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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

KARACHI PORT TO QAYUMABAD CORRIDOR PROJECT

EMC Pakistan Private Limited

PTQ EXPRESSWAY (PRIVATE) LIMITED

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1 Introduction

EMC Pakistan (Private) Limited was contracted by **PTQ Expressway (Private) Limited** to carry out the detailed Environmental & Social Impact Assessment (ESIA) for the proposed Karachi Port to Qayumabad Corridor Project. The proposed project will oversee the devleopment of a new, elevated 4 lane, access controlled expressway, spanning over 16.5 kilometers from Karachi Port to Qayumabad. This will allow for a direct connection between the Shahrah-e-Bhutto (which travels from Qayumabad along the Malir River, terminating at the Kathore Junction of the Karachi Hyderabad M-9 Motorway) and the Karachi Port (East Wharf), ultimately facilitating port traffic destined for travel towards the rest of the country with an unrestricted travel corridor. The project is envisioned as an essential component of the broader strategy to modernize Karachi's road network, accommodate traffic volume, alleviate traffic congestion, and improve logistical efficiency.

To address the potential environmental and social impacts from the development of this project, EMC Pakistan (Private) Limtied has prepared this Environmental and Social Impact Assessment (ESIA) in accordance with the guidelines of the Sindh Environmental Protection Agency (SEPA). Furthermore, whilst not being currently proposed for funding, the assessment also takes into account the Asian Development Bank's (ADB) Safeguard Policy Statement (SPS) for the purposes of abiding by Good International Industry Practices (GIIP).

1.1 Background

Located along the shores of the Arabian Sea, Karachi, set over 3500 square kilometers, is Pakistan's gateway and largest metropolitan city, where it serves many purposes including being the provincial Capital of Sindh, being the country's main seaport, and serves as the country's economic and financial center. Much like other port cities and commercial centers in the world, Karachi attracts people from all over the country and beyond. The lure of better economic prospects has seen Karachi experience mass migrations into the city, where in a study carried out by the Japan International Cooperation Agency (JICA) in 2012, termed the Karachi Transportation Improvement Project, the Agency predicted the growth of the city would increase from 18.9 million persons in 2010 to around 31.6 million persons in 2030, almost doubling the population. According to the National Census carried out in 2023, the city's population is estimated around 20.3 million residents[1].

This rapidly increasing population of the city has put, and will continue to put, increasing pressure on the city's infrastructure, especially the Urban Transport system (UTS) which is not yet operating in a manner which is suited to the needs of the population, with the system scarcely catering to the mobility residents of the need of the city. With dilapidated infrastructure and a lack of public services, coupled with other factors such as weak traffic management, lack of modern mass transit network, the city has seen a drastic increase in the private motor vechicles present on roads. This mass influx of vehicles has resulted in severe traffic congestions, unnecessary delays, noise, and air pollution along the main corridors of the city.

In a study published in 2018 by the World Bank titled, "*Transforming Karachi into a Livable and Competitive Megacity: A City Diagnostic & Transformation Strategy*", the study identified critical issues holding back Karachi from achieving its potential as a megacity. As part of these problems, the study identified that Karachi's road network has struggled to keep pace with rapid motorization and urban growth, with one of the key problem drivers of this being weak traffic management.
Karachi's transport system has long been under severe strain as the city has grown to account for the rapid increase in population, vehicle ownership, and land use in adjoining areas. The Asian Transport Observatory noted that the city's reliance on private vehicles – cars, motorcycles,

[1] Census 2023

rickshaws – coupled with relatively weak public transport alternatives, has overtime led to the intensification of congestion, reduced average speeds, and degraded air quality. Urban corridors throughout the city have grown to be constrained, with narrow lanes, limited rights of way, with governance issues over jurisdiction continuing to hinder any potential improvement to the situation[2].

In the same Karachi Transportation Improvement Study carried out by JICA, the agency predicted that by 2030, trips will rise by 1.67x relative to than current levels, pushing several major roads (e.g. Shahrah-e-Faisal, Shahrah-e-Pakistan, Rashid Minhas Road, etc.) past capacity thresholds unless mitigation measures are adopted. The study also assessed, that if the situation continues as it was, without any major interventions convened, then many of the city's major arterials would run the risk of becoming oversaturated[3].

