



NATIONAL HIGHWAY AUTHORITY

Feasibility Study and Detailed Design for Widening and Improvement of Lahore-Gujranwala Section along with Interchange at Chand-Da-Qila and Addition of Third Lane on Gujranwala Bypass (75KM)

**ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
REPORT**

MAY 2023



ASSOCIATED CONSULTING ENGINEERS ACE LIMITED, LAHORE

Transportation Engineering Services Division

in Joint Venture with



ASSOCIATED CONSULTANCY CENTRE (PVT.) LTD., ISLAMABAD



GLOBAL ENGINEERING SYSTEM, PESHAWAR





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LIST OF ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ACC	Associated Consultancy Centre
ACE	Associated Consulting Engineers
ACI	American Concrete Institute
AIDS	Acquired Immune Deficiency Syndrome
ASTM	American Society for Testing and Material
BOD	Biochemical Oxygen Demand
BOQ	Bill of Quantities
COD	Chemical Oxygen Demand
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMMP	Environment Mitigation and Monitoring Plan
EMP	Environment Management Plan
EPC	Environmental Protection Council
GoP	Government of Pakistan
HIV	Human Immunodeficiency Virus
HSE	Health Safety Equipment
IEE	Initial Environmental Examination
IEM	Independent Environmental Monitor
M&E	Monitoring and Evaluation
NCS	National Conservation Strategy
NGOs	Non-Government Organizations
NHA	National Highway Authority
NOC	No Objection Certificate
O&M	Operation and Maintenance
OP	Operational Policy
PAP	Project Affected Person
PD	Project Director
PEPA	Punjab Environmental Protection Agency
PEPC	Pakistan Environment Protection Council
PEQS	Punjab Environment Quality Standards
PKR	Pak Rupees
PM	Project Manager
PMC	Project Management Consultant

PPC	Pakistan Penal Code
PPE	Personal Protective Equipment
PSDP	Public Sector Development Project
PSDP	Public sector Development Programme
PSQCA	Pakistan Standards Quality Control Authority
PTCL	Pakistan Telecommunication Limited
RE	Resident Engineer
ROW	Right of Way
SPM	Suspended Particulate Matter
SRO	Statutory Regulation Order
UBC	Uniform Building Code
VOC	Vehicle Operating Cost
WAPDA	Water and Power Development Authority

EXECUTIVE SUMMARY

This report documents the Environmental Impact Assessment (EIA) carried out for Lahore Gujranwala Section of N-5 along with interchange at Chand-da-Qila and additional third lane on Gujranwala Bypass. The components include widening and improvement of road, culverts, interchange and service line. The project is administratively located in Lahore, Sheikhpura and Gujranwala districts of Punjab province.

Name of the Proponent

National Highway Authority (NHA) has been entrusted for the Widening and Improvement of Lahore to Gujranwala Road section (75 KM).

Name of Organizations preparing the Report

National Highway Authority (NHA) in coordination with Government of Punjab followed laid down guidelines commencing from the issue of Request for Proposals (RFP) documents to consulting firms and invited proposals and carried out evaluations thereof on priority. **M/s. Associated Consultancy Centre ACC (Pvt.)** Limited in JV with **M/S. Associated Consulting Engineers ACE Limited (ACE)** and **M/S. Global Engineering System** emerged as the lowest bidders and they were awarded contract for Feasibility Study and Detail Design of Widening and Improvement of Lahore Gujranwala Section of N-5 along with interchange at Chand-da-Qila and additional third lane on Gujranwala Bypass.

Need of Project

The project road is part of National Highway N-5 which starts from Karachi passing through major cities of Pakistan like Hyderabad, Sukkur, Bahawalpur, Multan, Lahore, Gujranwala, Rawalpindi, Peshawar and ultimately terminating at Torkham border with Afghanistan. It is the most important inter provincial road connecting Karachi Port with rest of the country.

The need of the Project is justified based on the existing condition of GT road from Shahdara town to Gujranwala area causing severe congestion, added fuel costs, expenses on frequent repairs of damaged roads, extended travel time, nuisance to surrounding population due to heavy traffic and road safety issues

Objectives of the Project

- ❖ The construction of proposed road will provide a better road facility for inhabitants of area.

- ❖ This section is intended to provide safer, quicker and more efficient passage between Lahore and Gujranwala.
- ❖ After addition of third lane on Gujranwala Bypass and improvement of existing lanes throughout the project length, smooth traffic flow will be possible. Problem of traffic blockage and congestion in will also be mitigated.
- ❖ The prime objective of the proposed Project is to facilitate safe and quick movement of people and goods transport, by providing better access to enhance the efficiency of the existing road network. Moreover, other social benefits resulting from the project include increase in employment opportunities and reduction of travelling cost between farms and commercial markets.
- ❖ It will reduce roadside accidents.
- ❖ Vehicle operating cost will be reduced.

Project Description

The project takes off 800 meters from Shahdara Chowk (Km. 1267+600 of N-5) near Lahore city and ends at Gujranwala Bypass (also known as Jinnah Interchange at Km. 1335+556 of N-5) near Gulshan Aziz Colony. Approximate length of the project is 68 km. The project also envisages the design of grade separated intersection at Chand-da-Qila (Start point of Gujranwala Bypass at Km. 1320+300). Presently, three legged at-grade roundabout is operational at Chand-da-Qila causing traffic congestion during peak hours and is problematic especially for long vehicles. The alignment traverses through various urban centers / towns such as Shahdara, Kala Shah Kaku, Muridke, Sadhoke, Kamoke, Eminabad More and subsequently Gujranwala City.

Environmental Baseline

The existing environmental conditions around the proposed project have been considered in physical, biological, and socio-economic aspects. The methodology used for the EIA preparation included the collection and review of relevant documents and firsthand data including policy and previous study documents, use of satellite imagery and Google Earth, onsite environmental, ecological, and social investigation, consultation with public and stakeholders, and undertaking the social impact assessment and analysis. Mitigation measures were then put in place to address negative impacts and compensatory plans are designed and recommended.

The Consultant has employed a participatory bottom-up transparent and consultative approach in the preparation of the Environmental Impact Assessment (EIA) report. Various qualitative and quantitative data collection tools were used to develop an environmental baseline for the proposed area.

Physical Environment:

The GT Road that connects Lahore to Gujranwala passes through a predominantly agricultural landscape, with fields of wheat, rice, and sugarcane visible on either side of the road. The area is generally flat, with occasional gentle slopes and small hills.

As you leave Lahore, you will pass through the city's outskirts, which include commercial and industrial areas. After a short distance, the landscape gives way to agricultural land. The road is well-maintained, with two lanes in each direction, and the surrounding areas are generally clean and free of litter.

As you travel along the GT Road, you will pass through several small towns and villages. These settlements are typically characterized by low-rise buildings, and you can expect to see shops, markets, and small businesses along the roadside. The road itself is relatively straight, with occasional bends and curves.

As you approach Gujranwala, you may notice an increase in commercial activity and urbanization. The city is known for its industrial and manufacturing sectors, and you may see factories and warehouses along the road. The surrounding countryside remains agricultural, however, and you can expect to see fields and farmland right up to the city limits.

Biological Environment

Agricultural land dominates much of the region, with crops such as wheat, rice, and sugarcane grown in large quantities. These crops provide habitat and food for a variety of bird species, including black-winged kites, kestrels, and shikras. The agricultural land also supports a variety of small mammals, such as field mice and rats, which are an important food source for larger predators such as owls and foxes. Along the edges of the agricultural land, there are areas of natural habitat, such as grasslands and wetlands. These areas provide important habitats for a range of bird species, including waders, waterfowl, and raptors. Wetland areas are also important breeding sites for amphibians, such as frogs and toads.

Urban areas along the GT road support a different set of species, including domestic animals such as dogs and cats, as well as a variety of bird species that have adapted to life in urban environments, such as pigeons and house sparrows. Some of the larger urban areas along the road may also support populations of larger mammals, such as jackals or mongooses.

Socio-Economic Environment:

The socio-economic environment along the Shahdara to Gujranwala GT Road is influenced by a mix of factors, including agriculture, industry, and urbanization.

Agriculture is a major economic activity along the road, with many farmers and landowners growing crops such as wheat, rice, sugarcane, and vegetables. These crops provide food and income for many local communities, but also face challenges such as water scarcity and price volatility. Many farmers in the region also rely on government subsidies and support to maintain their livelihoods.

Industry is also an important part of the socio-economic environment along the road, with several industrial zones and factories located in the region. These industries range from small-scale cottage industries to large manufacturing plants, and provide employment opportunities for local residents. However, industrial pollution and waste management remain major challenges in the region.

Environmental Impact Analysis And Mitigation Measures

During the field surveys, significant efforts were made to identify the main social, cultural, and environmental issues related to the construction/up gradation of the existing highway. Data from Various government departments and agencies were also contacted for obtaining salient information in this regard along with that from area residents and stakeholders. Following is the list of main issues and concerns:

- ✚ The physical scarring caused by clearing and levelling during project site construction activities could lead to alteration of soil quality by removal of topsoil, loses of plant cover and limited soil erosion induced by disturbance to native soil.
- ✚ Air pollution due to emissions from asphalt plant, vehicles, and construction machinery as well as dust and particulate matter during the construction phase and movement of vehicles during the operational phase
- ✚ Drainage issues during the construction phase and operation phase
- ✚ Contamination of surrounding soil and water resources from oil spills and release of contaminated water both during construction and operational phases
- ✚ Noise and vibration, construction works, and machinery movements during the construction phase;
- ✚ Waste from construction activities as well as labor camps at different locations during the construction phase
- ✚ Disturbance of traffic flow and pattern during the construction phase of the project
- ✚ Mobility and safety of Livestock during construction and operational phases;

- Health and safety issues of laborers at the site during construction and at the labor camp

Table ES-1: 'Activity Wise' Screening of Impacts during Design/Pre-Construction Phase

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
1	Improper road designing	Long term	Unlikely	Moderate	Severe
2	Improper selection of Camp, asphalt, and batching plant sites	Short term	Likely	Moderate	Mild
3	Lack of integration of EIA/EMP requirements into Construction bid documents	Short term	Likely	Moderate	Severe
4	Landscape	Short term	Likely	Moderate	Severe
5	Relocation of utilities	Long term	Unlikely	Minor	Low
6	Waste/construction material dumping site/s	Short term	Likely	Moderate	Mild
7	Natural Hazard Risks (Flooding, Earthquakes, etc.)	Short term	Likely	Moderate	Severe
8	Land Acquisition	Long term	Likely	Major	Severe
9	Cutting of Trees	Temporary	Rare	Minimal	Low

Table ES-02: 'Activity Wise' Screening of Impacts during the Construction Phase

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
1.	Construction of road not in accordance with approved design	Short term	Likely	Moderate	Severe
2.	Degradation of air	Short term	Likely	Moderate	Low

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
	quality due to construction works				
3.	Topography	Short term	Likely	Moderate	Low
4.	High noise levels and vibration from construction activities	Short term	Likely	Moderate	Mild
5.	Improper handling and/or disposal of hazardous and non-hazardous waste	Short term	Likely	Moderate	Low
6.	Untreated disposal of effluent from worker camps and construction sites	Short term	Likely	Moderate	Low
7.	Soil contamination, Erosion, and Sedimentation	Short term	Likely	Moderate	Low
8.	Wildlife Loss	Short term	Likely	Minor	Low
9.	Sedimentation of Streams and Water Bodies	Short term	Likely	Minor	Low
10.	Water resources	Short term	Likely	Minor	Low
11.	Temporary yard and Location and operation	Short term	Likely	Minor	Low
12.	Communicable diseases incl. COVID-19	Short term	Likely	Moderate	Mild
13.	Potential accidents and injuries to communities in the project area during construction works-Community Health & safety	Short term	Likely	Minor	Low
14.	Injuries to workers from lack of necessary training and/or not using PPEs etc. (Occupational Health & Safety)	Short term	Likely	Minor	Low

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
15.	Graveyard and physical cultural resources	Short term	Rare	Minimal	Low
16.	Labor influx	Short term	Likely	Minor	Low
17.	Traffic management	Temporary	Likely	Minor	Low

Table ES-03: 'Activity Wise' Screening of Impacts during Operation Phase

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
1	Air and Climatic Impacts	Short term	Likely	Moderate	Low
2	Potential Accidents due to high speed	Long term	Likely	Minor	severe
3	High noise levels	Short term	Likely	Moderate	Low
4	Impact on Social and Cultural Resources	Long term	Likely	Major	Mild

Environmental Management Plan (EMP)

For effective implementation and management of mitigation measures, an Environmental Management Plan has been prepared. The EMP provides a delivery mechanism to address potential impacts of project activities, to enhance project benefits and to introduce standards of good practice in all project activities. The EMP has been prepared with the objective of:

- Defining mitigation/ monitoring plan required for avoiding or minimizing potential impacts assessed by the EIA;

- ✚ Defining roles and responsibilities of the project proponent and the contractor;
- ✚ Defining requirements for environmental monitoring and reporting;
- ✚ Defining the mechanism with which training will be provided to the project personnel. Environmental sensitivities and impacts, as well as the associated mitigation plan have been addressed in the EMP.

NHA will ensure that the project staff will be adequately trained in HSE sensitivities and operational management procedures, so that all levels of staff effectively contribute to impact prevention and mitigation at all times.

An Environmental Management Plan (EMP) has been prepared and provided in Chapter 09 of the report, providing:

- ✚ A systematic approach to ensure that mitigation strategies prepared in this EIA are implemented during project activities.
- ✚ An appropriate monitoring plan is device to ensuring strict adherence to the environmental mitigation and control measures.
- ✚ A training program is device to providing awareness training on all potential environmental issues of the project to all personnel at site.
- ✚ A waste management plan, identifying the most suitable waste disposal and pollution control options throughout the project lifecycle.

Proposed Monitoring

Considering the environmental conditions of the project area and the assessment of potential impacts of the project made in the EIA, the following environmental parameters will be monitored at locations identified during the construction phase (e.g. location of asphalt plants, construction camps etc.).

Air Quality Monitoring

Air quality monitoring will be done during the construction and operation phase of the project at the representative locations. Ambient air quality parameters will include: NO_x, SO_x, CO, PM₁₀.

Water Quality Monitoring

Ground and surface water quality monitoring will be done during the construction and operation phase of the project at the representative locations.

Groundwater Quality Parameters:

Total Coliforms, Total Colonial Count, Faecal Enterococci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium. Wastewater Quality Parameters: pH, DO, TSS, Alkalinity, BOD5, COD, Turbidity.

Noise Monitoring

The monitoring will be carried out at key locations covering all receptors.

Institutional Arrangements

The overall responsibility of EMP implementation rests with NHA. Project Director (PD), Deputy Project Director (DPD), Quality Control Specialist (QCS), and other required official and supporting staff will be deputed by the NHA. The PD/Site Engineers will be responsible for general administration, handing over of sites, coordination with other authorities to ensure timely relocation of various utility services, oversight of environmental safeguards, management of social safeguards, and performance monitoring of civil works implementation.

The contractor will also be responsible for the implementation of EMP at the site. The contractor will hire qualified engineers/technical experts and fix their responsibilities for the proper implementation of EMP. All mitigation measures for adverse impacts proposed in the EMP will be duly and timely implemented in true letter and spirit. For this purpose, daily, monthly and annual checklists will be formulated and maintained by the contractor.

1 INTRODUCTION

1.1 Project Introduction

Road transport is the key component of economic and social development process, often absorbing a high proportion of national budget. Pakistan, with more than 220 Million people, has a reasonably developed transport infrastructure. Road transport is the backbone of Pakistan's transport system. Infrastructure is both a cause and consequences of economic growth. The role of infrastructure in integrating countries into the global economy by providing transport and telecommunication services is well known. Infrastructure can raise the quality of human capital, which is a key factor in achieving high and sustainable levels of growth. Improvements in the quality and quantity of infrastructure have a disproportionately positive impact on the poor, and thus play a vital role in reducing income inequality. Understanding the demand placed on the community's transportation network by development is an important dimension of assessing the overall impacts of development. All development generates traffic, and it may generate enough traffic to create congestion and to compel the community to invest more capital into the transportation network, whether it is in the form Roads and streets are the most important transport communication medium in the country and are used by almost everyone on a daily basis. Besides the fact that roads are provided for the benefit of the road user, they also play a significant role in promoting economic growth and the living standards of the population. Road infrastructure provide access to markets, places of work, clinics and hospitals, educational institutions, places for sports and leisure activities and vacations

Keeping this in purview, National Highway Authority (NHA) has taken up the Feasibility Study and Detail Design of Widening and Improvement of Lahore Gujranwala Section of N-5 along with interchange at Chand-da-Qila and additional third lane on Gujranwala Bypass. M/s. Associated Consulting Engineers ACE Limited (ACE) in joint venture with M/s. Associated Consultancy Center (ACC) Pvt. Ltd. and M/s. Global Engineering System has been appointed to carry out the Feasibility Study and Detail Design of subject road.

The project road is part of National Highway N-5 which starts from Karachi passing through major cities of Pakistan like Hyderabad, Sukkur, Bahawalpur, Multan, Lahore, Gujranwala, Rawalpindi, Peshawar and ultimately terminating at Torkham

border with Afghanistan. It is the most important inter provincial road connecting Karachi Port with rest of the country.

According to the Punjab Environmental Protection (Amendment) Act 2012 and its interpretation as per the Review of IEE & EIA Regulations, 2022 for filing, review, and approval of environmental assessments, the present project is categorized under Schedule II. Regulation 4 states that “A proponent of the project falling in any category specified in schedule II shall file an EIA”.

M/s. Associated Consulting Engineers ACE Limited (ACE) in joint venture with M/s. Associated Consultancy Center (ACC) Pvt. Ltd. and M/s. Global Engineering System has been appointed to carry out the Feasibility Study and Detail Design of subject road.

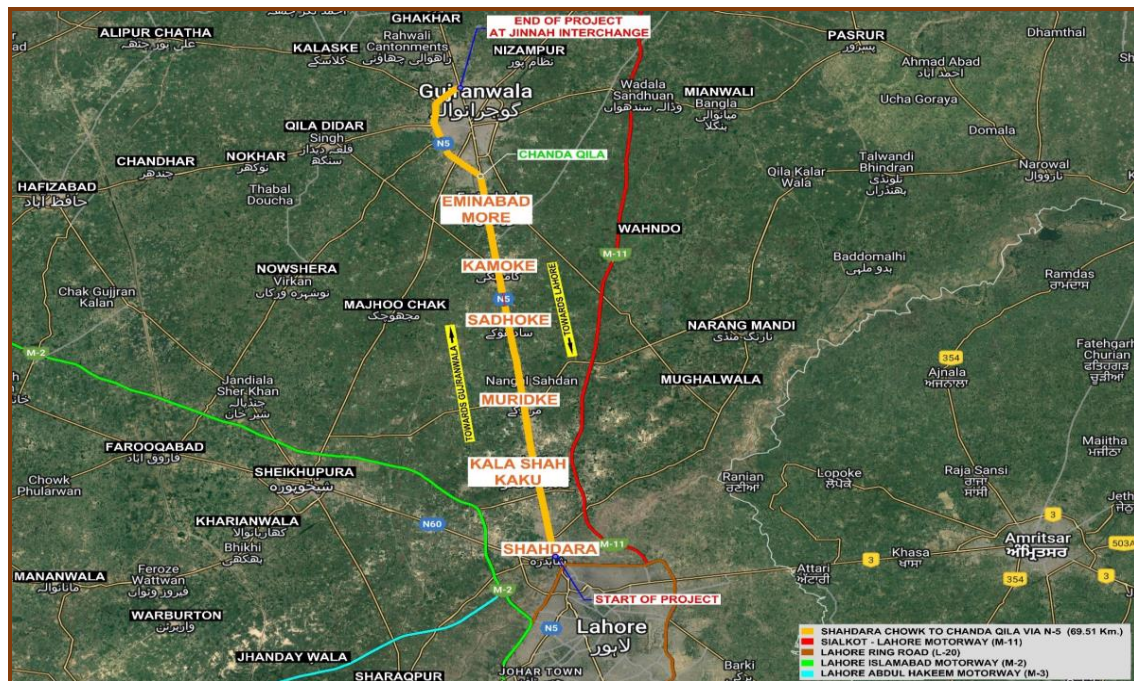


Figure 1-1: Location Map of Project

1.2 Purpose of the Report

EIA is mandatory according to the Punjab Environmental Protection Act (Amended), 2012. Section 12 (1) of the Punjab PEPA (Amended), 2012 states that: “No proponent of a project shall commence construction or operation unless he has filed with the Provincial Agency an initial environmental examination or, where the project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Provincial Agency approval in respect thereof”.

The specific objectives of this environmental assessment can be identified as follows:

- ✚ Collect the baseline data on the physical, biological, and socio-economic conditions of the project area using both primary and secondary sources.
- ✚ Carry out an environmental assessment, including the supporting administrative and legal framework of the proposed interchange infrastructure.
- ✚ Identify mitigation measures for the potential environmental impacts.
- ✚ Propose institutional responsibilities and methods of monitoring the mitigation measures and monitoring procedures.
- ✚ Prepare the Environmental Management and Monitoring Plan

1.3 Identification of Project and Proponent

The proponent of the project is “National Highway Authority (NHA)”; while M/s. Associated Consulting Engineers ACE Limited (ACE) JV with M/S Associated Consultancy Centre ACC (Pvt.) Limited and M/S Global Engineering System Peshawar has been assigned to prepare a complete feasibility of the project; including the preparation of the EIA of the said project to be submitted by them to NHA.

Project Proponent:

National Highway Authority is the proponent for proposed project.

Project Consultant:

M/s. Associated Consulting Engineers Limited (ACE) in JV With M/S Associated Consultancy Centre ACC (Pvt.) Limited and Global Engineering System Peshawar has been awarded to prepare Feasibility Study and detail Design for Widening and Improvement of Lahore- Gujranwala Section of N-5 along with Interchange at Chand da Qila additional third lane on Gujranwala Bypass.

1.4 Project Scope of Work

Project Alignment and its main features / characteristics are as follows

Table 1-1: Project Scope of Work as per TOR

Beginning of the Project (BOP) at Km.	800 m from Shahdara Chowk towards Gujranwala (Km 1267+600 of N-5)
End of Project (EOP) at Km.	End of Gujranwala Bypass at Jinnah Interchange (Km 1335+556 of N-5)
Length	67.956 Km.
Coordinates at BOP	Easting 432552.682 (m), Northing 3499121.375 (m)

Coordinates at EOP	Easting 422167.360 (m), Northing 3563192.010 (m)
Carriageway (Proposed)	❖ Six Lane Dual Carriageway (Three Lanes on Each Side) ❖ Lane Width = 3.65 m ❖ Inner Shoulder = 1.0 m ❖ Outer Shoulder = 2.5m + 0.5m Rounding
Existing Structures	N-5 : Shahdara to Chand-da-Qila ❖ <u>Bridges</u> = 16 Nos. Separate on N/B & S/B at 09 Locations ❖ <u>Flyovers</u> = 02 Nos. Separate on N/B & S/B at 01 Location ❖ <u>Culverts</u> = 81 Nos on N/B & S/B at 42 Locations ❖ <u>Pedestrian Overhead Steel Bridge</u> = 14 Nos. ❖ <u>Pedestrian / Vehicular Underpasses</u> = 13 Nos. Gujranwala Bypass ❖ <u>Bridges</u> = 02 Nos. separate on N/B & S/B at 01 Location ❖ <u>Flyovers</u> = 02 Nos. separate on N/B & S/B at 01 Location ❖ <u>Culverts</u> = 22 Nos on N/B & S/B at 11 Locations ❖ <u>Pedestrian Overhead Steel Bridge</u> = 01 No. Detailed Hydrology and Hydraulic study will be carried out on site to determine the adequacy of existing structures.
Proposed Structures (as per Initial Reconnaissance Site Visit)	N-5 : Shahdara to Chand-da-Qila All the bridges and flyovers are in good condition with minor repair works required except for bridges at Km. 1275+217. The slab and girder reinforcements are exposed and heavily damaged. All the bridges have requisite carriageway width required to cater three lanes in each direction. 19 Nos. existing slab culverts are proposed to be dismantled and replaced with Box culverts. Gujranwala Bypass All the bridges and flyovers are in good condition with minor repair works required. However, for widening / additional lane new structures are to be constructed besides, if possible. 18 Nos. existing slab culverts are proposed to be dismantled and replaced with Box culverts.
ROW on Lhr-Guj	North Bound: 30 – 35 m

Section	South Bound : 45 – 50 m
ROW on Gujranwala Bypass	43 m

1.5 Extent of the EIA Study and Scope of the Study

The present EIA report has been prepared in conformity with the rules and regulations of the Punjab Environment Protection Agency, Government of Punjab, and those guidelines required for the preparation of environmental assessment reports.

The main scope of the EIA study includes :

- ✚ Identifying the baseline condition of the project area.
- ✚ Evaluating the ability of the site because of social acceptance and environmental soundness.
- ✚ Providing maximum information to the proponent and other stakeholders about the existing environmental conditions and the implications of the proposed project.
- ✚ Identification of the potential environmental and social impacts related to the project implementation.
- ✚ Proposing mitigation measures to eliminate or reduce the negative impacts to an acceptable level.
- ✚ Developing well-resourced environmental management and monitoring plans to identify mitigation strategies targeted towards avoidance, minimization, and rehabilitation of the impacts.
- ✚ Preparing Environmental Management and Monitoring Plan to make the part of tender document.

The EIA aims to identify the likely potential impacts, both positive and negative, of the proposed project-related interventions to quantify and, where possible value these so that they can be used in a multi-criteria analysis for rational decision-making by the project authority and policymakers. The overall aim is to ensure that the recommended intervention is carried out in an environmentally sound and sustainable manner and that the EMP recommendations are followed by the project proponent / implementing agency during the project cycle.

1.6 EIA Methodology

The EIA project passes through series of stages prior to report preparation. The EIA process and the approach followed for the proposed project is defined below:

1.6.1 Scoping

Scoping is an early stage of the process and is designed to ensure that the environmental studies provide all the relevant information on:

- ✚ the impacts of the project, in particular focusing on the most important impacts;
- ✚ the alternatives to the project;
- ✚ Other environmental sensitivities to be addressed at early stage.

The EIA process started with the scoping. The purpose of scoping was to identify:

- ✚ the important issues to be considered in an EIA;
- ✚ the appropriate time and space boundaries of the EIA study;
- ✚ the information necessary for decision-making;
- ✚ the significant effects and factors to be studied in detail.

The scoping was followed by data collection describes in subsequent section.

1.6.2 Data Collection

Following literature review and data collection was carried out for EIA:

- ✚ A generic description of the proposed project and its related activities was collected from Associated Consultancy Centre ACC (Pvt.) Limited and Associated Consulting Engineers Limited (ACE)
- ✚ Baseline of the area's environmental and socio-economic settings was collected through literature search and field surveys.

1.6.3 Baseline

The environmental impact is measured through a change in the environment, resulting from a designated action or activity. In order to identify such a change, it is essential to have as complete as practicable understanding of the nature of the existing environment, prior to its interaction with the proposed activity. This translates into the need to characterize the existing baseline environmental conditions, including establishing prevailing conditions for a range of environmental media, particularly air, water, soil and groundwater, flora and fauna and the human environment. This was achieved through a detailed review of all secondary resources (i.e. existing documentation and literature); and the undertaking of project specific baseline studies and surveys to collect supplementary data in the following areas:

- ✚ Geology;

- ✚ Flora and fauna;
- ✚ Water quality characteristics;
- ✚ Soil quality;
- ✚ Traffic;
- ✚ Ambient air quality;
- ✚ Noise conditions;
- ✚ Socio-economic conditions;
- ✚ Archaeology.

Both the existing secondary sources and literature studies were conducted and integrated into one coherent description of baseline characteristics.

1.6.4 Stakeholder Consultation

Communities along the project area were consulted during the fieldwork to record their concerns and suggestions.

1.6.5 Evaluation of Alternatives

To establish an environmentally sound preferred option for achieving the objectives of the proposed project, different alternatives including site selection, raw material and technology alternatives were studied in collaboration with the project proponent. Technology selection was made taking in to consideration environmentally, economically and socially suitable as well as technically feasible options.

1.6.6 Impact Assessment and Mitigation

The information collected in the previous phases was used to assess the potential environmental impacts of the proposed project activities.. Detailed methodology is included in Chapter 8 of the report. Mitigation measures were evaluated to reduce the impacts of project activities on environment. The issues studied during impact assessment include potential impacts on:

- ✚ Physical environment of the area
- ✚ Biological environment of the area
- ✚ Socio-economic environment of the area

2 SCREENING OF PROJECT

2.1 Screening

According to the Punjab Environmental Protection (Amendment) Act 2012 and its interpretation as per the Review of IEE & EIA Regulations, 2022 for filing, review, and approval of environmental assessments, the present project is categorized under Schedule II. Regulation 4 states that "A proponent of the project falling in any category specified in schedule II shall file an EIA". The following projects relating to the transport sector fall in Schedule II:

The " Feasibility Study and Detail Design of Widening and Improvement of Lahore Gujranwala Section of N-5 along with interchange at Chand-da-Qila and additional third lane on Gujranwala Bypass." has been carried out by M/s Associated Consulting Engineers Limited (ACE) in a joint venture with M/s. Associated Consultancy Centre ACC (Pvt.) Limited and Global Engineering System Peshawar, The total investment amount of the project is Rs.46.193-billion.

According to the Punjab Environmental Protection Review of IEE & EIA Regulations, 2022, an EIA study is mandatory to be submitted to EPA Punjab and get its approval under section 12 of the Punjab Environmental protection Act (Amendment) 2012. as prescribed by the Federal Environmental Protection Agency (Pak-EPA), Government of Pakistan

3 SCOPING OF PROJECT

The scoping identifies the key issues and impacts that should be further investigated. The Scoping defines the spatial and temporal boundaries, important issues and concerns raised during consultation and significant impact factors to be determined.

3.1 Spatial And Temporal Boundaries of Environmental Assessment

The project takes off 800 meters from Shahdara Chowk (Km. 1267+600 of N-5) near Lahore city and ends at Gujranwala Bypass (also known as Jinnah Interchange at Km. 1335+556 of N-5) near Gulshan Aziz Colony. Approximate length of the project is 68 km. The project also envisages the design of grade separated intersection at Chand-da-Qila (Start point of Gujranwala Bypass at Km. 1320+300). Presently, three legged at-grade roundabout is operational at Chand-da-Qila causing traffic congestion during peak hours and is problematic especially for long vehicles. The alignment traverses through various urban centers / towns such as Shahdara, Kala Shah Kaku, Muridke, Sadhoke, Kamoke, Eminabad More and subsequently Gujranwala City.

The spatial temporal boundaries are given in the below map in **Error! Reference source not found..**

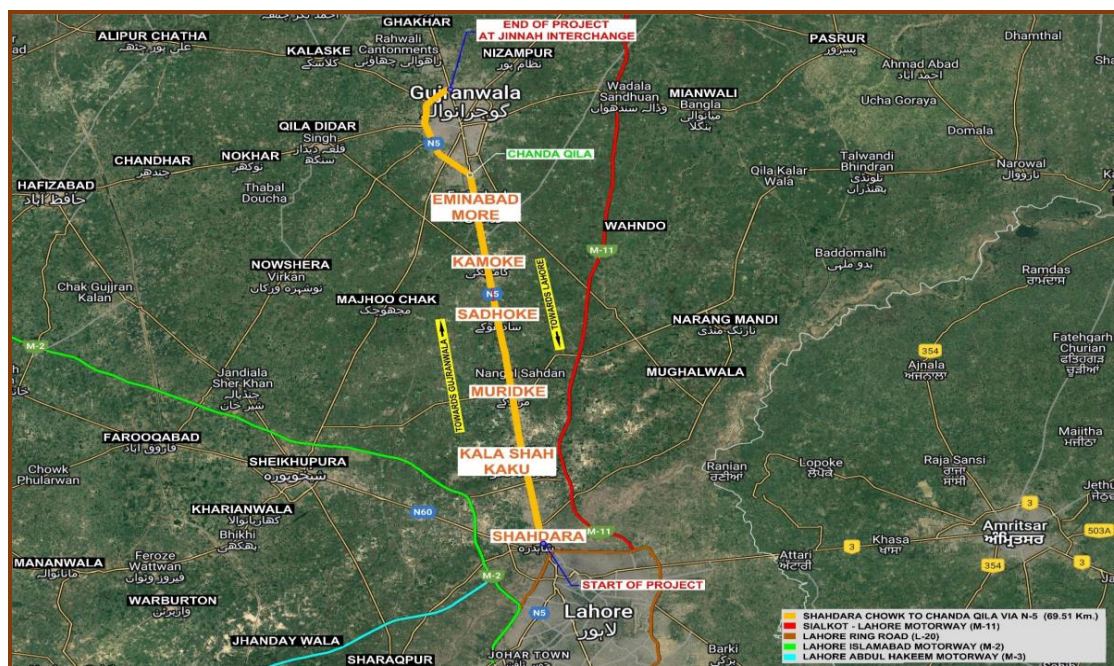


Figure 3-1: Spatial and Temporal Boundaries of the Project

3.2 Important Issues And Concerns Raised During Consultation

The consultation and scoping meeting were carried out in the project area to disseminate information about the project and its expected impact on the primary and secondary stakeholders. Several relevant stakeholders were consulted regarding the

proposed project activities during different interviews and discussions. Detailed information about the stakeholder concerns raised during the consultation are provided in chapter 10.

3.3 Significant Impacts And Factors To Be Determined

Considered during EIA Study, it was unanimously agreed by almost all the consultation participants that the Widening and Improvement of Lahore Gujranwala Section of N-5 is necessary for smooth and safe traffic flow. However, the major and significant impacts will be raised during construction phase of the project are air pollution, noise pollution traffic congestion, road accidents due to heavy machinery. All the participants are concerned that the Environmental Impacts and their mitigations should be addressed during the EIA study.

3.4 Approach To Work

The study is based on both primary and secondary data and information. The primary data includes data collected from field observations and secondary data includes a review of relevant information from Government Departments. Discussions were held with stakeholders including government officials, community representatives, and a wide range of road users and roadside dwellers. The main purpose of this approach was to obtain a fair impression of the people's perceptions of the project and its environmental impacts.

3.5 Methodology

3.5.1 Strategy Planning for Data Collection

After getting a clear overview of the project, a comprehensive data was formulated to develop the EIA report. The plan identifies the various data requirements of the projects and delineates the sources from where they will be obtained.

3.5.2 Field Data Collection

A team of experts visited the project locations to collect the area-specific primary data. Where required, the secondary data was also collected by the experts through the perusal of previously published literature and web research related to the project area. The following activities were carried out for data collection:

-  Site Reconnaissance Surveys
-  Analysis of Maps and Plans
-  Literature Review and Desk Research
-  Public Consultations and Focused group discussions

-  Field Observation and Site studies
-  Monitoring and Laboratory Analysis

3.5.3 Review of Secondary Data

Previous environmental and social soundness assessment for the North Punjab region and other published and unpublished information was collected to gain a complete understanding of existing environmental conditions of the area including:

- **Physical Environment:** topography, geology, soils, surface and groundwater resources, and climate;
- **Biological Environment:** habitat types, flora and fauna (particularly rare or endangered species), critical habitats/zones, and vegetation communities within the project area;
- **Socio-economic Environment:** settlements, socio-economic conditions, infrastructure, and land use.
- **Heritage Aspects:** sites of cultural, archaeological, or historical significance.

3.5.4 Two Stage Consultations

For this EIA study, two-stage consultation was carried out through one on one meetings. First stage consultation was limited to local government functionaries, affected persons, and local communities were consulted. The objective of the consultation was to assess the long-term as well as short-term impacts of the new development of the proposed project at an early stage. In the second stage consultations will be carried out through public participation if required.

3.5.5 Identification & Assessment of Impacts and Recommendations for Mitigation

Potential impacts arising from the construction as well as operational activities of the proposed project were identified. These include the effects of the activities on the physical, biological, socio-economic, archaeological, and cultural environments of the area. Impacts were identified and assessed based on field data, secondary data, and expert opinion. Mitigation measures were identified to help, prevent or minimize all potential adverse environmental impacts from the proposed project activities. The proposed mitigation measures are based on the sensitivity and behavior of environmental receptors within the project area.

3.5.6 Development of an Environmental Management Plan (EMP)

An EMP for the proposed project activities was prepared. The EMP provides a framework for implementing and managing the mitigation and monitoring measures recommended in the EIA. The EMP includes the following:

- ✚ Mitigation and monitoring plan.
- ✚ Definition of roles and responsibilities of the proponent, contractors, and monitoring teams.
- ✚ Requirements for communication, documentation, and training during the project.
- ✚ Restrictions on design, timing, and conduct of the project.
- ✚ Change Management Plan to cover unforeseen events/environmental conditions during the project.

3.6 EIA Report Structure

This document is part of the complete environmental Impact assessment as described by Environmental Protection Department (EPD) Punjab and EPA Pakistan.

The structure of the report is as follows

Executive Summary: Containing brief description of the report

Introduction: Containing general information about the project and process of carrying out the study.

Screening of Project: Describe the Legal framework of project whether it falls in EIA/IEE.

Scoping of the project: Identifies the key issues and impacts that should be further investigated

Alternative Analysis: Study alternatives will be considered that best suit the purpose and need for the Project.

Project Description: Describes an overall detail of the works to be done pertaining to the proposed project.

Description of the Environment: Gives information on Physical, Biological and Social conditions collected through survey of the Project Area.

Impacts Assessment: Identifies various environmental impacts and their preventive actions. This makes the basis of the Environment Management Plan.

Screening of Potential Impacts and mitigation Measure: This section identifies the potential impacts and their mitigation measures for proposed project

Environment Management Plan (EMP): Contains comprehensive prescriptions regarding environmental impacts and their mitigation measures. This also includes institutional arrangements and Environmental Management & Monitoring Plan.

Stakeholders Consultations: Explains the process of public consultation and disclosure of the project in related stakeholder. It makes this document a legal public document.

Grievance Redress Mechanism : this chapter enlightens the roles and responsibility of the GRC committee.

Conclusion and Recommendation: Concludes the EIA report with some practical recommendation

3.7 Incorporation Of Safeguards Documents In Contract Documents

The proposed EMP forms part of the Request for Proposals package/ Bid Documents and its compliance is mandatory. The contractor will be required to prepare site-specific plans as stipulated in Environmental Mitigation and Monitoring Plan. These site-specific plans will then be embedded into the civil works contracts and therefore will be legally binding on the contractor. The site-specific plans must be submitted to the Project Director/Project Engineer for review and clearance within 30 days of the signing of the contract or before mobilization on-site, whichever date is earlier.

4 ALTERNATIVES ANALYSIS

Study alternatives will be considered that best suit the purpose and need for the Project. Potential alternatives include:

1. No Project Option;
2. Using Alternative New Alignment;
3. Widening and improvement of existing Grand Trunk (GT) Road from Shahdara To Gujranwala .

4.1 NO PROJECT OPTION / WORST SCENARIO OPTION

A no-project or no-development scenario in which road development/improvement project is not executed. With the “no-project” option, existing levels of service and safety deficiencies in the project area will worsen as automobile and truck traffic volumes continue to increase and would make industrial and socio-economic development impossible or unaffordably expensive. This will negatively impact the nation’s economy that is highly dependent on good road network especially the accident prone N-5 section of the existing Lahore – Gujranwala Road. This scenario is therefore rejected as it would prevent meeting the state’s growing transport needs.

Strengths and Opportunities

If the project is not taken up at all then all the funds, efforts, and inconvenience will be saved and these will become available for diversion to other projects. No disturbance will be caused to any physical, biological, or social part of the environment. The people benefiting from a status quo will continue benefiting.

Weaknesses and Threats

Not taking up the project would mean withholding the development of the entire area along the extended area of the project in the whole of Lahore, Sheikhpura and Gujranwala. This would also mean restricting the trade opportunities between areas connected by road. The existing road, due to neglect does not meet national standards, and keeping it as such means declining to open the door of opportunity for better social uplift through education and poverty alleviation. Further, the recurring cost of the construction of the road will be increased along with enhanced operational costs. The project would provide greater job prospects to people during construction as well as the operational phase. Not taking up the project would mean depriving the local people of a blessing of a whole lot of new opportunities.

Conclusion

The “No project option” reveals the withholding of development activities in the entire area, trade limitations, and degradation of economic activities, therefore not recommended.

4.2 ALTERNATIVE ALIGNMENTS

Alternative alignment options would be prohibitively expensive and more disruptive, and could lead to loss of revenues from diverted traffic. This involves the adoption of an entirely new alignment that will by pass Sheikhpura ending up at the Gujranwala. This will be relatively more expensive in that it will be a totally new road which will also involve the construction of link roads to Sheikhpura and Gujranwala. It would also entail very high costs for property acquisition and compensation claims, loss of employment, a decreased tax base, and reduced access. This alternative is not acceptable as it would be prohibitively expensive.

4.3 WIDENING AND IMPROVEMENT OF EXISTING GARND TRUNK (GT) ROAD FROM SHAHDARA TO GUJRWALA .

The Preferred Alternative – widening and Improvement of Shahdara to Gujranwala Bypass road project alignment is a solution to the transportation needs in the project Corridor. It is identified based on a thorough analysis of its transportation performance and potential environmental impact in meeting the purpose and need of the proposed road project. Given this analysis, the Preferred Alternative is compared to the other alternative as follows:

- 📌 Environmental impacts of the Preferred Alternative within the Corridor are considered to be preventable, or able to be mitigated;
- 📌 Opportunities for enhancement of existing environmental conditions can be achieved through sound design practices; and
- 📌 The investments in the Preferred Alternative provides a balanced system of roadway and demand management strategies, which are expected to provide a reasonable long-term solution to the needs for personal, socio-economic activities, and freight mobility, safety, and improved traffic flow within the study area.

The main reasons for widening and improvement of existing the road are: (a) to increase access of the combined urban and rural populations to social services and business locations, resulting in overall improved quality of living; and (b) to boost regional commerce In addition, the Preferred Alternative accommodates potential

future planning for expanded managed lanes in the Corridor. The Preferred Alternative will improve the Shahdara, Kala Shah Kaku, Muridke, Sadhoke Kamoki and Gujranwala Corridor to an acceptable level. The construction of the road will also support the economic and social development of the project area. Thus, developmental opportunities, such as easy movement of motorists and commercial goods, creation of new jobs, and reduced vehicle operating costs, etc. would be enhanced. Although certain construction activities would have negative impacts, the socio-economic benefits to Lahore, Sheikhpura, Gujranwala and the country far outweigh any potential concern. This alternative is acceptable.

Table 4-1: Comparative Analysis of Silent Features Of Alternatives

ALTERNATIVES	ENVIRONMENTAL IMPACTS	SOCIAL IMPACTS	ECONOMIC IMPACTS
NO PROJECT OPTION	➤ Increase in air (including dust & noise pollution because of traffic congestion on the road. ➤ Higher emission of CO, NO_x, SO_x, PM₁₀, PM_{2.5} & oxidants ➤ Limited changes in existing ecology & biodiversity	➤ Lack of efficient transport system & road condition ➤ Traffic congestion & Hazards ➤ Health impacts due to air & noise pollution caused by increase in traffic on existing road. ➤ Lack of additional employment opportunities	➤ The road is designed to handle increased traffic load which will cause traffic congestions & deteriorate road conditions which would impact trade between the different districts.
ALTERNATE ROUTE OPTION	➤ Significant impacts on local ecology, hydrology, Agriculture, biodiversity, & environment. ➤ Increase in Noise & air pollution during construction phase	➤ Significant resettlement & acquisition issues ➤ Labor influx issues	➤ High resettlement costs ➤ Alternate route will be available for new developments.
PROJECT AS PROPOSED	➤ Minimum landscape transformation ➤ Minor impacts on local ecology, flora, fauna, and hydrology Increase in Noise and air pollution during construction phase	➤ Almost negligible land acquisition ➤ Reduction in road accidents and improves road safety ➤ Shifting of utilities lines, especially the electric transmission lines ➤ Labor influx issues	➤ Travel time reduced significantly ➤ High initial investment costs ➤ Provides development ➤ Better jobs and employment opportunities

5 DESCRIPTION OF THE PROJECT

5.1 Type And Category of The Project

According to the Punjab Environmental Protection (Amendment) Act 2012 and its interpretation as per the Review of IEE & EIA Regulations, 2022 for filing, review, and approval of environmental assessments, the present project is categorized under Schedule II. Regulation 4 states that “A proponent of the project falling in any category specified in schedule II shall file an EIA”. The following projects relating to the transport sector fall in Schedule II

This Environment Impact Assessment (EIA) has been prepared for National Highway Authority (NHA) by M/S Associated Consulting Engineers (ACE) in a joint venture with M/S Associated Consultancy Centre (Pvt.) Ltd. and Global Engineering System Peshawar, to address the environmental impacts of the proposed project. This study covers the impacts of the Widening and Improvement of Lahore Gujranwala Section of N-5 along with interchange at Chand-da-Qila and additional third lane on Gujranwala Bypass. This report has been prepared to meet compliance with environmental regulations and requirements under Punjab Environmental Protection Act (amendment) 2012.

