Acacia nilotica*
2	Phulai	*Acacia modeata*
3	Siris	*Albizzialebbek*
4	White Siris	*AlbizziaProgara*
5	Neem	*AadirachtaIndica*
6	Karir	*Capparisaphylla*
7	Analtas	*Cassia fistula*
8	Shisham	*Dalbergiasissoo*
9	Bans	*Dendrocalamusstrictuis*
10	Safaida	*Eucalyptus species*

11	Jaman	*Eugenia jambolana*
12	Pipel	*Ficusreligiosa*
13	Barh	*Ficusbengalensi*
14	Bakain	*Azaderach*
15	Sohanjna	*Pterygosperma*
16	Toot	*Morus alba*
17	Poplar	*Populusspp*
18	Date palm	*Phoenix dactylifera*
19	Jand	*Prosopis cineraria*
20	Mesquite	*Prosopisglandulosa*
21	Mesquite	*Posopisjuliflora*
22	Sukh chain	*Ponganniagjabra*
23	Willow or Baid	*Sallxtetrasperma*
24	Jal or Wan	*Saivadoraolcoides*
25	Ber	*Zizyphusmauritiod*
26	Eucalyptus	*Sufeda*
	Shrubs	
1	Babri	*Acacia jacquemontii*
2	Jawanh	*Alhagicamelorum*
3	Aak	*Calotropisprocera*
4	Lani	*Salsolafoetida*
5	Lana	*Sueedatfuticosa*
6	Pilchi	*Taqmarixdioca*
	Grasses	
1	Khabbal	*Cynodondactylon*
2	Khawi	*Cymbopogonjawarancusa*
3	Dhamah	*Cenchrusciliaris*
4	Dab	*Eragrostiscynosouroides*
5	Kana	*Saccharummunja*
6	Kundan	*Typhaanguati-folia*

Forestry

162. Shikarpur Forest Division is responsible for the entire forestry in the District. It is engaged in irrigated compact plantation as well as linear plantation along canals and roadsides. Forestry is developed through regeneration, afforestation and raising of bed/potted nurseries. Non-developmental processes cover thinning, salvage felling and main felling.

FAUNA

Wildlife (Mammals & Reptiles)

163. Many species of wildlife such as pig (*Susscorofa*), porcupine, jackal (*canissvreus*), hare (*oryctolaguscuniculus*), chinkara, snakes, wild lizards (Goh, Kirli, kirla, Gohira and Sanda) are found in District Shikapur.

164. Domestic animals include goats, sheep, camel, cows and buffaloes. Another important domestic animal of the area is donkey, which is used for pulling carts etc. is a common sight in the Project Area.

Birds

165. Many bird communities like green parrots, common crow, crested lark, myna, lark, owl, falcons, house sparrow, houbara bustard, vultures, quail, litter bustard and great bustard are seen in the area.

166. Grey and black partridges, though present in the area, have been reduced to a minimum quantity due to excessive hunting. Other birds include Indian roller (Chai), crested lark, vultures and quail. Water-fowl were seen in plenty along the small and large ponds located on both sides of road. These water birds include white stork, white pelican, herring gull, ringed plover pond heron, little brown dove and white beaked king fisher.

Fishes

167. The project area has many fishponds being managed under government and private systems. Rahu, Thaila, Mori, Grass Corp and Silver Corp are the commonly bred species.

Figure 4.4 Fish Farm at near the road side

Medicinal Plants

168. Except for the Neem tree (*Azadirachta indica*), which is growing in good numbers, there are no other significant plant species of medicinal value in the project area.

Endangered Species

169. Falcon / partridges bird species are endangered. The existing ecosystems are favorable for survival of biodiversity.

Natural Habitats

170. Because of high intensity of cultivation, scattered houses, villages and roads, natural habitats are not very common. There is human intervention in the form of cultivation and fishing. The ecosystem is well integrated consisting of plant and animal biodiversity. There is no mining activity in the project area.

SOCIO-ECONOMIC ENVIRONMENT OF PROJECT AREA

Population and Ethnicity

171. The total population of District Shikarpur according 1998 Census is 8.8 million persons, comprising 4.56 million males and 4.23 million females.

Administrative and Political Setup of Beneficiary Area

172. Shikarpur District consists of four Tehsils (or talukas) namely, Shikarpur, Garhi Yasin, Lakhi and Khan Pur. The total area of the district is 2,512 km^2, and the total population is 880,438 persons (52% male and 48% female). The four talukas contain over 245 villages (or Dehs), and there are seven urban localities (one municipal council and six town committees) and 33 union councils in the district. The administration headquarter is situated in Shikarpur.

173. The administrative set up consists of Executive Development Officer (Revenue), District Officer (Revenue) and District Development Officer (DDO General).

Communications

174. The Highway Division Shikarpur covers the whole jurisdiction of the district. The headquarters of the Division is at Shikarpur whereas the headquarters of Sub-Divisional Offices are at tehsil levels. The district headquarters Shikarpur is connected with its tehsil headquarters through metalled roads and the main railway line from Karach to Lahore.

Education

175. Shikarpur District has a poor educational network. There is only one university campus of Shah Abdul Latif University present in the area.

Medical Facilities

176. A reasonable healthcare infrastructure exists in District Shikarpur. There is a District Headquarter Hospital (DHQ) in Shikarpur city, and good medical facilities are available in Sukkur, Larkana and Jaccobabad.

Agriculture and Cropping Pattern

177. The major crops grown in the district include wheat, rice and sugarcane. Cotton is also cultivated and fruit is a major cash crop. The major crops grown in Shikarpur are:

- Wheat
- Jowar
- Bajra
- Maize
- Gram
- Barley
- Rapeseed
- Sesamum
- Sugarcane

Figure 4.5 Agricultural land near the road side

Horticulture

178. The main fruits of Shikarpur are mangoes, dates and bananas. Besides these fruits guava, orange and grapefruits are also grown in the district. Among vegetables, turnips, radish, potatoes and eggplant are grown.

Livestock

179. Good breeds of buffaloes and cows are found in the district. The graziers of Shikarpur taluka are well known for good varieties of sheep and goats. There are several livestock farms in Garhi Yasin taluka.

Irrigation

180. The district is irrigated by canals, which take off from Sukkur and Guddu barrages. Most of the area is irrigated by Guddu barrage through its canals viz Choi, Sindhwah and Begari. However, taluka Garhi Yasin and part of taluka Lakhi Ghulam Shah is irrigated through Khirthar canal, which off-takes from the Sukkur barrage.

Industry and Trade

181. Shikarpur is important for its industrial and commercial products. Textile mills, Asif Seven-up Factory and Vegetable Ghee Industries are important. Besides, there are rice husking mills, engineering works, and agricultural implements manufacturing works. Shikarpur is also famous for its cottage industry, in particular pickle making and folk embroidery.

Aesthetic, Recreational and Tourism Potential

182. There is no significant site of aesthetic, recreational and/or tourism potential in project area.

Women's Role in Socio-economic Activities

183. The survey has revealed that participation rate of women in various socio-economic activities in the project corridor is generally high, almost 100% in case of household activities, child caring and carrying out farm activities. Their participation

rate in case of social obligations, sale and purchase of property, livestock rearing and local representation was 93%, 58%, 55% and 8%, respectively.

Culture and Tradition

The food of the inhabitants is very simple. Maize, wheat and rice are eaten in the project area. The use of Desi ghee and lassi is very popular in the rural area. Milk is also available in sufficient quantity. The people of the area are fond of meat especially various forms of beef. The use of ornaments among the females is also common.

Religion

184. Religion plays a vital role in people's life. Majority of the project area population is Muslim. Cultural festivals are mostly related with religious traditional events. The visit to shrines (termed as Ziarat) is a very common among people. The only minority in the project area is Hindu who mostly live in cities and are engaged in business activities.