A particular problem highlighted continuously, was that of the physical condition and management of the roads, where many roads suffer from potholes, uneven pavements, eroded shoulders, poor signage, missing lane markings, and inadequate lighting, particularly in lower income or peri-urban neighborhoods[4]. These deficiencies exacerbate safety risks, and reduce the usable capacity of the roads (with vehicles having to slow down, serve, or avoid damaged sections). Informal encroachments in the form of street vendors, parked vehicles, utility poles, have over time also narrowed lanes and and obstructed pedestrian movement[5]. During periods of heavy rainfall, the drainage and stormwater capacity deficits manifest in localized flooding of roads, making many roads untraversable or forcing detours, where, as recent as in August 2025, flood levels from rainfall overwhelmed the city's system, with its drainage built to handle just around 40 mm of rainfall[6].

Safety and road traffic related fatalities constitute a major human cost. A recent article highlighted how that in one year, over 64 fatal road accidents in Karachi were attributable to careless driving, weak infrastructure, and conflicts with larger vehicles; where a 03 month span in 2025 saw over 207 deaths, and over 500 injuries in hospital records, many involving young males[7]. Karachi's pedestrian environment is equally as dangerous with sidewalks often broken, obstructed, or absent, pushing pedestrians into vehicle lanes.

The economic losses from traffic congestion are also considerable, where a case study of a major arterial in Karachi estimated that daily losses of about Pakistani Rupee (PKR) 1 million for just that corridor. When extrapolated citywide, the toll is large in terms of time wasted, fuel burnt, and productivity wasted[8]. The mixed flows of freight, commercial traffic, and passenger vehicles further aggravates conflicts. Freight vehicles accessing the port or industrial zones share urban roads with commuter traffic, generating bottlenecks. Authorities have atttempted to mitigate this via time window restrictions (e.g. night time movements for heavy trucks), however, enforcement is weak, leading to these problems continuing to plague residents of the city.

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1.2 Project Overview

Freight routes in Karachi play a vital role in supporting the industrial activities. Key corridors include the Northern Bypass (M-10), which connects Karachi Port to the M-9 Motorway, and the National Highway (N-5), linking the city to the rest of the country. Major freight routes also pass through important roads such as Mauripur Road, Korangi Road, DHA, Clifton.

These routes serve prominent industrial zones including the Sindh Industrial and Trading Estate (SITE), Korangi Industrial Area, Landhi Industrial Area, and Port Qasim Industrial Zone. The figure highlights major industrial zones, ports, and the main truck stand of Karachi. These are critical traffic generators of heavy traffic.

Understanding their locations and trends is essential for planning efficient freight movement routes across the city.