5.2 Project Objectives

The objectives of the project are:

- ✚ The construction of proposed road will provide a better road facility for inhabitants of area.
- ✚ This section is intended to provide safer, quicker and more efficient passage between Lahore and Gujranwala.
- ✚ After addition of third lane on Gujranwala Bypass and improvement of existing lanes throughout the project length, smooth traffic flow will be possible. Problem of traffic blockage and congestion in will also be mitigated.
- ✚ The prime objective of the proposed Project is to facilitate safe and quick movement of people and goods transport, by providing better access to enhance the efficiency of the existing road network. Moreover, other social benefits resulting from the project include increase in employment opportunities and reduction of travelling cost between farms and commercial markets.
- ✚ It will reduce roadside accidents.
- ✚ Vehicle operating cost will be reduced.

5.3 Project Details

The project takes off 800 meters from Shahdara Chowk (Km. 1267+600 of N-5) near Lahore city and ends at Gujranwala Bypass (also known as Jinnah Interchange at Km.

1335+556 of N-5) near Gulshan Aziz Colony. Approximate length of the project is 68 km. The project also envisages the design of grade separated intersection at Chand-da-Qila (Start point of Gujranwala Bypass at Km. 1320+300). Presently, three legged at-grade roundabout is operational at Chand-da-Qila causing traffic congestion during peak hours and is problematic especially for long vehicles. The alignment traverses through various urban centers / towns such as Shahdara, Kala Shah Kaku, Muridke, Sadhoke, Kamoke, Eminabad More and subsequently Gujranwala City.

The alignment can be categorized as following :

Lahore Gujranwala Section of N - 5

- ❖ From Km 1267+600 to Km. 1320+300
- ❖ Length is 52.70 Km.
- ❖ 6-Lane Dual Carriageway (3 Lanes on Each Side)

Gujranwala Bypass, N-5

- ❖ From Km. 1320+300 to Km. 1335+556
- ❖ Length is 15.26 Km.
- ❖ 4-Lane Dual Carriageway (2 Lanes on Each Side)

Shahdara Chowk Project

Lahore Development Authority (LDA) has launched a mega project for construction of multi-level grade separated intersection over Shahdara Chowk. The layout plan has been acquired and is provided in following figure. It has been informed that proposed flyover over G.T. Road (N-5) will terminate 800 meters from the Shahdara Chowk towards Gujranwala. The project is awarded to M/s NLC and mobilization of the Contractor is in progress.

5.3.1 Major Locations along the Alignment

The alignment traverses through following major cities at these approximate locations

- | | | | |
|---|-------------------|---|-----------------------------|
| ❖ | Shahdara | : | BOP – Km. 1272+600 |
| ❖ | Ferozewala | : | Km. 1272+600 – Km. 1275+200 |
| ❖ | Kala Shah Kaku | : | Km. 1275+200 – Km. 1284+400 |
| ❖ | Muridke | : | Km. 1284+400 – Km. 1296+800 |
| ❖ | Sadhoke | : | Km. 1296+800 – Km. 1299+700 |
| ❖ | Kamoke | : | Km. 1299+700 – Km. 1310+000 |
| ❖ | Eminabad More | : | Km. 1310+000 – Km. 1316+600 |
| ❖ | Chand – da – Qila | : | Km. 1316+600 – Km. 1320+300 |
| ❖ | Gujranwala Bypass | : | Km. 1320+300 – EOP |

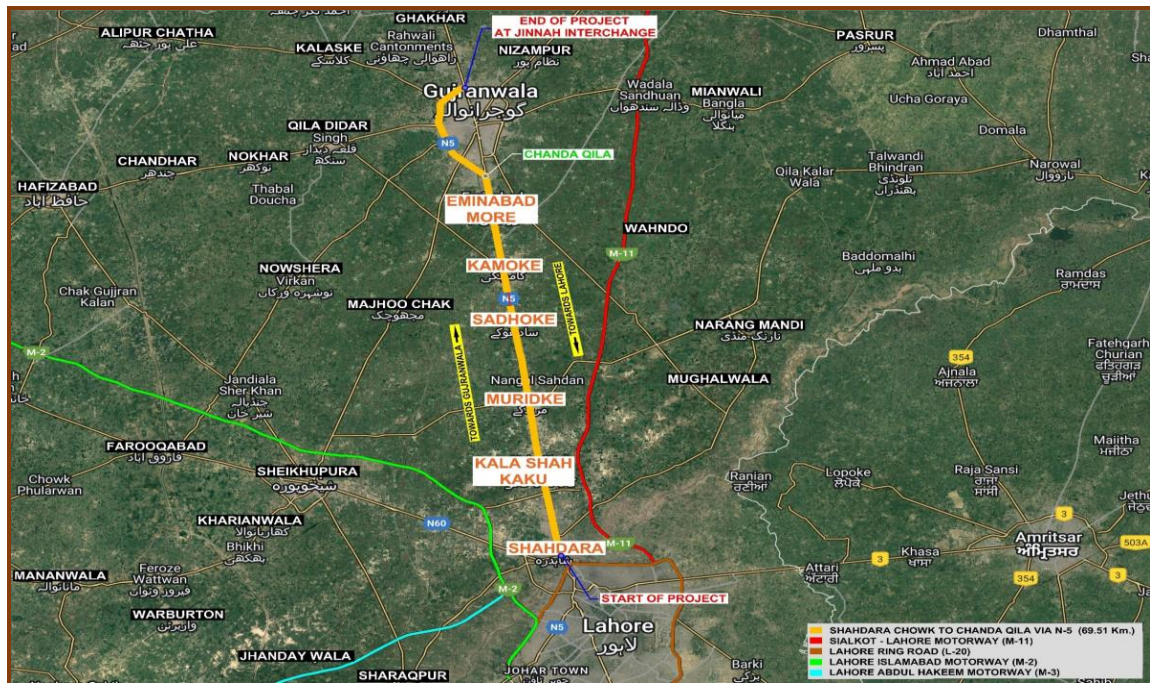


Figure 5-1: Location of Proposed Project

The current condition of the highway is shown in the following pictures :



START POINT OF THE PROJECT AT SHAHDARA CHOWK (KM. 1267+600)



**KALA SHAH KAKU TOLL PLAZA
(KM. 1275+050)**



**ROAD CROSS SECTION AT
KM. 1269+000**



**MURIDKE BUILT-UP AREA
(KM. 1286+000)**



**PEDESTRIAN OVERHEAD CROSSING
NEAR SADHOKE (KM. 1299+000)**



KAMOKE BUILT-UP AREA (KM. 1305+000)



EMINABAD BUILT-UP AREA (KM. 1315+000)



**CHAND-DA-QILA ROUNDABOUT
(KM. 1320+300)**



**GUJRANWALA BYPASS START POINT
(KM. 1320+300)**

5.4 Project Components

The Consultancy Work includes but not limited to the Planning, Detailed Surveys / Studies, Traffic and Pavement Design, Hydrology and Hydraulic Studies, Geo-technical and Soil Investigation, EIA Study, Detailed Engineering Design, Preparation of Estimates, Tender Documents, Implementation Programme.

5.5 Detailed Main Features of Alignment

Project Alignment and its main features / characteristics are as follows :

Beginning of the Project (BOP) at Km.	800 m from Shahdara Chowk towards Gujranwala (Km 1267+600 of N-5)
End of Project (EOP) at Km.	End of Gujranwala Bypass at Jinnah Interchange (Km 1335+556 of N-5)
Length	67.956 Km.
Coordinates at BOP	Easting 432552.682 (m), Northing 3499121.375 (m)
Coordinates at EOP	Easting 422167.360 (m), Northing 3563192.010 (m)
Carriageway (Proposed)	❖ Six Lane Dual Carriageway (Three Lanes on Each Side) ❖ Lane Width = 3.65 m ❖ Inner Shoulder = 1.0 m ❖ Outer Shoulder = 2.5m + 0.5m Rounding
Existing Structures	N-5 : Shahdara to Chand-da-Qila ❖ <u>Bridges</u> = 16 Nos. Separate on N/B & S/B at 09 Locations ❖ <u>Flyovers</u> = 02 Nos. Separate on N/B & S/B at 01 Location ❖ <u>Culverts</u> = 81 Nos on N/B & S/B at 42 Locations ❖ <u>Pedestrian Overhead Steel Bridge</u> = 14 Nos. ❖ <u>Pedestrian / Vehicular Underpasses</u> = 13 Nos. Gujranwala Bypass ❖ <u>Bridges</u> = 02 Nos. separate on N/B & S/B at 01 Location ❖ <u>Flyovers</u> = 02 Nos. separate on N/B & S/B at 01 Location ❖ <u>Culverts</u> = 22 Nos on N/B & S/B at 11 Locations ❖ <u>Pedestrian Overhead Steel Bridge</u> = 01 No. Detailed Hydrology and Hydraulic study will be carried out on site to determine the adequacy of existing structures.
Proposed Structures (as per Initial Reconnaissance Site Visit)	N-5 : Shahdara to Chand-da-Qila All the bridges and flyovers are in good condition with minor repair works required except for bridges at Km. 1275+217. The slab and girder reinforcements are exposed and heavily damaged. All the bridges have requisite carriageway width required to cater three lanes in each direction. 19 Nos. existing slab culverts are proposed to be dismantled and replaced with Box culverts. Gujranwala Bypass All the bridges and flyovers are in good condition with minor repair works required.

	However, for widening / additional lane new structures are to be constructed besides, if possible. 18 Nos. existing slab culverts are proposed to be dismantled and replaced with Box culverts.
ROW on Lhr-Guj Section	North Bound: 30 – 35 m South Bound : 45 – 50 m
ROW on Gujranwala Bypass	43 m

5.5.1 Adopted Geometric Design Criteria

Geometric Design includes all the visible dimensions of a highway facility, controlling the following elements of design :

(A) Horizontal Alignment :

- (i) Minimum Radius of Curvature (or Maximum Degree of Curve)
- (ii) Minimum Length of Tangent between Curves (Reverse or Compound Curves)
- (iii) Horizontal Sight Distance

(B) Vertical Alignment :

- (i) Minimum Gradient
- (ii) Maximum Length of Control Gradient
- (iii) Length of Parabolic Curves at Crests to obtain Minimum Stopping and passing Sight Distance
- (iv) Length of Parabolic Curves at Sags

(C) Cross Section :

- (i) Width and Crown of Pavement
- (ii) Width and Slope of Shoulders
- (iii) Minimum Depth and Standard Width of Side Ditches
- (iv) Slope of Cut Banks
- (v) Slope of Embankments
- (vi) Amount of Pavement Superelevation
- (vii) Horizontal Sight Distance

The different elements of Geometric Design are dealt in brief as follows :

5.5.2 Design Speed

Design speed can be defined as the maximum speed at which highway vehicles, operated by average drivers, can travel over a certain sector of highway, operating freely under normal traffic flows and under normal conditions, including wet weather, with a reasonable degree of safety.

The selection of a proper design speed is the first important step in the development of a balanced design, since many of the major standards of design are dictated by this selection.

Geometric Design Criteria	Plain Terrain
• Design Speed Kph (Plain)	100
• Horizontal Curvature :	
❖ Maximum Super Elevation	6%
• Cross Slope :	
❖ Pavement	2%
❖ Shoulders	4%
❖ Stopping Sight Distance (Min.)	> 185 m
❖ Passing Sight Distance (Min.)	> 320 m
• Gradient :	
❖ Maximum	3%
❖ Minimum	0.3% in Fill and 0.5% in Cut
• Design Life :	10 Years

5.6 Acquisition of Land

For Lahore – Gujranwala Section till Chand-da-Qila, the carriageway width including shoulders and existing service roads falls within NHA ROW. The carriageway width on one side is 10.95 meters with 2.5 – 3.0 meters outer shoulder and 0.6 meters inner shoulder. Width of existing service roads varies from 5 – 7 meters. Comparing to available NHA ROW, there will no additional land required for the sections where only widening of shoulders and service roads is required. However, in sections where protected U-turns are to be provided, land acquisition will be involved.

For Gujranwala Bypass, the existing carriageway width on one side is 7.30 meters with 2.5 – 3.0 meters outer shoulder and 0.6 meter inner shoulder. Keeping in view, the available ROW, land acquisition will not be required for sections where only widening of road is proposed by addition of one lane.

However, there is an existing 4-Lane flyover at Gujranwala Bypass over Sheikhpura Road. No space is available for additional lane on flyover. One lane having width of 6.5

m is running in parallel with flyover on both sides. For widening of road or provision of additional structure, extensive acquisition of urban / built – up area along with substantial building compensation cost shall be inevitable. Moreover, there are no existing service roads on bypass. To provide service road and protected U – Turns, land acquisition will be required. **Land acquisition for Re-modelling of Chan-da-Qila is also required.**

5.7 Location of the Project

The project takes off 800 meters from Shahdara Chowk (Km. 1267+600 of N-5) near Lahore city and ends at Gujranwala Bypass (also known as Jinnah Interchange at Km. 1335+556 of N-5) near Gulshan Aziz Colony. Approximate length of the project is 68 km. The project also envisages the design of grade separated intersection at Chand-da-Qila (Start point of Gujranwala Bypass at Km. 1320+300). Presently, three legged at-grade roundabout is operational at Chand-da-Qila causing traffic congestion during peak hours and is problematic especially for long vehicles. The alignment traverses through various urban centers / towns such as Shahdara, Kala Shah Kaku, Muridke, Sadhoke, Kamoke, Eminabad More and subsequently Gujranwala City.

5.8 Vegetation Features Of The Site

The proposed project are over the existing road network N-5. Land of the proposed area is surrounded by local infrastructures, build-up area and existing road area. However, the proposed project is within the right of way and not acquiring any further land.

5.9 Cost of Project

Tentative Engineer's Cost Estimate has been prepared based on Rates of NHA CSR 2022 District Gujranwala. Detailed Cost Estimates are provided below:

Table 5-1: : Estimated Breakup Cost of Proposed Project

BILL NO.	DESCRIPTION	TOTAL AMOUNT (Rs.)
1.	Earth Work & Allied Activities	320,580,483
2.	Subbase and Base Course	13,852,285,273
3.	Surfacing and Pavement	5,094,264,921
4.	Structures (Flyover, Bridges, Underpass, Culverts, Pedestrian Bridges)	5,737,017,735
5.	Drainage & Erosion Works	5,218,060,611
6.	Ancillary Works	604,874,776
7.	Engineer's & Client Facilities	124,871,945
(A)	TOTAL CONSTRUCTION COST (RS.)	30,951,955,744
(B)	Land Acquisition and Building Compensation (Rs.) =	12,155,873,087
(C)	Removal and Relocation of Utilities (Rs.) =	774,310,000

(D)	Detail Design and Construction Supervision @ 1.5% of (A) (Rs.) =	464,279,336
(E)	Physical Contingencies @ 2% of (A) (Rs.) =	619,039,115
(F)	Price Escalation for 2nd Year @ 6.5% (from Bill No. 1 to 6) (Rs.) =	1,202,256,268
(G)	Environment Protection And Mitigation Charges (Rs.) =	25,000,000
GRAND TOTAL AMOUNT (A + B + C + D + E + F + G) (Rs.)		46,192,713,550

Financial Cost includes all the costs of the project while economic costs include all costs excluding the land acquisition cost.

Table 5-2: Cost of Construction (Rs Million)

Alternative	Net Present Value Rs. Million	Benefit / Cost Ratio	Internal Rate of Return
Gujranwala Bypass (15.26 Km.)	5,875	1.77	21.0%
Lahore – Gujranwala (52.70 Km.)	20,752	2.01	23.4%

5.10 Project Implementation Schedule

The construction of the proposed project is expected to be completed within a time period of 24 months. The construction of the proposed project will be executed after receiving of all relevant NOCs.

Table 5-3 Schedule of Implementation

Project Component	2023	2024				2025		
	Q1	Q1	Q2	Q3	Q4	Q1	Q2	Q3
<i>Urban Development Project</i>								
Design Review and Approval of PC-1								
Bidding & Selection of Constructor								
Mobilization of Contractor								
Construction Supervision								
Landscaping								
Completion of Project								

5.11 Proposed Cross-Section of the Project

The Proposed Typical Cross Section complies with the TOR is shown in Figure 5-2 to Figure 5-4.

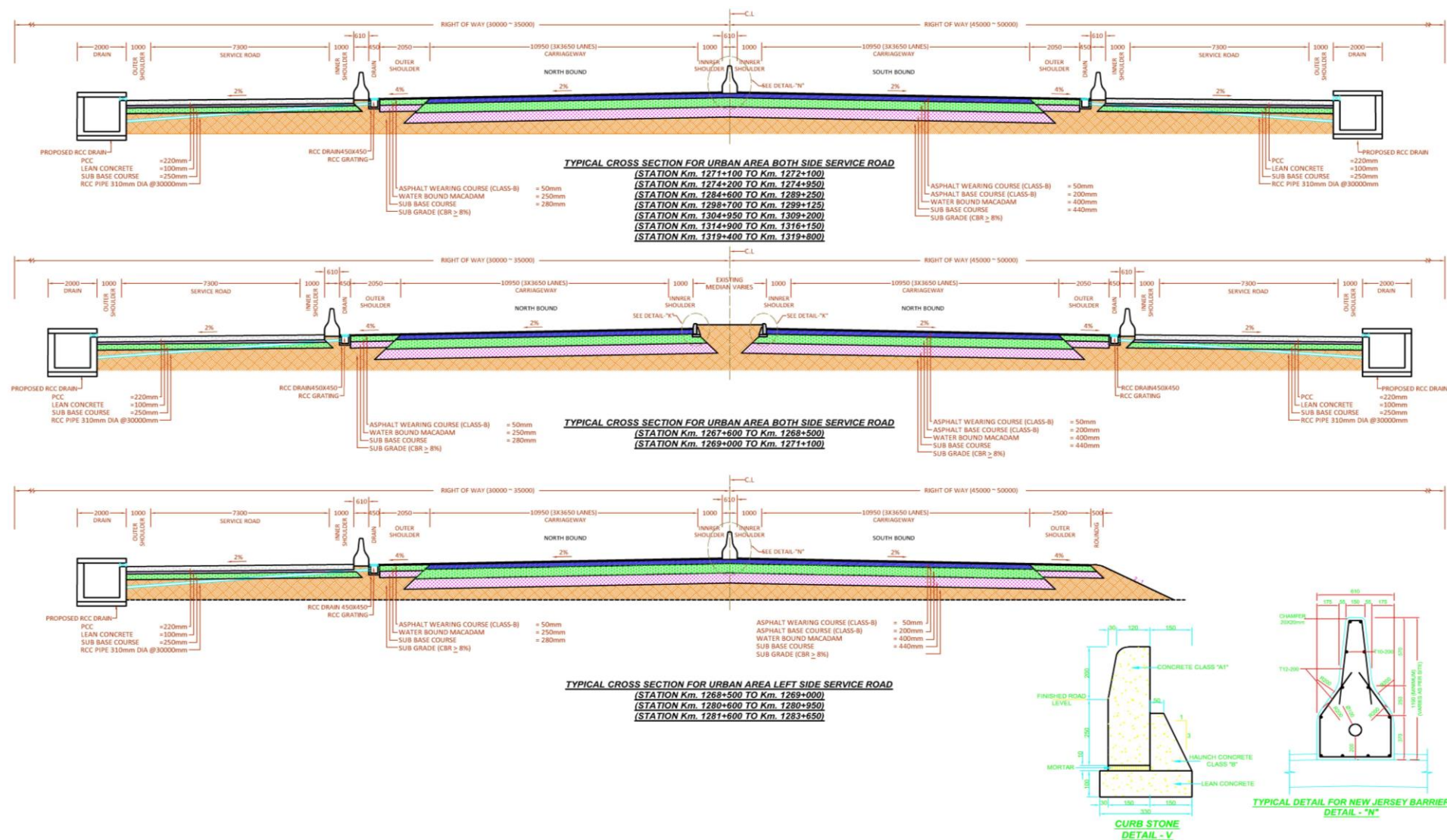


Figure 5-2 Proposed Typical Cross Sections for Shahdara to Gujranwala Chan-Da-Qila

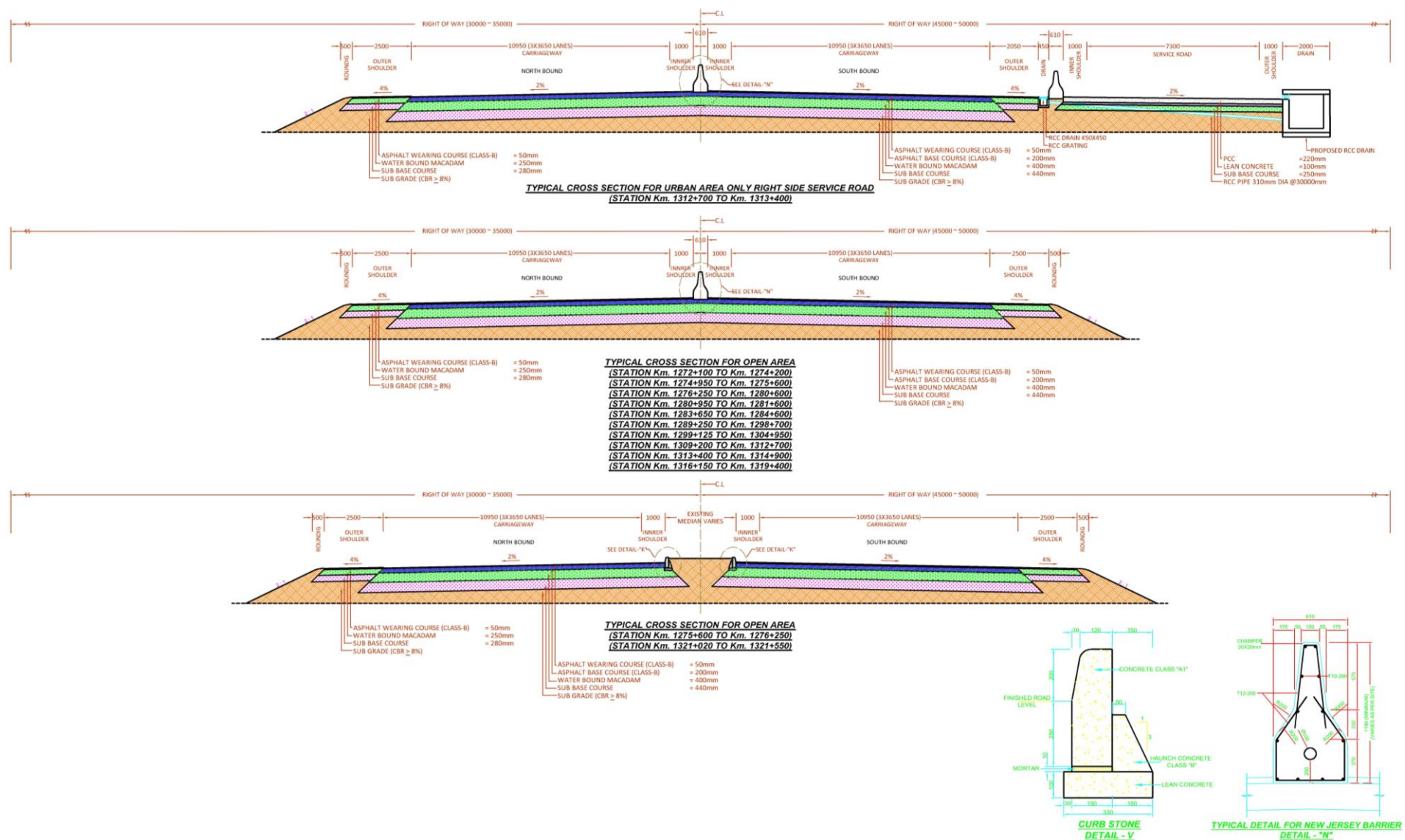


Figure – 5-3 : Proposed Typical Cross Sections for Shahdara to Gujranwala Chan-Da-Qila

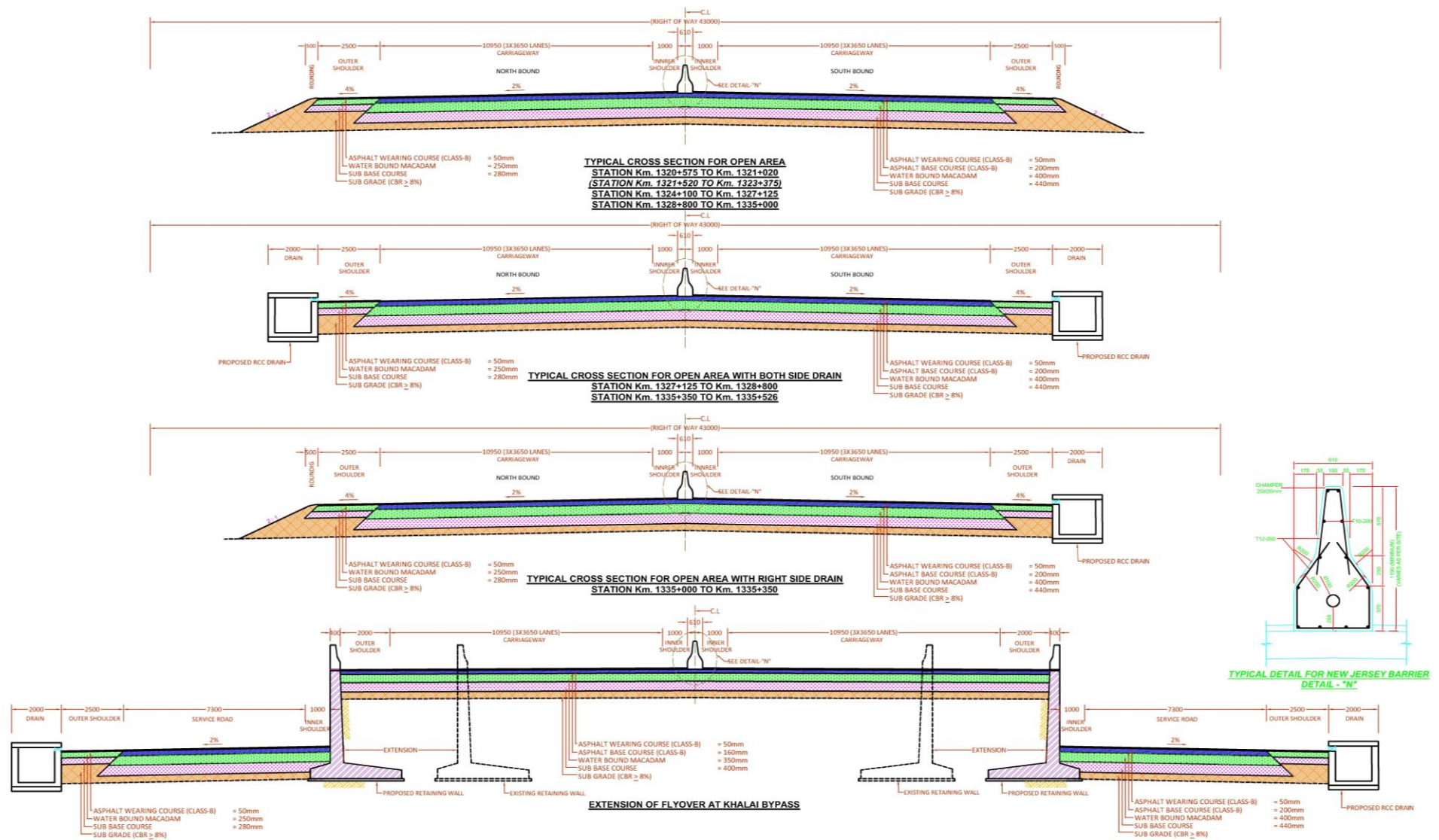


Figure – 5-4 : Proposed Typical Cross Sections for Gujranwala Bypass

5.11.1 Structure Design Standards

The design criteria adopted are in accordance with the recommendations of the National Highway Authority and the following design standards and policies have been adopted.

Table 5-4: Design Standards

Sr. #	Description	Design Code/Standard
1	Geometric Design	American Association of State Highway and Transportation Officials (AASHTO): A policy on Geometric Design of Highways and Streets (Latest Edition)
2	Analysis and Design of Structures	AASHTO - LRFD current edition, ASTM, ACI Code, Pakistan Highway Code of Practice for Bridges 1967 WPHC-67, UBC/IBC 2003 and Seismic Zone Mapping of Pakistan
3	Pavement Design	ASSHTO Guide for Design of Pavement Structures (1193) and TRL Overseas Road Note 31 (1993) for the design of pavements.
4	Drainage Design	Highway Drainage Guidelines By AASHTO (Latest version)
5	Roadside Design	AASHTO Road Side Design (Latest version)
6	Lighting	Roadway lighting design guide by AASHTO (latest version)
7	Design of Traffic Control Devices, Work Zone Safety, and preparation of Maintenance & Protection of	As per the latest published version of "Manual of Uniform Traffic Control Devices (MUTD)" by FHWAUSA
8	Testing and Specifications of Material	ASTM, AASHTO, NHA General Specifications, etc
9	Capacity Analysis and Level of Service Analysis	Highway Capacity Manual by the United States Transportation Research Board (2000) or the latest
10	Engineer's Estimate	As per the Prevailing CSR of NHA
11	Bidding Documents	As per requirement of Pakistan Engineering Council & NHA

5.11.2 Geometric Design Of Project

The geometric design of the project will be carried out in accordance with the AASHTO Policy on Geometric Design of Highways and Streets (latest version). The following details will be adopted during the geometric design:

- ✚ Plans and profiles at scales 1/1000 (H) and 1/200 (V) will be prepared for the project and service roads showing reference lines, edge lines, setting out data, curve radius, and data, gradients, ground, and finished levels, cross falls, superelevation application, and locations of crossing facilities such as bridges, underpasses, tunnels, culverts, and other structures.
- ✚ A Traverse plan (at an appropriate scale) showing the location, setting out, and levels of all traverse points and control stations will be prepared.
- ✚ Computer-generated horizontal and vertical geometric data sufficient for setting out and for all geometric calculations will be prepared.
- ✚ Typical cross sections of widening of road, and service roads, including earthwork slopes and pavement details will be prepared.
- ✚ Details layout of junction areas, intersections, and any other areas of complex three-dimensional geometry with sufficient information for setting out will be prepared.
- ✚ Typical details of intersections, recovery lanes, areas of lanes widening, merging lanes, superelevation application, and any other information necessary for setting out will be generated
- ✚ Expropriation plans (scale 1:2000) showing the limits of road work, and ROW will be prepared and marked on the drawings.
- ✚ Guardrail and fencing plans (1:1000 scale) showing the location, type, and terminal details of all proposed guardrails, New Jersey barriers, fencing, and right-of-way monuments will be prepared.

5.11.3 Design Standards & Criteria for Highway Structures

- ✚ American Association of State Highway and Transportation Officials (AASHTO): A Policy on Geometric Design of Highways and Streets (1995) for Geometric Design;
- ✚ Highway Capacity Manual, by the United States Transportation Research Board for the analysis of roadway capacity;
- ✚ AASHTO: Guide for Design of Pavement Structures (1993) and TRL Overseas Road Note 31 (1993) for the design of pavements; and
- ✚ The design criteria adopted are in accordance with the recommendations of the National Highway Authority and the following design standards and policies have been adopted :

✚ Pakistan Highway Code of Practice for Bridges & ASTM for the analysis and design of structures.

5.12 Traffic Survey Analysis

Traffic Data Collection and projections thereof of traffic volumes are basic requirements for planning of road development and management schemes. Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help identify critical flow time periods, determine the influence of large vehicles on vehicular traffic flow, vehicle hourly patterns, document traffic volume trends and annual traffic estimates. The length of the sampling period depends on the type of count being taken and the intended use of the data recorded.

The subject Traffic Study Report is intended to provide necessary input data for determination the magnitude and pattern of the traffic load for the project road. This involves collection, verification and analysis of the traffic data. From the collected data, the projected traffic for the design life is calculated and converted into Equivalent Standard Axle Loads (ESAL) for the structural design of pavement.

M/s ACC have conducted detailed traffic survey at locations finalized after detail discussion with NHA, please refer our Letter No. ACE/TESD/JB202/1467 dated March 16, 2023.

5.12.1 Purpose Of Traffic Analysis

The primary objective for this traffic survey is to determine the current traffic plying from Lahore to Gujranwala Section of N – 5 and Gujranwala Bypass to evaluate the existing traffic pattern, and an estimate of future traffic statistics including calculation of traffic ESALs and capacity analysis.

5.13 Scope and Methodology

The traffic study comprises of following main tasks:

- i. Classified Traffic counts
- ii. Origin and Destination Survey
- iii. Estimation of Growth Factors
- iv. Estimation of Projected volumes
- v. Capacity Analysis
- vi. Calculation of ESALs

5.13.1 Classified Traffic Counts

Traffic Counts have been carried out manually using traffic enumerators. Chief enumerator was stationed to overall review the quality of the traffic surveys. A detailed traffic survey has been carried out at the following locations during March – 2023.

Table 5-5:Traffic Counts Location

Sr.#	Location	Period
1	Gujranwala Lahore Bypass (N – 5), L – 1	7 Days (24 Hrs) Traffic Count
2	Chan Da Qilla (N – 5), L – 2	7 Days (24 Hrs) Traffic Count i/c 07 days OD Survey
3	Gujranwala – Kamonke (N – 5), L – 3	4 Days (24 Hrs) Traffic Count i/c 04 days OD Survey
4	Muridke - Kala Shah Kaku (N – 5), L – 4	3 Days (24 Hrs) Traffic Count i/c 03 days OD Survey
5	Kala Shah Kaku - Shahdara (N – 5), L – 5	7 Days (24 Hrs) Traffic Count

The traffic survey was stratified by vehicle type. The table lists the vehicle types counted during the traffic study:

Table 5-6: Traffic Survey Vehicle Types

Fast Moving Vehicles			
Sr.#	Vehicle Type	Sr.#	Vehicle Type
1	Motor Cycle/Rickshaw	7	Truck 2. Axle
2	Car/Taxi/jeep	8	Truck 3. Axle
3	Mini Bus	9	Truck 4. Axle
4	Large Bus	10	Truck 5
5	Pickup / Van	11	Truck 6 Axle
6	Mini Truck	12	Tractor Trolley

The location map of traffic count stations is provided in the Figure below:

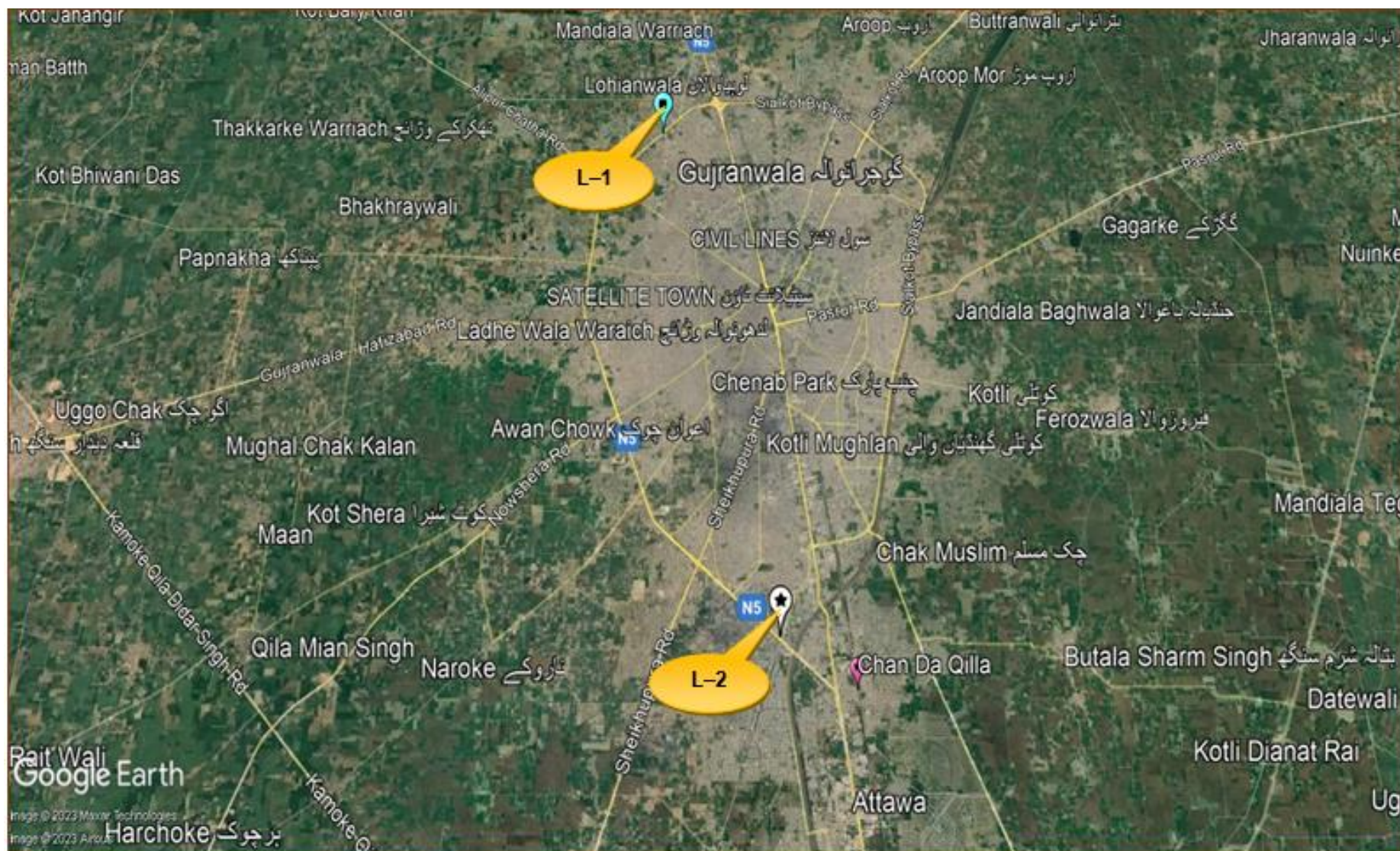


Figure – 5.5 : Location of Traffic Count Stations (L-1 & L-2)



Figure – 5.6 : Traffic Count Station (L-1) on Project Alignment

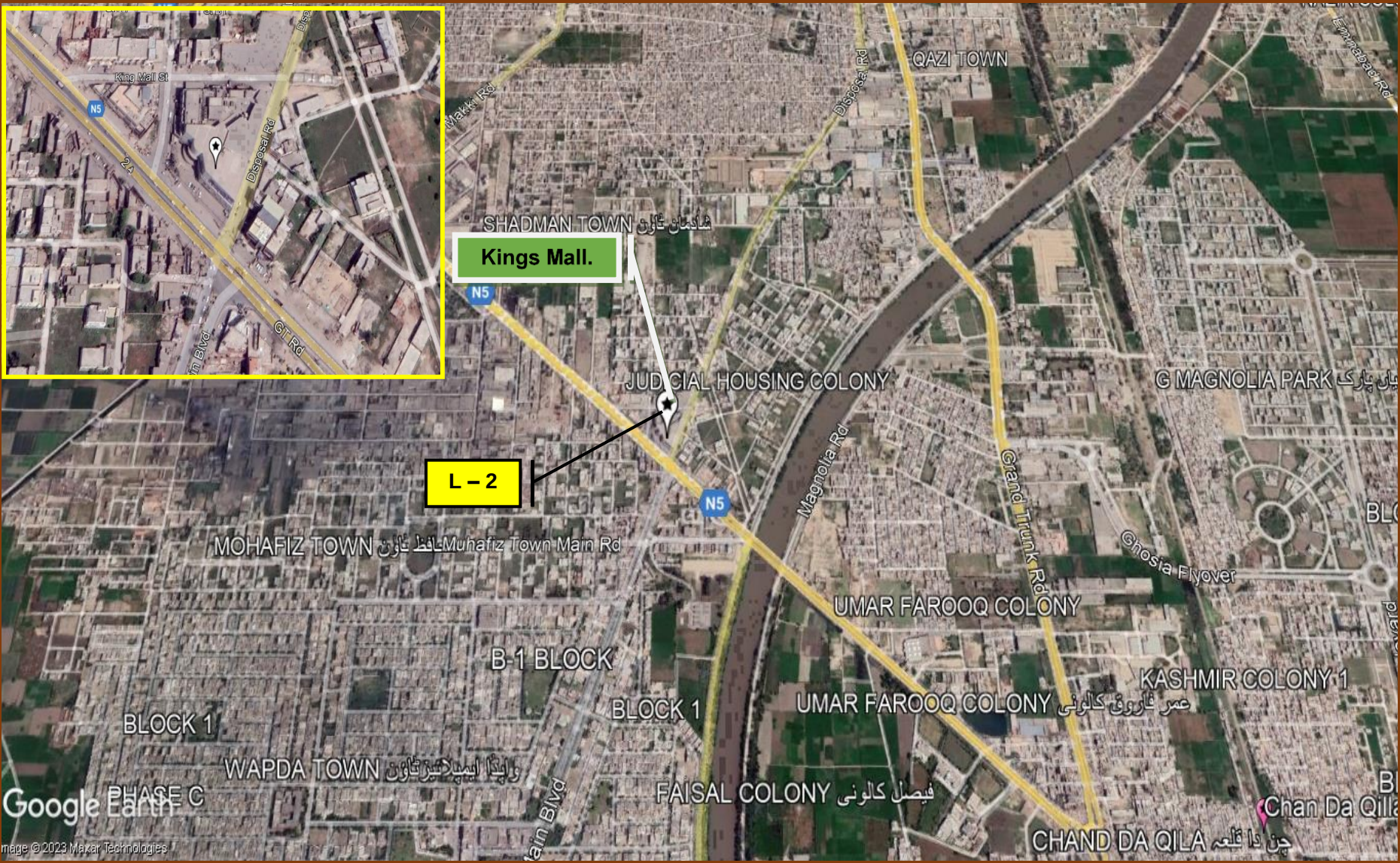


Figure – 5.7 : Traffic Count Station (L-2) on Project Alignment



Figure – 5.8 : Location Map of Traffic Count Station (L-3)

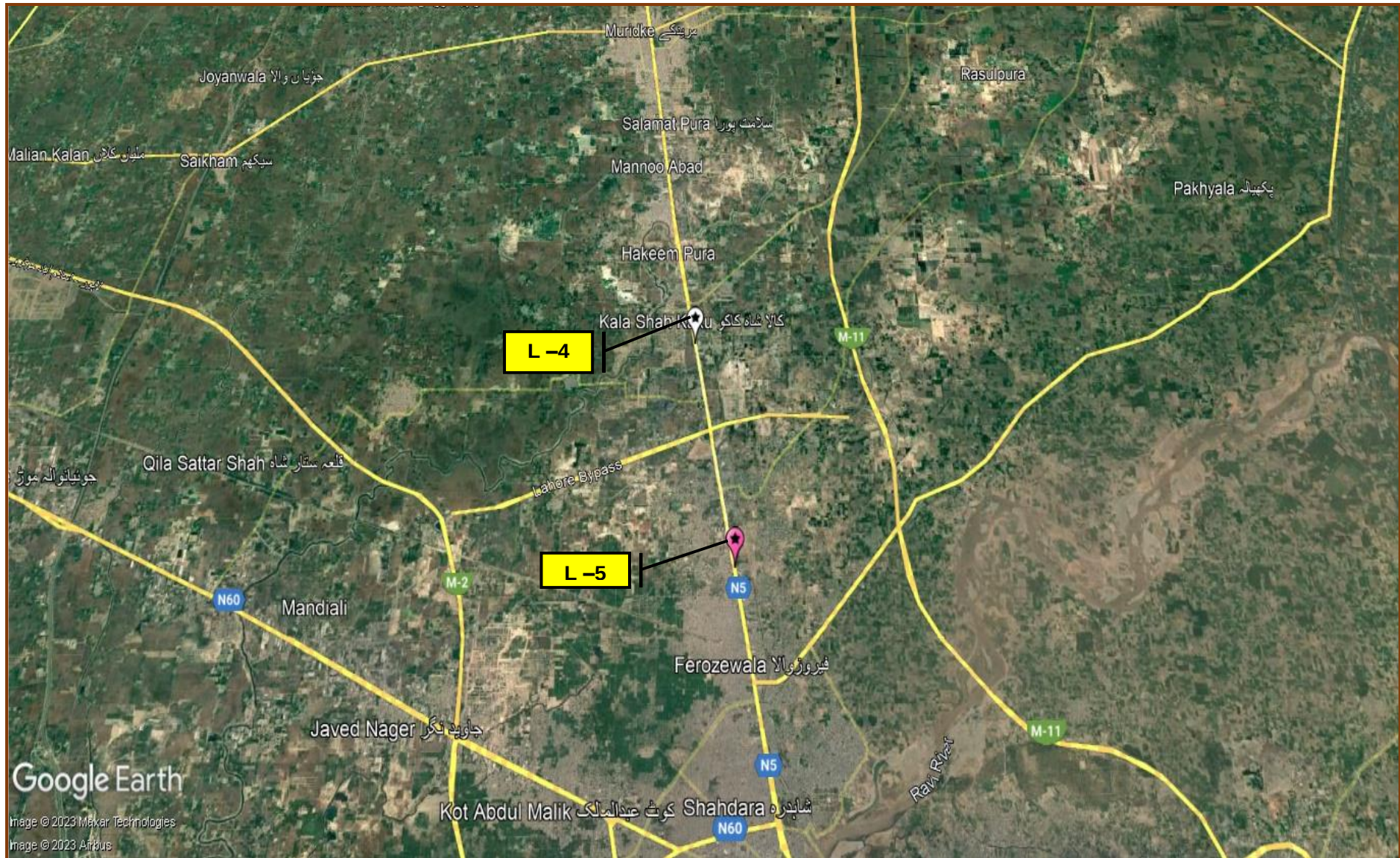


Figure – 5.9 : Location Map of Traffic Count Stations (L-4 & L-5)