4.2.3 Province of Khyber Pakhtunkhwa (Section 3: Dara Adam Khel-Peshawar)

PHYSICAL ENVIRONMENT

Topography and Geomorphology

185. Peshawar is the capital of the Khyber Pakhtunkhwa province of Pakistan. It is the largest city of Khyber Pakhtunkhwa, and according to the 1998 census was the ninth largest city of Pakistan. Peshawar is a metropolitan city and the administrative centre and economic hub for the Federally Administered Tribal Areas of Pakistan It is situated in a large valley near the eastern end of the Khyber Pass, close to the Pak-Afghan border. Peshawar is irrigated by various canals of the Kabul River and by its right tributary, the Bara River.

186. Darra Adam Khel is a town within the Federally Administered Tribal Areas (FATA) of Pakistan. It has gained fame and notoriety for its bazaar packed with gunsmiths and weapons merchants. The town consists of one main street lined with shops, with some alleys and side streets containing workshops. It is mostly inhabited by Pashtuns of the Afridi clan, the Adamkhel. Detail of the proposed site is shown in Figure- 1.1.

187. The road stretch between Bahadur Kalay to Darra Adam Khel is about 35km. The ground is generally flat at lower elevations (350m near Peshawar) and rises to around 750m toward Darra Adam Khel and Kohat. The area from Peshawar towards Kohat is mostly flat with about 1% slope towards Kohat. However, near Darra Adam Khel, the terrain becomes hilly. The average relief of the area along the road is about 350m.

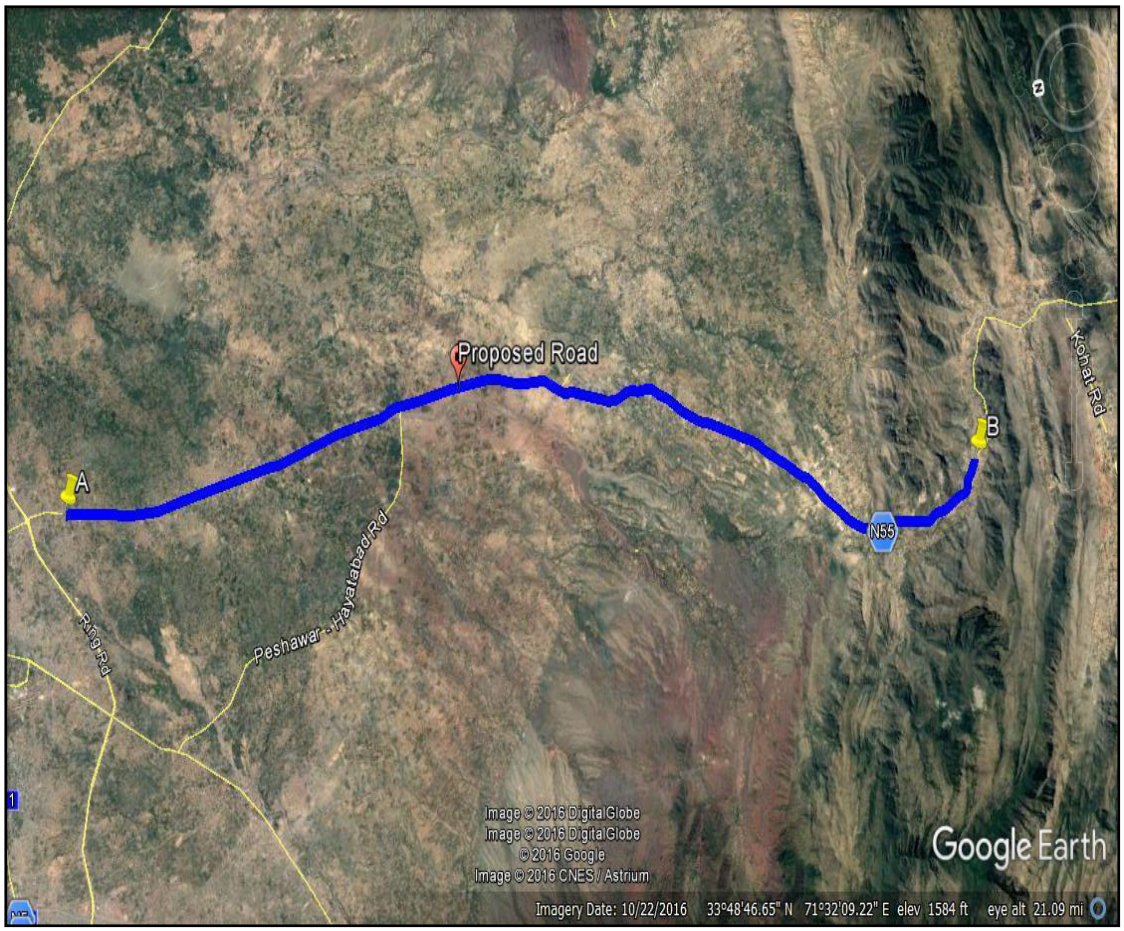


Figure- 4.11: View of proposed road (Peshawar- Dara Adam Khel)

Geology and Seismology

188. The geological conditions are interpreted based on the Geological Map of Kohat Quadrangle prepared and published by the United States Agency for International Developments in coordination with Geological Survey of Pakistan (GSP) in 1974. The road alignment has been overlaid on the geological map and presented in Figure 1.2.

189. This region lies in North-Western Himalayas, which was formed by the collision of Indian and Eurasian plates about 64 million years ago. This collision resulted in thrust faults in the Indian Plate. These faults run in the East-West direction and dip towards the north. In the north the Main Karakoram Thrust (MKT) marks the northern boundary of the Indian Plate, and southern thrust is Himalaya Frontal Thrust (HFT). Between these thrusts the Himalayas are divided into three zones; Higher Himalayas, Lesser Himalayas and Sub-Himalayas.

190. The project area lies in northwest Pakistan and is tectonically categorized in the Lesser Himalayas. The Main Boundary Thrust (MBT), which is thrust fault between Jurassic and Cretaceous rocks, passes through the road near Dara Adam Khel. MBT marks the boundary between Sub-Himalayas in the south and Lesser Himalayas in the north. Near Peshawar, towards Dara Adam Khel, the road runs along alluvial deposits where the terrain is gentle and elevation is about 350m. At Dara Adam Khel the terrain is steeper and elevation increases. Rocks of Samana Suk Formation of Jurassic age are exposed along the road.

191. Samana Suk formation in this region is composed of thinly to thickly bedded limestone. The limestone is grey to dark grey, which has oolitic and some shelly beds. It is inter-bedded with dolomite beds and sandy, ferruginous at places.