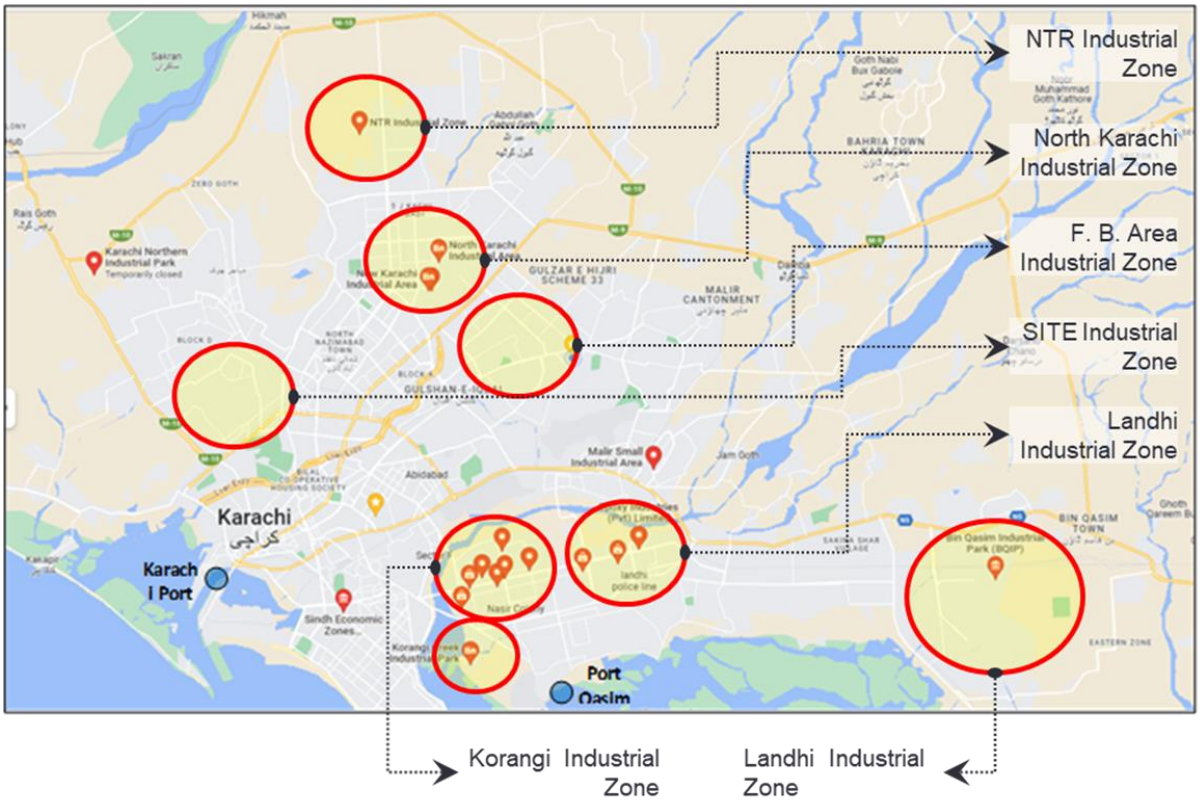


Figure 1.1 - Freight Routes of Karachi

There are four primary freight routes in Karachi that facilitate the movement of goods between Karachi Port and various exit points of the city.

- **Route 1** links the Karachi Port to the Link Road (Kathore Toll Plaza) via Korangi.
- **Route 2** connects Karachi Port to the Karachi Northern Bypass (KNBP) (M-10) Toll Plaza, forming part of the Karachi Northern Bypass.
- **Route 3** runs from Karachi Port to the Motorway (M-9) via Sohrab Goth.
- **Route 4** extends from the Karachi Port to the Link Road (Kathore Toll Plaza) through KNBP (M-10).

Among these, KNBP is the only freight corridor that allows 24-hour access for heavy vehicles, making it the most critical and unrestricted route. It is also the longest route, spanning approximately 79 km.

The other routes pass through dense urban zones such as SITE, Korangi, and Landhi industrial areas, using major roads like Shahrah-e-Pakistan, Sunset Boulevard, and Korangi Road. Due to alignment through congested areas, these routes operate under restricted hours, typically from 2200 to 0600 hours to minimize disruption to city traffic. These urban routes range from 54 km to 65 km in length and are essential links between the port and the city's industrial heartlands.

This is where the Karachi Port to Qayumabad Corridor project is seen to provide a direct link to freight traffic destined for other parts of the country, originating from the Karachi Port and travelling through a dedicated elevated corridor to the under development Shahrah-e-Bhutto, which when completed, will provide uninterrupted access to the Karachi Hyderabad Motorway, M-9.

The project will follow a 4 lane (2 lane each side) elevated expressway format, originating from Qayyumabad, and travel through the KPT Interchange onto Main Korangi Road from where it will take a left turn onto Sunset Boulevard and travel along it through Submarine Chowk, the KE head office, Schon Circle, and Boat Basin. From here it will go straight onto Mai Kolachi, take a left, and split into two portions under an earthen embankment format, with the first cutting through the creek to Clifton near the Dr Ziauddin Hospital (from where it will adopt an elevated expressway format once again) and terminate at the South Asia Port Terminal (SAPT) area to cater to traffic generating from the area. The other portion from Mai Kolachi will travel along the periphery of the creek adjacent to Bhutta Village, with the alignment terminating at Karachi Port at East Wharf (also in an elevated expressway format once back on land). An underpass is also proposed near the KE head office to allow for the continuous movement of traffic coming from Saudi Embassy towards Sunset Boulevard.