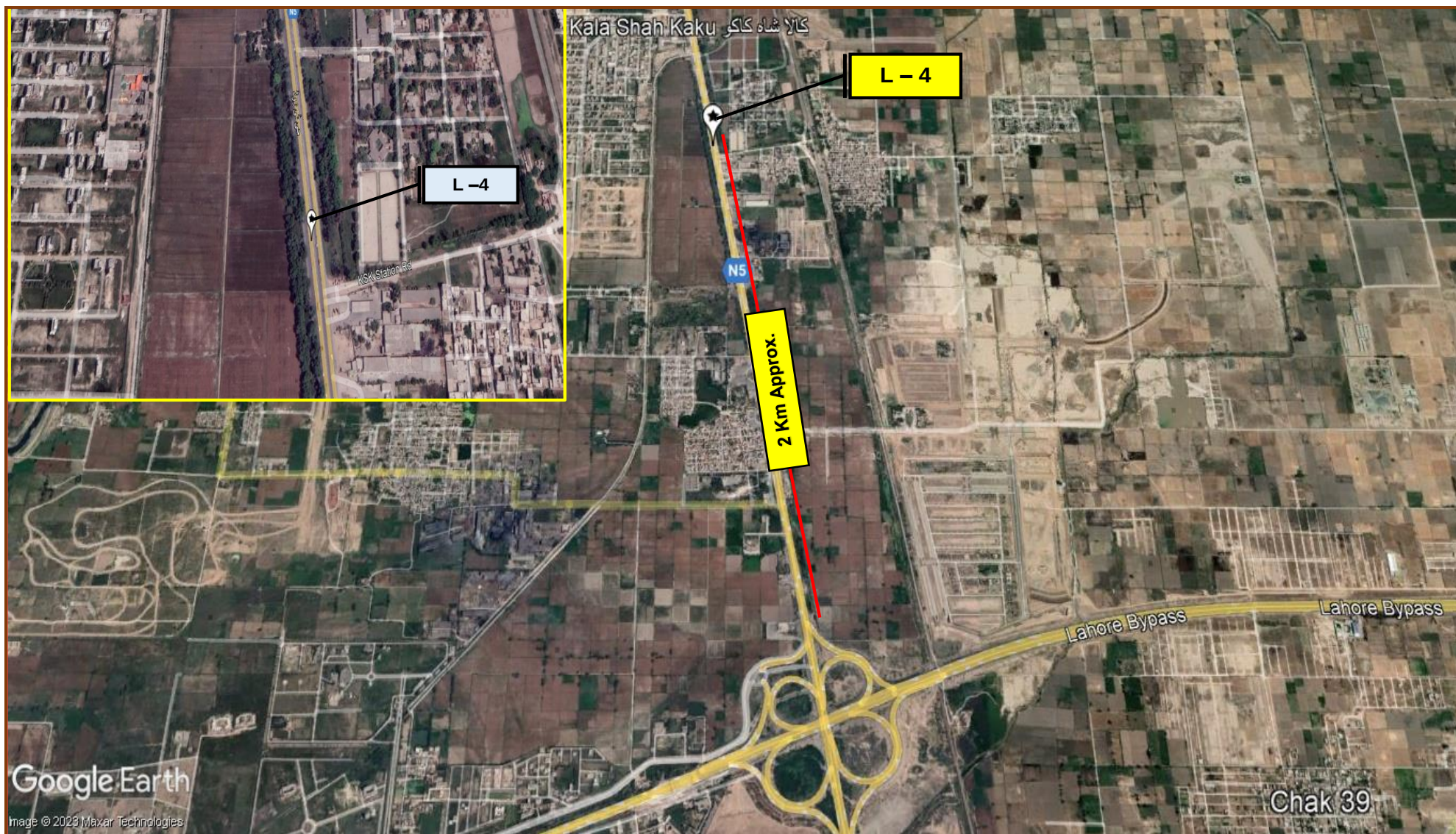


Figure – 5.10 : Traffic Count Station (L-4) on Project Alignment



Figure – 5.11 : Traffic Count Station (L-5) on Project Alignment

Pictorial view of the traffic counts and OD survey is as follows:

TRAFFIC COUNT & OD SURVEY PHOTOGRAPHS



17 March 2023



18 March 2023



19 March 2023



20 March 2023



21 March 2023



22 March 2023



23 March 2023



24 March 2023



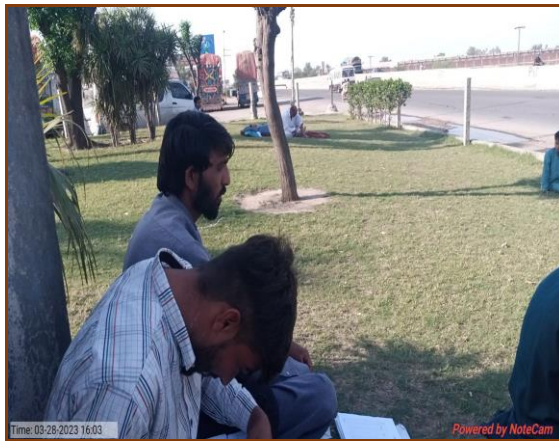
25 March 2023



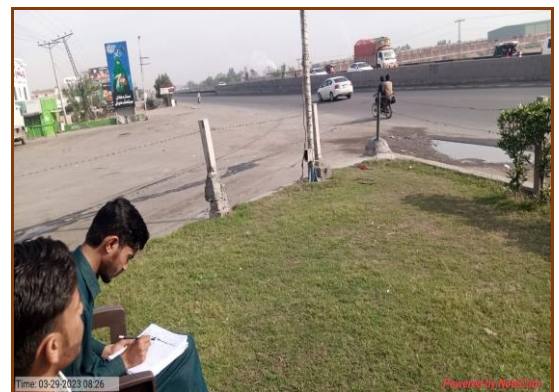
26 March 2023



27 March 2023



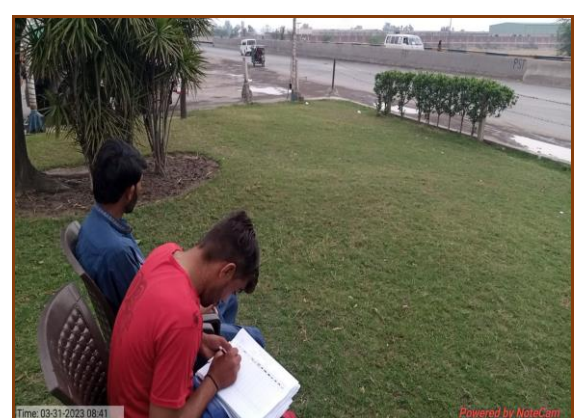
28 March 2023



29 March 2023



30 March 2023

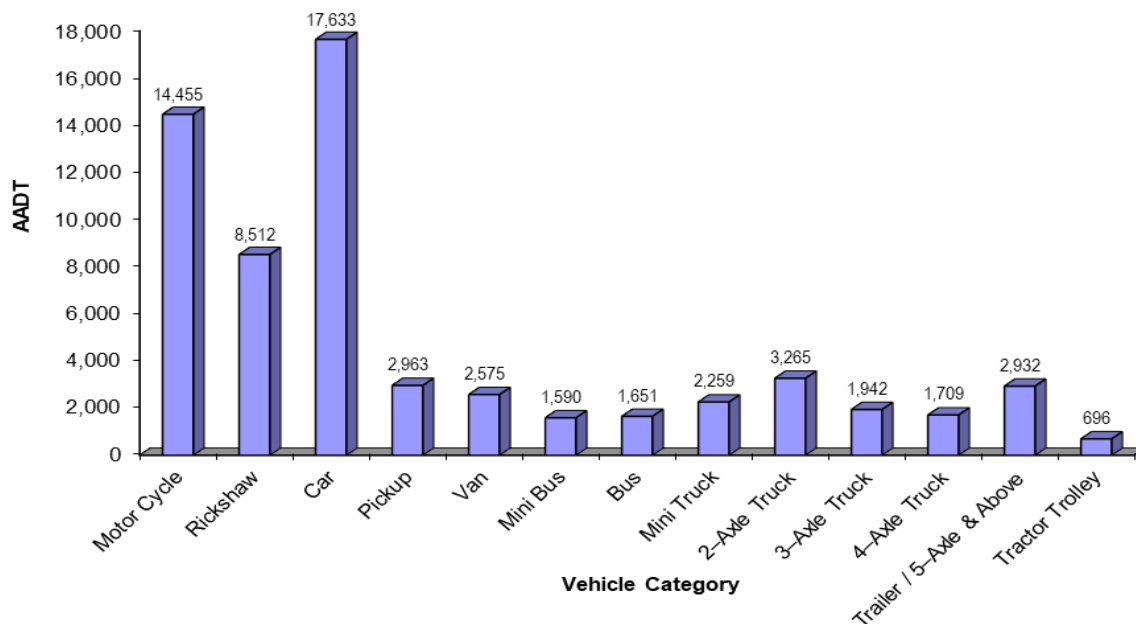


31 March 2023

5.14 Detail of Traffic Count

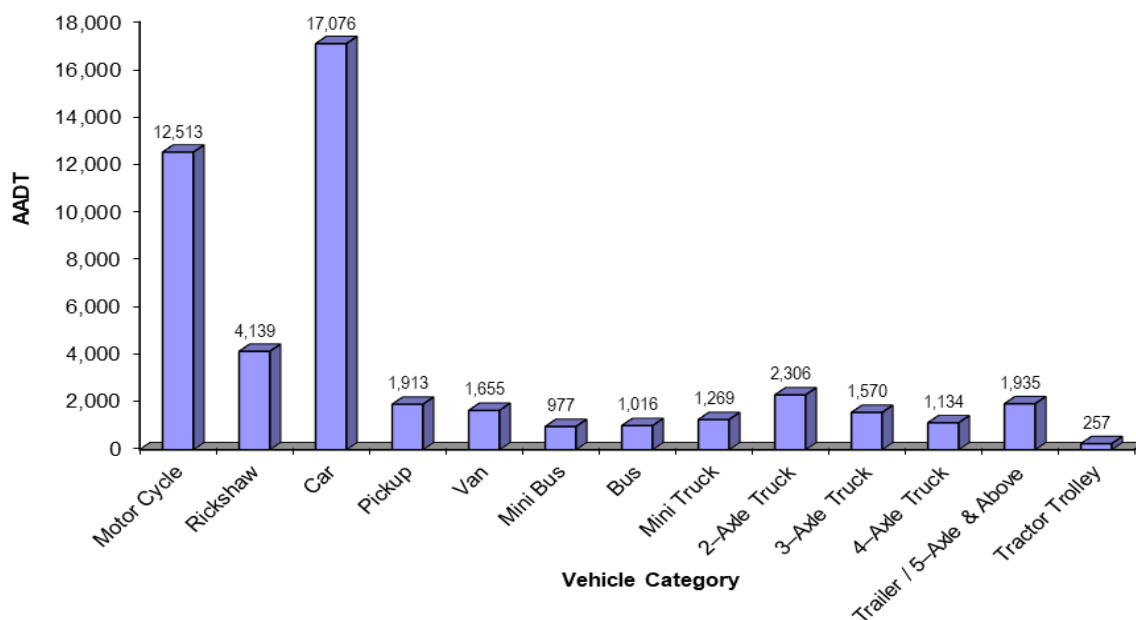
5.14.1 Average Annual Daily Traffic (AADT) @ L-1

Traffic counts were carried out in the month of **March 2023** for seven days (7 x 24 hrs.) in order to check the volume of traffic plying on **Lahore – Gujranwala Section of N-5**. Types of Vehicles surveyed included Car, Jeep, Passenger Buses and Multi Axle Trucks. The traffic counts were conducted for both directions at L-1. The value of AADT at this Section is **62,184 vpd**.



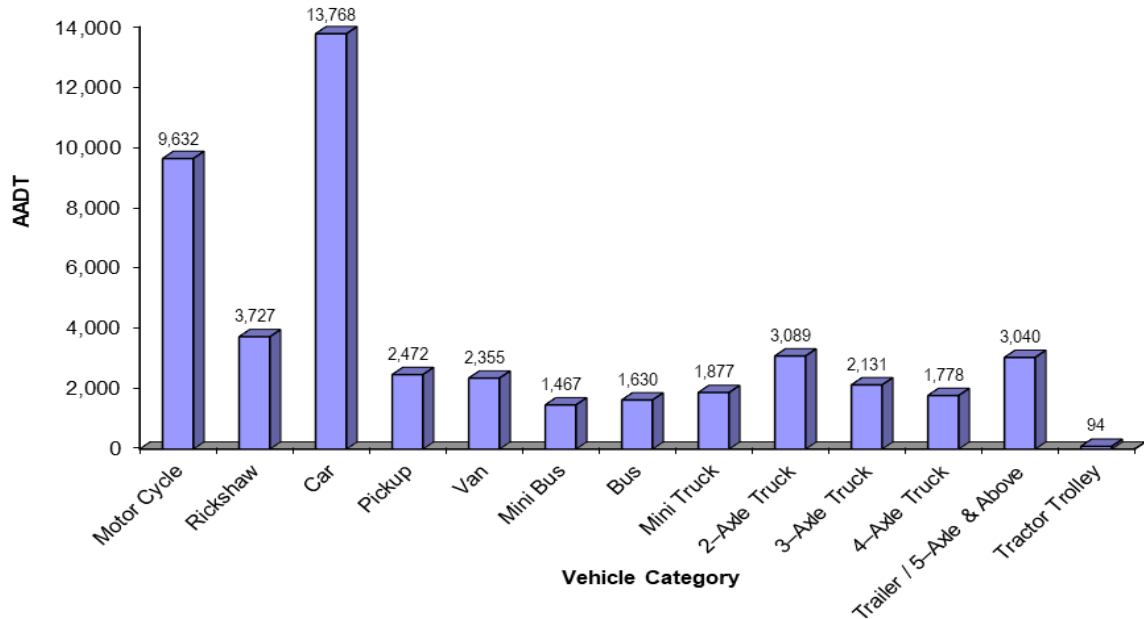
5.14.2 Average Annual Daily Traffic (AADT) @ L-2

Traffic counts were carried out in the month of **March 2023** for seven days (7 x 24 hrs.) in order to check the volume of traffic plying on **Lahore – Gujranwala Section of N-5**. Types of Vehicles surveyed included Car, Jeep, Passenger Buses and Multi Axle Trucks. The traffic counts were conducted for both directions at L-2. The value of AADT at this Section is **47,761 vpd**.



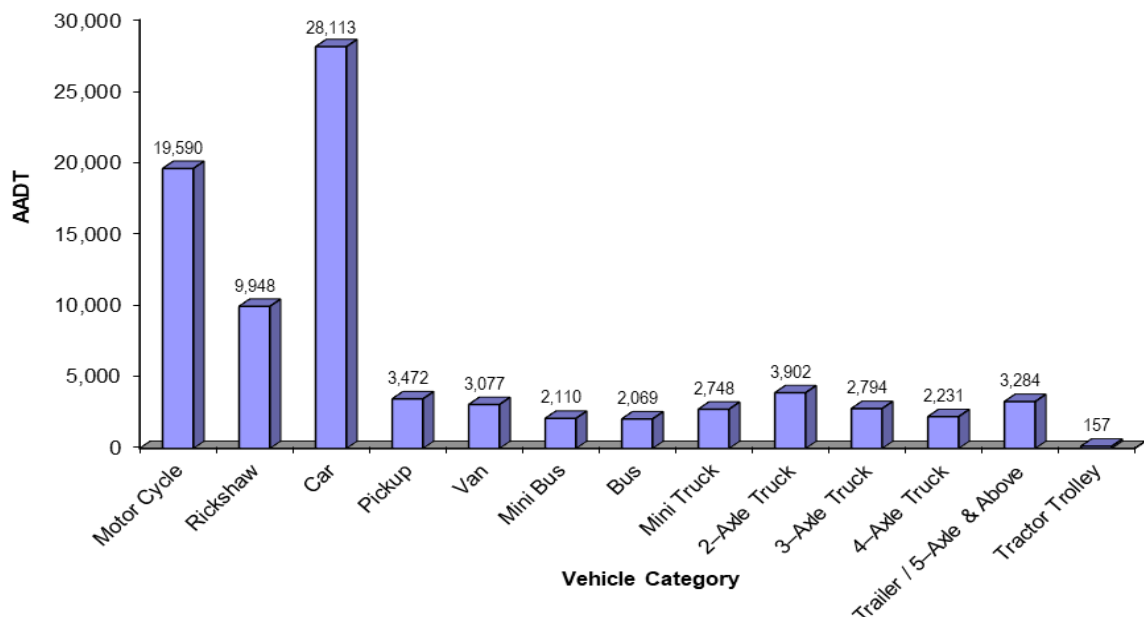
5.14.3 Average Annual Daily Traffic (AADT) @ L-3

Traffic counts were carried out in the month of **March 2023** for seven days (7 x 24 hrs.) in order to check the volume of traffic plying on **Lahore – Gujranwala Section of N-5.** Types of Vehicles surveyed included Car, Jeep, Passenger Buses and Multi Axle Trucks. The traffic counts were conducted for both directions at L-3. The value of AADT at this Section is **47,060 vpd.**



5.14.4 Average Annual Daily Traffic (AADT) @ L-4

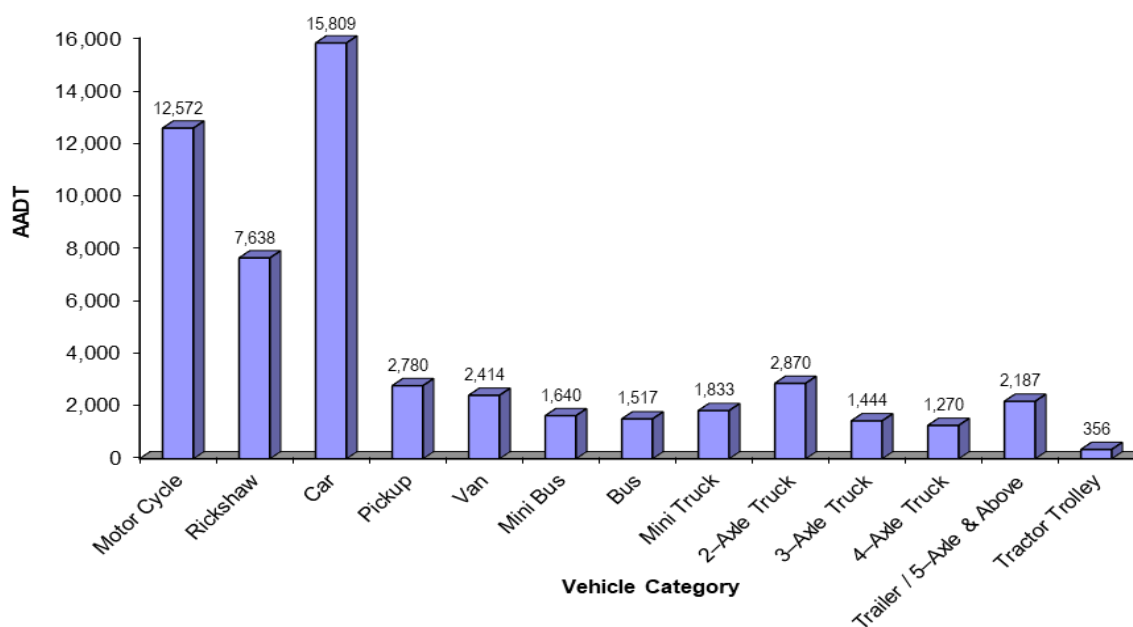
Traffic counts were carried out in the month of **March 2023** for seven days (7 x 24 hrs.) in order to check the volume of traffic plying on **Lahore – Gujranwala Section of N-5.** Types of Vehicles surveyed included Car, Jeep, Passenger Buses and Multi Axle Trucks. The traffic counts were conducted for both directions at L-4. The value of AADT at this Section is **83,495 vpd.**



5.14.5 Average Annual Daily Traffic (AADT) @ L-5

Traffic counts were carried out in the month of **March 2023** for seven days (7 x 24 hrs.) in order to check the volume of traffic plying on **Lahore – Gujranwala Section of N-5.** Types of Vehicles surveyed included Car, Jeep, Passenger Buses and Multi Axle

Trucks. The traffic counts were conducted for both directions at L-5. The value of AADT at this Section is **54,329 vpd**.



The above figures shows that the maximum of the traffic constitutes of the light vehicles (Motor Cycle / Rickshaw), Cars and followed by Vans, Pickups, Mini Buses and Trucks.

5.15 Construction Material.

The road will be constructed as a flexible pavement highway. The construction process involves base course preparation (using stone, slag/gravel, cement, asphalt coarse & fine aggregates, soil, water & other material) & compaction/grading, and the making of the final layer of hot asphalt mix (150-177 C) with further compacting, employing rolling at a speed of 5km/hr.

Following unit weight of structural material shall be used :

(a)	Reinforcing Bars	77.0 KN/M ³
(b)	Reinforced Concrete	23.6 KN/M ³
(c)	Lean Concrete	22.6 KN/M ³
(d)	Mortar	22.6 KN/M ³
(e)	Steel Plate	77.0 KN/M ³
(f)	Asphaltic Concrete	22.6 KN/M ³

5.16 Workforce And Machinery Requirement

Employment generation is a natural process of social development. Human beings bring with them into the world an array of needs that present employment opportunities for others to meet. The Employment hiring is purely based on merit and competency as well as sound technical and management skills to perform the project within the allocated time and budget.

Table 5-7: Contractor Staff

Sr. #	Designation	No of Posts	Duration (Months)
Contractor's Staff			
1	Project Manager	1	26
2	Deputy Project Manager	2	24
3	Structure Engineer	2	24
4	Highway Engineer	1	24
5	Quantity Surveyor	1	24
6	Chief Surveyor	1	24
7	Surveyor	2	24
8	Surveyor Helpers	4	24
9	Material Engineer	1	24
10	Lab Technician	2	24
11	Site Foreman	2	24
12	Store Keeper	2	24
13	Accountant	1	24
14	Skilled Labour	30	24
15	Unskilled Labour	60	24
16	Office Boy	2	24
17	Drivers	3	24
18	Chowkidars/ Guards	3	24

Table 5-8: Consultant Staff

Sr. #	Designation	No of Posts	Duration (Months)
Consultant / Supervisory Staff			
1	Chief Resident Engineer	1	24
2	Resident Engineer	1	24
3	Assistant Resident Engineer (Highways)	1	24

4	Assistant Resident Engineer (Structures)	1	24
5	Material Engineer	1	24
6	Senior Quantity Surveyor	1	24
7	Contract Specialist	1	24
8	Material Inspector	1	24
9	Site Inspector (Highways)	1	24
10	Site Inspector (Structures)	1	24
11	Surveyor	1	24
12	Surveyor Helpers	2	24
13	CAD Operator	2	24
14	Office Assistant	3	24
15	Computer Operator	3	24
16	Office Boy	6	24
17	Drivers	2	24
18	Chowkidars/ Guards	3	24

Table 5-9: Client Staff

Sr. #	Designation	BPS	No of Posts	Duration (Months)
Employer's Staff				
1	Project Director / Director (Engineer)	19	1	24
2	Deputy Director (Engineer)	18	1	24
3	Assistant Director (Engineer)	17	1	24
4	Assistant Director (A/C)	17	1	24
5	Surveyor	16	1	24
6	Accountant/Superintendent	16	1	24
7	Computer Operator	16	1	24
8	Office Assistant	16	1	24
9	Auto CAD Operator	11	1	24

10	Qanoongo	11	1	24
11	Patwari	5	1	24
12	UDC	3	1	24
13	LDC	1	1	24
14	Photo Copy Machine Operator	5	1	24
15	Driver	4	2	24
16	Naib Qasid	1	2	24
17	Chowkidar	1	2	24
18	Sweeper	1	2	24

Most of the road construction equipment is heavy machines and dozers whose engines run on diesel and thus require a temporary workshop close to the construction site for longer projects, for their regular maintenance and repair in case of any technical or mechanical glitch

5.17 Calculation of ADT

Following tables provide the ADT for March – 2023 @ L – 1, L – 2 , L – 3, L – 4 & L – 5. Traffic counts were conducted direction wise in the field, while they were combined for the calculation of Average Daily Traffic (ADT).

Vehicle Type	AADT				
	L-1	L-2	L-3	L-4	L-5
Motor Cycle	14,455	12,513	9,632	19,590	12,572
Rickshaw	8,512	4,139	3,727	9,948	7,638
Car	17,633	17,076	13,768	28,113	15,809
Pickup	2,963	1,913	2,472	3,472	2,780
Van	2,575	1,655	2,355	3,077	2,414
Mini Bus	1,590	977	1,467	2,110	1,640
Bus	1,651	1,016	1,630	2,069	1,517
Mini Truck	2,259	1,269	1,877	2,748	1,833
2-Axle Truck	3,265	2,306	3,089	3,902	2,870
3-Axle Truck	1,942	1,570	2,131	2,794	1,444
4-Axle Truck	1,709	1,134	1,778	2,231	1,270
Trailer / 5-Axle & Above	2,932	1,935	3,040	3,284	2,187
Tractor Trolley	696	257	94	157	356
Total AADT	62,184	47,761	47,060	83,495	54,329

5.18 Construction Logistics

5.18.1 Work Base

Since all works are located along the alignment, the best option would be to set up the work bases near the respective project sites, probably through private rental deeds.

5.18.2 Labor Supply

The contractor will be contractually bound to employ a maximum number of local people except for jobs where local expertise is not available. By and large, the daily wage rates fixed by the local authorities will be used.

5.18.3 Labor Camps

The majority of the labor force will come from local settlements. Some unskilled, semi-skilled, and skilled laborers will live in camps and will likely be brought in by contractors from far-off towns. Being located near the work base, the camps will make work access easy for the camp dwellers. Like camps, work bases will be required to be 500 m away from the nearest settlements.

5.18.4 Machinery Maintenance and Equipment Yards

Machinery and equipment yards will be sited near work camps. The yard will have enough storage and haulage space with ample moving and working space. The yard will be walled and will have a gate provided with ample security staff at the work base and a machinery and equipment yard will be provided. The yard will have enough storage and haulage space with ample moving and working space. The yard will be walled and will have a gate provided with ample security staff.

5.18.5 Material Depots

Near-work bases material depots will be required for storing construction materials. They will include temporary sheds for storing cement, steel, and asphalt and open space for storing stones, shingles, and bricks. The material depots will be walled and the gate will be provided with ample security. A storekeeper will keep account of incoming and outgoing material.

5.18.6 Machinery Repair Workshops

With a large number of vehicles and other similar machinery, a repair workshop is essential. The contractor may establish his workshop.

5.19 Approach To Work Bases

Since work bases will be established close to the road sections under can provide easy access to them. Public or private land (with the consent of the owner and/or locals) can be used for providing supplementary access roads and paths to work bases.

5.19.1 Camp Offices

Adjacent to labor camps and to work bases, the contractor will be allowed to set up a camp office to run his day-to-day field affairs. For that, the public or private land can be used by the contractor.

5.19.2 Security Arrangements

Given the prevailing field condition, security staff is necessary. Enough security will be required at the Work Base, Labor Camp, Material Store, Equipment Yards, and location of the work in progress on the work site. Coordination will be necessary with nearby law enforcement agencies.

5.20 Healthcare

With a large number of laborers and employees working on the project of road construction, minor accidents are expected to take place on all construction sites. A dispensary will be set up by the contractor. For major cases, the patients will be shifted to the District Hospital under a pre-coordinated arrangement.

5.20.1 Labor Reporting Office

Along the road and in work bases special areas will be marked where the labor can gather at the time of pick and drop, emergency, or briefing. Those places will be marked and kept open and clean and as per requirement equipped with a public address system.

5.20.2 Labor Transport

Almost all unskilled labor will be employed from local sources. The contractor will provide vehicle(s), to pick up and drop off local labor every day. This will also keep the camps less pressurized and manageable.

5.21 Occupational Health, Safety, And Personal Protective Equipments

The project's EHS hazards will likely include physical and chemical hazards such as noise and vibration, air quality, flammable materials, site traffic, etc. It will be ensured that the laborers engaged in breaking stones, handling bricks, mixing concrete, or mixing and laying asphalt use personal protective equipment such as helmets, body suits made of appropriate materials, safety glasses, safety boots, gloves, etc.

5.21.1 Signage

During construction, suitable signboards and traffic signs will be displayed on the entire road length in general, and on the construction site, in particular. This will help in forestalling any possible accidents.

5.21.2 Lighting and Illumination

In addition to natural light in workplaces, artificial illumination arrangements will be made by the contractor's overall work base, work sites, campsite, machinery yard, and material

depots. This can help the contractor with extended working hours as well as security. If WAPDA electric supply is not available, electricity generators will have to be arranged in all spots where lighting is required.

6 DESCRIPTION OF THE ENVIRONMENT

6.1 Introduction

This chapter describes the baseline conditions, which cover the existing physical, ecological, and socio-economic environment of the Study Area. Information on these aspects has been derived from the desk study of available data, field visits to the project area as well as information obtained through visits to the Government departments and other agencies namely the Health Department, Irrigation Department, Meteorological Department, Forest offices, and prevailing environmental laws and environmental quality standards, etc.

6.2 Desk Studies

Design data was collected from the project office, District offices. This data included the available documents, drawings, reports, etc. related to the proposed project. The experts conducted a detailed desk study of the above available data before the field visit. The salient features of the project were thoroughly reviewed to assess their environmental implications. The documents which were consulted and departments visited are the project head office, project site, Irrigation Department, Meteorological Department, Forest offices, and other related officials.

6.3 Site Visits

A team of experts visited the proposed site for the collection of baseline environmental data for ambient air, noise levels, drinking water and wastewater sampling, public consultation, baseline ecological environment data, etc. After the survey of the project area, the environmental data regarding physical, ecological, and socioeconomic aspects were collected for carrying out an environmental assessment. Secondary data were also collected from various sources mainly studies carried out by project proponents and reports of other line Departments. A social survey of the proposed area was carried out in which people living around the proposed site were interviewed to ascertain their views about the storage and utility facilities commissioning and operational activities to perceive the impacts on the natural and socioeconomic environment around the proposed project site. This included information on land, surface water, groundwater, air, vegetation, animals, and human.

6.4 Physical Environment

GT Road that connects Lahore to Gujranwala passes through a predominantly agricultural landscape, with fields of wheat, rice, and sugarcane visible on either side of the road. The area is generally flat, with occasional gentle slopes and small hills.

As you leave Lahore, you will pass through the city's outskirts, which include commercial and industrial areas. After a short distance, the landscape gives way to agricultural land. The road is well-maintained, with two lanes in each direction, and the surrounding areas are generally clean and free of litter.

As you travel along the GT Road, you will pass through several small towns and villages. These settlements are typically characterized by low-rise buildings, and you can expect to see shops, markets, and small businesses along the roadside. The road itself is relatively straight, with occasional bends and curves.

As you approach Gujranwala, you may notice an increase in commercial activity and urbanization. The city is known for its industrial and manufacturing sectors, and you may see factories and warehouses along the road. The surrounding countryside remains agricultural, however, and you can expect to see fields and farmland right up to the city limits.

Overall, the physical environment along the Lahore to Gujranwala GT Road is predominantly rural, with a mix of agricultural land and small settlements. The road itself is well-maintained and easy to navigate, and travelers can enjoy a pleasant and scenic journey through the heart of Punjab's countryside.

. The objective of the study was to establish:

-  Baseline conditions of surface and groundwater resources
-  Assess the surface and groundwater quality
-  Soil and geology baseline of the area

6.4.1 Soil

The soil nature along the Lahore to Gujranwala GT Road is predominantly alluvial, which means it is composed of materials deposited by flowing water. This type of soil is typically fertile and well-suited to agriculture.

The alluvial soil along the GT Road is derived from the deposition of sediments from the rivers that flow through the region, particularly the Ravi and Chenab rivers. The soil is typically loamy, which means it has a mixture of sand, silt, and clay particles. The soil may also have a high organic content due to the decomposition of plant material.

The fertility of the soil along the GT Road is one of the reasons why agriculture is such an important part of the local economy. Farmers in the region grow a variety of crops, including wheat, rice, sugarcane, and vegetables.

It is worth noting that the soil nature may vary slightly along different sections of the GT Road, depending on factors such as topography and drainage patterns. However, overall, the soil along the road is characterized by its alluvial nature, which is well-suited to supporting a thriving agricultural sector.

6.4.2 Topography

The topography along the Lahore to Gujranwala GT Road is generally flat with occasional gentle slopes and small hills. The area is situated in the floodplain of the Ravi and Chenab rivers, and the land is predominantly alluvial in nature, which means it has been formed by the deposition of sediments carried by these rivers.

As a result, the terrain along the GT Road is relatively uniform, with few significant changes in elevation. The road itself is relatively straight, with occasional bends and curves. There are some gentle inclines and declines along the way, but these are generally not significant enough to impact travel.

One notable topographical feature along the route is the Lower Chenab Canal, which runs parallel to the GT Road for much of the journey. The canal is a major irrigation system that provides water for agriculture in the region.

Overall, the topography along the Lahore to Gujranwala GT Road is relatively flat and uniform, with occasional gentle slopes and small hills. This makes for easy driving conditions and a relatively smooth journey through the region.



Figure 6-1: Topographic Map of Pakistan

6.4.3 Seismology

The Lahore to Gujranwala GT Road is situated in a seismically active region, with the potential for earthquakes to occur. The area is located in the Himalayan seismic zone, which is known for its frequent seismic activity.

There have been several significant earthquakes recorded in the past, including the devastating Kashmir earthquake of 2005. This earthquake had a magnitude of 7.6 and resulted in widespread damage and loss of life.

The potential for earthquakes along the GT Road underscores the importance of ensuring that buildings and infrastructure are designed to withstand seismic activity. In recent years, efforts have been made to improve the seismic safety of buildings in the region, with the introduction of new building codes and regulations.

In the event of an earthquake, it is important for drivers along the GT Road to exercise caution and remain alert to any potential hazards. It is also advisable to familiarize oneself with emergency procedures and evacuation routes, in case of a major earthquake or other natural disaster.).

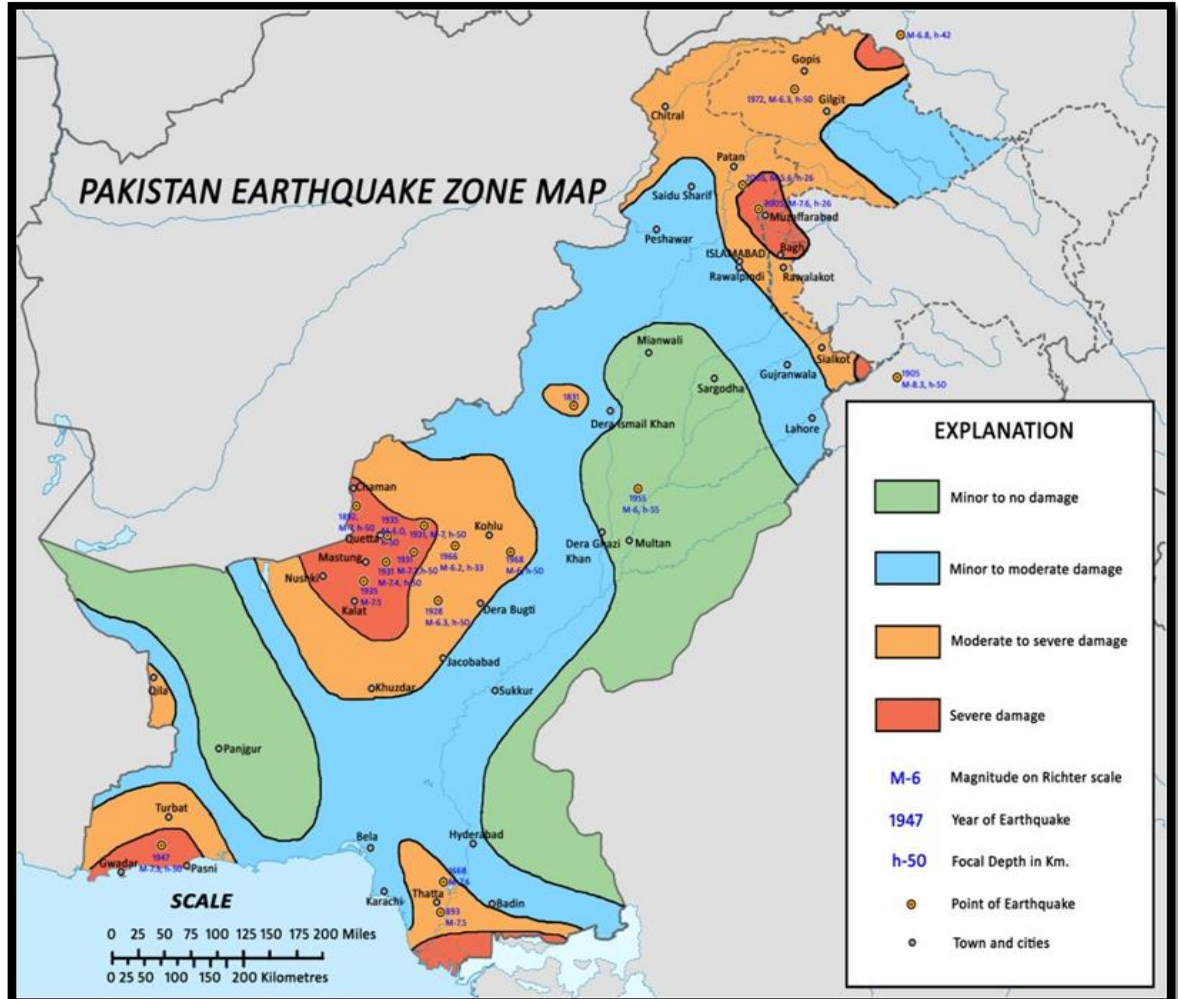


Figure 6-2: Seismic Zoning Map of Project Area

6.4.4 Climate

The climate along the Lahore to Gujranwala GT Road is characterized by hot summers and mild winters, with a distinct monsoon season.

During the summer months of May to September, temperatures can reach up to 40°C (104°F) or higher, with high humidity levels making it feel even hotter. The weather during this time can be quite oppressive, with little relief from the heat except for occasional dust storms or thunderstorms.

From October to March, temperatures are generally milder, with average highs ranging from 20-25°C (68-77°F). The winter months can also bring occasional fog, particularly in the early morning hours, which can affect visibility on the roads.

The monsoon season typically runs from July to September, bringing heavy rainfall to the region. This can lead to localized flooding and other weather-related hazards, particularly in low-lying areas. Drivers should exercise caution during this time, as road conditions can be hazardous.

Overall, the climate along the Lahore to Gujranwala GT Road is typical of the Punjab region, with hot summers, mild winters, and a distinct monsoon season. Travelers should be prepared for the weather conditions they are likely to encounter and take appropriate precautions to ensure a safe and comfortable journey..

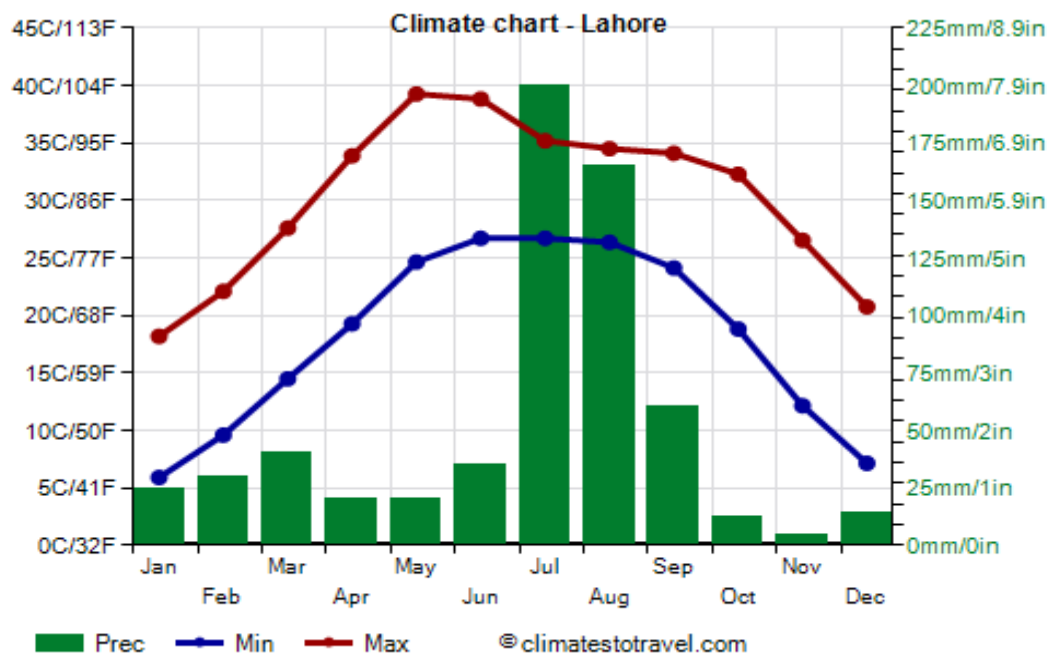


Figure 6-3: Climate Data of Lahore

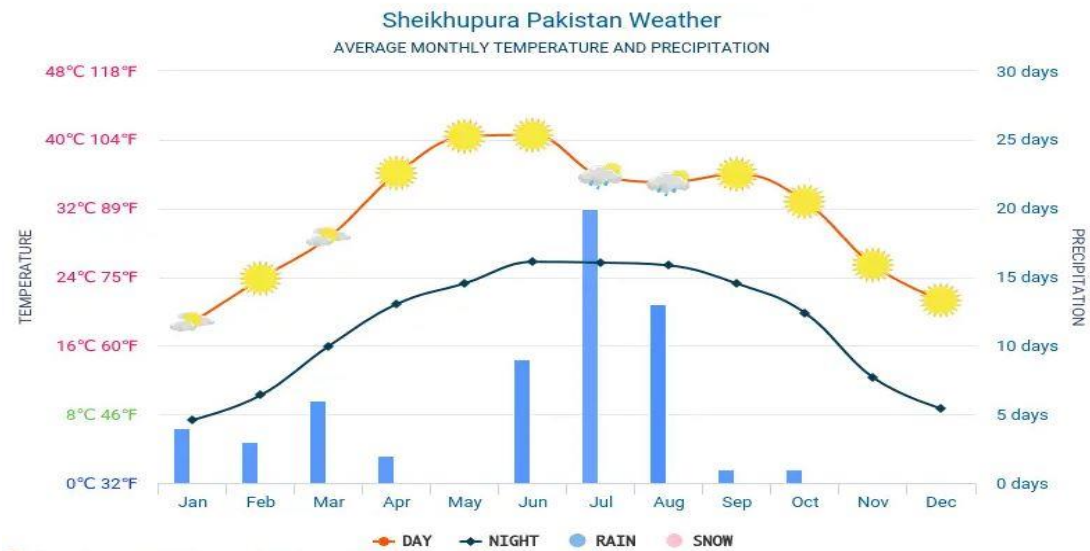


Figure 6-4 : Climate Data of Sheikhupura

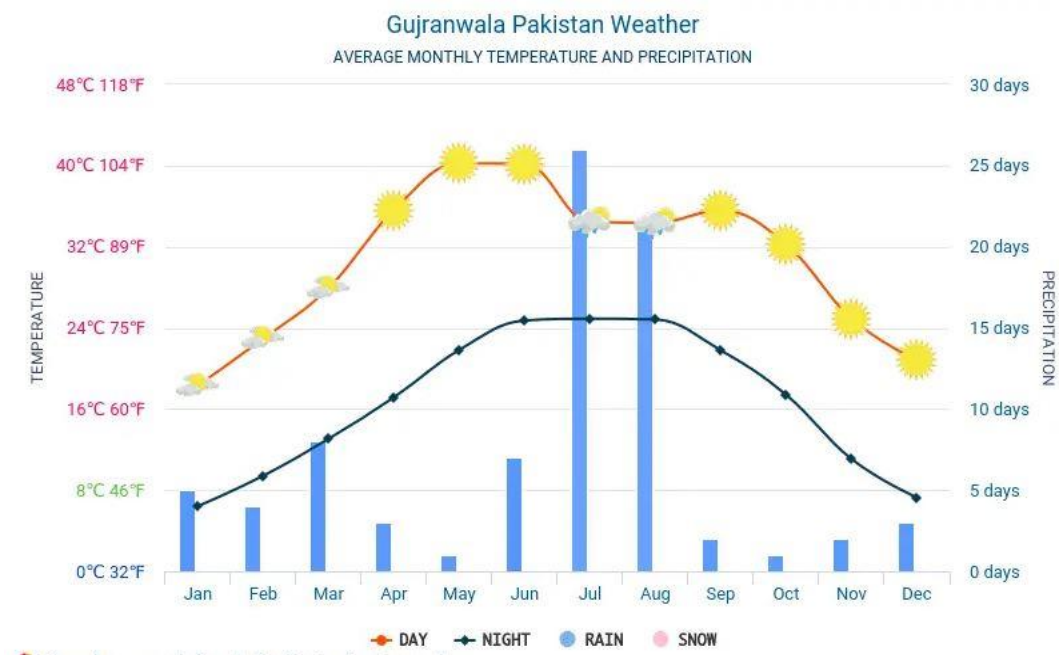


Figure 6-5 Climate Data of Gujranwala

6.4.5 Air Quality Monitoring

Ambient air quality was continuously monitored for 24 hours and the monitoring locations were selected nearest to the sensitive receptors along the road side to assess the airshed quality prior to commencement of works. The monitored data for ambient air including PM₁₀ & PM_{2.5}, CO, NO_x, SO₂ indicates that concentration of all parameters are within PEQS limit at all monitored locations since it is a highly commercial and industrial area. Keeping this in view, considerable efforts will need to be put in to ensure that during the project works, all required measures are put in

such as dust sprinkling etc to minimize particulate emissions as far as possible.