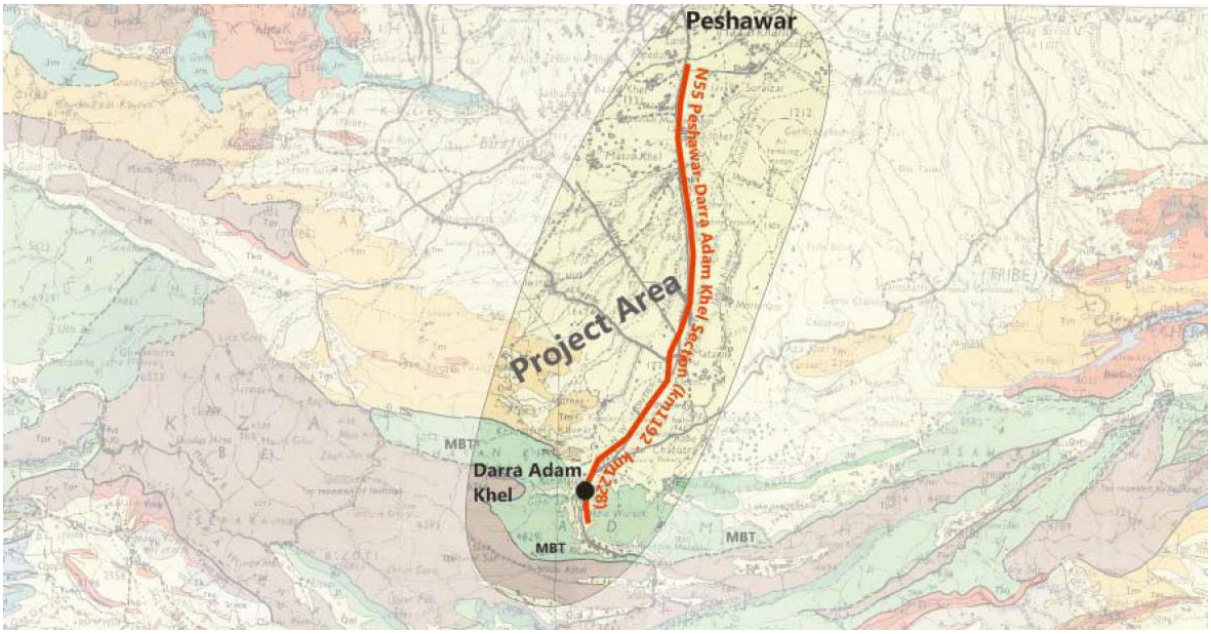


Figure- 4.12: Geological Map of the Project Area (Peshawar- Dara Adam Khel)

192. The Seismic Risk evaluation of the project area was made based on the seismic map of Pakistan compiled based on the Probabilistic Seismic Hazard Evaluation carried out in connection with updating of the Building Code of Pakistan after the destructive earthquake of 2005. The road stretch of the N-55 has been marked on the Seismic zonation map of Pakistan and is depicted in Figure 4.13.

193. According to this map, the proposed road stretch falls in Seismic Zone 2B, which indicates that the ground motions associated with 10% probability of exceedance in 50 years (return period of 475 years) are in the range of 0.16-0.24g. It is suggested that the proposed structures associated with the highway may be designed to withstand horizontal peak ground acceleration of >0.20g. The MBT is an active fault line.

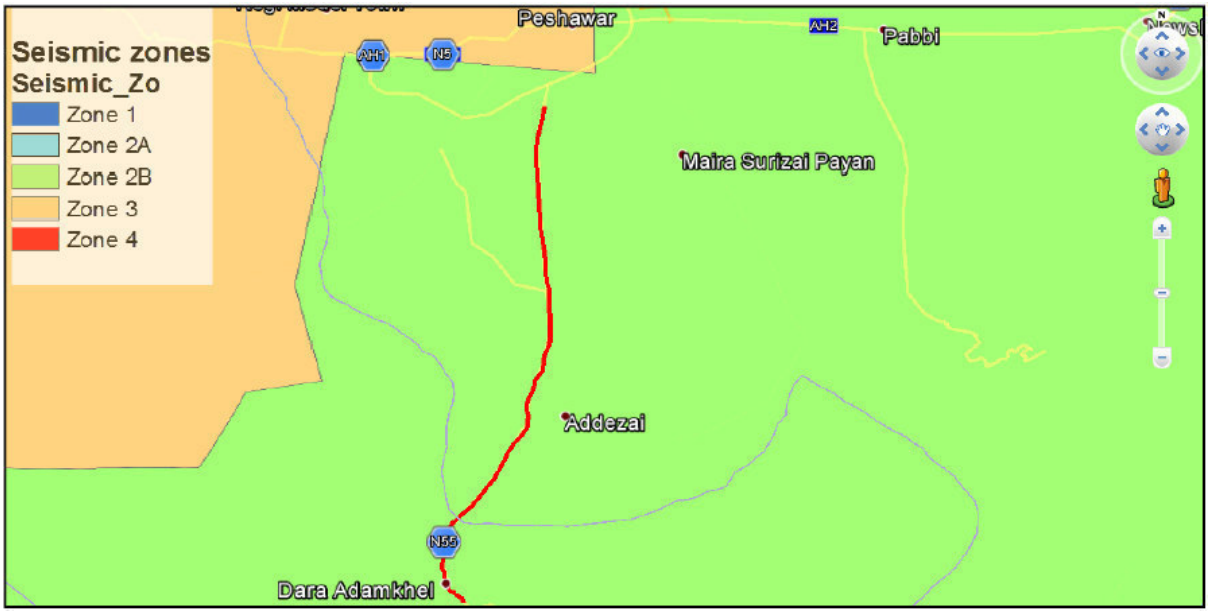


Figure- 4.13: Seismic Zonation Map of the Project Area (Peshawar- Dara Adam Khel)

Soil

194. The soil in the area comprises of silt loam with pH ranging from 5.6 to 8. The surface soil materials are loess deposits, residual mantle on sandstones and shale bedrocks, or narrow strips of silty/loam alleviation along major streams. The cropping pattern and intensity vary spatially as well as temporally with moisture availability. The soil characteristics vary within the area depending upon the parent material and the soil age. Inseptisols, Entisols and Ardisols are the dominant soil types.

Water Resources

195. Underground water is plentifully available, which is being harnessed by the industries and will be used as the source of water for the project. Underground water, from a depth of around 150 feet as the first aquifer, is harnessed by the locals for human consumption and irrigation on a limited scale. The second aquifer starting at a depth of about 300 feet and downwards contains abundant quantities of water. Extraction of underground water is quite costly for a common man. The requirements for water will be met from this second aquifer.

Climate

196. Due to the height from sea level the temperature in summer remains moderate. The region has semi-arid to sub humid subtropical climate. Like in other major parts of upper Punjab and Khyber Pakhtunkhwa, the site experiences four seasons - winter, summer, spring and autumn. The summer season prevails from April to October. Average monthly maximum and minimum temperatures during summer are 40°C and 15°C respectively. The hottest month is June, during which temperature sometimes rises as high as 40°C. Winter occurs from November to mid-February. The average maximum and minimum temperatures during winter are 25°C and 4°C respectively.

BIOLOGICAL ENVIRONMENT

Flora

197. The vegetation of the project area is dry deciduous scrub type. The stocking overall is poor. The trees include *Acacia farnesiana* (Phulahi), *Olea cuspidate* (Kau), *Deodonia viscose* (Sanatha) *Morusnigra* (Toot), *Meliaazadirachta* (Neema), while *Gymnosporiaroyleana* (Pataki), *Zizyphusnummularia* (Mullah), and *Monothecabuxifolia* (gurgura). Grasses are abundant, and include *Aristidadepressa* (Lamb), *Cymbopogan Jawarnica* (Khawi) and *Eleusineflajellifera* (Chhemar). Good quality fodder grasses like *Bothrochloapertusa* (Palwan) and *Digitaribicornus* (pharion) are found in moist places, where the incidence of grazing is less.

Morusnigra

Meliaazadirachta

Figure 4.14.

Fauna

198. Important mammal species that occur near the project area are *Valpusvalpus* (Fox), *Carnis aureus* (Jackal), *Hystrixindica* (Porcupine), *Susscrofa* (Wild boar) and Lepus (nigricollis). No endangered species is known in the project area. Additionally, to meet their requirements of milk, people keep cows, buffalos and goats.