This final alignment has emerged through a comprehensive, criteria-driven assessment that carefully weighed factors such as land availability, traffic flow efficiency, right-of-way constraints, integration with existing road networks, and potential conflicts with urban infrastructure. The selected alignment strikes a balance between engineering feasibility, logistical practicality, and urban compatibility.

The proposed alignment for this is provided below:



Figure 1.2 - Proposed Alignment of Expressway

1.3 Need for ESIA

This Environmental & Social Impact Assessment (ESIA) has been carried out to:

1. Understand the potential impacts from the project, including their extent, severity, and duration,
2. Identify the potential mitigation measures that would be required to address these impacts and bring them down to acceptable levels, and
3. Seek out stakeholder opinion and feedback on the project for incorporation into the project

Alongside this, the project is also mandated to carry out an ESIA and obtain an approval against it from the Sindh Environmental Protection Agency (SEPA) prior to the commencement of any civil works. The Sindh Environmental Protection Act - 2014 is the governing environmental law for the proposed project, with the Sindh Environmental Protection Agency (SEPA) as the governing authority for environmental matters pertaining to the project.

The need for this ESIA is warranted as per Section 17 of the Sindh Environmental Protection Act, 2014, which states:

> *"No proponent of a project shall commence construction or operation unless he has filed with the Agency an Initial Environmental Examination or Environmental Impact Assessment and has obtained from the Agency approval in respect thereof."*

Furthermore, the Review of Environmental Assessment Regulations 2021 of SEPA also provides the necessary details pertaining to the preparation, submission, and review of different environmental assessments, including ESIA reports. The categorization of the proposed project falls under the following category defined in the regulations:

Schedule III – Projects Requiring an EIA
Category E – Transport
Construction of Flyover, underpass, and bridges having total length more than one km

1.4 Objective of ESIA

The prime objective of the ESIA study is to identify and assess the anticipated impacts and risks of the proposed project, and to accordingly recommend adequate mitigation measures to prevent/ minimize the identified impacts on the surrounding physical, biological, and social environment. This is done through adopting changes and practices, which ameliorate the environmental and social performance of a project during its different stages (pre-construction, construction, and operation).

More specifically, other associated objectives of this ESIA are to:

- Facilitate the proponent in ensuring the environmental and social sustainability of the project.
- Establish a baseline of the existing environmental and social conditions in the project area prior to project initiation, by collecting secondary and primary data/ information on physical, biological, and socio-economic conditions.
- Identify potentially significant environmental and social impacts (positive and negative) during the different stages of the project.
- Conduct, record, and report public consultations and participation with major stakeholders; and
- Devise an Environmental and Social Management Plan (ESMP) for all stages of the project as a tool for the implementation of the suggested measures, along with a monitoring and

evaluation mechanism with adequate resources including capacity building of the implementing agencies.

1.5 Approach & Methodology

The detailed approach & methoodlogy used for this ESIA is given below:

1.5.1 Literature Review

Before mobilization, a desktop study was conducted, involving the collection and review of guidelines, data, and reports relevant to the project. This included: (a) an examination of applicable environmental legislation (b) analysis of Google Earth satellite imagery; (c) relevant design information provided by the client and design consultant; and (e) references to ESIA documents from similar projects.

This review encompasses various aspects, including previous studies, regional environmental data, socio-economic analyses, and documentation of similar projects in Pakistan and internationally.

1.5.2 Review of Environmental Laws an Institutional Requirements

A thorough review of environmental laws and institutional requirements is essential to ensure compliance with legal frameworks governing environmental and social impacts in Pakistan. This review includes national, provincial, and local regulations that pertain to the construction and operation of the project. All such laws and legislations related to the proposed project have been discussed in detail in chapter 3 of this ESIA.

1.5.3 Delineation of Corridor of Influence (COI)/ Area of Impact/ Influence (AOI)

The delineation of the corridor of influence is a crucial step in the ESIA process, defining the spatial area where the project may have direct or indirect environmental and social impacts. This corridor encompasses not only the physical footprint of the project but also the surrounding areas that may be largely affected by its activities.