Average concentration for Lab analysis results are give below in Table 6.1

Table 6-1 : Ambient Air Monitoring Average Concentration

Parameter		Particulate Matter (PM ₁₀)	Particulate Matter (PM _{2.5})	Carbon Monoxide (CO)	Nitrogen Dioxide (NO ₂)	Sulfur Dioxide (SO ₂)
Unit		µg/m ³	µg/m ³	mg/m ³	µg/m ³	µg/m ³
Duration		24hrs	24 hrs	24hrs	24hrs	24hrs
PEQSAA		150	35	5	80	120
Average Obtained Conc. At various sites	Main GT Road Muridke	96.89	24.17	0.81	15.97	12.88
	Main GT Road Kamoki	93.33	21.71	0.65	16.05	12.64



Figure 6-6 Environmental Monitoring On Project Site**6.4.6 Noise Level monitoring**

The monitored data for noise levels at different locations near sensitive receptors along the proposed project road during day and night times revealed that all the measurements are in compliance with the PEQS prescribed values for day and night times. However, during construction of the project, all the workers and staff will be equipped with ear muffs to avoid inconvenience.

Table 6-2 Average Values of Noise Level on Sensitive Receptors location

Sr. No.	Location	Units	Minimum	Maximum
1	Rafiq Bhatti Memorial Hospital GT Road Imamia Colony Shahdara	dB(A)	Day Time (06:00 AM – 10:00 PM)	
			65.81	67.99
			Night Time (10:00 PM – 06:00 AM)	
58.46	61.37			
2	Nasir Hospital GT Road Ferozwala Sheikhupura		Day Time (06:00 AM – 10:00 PM)	
			61.91	63.79
			Night Time (10:00 PM – 06:00 AM)	
56.68	58.10			
3	EPI Center RHC Kala Shah Kaku		Day Time (06:00 AM – 10:00 PM)	
			61.01	62.59
			Night Time (10:00 PM – 06:00 AM)	
53.09	55.41			
4	Abdu Ghani Trust Hospital GT Road Muridke Sheikhupura		Day Time (06:00 AM – 10:00 PM)	
			63.91	65.89
			Night Time (10:00 PM – 06:00 AM)	
59.64	62.28			
5	The Spirit School GT Road Near Muridke Police station		Day Time (06:00 AM – 10:00 PM)	
			66.31	65.69
		Night Time (10:00 PM – 06:00 AM)		
60.35	63.99			
6	Arshad Hospital GT Road Sadhoke Gujranwala	Day Time (06:00 AM – 10:00 PM)		
		60.27	64.52	
		Night Time (10:00 PM – 06:00 AM)		
		54.82	56.49	
		60.6	64.2	
		Night Time (10:00 PM – 06:00 AM)		
53.86	57.91			
PEQS: Punjab Environmental Quality Standards for Noise				
		Day Time	Night Time	
a)	Residential Area	55	45	
b)	Commercial Area	65	55	
c)	Industrial Area	75	65	

6.4.7 Water Resources

There are several important water resources along the Lahore to Gujranwala GT Road that play a vital role in supporting agriculture and other industries in the region. One of the major water resources in the area is the Lower Chenab Canal, which runs parallel to the GT Road for much of the journey. This canal is a major irrigation system that provides water to thousands of hectares of farmland in the region.

Another important water resource is the River Ravi, which flows through the region to the east of the GT Road. The river provides water for irrigation, as well as for drinking and other domestic uses.

There are also several small lakes and ponds along the GT Road that provide additional water resources for local communities. These include the Changa Manga Lake and the Hudiara Drain.

Overall, the water resources along the Lahore to Gujranwala GT Road are an important part of the local economy and play a vital role in supporting agriculture and other industries in the region. However, ensuring sustainable use and management of these resources remains an ongoing challenge.

Table show the water analysis results as follows

Table 6-3 Water Analysis Results

Sr. No.	Parameters	Analysis Method	Units	PEQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	7.8
2	Taste & Odor	In-house	--	Non Objectionable	Non Objectionable
3	Color	APHA-2120 B/C	TCU	<15	6
4	Turbidity	APHA-2130 B	NTU	<5	4
5	Total Coliform	APHA:9222 B	Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA:9222 D	Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	<1000	376
8	Total Hardness	APHA-2340 C	mg/L	<500	134
9	Nitrate	APHA-4500NO3 B	mg/L	≤50	4.1
10	Nitrite	APHA-4500NO2 B	mg/L	≤3	0.24
11	Ammonia	APHA-4500-NH3-B	mg/L	---	N.D
12	Arsenic	APHA-3500As B	mg/L	<0.05	N.D.
13	Antimony	APHA-3500Sb B	mg/L	<0.005	N.D.
14	Barium	APHA-3500Ba B	mg/L	0.7	N.D.
15	Chloride	APHA-4500Cl- B	mg/L	250	137
16	Fluoride	APHA-4500F- C	mg/L	<1.5	0.86

6.4.8 Irrigation Network; along the project alignment

Lahore to Gujranwala GT Road passes through a region that is heavily reliant on irrigation for agriculture. As a result, there is an extensive network of irrigation canals and channels that criss-cross the region, providing water to thousands of hectares of farmland.

One of the major irrigation systems in the area is the Lower Chenab Canal, which runs parallel to the GT Road for much of the journey. This canal is a major source of water for the region's agricultural sector, and provides irrigation water to a vast area of farmland.

In addition to the Lower Chenab Canal, there are numerous smaller irrigation canals and channels that branch off from the main canal and provide water to more localized areas. These canals are often managed by local irrigation departments, who oversee the distribution of water to individual farms and fields.

Efforts have been made in recent years to improve the efficiency of the irrigation system in the region, with a focus on reducing water waste and increasing productivity. This has included the installation of more efficient irrigation systems, such as drip irrigation, as well as the development of better water management practices.

Overall, the irrigation network along the Lahore to Gujranwala GT Road is a vital part of the region's economy, supporting agriculture and other industries. The efficient use and management of this water resource remains an important challenge for the region's policymakers and farmers.



Figure 6-7 Ninki Degh Canal Sheikhupura

6.5 Biological Environment

Shahdara to Gujranwala GT road passes through a region that is characterized by a mix of agricultural land, natural habitats, and urban areas. As a result, the biological

environment along the road is quite diverse, with a range of different plant and animal species.

Agricultural land dominates much of the region, with crops such as wheat, rice, and sugarcane grown in large quantities. These crops provide habitat and food for a variety of bird species, including black-winged kites, kestrels, and shikras. The agricultural land also supports a variety of small mammals, such as field mice and rats, which are an important food source for larger predators such as owls and foxes. Along the edges of the agricultural land, there are areas of natural habitat, such as grasslands and wetlands. These areas provide important habitats for a range of bird species, including waders, waterfowl, and raptors. Wetland areas are also important breeding sites for amphibians, such as frogs and toads.

Urban areas along the GT road support a different set of species, including domestic animals such as dogs and cats, as well as a variety of bird species that have adapted to life in urban environments, such as pigeons and house sparrows. Some of the larger urban areas along the road may also support populations of larger mammals, such as jackals or mongooses.

Overall, the biological environment along the Shahdara to Gujranwala GT road is quite diverse, with a range of different plant and animal species inhabiting the agricultural, natural, and urban environments along the road.:

6.5.1 Fauna

Agricultural land along the road supports a variety of small mammal species, such as field mice, rats, and rabbits, which are an important food source for larger predators such as foxes, jackals, and birds of prey. Domestic animals such as cows, buffaloes, and goats are also commonly seen in this area.

Along the edges of the agricultural land, there are areas of natural habitat, such as grasslands and wetlands. These areas provide important habitats for a range of bird species, including waders, waterfowl, and raptors. Wetland areas are also important breeding sites for amphibians, such as frogs and toads. Other animals that may be found in natural habitats along the road include reptiles, such as snakes and lizards, and small mammals, such as hedgehogs and mongooses.

Urban areas along the road support a different set of species, including domestic animals such as dogs and cats, as well as a variety of bird species that have adapted to life in urban environments, such as pigeons and house sparrows. Some of the larger urban areas along the road may also support populations of larger mammals, such as jackals or mongooses.

Overall, the fauna along the Shahdara to Gujranwala GT road is quite diverse, with a range of different animal species inhabiting the agricultural, natural, and urban environments along the road.

6.5.2 Flora

Agricultural land along the road is largely devoted to crops such as wheat, rice, and sugarcane, with occasional fields of maize, cotton, and other crops. These crops provide important food and income for local communities, but do not support a diverse range of natural plant species.

Along the edges of the agricultural land, there are some areas of natural vegetation, including grasslands, wetlands, and patches of forest. These areas may contain a variety of plant species, including grasses, shrubs, and trees, depending on the specific habitat. Wetland areas in particular may be home to a variety of aquatic plant species, including water lilies and reeds.

Urban areas along the road support a variety of ornamental and shade trees, such as eucalyptus, neem, and peepal. These trees provide important shade and aesthetic value, but may not be native to the region.

Overall, the flora along the Shahdara to Gujranwala GT road is largely dominated by cultivated crops, but also contains some areas of natural vegetation and urban plants. The specific plant species present along the road will depend on the specific habitat and management practices in each area.

6.6 Socio-Economic Environment

The socio-economic environment along the Shahdara to Gujranwala GT Road is influenced by a mix of factors, including agriculture, industry, and urbanization.

Agriculture is a major economic activity along the road, with many farmers and landowners growing crops such as wheat, rice, sugarcane, and vegetables. These crops provide food and income for many local communities, but also face challenges such as water scarcity and price volatility. Many farmers in the region also rely on government subsidies and support to maintain their livelihoods.

Industry is also an important part of the socio-economic environment along the road, with several industrial zones and factories located in the region. These industries range from small-scale cottage industries to large manufacturing plants, and provide employment opportunities for local residents. However, industrial pollution and waste management remain major challenges in the region.

Major Industries in Project administrative districts are as follows

Sadiq Paper Products

- Asia Automobile Industries

- Halal Gelatin (Pvt) Limited
- Jamal Pipe Industry
- Eithad Chemical Industry
- Izhar Concrete Pvt Ltd
- Muridke Flour Mills
- Super Foods Pvt Ltd
- Asian Polymer Industries
- Master Beverages & Foods Limited
- Madni Poly Tex Pvt Ltd
- Sonex Tiles
- Waqar Rice Mills
- National Automotive Components
- Craftimus Onyx Marble Industries (Pvt. Ltd)
- Rehman Classics Pvt Ltd
- Madni Dying & Printing Mills
- Prime Oil & Ghee Mills
- Master Tiles & Ceramic Industries Limited
- Amir Rice Mills
- Pak West Industries Pvt Ltd

Urbanization is another key factor in the socio-economic environment along the road, with several towns and cities located along the route. These urban areas provide services and amenities for local residents, including schools, hospitals, and markets. However, rapid urbanization has also led to issues such as overcrowding, traffic congestion, and pollution.

6.6.1 Administration of project area

The Shahdara to Gujranwala GT Road passes through several districts in the Punjab province of Pakistan, each with its own administrative setup.

Starting from Shahdara, which is located in Lahore district, the road passes through Sheikhpura district, where it intersects with the Lahore-Sialkot Motorway. It then enters Gujranwala district, passing through several towns and cities along the way, including Kamoke, Wazirabad, and Gujranwala city.

Each district along the road is governed by a Deputy Commissioner (DC), who is responsible for maintaining law and order, coordinating with local authorities and agencies, and providing public services to residents. The DC is supported by a team of Assistant Commissioners, Tehsildars, and other officials who oversee various

administrative functions, including land revenue collection, record keeping, and public works.

At the local level, each district is divided into several tehsils and union councils, which are responsible for providing basic services to local communities, including education, healthcare, and sanitation. Each union council is governed by an elected Nazim (Chairman), who works with a team of councilors to manage local affairs and represent the interests of their constituents.

Overall, the administrative setup along the Shahdara to Gujranwala GT Road is designed to ensure efficient and effective

Lahore:

Lahore is divided into nine administrative towns, each of which is further divided into several union councils. There are a total of 274 union councils in Lahore, each responsible for providing basic services to its local community.

Here is a breakdown of the nine administrative towns in Lahore, along with the number of union councils in each:

1. Ravi Town: 33 union councils
2. Shalimar Town: 24 union councils
3. Wagah Town: 32 union councils
4. Aziz Bhatti Town: 21 union councils
5. Data Ganj Bakhsh Town: 28 union councils
6. Gulberg Town: 20 union councils
7. Samanabad Town: 23 union councils
8. Iqbal Town: 20 union councils
9. Nishtar Town: 33 union councils

Each union council is governed by an elected Chairman (Nazim) and Vice Chairman, along with several councilors. The council is responsible for managing local affairs, including providing services such as education, healthcare, and sanitation to its constituents.

Sheikhupura:

Sheikhupura is a city located in the Sheikhupura district of Punjab province, Pakistan. The city is divided into several union councils, each responsible for providing basic services to its local community.

There are a total of 16 union councils in Sheikhupura. Here is a list of those union councils:

- | | |
|--------------------------|----------------------------|
| 1. UC-1 Sheikhupura City | 9. UC-9 Sheikhupura City |
| 2. UC-2 Sheikhupura City | 10. UC-10 Sheikhupura City |

- | | |
|--------------------------|----------------------------|
| 3. UC-3 Sheikhupura City | 11. UC-11 Sheikhupura City |
| 4. UC-4 Sheikhupura City | 12. UC-12 Sheikhupura City |
| 5. UC-5 Sheikhupura City | 13. UC-13 Sheikhupura City |
| 6. UC-6 Sheikhupura City | 14. UC-14 Sheikhupura City |
| 7. UC-7 Sheikhupura City | 15. UC-15 Sheikhupura City |
| 8. UC-8 Sheikhupura City | 16. UC-16 Sheikhupura City |

In addition to the union councils, Sheikhupura also has a number of other local government bodies, including the Sheikhupura Development Authority (SDA), which is responsible for planning and managing urban development projects, and the Parks and Horticulture Authority (PHA), which is responsible for managing the city's parks and green spaces.

Gujranwala:

Gujranwala is a city located in the Gujranwala district of Punjab province, Pakistan. The city is divided into several union councils, each responsible for providing basic services to its local community.

There are a total of 31 union councils in Gujranwala. Here is a list of those union councils:

- | | | |
|------------------------|---------------------------|---------------------------|
| 1. UC-1 Model Town | 11. UC-11 Kamoke | 21. UC-21 Gujranwala City |
| 2. UC-2 Satellite Town | 12. UC-12 Kamoke | 22. UC-22 Gujranwala City |
| 3. UC-3 Satellite Town | 13. UC-13 Kamoke | 23. UC-23 Gujranwala City |
| 4. UC-4 Satellite Town | 14. UC-14 Wazirabad | 24. UC-24 Gujranwala City |
| 5. UC-5 Satellite Town | 15. UC-15 Wazirabad | 25. UC-25 Gujranwala City |
| 6. UC-6 Peoples Colony | 16. UC-16 Gujranwala City | 26. UC-26 Gujranwala City |
| 7. UC-7 Peoples Colony | 17. UC-17 Gujranwala City | 27. UC-27 Gujranwala City |
| 8. UC-8 Peoples Colony | 18. UC-18 Gujranwala City | 28. UC-28 Gujranwala City |
| 9. UC-9 Peoples Colony | 19. UC-19 Gujranwala City | 29. UC-29 Gujranwala City |
| 10. UC-10 Kamoke | 20. UC-20 Gujranwala City | 30. UC-30 Gujranwala City |
| | | 31. UC-31 Gujranwala City |

In addition to the union councils, Gujranwala also has a number of other local government bodies, including the Gujranwala Development Authority (GDA), which is responsible for planning and managing urban development projects, and the Parks and Horticulture Authority (PHA), which is responsible for managing the city's parks and green spaces.

6.6.2 Demographics & Population

The demographics of Lahore, Sheikhupura and Gujranwala districts have undergone significant changes over the year. Table 6.3 gives the population of Lahore, Sheikhupura and Gujranwala districts

Table 6-4: Population Of Project Districts

Administrative Unit	Area Sq KM	Population 2017			All Sexes	Population 1998	Sex Ratio	1998-2017 Average Annual Growth Rate
		Male	Female	Transgender				
Lahore District.	1,772	5,813,987	5,303,982	2,016	11,119,985	6,340,114	109.62	3.00
Sheikhupura District	3,744	1,786,383	1,673,242	379	3,460,004	2,276,164	106.76	2.22
Gujranwala District	3,622	2,528,990	2,481,457	619	5,011,066	3,400,940	101.92	2.06

6.6.3 Health

Shahdara to Gujranwala GT road is a major thoroughfare in Punjab province, Pakistan, connecting the cities of Lahore and Gujranwala. Along this road, there are several health facilities, including hospitals, clinics, and medical centers, which provide healthcare services to the local population and travelers.

Here are some of the major health facilities along Shahdara to Gujranwala GT road:

Sheikh Zayed Hospital Lahore: This is a major public hospital located in Lahore, near Shahdara. It is one of the largest hospitals in the city, providing a wide range of healthcare services to patients from all over the region.

1. **Gujranwala Institute of Nuclear Medicine & Radiotherapy (GINUM):** This is a specialized medical center located in Gujranwala, which provides diagnostic and therapeutic services related to nuclear medicine and radiation therapy.
2. **Al-Khidmat Hospital Gujranwala:** This is a private hospital located in Gujranwala, which provides a range of medical services, including emergency care, surgery, and outpatient services.
3. **City Hospital Gujranwala:** This is another private hospital located in Gujranwala, which provides healthcare services to patients from the city and surrounding areas.
4. **National Hospital and Medical Center Lahore:** This is a private hospital located in Lahore, near Shahdara, which provides a range of medical services, including surgery, internal medicine, and pediatrics.

These are just a few examples of the many health facilities located along Shahdara to Gujranwala GT road. There are many other hospitals, clinics, and medical centers in the area, providing a range of healthcare services to meet the needs of the local population and travelers.

Healthcare facilities along the project road side are given in following table

Social Security Hospital Kala Shah Kaku Sheikhupura	
Tehsil Headquarter Hospital Muridke	
Haider Hospital Muridke	

Arshad Hospital Sadhoke	
Ahsan Welfare Surgical Centre Kamoke	
Muhammad Nazeer Hospital Kamoke	

Central Hospital GT Road Gujranwala	
Wapda Hospital GT Road Gujranwala	

6.6.4 Agriculture

Shahdara to Lahore GT Road is an important route that connects Lahore, the capital city of Punjab, with the rest of the province. The area along this road is predominantly agricultural, with vast stretches of farmland and orchards that produce a variety of crops and fruits. The fertile soil, availability of water, and favorable climate make this region suitable for agriculture.

Here are some of the major crops and fruits grown along Shahdara to Lahore GT Road:

- 1. Wheat:** Wheat is the major crop grown in the area, with the Punjab province being the largest producer of wheat in Pakistan. The fertile soil and availability of water make the area along the GT Road ideal for wheat cultivation.
- 2. Rice:** Rice is another major crop grown in the area, particularly in the low-lying areas near the rivers. The Punjab province is the second-largest producer of rice in Pakistan, and the crop is grown in large quantities along the GT Road.

3. Sugarcane: Sugarcane is grown extensively in the region, with many sugarcane mills located along the GT Road. The area along the road is one of the major sugarcane-growing regions in Punjab.

4. Citrus fruits: The region is known for its production of citrus fruits, such as oranges, mandarins, and grapefruits. The favorable climate and availability of water make the area ideal for citrus fruit cultivation.

5. Mangoes: Mangoes are another major fruit crop grown in the area, with many orchards located along the GT Road. The region is known for its high-quality mangoes, particularly the Anwar Ratol variety.

6. Vegetables: A variety of vegetables, such as tomatoes, cucumbers, and peppers, are grown in the area, both for local consumption and for export to other parts of the country.

Overall, agriculture is an important economic activity along Shahdara to Lahore GT Road, providing livelihoods to a large number of people and contributing significantly to the regional and national economy.

6.6.5 Livestock in project area

Livestock farming is an important economic activity along the project site. The region has a large number of dairy farms, poultry farms, and livestock markets that contribute significantly to the local and national economy. Here are some of the major livestock activities along the GT Road:

1. Dairy farming: Dairy farming is a major activity in the region, with many large and small-scale dairy farms located along the GT Road. The farms produce a variety of dairy products, such as milk, yogurt, and cheese, which are sold in local markets and to dairy processing companies.

2. Poultry farming: Poultry farming is another major activity in the area, with many large and small-scale poultry farms located along the GT Road. The farms produce a variety of poultry products, such as chicken meat and eggs, which are sold in local markets and to poultry processing companies.

3. Livestock markets: There are several livestock markets along the GT Road, where farmers bring their animals for sale. These markets are an important source of income for many small-scale farmers and provide a wide variety of animals, such as cows, buffaloes, sheep, and goats.

4. Animal feed industry: The animal feed industry is also an important economic activity in the region, with many feed mills located along the GT Road. These mills produce a variety of animal feed products, such as cattle feed, poultry feed, and fish feed, which are sold to farmers in the area.

5. Leather industry: The leather industry is also a major economic activity in the region, with many tanneries and leather processing units located along the GT Road. The industry produces a wide variety of leather products, such as shoes, bags, and belts, which are sold in local and international markets.

Overall, livestock farming is an important economic activity along Shahdara to Gujranwala GT Road, providing livelihoods to a large number of people and contributing significantly to the regional and national economy.

6.6.6 Industries

Shahdara to Gujranwala GT Road is a significant industrial corridor in Punjab, Pakistan, with many industries located along the road. Some of the major industries along the Shahdara to Gujranwala GT Road include:

1. Textile industry: The textile industry is the most significant industry along the GT Road, with many textile mills, spinning mills, and garment factories located along the road. The industry produces a wide variety of textile products, such as cotton yarn, fabric, and ready-made garments, which are sold in local and international markets.

2. Chemical industry: The chemical industry is also an important industry along the GT Road, with many chemical processing plants, including fertilizer and pesticide plants, located in the region. These plants produce a variety of chemical products, such as fertilizers, pesticides, and industrial chemicals.

3. Food processing industry: The food processing industry is another significant industry along the GT Road, with many food processing factories, such as rice mills and flour mills, located in the region. These factories process a variety of food products, such as rice, wheat, and other grains, which are sold in local and international markets.

4. Engineering industry: The engineering industry is also significant along the GT Road, with many engineering workshops and factories located in the region. These factories produce a wide range of engineering products, such as machinery, equipment, and tools, which are used in various industries.

5. Leather industry: The leather industry is also significant along the GT Road, with many tanneries and leather processing units located in the region. These factories produce a variety of leather products, such as shoes, bags, and belts, which are sold in local and international markets.

Overall, the the part of this GT Road is an important industrial corridor in Punjab, Pakistan, with a diverse range of industries located along the road. These industries provide employment to a large number of people and contribute significantly to the regional and national economy.

6.6.7 Economic Infrastructure

projected Road is an important economic corridor in Punjab, Pakistan, and has a range of economic infrastructure facilities to support the industries and businesses in the region. Some of the economic infrastructure facilities along the road include:

1. Industrial Estates: There are several industrial estates located along the GT Road, such as the Gujranwala Industrial Estate and the Sheikhpura Industrial Estate. These estates provide land and infrastructure facilities to businesses and industries, such as electricity, water supply, and waste management.

2. Transport infrastructure: GT Road is a major transportation route in Punjab, and has a well-developed transport infrastructure to support the movement of goods and people. There are several bus terminals, truck stops, and petrol stations located along the road, which provide transportation and logistics services to businesses and industries.

3. Banking and financial services: There are several banks and financial institutions located along the GT Road, which provide a range of banking and financial services to businesses and individuals. These services include loans, credit facilities, and financial advice, which are essential for businesses and industries to grow and expand.

4. Warehousing and storage facilities: There are several warehouses and storage facilities located along the GT Road, which provide storage and logistics services to businesses and industries. These facilities are essential for businesses that need to store and transport goods, such as the textile and food processing industries.

5. Telecommunications infrastructure: The GT Road has a well-developed telecommunications infrastructure, which includes high-speed internet, mobile networks, and telecommunication towers. These facilities provide connectivity to businesses and individuals, and enable them to communicate and access information easily.

Overall, the economic infrastructure along the Shahdara to Gujranwala GT Road is well-developed and provides essential services to support the businesses and industries in the region. This infrastructure plays a vital role in the economic development and growth of the region and the country as a whole.

6.6.8 Education

The Shahdara to Gujranwala GT Road is home to a number of educational facilities, ranging from primary schools to higher education institutions. Here are some of the key educational facilities located along the GT Road:

1. **Schools:** There are a number of primary and secondary schools along the GT Road, providing education to students from the surrounding areas. Some of the notable schools in the region include the Beaconhouse School System, City School, and Lahore Grammar School.

Figure 6-8 : Schools along the Project Site





2. Colleges: The GT Road is home to several colleges offering intermediate and undergraduate-level education. These include Government College for Women, Gujranwala, Government College University Lahore, and Punjab Group of Colleges.

Figure 6-9 : Colleges along the road side





Technical and vocational institutes: There are several technical and vocational institutes along the GT Road, offering vocational training in a range of trades and skills. These include the Government Technical Training Institute Lahore, the Punjab Vocational Training Council, and the National Vocational and Technical Training Commission.

Figure 6-10: Vocational Training Institute



Overall, the educational facilities along the Shahdara to Gujranwala GT Road provide access to education and training opportunities for people in the surrounding areas. The region has a strong potential for further growth and development in the education sector, particularly in the areas of technical and vocational training.

6.6.9 Ethnicity

The Shahdara to Gujranwala GT Road passes through a diverse region with people from different ethnic backgrounds living in the area. The majority of the population is Punjabi, which is the dominant ethnic group in the region. However, there are also significant populations of other ethnic groups, including:

1. **Kashmiris:** There is a significant population of Kashmiris living along the GT Road, particularly in the city of Gujranwala.
2. **Muhajirs:** The Muhajir community, who migrated to Pakistan from India after partition, is also present in the region, particularly in urban areas like Lahore.
3. **Sindhis:** The Sindhi community is also present in the region, particularly in urban areas like Lahore and Gujranwala.

Overall, the region along the Shahdara to Gujranwala GT Road is diverse, with people from different ethnic backgrounds living together and contributing to the social and cultural fabric of the area.

6.7 SUITABILITY OF THE SITE

The National Highway N-5 started from Karachi passing through major cities of Pakistan like Hyderabad, Sukkur, Bahawalpur, Multan, Lahore, Gujranwala, Rawalpindi, Peshawar and terminates at Torkham (Pakistan-Afghanistan Border). N-5 is very important interprovincial road carries heavy loaded traffic coming from Karachi Port and other industrial cities of Pakistan to up-country. As this is existing road, the current conditions of this road are not quite good. This is causing disturbance to the drivers/road users. Because of the low profile, vehicles coming from the opposite direction during night times have to face road safety related hazards. Traffic congestion from Rawalpindi to Hassanabdal causing fatal road accidents. Widening & Improvement of Existing Carriageway from Shahdara to Gujranwala 69.1 Kms is a major initiative required to improve this section of N-5. improvement of existing road will increase the traffic carrying capacity of the road. The existing structures will be accessed and improved to cater for the local catchment hydrology. Geometry of sharp curves and turns also require improvement. The existing structures require evaluation & will be constructed accordingly.

6.8 Social Survey Results

The findings of the social survey are described below:

- Most of the people in the project area were found to be aware of the need for the project
- The majority of the respondents contacted favored the construction of the road but at the same time demanded fair and transparent compensation for their lost properties;
- The majority of the respondents contacted were between the age groups of 25 to 45 years, to be mature enough to give some response about the project implementation;

- ✚ Most of the respondents interviewed were associated with the profession of shop and transportation sector keeping running their business in the Project area during the day hours.
- ✚ The main protective measures suggested by the respondents include the timely completion of the project, a regular sprinkling of water at the construction site to control dust emissions, and proper compensation for the lost assets.

7 IMPACT ASSESSMENT

7.1 Impact Assessment Methodology

The significance of potential impacts on the environment was assessed using the risk assessment methodology that considers the impact magnitude and sensitivity of receptors, described below.

7.2 Impact Magnitude

The potential implications of the project have been categorized as major, moderate, minor, or nominal based on consideration of the parameters such as i) duration of the impact and its effect; ii) the spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria.

The magnitude of each potential impact of the project has been identified according to the categories outlined in Table - 7.1.

Table 7-1: Parameters for Determining Magnitude

Parameters	Major	Moderate	Minor	Minimal
Duration of the potential impact	Long-term (beyond the project period)	Medium Term Lifespan of the project (within the project period)	Limited to the construction period	Temporary with no detectable potential impact
The spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond the next project components, site boundaries, or local area	Within project boundary	A specific location within project components or site boundaries with no detectable potential impact
Reversibility of potential impacts	The potential impact is effectively permanent, requiring considerable	Benchmark needs a year or so with some responses to come back to baseline	Baseline returns naturally or with a limited response within a few months	Baseline remains constant

	intervention to return to baseline			
Legal standards and established professional criteria	Breaches national standards /obligation	Complies with limits given in national standards	Meets minimum national standard limits	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Happens under worst-case (negative consequences) or best-case (positive impact) working conditions (Likely)	Occurs under abnormal, exceptional, or emergency conditions (occasional)	Unlikely to happen

7.3 Sensitivity Of Receptor

The sensitivity of a receptor has been determined based on a review of the population (including proximity/numbers/vulnerability) and the presence of features on the site or the surrounding area. Each detailed assessment has defined sensitivity to the topic. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in Table - 7.2.

Table 7-2: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very Severe	The vulnerable receptor with little or no ability to absorb proposed changes or minimal opportunities for mitigation
Severe	The vulnerable receptor with little or no ability to absorb proposed changes or limited opportunities for mitigation.
Mild	The vulnerable receptor with some ability to absorb proposed changes or moderate opportunities for mitigation
Low	The vulnerable receptor with a good ability to absorb proposed changes or/and excellent opportunities for mitigation

7.4 Assessing Significance

Following the assessment of impact magnitude and determining the quality and sensitivity of the receiving environment or potential receptor, the significance of each potential impact was established using the impact significance matrix shown in Table - 7.3.

Table 7-3: Criteria for Determining Impact Significance

Magnitude of Impact	Sensitivity of Receptors			
	Very Severe	Severe	Mild	Low
Major	Critical	High	Medium	Negligible
Moderate	High	High	Medium	Negligible
Minor	Medium	Medium	Minor	Negligible
Minimal	Negligible	Negligible	Negligible	Negligible

Risk Score

Likelihood	Consequence				
		Catastrophic	Major	Moderate	Minor
	Certain	25	15	10	5
	Likely	15	9	6	3
	Unlikely	10	6	4	2
	Rare	5	3	2	1

Risk: Significant: 15-25

Medium: 6-10

Low: 1-5

7.5 Impact Phases

These impact assessment and mitigation measures cover the entire cycle of the project activities, from pre-construction to construction and operations of the project. The coverage of each of the project phases is defined as follows:

 Design / Pre-construction Phase

 Construction Phase

 Operation Phase

7.6 Impact Screening Matrix

The 'activity-wise' screening of potential impacts during the design/pre-construction construction and operations phases is provided in Tables - 7.4, 7.5, and 7.6 respectively while details are given hereunder.

Table 7-4: 'Activity Wise' Screening of Impacts during Design/Pre-Construction Phase

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
1	Improper road designing	Long term	Unlikely	Moderate	Severe
2	Improper selection of Camp, asphalt, and batching plant sites	Short term	Likely	Moderate	Mild
3	Lack of integration of EIA/EMP requirements into Construction bid documents	Short term	Likely	Moderate	Severe
4	Landscape	Short term	Likely	Moderate	Severe
5	Relocation of utilities	Long term	Unlikely	Minor	Low
6	Waste/construction material dumping site/s	Short term	Likely	Moderate	Mild
7	Natural Hazard Risks (Flooding, Earthquakes, etc.)	Short term	Likely	Moderate	Severe
8	Land Acquisition	Long term	Likely	Major	Severe
9	Cutting of Trees	Temporary	Rare	Minimal	Low

Table 7-5: 'Activity Wise' Screening of Impacts during the Construction Phase

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
1	Construction of road not in accordance with approved design	Short term	Likely	Moderate	Severe
2.	Degradation of air quality due to construction works	Short term	Likely	Moderate	Low
3.	Topography	Short term	Likely	Moderate	Low
4.	High noise levels and vibration from construction activities	Short term	Likely	Moderate	Mild
5.	Improper handling and/or disposal of hazardous and non-hazardous waste	Short term	Likely	Moderate	Low
6.	Untreated disposal of effluent from worker camps and construction sites	Short term	Likely	Moderate	Low
7.	Soil contamination, Erosion, and Sedimentation	Short term	Likely	Moderate	Low
8.	Wildlife Loss	Short term	Likely	Minor	Low

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
9.	Sedimentation of Streams and Water Bodies	Short term	Likely	Minor	Low
10.	Water resources	Short term	Likely	Minor	Low
11.	Temporary yard Location and operation	Short term	Likely	Minor	Low
12.	Communicable diseases incl. COVID-19	Short term	Likely	Moderate	Mild
13.	Potential accidents and injuries to communities in the project area during construction works- Community Health & safety	Short term	Likely	Minor	Low
14.	Injuries to workers from lack of necessary training and/or not using PPEs etc. (Occupational Health & Safety)	Short term	Likely	Minor	Low

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
15.	Graveyard and physical cultural resources	Short term	Rare	Minimal	Low
16.	Labor influx	Short term	Likely	Minor	Low
17.	Traffic management	Temporary	Likely	Minor	Low

Table 7-6: 'Activity Wise' Screening of Impacts during Operation Phase

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
1	Air and Climatic Impacts	Short term	Likely	Moderate	Low
2	Potential Accidents due to high speed	Long term	Likely	Minor	severe
3	High noise levels	Short term	Likely	Moderate	Low
4	Impact on Social and Cultural Resources	Long term	Likely	Major	Mild

The 'activity-wise' screening of potential impacts during the design/pre-construction phase is provided in Table 4.4 while details are given hereunder.

7.7 Potential Impacts During The Design/Pre-Construction Phase

7.7.1 Improper Road Designing

Impacts

The possibility exists that in case the road is not designed in accordance with international standards and guidelines; the American Association of State Highway and Transportation Officials (AASHTO) for road development, particularly with regards to compatibility with the local climate and keeping in view the hilly terrain, it could result in multiple potential impacts that could adversely affect the project area and economic losses. If the project design shall not take into account the

consideration related to ground conditions, the geology, and the hydrogeology of the site, long-term potential environmental impacts may arise.

Consideration like the provision of culverts, water drains, side walls, etc is crucial; any fault may result in a possible traffic accident and road damage, and water and other operational complexities.

Mitigation Measures

The following design-related measures will be implemented to ensure the road operation does not result in the unanticipated, long term and potentially irreversible impacts:

- ✚ The road has been designed in accordance with international standards and guidelines for road development (AASHTO).
- ✚ Consideration has been given to the stability of the sub-base, the base system to make all-weather roads. The subgrade and the base will be sufficiently stable as per international standards.
- ✚ The provision of appropriate culverts, box-culvert, side drains, water drains, side walls, etc. are given in the road design.
- ✚ Sign boards and road safety gadgets are given in the road design.

Residual Impact

The impacts of the road design on a project are not expected to be significant. With the implementation of the mitigation measures outlined above, the environmental impact will be low in magnitude. Therefore, residual impact is expected to be not significant.

7.7.2 Improper Selection Of Camp, Asphalt, And Batching Plant Sites

Impacts

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

The batching and asphalt plant location near any sensitive receptor may cause potential social and environmental impacts.

Mitigation measures

- ✚ To prevent a nuisance, specific locations shall be designated for the development of the labor camps. All necessary facilities and amenities shall be provided in these camps such as electricity, sufficient supply of water, solid and liquid effluent waste disposal facilities, etc.
- ✚ The use of proper planning while identifying locations for the labor camps will ensure there is minimal disturbance to all key receptors and the traffic is not disrupted by labor camps being set up roadside next to the construction sites.
- ✚ It shall be ensured that the labor camp, batching plant, and asphalt plant are situated at least 500m away from any populated area, or in cases, within the populated area the camp should be safeguarded with security persons to avoid any inconvenience to the locals.
- ✚ It shall be ensured that the batching plant and asphalt plant are equipped with pollution abatement technology (i.e. wet scrubbers or dry scrubbers).

Residual Impact

The impacts of improper selection of camp, asphalt, and batching plant sites on the project are not expected to be significant with the implementation of mitigation measures outlined above. Therefore, residual impact is expected to be not significant.

7.7.3 Lack Of Integration Of EIA/EMP Requirements Into Construction Bid Documents

Impacts

- ✚ The bidding documents must reflect the requirement to select a qualified and experienced Contractor from the perspective of ensuring the implementation of required safeguards during project development.
- ✚ Lack of contractor's environmental safeguard capacity or selection of environment non-responsive contractors may fail in EMP implementation and may be a source of some non-compliances.
- ✚ Contractors that do not possess the required capacity for safeguards management must not be pre-qualified and selected.

Mitigation Measures

- ✚ It will be ensured that the 'Safeguards unit' is active and operational in PIU.
- ✚ The existing 'Safeguards unit' at the PIU will be assigned the task to check that design and bid documents are responsive to key environmental, social, and

safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP.

- ✚ The bid documents must include the EMP and its implementation cost must be reflected in the BoQ.
- ✚ EIA/EMP implementation and monitoring requirements must be part of bidding documents and necessary contractual binding must be agreed upon by project contractors before the award of the contract.
- ✚ Project contractors shall have qualified and experienced environmental staff to plan, arrange, implement, monitor, and report EIA/EMP requirements.
- ✚ The Contractor will be required to define an Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment. These procedures should be developed and approved by the PIU in collaboration with the CSC before the Contractor commences any physical works on the ground.

Residual Impact

The impacts of the lack of integration of EIA/EMP requirements into construction bid documents are not expected to be significant with the implementation of mitigation measures outlined above. Therefore, residual impact is expected to be not significant.

7.7.4 Landscape

Impacts

The physical scarring caused by clearing and levelling during project site construction activities could lead to alteration of soil quality by removal of topsoil, loses of plant cover and limited soil erosion induced by disturbance to native soil.

Mitigation Measures

To reduce physical scarring of the landscape, unnecessary widening and clearing of vegetation will be avoided. Greenbelt plantations will be maintained, and parking of construction vehicles will not be allowed on the median. Borrow areas will be selected in consultation and approval of the Project Director and would not be much deeper to avoid alteration of drainage and soil erosion. The borrow area will be leveled and topsoil restored.

Residual Impacts

The nature of impact is direct and its duration is short term in nature but takes time to rehabilitate the natural environment of the area

7.7.5 Relocation of Utilities

Impacts

Due to the proposed project, public utilities may affect and may disrupt public services and economics.

Mitigation Measures

The road construction is being done in the available RoW. No relocation of utilities is anticipated to be affected by the proposed project.

Residual Impact

The residual impact is expected to be not significant with the implementation of mitigation measures.

7.7.6 Waste/Construction Material Dumping Sites

Impacts

During the construction, it is anticipated that construction waste material will be generated which will require sustainable disposal. Therefore, waste disposal sites should be identified before starting construction.

Mitigation Measures

-  The contractor shall submit and get approval for the waste management plan as well as the dumping site/s for construction waste disposal.
-  A waste management plan will be developed before the start of construction. This plan will cater to the sorting of hazardous and non-hazardous materials before disposal, placing of waste bins at the project sites for waste disposal, and an onsite hazardous waste storage facility i.e. designated area with secondary containment.

Residual Impact

The impacts of the lack of Waste/construction material dumping sites are not expected to be significant with the implementation of mitigation measures outlined above. Therefore, residual impact is expected to be not significant.

7.7.7 Natural Hazard Risks (Flooding, Earthquakes, Etc.)

Impacts

- 🌧️ Rainfall can cause flooding in the project area, particularly during the monsoon season, due to inadequate storm and sewer systems within the area. Floods in the study area in the past were triggered by extreme rainfall events.
- 🌧️ Some projects are located in the seismic Zone 3 and thus there is a risk to the project related to seismic events. According to the Pakistan Seismic Zone Map, Chagai district(proposed project site) falls in Zone 2A, which means minor or no damage to property due to earthquakes

Mitigation Measures

- 🌧️ Required provisions in the project design, such as stormwater drainage, shall be incorporated into the roads' design to cater to extreme weather events.
- 🌧️ Similarly, the design is made keeping in view seismic Zone requirements.

Residual Impact

Not required

7.7.8 Cutting of trees

Impact

As Existing grand Trunk (GT) road over Shahdara – Gujranwala bypass Road is utilized for improvement and widening within ROW. Hence, no cutting of tree is involve.

Mitigation

It may be ensured that the contractor will remain strict with the design and that no deviation from the design occurs during the implementation of the project. New trees will be planted at a construction site after the completion of the project.

Residual Impact

Not required.

7.8 Potential Impacts During The Construction Phase

7.8.1 Construction Of Road Not According To The Approved Design

Impacts

If the road is not constructed in accordance with the finalized design and its corresponding design parameters, it could lead to several unanticipated impacts such as water accumulation on the road, road cracks, poor roadways, and road safety equipment will lead to accidents, etc.

Mitigation measures

The following mitigation measures will be implemented:

- ✚ Method statements must be prepared by the Contractor and approved by the Construction Supervision Consultant (CSC) before the commencement of construction works.
- ✚ The CSC must closely monitor the construction works being conducted by the Contractor to ensure the finalized design is implemented in full and the road design is developed completely in compliance with the approved finalized designs.
- ✚ Any variation by the Contractor from following the finalized design must be immediately highlighted and corrective measures must be implemented to ensure full compliance with the finalized design of the road.
- ✚ PIU shall ensure that construction activities are being carried out in compliance with project design following best international practices. It will closely review and monitor the activities of CSC and contractors involved in construction activities.

Residual Impact

The impacts of the road rehabilitation design on the project are not expected to be significant with the implementation of mitigation measures outlined above. Therefore, residual impact is expected to be not significant.

7.8.2 Air Quality

Impacts

- ✚ The construction will involve earthworks and transporting and dumping of dry material. This will likely lead to an increase in Suspended Particulate Matter (SPM) in and around the construction zones.
- ✚ Potential sources of particulate matter emission during construction activities include earthworks (dirt or debris pushing and grading), exposed surfaces, exposed storage piles, truck dumping, hauling, vehicle movement on unpaved roads, combustion of liquid fuel in equipment and vehicles, land excavation, and concrete mixing and batching.
- ✚ Vehicles carrying construction materials are expected to result in increased SPM levels near the haul roads. This can be of potential importance if the vehicles pass through areas with a high concentration of sensitive receptors, such as residential areas, in this particular case.

- ✚ At the construction yard, the dust levels are also expected to increase due to the unloading of construction materials. It shall be ensured that most of the excavated material will be used within the project, with minimal cut and fill material coming from outside the site.
- ✚ Poor air quality due to the release of contaminants into the workplace can result in possible respiratory irritation, discomfort, or illness to workers. Employers should take appropriate measures to maintain the air quality in the work area.
- ✚ The quantity of dust that will be generated on a particular day will depend on the magnitude and nature of the activity and the atmospheric conditions prevailing on the day. Due to the uncertainty in values of these parameters, it is not possible to calculate the quantity from a 'bottom-up' approach, that is, by adding PM10 emissions from every activity on the construction site separately.

Mitigation Measures

The following mitigation measures will be adopted for the preservation of the environment:

- ✚ At the active road construction site and the immediately adjoining areas, water will be sprinkled every three hours and at a higher frequency if felt necessary, at all construction sites to suppress dust emissions if required.
- ✚ All heavy equipment and machinery shall be fitted in full compliance with national and local environmental standards.
- ✚ Stockpiled soil and sand shall be slightly wetted before loading, particularly in windy conditions.
- ✚ Fuel-efficient and well-maintained haulage trucks shall be employed to minimize exhaust emissions.
- ✚ Vehicles transporting soil, sand, and other construction materials shall be covered with tarpaulin.
- ✚ Limitations to speeds of such vehicles as felt necessary. Transport through the densely populated area should be avoided.
- ✚ Concrete plants are to be controlled in line with statutory requirements and shall not be close to sensitive receptors.
- ✚ The stack height of generators will be at least 3 meters above the ground.
- ✚ Project traffic will maintain a maximum speed limit of 20 km/hr on all unsealed roads within the project area.

- ✚ A minimum distance of 300 meters will be ensured between batching plant(s) and the nearest community.
- ✚ The need for large stockpiles shall be minimized by careful planning of the supply of materials from controlled sources. Stockpiles should not be located within 50m of sensitive receptors and shall be covered with tarpaulin when not in use and at the end of the working day to enclose dust. If large stockpiles (>25m³) of crushed materials are necessary, they should be enclosed with side barriers and also covered when not in use.
- ✚ Dust emissions due to road travel shall be minimized through good construction practices (such as keeping stockpiles downwind and away from communities) and sprinkling water over the access road.