Aquatic Life

199. There is no significant aquatic life within 10 km vicinity of project area.

Endangered Species

200. No endangered species has been identified in the project area.

SOCIO-ECONOMIC ENVIRONMENT

Population

201. Khyber Pakhtunkhwa province has an area of about 74,521 km^2 and Peshawar is its capital city. The total population of the province is estimated to be 874,000 in 2009 with an estimated growth rate of 2.14%. The population is spread over 1725 km^2 with an average population density of 400 persons per km^2. Out of those only 12.0% of the population live in urban areas, while, the rest (88.0%) of the population lives in the rural areas. Average household size of the district is 6.6 persons per household.

The overall literacy rate of district is 53.7%, substantially higher than the provincial literacy rate in Khyber Pakhtunkhwa (35.2%). The female literacy is lower (37.4%) than male literacy (70.5%) (District Census Report 1998).

Traditional and Cultural Heritage

202. The communities of Peshawar form a diverse spectrum ranging from locals settled for generations to expatriates on temporary assignments belonging to different ethnicities and cultural backgrounds. Pashtuns, Urdu Speakers, Persian and Hindko speakers as well as Afghan refugees are the main residents of Peshawar. People mostly follow old traditions in almost all walks of their life. Elders are very much respected and play a vital role in decision-making. Old people are mostly illiterate. Due to awareness about the importance of education, most of younger generation, is now trying to get education. There is a rising trend in the society to change their old traditional socioeconomic pattern of life. Print and electronic media are playing a great role in bringing tangible change in the old pattern of life. People of residential colonies are the natives of different areas of the country who came here seeking livelihood. They follow traditions of their native lands.

Education and Health

203. The gross and net enrollment of both boys and girls at the primary level has slightly increased from 55,190 in 1997 to 58,983 in 2001, an increase of 6.87 percent during. Peshawar District has a Post Graduate College that is funded by the Government. The city also has two colleges for girls, which are also funded by the Government to provide higher education for girls coming from all over the city. The mosque schools were introduced under the National Education Policy of 1979 at the time of Fifth Five-Year Plan 1978–83. During 2000–2001, 166 mosque schools (15.47% of the total primary schools) were functioning in district, while in 1997–98, this number was 180.

Socio-economic Condition

204. Agriculture is among one of the livelihood sources in the project area. The land around the project area is quite fertile but extracting ground water through tube wells for irrigation is quite expensive. Average land holdings are very small, and the people supplement their income by rearing of goats, sheep and cows on a limited scale. A large number of people work as labor in factories in the area, and others run their transportation business or shops. Some are working in Middle East. Around 50% of the younger generation serves in the Pakistan Army.

205. The detailed socioeconomic profile of the proposed three subprojects' area is being prepared by the Social Gender and Resettlement Specialist, and will be presented in a separate report.

5. ALTERNATIVE ANALYSIS

206. An analysis of various project alternatives was undertaken to assess best option to fulfill the objectives of the project. The alternatives considered were the no project option, improvement of pavement without the construction of an additional carriageway, and construction of an additional carriageway.

5.1 Option 1: No Project Alternative

207. In the case that the project is not undertaken, or if the rehabilitation works are limited to pavement improvement only without the addition of another carriageway, the existing three road sections of N-55 that come under tranche 1 will bear the increasing traffic load that is expected with this national highway becoming part of the CAREC route. Currently N-55 is one of the main north-south transportation routes of the country, with a carriageway width of 7.3m and 2-3m earthen shoulders on each side. Over time, the highway has become insufficient to cater to the increasing traffic load, and traffic accidents are common. The road safety conditions are expected to further deteriorate in future with increase in traffic, which is projected with the development of CAREC routes. The existing single carriageway will become a bottleneck to expected growth of traffic and travelers along this CAREC route and its continued deterioration will deny the investment objectives and socioeconomic development in the region. Hence this option is not feasible.

5.2 Option 2: Pavement Improvement without Additional Carriageway

208. The areas of influence (AOIs) of the three subprojects do not contain any environmentally sensitive areas or receptors. If the option of pavement improvement without the construction of an additional carriageway is adopted, it will not be able to cater to the traffic loads projected for this road with the development of the CAREC corridor in Pakistan. The increased traffic will pose a constant hazard to the local communities, and cause an increase in traffic accidents. Although with this option the disturbance to the local communities will be minimal, it will result in further worsening of the socioeconomic environment of the area, increased disturbance to local residents, and heightened risk of road accidents. The single carriageway will constitute a bottleneck to the expected growth of traffic along this CAREC route, and its continued deterioration will deny the investment objectives and socioeconomic development in the region.

5.3 Option 3: Construction of an Additional Carriageway

209. The construction of an additional carriageway using the same RoW, as proposed under this project, will have manageable environmental impacts while providing the desired socioeconomic benefit. The existing ROW is between 40-50 meters (132 to 165 feet) and is generally adequate to construct an additional 7.3 meters carriageway.

210. Different design options were considered to avoid and minimize the environmental and resettlement impacts to the maximum extent. Specific design solutions have been adopted near urban and rural settlements such as widening of the existing carriageway on either side from the center line in urban areas according to the availability of space, the shifting of the additional carriageway on the opposite sides of rural settlements to minimize construction related impacts etc. Adequate crossings, culverts and drainage infrastructure is incorporated in the design to minimize impacts on the communities and the local environment.

d. Conclusion

211. From the description of the three project alternatives provided above Option 3: Construction of an Additional Carriageway is the most feasible as it fulfills the economic and socioeconomic objectives of the project with minimum disturbance to the local communities and the environment.

6. SCREENING POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1 Overview

212. This section assesses impacts from road construction and operation including type and significance of potential impacts. It also discusses the possible mitigation measures that can be put in place to help mitigate any negative impacts. When considering the interaction between engineering operations and activities and the environment, it is common practice to consider impacts occurring in three different phases as follows:

- Design phase,
- Construction phase,
- Operation & Maintenance Stage

213. As a general principle, therefore, it is important to undertake planning and design work in an environmentally sensitive manner so as to prevent or reduce negative impacts happening during the later phases of the project. This will also be the most cost effective way of mitigating adverse impacts.

6.2 Potential Environmental Impacts and Mitigation Measures

214. The activities in each of these phases can Impact the environment both adversely and positively, although naturally the emphasis of most environmental management is on minimizing the negative impacts. Attention is drawn particularly to those impacts that are potentially the most significant or serious. A discussion on the scaling and evaluation of impacts is given as below.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES		
Physical Resources		
Impacts on Landscapes		
1	Activities	• Cut and fill. • Borrow Pit Excavations • Quarry Operations
	Impact	Potential impacts to area landscapes are most likely to occur in the construction stage due to: *Cut and Fill.* Cut and fill activities will occur in Patero-Sehwan and Ratodero – Shikarpur subprojects. Those subprojects involve a considerable amount of fill for new embankments as well as some cut on soil and rocky material in mountainous sections (Patero-Sehwan) to establish the new carriageway. The construction materials such as soil, stone boulders, stone aggregates and sand in form of crushed stone generated from the cuts are not sufficient in the subproject area. *Borrow Pit Excavations.* Embankments and other requirements for fill will require the use of borrow pits in some areas. Unless properly controlled, borrow pits cause drainage and visual problems and present a potential for increased vector activity. When water-filled, they also attract livestock to the roadway thereby slowing of traffic flow and creating safety hazards. *Quarry Operations.* Crushed rock will be needed for construction purposes. Considerable changes in this aspect of the landscape could result from quarry operations. Potential site-specific sources have been identified for each of the subprojects as indicated below.
	Mitigation	The following provisions are recommended for incorporation in the detailed design, bid documents and construction contracts: *Cut and Fill.* The design of the subprojects should consider all relevant topographic and soil conditions. Bid and contract documents are recommended to include requirements to ensure: • Selection of less erodable material, placement of gabions and riprap and good compaction, particularly around bridges and culverts. • Specification that final forming and re-vegetation will be completed as soon as possible following fill placement to facilitate regeneration of a stabilizing ground cover. • Trenching where necessary will ensure successful establishment of vegetation. • Seeding with a fast-growing crop and potential native seed mix immediately after fill placement will be required to prevent scour and to encourage stabilization. • Placement of grass sods where applicable. • Stabilization of embankment slopes and road cuts by re-vegetation with grazing resistant plant species, placement of fiber mats, riprap, rock gabions, or other appropriate