The Corridor of Influence (COI) for this project includes the main right of way for the bridge, the construction area required for the movement of machinery during the construction phase, and the adjoining area where impacts from the project are expected to extend to. The COI also includes any associated facilities, such as contractor camps, temporary material storage areas, and vehicle parking areas, where project impacts are expected to occur. Environmental and social risks and impacts were assessed for all relevant stages of the project cycle, including pre-construction, construction, and operational phases. For this project, the COI has been defined as 500 meters on either side of the RoW of the centerline of the alignment, which includes the width of the expresway, the area where the works will take place, and adjoining areas where impacts from the project are anticipated to extend to.

Furthermore, given that the project relies on a mostly linear corridor, the COI/AOI terms have been used interchangably in the report.

1.5.4 Analysis of Alternatives

The ESIA process mandates for the assessment of each potential alternative available for the project that could be developed to meet the objectives, and from this assessment, to recommend the most environemntally, socially, and economically feasible option.

To select the most viable design for the project, and route for expressway, the analysis of different alternatives was carried out. In addition, the No Project Option (NPO) was also discussed with reference to the increasing traffic in the city.

1.5.5 Environmental & Social Baseline Surveys for the Project

Baseline surveys are essential for establishing the current environmental and social conditions within the project area. These surveys provide a reference point against which potential impacts can be assessed, enabling the identification of significant changes resulting from project activities. Prior to the start of field activities, comprehensive checklists, proformas, and maps were developed covering the following main parameters:

A) Physical Environment

The information required for the establishment of the physical baseline included the following parameters:

- Land Resources (including land use pattern, soil composition, soil erosion, etc.)
- Water Resources & Flow Patterns (including available surface and groundwater resources, and natural streams, hydrology, spring water, water supply, water contamination sources,etc.)
- Climate data (including temperature, rainfall, humidity, wind speed, and direction, etc.)
- Ambient air quality and noise levels monitoring data
- Existing traffic patterns and trips

B) Ecological Environment

Information collected through primary (field surveys) and secondary data sources for the establishment of the ecological baseline included the following main parameters:

- Flora (trees, shrubs, herbs, grasses, and overall vegetation including valuable or rare trees and their losses due to implementation of the project, etc.)
- Fauna/ Wildlife (mammals, repitles, amphibians, avifauna)

C) Socio-Economic Environment

- Identifying potential sensitive receptors along the alignment, including their potential sensitivities
- Identifying significant cultural and historical sites within the project area, ensuring that potential impacts on heritage are recognized and addressed.
- Mapping existing land uses within the project area, including agriculture, residential areas, and natural habitats, to assess potential conflicts with project activities.
- Identifying key stakeholders, including community leaders, local organizations, and government authorities, to facilitate effective engagement throughout the ESIA process.

1.5.6 Stakeholder Consultation

Extensive stakeholder identification and consultations were also conducted for the project. The project stakeholders were identified during the inception/ scoping stage and meetings were conducted with them to receive feedback on the anticipated environmental and social issues related to the project impacts and suggested mitigation measures, including relevant departments to discuss the issues/ constraints and get their views and feedback to mitigate the potential environmental and social impacts associated with the implementation and operation of the project. Letters were also written to the concerned departments through the clients for communication and feedback on the project.

1.5.7 Impact Assessment & Mitigation Measures

The impact assessment process for the proposed project involved evaluating potential environmental and social impacts, identifying both negative and positive effects to develop appropriate mitigation measures aimed at minimizing adverse outcomes. Baseline data, stakeholder consultations, and expert input were analyzed to identify impacts associated with project activities such as pre-construction, construction, and operation. Each identified impact was assessed for significance, considering factors like magnitude, duration, and likelihood of occurrence, which helped prioritize the impacts requiring mitigation.

The assessment also included a detailed evaluation of the nature, extent, location, timing, and duration of potential impacts. Severity was determined by correlating the impacts to the project's location, design, construction, and operational stages, taking into account the sensitivity of the receptor. Based on predictions and public consultations, the ESIA team screened adverse environmental and social impacts for inclusion in mitigation measures and the Environmental and Social Management Plan (ESMP).