7.8.3 Vehicular & Equipment Emissions

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

- ✚ Periodically check and conduct maintenance of the construction machinery and haul vehicles. Generators, compressors, and vehicles used during construction works will be maintained in a good condition to ensure that emissions are kept to a minimum level.
- ✚ Regularly change the engine oil and use new engines/machinery/equipment having good efficiency and fuel-burning characteristics.
- ✚ Controlled technology generators and batching plants will be used to avoid excessive emissions.
- ✚ Burning of wastes at any site will not be allowed.
- ✚ The stack height of generators will be at least 3 meters above the ground.
- ✚ Training of the technicians and operators of the construction machinery and drivers of the vehicles.
- ✚ All types of machinery and generator must comply with the NEQS. Vehicles, which are not in compliance with NEQS, are not allowed to use.
- ✚ Periodic emission monitoring of vehicles, generators, and batching plants is proposed.
- ✚ Project activities should be planned to avoid harsh weather conditions.

Residual Impact

Implementation of the proposed mitigation measures is likely to leave no long-term residual impact on the ambient air.

7.8.4 Topography

Impacts

The topography along the project area will change to some extent because of construction of project related structures such as embankments, culverts etc.

Mitigation Measures

Visual changes to the topography will be of short term in nature and do not require any mitigation measures, except that the project design should consider aesthetic concerns.

Residual Impacts

Not required

7.8.5 Noise Levels And Vibration

Impacts

- ✚ The road development will result in different construction equipment and machinery being used which will generate high noise levels at the project site and in the project area.
- ✚ The detailed mapping of sensitive receptors has been conducted and the types of receptors are provided earlier. However, any required mitigation measures that shall be proposed will be to control potential impacts on noise to prevent any long-term impacts within the project area.
- ✚ Each construction activity has its unique noise characteristics due to the use of different equipment items. The construction activities will include the use of a large number of trucks, generators, excavators, etc., which can generate significant noise.
- ✚ The equipment used for construction will be the major source of the noise.
- ✚ Since various modern machines are acoustically designed to generate low noise levels, high noise levels that might be generated will only be for a short duration during the construction phase.
- ✚ Depending on the construction equipment used and its distance from the receptors, the community, and the workers may typically be exposed to intermittent and variable noise levels. During the day, such noise results in

general annoyance and can interfere with sleep during the night. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level.

- ✚ Due to the various construction activities, there will be temporary noise impacts near the project site. The movement of heavy vehicles, loading, transportation, and unloading of construction materials produces significant noise during the construction stage. However, these increased noise levels will prevail only for a short duration during the construction phase.
- ✚ The mitigation measures listed below shall be implemented to minimize noise levels during the construction activity as far as possible.

Mitigation Measures

The following mitigation measures will be implemented:

- ✚ Equipment noise will be reduced at source by proper design, maintenance, and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by the use of proper silencers and mufflers.
- ✚ Excessive noise-emitting equipment will not be allowed to operate and will be replaced.
- ✚ Blowing of horns will be prohibited on access roads to work sites.
- ✚ As a rule, the operation of heavy equipment shall be conducted during daylight hours.
- ✚ Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise.
- ✚ Well-maintained haulage trucks will be used with speed controls.
- ✚ The use of ear plugs and ear muffs must be ensured during construction. No employee should be exposed to a noise level greater than 85 dB (A) for more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- ✚ Before the issuance of hearing protective devices as the final control mechanism, the use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible.

- ✚ Periodic medical hearing checks should be performed on workers exposed to high noise levels.
- ✚ All the equipment and machinery used during the construction phase should be well maintained and in compliance with NEQS.
- ✚ A grievance redress mechanism will be established.
- ✚ Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration-dampening pads or devices, and limiting the duration of exposure. Limits for vibration and action values. Exposure levels should be checked based on the daily exposure time and data provided by equipment manufacturers.
- ✚ Other sources of vibration at a construction site are rollers, compactors, or any loose part of machinery exposure which may cause serious injury or workplace sickness. No equipment and machinery with loose or vibratory parts will be allowed to work. Such issues will be fixed through maintenance of the machinery periodically. The use of rollers for land grading will be carried out during day times and with intermittent intervals to reduce the impacts of vibration on the surrounding environment.
- ✚ Considering the project setting, which is not in a congested rural environment and instead is a hilly terrain, there are no potential risks concerning vibration.

Residual Impact

Provided the proposed mitigation measures are implemented, the noise levels and vibration from construction activities will be short-term and moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.6 Hazardous & Nonhazardous Waste Management

Impacts

- ✚ During construction/civil works potential sources of waste will include spoils generated during road excavation, excavation waste for other civil works, domestic wastes (solid & wastewater), fuel or oil leakages or spills, onsite effluents from vehicle wash & cleaning, and cement spills.
- ✚ Waste disposal of materials containing contents of both hazardous and non-hazardous nature such as scrap wood, bricks, concrete, asphalt, plumbing fixtures, piping, insulation (asbestos and non-asbestos), metal scraps, oil,

electrical wiring, and components, chemicals, paints, solvents, etc. can potentially become a serious environmental issue, particularly with the local contractors.

- Domestic wastes generated during the construction of the road will include sewage, grey water (from the kitchen, laundry, and showers), kitchen wastes, combustible wastes, and recyclable wastes from contractor camps.

Mitigation measures

- A waste management plan will be developed before the start of construction. This plan will cater to the sorting of hazardous and non-hazardous materials before disposal, placing of waste bins at the project sites for waste disposal, and an onsite hazardous waste storage facility i.e. designated area with secondary containment.
- Licensed waste contractors will be engaged to dispose of all non-hazardous waste material that cannot be recycled or reused.
- All types of combustible and non-combustible waste including plastic or glass bottles and cans will be temporarily stored on-site and later sold/handed over to a waste/recycling contractor who will utilize these wastes for recycling purposes.
- Waste management training for all site staff is to be included in Contractor's training plan.
- Fuel storage areas and generators will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area should be equal to 120% of the total volume of fuel stored.
- Fuel and hazardous material storage points must be included in the camp layout plan to be submitted for approval. Hazardous material storage areas shall include a concrete floor to prevent soil contamination in case of leaks or spills. Fuel tanks will be checked daily for leaks and all such leaks will be plugged immediately.
- Designated vehicles and refueling points must be included in the camp layout plan to be submitted for approval.
- Hazardous waste will be initially stored on-site at the designated area and then handed over to EPA certified contractor for final disposal.
- Record of waste generation and transfer shall be maintained by project contractors.
- Spill kits, including sand buckets (or other absorbent material) and shovels, must be provided at each designated location.

- ✚ At the time of restoration, septic tanks will be dismantled and backfilled with at least 1m of soil cover keeping in view the landscape of the surrounding natural surface.
- ✚ It will be ensured that after restoration activities, the campsite is clean and that no refuse has been left behind.
- ✚ Clinical wastes will be temporarily stored onsite separately and will be handed over to approve waste contractor for final disposal.
- ✚ Training will be provided to personnel for identification, segregation, and management of waste.

Residual Impact

Provided the proposed mitigation measures are implemented, the Hazardous & Non-Hazardous Waste Management during the construction phase will be short-term and moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.7 Untreated Disposal Of Effluent

Impacts

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

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

Mitigation measures

- ✚ It will be ensured that no untreated effluent is released into the environment.
- ✚ A closed sewage treatment system including soak pits and septic tank will be constructed to treat the effluent from the construction/labor camps.
- ✚ A sewage treatment system will be installed at each respective labor camp based on the number of laborers residing at the respective camp.
- ✚ Wastewater from laundry, kitchen washings, and showers will be disposed of in soak pits or septic tanks.

- ✚ Soak pits /septic tanks will be built in absorbent soil and shall be located 500 m away from the water well, hand pump, or surface water body. Soak pits in non-absorbent soil will not be constructed.
- ✚ Ensure that the soak pits remain covered all the time and that measures are taken to prevent the entry of rainwater into them.
- ✚ A sprinkling of grey water or sewage will not be allowed; in case the septic tank gets filled with sludge, the septic tank shall be emptied through a vacuum truck and the material shall be transferred to a treatment facility or approved municipal drain.
- ✚ Water being released from any batching plant(s) must be treated as per requirements of NEQS before release to the sewerage system/any other water body.

Residual Impact

By implementing the above mitigation measures, the effluent during the construction phase will be short-term and moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.8 Soil Contamination, Erosion, And Sedimentation

Impacts

- ✚ The majority of the works proposed for the road may result in soil erosion and sedimentation. Spoils will be generated from the excavation activities, particularly during construction works. Potential impacts from spoils and their disposal are (i) land for disposal of spoil, (ii) potential erosion from the spoil areas and spoil material reaching the waterways, and (iii) aesthetic impacts. Excavated soil will be stored at the designated site and will be used for backfilling.
- ✚ During the project construction, spills of fuel, lubricants, and chemicals can take place while transferring from one container to another or during refueling. Also, during maintenance of equipment and vehicles, through leakages from equipment and containers and as a result of traffic accidents.
- ✚ Depending on the nature of the material, location of the spill, and quantity of spill, the soil can get contaminated.

Mitigation measures

- ✚ Any drainage structures, culverts, or pipes crossing the project site may need to be modified or protected and the detailed designs must make provisions to

protect or re-provision all infrastructures that may be affected by the construction works.

- ✚ It will be ensured that spill-prevention trays are provided and used during refueling. Also, on-site maintenance of construction vehicles and equipment will be avoided as far as possible. In case on-site maintenance is unavoidable, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil.
- ✚ Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities.
- ✚ Fuels, lubricants, and chemicals will be stored in covered bounded areas, underlain with impervious lining. Appropriate arrangements, including shovels, plastic bags, and absorbent materials will be available near fuel and oil storage areas.

Residual Impact

Provided the proposed mitigation measures are implemented, the soil contamination, erosion, and sedimentation during the construction phase will be short-term and moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.9 Wildlife Loss

Impacts

During the construction phase, there will be considerable human interventions in the project area which can potentially affect the wildlife resources of the project area. No environmentally sensitive area is located in the vicinity of the project area. The project area has been under cultivation and human habitation for almost half a century, and the natural vegetation and habitats have been degraded in most areas. As a result, most wildlife species have either left the area or become locally extinct. Most of the animals found are common species that are highly adaptable and able to co-exist with people.

Mitigation measures

- ✚ A “no hunting, no trapping, no harassment” policy will be strictly enforced
- ✚ Wildlife protection rules will be included in the Camp Rules.
- ✚ Trading of wild animals or birds by project personnel will also be prohibited.

- Regular consultation with the area officer of the wildlife and forest department will be done during the construction phase.

Residual Impact

Provided the proposed mitigation measures are implemented, wildlife loss during the construction phase will be short-term and low. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.10 Sedimentation Of Streams and Water Bodies

Impacts

The works proposed for development may result in soil erosion and sedimentation. Spoils will be generated from the excavation activities, particularly during the construction of a road. Potential impacts from spoils and their disposal are (i) land for disposal of spoil, (ii) potential erosion from the spoil areas and spoil material reaching the waterways, and (iii) aesthetic impacts. Excavated soil will be stored at the site and will be used as backfilling during operations.

Mitigation measures

Any drainage structures, culverts, or pipes crossing the project site may need to be modified or protected and the detailed designs must make provisions to protect or re-provision all infrastructures that may be affected by the construction works.

Residual Impact

Provided the proposed mitigation measures are implemented, the sedimentation impact during the construction phase will be short-term and low. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.11 Water Resources

Impacts

Water will be required during construction activities. Water will be procured from both ground and surface water resources. Water conservation practices will be utilized to reduce the overall water consumption during proposed project activities.

Proposed activities could affect the area's water resources in two ways:

- Reduction due to overuse, and
- Contamination (surface or groundwater)

Surface or groundwater quality may deteriorate if pollutants are mixed with surface runoff during rain and carried to water resources in the vicinity or seeped in the ground. Potential sources of pollution in such cases may include:

- ✚ Domestic waste (sanitary and kitchen discharge);
- ✚ Oil and grease from vehicles and machinery;
- ✚ Stored fuel, oil and other chemicals;

Sewage from the camp should go into an impermeable septic tank. The impermeable septic tank will prevent untreated sewage from polluting surface water.

Mitigation Measures

The mitigation measures described below will ensure that the project area's surface and aquifer resources are not significantly affected by project activities.

- ✚ The water extraction will be kept at minimum;
- ✚ A water management plan will be developed. The plan will also include strategies to minimize water use (and therefore volume of discharge) and maintain reserves;
- ✚ Follow good housekeeping practices with all machinery that may potentially discharge wastewater;
- ✚ No untreated effluents will be released to the environment
- ✚ Effluents from the camp offices and the residential camps will be treated in the septic tank before its disposal. The treated water (if confirming to PEQS) will be used for tree plantation or will be disposed-off through waste contractor (if effluent does not confirm to PEQS). The septic tank will be completely covered, so that surface runoff may not come in contact with the effluent.
- ✚ Fuels, lubricants, and chemicals will be stored in covered and with bund walls, underlain with impervious lining.
- ✚ Spill prevention plan shall be followed to mitigate any kind of spill.

Residual Impacts

Further, proper implementation of the required mitigation and monitoring techniques will prevent any adverse water quality impacts. Residual impacts are foreseen to be negligible / low in this case.

7.8.12 Temporary Yard Location And Operation

Impacts

Temporary yard location and its operation may cause social disturbance and land contamination with oil and grease.

Mitigation Measures

Mitigation measures included are;

- ✚ Proper fencing of the yard
- ✚ Oil spill management plan at the site
- ✚ And rehabilitation at the end of the project is recommended.

Residual Impact

Provided the proposed mitigation measures impacts are short term and low. Therefore, no significant adverse residual environmental impacts are likely to occur

7.8.13 Communicable Diseases Incl. Covid-19

Impacts

- ✚ Communicable diseases such as COVID-19 and HIV may be introduced due to the immigration of workers associated with the project.
- ✚ Ministry of National Health Services, Regulations, and Coordination, GoP issued guidelines in April 2020 for the Health & Safety of Building and Construction Workers during the COVID-19 outbreak. These guidelines are prepared for the workers involved in building and construction work during the current epidemic of COVID-19. These guidelines provide the safety measure to be implemented at the construction site having a dusty environment, continuous flow of different materials, and make-shift type of arrangements for storage, food, and sanitation calls for the implementation of safety precautions at the very basic level of personal hygiene only.

Mitigation measures

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

7.8.14 COVID-19-Specific Measures WHO

- ✚ All workers must perform complete sanitization at the site as per SOPs/guidelines issued by WHO and the national guidelines issued by the Government of Pakistan (GOP).

- ✚ All workers must wear a mask and gloves as soon as they arrive at the site and must keep wearing them at all times while present at the work site/hospital premises. As soon as workers arrive at the work site, their body temperature must be checked and in case any worker is assessed to be running a fever or suffering from the flu or cough, he must be informed to leave immediately and self-isolate for two weeks and not report for work until this two-week mandatory period has been completed.
- ✚ At the work site(s), social distancing measures must be strictly implemented and gathering of workers at any location at the work site(s) must be strictly forbidden. In case of workers not taking this measure seriously, strict penalties must be imposed to ensure implementation.
- ✚ The work tasks must be divided into shifts, as far as possible, to reduce the workforce present at the work site(s) at any one moment and improve the working speed/efficiency.
- ✚ All workers will be strictly advised to wash their hands as frequently as practicable and not to touch their faces during work.
- ✚ A supply of safe drinking water will be made available and maintained at the project site(s).
- ✚ Chlorinated disinfecting spraying must be conducted at the work site(s).
- ✚ COVID awareness signboards must be installed at the camp clinic and the work site(s).
- ✚ Contact details of all workers will be kept in a register on-site to efficiently trace and manage any possible workers that might experience symptoms of COVID-19.
- ✚ Prohibition of entry for local community/any unauthorized persons at work sites.
- ✚ Proper hygiene practices in the toilets and washrooms will be implemented with proper and adequate use of soap and disinfectant spray.
- ✚ Social distancing must be maintained during the pick-up and dropping off of workers from their residences to and from the work site(s).

Residual Impact

Provided the proposed mitigation measures are implemented, the Communicable diseases incl. COVID-19 during the construction phase will be short-term and

moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.15 Potential Accidents And Injuries To Communities In The Project Area (Community Health & Safety)

Impacts

The road improvement and widening will involve the use of considerable heavy machinery at the project site along with posing the risk of community members falling into trenches. In addition, the risk to commuters on the road during the construction works will be significant and thus many precautionary measures will be necessary to minimize the risk of possible accidents. Community Health & Safety may be compromised during road travel particularly at night hours if adequate barriers and lighting are not provided at construction sites.

Mitigation Measures

The following mitigation measures will be implemented:

- ✚ Work areas outside the project site, especially where machinery is involved, will be barricaded and will be constantly monitored to ensure that residents, particularly children stay away while excavated areas are being prepared for the road. Road-related infrastructure will be cordoned off. Also, no machinery will be left unattended, particularly in running condition.
- ✚ Local communities in the project area will be briefed on traffic safety.
- ✚ A speed limit of 20 km/hr will be maintained by all project-related vehicles and nighttime driving of project vehicles will be limited where possible.
- ✚ Educate drivers on safe driving practices to minimize accidents and prevent the spill of hazardous substances and other construction materials during transport.
- ✚ A contractor must take proper safety measures (placing warning tapes around excavations) to avoid people, especially children, accidentally falling into excavations.
- ✚ All the working platforms must be cordoned off with special care by well-trained skilled workers.
- ✚ A contractor will prepare a construction management plan which will include a hazard prevention and safety plan, which will address the health and safety of the people in the project area.

- PIU should ensure the contractor staff working on the project is well trained and educated in the Health, Safety, and Environment (HSE) hazards associated with their duties, and that of the public, in the project area.

Residual Impact

Provided the proposed mitigation measures are implemented, the community health and safety impacts due to construction works will be short-term and minor. Therefore, no significant adverse residual environmental impacts are likely to occur

7.8.16 Injuries To Workers From Lack Of Necessary Training And/Or Not Using PPEs (Occupational Health & Safety)

Impacts

- There is invariably an OHS risk when construction works for the road are conducted, and precautions will be needed to ensure the safety of the workers.
- The major OHS hazards expected during the proposed activities are as follows:
 - Falls from height, especially when standing/working on ladders;
 - Slips, trips, and falls, especially while carrying heavy or bulky loads;
 - Cuts and injuries caused by sharp instruments and tools;
 - Psychological stress due to dissatisfaction at work due to issues with peers, superiors, etc.;
 - General ill feelings as a result of work in confined spaces and the development of 'sick building syndrome

Mitigation Measures

The Contractor will be required to prepare and implement an effective Worker Health and Safety Plan that is supported by trained first aid personnel and emergency response facilities. Construction contracts will include standard Worker Health and Safety measures and contractors will be bound to implement these fully.

- Monitoring will be required to ensure that the health and safety plan based on contract specifications is followed.
- Cement feed hopper areas will be inspected daily to ensure compliance with the requirement of dust masks.
- Surfaces (including flooring and work surfaces) in camps, kitchens, dining areas, and workshops should be solid and easy to clean. Flooring for work camps must be float-finished concrete or better.

- ✚ All drivers engaged by Contractors must hold a valid license for the vehicle they are operating.
- ✚ Work in a confined space shall be executed with available safety standards. Adequate monitoring and equipment shall be available to detect deficient oxygen levels.
- ✚ The Contractor shall submit to the Engineer of CSC for approval an emergency evacuation plan and practice the procedure annually.
- ✚ The Contractor shall submit to the Engineer of CSC for approval a site layout plan, identifying work areas, accommodation, kitchen, dining area, sanitary facilities, location of generators, plant and vehicle parking, transport routes through the camp, pedestrian routes through the camp, evacuation routes, emergency exits, batching plants, storage areas, waste facilities, etc.
- ✚ Fire extinguishers should be provided throughout camps and work sites. Fire extinguishers should be inspected monthly and maintained as necessary.
- ✚ An adequate and reliable supply of safe drinking water shall be made available at readily accessible and suitable places including at all camps.
- ✚ The Contractor shall take samples from each supply of drinking water and arrange for analysis of these samples at a Punjab EPA-certified laboratory before their use by the Contractor's staff. The results of these tests for each supply must be submitted to the Engineer of CSC and must demonstrate that each water supply meets national and World Health Organization standards for drinking water.
- ✚ The Contractor shall provide and maintain adequate hygienic kitchens which are sheltered and separated from the living quarters. Kitchens shall include raised and washable surfaces suitable for food preparation.
- ✚ The Contractor shall provide and maintain adequate hygienic dining areas for staff. Workplaces and camps should be provided with both natural & artificial light. Artificial lighting should be powered by a generator in the event of power cuts.
- ✚ Public sensitization training should be provided to workers to avoid social conflicts between residents and the construction contractor. Occurrence of any such impacts can be avoided by community-sensitive project planning and implementation and through the effective involvement of local administration.
- ✚ All OHS protocols should be implemented in true letter and spirit.

- ✚ The contractor must appoint an OHS resource to implement, monitor and report the HSE management plan to the concerned authorities.
- ✚ The contractor must ensure the provision of a first aid facility at the construction site and camps by hiring medics and establishing a dispensary at the campsite.
- ✚ A reasonable number of first aid kits should be available on construction sites and within contractor camps.
- ✚ Site personnel will be provided with the appropriate type of personal protective equipment (PPEs). The contractor will ensure consistent use of PPEs.
- ✚ Based on the type of hazard applicable during the proposed works at the site, the following mitigation measures for Occupational Health and Safety (OH&S) must be implemented:
 - ✚ Injury or death can occur from being trapped, entangled, or struck by machinery parts due to unexpected starting of equipment or unobvious movement during operations. Mitigation measures related to rotating and moving equipment hazards for workers are provided below:
 - ✚ Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions.
 - ✚ Where a machine or equipment has an exposed moving part or exposed pinch point that may endanger the safety of any worker, the machine or equipment should be equipped with, and protected by, a guard or other device that prevents access to the moving part or pinch point. Guards should be designed and installed in conformance with appropriate machine safety standards.
 - ✚ Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts, or in which energy can be stored (e.g. compressed air, electrical components) during servicing or maintenance.
 - ✚ Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms.
 - ✚ Exposed or faulty electrical devices, such as circuit breakers, panels, cables, cords, and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into proximity with overhead

wires can result in arcing between the wires and the object, without actual contact. Recommended actions include:

- ✚ Marking all energized electrical devices and lines with warning signs;
- ✚ Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance;
- ✚ Checking all electrical cords, cables, and hand power tools for frayed or exposed cords and following manufacturer recommendations for a maximum permitted operating voltage of the portable hand tools;
- ✚ Double insulating/grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits;
- ✚ Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas;
- ✚ Conducting detailed identification and marking of all buried electrical wiring before any excavation work.
- ✚ Welding creates an extremely bright and intense light that may seriously injure a worker's eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases. Recommended measures include:
 - ✚ Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific workstation (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required.
 - ✚ Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated.

- ✚ Fuel storage areas and generators will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area should be equal to 120% of the total volume of fuel stored.
- ✚ Storing flammables away from ignition sources and oxidizing materials. Further, the flammables storage area should be:
 - ✚ Remote from entry and exit points into camps
 - ✚ Away from facility ventilation intakes or vents
 - ✚ Have natural or passive floor and ceiling level ventilation and explosion venting
 - ✚ Use spark-proof fixtures
- ✚ Be equipped with fire extinguishing devices and self-closing doors, and constructed of materials made to withstand flame impingement for a moderate period.
- ✚ Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in the use of smoking materials, cellular phones, or other potential spark-generating equipment).
- ✚ Providing specific worker training in handling flammable materials, and in fire prevention or suppression.
- ✚ Corrosive, oxidizing, and reactive chemicals present similar hazards and require similar control measures as flammable materials. However, the added hazard of these chemicals is that inadvertent mixing or intermixing may cause serious adverse reactions. This can lead to the release of flammable or toxic materials and gases and may lead directly to fires and explosions. These types of substances have the additional hazard of causing significant personal injury upon direct contact, regardless of any intermixing issues. The following controls should be observed in the work environment when handling such chemicals:
 - ✚ Corrosive, oxidizing, and reactive chemicals should be segregated from flammable materials and from other chemicals of incompatible class (acids vs. bases, oxidizers vs. reducers, water sensitive vs. water-based, etc.), stored in ventilated areas and in containers with appropriate secondary containment to minimize intermixing during spills.
 - ✚ Workers who are required to handle corrosive, oxidizing, or reactive chemicals should be provided with specialized training and provided with, and wear, appropriate PPE (gloves, apron, splash suits, face shields or goggles, etc).

- Where corrosive, oxidizing, or reactive chemicals are used, handled, or stored, qualified first-aid should be ensured at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work, and eye-wash stations and/or emergency showers should be provided close to all workstations where the recommended first-aid response is immediate flushing with water.

Residual Impact

Provided the proposed mitigation measures are implemented, the worker health and safety impacts due to construction works will be short-term and minor. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.17 Graveyards and Physical Cultural Resources Impacts

Graveyards and burial sites are very sensitive for the local communities. The shifting of graves falling in the ROW may cause social disruption leading to possible conflicts, ultimately affecting the project works. No graveyards and physical cultural resources have been identified in the project area.

Mitigation measures

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

Residual Impact

Provided the proposed mitigation measures are implemented, the archaeological sites' impact during the construction phase will be short-term and low. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.18 Labor Influx

Impacts

- Social invasion due to the large number of laborers in the area
- Spread of communicable diseases.
- Disturbance of local privacy

Mitigation measures

- The labor camp will be 500m away from any residential dwellings.
- Regular medical checkups of workers for HIV/AIDS.

- ✚ Fencing of a labor camp.

Residual Impact

Provided the proposed mitigation measures impacts are short term and low. Therefore, no significant adverse residual environmental impacts are likely to occur

7.8.19 Traffic Management

Due to construction activity, there will traffic congestion at the entry/exit of the motorway. Since during the construction period, the existing motorway will be operational for traffic movement, therefore traffic management will not be a major problem.

Mitigation Measures

- ✚ Installation of Over Hanger Exit Signs as per drawing including RCC foundations complete with all respect and as directed by the engineer
- ✚ Installation of Gantry Signs as per drawing including RCC foundations complete with all respect and as directed by the engineer.
- ✚ The delineator, attached to the metal barriers, can show the outer contour of the highway when being illuminated by the car lamps, thus ensuring driving safety
- ✚ Object marking, a kind of reflective membrane pasted on the Guard Rail, overpass pier, and gantry-type signposts to warn the vehicles during the night.

Residual Impact

This impact is temporary and minor negative in nature and can be mitigated by providing a proper alternate traffic management plan during the construction activities. Impacts can also be mitigated by following measures provided by the engineer.

7.9 Potential Impacts During The Operation Phase

7.9.1 Operational and Management Manual

During the operational phase, the Project Manager will develop a comprehensive operational and Management Manual of the roads and an effective monitoring plan. Mistakes at the operational level or handling of operations by untrained staff can prove very risky and costly. Important points to be attended at the operational stage are as follows:

- ✚ The strict application of the prescribed M&E plan
- ✚ Continuous evaluation of design efficiencies

- ✚ Understanding and training in Operational and Maintenance Manual
- ✚ Regular maintenance of engineering works (mechanical as well as civil).
- ✚ Continued Public consultation and feedback
- ✚ Refresher Training Courses for operational and maintenance staff

7.9.2 Air Quality

Impact

Highway activities can have a major impact on the local and regional air quality. The pollutants can seriously impair human health and ecological environment and other materials. The emissions include sulphur dioxide, oxides of nitrogen, carbon monoxide, carbon dioxide, and particulates (which may contain trace metals). The emission levels depend on the type and size of facility, the type and quality of fuel and the manner in which it is burned. A significant impact will be interpreted if the concentration of pollutants in the ambient air exceeds the PEQS. The impact will also be considered significant if the pollutants emission level as well as the ground level concentration exceed the values as set out by Punjab- EPD. It is obvious that the transport will be shifted from nearby roads to proposed Highway. Still there will be an increase in transportation. This distribution of traffic will share the air pollution load which will result in a slight change in existing air quality scenario in proposed project area.

Potential Impacts Impacts on local air quality may arise from the following project activities:

- ✚ Biomass Combustion due to traffic
- ✚ Particulate matter emissions results from unburned carbon and impurities in fuels
Likely impacts of these activities can include:
 - ✚ Deterioration of local and regional air quality
 - ✚ Respiratory diseases in local community
 - ✚ Global Warming (Increase in CO₂ and NO_x in the atmosphere can cause global warming)
 - ✚ Acid Precipitation (impact on aquatic ecosystem of surface water and ground water through acidification).

Mitigation measure

The proposed mitigation measures to reduce the impacts on air quality during the proposed operation activities are:

- ✚ Use of cleaner fuels and if possible to renewable fuels
- ✚ Annual Environmental Audit based upon Tri-base assessment.
- ✚ Tree plantations in the area
- ✚ Comprehensive Operational and Maintenance Rules as per ISO standards should be prepared and implemented by the C&W.
- ✚ The strict application of prescribed Monitoring and Evaluation of the plan
- ✚ Regular maintenance of engineering works of road.
- ✚ Ambient air quality monitoring should be carried out during the operation phase.
- ✚ Regular road maintenance to ensure good surface condition.
- ✚ Regular vehicle checks to control/ensure compliance with air quality standards;
- ✚ Enforcement and penalties against traffic rules violators.
- ✚ Ambient air quality monitoring will be conducted to ensure the ambient air quality for the area will comply with the limits.

Residual Impact

If the mitigation measures are effectively implemented, the residual impact of the proposed activities on the area's air quality is expected to be low in significance.

7.9.3 Potential Accidents Due To High Speed

Impact

While the proposed project of the widening and improvement from Shahdara Chowk to Gujranwala Bypass road will increase traffic and the potential for higher speeds may result in more road accidents.

Mitigation measures

- ✚ Traffic calming measures and speed limit signage will be provided to reduce the impact of traffic through populated areas.
- ✚ Crossing areas will be marked and amber flashing lights installed in areas where some population exists when full traffic signals are not warranted.
- ✚ Improved traffic signage and road markings will be used to warn motorists of impending changes in road standards and to advise appropriate speeds.

- ✚ Properly designed traffic calming measures such as speed humps, speed signs and, possibly traffic signals will be installed where settlements are nearest.
- ✚ Traffic police should be trained to enforce road rules.
- ✚ Better enforcement of road rules and more stringent penalties should be sought.

Residual Impact

Provided the proposed mitigation measures are implemented, the accidents due to high speed during the operational phase will be short-term and low. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.9.4 Noise Levels

Impact

The construction of the road will result in different construction equipment and machinery being used which will generate high noise levels at the project site and in the project area.

The detailed mapping of sensitive receptors has been conducted and the types of receptors and their respective distances from the work sites are provided earlier. However, any required mitigation measures that shall be proposed will be to control potential impacts on noise to prevent any long-term impacts within the project area.

The assessment of the noise impacts on the sensory receptors that have been identified at various locations in the project area depends upon:

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

Each construction activity has its unique noise characteristics due to the use of different equipment items. The potential sources of noise during the preparation, construction, and worksite closure phases for the project works include equipment, machinery, and transportation used for the construction activities. The equipment used for construction will be the major source of the noise.

The construction activities will include the use of a large number of trucks, generators, excavators, etc., which can generate significant noise.

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

Depending on the construction equipment used and its distance from the receptors, the community, and the workers may typically be exposed to intermittent and variable noise levels. During the day, such noise results in general annoyance and can interfere with sleep during the night. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level.

Due to the various construction activities, there will be temporary noise impacts near the project site. The movement of heavy vehicles, loading, transportation, and unloading of construction materials produces significant noise during the construction stage. However, these increased noise levels will prevail only for a short duration during the construction phase.

The following mitigation measures will be implemented:

- ✚ Equipment noise will be reduced at source by proper design, maintenance, and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by the use of proper silencers and mufflers.
- ✚ Excessive noise-emitting equipment will not be allowed to operate and will be replaced.
- ✚ Blowing of horns will be prohibited on access roads to work sites.
- ✚ As a rule, the operation of heavy equipment shall be conducted during daylight hours.
- ✚ Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise.
- ✚ Well-maintained haulage trucks will be used with speed controls.
- ✚ The use of ear plugs and ear muffs must be ensured during construction. No employee should be exposed to a noise level greater than 85 dB (A) for more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- ✚ Before the issuance of hearing protective devices as the final control mechanism, the use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible.
- ✚ Periodic medical hearing checks should be performed on workers exposed to high noise levels.

- ✚ All the equipment and machinery used during the construction phase should be well maintained and in compliance with NEQS.
- ✚ A grievance redress mechanism will be established.
- ✚ Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration-dampening pads or devices, and limiting the duration of exposure. Limits for vibration and action values. Exposure levels should be checked based on the daily exposure time and data provided by equipment manufacturers.
- ✚ Other sources of vibration at a construction site are rollers, compactors, or any loose part of machinery exposure which may cause serious injury or workplace sickness. No equipment and machinery with loose or vibratory parts will be allowed to work. Such issues will be fixed through maintenance of the machinery periodically. The use of rollers for land grading will be carried out during day times and with intermittent intervals to reduce the impacts of vibration on the surrounding environment.
- ✚ Considering the project setting, which is not in a congested rural environment and instead is a hilly terrain, there are no potential risks concerning vibration.

Residual Impact

Provided the proposed mitigation measures are implemented, the noise levels and vibration from construction activities will be short-term and moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.9.5 Social And Cultural Resources

Population and Communities

Impact

- ✚ The construction activities for the road will generate jobs for the local people. In addition, indirect economic activities will increase i.e., hotels, shops, and petrol pumps may come up along the highway during the operation stage.
- ✚ A large number of non-locals will come for working on various jobs; therefore there is a possibility of social or cultural conflict. It is recommended that the services of local skilled or unskilled local labor may be utilized as far as possible. The influx of non-locals may however have some positive impacts also, including the possibility of bringing awareness and cultural uplift to the Project Area.

- ✚ Business and trade activity will increase significantly providing economic benefits to the people living in the area.
- ✚ The improvement in existing transportation facilities will boost tourism in the area. The Project may impart different skills to the residents and training on the Project will help them in their future life hence human resource development will take place for the future progress of the area.
- ✚ Levels of necessities like health, education, and transportation are expected to be enhanced benefiting the people residing in the area.
- ✚ Road rehabilitation projects can lead to changes in the community or social environment around the road, influencing various aspects of lifestyles, travel patterns, and social and economic activities.
- ✚ The overall socioeconomic benefits of the Project being more than the negative impacts will result in raising the standard of living and alleviation of poverty in the project area.

Mitigation Measures

The impacts on population and communities will be overwhelmingly beneficial from all project activities

7.9.6 Environmental and Social Benefits

Changes in Land Value

The proposed project is expected to appreciate the current land values of associated villages, towns and cities. Land owners will have an opportunity to sell their land on increased prices and start new businesses. This impact will be major positive in nature.

Employment

The project will generate directly hundreds of jobs during the construction phase of the project. The project operational phase will also generate new jobs. Most of these vacancies will be filled by Pakistani nationals. Similarly the construction and operation of the project will create far greater number of indirect income resources for example income resource for transporters for the transportation of the materials, procurement of goods from local market etc. Overall the proposed project will have a very positive impact on the employment opportunities in Pakistan

7.9.7 Additional Considerations

As an additional measure, the following steps will further enhance roadways environments where its related dividends will be continued to be received for a very long time far beyond the project life;

Unattended or Leftover Work The contractor might be failed to clean waste from all work areas, such as construction wastes left behind by workers and waste left blocking newly constructed culverts and other structures. The contractor may also fail to properly close or rehabilitate some borrow and disposal areas.

Mitigation Measures

Based on a careful inspection of the work areas the contractor and CSC will establish a remediation plan and exercise by the contractor if required.

Tree Plantations: Tree plantations on top of embankments and in RoW will serve as small forests and wood lots for the residents, having tangible benefits in the shape of timber, fuel wood, and fodder. Besides soil retention, erosion control, and biotic improvements, such plantations will also provide aesthetic and visual screens against sound, dust, wind, toxic emissions, vibrations, night glare, and pollution of waterways.

Environmental Training: Capacity building can be achieved through on-the-job training, short courses, training workshops, lectures, educational visits, and seminars. Such interactions include leading team members of PIU CSC, construction managers/supervisors, and other related agencies on road-related environmental issues.

Awareness Raising: Awareness about roads related to current and potential environmental threats for the public at large and roadside dwellers, in particular, requires due attention; the aspect neglected in the past. Enhanced education in road-related environmental issues and awareness raising can be achieved through campaigns by; Visual graphics, Print media, Seminars & workshops.

Community Participation and Initiatives: Wherever possible, the Deputy Director (Environment & Resettlement) along with the Social and environment expert of CSC must involve local communities, for contractors' camp locations, resource sharing with construction workers, and their choice of tree species. In this way, a sense of ownership will be inculcated in residents who will also protect core roads and their related resources. The past practices of isolated working methodology must transform into a participatory mode.

7.9.8 Socio-economic Impacts on the Overall Project Area

In the ultimate analysis, the impacts of the project on social and economic activities in the Project area will be mostly positive. The economic analysis shows very high economic benefits compared to the cost. Salient economic benefits of the project are:

- ✚ The improved mobility of human and material resources leads to a better economy. The construction of roads in the area will not only provide markets for material resources but will also give the local population access to job markets.
- ✚ Boosting trade through ensured and enhanced capacity to take additional traffic.
- ✚ Increased economic activity with improved transport will ensure easy marketing of agriculture and livestock produce.
- ✚ With the improved economy, there will be further improvement in services in the area, and opportunities for employment, education, and healthcare, especially for women and children, will improve.
- ✚ Employment during the construction phase will employ and train a large number of unemployed youths. They will receive a lifetime benefit through skill training, capacity building, and poverty alleviation. Many semi and unskilled workers in the project area will be hired.
- ✚ As populations grow, the limited village lands and resources cannot sustain the local community. To sustain the future communities, villages, and settlements need to expand, this is only possible through transportation networks.

Table 7-7: Characterization of Potential Environmental Impacts (Construction Phase)

Environmental Components	Impacts		Nature of Impact		Duration			Location			Likelihood			Reversibility		Significance				Consequences
	Positive	Negative	Direct	Indirect	Short Term	Intermediate	Long term	Local	National	Global	Low	Moderate	High	Reversible	Irreversible	Major	Minor	Moderate	Beneficial	
Air Quality		•	•		•			•					•	•		•				M
Noise		•	•		•			•					•	•			•			M
Surface Water Quality		•	•		•			•			•			•			•			L
Ground Water Quality		•		•	•			•			•			•			•			L
Soil Quality/Erosion		•	•			•		•				•		•			•			M
Solid Waste		•	•		•			•				•		•				•		M
Wildlife loss		•	•			•		•			•			•			•			L
Disturbance to Public Life		•	•		•			•			•			•			•			L
Occupational Health & Safety		•	•		•			•			•			•				•		L
Traffic Management		•	•		•			•			•			•			•			L
Local Economy and Employment	•		•			•			•			•		NA					•	Positive

Table 7-8: Characterization of Potential Environmental Impacts (Operation Phase)

Environmental Components	Impacts		Nature of Impact		Duration			Location			Likelihood			Reversibility		Significance				Consequences
	Positive	Negative	Direct	Indirect	Short Term	Intermediate	Long term	Local	National	Global	Low	Moderate	High	Reversible	Irreversible	Major	Minor	Moderate	Beneficial	
Air Quality		•	•				•	•				•			•		•			L
Noise		•	•				•	•			•				•		•			L
Local Economics	•		•				•	•					•		•				•	Positive
Traffic Situation	•		•				•	•					•		•				•	Positive
Lifestyle and culture	•		•				•		•				•		•				•	Positive
Community Development	•		•				•	•					•		•				•	Positive

LEGEND

Levels of Negative Consequences					Levels of Positive Consequences		
High		Moderate		Low	Characterize impact	Positive	Not applicable

8 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS OF PROPOSED PROJECT AND MITIGATION MEASURES

This section identifies the potential impacts of the Widening and improvement of Shahdara Chowk to Gujranwala Bypass, the project under consideration in this EIA Report.

8.1 Project Location

The project takes off 800 meters from Shahdara Chowk (Km. 1267+600 of N-5) near Lahore city and ends at Gujranwala Bypass (also known as Jinnah Interchange at Km. 1335+556 of N-5) near Gulshan Aziz Colony. Approximate length of the project is 68 km. The project also envisages the design of grade separated intersection at Chand-da-Qila (Start point of Gujranwala Bypass at Km. 1320+300). Presently, three legged at-grade roundabout is operational at Chand-da-Qila causing traffic congestion during peak hours and is problematic especially for long vehicles. The alignment traverses through various urban centers / towns such as Shahdara, Kala Shah Kaku, Muridke, Sadhoke, Kamoke, Eminabad More and subsequently Gujranwala City.

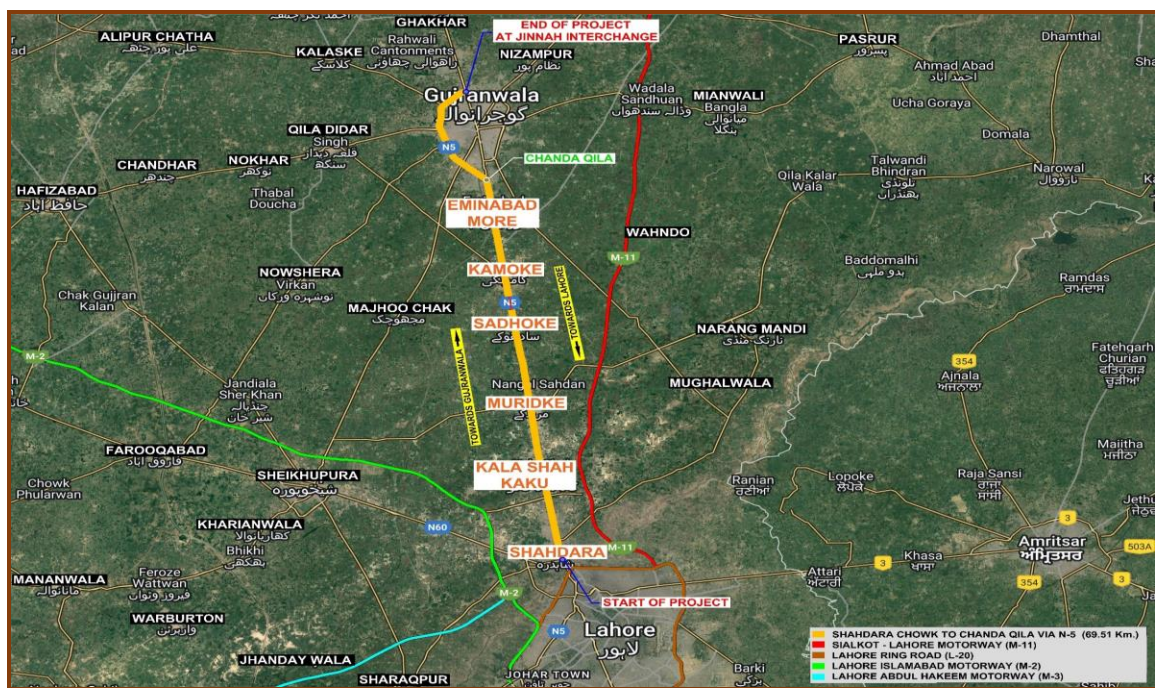


Figure 8-1: Location Map of Road Section

8.2 Potential Impact Sources

Environment and social impacts attributable to the project can broadly be classified into those taking place during construction and those occurring during the operational phase. Some of these impacts can be anticipated and avoided through appropriate adjustments/provisions in the project design. Some can be mitigated by careful implementation of the project's Environmental Management Plan while some other can

be adjusted by appropriately following the operational manual and effective collaboration with concerned stakeholders.

Construction related Impacts are heavily dependent on:

- ✚ The contractor's work practices, especially those related to the storage of construction materials and cleanliness of the work site;
- ✚ Cooperation between local communities and local authorities and the contractor in terms of observance of stakeholders and use of public space and utilities;
- ✚ Project management's enforcement of correct construction practices and standards;
- ✚ The quality of Monitoring and Reporting of EMP implementation.

Operational impacts of the proposed project are associated with the movement of vehicular traffic on it and allied activities. These include air and noise pollution, safety hazards, and other similar impacts.

For this Project, potential impacts are reviewed under construction and operational phases. The environment has been studied under the following subheads:

Physical Environment

- ✚ Land Resource
- ✚ Water Resource
- ✚ Air Quality
- ✚ Noise Level

Biological Environment

- ✚ Flora
- ✚ Fauna
- ✚ Fish
- ✚ Endangered Species

Socio-Economic Environment

Table 8.1 provides a checklist of potential impacts associated with the project activities. In general, these areas are divided into groups based on general environmental aspects which are affected or likely to be affected by the modification in the flow of traffic. The set of impacts based upon physical, biological, cultural, and social aspects have been classified as under construction and operational phases. Each subfactor has been marked as curable, reversible, or irreversible.