		technologies. • Completion of discharge zones from drainage structures with riprap to reduce erosion when required. • Down drains/chutes lined with rip-rap/masonry or concrete to prevent erosion. • Side slopes adjusted in the range from based on soil and other conditions and within a range as specified by the subproject specifications to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion. • Stepped embankments for embankments greater than six meters. Construction in erosion- and flood-prone areas should be restricted to the dry season. *Borrow Pits Excavations.* It is recommended that bid and contract document specify that: • Borrow areas will be located outside the ROWs. • Pit restoration will follow the completion of works in full compliance all applicable standards and specifications. • Arrangements for opening and using material borrow pits will contain enforceable provisions. • The excavation and restoration of the borrow areas and their surroundings, in an environmentally sound manner to the satisfaction of the Construction Supervision Consultant (CSC) will be required before final acceptance and payment under the terms of contracts. • Borrow pit areas will be graded to ensure drainage and visual uniformity, or to create permanent tanks/dams. • Topsoil from borrow pit areas will be saved and reused in re-vegetating the pits to the satisfaction of the CSC. • Additional borrow pits will not be opened without the restoration of those areas no longer in use. *Quarry Operations.* To ensure adequate mitigation of potential adverse impacts, contract documents will specify only licensed quarrying operations are to be used for material sources. If licensed quarries are not available, the contractors may be made responsible for setting up their dedicated crusher plants at approved quarry sites. Collection of permits and clearances from National Environmental Protection Agency (PakEPA) and Ministry of Mines through Ministry of Public Works and maintain procedure laid down in the PakEPA's permission order.
	Subproject-specific considerations	Subproject-specific considerations regarding impact on landscapes conditions along the subprojects are as follows. **Patero – Sehwan** Ten borrow areas for embankment soil material near Km 9+000, 18+700, 31+300, 45+200, 55+000, 74+000, 83+000, 95+200, 109+500 and 12+700, two crusher plant near Km 21+200 on the left side and Km 110+000 on the left side for aggregate and one source of sand from Bolari area have been identified. No significant adverse impacts to the area landscape are anticipated due to the use of these sources.

		Ratodero - Shikarpur Two borrow areas for embankment soil material, three sources of aggregate (crushing plants) and two sources of sand were identified. No significant adverse impacts to the area topographic characteristics are anticipated due to the use of these sources. **Dara-Adamkhel - Peshawar** Three borrow areas for embankment soil material near Km 11+970, Km 18+800 and Km 29+200; two crusher plants near Km 7+000 on the left side and Km 31+550 on the left side for aggregates and one source of sand in Bolari area have been identified. No significant adverse impacts to the area topographic characteristics are anticipated due to the use of these sources.
Impact on Soils		
	Activities	• Construction of additional carriageways and bypasses • Operations with borrow pits
2	Impact	Potential impacts on soils due to project location and design include: *Loss of soil for agricultural production.* The project will cause loss of soil for agricultural production at Patero-Sehwan and Ratodero – Shikarpur due to construction of the additional carriageways and bypasses. *Borrow Pits.* Increased embankment heights and additional carriageways will require fill, which will be supplied by area soils. *Soil Erosion.* Several types of road construction activities such as construction of roadcut and fill embankments, removal of vegetation, generation of spoil can result in soil erosion, and concentrated runoff. *Soil contamination*. Storage of materials like bitumen, emulsion, benzene, chemicals like $CaCl_2$, fuel and lubricant etc. at the base camp like Dara- Adamkhel- Peshawar section: Ghandy Khail , Landi, Khail Village, Rahim Abad Village, in the Ratodero-Shikarpur, subproject: Dokhan Market Area near the Round about of Shikarpur, Ghari Yasin and, Ratodero, and in the Petaro-Sehwan section: Ghot Khassai Village, Manzorabad Village and at Kaleri Slop (Sunkari) Village and may result in soil contamination if spilled out from the storage areas.
	Mitigation	Mitigation related to the potential soil-related impacts is recommended as follows: *Loss of Soil for Agricultural Production.* Losses of irrigated and non-irrigated land due to direct impacts will take place in Patero-Sehwan and Ratodero – Shikarpur subprojects. Any productive soils as might be lost will be mitigated by the enhanced productivity of the remaining areas and improved access to markets. Loss of those displaced from agricultural lands will be mitigated in accordance with a Land Acquisition and Resettlement Plan. *Borrow pits.* Significant losses due to borrow pit excavations will be

		avoided through the mitigation actions discussed above. *Erosion.* Potential erosion impacts will be avoided by lining spillage ways with riprap to prevent undercutting. Drains will be provided at points where surface flows currently overtop the road, depositing soil and debris of the existing pavement, thereby creating serious hazards to traffic after storms. Improvements in drainage structures will better contain the intermittent flows to existing drainage ways and reduce sheet erosion which may occur when the road is overtopped by flash flooding. Mitigation plantings and fencing will be provided to stabilize the soil and reduce erosion. Storm drainage will be upgraded and drainage ways will be adequately sized, lined and contoured to minimize erosion potential.
	Subproject-specific considerations	Subproject-specific considerations regarding soils along the subprojects are as follows: **Patero – Sehwan** The construction of additional carriageway will follow the existing ROW, however, limited acquisition of ROW land, including agricultural land, for a 3.4 km new bypass road (Km 38+600 to Km 42+000) near Khanote and to cater geometrical improvements in sections with sharp curves is envisaged. Besides, retrieval of encroached sections of ROW in some section along enroute settlement will result in resettlement related impacts due to clearance of structures (residential and commercial) and restriction of ROW use for agricultural activity. It is expected that 32.71 acre of irrigated agricultural land, 14.04 acre of barren uncultivated land, and 32.71 acre of the cropped land will be impacted. It was observed that land on the right side of the alignment is mostly cultivated while there are large higher areas of barren land susceptible to erosion on the left side. **Ratodero - Shikarpur** The additional carriageway will follow the existing ROW, however, limited acquisition of ROW land, including agricultural land, for a 2.3 km new bypass road (km 10+450 to km 12+750) at Dakkan town. Besides, retrieval of encroached sections of ROW in some section along enroute settlement will result in resettlement related impacts due to clearance of structures (residential and commercial) and restriction of ROW use for agricultural activity. It is expected that 48.98 acre of irrigated agricultural land, and 30.91 acre of bypass irrigated agricultural land will be impacted. **Dara-Adamkhel - Peshawar** No impacts on agricultural lands is anticipated on this subproject as rehabilitation do not envisage activities outside the RoW
Impacts of Seismic Events		
3	Activities	Seismic events
	Impact	Potential adverse impacts of seismic events in the construction and operational phases could be exacerbated or lessened as a result of the rehabilitation of bridges and other highway structures.
	Mitigation	Based on geotechnical investigation conducted during the feasibility study it was established that seismic risk factor should be addressed