1.5.8 Environmental & Social Management Plan

An ESMP has also been prepared to ensure the adequacy and effectiveness of the proposed measures by clearly identifying the roles and responsibilities of the agencies responsible for implementation, monitoring, and auditing of ESMP activities, existing and suggested framework, necessary approvals, training needs and the required further studies. It includes an organizational setup, a monitoring mechanism, monitoring plan along with frequency of monitoring activities, and method for data collection and environmental monitoring, ecological and social component/ social mitigation measures were introduced as part of the ESMP.

1.6 Report Organization

This report contains nine chapters, where the contents of each chapter are described as follows:

- **Chapter 1** – "Introdction" describes introduction, location of proejct, objective, purpose of the ESIA, along with the methodology.
- **Chapter 2** – "Project Description" furnishes an overall description of the project, including its background, features, and key components, timeframe, and cost.
- **Chapter 3** – "Review of Pertinent Legislations" elaborates upon the current legal framework including natioanl and provincial requirements which are applicable to the proposed project in the context of the environment and sustainable development
- **Chapter 4** – "Analysis of Alternatives" provides details on alternate technologies, routes, and opertions considered for the proposed interventions
- **Chapter 5** – "Description of the Environment" comprises a detailed narrative of the existing "baseline" conditions of the project area, with respect to its physical, biological, and socio-economic environment
- **Chapter 6** – "Anticipated Impacts & Mitigation Measures" elaborates upon the likely impacts of the project on the physical, biological, and socio-economic environment during

the construction and operational stages, and proposes measures to mitigates the adverse impacts

- **Chapter 7** – “Stakeholder Consultations” provides a summary of the consultations carried out with relevant stakeholders for the proejct along with their suggestions and obervations on the project
- **Chapter 8** – “Grievance Redress Mechanism” provides a layout for the grievance redress mechanism that is to be implemented prior to project implementation to allow for registering and resolving project related complaints
- **Chapter 9** – “Environmnetal & Social Management Plan” outlines the mechanism to be adopted for the implementation of measures and monitoring of environment during all stages of project implementation

2 Project Description

This chapter provides a detailed overview of the project including the details of the project type, design considerations, construction aspects, procedures, and ultimately its operations and maintenance.

2.1 Need for Project

Freight routes in Karachi play a vital role in supporting the industrial activities. Key corridors include the Northern Bypass (M-10), which connects Karachi Port to the M-9 Motorway, and the National Highway (N-5), linking the city to the rest of the country. Major freight routes also pass through important roads such as Mauripur Road, Korangi Road, DHA, Clifton.

These routes serve prominent industrial zones including the Sindh Industrial and Trading Estate (SITE), Korangi Industrial Area, Landhi Industrial Area, and Port Qasim Industrial Zone. The figure highlights major industrial zones, ports, and the main truck stand of Karachi. These are critical traffic generators of heavy traffic.

Understanding their locations and trends is essential for planning efficient freight movement routes across the city.