Table 8-1: Assessment of Environmental and Social Impacts

ASPECTS	IMPACTS ASSESSED	ASSESSMENT		
		Slight	Moderate	Significant

		1*	2*	3*	1*	2*	3*	1*	2*	3*
Pre construction phase										
	Topography							✓		
	Land acquisition		✓							
	Cutting of tree	✓								
	Natural hazards risks						✓			
1. Construction Phase										
Impacts on Soils and Land Resources	Site for disposal of waste construction material					✓				
	Unstable soil or similar unforeseen conditions		✓							
	Location of labor camps, material dumps, equipment yard, and approach road.		✓							
	Natural disasters heavy rains and floods, etc.					✓				
	Soil contamination from diesel and other spills from construction machinery								✓	
	Damage/blockage of drains, paths, roads, and cross drainage by moving machinery.					✓				
	Scouring of earthen embankment or concrete work edge				✓					
	Release of construction water on an unstable slope or any public/private property							✓		
	Release of construction water to any water structure such as a bridge/culvert.								✓	
	Impact of taking borrow material from earth borrow site.								✓	
	Impact on paths or roads used for transport of construction material.					✓				
	Impact of stone quarrying.		✓							
	Any blasting during Construction									✓
Impacts on Water Resources	Sourcing of construction water.		✓							
	Impact of surface water.		✓							
	Impact of groundwater.		✓							

*1. Avoidable through design (Avoidance) : Curable

*2. Mitigation through contractor's obligation or by EMP implementation (Curative) : reversible

*3. Non-reversible, Permanent change (to be adopted) : irreversible

ASPECTS	IMPACTS ASSESSED	ASSESSMENT								
		Slight			Moderate			Significant		
		1*	2*	3*	1*	2*	3*	1*	2*	3*
	Impact of drinking water.		✓							
	Diesel and other fluids spill over to the water body from machinery.				✓					
	Damages from floods of streams.								✓	
	Obstruction of the flow of water in any stream.		✓							
	Effect on surface flow conditions in rains.		✓							
Air Quality and Noise Pollution.	Dust, smoke, and other pollutants from construction Machinery including asphalt and concrete batching plant.					✓				
	Dust or other emissions from stored material and spoil keeps.					✓				
	Smoke from burning waste material or burning firewood.					✓				
	Noise from the use of old or outdated machinery.					✓				
	Noise due to any blasting.					✓				
	Soil compaction due to labor camps and machinery yards.	✓								
Impacts on Biological Resources	Damage to biological resources		✓							
	Damage to fisheries		✓							
	Impact on (adjacent) open land		✓							
	Impact on any migratory birds.		✓							
	Impact on endangered species.		✓							
Impacts on Socio Economic Cultural and Archeological issues.	Existing services education, health, electricity, and water supply communication.		✓							
	Local ethnicity, Tribal Tensions, communal rivalries		✓							
	Impact on the area under crops					✓				
	Land ownership / Land tenure system		✓							
	Access to construction material.		✓							
	Adverse effect on cultural and archaeological heritage (if any).		✓							
	Public safety at the construction site.					✓				

ASPECTS	IMPACTS ASSESSED	ASSESSMENT								
		Slight			Moderate			Significant		
		1*	2*	3*	1*	2*	3*	1*	2*	3*
	Health and safety of labor and employees on construction site.					✓				✓
	Loss of livelihood due to loss of land and ancestral villages.		✓							
	HIV / AIDS and infectious diseases such as cholera and Jaundice in the laborers, employees, and nearby Public.		✓							
	Employment		✓							
	Women status: Exposure to employment and education opportunities.		✓							
	Hurdle in cultural Reunion.		✓							
	Hurdle in accessing market opportunities for agricultural produce.		✓							
	Reduction in recreation opportunities.		✓							
2. Operational Phase										
Monitoring and Evaluation as per the operational manual and monitoring plan	Compliance with the M&E plan.								✓	
	continuous evaluation of design efficiency								✓	
	Understanding and training of operational manual.								✓	
	Environmental annual Audit								✓	
	Regular Maintenance								✓	
	Staff welfare								✓	
	Continuous public consultation					✓				
	Continued gender issues and women consultation.					✓				
	Refresher courses for operational staff.					✓				

8.3 DESCRIPTION OF IMPACTS AND MITIGATION MEASURES

8.3.1 Disposal of Waste Construction Material

Impacts

The project area is comparatively flat. These may be surplus earth or waste construction material that needs disposal.

Mitigation Measures

The construction waste material will be disposed of in selected barren spots as allowed/approved by Resident Engineer and level so that it becomes useful. No waste material will be thrown into the nullah or other surface water bodies.

8.3.2 Sitting of Labor Camps, Material Depots, Equipment Yards, and Approach Roads Impacts

Because of the availability of public/private land on either side of the road sections siting of labor camps material depots, equipment yards, and approach roads will not cause any serious problems. Therefore, this is a matter of low significance that can easily be mitigated.

Mitigation Measures

The contractor will, in consultation with RE, select the siting for all those facilities within the public land. The camp / other facilities will be set up on flat land without much natural vegetation, at least 250 m away from any community. Satellite images can also be used to select suitable sites, record the pre-construction conditions, and monitor the condition of these sites during and after the construction phase.

8.3.3 Natural Disasters: Heavy Rains, Floods, and Earthquakes Impacts

Natural disasters such as heavy rains, floods, or earthquakes can potentially impact the project works especially the area in the vicinity of the water body and bridges.

Mitigation Measures

The contractor in consultation with RE and the local community will resolve the issues, in the best interest of the NHA. Neither party will however be held responsible for any force majeure.

8.3.4 Contamination from Diesel and Oil Spills from Construction Machinery Impacts

Any leakage or spillage of diesel, oil, or any other chemical will contaminate the soil which may in turn impact the water sources, nearby community, and/or productive land.

Mitigation Measures

✚ A contractor will apply strict rules on his workers and labor to ensure that no spills or leakages are caused. All fuels, oils, and bitumen will be stored appropriately, with concrete padding and bunding for containment in case of leakage. If the spills or leakages do take place, it must be followed by the treatment prescribed below as per the degree of spill or leakages.

- ✚ Moderate Spills are defined as spills of volume less than or equal to 200 liters to be contained and controlled using shovels, sand, and native soil. These equipment and materials are to be made available at campsites during the operation. The contaminated soil is to be excavated and stored in a burn area lined with an impermeable base. Depending on the volume, the contaminated soil is either disposed of by burning in the burn pit or by specialized treatment such as bioremediation.

8.3.5 Damage to Roads, Cross Drainages

Impacts

Damage to roads and cross-drainages can arise through the carelessness of the heavy machinery drivers or operators. Such carelessness can cause considerable damage to paths, roads, and drainages if the drivers/operators are not made aware, trained, and bound to be careful. It is a concern of moderate significance but can be mitigated through care and regulation.

Mitigation Measures

The contractor will prepare standard operating procedures and impose strict control over operators and drivers of all types of vehicles to minimize any damage to roads or structures. Should any damage take place, the contractor will carry out repairs immediately. An effective sinology and a good traffic plan can reinforce the instructions to drivers.

8.3.6 Earthen Embankments or Concrete Work, Edge Scouring

Impacts

Poor design and inappropriate construction procedures can potentially damage embankments, concrete works, or road edges. The impact is moderately significant but can easily be mitigated.

Mitigation Measures

Edge scouring of earthen embankments or concrete work must first be dealt with at the design stage. Wherever such a situation is anticipated, aprons should be provided to secure edges and specifications must be kept of high standards. During the construction phase, this aspect should be addressed through appropriate construction methodology and employing appropriate techniques such as protection walls and rip rap. The contractor will repair all damages to the earthen embankments, concrete works, or pavement edges caused by the construction works. During the operation phase, appropriate measures need to be incorporated into the Operational Manual.

8.3.7 Impact of Borrowing Material from Earth Borrow Sites

Impacts

A large quantity of earth will be removed from borrow pits located within the designated/approved areas by the NHA. This can potentially cause loss of soil/land productivity, uneven terrain, and altered drainage.

Mitigation Measures

The borrow areas will be selected after obtaining approval from the RE. The contractor will ensure that the borrowing does not cause loss of soil/land productivity, uneven terrain, and altered drainage. Wherever possible/necessary, these places will be leveled and planted with trees using appropriate planting technology/methodology.

8.3.8 Impact on Roads / Infrastructure Used for Transport of Construction Materials including Asphalt, Bitumen

Impacts

Transport of construction machinery, construction material, and construction workers will cause additional wear and tear on the roads/infrastructure and raise considerable dust. This impact will be moderately significant and can be adequately mitigated.

Mitigation Measures

The contractor will be responsible to repair any damage caused to the local infrastructure by the construction activities. Water sprinkling will be carried out where necessary to minimize dust emissions.

8.3.9 Source of Drinking Water

Impacts

The construction activities can potentially damage/affect the drinking water sources of the communities. The usage of unsafe water by construction workers can cause health problems.

Mitigation Measures

It will be ensured that the drinking water sources of the communities are not affected. The contractors will repair/replace/compensate for any damages caused by the construction activities. The contractor will make arrangements to supply safe drinking water to its staff and workers.

8.3.10 Dust and Gaseous Emissions from Construction Machinery or Asphalt Plants

Impacts

The construction activities and operation of vehicles and machinery will release exhaust emissions and also raise dust.

Mitigation Measures

The contractor will ensure that its vehicles, machinery, and generators are properly designed and maintained, and comply with the applicable PEQS. The asphalt plant will

not be operated without a properly functioning dust control system such as a wet scrubber and will be located away from any residential or commercial settings. Water will be sprinkled where necessary to control the dust emissions.

8.3.11 Smoke from Burning of Waste Material or Burning Firewood

Impacts

A large number of big and small fires in the labor camp and the burning of waste can produce smoke and smog which can cut off visibility, reduce visibility and cause suffocation along with causing diseases of the respiratory tract including cancer.

Mitigation Measures

The contractor will use clean and smoke-free fuel in the labor camp. Cutting and burning trees/shrubs for fuel will be prohibited. Instead, gas cylinders should be used in the labor camp for cooking purposes. Similarly, waste burning will not be allowed. The contractor will prepare a waste management plan and have it approved by the RE.

8.3.12 Noise

Impacts

The construction activities will generate noise, which can potentially affect the communities and also the construction workers.

Mitigation Measures

The contractor will strictly follow the environmental quality standards for ambient noise. All necessary measures such as noise barriers will be taken to reduce the noise, particularly near the communities. Personal protective equipment (PPE) will be provided to the construction workers and its usage will be made mandatory.

8.3.13 Disposal & Impact of Milled Asphaltic Material

Impacts

The project activities may potentially generate surface-milled asphaltic material disposal which may cause potential environmental impacts of water through the leaching process and solid waste material, therefore, proper utilization or disposal of the material is mandatory for sustainable development.

Mitigation Measures

Reclaimed material can be used in the asphaltic base course or shoulders. Generally, 15–20% of the material can be usable. However, this may be done with the permission of NHA. As the project shall be implemented in a segmented phase it's suggested that the contractor will devise a disposal plan for sustainable disposal of the material. With the consultation of the local community during project implementation some barren

places can be identified for the burial of this material. It is also suggested that some latest techniques for the reclamation of Milled Asphaltic Material may also be adapted for the utilization of this material on unpaved areas.

8.3.14 Damage to Biological Resources (Flora and Fauna)

Impacts

The project activities may potentially cause some disturbance to the wild species of the area; however, this impact is not significant. The area has already undergone modification because of human settlements and associated vehicular traffic, therefore most of the wild fauna species would have already left the area.

Mitigation Measures

No killing/hunting/trapping of wild animals will be allowed. Compensation will be paid for any tree cutting on the private land. Compensatory tree plantation will be carried out for Forest Department-owned trees and each tree removed, five saplings will be planted. Borrow material will be obtained without causing any damage to the natural vegetation. Since the project will be executed on the alignment option presented above only a small amount of tree cutting is expected to be cut. Removing all the growth, trees, bushes leveling dressing, and disposal of excavated material will be allowed as per instruction of the Engineer-in-charge and complete in all respects as per drawing and specification and to the approval of the Engineer-in-charge.

8.3.15 Infrastructure within RoW

Impacts

No public infrastructure such as schools, hospitals, or offices falls within RoW. Budgetary provisions for a campsite, asphalt and batching plant will be made accordingly.

Mitigation Measures

The cost of these utilities may be included in the project's main cost.

8.3.16 Increased Risk of Accidents Caused by Partial Closure of Road during Construction

Impacts

During construction activities, traffic flow will be disturbed. At sections passing through populated areas, there will be limited scope for providing diversion tracks for the mobility of local and thorough traffic. As a result of construction the traffic volume will increase during the operation stage, and there may be safety hazards for the locals residing along the edge of the road as well as vehicular traffic.

Mitigation Measures

- ✚ Proper site-specific measures will be carried out in consultation with supervisory consultants to ensure the safety of the population residing along and around the project corridor. Traffic Management Plan (TMP) prepared in this report will be implemented by the Contractor with the approval of the Project Engineer.
- ✚ Necessary measures will be taken to ensure the safety of traffic during construction, including barricades (including signs, pavement markings, flags, and lights) erected as required by the NHA and set up as per local regulations.
- ✚ The construction work will be managed such that part of the carriageway at a time is upgraded leaving the other part available to serve one-way traffic. Construction work will be carried out in small stretches instead of long stretches.
- ✚ Periodic inspections will be made by the contracted firm particularly in monsoon season to identify the landslide areas and their remedial measures. In case of any landslide contracted firm will clear the road within a minimum time. For this purpose, the firm should be fully equipped and there should be a contingency plan in case of any emergency/natural disaster.

8.3.17 Safety and Health Hazards

Impacts

The occurrence of accidents/incidents during construction activities, particularly from excavation activities is generally common. The workers and general public residing along the project corridor or near the work sites will particularly be at risk. In addition, contractor staff while on work may get injuries.

Mitigation Measures

The construction workers will be trained in construction safety procedures, and social awareness, equipping all construction workers with safety boots, helmets, gloves, and protective masks, and monitoring their proper and sustained usage. The contractor will ensure the provision of medicines, first aid kits, vehicles, etc. at the campsite.

8.3.18 Restricted Mobility of Local Population

Impacts

During the construction phase, the general mobility of the residents and their livestock in and around the project area is likely to be hindered. Likewise, access to natural resources may be affected. This particularly implies to women folk and children. Construction activities, particularly excavation and movement of haul trucks and machinery may disrupt the existing tracks leading from the main road to settlements. This will limit the accessibility of the local population to the main road.

Mitigation Measures

- ✚ The contractor will ensure that the mobility of the local communities and their livestock is not hindered by the construction activities. The contractor will provide crossing points on the road at appropriate places to facilitate the people going across the road for their daily work and having free access to natural resources.
- ✚ Generally, the contractor will avoid using the village tracks for hauling the construction material. However, if it is unavoidable, the existing ones will be widened, overlaid with shingle, or surface treated to accommodate local as well as contractors traffic under the approval of the Project Engineer.

8.3.19 Social Conflicts and Employment of Locals on the Project**Impacts**

The presence of outside construction workers may cause some degree of social disruption and even active disputes with the local community as a result of social/cultural differences. This particularly relates to the disruption of the privacy of women folk working in the fields or even in the yards of their houses, should the house lie at lower elevations than the working sites. Likewise, the risk of theft of the community assets by the Contractor workers and vice versa may occur.

Mitigation Measures

Good relations with the local communities will be promoted by encouraging Contractors to provide opportunities for skilled and unskilled employees to the locals, as well as on-the-job training in construction for young people.

8.3.20 Spread of Communicable Diseases amongst the Project Labor and Adjoining Population**Impacts**

The presence of a large number of construction workers and other associated personnel may lead to the spread of communicable diseases such as Covid-19, HIV/AIDS, and hepatitis.

Mitigation Measures

The contractor will arrange awareness programs for communicable diseases in the field camps on regular basis by a qualified expert/doctor. The contractor will provide PPE, i.e. masks, and proper sanitation facilities to all the workers. The contractor will provide recreational facilities such as playing volleyball or football after work hours. Similarly, he will provide indoor recreation in terms of radio and TV at the eating place. The Contractor will ensure regular medical checks-of the camp staff from a qualified doctor on fortnightly basis. If any person is found affected with any of the transmittal diseases

will be immediately shifted from the camp to the hospital for a detailed checkup and treatment. The cost will be borne by the Contractor. The contractor will restrict his permanent staff to mix with the locals to avoid any social and health problems.

8.4 OPERATIONAL AND MANAGEMENT PHASE

During the operational phase, the Project Manager will develop a comprehensive operational and Management Manual of the Highway and an effective monitoring plan. Mistakes at the operational level or handling of operations by untrained staff can prove very risky and costly. Important points to be attended at the operational stage are as follows:

- ✚ Comprehensive O&M Rules as per ISO standards
- ✚ The strict application of the prescribed M&E plan
- ✚ Continuous evaluation of design efficiencies
- ✚ Understanding and training in Operational and Maintenance Manual
- ✚ Annual Environmental Audit based upon tri-base assessment.
- ✚ Regular maintenance of engineering works (mechanical as well as civil).
- ✚ Staff Welfare
- ✚ Continued Public consultation and feedback on that
- ✚ Continue attention to Gender issues and women's consultation
- ✚ Refresher Training Courses for operational staff

9 ENVIRONMENT MANAGEMENT PLAN (EMP) AND ENVIRONMENT MONITORING PLAN

9.1 GENERAL

Environmental assessment of any development project plays an important role in sustainable project implementation. The proposed project is the Widening and Improvement of Shahdara Chowk to Gujranwala Road section therefore, a detailed assessment was carried out in accordance with the Punjab Environmental Protection Agency (PEPA). To comply with the regulatory requirements of PEPA a comprehensive EMP has been devised for its implementation during the project execution.

Purpose and Objectives of the EMP The primary objectives of the EMP are to:

- ✚ Achieve NHA Corporate HSE goals
- ✚ Facilitate the implementation of the mitigation measures identified in the EIA.
- ✚ Define legislative requirements, guidelines and best practices that apply to the project.
- ✚ Define the responsibilities of the project proponent.
- ✚ Define a monitoring mechanism and identify monitoring parameters in order to:
Ensure the complete implementation of all mitigation measures.
- ✚ Ensure the effectiveness of the mitigation measures.
- ✚ Define requirements for environmental monitoring and auditing.
- ✚ Provide a mechanism for taking timely action in the face of unanticipated environmental situations.
- ✚ Identify training requirements at various levels.

9.2 ANTICIPATED ENVIRONMENTAL IMPACTS

The project activities will involve the Construction of the new road in all cases. Since the candidate road project will mainly include the construction of a road the project is unlikely to cause any significant adverse environmental impacts.

Potential issues during the pre-construction stage are delays in obtaining required clearances and permits for the establishment and operation of facilities such as hot mix plants and stone crushing plants. Anticipated impacts during construction which are typical of road construction projects include the generation of dust from earthworks; noise and exhaust from the operation of equipment/machinery/vehicles; generation of construction waste as well as wastes from construction and worker camps; water contamination and water supply issues; occupational health and safety issues with the

workers and local communities. Key benefits of the project will be better connectivity through enhanced road quality and safety. Given this, the main long-term environmental impact will be increased greenhouse gas emissions from the increased traffic.

Mitigation measures that will be proposed to address these anticipated impacts will include but not be limited to wet spraying to control dust; limiting working hours to minimize disturbance; regular maintenance of vehicles involved in construction; reuse or proper disposal of construction debris; maintenance of proper hygiene and safety standards and facilities in the camps and working areas; development and implementation of an erosion control and silt management measures; and compensatory plantation. These anticipated impacts will be addressed through mitigation measures provided in the Environmental Management Plan (EMP) which will be made mandatory for the contractor to implement. Further institutional mechanisms will be established between the Executing Agency, Construction Supervision Consultants, contractors, and other concerned agencies to ensure all unanticipated environmental impacts are appropriately addressed

9.3 ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES

This section provides an organizational structure for environmental management during the proposed project operation and defines the roles and responsibilities of the various players for the duration of the project. The proposed project includes the following organizations:

NHA as the project proponent and owners of the EMP;

Project construction contractor(s) as executors of the EMP during construction phase of the project;

Operation & Maintenance (O&M) team as executor of the EMP during the operational phase of the project. These organizations will have the following roles and responsibilities during the project.

Roles and Responsibilities of NHA

National Highway Authority (NHA) as project proponent will be responsible for ensuring the implementation of the EMP. NHA will be responsible for the overall environmental performance of the project. Project proponent will monitor the environmental performance of the project to ensure that the project is carried out in accordance with governing legislation, project proponent corporate policies and recommendations of this EIA. Details of specific NHA personnel involved in the project are given below:

Project Director:

Project Director will be responsible for the successful implementation of the Project. He will be assisted by the Supervision Consultants. Project Director will have a Deputy Director for the said project.

Deputy Director (Environment) will be assisted by Assistant Director (Environment) for the execution of Environmental Management Plan (EMP) for the Project. Deputy Director (Social and Land/Resettlement) will be responsible for the land acquisition and resettlement related issues.

Executive District Officer (E.D.O. Revenue) will be assisted by D.D.O (Revenue), Assistant Revenue Officer and Patwaris in assessing the award price for land acquisition to the affectees. The responsibilities of Director (Environment) may be briefly described as follows:

- ✚ To coordinate with regulatory agencies including PEPD, EIA consultant, local NGOs, that could assist the NHA in independent reviews of environmental and social compliance;
- ✚ To supervise environmental and social assessment reports, and provide substantial inputs and guidance to the EIA consultant;
- ✚ Supervise Project design consultant to get the approval of EIA from the EPD Punjab; To ensure that the design consultant has incorporated all the mitigation measures proposed for the design phase in the design and included in the contract documents; Specifically, before the start of the Project, the NHA's Deputy Director (Social and Land/Resettlement) will ensure that the following activities are carried out in a transparent manner and according to the acceptable standards:
 - ✚ Identifying and verifying Project affected persons (PAPs) on the basis of specified documents;
 - ✚ Identifying which public facilities and utilities need to be relocated;
 - ✚ Identifying alternative resettlement sites for PAPs outside the ROW;
 - ✚ Carrying out a consultation and dissemination campaign with regard to compensation procedures, entitlement packages, and proposed alternative resettlement sites;
 - ✚ Preparing individual entitlement files;
 - ✚ Preparing and approving compensation budgets;
 - ✚ Ensuring that an adequate notice period is given to PAPs before shifting;
 - ✚ Providing shifting assistance to displaced squatters and to assist squatter owners to salvage their facilities; and
 - ✚ Approve the SSEMP prepared by the contractor prior to the commencement of civil works

Director (Environment, Social and Land/Resettlement):

The Director (Environment) will be the overall incharge for handling NHA's obligations with respect to the EMP. The Director (Environment) will depute one Deputy Director (Environment) for the Project, who will be responsible for ensuring that the provisions of the EMP and Site Specific Environmental Management Plan (SSEMP) are implemented.

Roles and Responsibilities of Contractors

NHA will appoint design consultants, supervision consultants, construction contractor(s) for the construction, testing and commissioning of the proposed project including the auxiliary facilities.

Design Consultant:

Design consultant will ensure that all the mitigation measures designated for the design phase are incorporated in the design and included in the contract documents. Supervision Consultants: Supervision consultants appointed by the Project Director (NHA) will be headed by a "Project Manager".

Supervision consultant

Supervision consultant along with his team will supervise the Project contractors to ensure quality of work and fulfilment of contractual obligations. The Supervision Consultant (SC) will provide one Environmental Specialist/ Monitoring Consultant (MC) who will:

- ✚ Ensure that all the environmental and social parameters/provisions comply with the applicable standards;
- ✚ Ensure that day-to-day construction activities are carried out in an environmentally sound and sustainable manner;
- ✚ Organize periodic environmental training programmes and workshops for the Contractors' staff and NHA site staff in consultation with the NHA; and
- ✚ Develop "good practices" construction guidelines to assist the Contractors and NHA staff in implementing the EMP;
- ✚ Assist NHA as required in developing the bi-annual environmental monitoring reports;
- ✚ Assist NHA in reviewing the SSEMP developed by the contractor

Construction Contractor:

EMP will be made a part of the contract agreement and the contractor will ensure that all Project activities are in compliance with the EMP and NEQS.

Operations and Maintenance (O&M) Contractor:

Similarly, Operations and Maintenance (O&M) team will be appointed during operational phase of the project. These contractors will be responsible for implementation of, or adherence to, all provisions of the EMP and with any environmental and other codes of conduct required by project proponent. Overall responsibility for environmental performance of the operation will be the liability of the senior management of the contractors. Site managers of the contractors will be responsible for the effective implementation of the EMP

An environmental specialist from the Project Supervision Consultant, if a supervision consultant is involved, will provide technical support to the environmental expert. An external monitor will conduct periodic external monitoring of EMP implementation. Environmental awareness and EMP implementation training will be held for contractors and Supervision Consultants.

9.4 MONITORING AND REPORTING

NHA has the responsibility for undertaking environmental due diligence and monitoring the implementation of environmental mitigation measures for the project. The due diligence report as well as monitoring the implementation of the environmental management plan needs to be documented systematically.

The EMP will have both internal and external monitoring. The monitoring reports will document progress made in EMP implementation, with particular attention to compliance with each component of EMP. Monitoring during construction will also be the responsibility of the NHA. Monitoring will relate to compliance with construction contracts, the effectiveness of mitigation measures, and complaints (also known as “Project Performance Monitoring” or Compliance Status Report), and the state and health of nearby environmental resources (also known as “Ambient Environmental Monitoring”).

Monitoring during operation should be conducted on an as-needed basis.

9.5 ENVIRONMENT MANAGEMENT PLAN (EMP)

This EMP has been formulated to avoid, and mitigate anticipated environmental impacts for the road sections :

Table 9-1: Environmental Management Plan (EMP)

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
DESIGN & PRE CONSTRUCTION ACTIVITIES								
Alterations of the drainage pattern of the site	Avoid dumping spoiled materials on nearby Water Bodies	Physical Impact	To be checked all along the project corridor	At planning Stage	Low	✚ Design of cross drainage structures would be carried out to avoid alteration of drainage pattern. The design would be done considering a 50-year return flood level to avoid overtopping the roads and maintain natural drainage	Contractor	NHA / Supervision Consultant
Cultural / Environmental Sensitive properties	Impact on houses and shops etc. along the proposed RoW	Social Impacts	To be checked all along the project corridor	At planning Stage	Low	✚ Construction activities avoid any interference with cultural heritage/environmentally sensitive sites including houses and shops, etc. ✚ In case of unavoidable interference prior notification and consultation are needed for consensus on options e.g. start of construction work	NHA in bid documents for Contractor, Environment Specialist	NHA / Supervision Consultant
Planning site activities	Construction causes danger to workers, locals	Community Health & Safety	To be checked all along the project corridor	At planning Stage	Low	✚ Prepare Community & Health Safety	Contractor	NHA / Supervision Consultant
Damage to trees (Flora)	Cutting off trees and bushes of	Ecological Impacts	Within the ROW	At planning stage	Medium	✚ A sufficient amount of planting will be done on	Contractor	NHA/ Supervision

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
along the RoW	different species					both sides. ✚ If a tree of rare species is growing within the ROW and is required to be removed. It will not be filled but uprooted and transplanted in close consultation with the forest department. ✚ Efforts should be made to save as many trees as possible even if they are young or poll stage. Proper irrigation and maintenance of plants will be done.		Consultant
CONSTRUCTION PHASE								
CAMPSITE AND CONSTRUCTION WORKS								
Grievance Redress								
Grievances	Social Impact	Social Disputes	Valid for the entire construction area throughout the construction period	Throughout The project	Low if recommendations are followed	✚ Officials in charge of people's Grievances will be designated. ✚ A leaflet outlining environmental protection measures and listing grievance contact points will be Distributed. ✚ Community leaders will be given detailed information on the grievance management process	PMU, Contractor	NHA, supervision consultant, Contractor, Grievance Specialist

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						NGOs will be informed in the same manner as the community leaders.		
Construction Camps	Physical	Damage of topsoil Contamination related to fuel storage and fueling operations Sewerage related contamination Waste Management	Valid for the entire construction area throughout the construction period	Throughout project	Minor if recommendations are followed	- Proper construction camp management in compliance with Construction Camp Management Plan - Proper waste management in compliance with Waste Management Plan - Proper spill management in compliance with Spill Management Plan	Design Engineer, Contractor	NHA, supervision consultant Environment Specialist, Contractor
Utilities								
Public Utilities	Social Impact	Possibility of Damage to gas or water pipelines, cropland. Disconnection & distortion of the phone line	All along the construction site	During Construction	Medium	All public utilities likely to be impacted, such as gas and/or water pipes, power and/or phone lines, etc. must be relocated to suitable places, in consultations with respective agencies proper compensation will be paid to the land owners.	Contractor	NHA, Environment Specialist, Contractor
Site selection and operation of construction camp.	Socio-cultural Environmental Acceptability to public/owner;	Sanitary waste disposal, solid waste (Kitchen waste)	Several sites along the roadside for construction	Throughout construction period	Minor if recommendations are followed.	Prior consultation with the local Contractor need to obtain NOC for sitting work camps & workshop, or an	Contractor	NHA, supervision consultant Environment

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
Store materials Human activities on-site Travel to/from construction camp	Friction with residents	disposal, fuel leakage. Noise and additional traffic. Water usage of pollution	campsites			agreement made with the landowner ✚ Site construction to be supervised ✚ Proper storage and fencing/locking of storage rooms containing hazardous material ✚ Setting up of complaints office, advertising ways to voice complaints		Specialist, Contractor
Site restoration after the contract completion	Loss of roadside vegetation/assets and plantations if any in an area of scarce biodiversity and dissatisfaction with rehabilitation measures after completion	Loss of Plants in an area with already scarce biodiversity, and loss of functional benefits from roadsides plants	All along the route, campsites	Long-lasting	Moderate	✚ Manage design to minimize removal of roadside plantation ✚ Apply flexibility in the decision in reducing locally the shoulder with. ✚ Plan for compensatory planting for each felled 10 plants of similar/local flora species ✚ The contractor will provide a plan for removal & rehabilitation of the site upon completion ✚ Photographic and botanical inventory of vegetation before clearing the site ✚ Disallow introduction of exotic species or species	Design Engineer, Contractor	NHA, supervision consultant Environment Specialist, Contractor

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						with known environmental setbacks (e.g Eucalyptus etc.)		
Creation and burning of wastes at or near campsites	Solid-liquid waste generated and air pollution associated with burning garbage	Air pollution associated with burning garbage	Along campsites	throughout construction	Moderate	- Disallow sitting for the work camp, including waste dump sites, at distances closer than 300m to any inhabited areas - Incorporate technical design features for refuse collection containers at sites that would be minimized burning impacts - Devise a plan for the safe handling, storage, and disposal of harmful materials - Disallow burning	Contractor	NHA, supervision consultant Environment Specialist, Contractor
Safety & Accident Risks								
Construction Activities and Accident Risks through transportation of material through labor	Health & Safety	Minor And major injuries, can even lead to fatalities in case of ignoring safety practices	Various construction sites throughout the project corridor	During construction	low	- Safety signals will be installed on all temporary routes During construction. Strict enforcement of traffic rules and regulations. - Workers will be provided safety equipment such as helmets, masks, and safety goggles. - A readily available first aid unit, dressing Materials,	Contractor	NHA, supervision consultant Environment Specialist, Contractor

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						ambulance, and nursing staff will be ensured at critical locations. ✚ Road safety education will be imparted to drivers of construction vehicles. ✚ Traffic management will be ensured during Construction periods. ✚ Information dissemination through newspaper, radio and/or TV and banners, etc. about project time frame, activities causing disruption, and temporary arrangements for public relief must be ensured.		
Loss of Access	Traffic congestion	Air pollution & fatigue	Various construction sites throughout the project corridor	During Construction	Minor if properly mitigated	✚ Alternatives and temporary accesses will be provided at all construction, bridges, and culverts, in congested areas. Such diversions will have proper drainage facilities.	Contractor	NHA, Environment Specialist, Contractor
Health and safety at the workplace	Health risks if work conditions provide unsafe and/or unfavorable work conditions	Worker injury	Valid for the entire construction area throughout the	At the establishment of campsites and the construction period	High	✚ Drainage, sanitation, and waste disposal facilities will be provided at workplaces. Drainage will be maintained to avoid water logging, which leads to	Contractor	NHA, Environment Specialist, Contractor

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
			construction period			mosquitoes and disease. - Suitable sanitation and waste disposal facilities will be provided at camps using septic tanks and soakage pits, etc. A sufficient water supply will be maintained at camps to avoid water-related diseases and to secure workers' health. - Health education & preventive medical care will be provided to workers. - Routine medical checkups of workers to avoid Communicable disease - Provide basic medical training to specified work staff, and basic medical services and supplies to workers - Layout plan for campsite indicating safety measures taken by the contractor, e.g. firefighting equipment, safe storage of hazardous material, first aid, security, fencing, and contingency		

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						measures in case of accidents ✚ Work safety measures and good workmanship practices to ensure no health risks for laborers ✚ Protection devices (ear muffs) will be provided to the workers operating in high noise-generating machines, blasting ✚ Proper maintenance of facilities for workers ✚ Regular pest control measures in dormitories ✚ Obligatory warning of work staff if pest hazard is imminent or detected ✚ Awareness campaigns for protection from AIDS / HIV / Hepatitis		
Digging borrow pit areas	Physical environment	Borrow pit collect water, material mosquitoes	The entire length will require fill to raise the level of the carriageway	Early in construction	Low	✚ Used approved borrowed areas. Borrow roads made good on completion of the contract ✚ Inspection of sites ✚ Borrow pits shall be dewatered and fences should be provided as appropriate, to minimize	Digging borrow pit areas	NHA, supervision consultant Environment Specialist, Contractor

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						health and safety risks.		
Laying of asphalt	Physical Environment	Emission of dust and fumes from asphalt plant; Runoff of hydrocarbons during "curing" period	In the asphalt batching plant area, One length of road where surface laying is taking place	In later stages of construction Within 48 hours of laying asphalt	Low if the laying of asphalt does not occur in the rain	- Ensure Workers use appropriate clothing - Lay asphalt during dry periods	Contractor	NHA, supervision consultant Environment Specialist, Contractor
Quarrying materials	Physical environment	Cuts scar natural hillsides	In mountain section	During construction	Low fill should be available	Use existing quarry sites	Contractor	NHA, supervision consultant Environment Specialist, Contractor
Construction of structures, bridges/culverts.	Socio-cultural	Severance to the local population	At points where the road crosses established tracks	During construction	Low provision for crossings is gives	- Ensure provision of adequate crossing points - Work on irrigation canals shall be kept to a minimum to avoid disrupting water supplies to croplands. Damaged irrigation canals shall be repaired immediately.	Contractor	NHA, Environment Specialist, Contractor
Planting trees	Ecological	Introduction of appropriate species	Alongside new road	After Construction	Medium	Use Forest Departments to select appropriate plants. Require approved plan to be prepared and used	Forestry Department	NHA, supervision consultant Environment Specialist, Contractor
	Socio-cultural	Trees create a safety hazard	Where trees are planted	Once trees have matured	Medium	Planting scheme to include shrubs close to the road as		

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						a barrier		
Removal of Construction Camp	Socio-cultural	Adverse effects on residents	At camps	After completion of construction	Low if correct closure plan implemented	- Supervise and enforce closure plan - Monitor	Contractor	NHA, supervision consultant Environment Specialist, Contractor
Closure Plan								
Clearing site	Damage not restored on departure	Loss land	Site in contractor custody	Completion stage	Medium	- Borrow roads made good on completion of the contract - Supervise and enforce closure plan. Monitor	Contractor	NHA, supervision consultant Environment Specialist, Contractor
Discharge Control								
Drinking water	Water born disease	Workers/labor health	Const camp	Throughout construction period	Medium	- The contractor will ensure the Provision of safe drinking water to all the workers/labor - Water quality should conform to PEQS/WHO standards - Should be reconfirmed once during the construction phase	Contractor	NHA, supervision consultant Environment Specialist, Contractor
Wastewater discharges	Water pollution	Contamination of water sources	Contractor Campsites	Throughout construction period	Low	Suitable sanitation and waste disposal facilities will be provided at the camp using a septic tank linked with soaking pits.	Contractor	NHA, supervision consultant Environment Specialist,

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						- All discharges should comply with PEQS through a certified laboratory - Should be verified monthly		Contractor
Noise from construction equipment	Physical Construction site including road approaches	Noise and vibration nuisance to surrounding communities. The impact will be mainly limited to pile driving and compaction of the access road.	Valid for the entire construction area throughout the construction period	At the establishment of campsites and the construction period	High	Maintenance of vehicles, equipment, and machinery will be regular and to the satisfaction of the Engineer, to keep noise from these at a minimum. All vehicles and equipment used for construction will be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers will be checked and will not exceed the prescribed limit of PEQS	Contractor	NHA, supervision consultant Environment Specialist, Contractor
Vehicular movement and operation of machinery	Emissions from construction vehicles and machinery, cause public health risks, nuisance, and other impacts on the biophysical environment	Dust and other emissions	Workshops at Contractor Campsites	Throughout construction period	Low	- All temporary service and access roads will be regularly to minimize dust generation: Haul roads to be dust controlled, and all vehicles carrying loose friable material to be covered - All machinery and plants will be placed at min. 300m in downwind direction to	Contractor Approved Labs	NHA, supervision consultant Environment Specialist, Contractor

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						human settlements - All vehicles, equipment, and machinery used for construction be regularly maintained to ensure that the pollution emission levels conform to the PEQS - Air quality parameters will be monitored at determined sites monthly - Incorporate design features enabling the continuation of traffic flow and traffic jams - Water will be sprinkled to avoid kick-off dust.		
Generation of Dust	Dust generation from construction types of machinery causes health risks to operating workers, impacts the biophysical environment	Dust emissions from the crusher and screening plant Emission of dust and fumes from the asphalt plant	At sites of plants, crushers	Throughout construction period	High	- Ensure precautions to reduce the level of dust emissions from, mixers, plants, crushers, and batching plants, e.g. providing dust extraction units. Crushers are to be fitted with dust suppression equipment. Plant to have suppression equipment. - Water will be sprayed in lime/cement and earth mixing sites	Contractor	NHA, supervision consultant, Environment Specialist, Contractor

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						- Work safety measures like dust masks and appropriate clothing will be used to ensure no health risks for operators - Equipment be well maintained - Asphalt plants are located 300m away from populated areas (downwind) and may have a wet scrubber - Water Sprinkling will be carried out		
Transportation of materials, and other construction activities that create dust and emissions	Physical	Dust and emissions from machinery cause health risks to operators and impacts the biophysical environment	Throughout Project Road Construction sites near the major settlements	During construction	Low	- Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered to reduce spills on existing roads. - Ambient air quality monitoring be carried out in accordance with the EMP - If monitored parameters are above the prescribed PEQS-limits suitable control measures must be taken	Contractor	NHA, supervision consultant, Environment Specialist, Contractor
Disposal of waste from rehabilitation works	Physical Health Risk	Degrading Soil and Water Quality	Project Road Construction sites near the major	Construction	Low	- All construction waste collected - The site is kept tidy and no waste will be allowed to	Contractor	NHA, supervision consultant Environment

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
			settlements			build up in the yard. ✚ Disposal sites are to be kept away from the localities (preferably 300 meters / at least 500 meters)		Specialist, Contractor
✚ FAUNA AND FLORA: Wildlife & Adjacent Ecological Sensitive Areas								
Access to sensitive areas of the fragile ecosystem	Poaching on wildlife plants, disturbance of nullah habitats	Disturbance to the ecologically sensitive areas adjacent to or near roads	Near nullah banks	Throughout construction period	Low	✚ The use of firewood for cooking and execution of works be prohibited ✚ No open fires are allowed ✚ Restoration of vegetated areas ✚ The strict instruction from the Contractor to work staff (particularly the cooks) concerning poaching local wildlife ✚ Signage for wildlife crossing to raise attention ✚ Assist in public awareness programs ✚ Special bushes/plants for sandy areas along the roadway ✚ Patrolling and enforcement	Contractor	NHA, supervision consultant, Environment Specialist, Contractor
Use of local resources and products	Competition for natural resources, e.g. with farmers,		Agricultural areas with tube wells and canal	Throughout construction period	Low	✚ Water supply/sanitation facilities labor not exacerbate the existing shortages	Contractor	NHA, Environment Specialist, Contractor

Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
	livestock raisers, and nomads for range land & water		irrigation limited water availability			environmental hazards; Contractors should primarily seek its sources of water by deep well boring at 4–5 locations in the due distance (min. 1 km) from local user's wells. ✚ Ensure labor does not exploit adjacent forest resources is a ban on tree cutting		
✚ Environmental Enhancements								
Roadside Landscape Development			Various construction sites throughout the project corridor	During Construction	Low	✚ Avenue plantation of mixed specie aesthetic trees, shrubs, and aromatic plants will be carried out.	Contractor	PHA, NHA, Supervision consultant, Environment Specialist, Contractor
Roadside Amenities			Various construction sites throughout the project corridor	During Construction	Low	✚ Road furniture including footpaths, railings, traffic signs, speed zone signs, wildlife warning boards, etc. will be erected at suitable places	Contractor	NHA, supervision consultant, Environment Specialist, Contractor
Cultural Properties	Socio economic / cultural		Various construction sites throughout the project corridor	During Construction	Low	✚ All cultural properties will be enhanced and access roads will be provided, wherever required	Contractor	NHA, supervision consultant, Environment Specialist, Contractor

Table 9-2: Environmental Monitoring Plan

Parameter to be measured	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Pre-Construction/ Desing Phase						
Ambient Air Quality	To establish baseline air quality levels	CO, NO ₂ , SO ₂ , & PM ₁₀ (particulate matter smaller than 10 microns) concentration at receptor level, PM _{2.5}	1-hr and 24-hr concentration levels	At three random receptor locations in the project area both upwind and downwind	Once	CSC
Ambient Noise	To establish baseline noise levels	Ambient noise level near receptors in project area	A-weighted noise levels– 24 hours, readings taken at 15 s intervals over 15 min. every hour, and then averaged	At three random receptor locations in the project area	Once	CSC
Water Analysis	To determine the existing condition of water quality during baseline survey	Total Coliforms, Fecal Coliform, Total Colonial count, Fecal Enterococci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium) and all parameters as mentioned in PEQS for drinking water quality	Grab Sampling	From Sensitive receptors location along the road	Once	CSC
Traffic load	To manage traffic flow in project area	Traffic flow in project area	Traffic flow rate and peak hours will be	At different locations around	Once	CSC

Parameter to be measured	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
			monitored	the project area		
Construction Phase						
Noise Disturbance due to noise from construction activity	To determine the effectiveness of noise abatement measures on sound pressure levels	Ambient noise level at different locations in project area	A-weighted noise levels – 24 hours, readings taken at 15 s intervals over 15 min. every hour at 15 m from receptors, and then averaged	At three random receptor locations along project area	Quarterly basis on a typical working day	Contractor's Environmental officer, CSC/NHA
Air Quality Dust emissions from construction vehicles and equipment	To determine the effectiveness of dust control program on dust at receptor level	CO, NO ₂ , SO ₂ , O ₃ & PM ₁₀ (particulate matter smaller than 10 microns), PM _{2.5} concentration at receptor level	1-hr and 24-hr concentration levels	At three random receptor locations in project area	Quarterly basis on a typical working day	Contractor's Environmental officer, CSC/NHA
		Visible dust	Visual observation of size of dust clouds, their dispersion and the direction of dispersion	Construction site	Once daily during peak construction period	Contractor's Environmental officer, CSC/NHA
Safety precautions by Safety workers	To prevent accidents for workers and general public	Number of near miss events and accidents taking place	Visual inspections	Construction site	Once Daily	Contractor's Environmental officer, CSC/NHA
Operational Phase						
All Environmental	To implement the effective EMP	All Parameters specified by EPA	Quarterly	Along the road Side	As Per EPA Laws	Executive Engineer of the

Parameter to be measured	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Aspects						area

9.6 ENVIRONMENTAL MANAGEMENT TEAM ALONG WITH THEIR ROLES AND RESPONSIBILITIES

- ✚ Administrative arrangements for the implementation of the project.
- ✚ Ministry of Communication and NHA are sponsoring and executing agencies respectively. NHA will hire Government approved Contractor for the execution of the Civil works. However supervisory consultant will also be engaged for quality execution work. NHA owns project staff will remain full-time at the project site up to the completion of the project.

9.7 Tree Plantation Plan

Tree planting is often used to enhance the appearance of roads and to provide a natural buffer between the road and adjoining land. If trees are selected without due consideration to the special needs of roads, they can generate safety and sustainability problems. Inappropriate species can cause environmental damage. Tree plantations on top of embankments and rights-of-way will serve as small forests and wood lots for residents, having tangible benefits in the form of timber, fuel wood, and fodder. Besides soil retention and erosion control, such plantations will also provide aesthetic and visual screens against sound, dust, wind, toxic emissions, night glare, and pollution of waterways.

A tree plantation plan has been prepared for the proposed project keeping in view the design and length of the project. This plan is based on the best possible estimations and can be modified accordingly at the execution stage.

Plantation Plan

For plantation, two plans have been recommended as “Minimum Requirement” with 1 row of plants on each side of the road, and, “Desirable Requirement” with 2 rows of plants on each side of the road. Details of both the plans are given below:

i) Minimum Requirement: Two rows of plants (one row on each side) will be raised at the proposed site. Plant to plant distance will be kept as 2 meters, so there will be 500 plants in one row of one Km length..

ii) Desirable requirement:

Four rows of plants (two rows on each side) will be raised of the proposed road green belt. These plants are to be planted along the side roads and within the loops. Native species would be planted like sheesham, (dalbergia sissoo), keekar (acacia arabica), shareen (albizzia lebbek) and bari (ziziphus jujuba) and no invasive/ exotic species would be introduced

9.8 Traffic Management Plan

Contractors will develop and adhere to Traffic Management Plans throughout the construction phase of the Project. Safety of site access roads and intersections with classified road networks is paramount. Safe sight distance and appropriate signals will be maintained. Suitable vehicles parking and storage area will be provided onsite and maintenance of construction vehicles will be provided onsite, with regular inspection of the lighting system, brakes, and tires.