		by using a horizontal peak ground acceleration factor of >0.12g in structural designs for Patero-Sehwan and Ratodero – Shikarpur subprojects, and >0.20g for Dara-Adamkhel – Peshawar subproject.
	Subproject-specific considerations	As detailed above
Impact on Water Resources		
4	Activities	• Poor design of drainage structures • Clearing, grubbing and grading activities • Operation of construction camps
	Impact	Potential impacts on water resources were considered from the prospective of modification of surface and groundwater flows, and water quality deterioration as follows: *Surface Water Flow Modification.* Patero-Sehwan and Ratodero – Shikarpur sections run along Indus River and can potentially concentrate natural flows and increase their speed. This can cause soil erosion, flooding and siltation of water streams. However, in this instance, the existing 2-lane carriageway has already modified the surface water flows, and the proposed improvements to drainage structures will facilitate passage of high flows and reduce scouring and bank erosion near the road, ensuring the integrity of the road surface. *Groundwater Water Flow Modification.* No impact on the groundwater resources is anticipated as, like in case of surface water, the existing carriageway has already impacted groundwater flow. It is a remote probability that the new carriageway, built in parallel, will add more impact on groundwater resources. *Water Quality Deterioration.* Due to removal of vegetation for clearing, grubbing and grading activities soil is exposed and becomes more susceptible to erosion and can cause surface water quality issues. Additionally, surface water pollution can be caused by construction/reconstruction of the bridges, and replacement/upgrading of culverts. Finally, construction camps can generate wastewater that can pollute surface water reserves, if not duly treated. Oils and lubricants, solvents and cleaners, and other harmful chemicals can contaminate soil and be washed off into water streams.
	Mitigation	Mitigation actions to address those potential impacts are recommended to include: *Surface Water Flow Modification.* The project will install on all the sections adequately sized culverts to accommodate predictable hydrological conditions as recommended by Hydrology Study Report (part of the Feasibility Study), and will stabilize downstream slopes with concrete, or rock gabions, or walls to avoid erosion. Among other mitigation measures are adherence to good design and construction practices and the enforcement of contract provisions related to drainage systems. Detailed design should ensure that the road drainage provisions on the new embankments do not alter the status of natural water bodies and irrigation structures adjacent to alignments.

		Groundwater Water Flow Modification. No impact to groundwater hydrology is anticipated from all the subprojects as the existing carriageways have already modified them. *Water Pollution.* To avoid water pollution issues during construction of the new embankments, bridges and culverts it is recommended to take the following precautionary measures: • Schedule construction works that will expose large areas of soil will not be planned for rainy seasons (considered in subproject-specific considerations below); • using clean fill materials around rivers and canals (quarried rock containing no fine soil); and • leaving buffer zones of undisturbed flora between subprojects' sites and water streams. Among mitigation measures to control erosion and water pollution are: • mulching of the exposed areas with natural biodegradable material such as plant residue; • use of settlement ponds and silt fences, if practicable; • prompt revegetating of the exposed areas after completion of works; Domestic sewage in the construction camps will be treated by properly designed, installed and maintained septic systems.
	Subproject-specific considerations	**Petaro – Sehwan** The road section runs in N-S direction along the right bank of the Indus River, hydrology of which dominates in the area. The existing alignment includes 11 bridges crossing natural drains, which carry flood water during rainfall in the area from Kirthar range towards the Indus river. In addition, there are 315 culverts (box, pipe and single slab) along the section. The subproject will improve drainage on the section by adding 1 new bridge, and 15 new box culverts. **Ratodero – Shikarpur** The section also runs along the right bank of the Indus River. The existing alignment includes 4 bridges and 92 culverts. The subproject will improve drainage on the section by adding 9 new culverts. **Dara-Adamkhel - Peshawar** The existing alignment includes 4 bridges and 57 culverts. The subproject will improve drainage on the section by replacing old culverts.
Climate and Air Quality		
5	Activities	Operation of construction machinery and equipment Operation of asphalt and hot-mix plants, and crushers Open burning
	Impact	Climate and air quality play significant role in the design and construction phases of the project. The climate of the project's areas was considered in the Hydrology Report of the Feasibility Study. Air quality impacts could occur in and around major construction sites and related activities. Potential impacts are identified as follows:

		The sources of air quality impacts are construction machinery and equipment, plants for crushing rocks, hot-mix and asphalt plants, and so on. Potential air pollutants include dust, diesel emissions such as unburned hydrocarbons, carbon monoxide (CO), nitrogen oxides (NOx) and particulate matter, asphalt plant emissions such as sulfur dioxide (SO_2), nitrogen oxides (NO_X), carbon monoxide (CO), and volatile organic compounds (VOC).
	Mitigation	Potential air quality impacts will be mitigated through preventive and mitigation strategies, and environmental monitoring. The following mitigation measures are recommended to be included in the Environmental Management Plans: • Asphalt and hot-mix plants will be located at least 500 meters away from the nearest sensitive receptor such as schools and hospitals; • Operators will be required to install emission controls; • Contractors will be required to suppress dust on access/bypass road surfaces, excavation and construction sites with water or non-toxic chemicals; • Dump trucks carrying earth, sand or stone will be covered with tarps or similar material to avoid spilling; • Machinery and equipment will be fitted with pollution control devices, which will be checked at regular intervals to ensure that they are in working order. Best available pollution control technologies will be required; • Open burning will be prohibited and requirements for spraying and related dust control measures and the proper use of solvents and volatile materials will be in incorporated in the contract provisions. • Workers will be required to use Personal Protective Equipment near sources of fugitive dust; • Pre-construction baseline monitoring of air quality will be undertaken for each subproject. Routine air quality monitoring will be conducted in areas of high potential impact (asphalt plants, construction camps, etc) during construction stage. Requirements for both baseline and routine construction monitoring and institutional strengthening to ensure that the requirements are enforced are specified in the Environmental Management Plan.
	Subproject-specific considerations	No specific mitigation measures in regards with subprojects is required, except the ones detailed above.
Noise and Vibration		
6	Activities	• Operation of construction machinery and equipment • Operation of crushers
	Impact	Temporary noise and vibration impacts in the project area can occur due to construction activities such as excavation, compaction, and grading. The magnitude of impact will depend on the types of equipment to be used, the construction methods employed and the scheduling of the work.
	Mitigation	It is recommended that project bid and contract documents specify that noise and vibration impacts during the construction phase will be mitigated using:

		• *Source Controls.* i.e., requirements that all exhaust systems will be maintained in good working order; properly designed engine enclosures and intake silencers will be employed; and regular equipment maintenance will be undertaken; • *Site Controls.* Stationary equipment should be placed as far from sensitive receptors as practical; selected to minimize noise impacts, and provided with shielding mechanisms where possible; • Time *and Activity Constraints.* Construction activities should be scheduled to coincide with periods when people would least likely be affected; work hours and workdays will be limited to less noise-sensitive times. Work hours will be approved by the Resident Engineer with due regard for possible noise disturbance. Construction activities will be strictly prohibited between 10 PM and 6 AM in the residential areas. • *Community Awareness*. Public notification of construction operations will incorporate noise considerations; methods to handle complaints will be specified. Sensitive receptors will be avoided as possible. Disposal sites and haul routes will be coordinated with local officials. • *Baseline and Routine Noise Monitoring*. Pre-construction monitoring of existing noise and vibration will be undertaken to provide a baseline for the measurement of impacts during the construction period. Routine monitoring will also be required in areas of high potential impact (pile-driving sites and areas of intensive noise-generating activities) during construction.
	Subproject-specific considerations	**Petaro – Sehwan** There are no sensitive receptors along the section, except for school, which is located in government financed road section and will be not impacted as the additional 2-lanes of highway will be built from the left side. **Ratodero – Shikarpur** There are no any sensitive receptors along this section. **Dara-Adamkhel - Peshawar** No sensitive receptors are located along this section. Commercial area is located on the both sides of the road in Peshawar.
Ecological Resources		
Impacts on Flora		
7	Activities	• Construction works in the RoW
	Impact	No threatened or endangered species are located within the potentially affected ROWs and no adverse impacts to such species are likely to occur due to construction activities. Plant species present within the ROW are either introduced species native species, which are tolerant of grazing, compaction, and other physical disturbances. Construction activities will impact only a narrow band of vegetation adjacent to the existing highway. The project will have impacts on roadside shrubs and trees growing in the RoW for Petaro-Sehwan and Ratodero-Shikarpur sections.

	Mitigation	The project will include roadside planting on Petaro-Sehwan section to ensure slope stabilization. No areas of sensitive flora habitat are within the impact area. The bidding and contract documents will have a provision that the contractor should avoid loss of trees where possible and should employ techniques such as asymmetrical widening. Where trees must be cut, the contractor shall ensure that each one removed should be replaced by at least five new trees of the same species or other at suitable locations. Tree Replanting Program will be developed by the contractor as part of EMP.
	Subproject-specific considerations	**Petaro-Sehwan** According to LARP the project will impact 6 non-fruit trees that will be removed from the RoW, and compensated. **Ratodero-Shikarpur** According to LARP the project will impact 373 timber wood trees that will be removed from the RoW, and compensated. **Dara-Adamkhel - Peshawar** No trees will be impacted on this section.
Impacts on Fauna		
	Activities	• Construction activities
	Impact	Assessment of the direct impacts on fauna has been conducted in terms of the following aspects: *Habitat Loss.* A new carriageway will be constructed from the left or right side of the existing alignment for Patero-Sehwan and Ratodero – Shikarpur sections within mostly barren or previously disturbed agricultural areas. No any significant reduction in habitat quality is anticipated. Borrow pits and quarries will be restricted to previously disturbed licensed areas. No habitat loss is anticipated for Dara-Adamkhel – Peshawar section. *Landscape connectivity.* No significant impacts on habitat connectivity is envisaged as biodiversity in the areas adjacent to the project's sections is not high, and the existing road with intensive traffic has already impacted the transport corridor permeability. On the other hand, availability of numerous drainage structures contributes to better landscape connectivity. *Wildlife Migrations.* A road blocking a wildlife corridor results in either a cessation in its use because animals are reluctant to cross the road, an increase in mortality due to collisions, or a delay in migration patterns. No interrupted corridors of wildlife migration have been observed in the subproject areas. *Road Mortality.* Accidents involving wildlife attempting to cross the road are a potential impact faced by many road projects due to the potential for increased traffic volumes and speeds and other factors. In all subprojects, there is no indication that accidents involving wildlife are common and significant increases in the numbers of accidents will occur.

	Mitigation	Environmental examination revealed no areas at which mitigation actions related to wildlife are warranted.
	Subproject-specific considerations	None.
Impacts on Protected Areas		
	Activities	• Construction activities
	Impact	No project roads are located in vicinity or within the protected area, and no impact on them is envisaged.
	Mitigation	No mitigation measures are required.
	Subproject-specific considerations	None.
Socioeconomic Resources		
Impacts on Infrastructure		
	Activities	• Construction activities, largely on embankment • Construction of bridges
	Impact	Potential impacts on infrastructure include: • *Roads.* It is anticipated that the project will have site-specific impacts on existing transport infrastructure due to transportation of construction materials, equipment and machinery, and labor to/from construction sites. It can cause traffic disturbances as the current traffic on the project's sections is intense. • *Railways*. Petaro-Sehwan section crosses and can have an impact on railway track in 3 locations during construction of bridges. It can temporarily interrupt railway operations. No concerns related to railway infrastructure on other sections. • *Irrigation systems.* The project can have impact on irrigation systems located along the alignment and crossed by the project • *Water Supply Systems.* The project will have no direct impact on water supply systems. • *Sewerage Systems*. The project will have no direct impact on sewerage systems. • *Transmission lines.* The project can have direct impact on high- and medium voltage transmission lines. Relocation of some sections of TLs can be required on Petaro-Sehwan and Ratodero-Shikarpur sections. • *Waste Disposal.* Potential waste disposal impacts could occur to the improper disposal of construction waste, waste oil and solvents, and human waste from construction camps on all the road sections.
	Mitigation	Mitigation related to potential non-transport infrastructure has been assessed as follows: • *Roads*. Traffic Management Plan needs to be prepared by the contractor to minimize potential disruptions. • *Railways*. Coordination with Pakistan Railways is required. • *Irrigation systems*. Coordination with Provincial Department of Irrigation is required.

		• *Water Supply Systems.* None required other than coordination with Public Health and Engineering Department. • *Sewerage Systems*. None required other than coordination with Public Health and Engineering Department. • *Energy Systems.* None required other than coordination with NTDC. • *Waste Disposal.* Contacts for the project will include enforceable provisions for the proper disposal of waste.
	Subproject-specific considerations	The existing alignment crosses the railway track at km 53+361, km 97+840, and km 114+340. Coordination with Regional Department of Pakistan Railways will be required. Also, coordinate with NTDC, Public Health and Engineering Department, and Provincial Department of Irrigation. **Ratodero – Shikarpur** None required other than coordination with NTDC, Public Health and Engineering Department, and Provincial Department of Irrigation. **Dara-Adamkhel - Peshawar** None required other than coordination with NTDC, Public Health and Engineering Department, and Provincial Department of Irrigation.
Occupational Health and Safety		
	Activities	• Road construction
	Impact	The project can have occupational health and safety impacts related to the following aspects: • Physical hazards such as rotating and moving equipment, noise, vibration, electrical, welding, working in height, and so on • Chemical hazards such as air quality, fire and explosions, corrosive, oxidizing, and reactive agents, and asbestos containing materials. • Biological hazards
	Mitigation	The strategies to deal with occupational health and safety issues[2] will include: • *Avoiding the hazard* by removing the activity from the work process. For example, old and poorly maintained construction machinery and equipment will not be allowed on the construction sites. • *Controlling the hazard at its source through use of engineering controls.* For example, asphalt plants will be required to install emission controls. • *Minimizing the hazard* through design of safe work systems and administrative or institutional control measures. For example, training in safe work procedures, and workplace monitoring will be conducted. • *Providing appropriate personal protective equipment* (PPE) in conjunction with training, use, and maintenance of the

[2] WB Group EHS General Guidelines. 2.0. Occupational Health and Safety.

		PPE. The WB Group Environment, Health and Safety General Guidelines for 2.0 Occupational Health and Safety, and 4.0 for Construction and Decomissioning that provide guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety should be followed
	Subproject-specific considerations	None
HIV/AIDS and other sexually transmitted diseases		
	Activities	Irresponsible sexual behavior
	Impact	HIV/AIDS and other Sexually Transmitted Diseases (STDs) in construction camps: • Increase in sexual partners because of separation from family. • Increased illness and death among workers.
	Mitigation	Among mitigation measures are: 1. Increasing use of local labor; 2. Requiring contractor to provide health education measures. 3. Distributing condoms. 4. Treating Sexually Transmitted Diseases.
	Subproject-specific considerations	No specific mitigation measures in regards with subprojects is required, except the ones detailed above.