The construction activities can potentially impact the residents and the use of construction vehicles on the roads in the project area. A Traffic Management Plan will be implemented that will aim at ensuring uninterrupted traffic during construction hours. Where applicable to the activities being undertaken, contractors will identify measures in their Traffic Management Plans consistent with the measures described below related to:

- ✚ Road Safety Signs
- ✚ Speed limit signs
- ✚ Control of and restrictions for Project roads;
- ✚ Access roads to be decommissioned after Project use; if available
- ✚ Traffic control measures;
- ✚ brake checks;

9.8.1 Objectives of TMP

The traffic must be managed to ensure:

- ✚ The continuous, safe, and efficient movement of traffic for both the public and workers.
- ✚ The capacity of the Local Roads is maintained,
- ✚ Delays and disruptions are kept to a minimum.

9.8.2 Responsibilities of Workers

Workers include logistics workers, operators, drivers, and so on.

Their responsibilities include:

- ✚ Follow workplace traffic instructions and safety warnings or signage's at the workplace;
- ✚ Attend workplace traffic safety and health training or briefing sessions
- ✚ Only operate plant or equipment if they hold valid licenses, possess the relevant safety certification, and have been given the authorization to do so

- ✚ Observe emergency procedures, instructions, and arrangements as established and instructed
- ✚ Operate equipment with care and do not use equipment (including vehicles) beyond their capacity or designated purpose
- ✚ Use all safety devices and PPE as provided
- ✚ Never misuse, interfere with, or modify any of the devices or equipment
- ✚ Report any damage, malfunction, or suspected defect of plant, equipment, safety device, or PPE to their respective supervisor
- ✚ Report accidents, incidents, diseases, and any workplace hazards to the supervisor or person-in-charge
- ✚ Suggest ways to improve traffic safety at the workplace if they identify any lapses during work.

9.8.3 Advance Warning Area

The warning system must change the driver's normal expectation of the roadway situation, and inform him of what to expect.

9.8.4 Signing

Warning signs are intended to provide adequate time (and distance) for the driver to perceive and react to the condition ahead.

9.8.5 Flags / Warning Lights

Red flags attached to a sign attract attention during daytime operations and should be considered for application on the first warning sign. Flash warning lights add emphasis during nighttime operations.

9.8.6 Rumble Strips

Rumble strips present vibratory and audible warnings, which alert drivers. They are used with the first warning sign or any other arrangement approved by the Engineer.

9.8.7 Speed Reduction

A basic principle of good temporary traffic control is that traffic movement should be inhibited as little as practical. Drivers will reduce their speed only if they perceive a need to do so.

9.8.8 Requirement for Transition Area

- ✚ Tapers
- ✚ Channelizing Devices
- ✚ Chevron Sign

The Chevron sign should be used on curves and tapers to supplement other devices and provide additional emphasis and guidance for the motorist. Spacing shall be such that at least three Chevron signs are always visible to the motorist. Chevron signs shall be mounted on flexible supports.

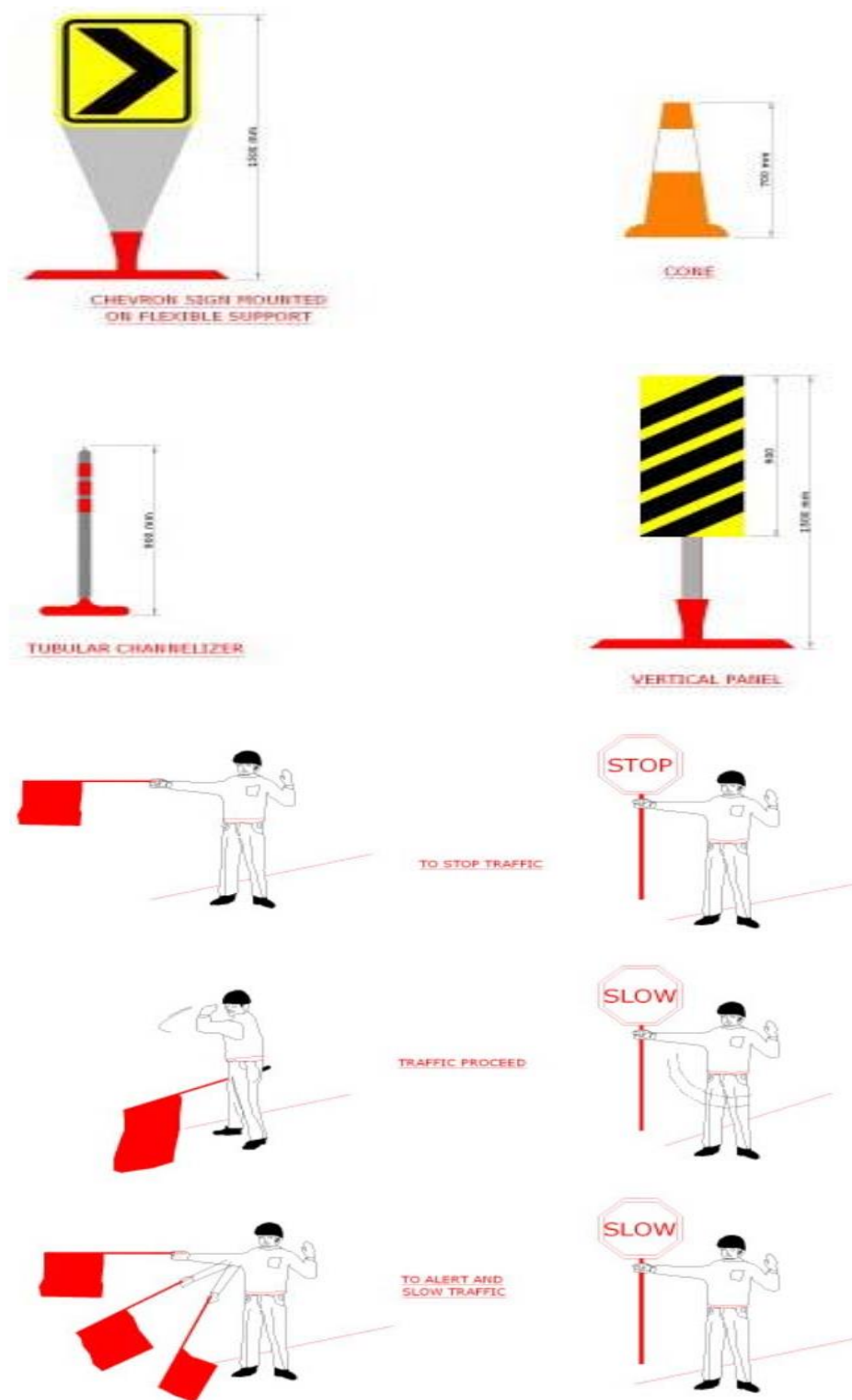


Figure 9-1: Chevron Signs

9.8.9 Buffer Area

The Buffer Area separates traffic flow from the work activity. It provides a recovery space for errant vehicles and safety for workers. Design guidelines for the buffer space include:

The buffer space length must be at least as long as the taper length.

Channelization devices shall be spaced every 10 meters along the parallel portion of the buffer area.

9.8.10 Working Area

It is preferred that an approved barrier by NHA be used to separate traffic from the Work Space. Concrete portable crashworthy safety barriers are an example of a barrier that prevents vehicles from penetrating work areas, and also minimizes vehicle occupant injuries. However, the type of barrier to be used can be decided at the site depending upon the duration of work in the working area, availability of material, and traffic volume.

9.8.11 Termination Area

The downstream end of the work site may require a closure taper to reduce the chance of a vehicle coming from the opposite direction entering the work site at high speed. The closure distance from the work site, including the taper, is usually a distance of 50 meters.

9.8.12 Flagging Procedures

Flaggers must be well trained and must be provided frequent relief during the flagging operation. The flagger must wear a reflective safety vest and should be positioned at least 150 meters upstream of the work site. The illumination must be provided when flaggers are operating during nighttime conditions. In preparing a layout of traffic control devices, the used distance guidelines are shown in the application diagrams. Beginning at the Work Area, workers work back through the Buffer Area, the Transition Area, and the Advance Warning Area.

Typical application diagrams are presented on the following pages for a variety of highway conditions. These are not intended as a substitute for engineering judgment. Typical applications can be altered, when necessary, to fit the conditions of a particular temporary traffic control zone.

Upon completion of the above procedure, the supervising Engineer at a site must inspect the field, the location where the initial sign in the Advance Warning Area is to be placed. The initial sign must be visible to oncoming traffic for a long distance. If necessary, additional signs must be placed to assure good visibility.

A trained person is proposed to be assigned the responsibility for safety at the work site. He must monitor operations when the site is initially opened and at routine intervals, both day and night, and assure that all traffic control elements are effective in providing safe conditions for both motorists and workers. He is expected to implement changes, when necessary, to assure safe conditions.

9.9 Muck Disposal Plan

Environmental Management Plan for the disposal of muck generated by the construction. The Plan was developed based on the specifications and recommendations provided in the Manual for Developing Environmental Management Plans for Works under Concession, published by the Ministry of Public Works (2004). In particular, it establishes the environmental considerations for operating the muck disposal sites to be implemented during the road construction phase.

9.9.1 Objective

The objective of the Environmental Management Plan is to provide data on the location of the muck disposal sites, the related activities of the construction phases, the identification and assessment of associated impacts, the control, mitigation, and restoration measures, and the monitoring plan.

The selection of locations, the design, and the management practices relating to the muck disposal sites were all based on technical, environmental, and safety criteria

9.9.2 Location

In selected barren spots as allowed/approved by Resident Engineer.

9.9.3 Description of Activities and General Environmental Criteria

The activities and environmental criteria associated with the setup, management, and abandonment of the muck disposal sites are discussed below, based on the Manual for Developing Environmental Management Plans for Works under Concession.

The measures adopted during the setup, operation, and abandonment phases of the muck disposal sites will be implemented by the works contractor.

9.9.4 Muck Disposal Site Setup

The activities involved in setting up the muck disposal sites include :

(i) Identifying the Work Areas

The location of the muck disposal site followed the environmental criteria.

(ii) Topographic Layout

The filling sites will be located adjacent to natural elevations so that the filling terraces will provide continuity to the area's general morphology. When setting up the disposal sites, care will be taken to ensure that the height of the dumps and their final form at closure adapt to the topographical features of the area where they are located.

(iii) **Rehabilitating Access Roads for Muck Disposal Operation**

As long as the muck disposal sites are operational, access to the deposit areas will be controlled. The public roads to be used to access the muck disposal sites will be rehabilitated with the traffic solutions and signaling proposed by the study of the road capacity

(iv) **Installing Safety Signs**

Safety signs will be installed for the protection of workers and visitors.

9.9.5 **Muck Disposal Site Operation**

Deposition Mechanisms

During the operation phase of the muck disposal sites, the following measures will be adopted to protect the environment:

- ✚ People who are not involved in the works and animals will not be allowed in the muck disposal sites. For this purpose, fences with gates and controlled access points will be installed.
- ✚ The areas surrounding the muck disposal sites, as well as the access roads, will be kept clean of excavated material, dampened, and perfectly passable.
- ✚ All roadways used by project-related equipment and vehicles will have an adequate signaling system.
- ✚ Equipment and vehicle traffic will be restricted to the access points and roads designated for Project works. The contractor will be responsible for clearly delimiting the roadways and parking areas to be used for carrying out activities, and ensuring that unauthorized areas are not used.
- ✚ Dumping of organic waste, scrap, wood, paper, mud, petroleum derivatives, and hazardous waste will be prohibited.
- ✚ Burning of waste material will be prohibited.
- ✚ The muck disposal sites will not accept construction debris. The latter will be transported to an authorized dump site.

i. Equipment

The operation of the muck disposal sites requires the following equipment :

Dump trucks and Haulage trucks will transport waste to the disposal sites.



Figure 9-2: Machinery Used for Disposal of Muck

ii. Muck Disposal Site Abandonment

Site abandonment activities include :

- ✚ The final shape of each deposit will fit into the local topography. The terraces will be leveled to form a flat surface, and the slopes resulting from the piling and compacting of the waste material will be graded. The finished slopes will not exceed 30% to prevent landslides and water erosion.
- ✚ All temporary structures or facilities set up by the contractor will be removed, together with the signaling system.
- ✚ Sterile material will be covered with soil from the slopes of the dump itself, the roads, and the above-groundworks. The thickness of the cover will be at least 20 cm.

iii. Period of Use

The period of use will vary across muck disposal sites, depending on the rate of progress of the work front, and the site's storage capacity and shape.

In general, muck disposal sites will operate parallel to the daily activities at the work fronts.

To the extent possible, disposal site activities involving the use of equipment will be carried out during the day.

9.9.6 Rainwater Management

Although the construction period will produce inert material, the residual water that could eventually result from the contact of the muck with rainwater will be controlled as follows:

- ✚ The ground surfaces of the muck disposal sites will be graded so that rainwater runoff is directed outward.
- ✚ Trenches dug along the perimeter of contact between the sites and the ground surface will stop runoff from adjacent terrains

9.10 Batching And Asphalt Plant Management Plan

The Contractor shall ensure the use of a relatively new, well-maintained hot mix plant (batch type) so that any emission conforms to the PEQS norms and be fitted with a dust extraction unit to avoid prolonged engine-powered equipment illness. The hot mix plant, WMM plant, batching plant, generator set & crusher shall be located more than 500 m from any community or residence. The concessionaire has to obtain necessary consent/clearance from the state pollution control board to operate the hot mix plant, WMM plant, batching plant & crusher before the commencement of works. All vehicles, equipment, and machinery needed for construction will be regularly maintained to ensure that pollution emission levels conform to PEQS norms. All vehicles will be fitted with silencers. Construction vehicles, machinery & equipment will move or be stationed in designated areas to avoid compaction of the soil to ensure the preservation of the topsoil for agriculture.

Where it is necessary to use some such substance that can cause injury to the health of the workers, the contractor shall provide suitable protective clothing or appliances to his workers, viz. Earplugs, helmets, or dust masks. Additionally following management measures will be adopted :

- ✚ The asphalt plant will be equipped with pollution control devices. According to the specification; no gas emissions will result from the asphalt plant operation itself.
- ✚ Insuring proper operation conditions such as sufficient flame volume, and clean combustion to ensure lowers VOCs are produced.
- ✚ Provide the workers with all safety measures; including masks, ear muff, gloves, and other safety means and periodic medical testing.
- ✚ Periodic maintenance and replacement of filters of the asphalt plant and generator wherever possible
- ✚ Staff and persons who will be working within the noisy zone, they will be supplied with personal protective equipment (PPE) in order not to impair their health as a result of overexposure to noise. It is expected that all the noise generated during asphalt plant operations is within the required norms. Moreover, the plant generators are all fitted with noise-reduction equipment. The placement of a noise breaker screen at the site will also be further investigated if needed.
- ✚ The sludge waste, it's dealt with by the asphalt plant manager to use to pave some surfaces to reduce dust emission, or it can be reused and utilized through recycling back into the asphalt.
- ✚ The domestic wastewater generated by the working staff at the asphalt plant will be disposed of in a septic tank which is acting as a holding tank with sealed bottom and

walls and drained from time to time into wastewater septic Tanks. An official permit from the municipality will be gained by the contractor to dispose of this waste. Wastewater from wash basins (gray water) will be collected separately where there will be two separate sewage networks and used for irrigation and water sprinkling activities.

- ✚ The following measures will be adopted to ensure the effectiveness of safety within the premises.
- ✚ To prevent bitumen burns it will be compulsory for the workers handling hot bitumen to wear full-body protection.
- ✚ All transportation, handling, and storage of bitumen will be handled by experienced personnel.
- ✚ The dust from the manufacturing processes may pose respiratory hazards, hence protective air masks will be provided to the operators of the loading and unloading of the aggregates.
- ✚ Ear-muffs will be provided to those working at the plant.
- ✚ A first aid kit will be available on-site for the workers in case of an emergency.
- ✚ The material safety and data sheets (MSDS) for each chemical will be accessible on the site and displayed.
- ✚ Safety signs will be posted throughout the site and entry and exit will be marked clearly.
- ✚ Regular health checks will be conducted for employees and staff working at the asphalt plant.

9.10.1 Training

All supervisory and site personnel are to receive training on batch and asphalt plant management as required by the regulations. In-house training of personnel on management issues will form part of the site induction process. Reinforcement of such will occur daily by supervisory plant personnel and management during routine visits. The company currently has a manager and two plant supervisors who are responsible for the management of the company's existing facilities.

9.11 Health And Safety Plan

This Health and Safety Plan provides a general description of the levels of personal protection and safe operating guidelines expected of each employee or subcontractor associated with the environmental services being conducted at the site. HASP

Supplements will be generated as necessary to address any additional activities or changes in site conditions which may occur during construction.

9.11.1 Health & Safety Rules of the Site

All site personnel shall adhere to General Safety Rules, during construction operations. In addition, the housekeeping and personal hygiene requirements will also be observed.

9.11.2 Housekeeping

During site activities, work areas will be continuously regulated for the identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) before disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials. Again, it's advisable to rotate monthly with an acid foamer. Especially in the dirty zone, it is important to follow the correct procedures

- ❖ Remove all visible debris manually (with a shovel and brush)
- ✚ High-pressure wash with foam lance
- ✚ Rinse
- ✚ Allow drying
- ✚ Disinfect

9.11.3 Smoking, Eating, or Drinking

Smoking, eating, and drinking will not be permitted inside any controlled work area at any time. The workers will first wash their hands and face immediately after leaving controlled work areas (and always before eating or drinking).

9.11.4 Personal Hygiene

The following personal hygiene requirements will be observed:

✚ Water Supply

A water supply meeting the following requirements will be utilized:

✚ Potable Water

An adequate supply of potable water will be available for personal consumption. Potable water can be provided in the form of water bottles, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified to distinguish them from non-potable water sources.

✚ Non-Potable Water

Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:

✚ Toilet Facilities

A minimum of one toilet will be provided, with separate toilets maintained for each sex except where there is less than 5 total personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities, on-site facilities are not required.

Washing Facilities

Employees will be provided washing facilities (e.g., buckets with water, etc.) at each work location. The use of water and hand soap (or similar substance) will require by all employees following exit from the Exclusion Zone, before breaks, and at the end of daily work activities.

Stop Work Authority

All employees have the right and duty to stop work when conditions are unsafe and to assist in correcting these conditions. Whenever the site person determines that workplace conditions present an uncontrolled risk of injury or illness to employees, immediate resolution with the appropriate supervisor shall be sought. Upon issuing the stop work order, the site person shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the Safety Professional has concurred that workplace conditions meet acceptable safety standards.

First Aid Facility

Adequate first aid facility will be available at the site

9.11.5 Awareness

Staff working at the facility shall be given information to help them to identify the risks and take necessary measures of safety and protection during their work. To create awareness, personnel at the facility shall be briefed through handouts, in-house seminars, and mock safety drills. Particular areas of interest shall be:

-  Moral Obligation
-  Hazard Recognition
-  Importance of Personnel Protective Equipment (PPEs)
-  Accident Prevention
-  Importance of HouseKeeping
-  Machine Guarding
-  Fire Fighting

9.11.6 Use of Safety Equipment

The purpose of personal protective equipment (PPE) is to provide a barrier, which will shield or isolate individuals from the chemical and/or physical hazards that may be encountered during work activities. The use of Personal protective equipment (PPEs) will be made mandatory.

Following Personal Protective Equipment (PPEs) will be provided to the workers:

- ✚ Safety Helmet
- ✚ Safety Shoes/Dry Shoes
- ✚ Dust Mask
- ✚ Safety Gloves
- ✚ Safety Jackets
- ✚ Earmuffs
- ✚ Insulating Gloves and Suits

9.11.7 Training and Capacity Building

Under the Environmental Management and training, it is proposed to provide a “Three Level Hierarchical Structure” for environmental and safety management. The responsible person should be given proper training for capacity building.

The first level shall comprise professionals from the managers and supervisors and they will be responsible for monitoring and recording air emissions parameters, water quality parameters, noise level, and occupational health and safety to ensure and confirm that the operational works comply with Punjab Environmental Quality Standards (PEQS). Unit administrative personnel will submit records to enforcement, as required ensuring compliance with environmental and occupational health and safety regulations and No objection certificate (NOC) conditions. A well-trained person will provide training and equipment to monitor effluent and emission quality compliance with PEQS. The second level shall be the over sighted function to be performed by the Senior Management Officer, the Director, Administrative Officer, and with the feedback of the Environmental and Safety Staff, shall be responsible for providing direction and training, to keep personnel up to date on equipment operation, environmental control, monthly safety meetings for administrative personnel, training on firefighting emergency response and emission and effluent quality monitoring. Administrative personnel and Environmental Health and safety staff should have to well informed of new environmental regulations and safety precautions.

On the third level, the Executive Director should hold meetings and communications regularly with responsible personnel to keep them informed about the status of Quality, Environment, Health, and Safety issues in the building. The responsible staff should maintain a proper record of all these issues.

The responsibilities of the Environment Manager, Health and Safety Officials, and relevant staff are as follows:

- ✚ To ensure the implementation of all the planned mitigation measures during the operational stages of the proposed project and ensure that the proposed project is

implemented in an environmentally friendly manner, causing the least harm to the existing environment.

- ✚ To organize regular monitoring programs of emission, effluent, noise, occupational health, and implementation of safety measures, etc.

- ✚ To develop operational guidelines and implementation schedules.

Receiving complaints from residents and institutions and assisting the local environmental authorities including Environmental Protection Department (EPD), Punjab

9.11.8 Safety Training

Skilled, semi-skilled, and un-skilled staff will be provided with proper training about the work and safety practices that need to adopt during the process activities

10 STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE

10.1 General

This section describes the outcomes of the stakeholder consultation process as part of the EIA report. The feedback from communities and other stakeholders, directly or indirectly affected by the project, was collected to adjust and improve the project's design, planning, and implementation, and help the implementation agency ensure the project's environmental and social sustainability. The consultation process was carried out in accordance with the requirements of the Punjab EPA on public consultation.

The objectives of this consultation process were :

- ✚ To disseminate information on the project and expected project impact, both long-term and short-term, among primary and secondary stakeholders,
- ✚ To gather information on relevant issues so that the feedback received could be used to address these issues at an early stage,
- ✚ To determine the extent of the negative impacts of different project activities and to suggest appropriate mitigation measures.

10.2 Proponents Environment Management Team

All possible impacts and mitigation measures related to the project were discussed with the proponent, management team, and all the stakeholders like

- ✚ Project Contractor
- ✚ NHA
- ✚ Service providers
- ✚ HSE
- ✚ Civil Workers
- ✚ Environmentalist
- ✚ Grievance Redress Committee (GRC)

Proponent assured us to take all suggested mitigation measures to control any discrepancy that arose in the project and to make the project environmentally friendly. The following points were discussed during the public consultations: project components, project activities, and impacts as detailed below.

- ✚ Needs, priorities, and feedback of the population regarding the project.
- ✚ Employment opportunities and livelihoods of communities.
- ✚ Contractor's camps and access to them
- ✚ Potential environmental issues
- ✚ The basis for determining the rates of the land, houses, and other infrastructure.

10.3 The Responsible Authority

i)	Sponsoring		Ministry of Communications
ii)	Execution		National Highway Authority
iii)	Operation	and	National Highway Authority
	Maintenance		
iv)	Concerned federal ministry		Ministry of Communications

10.4 Other Departments And Agencies

The impact analysis is detailed with the management, local community, educational institutes, health institutes, hospitals, and NGOs. All issues were discussed related to the implementation of the project. Scoping sessions, focused group discussions, and wayside consultations were held with the relevant stakeholders in the area.

10.5 Environmental Practitioners And Experts

Project Management Unit visited the project site, had discussions with stakeholders, and consulted with the local people of nearby and other villages to evaluate the project's socio-economic impacts. People of the area belong to different professions mostly belong to employment, own businesses, doctors, some abroad, in Army, teaching, agriculture, etc. women were also consulted for their point of view regarding the betterment of the area by this project, some of them communicated but according to the social value of the area, they mostly hesitate to communicate comfortably and get pictured. People provide a massive information about the project and have positive remarks regarding the project development. Maximum local people, responsible authorities, and other departments were consulted.

10.6 Identification Of Main Stakeholders

During Environment and social impact assessment in the field, a series of consultations were carried out with a wide range of stakeholders including affected farmers, residents, departmental officials, the business community along the route, road users, students, and the general public. All these stakeholders have different types of stakes according to their stated and vested interests and involvements in various aspects of the project.

The aims of community and stakeholder consultations and information dissemination with PAPs during social impact assessment and EIA preparation were to:

- ✚ introduce project details, objectives, proposed implementation plan and strategies, and potential impacts to the community members;
- ✚ identify the communal property and public infrastructure and facilities likely to be affected;
- ✚ identify the vulnerable social groups that may require special support;
- ✚ Identify various socially and culturally acceptable resettlement and other mitigation alternatives.

10.7 Identification Of Stakeholders

Two types of stakeholders can be distinguished: primary and secondary as detailed below:

10.7.1 Primary Stakeholders

The primary stakeholders are the ones directly affected by the project, as well as the general public residing in the project area. Accordingly, the consultations/ focus group discussions were conducted with primary stakeholders to share information about the proposed project, and its expected impacts and to understand stakeholders' concerns by considering the category of stakeholders.

10.7.2 Secondary Stakeholders

The secondary stakeholders are the representatives of Government Departments / Agencies involved in the planning, design, implementation, and operation of the project, including various government departments such as :

- ✚ Local Government Department
- ✚ Forest and Wild Life Department
- ✚ District Coordinating Office-Additional (ADC)
- ✚ Pakistan Red Crescent Society

Consultation with Officials of Environment Protection Department



Consultation With Mr. Noor Ahmed
(Deputy Director EIA)



Consultation With Mr. Naseem ur Rehman Shah
(Director EIA)



Consultation with District Environment Officer Gujranwala

10.8 Stakeholder Consultation Process

The overall strategy for stakeholder consultation is as shown in the table below :

Table 10-1: Process of Stakeholder Consultation

STAKEHOLDER	CONSULTATIONS		
Primary Stakeholder	- Information gathering and data collection. - Information sharing about the project (disclosure) - Opinion seeking (concerns and expectations) - Grievance redress	- Focus Group Discussions - Formal and informal Community meetings	- Baseline Study - Impact Assessment - Inventory of Losses
Secondary Stakeholder	- Participation in the process - Information gathering Authentication and validation of the processes verification of the record	- One-on-one meetings - In-depth interviews - Group meetings	On need basis

Stakeholder consultation for this project was a planned process. The meetings were conducted to inform stakeholders about the project and how it may affect their lives/activities, and to record their concerns, whether real or perceived. Through the use of various tools, the study team tried to involve the stakeholders in active decision-making. However, due to pandemic situations, no large gathering was done.

10.9 Primary Stakeholders Consultation

Apart from gathering quantitative data throughout the project site, a survey of the area of influence and a survey of the project's affected people and other local communities were conducted to share information about the project and record people's concerns/ feedback associated with this project. As the proposed activities are providing better transport facilities by constructing a new road, fewer APs are anticipated during the assessment.

10.10 Topics For Discussion

The following points were discussed during the public consultations: project components, project activities, and impacts as detailed below.

- Needs, priorities, and feedback of the population regarding the project.
- Employment opportunities and livelihoods of communities.
- Contractor's camps and access to them
- Potential environmental issues

- ✚ The basis for determining the rates of the land, houses, and other infrastructure, if falling in the RoW.



Figure 10-1 : Focus Group Discussion with Locals

10.11 Consultation Outcomes

Overall, people expressed their wish for the construction of the road and their support for the proposed project. The widening and Improvement of road project was welcomed by the people as

it will reduce traffic congestion and minimize other road hazards along the selected road section. Local communities demanded that they should be part of a continuous consultation process, together with other stakeholders, during different stages of the project including design, construction, and operation. The concerns raised by the stakeholders/communities are described below:

- ✚ The design of the road must meet national standards.
- ✚ Damage to any structure, if any should be properly compensated.
- ✚ The waste material should not be dumped into the surface water body or along the road.
- ✚ Avoid undue delays in road construction and ensure that project works are carried out at a stretch rather than piecemeal.
- ✚ Avoid dumping construction material along the highway and median.
- ✚ Adopt measures to minimize dust, smoke, and noise pollution, and to control spillages from construction machinery.
- ✚ Carry out construction activities preferably at night to avoid traffic jams/hazards.
- ✚ A proper traffic management plan should be provided during construction activities.
- ✚ Job opportunities should be provided to the locals during construction activities.
- ✚ The safety of residents along the road should be ensured.
- ✚ Erect cautionary and information signs.
- ✚ Control over-speeding, overloading, traffic disorders, and violations of traffic regulations; construct speed breakers where required.
- ✚ Prohibit commercial vendors and squatters from encroaching on the ROW.
- ✚ Ensure that cross-drainage pipes and culverts are regularly cleaned.
- ✚ Regularly remove accumulated piles of rubbish from the ROW.

10.12 Redress Of Stakeholders' Concerns

Most of the concerns raised by stakeholders have already been incorporated into the project's design and will be implemented through mitigation measures as described below :

Suggestions / Concerns of Stakeholders	Prevention Methods
Road Safety	Road safety audits and improved road markings/signage and demarcation of accident-prone junctions will be made to improve the horizontal and vertical geometry and reduce conflicting movement during operation, particularly along inhabited stretches of road.
	Roadside furniture and traffic control devices, including information and cautionary signs, signals, traffic diversion, and flow markings will be provided, to ensure pedestrian safety during construction and operation.

Suggestions / Concerns of Stakeholders	Prevention Methods
	Adequate drains will be designed to cater to the road drainage
Road Construction	Construction vehicles will remain confined within their designated areas of movement.
	Good relations with local communities will be established by encouraging contractors to provide opportunities for skilled and unskilled employment to locals, as well as on-the-job training in construction for young people.
	The solid waste generated during construction and at campsites will be properly managed and safely disposed of only at demarcated waste disposal sites approved by supervision consultants.
	Contractors will be required to instruct and train their workforce in the storage and handling of materials and chemicals that can potentially cause soil contamination.
	All necessary measures will be taken to ensure the safety of traffic during construction, including barricades (including signs, pavement markings, flags, and lights) erected as required by the NHA. All such barricades will be set up as per local regulations.

The stakeholders supported the project, provided that environmental and social issues are addressed through mitigation measures.

11 GRIEVANCE REDRESS MECHANISM

11.1 General

The stakeholder or affected people's concerns, complaints, and grievances about the project's environmental performance will be received, recorded, and replied to in a systematic way using an understandable and transparent process that is gender-responsive, culturally appropriate, and readily accessible to all segments of the affected people at no cost and without retribution.

NHA will establish a Grievance Redress Committee (GRC) to facilitate the resolution of complaints by Affected People (APs) and grievances about the project's environmental performance, in line with the requirement of National and provincial requirements. The GRC will be coordinated by the Deputy Director – Env of NHA. The GRC will address affected people's concerns and complaints promptly, using an understandable and transparent process.

11.2 Composition Of GRC

The GRC will work directly under the supervision of the Director of Environment of NHA.

The following members are recommended to form a GRC to look into environmental matters.

- ✚ DD Environment –NHA
- ✚ Representatives from Affected People (APs)
- ✚ Environmentalist of Supervision Consultant / Contractor

Director Environment will nominate one Deputy Director as a member of GRC and shall act as Project Environmental Grievance Officer (PEGO).

He will review the case on merit and address the problem in accordance with prevailing rules/ procedures applicable to such grievances as per Environmental Management Plan (EMP). The PEGO will then refer the case to GRC for a final decision, on whether to update and make necessary amendments in EMP. The GRC will deliver its decision within thirty (30) days of registration of the case. If the affected person does not receive a response from GRC within thirty (30) days of the registry of the complaint, he/she can appeal to the Director of Environment, who should act on the complaint/ grievance within two weeks of the day of its filing. If the affected person is not satisfied with the decision of the Director of Environment, then it can be referred to higher authorities / relevant govt. departments for its resolution. As a last resort, he/she may submit the complaint to Punjab EPA.

11.3 Responsibilities Of GRC

The responsibilities of GRC will include the following:

- ✚ The GRC shall review, consider and resolve grievances related to environmental issues during implementation received by the PD office – NHA.
- ✚ Environmental Specialist is responsible for conducting investigations on these grievances.
- ✚ Any grievances presented to the GRC should ideally be resolved on the first day of the hearing or within one week, in case of complicated issues requiring additional investigations.
- ✚ GRC is empowered to take a decision that is binding on NHA and considered final.

GRC meeting will be held in the NHA, PD office, or other locations agreed by the committee. If needed GRC members will conduct field visits to verify and review the issues in dispute.

11.4 Procedure For Redress Of Grievances

Suggested procedures to be adopted for the redressal of the grievances are given below:

- ✚ Project Affectee will submit his/her application to the Field Implementation Unit for consideration. Within 15 days of the receipt of the complaint, action will be taken up for redressal of the grievance. Wherever policy matters are involved, the case will be referred to the appropriate authority or committee appointed by the Project to decide the matter.
- ✚ In case some response to the complaint is not received within 15 days of the receipt of the complaint, the complainant may also send a reminder within 15 days' notice to take legal remedial measures.
- ✚ All complaints received in writing or written when received verbally will be properly recorded and documented.

11.5 Proposed Mechanism For Grievance Redress

Under the Project, the following will be established or appointed to ensure the timely and effective handling of grievances:

- ✚ A Public Complaints Unit (PCU), will be responsible to receive, log, and resolve complaints.
- ✚ A Grievance Redress Committee (GRC), is responsible to oversee the functioning of the PCU as well as the final non-judicial authority on resolving grievances that cannot be resolved by the PCU.
- ✚ Grievance Focal Points (GFPs) have educated people from each community that can be approached by the community members for their grievances against the Project. The GFPs will be provided training by the Project in facilitating grievance redress.

Details of the proposed mechanism are given below:

(i) Project Management Unit (PMU)

The overall responsibility for the implementation of the Environmental Management / Monitoring Plan rests with the Project Management Unit (PMU) along with the assistance of the Environmental Unit (EU) of the PMU. The EU consists of the Director of Environment & Sociology, the Deputy Director of Environment, and the Deputy Director of Sociology. PMU will assume overall responsibility for ensuring:

That while executing the contract and undertaking the construction all environmental norms, regulations, and requirements promulgated by Punjab Environmental Protection Act (PEPA), Punjab Protection Agency (EPA) for the work site and adjacent areas are fully respected and implemented and overall responsibility for implementation of EMP. Ensure that Contractor and Construction Supervision Consultants appoint a dedicated environmental officer and allied staff. PMU will also ensure that all environmental personnel is authorized to implement the socio-environmental policies and requirements of the EMP.

(ii) Environment Unit (EU) of PMU

- ✚ The Environmental Unit (EU) within PMU will monitor Project performance.
- ✚ The EU will function in coordination with the Construction Supervision Consultants and will receive reports from them on behalf of PMU.

(iii) Head PMU / The Project Director

The Project Director shall provide or arrange the logistics including communication, transport, and accommodation to all visiting persons/teams experts from any of the above monitoring units and shall coordinate with the contractor(s) to facilitate the visits/inspections.

(iv) Contractor

The contractor will be responsible for the implementation of the project EMP. The contractor will ensure that EMP for the project is implemented fully and must be integrated into the Project implementation and made an integral part of the contract document. Any default damages so caused will be remediated by the contractor at his own cost and expenses. In case the contractor fails to rectify the damage the employer will remediate at the risk and cost of the contractor. The amount will be determined by the Construction Supervision Consultants and will be adjusted from the amount due to the contractor.

(v) PCU – Function and Structure

PCU will be set up as part of the environment, health, and safety department of the Project. A senior official with experience in community and public liaison will lead the unit. Two assistants, one male, and one female will be responsible for coordinating

correspondence and preparing documentation work and will assist the senior official. The senior official will be responsible to review all documentation. The PCU will be responsible to receive, log, and resolve grievances. Given that the female community members have restricted mobility outside of their homes, the female PCU staff will be required to undertake visits to the local communities. The frequency of visits will depend on the nature and magnitude of activity in an area and the frequency of grievances.

(vi) GRC – Function and Structure

The GRC will function as an independent body that will regulate PCU and the grievance redress process. It will comprise of:

- ✚ Officials of environment, health, and safety of the proposed Project.
- ✚ A senior engineer is responsible to oversee the contractors.
- ✚ Two literate representatives from the communities residing near the project site;
- ✚ Representative of the local government. If not, this would be the District Coordinating Officer (DCO) or an appointed representative;
- ✚ A senior member of the local civil society with experience in community relations;
- ✚ A female member of the local civil society.

The GRC will meet once every three months to review the performance of the PCU; the frequency can be changed depending on the nature and frequency of grievances received. The performance will be gauged in terms of the effectiveness and the timeliness with which grievances were managed. In case there are any unresolved or pending issues, the GRC will deliberate on mechanisms to resolve those and come up with solutions acceptable to everyone.

11.6 Environment And Social Complaints Register

The consultant's environmental team will maintain an environment & social complaint register at the campsite office to document all complaints received from the local communities. The register will also record the measures taken to mitigate these concerns. The final report will be communicated to the Environmental section of PMU.

12 CONCLUSION AND RECOMMENDATIONS

Widening and Improvement of N-5 will largely contribute to the economic and social development of the adjoining areas as well as Pakistan on a larger scale. It will bring more population into the stream of benefits, which in turn will change the social complexion of people around this highway. This link will bring about further revolution in the road transport and time saving journey for passengers. It will also contribute to ensure smooth and efficient movement of trade, goods and traffic in relatively shorter time. Where the proposed project will help towards achieving this objective, the environmental study of the project area requires that potential environmental effects due to the proposed project are evaluated, mitigation measures required to minimise or obviate these impacts are assessed, implemented and monitored. Any residual impacts are assessed for their significance. These requirements have been addressed in this EIA, which has covered in detail the following:

The proposed project activities;

- ✚ Alternatives considered in finalizing the project;
- ✚ Environmental conditions of the project area;
- ✚ Potential environmental effects of the proposed project activities on the physical, natural and socio-economic receptors.
- ✚ Mitigation and monitoring measures that will help in avoiding or minimizing these impacts.

After assessing the significance of potential impacts, it has been concluded that if the project activities are carried out as described in this report, and the suggested mitigation measures are implemented, the proposed project will not have a significant impact on the area's natural and socioeconomic environments. Hence, this EIA concludes that the upon implementation of the mitigation, the residual impacts of the proposed operation will be low and careful implementation of the provided EMP will ensure that environmental impacts are managed and minimised and all statutory requirements are met by the project proponent.

GLOSSARY

Air Quality	Measurement of the pollutants in the air; a description of the healthiness and safety of the atmosphere.
Area Of Influence	Area of influence is the overall area affected by the Project, including, for example, construction camps and lay-down areas. The percentage of habitat impacted is by reference to the national area of such habitat. In practice it is not possible, nor is it intended to try, to calculate these percentages. Instead, this criterion is used to provide an approximate indication, based on professional judgment and available knowledge, of the proportion of any one type of habitat that may be affected, primarily to highlight where a large proportion of habitat is affected
Consultation	Consultation refers to the two-way transfer of information or joint discussion between project staff and the affected population. Systematic consultation implies a sustained and rigorous sharing of ideas. Bank experience shows that consultation often yields the best resettlement alternatives, fruitful procedures for continued participation, and independent information on actual conditions for implementation.
Disclosure	The action of making new or secret information known
Environmental Management	Attempt to control human impact on and interaction with the environment to preserve natural resources
Environmental Audit	An analysis of the technical, procedural, and decision-making aspects of an EIA is carried out sometime after a proposal has been implemented.
Evaluation	The making of a judgment about the amount, number, or value of something; assessment.
Exploration	Exploration is the act of searching for the discovery of information or resources
Geology	A science that studies rocks, layers of soil, etc., to learn about the history of the Earth and its life
Ground Water	Aquifers are currently being used as a source of drinking water or those capable of supplying a public water system. They have a total dissolved solid content of 10,000 milligrams per liter or less, and are not "exempted aquifers."
Haulage	Haulage is the commercial transpiration of goods and materials
Hazardous	Substance or material, which could adversely affect the safety of the public, handlers, or carriers during transportation

Household	People residing under one roof, using the same hearth, and operating as a single economic unit.
Impact	Effect on someone or something
Jurisdiction	The extent of the power to make legal decisions and judgments.
Land Acquisition	The process whereby a person is compelled by a public agency to cede all or part of the land a person owns or possesses, to the ownership and possession of that agency, for a public purpose in return for compensation.
Mitigation	The action of reducing the severity, seriousness, or painfulness of something
Monitoring	Supervising activities in progress to ensure they are on course and on schedule in meeting the objectives and performance targets
Occupational Health	Maintenance of the highest degree of physical, mental, and social well-being of workers in all occupations by preventing departures from health, controlling risks, and adaptation of work to people, and people to their jobs
Project Area	The area specified by the funding and/or implementing agency according to the Official Gazette Notification and includes the areas within the administrative limits of the Federal or Provincial Government.
Proponent	A person who advocates a theory, proposal, or course of action.
Proposed Project	It is a document that is used to convince a sponsor that a project needs to be kicked off to solve a particular business problem or opportunity. It describes in depth, how the project is going to be commenced so that the sponsor understands what is involved early.
Rehabilitation	Include all compensatory measures to re-establish; at least lost incomes, livelihoods, living, and social systems. It does not include the payment of compensation for required assets.
Resettlement	This means all measures taken to mitigate any adverse impacts, resulting due to the execution of a project on the livelihood of the project-affected persons, and their property, and includes compensation, relocation, and rehabilitation.
Scope	The extent of the area or subject matter that something deals with or to which it is relevant
Scoping	An exercise involving the preliminary identification of the environmental issues surrounding a project that requires an assessment. Scoping should take place soon after the project has passed the Initial Review. Scoping identifies the potential impacts

	which are to be addressed in detail by the assessment. Scoping will usually initiate the public consultation/public participation process.
Social Environment	It includes the culture that the individual was educated or lives in and the people and institutions with whom they interact.
Stakeholders	Include affected persons and communities, proponents, private and public businesses, NGOs, host communities, and EPA.
Topography	Details of the surface features of the land. It includes the mountains, hills, creeks, and other bumps and lumps on a particular hunk of earth.