II. OPERATION PHASE		
Physical Resources		
Noise		
1	Activities	• Road operation
	Impact	The project foresees increase in the average daily vehicle-km of project roads to 6.62 million by 2027 against the baseline 4.26 million in 2016). This is the factor which will contribute to higher level of noise from vehicle fleet. On the other hand, the road surveys on the project sections found no sensitive receptors such as schools, hospitals, in proximity to the road on any of the sections. As a result, no significant impacts on the noise levels are anticipated.
	Mitigation	Provisions for baseline noise monitoring have been included in the budget provisions.
	Subproject-specific considerations	None
Air Quality		
	Activities	• Road operation
	Impact	The project foresees increase in the average daily vehicle-km of project roads to 6.62 million by 2027 against the baseline 4.26 million in 2016). This is the factor which will contribute to higher level of air emissions from vehicle fleet. Another aspect that adversely impact air quality is old and/or poorly maintained vehicle fleet. On the other hand, it is predicted that the average travel time on project

		roads will be reduced to 7.0 hours by 2027 from a baseline of 9.8 hours in 2016. This means that the traffic flow will be improved with less congestion, and improved vehicle performance, which will serve to alleviate potential air pollution levels to a modest degree. Additionally, it is expected that by 2027 the country will be using stricter fuel standards with less emissions (Euro-II standard since 2017) although this process may be slow. As a result, it is expected that the total emissions on the subprojects may moderately grow.
	Mitigation	Preventive measures to avoid impacts of the air quality deterioration on people's health has been taken as follows: • Bypassing of the settlements (in this instance, Khanote bypass on Petaro-Sehwan section, and Dakkan bypass on Ratodero – Shikarpur section) • The project is aimed at increasing capacity of Petaro-Sehwan, and Ratodero – Shikarpur sections to avoid congestions. • Geometry of the road will be improved wherever possible during detailed design to avoid sharp curves, and steep grades. Additionally, the mitigation measure will include planting roadside trees in accordance with Tree replanting plan and monitoring.
	Subproject-specific considerations	No specific mitigation measures in regards with subprojects is required, except the ones detailed above.
Blowing and Drifting Sand		
	Activities	• Road operation
	Impact	Blowing and drifting sand on Petaro – Sehwan Section can impact traffic safety and cause road accidents due to poor visibility, contribute to air quality deterioration, and increase road maintenance costs.
	Mitigation	Mitigation measures to protect the road from blowing and drifting sand will include installation of sand barriers at sections prone to drifting sand
	Subproject-specific considerations	Petaro – Sehwan section can be impacted by blowing and drifting sand, specifically in the southern part.
Socioeconomic Resources		
Impacts on Communities		
	Activities	• Design and Operation of the project
	Impact	Potential socioeconomic impacts will likely include: ▪ *Land acquisition and resettlement*. Two subprojects (Petaro-Sehwan Section and Ratodero-Shikarpur section involve acquisition of ROW for proposed improvements in curve geometry, vertical and horizontal alignment and construction of a bypass at one section of Ratodero-Sikarpur subproject. In addition, retrieval of ROW land to implement the project works will cause resettlement related impacts due to clearance of structures (residential and commercial) and restriction of ROW use for agriculture purpose. For the Dara-Adamkhel-Peshawar Section, civil works will follow the existing pavement width and will not have LAR impacts. ▪ Implementation of tranche-1 project will result in acquisition of

		126.7 acres land (about 46.8 acres land for Petaro Sehwan Section and 79.9 acres land for Ratodero Shikarpur Section) and permanent dislocation of 59 residential structures and 71 commercial structures (including 43 fixed permanent structures and 28 moveable/temporary structures). It is estimated that a total 356 asset owners will lose their assets due to acquisition of land or clearance of ROW limits. The project will result significant economic displacement of 136 DPs i.e 35 land owners DPs losing more than 10% of their productive agricultural land and 101 DPs facing loss of livelihood source due to loss of commercial structures. Fifty-nine DPs will lose their residential structure resulting in physical displacement of 412 persons (residential structure owners with their dependents living with them). Overall, the project will significantly affect 548 persons (136 economically displaced and 412 physically displaced). *Economic Development.* The MFF will contribute to enhancement of regional connectivity and trade via the CAREC Corridors. Under the Tranche 1, 66 km of Petaro–Sehwan section and 43 km of Ratodero–Shikarpur section will be improved by building a 2-lane new carriageway along the existing 2-lane carriageway road; and 34 km of existing 4-lane carriageway road of Dara Adamkhel–Peshawar will be rehabilitated. It will allow traffic to flow more smoothly and efficiently, and facilitate movement of people, produce, and products along the Indus Highway. The main direct beneficiaries of the MFF will be agricultural traders, freight forwarders, transporters, commuters, and those living and working along the project road sections. Indirect beneficiaries include large sectors of the population who will gain from more employment opportunities in trade and transport business and ready access to markets and resources across the country. Local population will get employment opportunities during construction and operation phases of projects under the investment program. Women will benefit from the MFF through improved access to basic social services such as health, education and social networking facilities. - *Split Communities.* Both Petaro – Sehwan and Ratodero – Shikarpur sections have a potential for split communities due to adding additional carriageway, and Jersey barriers. It can impact coherence of communities traversed by the roadway. - *Loss of Roadside* Community *Business and Social Activities.* The project will impact both business and social activities adjacent to the existing carriageways. The details are provided below under subproject-specific considerations. *Income and Employment Trends.* Following construction, the road improvements themselves may also contribute to the development potential of some areas, including increases in income and employment.
	Mitigation	*Land acquisition and resettlement*. Impacts of land acquisition and resettlement will be compensated by implementing LARPs.

		Loss of Roadside Community *Business and Social Activities.* Impacts of land acquisition and resettlement will be compensated by implementing LARPs. *Split communities*. Provisions for crosswalks like pedestrian bridges and underpasses so that the non-traffic users can cross anytime safely needs to be incorporated in the project. The detailed design should retain existing underpasses, and include more wherever feasible.
	Subproject-specific considerations	**Petaro-Sehwan** *Split communities*. The existing underpasses are located at km 114+480. *Loss of Roadside* Community *Business and Social Activities* 38 DPs losing shops (20 shop, 5 restaurant, 15 kiosks owners) and 11 renter operators of affected shops will lose their income source. **Ratodero – Shikarpur** *Loss of Roadside* Community *Business and Social Activities* DPs losing shops and kiosks (28 shop and kiosk owners and 24 renter operators of affected shops/kiosk) will lose their income source. Green belts of 6 petrol pump stations along the road affected without any impact to the functional units. **Dara-Adamkhel - Peshawar** *Split communities.* The existing underpasses are located at km 17+741 and 19+222.
Public Health and Safety		
	Activities	• Road operation
	Impact	Public health and safety issues in the road sector typically include issues related to road traffic safety and accidents, and air and noise pollution. The aspects considered under public health and safety are as follows: *Road traffic safety and accidents.* According to UNECE[3] more than 1.25 million people die each year as a result of traffic accidents, and up to 50 million suffer non-fatal injuries. Besides, road traffic accidents cost at least one per cent of the world's gross domestic product (GDP), or roughly US$ 750 billion per year. WHO assesses the reported traffic fatalities in Pakistan as 25,781 (2013) or 14.2 per 100,000 population.[4] It is anticipated that the project can have a positive impact on traffic road safety by providing better road design including road geometry, median dividers, pedestrian crossings, and road signs and road markings. Positive health impacts may result due to quicker response time in emergency situations and improved access to health care facilities for those living in proximity to the improved roadway. *Air pollution and noise along transport corridors.* Increase in traffic can cause increase in air emissions such as carbon monoxide, nitrogen oxides, particulate matter, etc. and noise impacts. It can

[3] http://www.unece.org/fileadmin/DAM/trans/main/wp1/wp1doc/ECE_TRANS_255_FINAL.pdf

[4] http://www.who.int/violence_injury_prevention/road_safety_status/2015/Country_profiles_combined.pdf

		impact both people living along road corridors, and drivers and passengers. Those impacts were discussed in more details above.
	Mitigation	▪ *Road traffic safety and accidents.* Mitigation measures to improve safety of the road can include: ▪ Improving road alignment, design safe intersections during design stage ▪ Providing accessible and safe pedestrian overpasses and underpasses in places with high traffic volumes, designing refuge islands and medians for pedestrians ▪ Design and improve road signs and road markings
	Subproject-specific considerations	No specific mitigation measures in regards with subprojects is required, except the ones detailed above.