**ANNEXURE-A
BASELINE ENVIRONMENTAL MONITORING
REPORTS**



AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	NHA/ENV/47-2023		
Project Name:	Widening and Improvement of Lahore-Gujranwala Section along with Interchange at Chand-Da-Qila and Addition of Third Lane on Gujranwala Bypass (75KM)		
Source:	Ambient Air	Monitoring Instrument:	AQMS 65, Serial # 1310
Monitoring Location	Main GT Road Muridke		

Sr. No	Time	Parameters		Results (Average 24 Hrs)	
		PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀
		Units			
	(µg/m ³)	(µg/m ³)			
1.	09:00 A.M	30.44	104.83	24.17 (µg/m ³)	96.89 (µg/m ³)
2.	10:00 A.M	28.17	105.7		
3.	11:00 A.M	26.25	104.15		
4.	12:00 P.M	25.5	107.44		
5.	01:00 P.M	25.53	105.89		
6.	02:00 P.M	25.89	105.18		
7.	03:00 P.M	25.83	102.65		
8.	04:00 PM	25.43	101.43		
9.	05:00 PM	24.33	98.21		
10.	06:00 PM	23.1	96.69		
11.	07:00 PM	22.33	94.96		
12.	08:00 PM	22.73	96.44		
13.	09:00 PM	23.23	93.72		
14.	10:00 PM	23.6	92.99		
15.	11:00 PM	21.34	92.47		
16.	12:00 AM	23.22	89.74		
17.	01:00 AM	22.36	89.21		
18.	02:00 AM	23.93	90.5		
19.	03:00 AM	23.23	90.93		
20.	04:00 AM	22.81	89.24		
21.	05:00 AM	22.4	90.09		
22.	06:00 A.M	21.53	92.37		
23.	07:00 A.M	23.21	93.28		
24.	08:00 A.M	23.73	97.27		
PEQSAA				35 (µg/m ³)	150 (µg/m ³)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were $\mu\text{g}/\text{m}^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature of Analyst:

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Khyber Pakhtunkhwa
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AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	NHA/ENV/47-2023		
Project Name:	Widening and Improvement of Lahore-Gujranwala Section along with Interchange at Chand-Da-Qila and Addition of Third Lane on Gujranwala Bypass (75KM)		
Source:	Ambient Air	Monitoring Instrument:	AQMS 65, Serial # 1310
Monitoring Location:	Main GT Road Kamoki		

Sr. No	Time	Parameters		Results (Average 24 Hrs)	
		PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀
		Units			
	Hours	(µg/m ³)	(µg/m ³)		
1	10:00 A.M	27.98	101.27	21.71 (µg/m ³)	93.33 (µg/m ³)
2	11:00 A.M	25.71	102.14		
3	12:00 P.M	23.79	100.59		
4	01:00 P.M	23.04	103.88		
5	02:00 P.M	23.07	102.33		
6	03:00 P.M	23.43	101.62		
7	04:00 PM	23.37	99.09		
8	05:00 PM	22.97	97.87		
9	06:00 PM	21.87	94.65		
10	07:00 PM	20.64	93.13		
11	08:00 PM	19.87	91.4		
12	09:00 PM	20.27	92.88		
13	10:00 PM	20.77	90.16		
14	11:00 PM	21.14	89.43		
15	12:00 AM	18.88	88.91		
16	01:00 AM	20.76	86.18		
17	02:00 AM	19.9	85.65		
18	03:00 AM	21.47	86.94		
19	04:00 AM	20.77	87.37		
20	05:00 AM	20.35	85.68		
21	06:00 A.M	19.94	86.53		
22	07:00 A.M	19.07	88.81		
23	08:00 A.M	20.75	89.72		
24	09:00 A.M	21.27	93.71		
PEQSAA				35 (µg/m ³)	150 (µg/m ³)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

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- Quality was assured through self calibration of the instrument.
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AMBIENT GASEOUS MONITORING REPORT

Reference Number	NHA/ENV/47-2023		
Project Name:	Widening and Improvement of Lahore-Gujranwala Section along with Interchange at Chand-Da-Qila and Addition of Third Lane on Gujranwala Bypass (75KM)		
Source:	Ambient Air	Monitoring Instrument:	AQMS 65, Serial # 1310
Monitoring Location	Main GT Road Muridke		

Sr. No	Time	Parameters			
		CO	NO	NO ₂	SO ₂
		Units			
	Hours	(mg/m ³)	(µg/m ³)	(µg/m ³)	(µg/m ³)
1.	09:00 A.M	1.32	16.54	17.94	15.13
2.	10:00 A.M	0.5	10.16	16.71	15.27
3.	11:00 A.M	1.26	16.16	17.75	16
4.	12:00 P.M	1.1	14.95	17.13	14.61
5.	01:00 P.M	0.47	9.99	16.62	15.01
6.	02:00 P.M	1.08	14.8	17.05	13.56
7.	03:00 P.M	0.61	11.03	15.16	14.35
8.	04:00 PM	0.45	9.81	14.54	13.87
9.	05:00 PM	0.75	12.07	15.68	12.69
10.	06:00 PM	0.6	10.86	15.07	12.13
11.	07:00 PM	0.43	9.64	14.45	12.49
12.	08:00 PM	0.74	11.91	15.61	12.21
13.	09:00 PM	0.58	10.7	14.99	11.25
14.	10:00 PM	0.88	12.94	16.13	12.58
15.	11:00 PM	0.72	11.74	15.52	10.58
16.	12:00 AM	0.56	10.52	14.9	11.54
17.	01:00 AM	0.86	12.78	16.06	12.57
18.	02:00 AM	0.7	11.57	15.44	11.58
19.	03:00 AM	0.99	13.81	16.57	11.6
20.	04:00 AM	0.84	12.61	15.97	12.47
21.	05:00 AM	1.13	10.2	14.74	12.13
22.	06:00 A.M	0.97	13.64	16.49	10.62
23.	07:00 A.M	0.81	12.43	15.88	12.07
24.	08:00 A.M	1.11	14.66	17	12.85
Average Concentration		0.81	12.31	15.97	12.88
PEQSAA		05 (24 hr)	40 (24 hr)	80 (24 hr)	120 (24 hr)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m³ and µg/m³ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
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- The report is not valid for court.

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AMBIENT GASEOUS MONITORING REPORT

Reference Number	NHA/ENV/47-2023		
Project Name:	Widening and Improvement of Lahore-Gujranwala Section along with Interchange at Chand-Da-Qila and Addition of Third Lane on Gujranwala Bypass (75KM)		
Source:	Ambient Air	Monitoring Instrument:	AQMS 65, Serial # 1310
Monitoring Location:	Main GT Road Kamoki		

Sr. No	Time	Parameters			
		CO	NO	NO ₂	SO ₂
		Units			
	Hours	(mg/m ³)	(µg/m ³)	(µg/m ³)	(µg/m ³)
1	10:00 A.M	1.16	15.75	18.02	14.9
2	11:00 A.M	0.34	9.37	16.79	15.04
3	12:00 P.M	1.1	15.37	17.83	15.77
4	01:00 P.M	0.94	14.16	17.21	14.38
5	02:00 P.M	0.31	9.2	16.7	14.78
6	03:00 P.M	0.92	14.01	17.13	13.33
7	04:00 PM	0.45	10.24	15.24	14.12
8	05:00 PM	0.39	9.02	14.62	13.64
9	06:00 PM	0.57	11.28	15.76	12.46
10	07:00 PM	0.44	10.07	15.15	11.9
11	08:00 PM	0.37	8.85	14.53	12.26
12	09:00 PM	0.58	11.12	15.69	11.98
13	10:00 PM	0.42	9.91	15.07	11.02
14	11:00 PM	0.72	12.15	16.21	12.35
15	12:00 AM	0.56	10.95	15.6	10.35
16	01:00 AM	0.4	9.73	14.98	11.31
17	02:00 AM	0.7	11.99	16.14	12.34
18	03:00 AM	0.54	10.78	15.52	11.35
19	04:00 AM	0.83	13.02	16.65	11.37
20	05:00 AM	0.68	11.82	16.05	12.24
21	06:00 A.M	0.97	9.41	14.82	11.9
22	07:00 A.M	0.81	12.85	16.57	10.39
23	08:00 A.M	0.65	11.64	15.96	11.84
24	09:00 A.M	0.95	13.87	17.08	12.62
Average Concentration		0.65	11.52	16.05	12.65
PEQSAA		05 (24 hr)	40 (24 hr)	80 (24 hr)	120 (24 hr)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m³ and µg/m³ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
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NOISE LEVEL MONITORING REPORT

Reference Number	NHA/ENV/47-2023		
Project Name:	Widening and Improvement of Lahore-Gujranwala Section along with Interchange at Chand-Da-Qila and Addition of Third Lane on Gujranwala Bypass (75KM)		
Source:	Ambient Noise	Monitoring Instrument:	Noise Meter-IEC651-
Monitoring Location	Main GT Road Muridke		Type-2

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	09:00 AM	dB(A)	58.9	61.8	60.31
2.	10:00 AM		58.7	61.5	60.1
3.	11:00 AM		58.4	61.3	59.88
4.	12:00 PM		58.2	61.1	59.63
5.	01:00 PM		58.0	60.9	59.45
6.	02:00 PM		57.8	60.7	59.23
7.	03:00 PM		57.6	60.5	59.01
8.	04:00 PM		57.4	60.2	58.8
9.	05:00 PM		57.1	60.0	58.58
10.	06:00 PM		56.9	59.8	58.36
11.	07:00 PM		56.7	59.6	58.15
12.	08:00 PM		56.5	59.4	57.93
13.	09:00 PM		56.3	59.2	57.71
14.	10:00 PM		56.1	58.9	57.5
15.	11:00 PM		55.8	58.7	57.28
16.	12:00 AM		55.6	58.5	57.05
17.	01:00 AM		55.4	58.3	56.85
18.	02:00 AM		55.2	58.1	56.65
19.	03:00 AM		55.0	57.9	56.45
20.	04:00 AM		54.8	57.6	56.2
21.	05:00 AM		54.5	57.4	55.95
22.	06:00 AM		54.3	57.2	55.75
23.	07:00 AM		54.1	57.0	55.55
24.	08:00 AM		53.9	56.8	55.35
PEQS limit : 65 dB – 55 dB					

PEQS: Punjab Environmental Quality Standards

Leq: Log Equivalent Continuous Sound Level

Note:

- Selected measurement units were dB (A) otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
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Reference Number	NHA/ENV/47-2023		
Project Name:	Widening and Improvement of Lahore-Gujranwala Section along with Interchange at Chand-Da-Qila and Addition of Third Lane on Gujranwala Bypass (75KM)		
Source:	Ambient Noise	Monitoring Instrument:	Noise Meter-IEC651-
Monitoring Location:	Main GT Road Kamoki		Type-2

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	10:00 AM	dB(A)	53.9	56.8	55.31
2.	11:00 AM		53.7	56.5	55.1
3.	12:00 PM		53.4	56.3	54.72
4.	01:00 PM		53.2	56.1	54.61
5.	02:00 PM		53.0	55.9	54.45
6.	03:00 PM		52.8	55.7	54.23
7.	04:00 PM		52.6	55.5	54.01
8.	05:00 PM		52.4	55.2	53.8
9.	06:00 PM		52.1	55.0	53.58
10.	07:00 PM		51.9	54.8	53.36
11.	08:00 PM		51.7	54.6	53.15
12.	09:00 PM		51.5	54.4	52.93
13.	10:00 PM		51.3	54.2	52.71
14.	11:00 PM		51.1	53.9	52.5
15.	12:00 AM		50.8	53.7	52.28
16.	01:00 AM		50.6	53.5	52.05
17.	02:00 AM		50.4	53.3	51.85
18.	03:00 AM		50.2	53.1	51.65
19.	04:00 AM		50.0	52.9	51.45
20.	05:00 AM		49.8	52.6	51.2
21.	06:00 AM		49.5	52.4	50.95
22.	07:00 AM		49.3	52.2	50.75
23.	08:00 AM		49.1	52.0	50.55
24.	09:00 AM		48.9	51.8	50.35
PEQS limit : 65 dB – 55 dB					

PEQS: Punjab Environmental Quality Standards

Leq: Log Equivalent Continuous Sound Level

Note:

- Selected measurement units were dB (A) otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
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DRINKING WATER ANALYSIS REPORT

Reference Number	NHA/ENV/47-2023		
Project Name:	Widening and Improvement of Lahore-Gujranwala Section along with Interchange at Chand-Da-Qila and Addition of Third Lane on Gujranwala Bypass (75KM)		
Source	Drinking Water	Sampling Location:	Jamia Masjid Main GT Road Muridke
Analysis Method	APHA/USEPA Standard Methods		

Sr. No.	Parameters	Analysis Method	Units	PEQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	7.8
2	Taste & Odor	In-house	--	Non Objectionable	Non Objectionable
3	Color	APHA-2120 B/C	TCU	<15	6
4	Turbidity	APHA-2130 B	NTU	<5	4
5	Total Coliform	APHA:9222 B	Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA:9222 D	Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	<1000	376
8	Total Hardness	APHA-2340 C	mg/L	<500	134
9	Nitrate	APHA-4500NO3 B	mg/L	≤50	4.1
10	Nitrite	APHA-4500NO2 B	mg/L	≤3	0.24
11	Ammonia	APHA-4500-NH3-B	mg/L	---	N.D
12	Arsenic	APHA-3500As B	mg/L	<0.05	N.D.
13	Antimony	APHA-3500Sb B	mg/L	<0.005	N.D.
14	Barium	APHA-3500Ba B	mg/L	0.7	N.D.
15	Chloride	APHA-4500Cl- B	mg/L	250	137
16	Fluoride	APHA-4500F- C	mg/L	<1.5	0.86

PDWQS: Punjab Drinking Water Quality Standards

N.D = Not Detectable

Note:

- Selected measurement units were mg/L otherwise stated.
- The measurements were carried out on client request. The client is responsible lawful usage of reported data in future. The report is not valid for court.



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**ANNEXURE-B
BATCHING AND ASPHALT PLANT
MANAGEMENT PLAN**

BATCHING AND ASPHALT PLANT MANAGEMENT PLAN

The contractor shall ensure the use of a relatively new, well maintained hot mix plant (batch type) so that any emission conforms to the PEQS norms and be fitted with a dust extraction unit to avoid prolonged engine powered equipment illness. Hot mix plant, WMM plant, batching plant, generator set & crusher shall be located more than 500 m from any community or residence. The concessionaire has to obtain necessary consent/clearance from state pollution control board to operate hot mix plant, WMM plant, batching plant & crusher before commencement of works. All vehicles, equipment and machinery needed for construction will be regularly maintained to ensure that pollution emission levels conform to PEQS norms. All vehicles will be fitted with silencers. Construction vehicles, machinery & equipment will move or be stationed in designated areas to avoid compaction of soil to ensure the preservation of the top soil for agriculture.

Where it is necessary to use some such substance which can cause injury to the health of the workers, the contractor shall provide suitable protective clothing or appliances to his workers, viz. Earplugs, helmets or dust masks. Additionally following management measures will be adopted:

- ✚ The asphalt plant is equipped with pollution control devices. According to the specification; no gases emissions will result from asphalt plant operation itself.
- ✚ Insuring proper operation conditions such as sufficient flame volume, clean combustion to ensure lower VOC'S are produced.
- ✚ Provide the workers with all safety measures; including masks, ear muff, gloves and other safety means and periodic medical testing.
- ✚ Periodic maintenance and replacement of filters of the asphalt plant and generator wherever this possible
- ✚ For staff and persons whom will be working within noisy zone they will be supplied with personal protective equipment (PPE) in order not to impair on their health as a result of over exposed to noise. It is expected that all the noise generated during asphalt plant operations to be within the required norms. Moreover, the plant generators are all fitted with noise reduction equipment. The placement of a noise breaker screen at the site will also be further investigated if needed.
- ✚ For the sludge waste, it's dealt with the asphalt plant manager to use it to pave some surfaces to reduce the dust emission, or it can be reused and utilized through recycling it back into the asphalt.
- ✚ The domestic wastewater generated by the working staff at the asphalt plant will be disposed of in a septic tank which is acting as a holding tank with sealed bottom and walls and drained from time to time to wastewater treatment plants (called the indian

Batching and Asphalt Plant Management Plan

wastewater treatment plant) which is about 40 km away from the asphalt plant. An official permit from the municipality will be gained by the contractor to dispose this waste. Wastewater from wash basins (gray water) will be collected separately where there will be two separated sewage networks and used for irrigation and water sprinkling activities.

✚ The following measures will be adopted in order to ensure the effectiveness of safety within the premises.

- To prevent bitumen burns it will be compulsory for the workers handling hot bitumen to wear full – body protection.
- All transportation, handling and storage of bitumen will be handled by experienced personals.
- The dust from the manufacturing processes may pose respiratory hazards, hence protective air masks will be provided to the operators of the loading and unloading of the aggregates.
- Ear-muffs will be provided to those working at the plant.
- First aid kit will be available on site for the workers in case of an emergency.
- The material and data sheets (MSDS) for each chemical will be accessible on the site and display.
- Safety signs will be posted throughout the site and entry and exit will be marked clearly.
- Regular health checks will be conducted for employees and staff working at the asphalt plant.

ANNEXURE-C

BORROW SITE REHABILITATION PLAN

BORROW SITE REHABILITATION PLAN

The rehabilitation measures for the borrow areas shall be dependent on the following factors:

- Land use objectives and agreed post-borrowing activities
- Physical aspects (landform stability, erosion, re-establishment of drainage)
- Biological aspects (species richness, plant density,) for areas of native re vegetation
- Water quality and soil standards and
- Public safety

Rehabilitation should be simple and maintenance free. Depending on the choice of the individual land owner/community, the contractor shall prepare redevelopment plans for the borrow areas. The options can be:

- (i) Restoring the productive use of the land
- (ii) Development of detention ponds in barren

Option I: Suitable in locations with high rainfall and productive areas

Topsoil will be placed, seeded, and mulched within 30 days of final grading if it is within a current growing season or within 30 days of the start of the next growing season. Vegetative material used in reclamation must consist of grasses, legumes, herbaceous, or woody plants or a combination thereof, useful to the community for the fuel and fodder needs. Plants must be planted during the first growing season following the reclamation phase. Selection and use of vegetative cover must take into account soil and site characteristics such as drainage, pH, nutrient availability, and climate to ensure permanent growth. The vegetative cover is acceptable if within one growing season of seeding, the planting of trees and shrubs results in a permanent stand, or regeneration and succession rate, sufficient to assure a 75% survival rate.

Option II: In barren land, the borrow areas can be redeveloped into detention ponds.

These will be doubled up as water bodies and also for removal of sediment from runoff flowing through the ponds. Design of the detention basin depends upon the particle size, settling characteristics, residence time and land area. A minimum of 0.02 mm size particle with a settling velocity of 0.02 cm/sec (assuming specific gravity of solids 2.65) can be settled in the detention basin.

Inspection of Rehabilitation Area

Inspection needs to be carried out by the PIU for overseeing the redevelopment of borrow areas as per the plan.

- Compliance of post-borrowing activities and land use with the restoration plan
- Drainage measures taken for inflow and outflow in case borrow pit is developed as a detention pond

Borrow Site Rehabilitation Plan

- Leveling off the bottom of the borrow areas
- In case the borrow area is on private property, the contractor shall procure written letter from landowner for satisfaction on rehabilitation. In case of no rehabilitation is desired by the landowner the letter should include statement “no responsibility on R&BD” on contractor in the event of accident
- Condition of the reclaimed area in comparison with the pre-borrowing conditions

Camp Site Rehabilitation Plan

At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

- Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas.
- Soak pits, septic tanks shall be covered and effectively sealed off.
- Debris (rejected material) should be disposed off suitably
- Ramps created should be leveled.
- Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed.
- If the construction camp site is on an agricultural land, top soil can be spread so as to aid faster rejuvenation.
- Proper documentation of rehabilitation site is necessary. This shall include the following:
 - Land owner consent letter for satisfaction in measures taken for rehabilitation of site;
 - Undertaking from contractor; and
 - Certification from Engineer in-charge of the PIU

In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this guideline. Also, he would have to obtain a certificate for satisfaction from the landowner.

ANNEXURE-D

CAMPSITE MANAGEMENT PLAN

CAMPSITE MANAGEMENT PLAN

Campsite Environmental Plan for Construction of Campsite essentially provides the implementation mechanism for the environmental and social mitigation measures during sub-project implementation stages.

The CMP describes the mitigation and management measures, clarifies responsibilities for implementation, and provides an implementation plan to ensure that this is done with little or no harm to the environment at large; at the same time protecting project affected persons and the vulnerable groups in particular from impacts that may emanate as a result of the program. The basic objective of this ESMP is to manage, prevent, and mitigate potentially adverse impacts of the project interventions in a way that minimizes the adverse impact on the environment and people at the Campsite.

Campsite Drainage

Irresponsible use of water can cause wastage of water due to careless practices due to construction and leaks from tanks and taps. To mitigate the water wastage employees will be educated on sustainable and effective use of water, e.g. avoiding running taps. Water shall be used sparingly throughout the construction of the development. Water reservoirs shall be fixed. The water tank or taps shall be accessible to visual inspection. All faulty and leaking taps and pipes shall be immediately repaired if there is any leakage found.

Campsite power and safety provisions**Campsite security**

Armed security guards shall be recruited to ensure safety of people and property and to monitor and track people movements with visitors and employee register around site entrance. Security Due to large number of workers on site, the safety of personnel and property shall be given special attention though:

- Sensitize the community about the negative effects of stealing and vandalism
- Local workers to be vetted by the LC executive
- Guard equipment and limit intruders onto working sites
- Cooperate with local security officials including the Secretary for Defense at the local level (LC)

Campsite Organization

Outsourced workers sometimes find it hard to settle in the area which they are not familiar with. A campsite has been erected to accommodate outsourced workers. The arrangements for the campsite are tabled below.

Item	Responsibility
Construction workers campsite	
The campsite will be erected on an area where the least possible damage will be inflicted on the vegetation and also away from waterways. However, the site must also be accessible, enabling the movement of people and vehicles.	Contractor
The land use and ownership of the proposed site shall be determined beforehand. Permission shall be obtained from relevant authorities and/or owners of the land where the	Contractor

Campsite Management Plan

Item	Responsibility
construction campsite will be erected.	
To prevent conflict, the campsite shall not be erected near agricultural fields and also not close to community water points.	Contractor
The campsite shall be fenced-off, access shall be controlled and children/minors are not allowed within the boundaries of the campsite.	Contractor

Electrical Supply and Distribution

Before the connection of commercial electrical power by UMEME (Utilities provider), a centralized camp electrical supply source will be used. Diesel engine driven electrical generators with approved manufacture's control measures shall be used and positioned as necessary around the camp. Priority for electrical power shall go to security lighting, access lighting and operating water pumps around the camp.

Food/Hydrocarbon Storage

Raw/fresh food shall be sourced from markets/farmers known for quality and hygiene and growing organic food. Food will be kept in the store on containers approved by the HSE Officer, manufacture and expiry dates of all foodstuffs on store shall be documented and all expired food will not be cooked but disposed to the trash collection facility.

Personnel orientation / trainings

All construction staff shall undergo safety education training before entering in the site, Work will only start after passing the examination set by the recruitment office, ETL will establish regular education and pre-working safety education, handing over system, special operating operators shall be trained to get special operation operating certificate before starting work. Tool-box meetings will be done daily to address general issues of safety, Community health, HIV/Aids, Work conflicts, Gender Based Violence, and so on. This will be the opportunity for individuals on the project to identify safety issues and concerns of a general nature. It is also the opportunity to coordinate the control of recognized hazards and promote safety awareness. A valuable tool to instill a Safety First culture among employees is to review lessons learned from this job or from another job.

Campsite Excavations and mitigation measures

The engineers and surveyors will draft a plan for approval before commencement of excavations. This plan shall indicate the required resources and sensitive areas that may not be mined (indication of mature trees).

- The removal of sand at excavation sites shall be focused where the least significant vegetation exists.
- Empire Tools Limited shall liaise with the applicable local headmen and residents regarding the location of excavation sites.
- All burrow-pits shall be restored using top-soils to facilitate regeneration of biodiversity

Fire Protection and Evacuation procedures

- Only approved containers and tanks shall be used for storage and handling of flammable and combustible liquids. Containers of flammable and combustible liquids shall be tightly capped when not in actual use.

Appropriate measures will be implemented at all workplaces, including adequate:

- **Means of fire detection.**
- **Raising the alarm in the event of a fire.**
- **Firefighting equipment.**
- **Installation of emergency lighting.**

Appropriate measures will be implemented for regular maintenance, servicing and testing of fire prevention equipment and procedures will be produced at all workplaces detailing action to be taken in the event of a fire, including on discovering a fire, hearing a fire alarm, evacuation routes and assembly points.

The Safety Officer will regularly inspect the designated evacuation routes for obstructions

All employees will be informed, instructed and where necessary, trained in fire prevention and evacuation procedures (action to be taken, fire alarm, types and use of fire equipment). These procedures will be practiced regularly and records will be maintained.

ANNEXURE-E

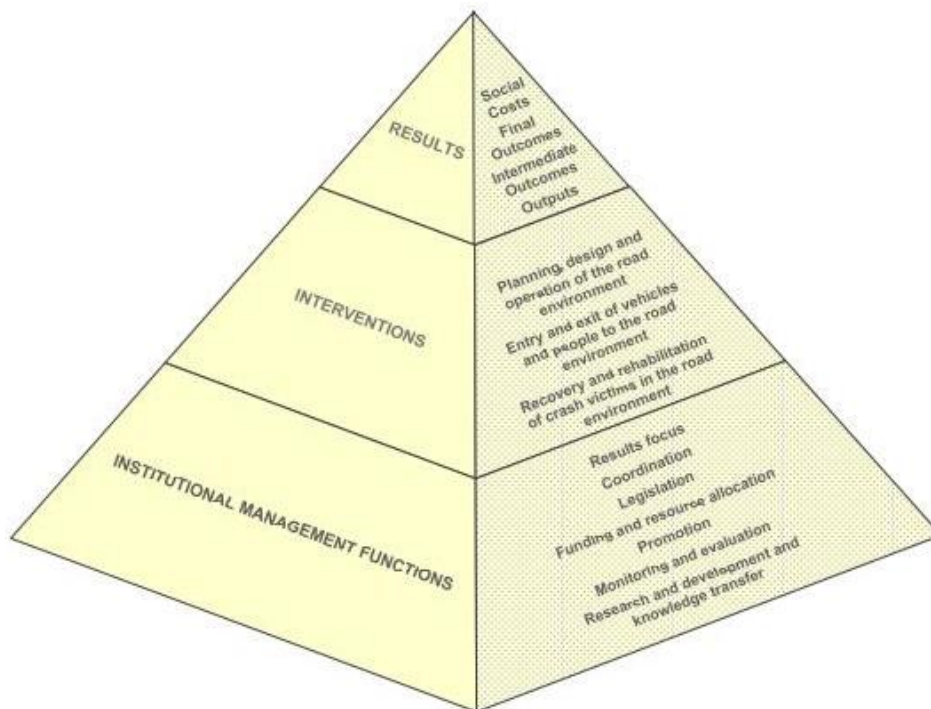
ROAD SAFETY MANAGEMENT PLAN

ROAD SAFETY MANAGEMENT PLAN

The action plan is built on the following five main pillars:

1. Workers Health & Safety
2. Safer Vehicles
3. Safer Road Users
4. Post-crash Response
5. Safer Road Environments

Safety is produced just like other goods and services and the production process is viewed as a management system with three levels: institutional management functions which produce interventions, which in turn produce results.

**OBJECTIVE**

The main objectives of road safety management plan are as follows

- Reduce intersection fatalities and serious injuries
- Reduce the total number of crashes
- Increase the safety of the transportation system for all users
- Achieve a significant reduction in traffic fatalities and serious injuries on all public roads
- Increase the safety and security of the transportation system for motorized and non motorized users

SUPERVISION

Supervision, by Project Implementation Unit (PIU) is essential to ensure the activity is completed as planned, and to a safe system of work.

SAFE SYSTEMS FOR WORK PLAN**Safe Pass**

Alternate safe pass will be provided to all people engaged in during the construction work.

WC & Washing Facilities

Arrangements will be made to provide toilets and hand-washing facilities on all sites. The facility will include a sufficient supply of hot or warm water and cold running water, toilet tissue, soap and towels. The facility must be conveniently accessible and be kept clean and hygienic. In addition, it is recommended that anti-bacterial wipes be provided on all sites. For exceptionally short duration work (3 days or less), a nearby convenient facility must be identified and the location communicated to the personnel on site. Such facilities may include: local depot; mobile welfare unit (under the control of the contractor); use of public toilets where it is impractical to return to other facilities; and – in limited circumstances – pre-arranged (preferably in writing) use of private facilities. Where public and private toilets are used they need to be readily accessible to the site, be open at all relevant times, be at no cost to the employee, be of an acceptable standard in terms of cleanliness and be provided with hand-washing facilities. Depending on the number of persons at the work place and the duration and nature of the work activity, further arrangements may provide.

Drinking Water

An adequate supply of wholesome drinking water will be provided at a convenient point (or points).

First Aid

First-aid equipment will be provided and maintained, and be easily accessible. At least one first aider will be available if the site-specific Risk Assessment shows that this is necessary. A trained first aider will generally be available to all road workers.

PPE's

The primary means of protecting the safety and health of employees will be measures to eliminate work place risks at source: firstly by technical means; secondly by organizational provision; and thirdly by collective protection measures. Where these measures are not sufficient, Personal Protective Equipment (additional protection to the individual) will be used to protect against hazards which are unavoidable.

Live Traffic

This will deals with some of the key controls associated with managing and controlling traffic flow to safeguard workers and members of the public from road works. When any work activity near or on a public road is being planned, traffic and pedestrian (members

Road Safety Management Plan

of the public) management will be considered as part of the detailed Risk Assessment. As part of this assessment, where other controls are identified, these will also be planned for and implemented.

Liaison/Gardaí

All road activity resulting in road diversions or lane or road closures or changes to road junctions or road layout may impact on the safety of road users such as the emergency services, local residents, farmers and traders. All of these will be made aware of how the works may affect them. In particular the Gardaí will be fully informed of any intended changes to traffic flows etc. All arrangements will form part of the site's traffic management plan.

Diversion

A road diversion may be needed so that members of the public and related traffic do not come close to the road works. This control should first be considered during the design process in conjunction with the Gardaí. A road diversion may solve some problems, but care needs to be taken to ensure that it does not create greater problems. Road diversions will be meticulously planned to ensure that the volume and size of traffic diverted can safely navigate the alternative road. Possible issues include bridge clearances, safe public/local access, road markings, road surfaces and road width. Adequate road markings, warning signs, etc, will be provided.

Road Signage

During construction activities proper guiding principles on the use of cones, lane tapering, lane widths, markings, safety zones, signals, sign boards, etc, for a variety of roadwork scenarios will be install.

Flagman/Stop-Go Man

Where roadwork activities require the managing of traffic or pedestrians in nearby public areas, trained flagmen (to slow down traffic) or trained stop-go men (to halt traffic) will be used to ensure safety. Stop-go men and flagmen must wear high visibility vests and use approved stop-go signs or flags. Where two stop-go men are required, they must be able to see each other clearly or be able to communicate with each other by voice and as necessary with the appointed works contact man, e.g. use of two-way radio etc.

Traffic/Speed Control

Traffic-control plans are prepared to help plan and control traffic movement. Measures to control traffic will may include: bollards, flagmen, ramps, stop go men, stop-go systems, temporary traffic lights and warning signs. Liaison with local Gardaí may be necessary. The activity of installing and removing cones, signs and traffic-control systems, will be planned with the same care and attention as other aspects of road

Road Safety Management Plan

works. In carrying out these activities, it is essential to ensure that you can see the traffic and the traffic can see you. Vehicular speeds must be controlled when passing through or in the vicinity of roadwork activities. Speed signs advising drivers of permitted speeds must be erected and displayed appropriately. Road surfaces and prevailing sight lines must be considered when deciding appropriate speeds. Speed limit sign boards will be installed along the road side where necessary.

Vehicle Crash Barriers

Where everyday transport moves close to road works, careful segregation will be planned, including the use of vehicle bollards, crash barriers, guardrails, signs, stones for retaining walls & riprap etc. The choice of the appropriate Vehicle Crash Barrier will be based on a Risk Assessment.

Crash Cushion Lorry

Where everyday public transport moves close to road works, construction personnel and traffic, careful segregation will be provided.

Site/Private Parking

Vehicles unrelated to construction will be parked in designated areas away from site traffic.

Erecting Traffic-Control Signs

Before road works or road-related activity is undertaken, traffic-control signs will be erected. These should alert the public to the works ahead and to any change of road layout or diversions.

Barriers

All ongoing works – in particular exposed manholes, street-related activities, open excavations, etc – will be protected with barriers and identified with warning signs.

Pedestrian Routes

Where members of the public have to access close to, or around construction work, suitable safe routes will be provided to protect them.

Security

Only authorized people will be allowed onto construction sites. Trained security personnel can help to control access and resolve the complaints at site.

Vehicle/Plant Controller

Where safe direction is required to be given to operators of construction and road vehicles, operatives will be appropriately trained, wear the appropriate PPE so that they are readily identifiable and as required use only approved flags, hand signals, signs, etc.

Lighting

Road Safety Management Plan

Adequate lighting must be provided in darkened areas to prevent people from falling, slipping or tripping or being hit by projecting objects. Cat's eyes or retro-reflective raised pavement markers (RRPMs) will be used for Visual lane marking to avoid the accidents.

Dust/Muck

Excessive amounts of dust can cause eye and respiratory irritation, especially in dry conditions. In general, dust and muck represent a nuisance to both workers and others in the vicinity. All traffic routes in public areas near construction works will be kept clear of muck. To reduce the effects of air-borne dust, water spraying is recommended. Where water bowsters drawn by tractors are used, a power-take-off (PTO) guard will be fitted.

Typical operational activities to avoid road accidents will be adopted are as follows:

- Cleaning e.g. street sweeping, graffiti removal and litter collection;

Asset management activities e.g. data collection;

- Asset Inspections, condition auditing and monitoring;
- Tree trimming;
- Roadside vegetation maintenance;
- Pavement testing;
- Storm clean-up;
- Removal of dead animals;
- Pest control;
- Drain Cleaning. The cost of these activities is incorporated in road assets maintenance budgets.

ANNEXURE-F PARTICULATE EMISSION MANAGEMENT PLAN

Particulate Emission Management Plan**PARTICULATE EMISSION MANAGEMENT PLAN****General**

The purpose of this plan is to describe the measures that the project shall take to ensure that the risk of emissions from dust generated by site operations during construction are minimized and that best practice measures are implemented.

Dust emissions from construction can cause ill health effects to Contractor staff along with nuisance and annoyance to members of the local community. Dust will be controlled through:

- Elimination
- Reduction/Minimization
- Control

This dust management plan shall be implemented based on the measures already provided in the Environmental Management Plan (EMP) relating to controlling dust emissions.

Methodology

The following methodology will be undertaken for each project section:

Step 1 – Identify the dust generating activities

Construction activities that are likely to produce dust will be identified. The activities that will be taken into account are:

Haulage Routes, Vehicles and Asphalt/Concrete Batching Plant

Roads, surfaces and public highways

Static and mobile combustion plant emissions

Tarmac laying, bitumen surfacing and coating

Materials Handling, Storage, Spillage and Disposal

Storage of material

Stockpiles

Spillages

Storage of Waste

Site Preparation and Restoration after Completion

Earthworks, excavation and digging

Storage of spoil and topsoil

Step 2 – Identify Sensitive Receptors

Sensitive receptors have already been identified. The nature and location of the sensitive receptors will be taken into account when implementing control measures.

Step 3 – Implement Best Practice Measures to Control

Based on the nature of the activity producing the dust, the likelihood of dust being produced and the possible consequence of dust based on the sensitive receptors, the most effective control measure will be identified and implemented.

Step 4 – Monitor effectiveness of control

Construction Supervision Staff (CSC) will have the responsibility to ensure that dust control measures are being implemented and are effective.

Step 5 – Record and report result of monitoring

Particulate Emission Management Plan

All inspections, audits and results of monitoring will be recorded and kept as part of the site filing system.

Method Statements and Risk Assessments

The Contractor's Risk Assessments and Method Statements will be required to be approved by the CSC prior to commencing work and will be required to contain environmental aspects of the task, including dust control measures where required.

Where dust has been identified within the risk assessment as a significant issue, the method statement will be required to cover the following:

Methods and materials that will be used to ensure that dust generation is minimized.

The use of pre-fabricated materials where possible.

Optimum site layout:

Dust generating activities to be conducted away from sensitive receptors

Supply of water for damping down.

Good housekeeping and management

All employees will be briefed on the Risk Assessment and Method Statement before starting work.

Training

All Contractor staff will be required to attend training seminars as already mentioned in the EMP document. A site-specific induction will also be required before being allowed to work on site. These will include site-specific sensitive receptors and details regarding dust control measures to be taken.

Toolbox talks on air pollution and minimizing dust emissions will be provided on a regular basis to Contractor staff.

Identification of Dust Generating Sources and Control Methods

Haulage Routes, Vehicles and Asphalt/Concrete Batching Plant	
Dust Source	Dust Control Methods
Major haul roads and traffic routes	Haul roads will be dampened down via a mobile bowser, as required.
Public Roads	Road sweeper will be used to clean public roads as required.
Site traffic management	Site traffic will be restricted to constructed access roads as far as possible. Site speed limit will be set at 10 mph as this will minimize the production of dust.
Road Cleaning	A mechanical road sweeper will be readily available and used.
Handling, Storage, Stockpiling and Spillage of Dusty materials	
Material handling operations	The number of times a material will have to be handled will be kept to a minimum to prevent double handling and ensure dusty materials are not handled unnecessarily.
Transport of fine dusty materials and aggregates.	Closed tankers will be used or sheeted vehicles.
Vehicle loading/unloading	Dusty materials will be dampened down

Particulate Emission Management Plan

materials on to vehicles and conveyors.	Drop heights will be kept to a minimum and enclosed where possible.
Storage of Materials	
Fine dry materials	These will be protected from the weather and by storing in appropriate containers and indoors, where necessary.
Storage location	Material will be stored in dedicated lay-down areas.
Storage of Stockpiles	
Stockpile location	Stockpiles will be placed so as to minimize double handling and facilitate the site restoration.
Building stockpiles	Stockpiles, tips and mounds will not be stored at an angle greater than an angle of repose of the material.
Small and temporary stockpiles	Where possible, stockpiles will be placed under sheeting. Dusty material will be damped down. Wind barriers (protective fences) of a similar height to the stockpile will be erected, if required.
Large and long term stockpiles	Long-term stockpiles will be vegetated and stabilized as soon as possible. Stock piles will be dampened down until stabilized, where necessary. Wind barriers (protective fences) of a similar height to the stockpile will be erected, if required.
Waste Material from Construction	
Disposal method	A dedicated lay-down area will be available for waste. Waste will not be allowed to build up and will be disposed off at the designated locations as per EMP.
Site Preparation and Restoration	
Earthworks, excavation and digging	These activity areas will be kept damp where required and if possible, will be avoided during dry and windy periods.
Completed earthworks	Surfaces will be stabilized by re-vegetation as soon as possible, where applicable.
Construction and Fabrication Process	
Crushing of material for reuse, transportation and disposal	Authorization will be obtained from PMU and Client before using any mobile plant on site for activities such as crushing and screening. Any crushing or screening activities will be

Particulate Emission Managemnt Plan

	located away from sensitive receptors.
Cutting, grinding, drilling, sawing, trimming, planning, sanding	These activities will be avoided wherever possible. Equipment and techniques that minimize dust will be implemented. Water will be used to minimize dust.
Cutting roadways, pavements, blocks	Water sprinkling to be used.
Angle grinders and disk cutters	Best practice measures will be used such as dust extraction.

Monitoring Arrangements

Monitoring will be conducted at sensitive receptor locations in the project area as provided in the EMP. Furthermore, at locations where PM levels are exceeding applicable guidelines, additional stringent measures will be implemented at the respective location(s) in the project area to ensure dust levels are controlled as far as possible.

ANNEXURE-G

EMERGENCY RESPONSE PLAN

EMERGENCY RESPONSE PLAN

Objective

Emergency preparedness helps to minimize the human suffering and economic losses that can result from emergencies.

It should be understood that the size and complexity of projects, as well as their access and location, have a bearing on the degree of planning necessary for emergencies. It is therefore strongly recommended that the contractor ensure that a member of staff **on site** assist in developing the emergency response plan.

How to Develop A Plan

Planning shall begin before any work commences on the project. Although there may be little time between the award of the contract and the start of the project, a good emergency response plan can be generic and, with some minor changes, can be easily adapted to specific sites and readily implemented. This is especially the case where a contractor specializes in similar types of projects.

Development should include the following considerations:

- 1) hazard identification/assessment
- 2) emergency resources
- 3) communication systems
- 4) administration of the plan
- 5) emergency response procedure
- 6) communication of the procedure
- 7) Debriefing and post-traumatic stress procedure.

Each of these points is explained in the following sections.

Hazard Identification/Assessment

The process of hazard identification and assessment involves a thorough review that should include, but not be limited to, the following points:

- transportation, materials handling, hoisting, equipment or product installation, temporary structures, material storage, start-up, and commissioning activities
- environmental concerns
- consultation with the client regarding potential hazards when working in or adjacent to operating facilities
- resources such as material safety data sheets (MSDSs) to determine potential hazards from on-site materials
- proximity to traffic and public ways.

Because construction sites are frequently fast-changing, the process of hazard assessment must be ongoing to accommodate the dynamic environment. Once hazards are identified, the next task is to assess the potential or risk involved in each. For each hazard identified, ask:

- What can go wrong?
- What are the consequences?

Emergency Response Plan

For each potential hazard it is important to identify resources necessary for an appropriate emergency response. For most events in construction, a simple analysis based on the experience of the people involved on the project is likely sufficient.

Emergency Resources

It is important to identify which resources are available and have contingency plans in place to make up for any deficiencies.

The most important resource on most projects will be a 1122 Rescue system. It is essential to verify that 1122 is in effect in the area. Most communities have a 1122 rescue team in place, but it is important to know the facilities or limitations available in that location. Is a high-reach rescue team available? What is the response time? What must site personnel do in the meantime?

Other on-site resources such as fire extinguishers, spills containment equipment, and first aid kits must be maintained and clearly identified. Construction equipment may be included among potential emergency resources. Personnel, especially on-site medical staff or workers trained in first aid, should be included in the plan.

There may be situations where outside resources are so far away that an adequate response is not possible. In these situations, resources may have to be obtained and kept on site. Examples would include fire protection or ambulance/medical resources in remote areas.

Whatever the situation may be, people, equipment, facilities, and materials are needed for emergency response. Where they will come from must be determined in advance. Moreover, the people supplying these resources must be made aware of their role in the plan.

Communication Systems

An important key to effective emergency response is a communications system that can relay accurate information quickly. To do this, reliable communications equipment must be used, procedures developed, and personnel trained. It is a good idea to have a backup system in place, in case the system is rendered useless by the emergency. For example, telephone lines may be cut.

The type and location of emergency communication systems must be posted on the project. This will include location of telephones, a list of site personnel with cellular phones or two-way radios, and any other equipment available. Emergency phone numbers and the site address/location should be posted beside all site phones. A communication system must be made up of strategically placed equipment and properly defined responsibilities. The emergency response plan posted in a conspicuous place on the project must identify the designated equipment and the people to operate it.

Administration of the Plan

The task of administering and organizing the plan is vital to its effectiveness. The person who has this task will normally be the person in charge of the emergency response operation. It is their task to ensure

- everyone clearly understands their roles and responsibilities within the emergency response plan (a chart may be helpful in this regard)
- Emergency resources, whether people or equipment, are kept at adequate levels in step with the progress of the project.

It is very important to review the emergency plan on a regular basis and especially after an emergency has occurred. Changes may be necessary where deficiencies became apparent as the plan went into operation.

Emergency Response Plan**Emergency Response Procedure**

An emergency can be reported from any source—a worker on site, an outside agency, or the public. Remember that circumstances may change during the course of an emergency. Any procedures developed by consultant/ contractor must be able to respond to the ongoing situation.

The following list covers basic actions to take in an emergency. These steps apply to almost any emergency and should be followed in sequence.

- Stay calm.
- Assess the situation.
- Take command.
- Provide protection.
- Aid and manage.
- Maintain contacts.
- Guide emergency services.

Stay calm – Your example can influence others and thereby aid the emergency response.

Assess the situation – Determine what happened and what the emergency is. Look at the big picture. What has happened to whom and what will continue to happen if no action is taken? Try to identify the cause that must be controlled to eliminate immediate, ongoing, or further danger.

Take command – The most senior person on the scene should take charge and call, or delegate someone to call, emergency services—generally 1122 and explain the situation. Assign tasks for controlling the emergency. This action also helps to maintain order and prevent panic.

Provide protection – Eliminate further losses and safeguard the area. Control the energy source causing the emergency. Protect victims, equipment, materials, environment, and accident scene from continuing damage or further hazards. Divert traffic, suppress fire, prevent objects from falling, shut down equipment or utilities, and take other necessary measures. Preserve the accident scene; only disturb what is essential to maintain life or relieve human suffering and prevent immediate or further losses.

Aid and manage – Provide first aid or help those already doing so. Manage personnel at the scene. Organize the workforce for both a headcount and emergency assignments. Direct all workers to a safe location or command post. This makes it easier to identify the missing, control panic, and assign people to emergency duties. Dispatch personnel to guide emergency services on arrival.

Maintain contact – Keep emergency services informed of situation. Contact utilities such as gas and hydro where required. Alert management and keep them informed. Exercise increasing control over the emergency until immediate hazards are controlled or eliminated and causes can be identified.

Guide emergency services – Meet services on site. Lead them to emergency scene. Explain ongoing and potential hazards and cause(s), if known.

Communication of the Procedure

Emergency Response Plan

To be effective, an Emergency Response Procedure must be clearly communicated to all site personnel. The following activities should be considered:

- Review the procedure with new site subcontractors and new workers to ensure that it covers their activities adequately.
- Review the procedure with suppliers to ensure that it covers any hazards that the storage or delivery of their materials might create.
- Review new work areas in operating plants with owner/client to ensure that new hazards are identified and covered in the procedure.
- Review the procedure with the Joint Health and Safety Committee or Health and Safety Representative on a regular basis to address new hazards or significant changes in site conditions.
- Post the procedure in a conspicuous location.

The Emergency Response Procedure for a construction project must continually undergo review and revision to meet changing conditions.

Debriefing and Post-Traumatic Stress Procedure

The recovery process, or what happens after the emergency response has been completed, is a critical step in the plan.

Many emergency tasks may be handled by people who are not accustomed to dealing with emergencies. People may have seen their work partners and friends badly injured and suffering great pain.

Once the emergency is over, the attitude should not be “Okay, let’s get back to work” or “Let’s go home.” Some of the people involved may need assistance in order to recover. In some cases professional counselling may be needed. As part of site emergency planning, construction companies should have measures in place to deal with post-traumatic stress. For more information, refer to the brochure Post-Traumatic Stress (F013), available from CSAO. Local hospitals, ambulance services, and medical practitioners may also be able to help.

Debriefing is necessary to review how well the plan worked in the emergency and to correct any deficiencies that were identified. Debriefing is critical to the success of future emergency response planning.

SUMMARY

Slow response, lack of resources, or the absence of trained personnel will lead to chaos in an emergency. To minimize human suffering and financial losses, all personnel must know their responsibilities under the emergency response plan.

Remember – planning for emergencies should include the following points:

- 1) hazard identification/assessment
- 2) emergency resources
- 3) communication systems
- 4) administration of the plan
- 5) emergency response procedure
- 6) communication of the procedure
- 7) Debriefing and post-traumatic stress procedure.

In any Emergency Response Procedure, the following steps are basic and essential:

- Stay calm.
- Assess the situation.
- Take command.

Emergency Response Plan

- Provide protection.
- Aid and manage.
- Maintain contact.
- Guide emergency services.