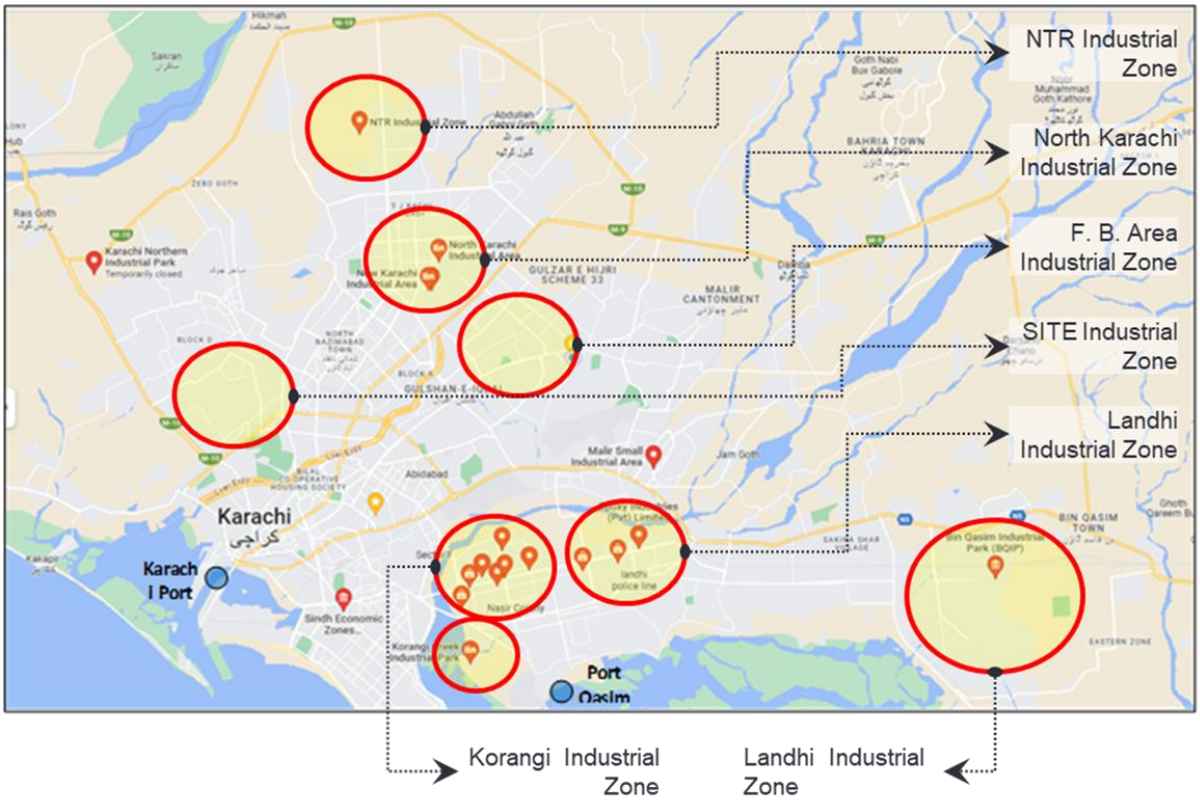


Figure 2.1 - Freight Routes of Karachi

There are four primary freight routes in Karachi that facilitate the movement of goods between Karachi Port and various exit points of the city.

- **Route 1** links the Karachi Port to the Link Road (Kathore Toll Plaza) via Korangi.
- **Route 2** connects Karachi Port to the Karachi Northern Bypass (KNBP) (M-10) Toll Plaza, forming part of the Karachi Northern Bypass.
- **Route 3** runs from Karachi Port to the Motorway (M-9) via Sohrab Goth.
- **Route 4** extends from the Karachi Port to the Link Road (Kathore Toll Plaza) through KNBP (M-10).

Among these, KNBP is the only freight corridor that allows 24-hour access for heavy vehicles, making it the most critical and unrestricted route. It is also the longest route, spanning approximately 79 km.

The other routes pass through dense urban zones such as SITE, Korangi, and Landhi industrial areas, using major roads like Shahrah-e-Pakistan, Sunset Boulevard, and Korangi Road. Due to alignment through congested areas, these routes operate under restricted hours, typically from 2200 to 0600 hours to minimize disruption to city traffic. These urban routes range from 54 km to 65 km in length and are essential links between the port and the city's industrial heartlands.

This is where the Karachi Port to Qayumabad Corridor project is seen to provide a direct link to freight traffic destined for other parts of the country, originating from the Karachi Port and travelling through a dedicated elevated corridor to the under development Shahrah-e-Bhutto, which when completed, will provide uninterrupted access to the Karachi Hyderabad Motorway, M-9.

This final alignment has emerged through a comprehensive, criteria-driven assessment that carefully weighed factors such as land availability, traffic flow efficiency, right-of-way constraints, integration with existing road networks, and potential conflicts with urban infrastructure. The selected alignment strikes a balance between engineering feasibility, logistical practicality, and urban compatibility.

2.2 Project Timeline

In line with the activities defined above, the time required for construction and commissioning of the infrastructure is estimated to span **30 months.**

2.3 Project Location

The project will follow a 4 lane (2 lane each side) elevated expressway format, originating from Qayyumabad, and travel through the KPT Interchange onto Main Korangi Road from where it will take a left turn onto Sunset Boulevard and travel along it through Submarine Chowk, the KE head office, Schon Circle, and Boat Basin. From here it will go straight onto Mai Kolachi, take a left, and split into two portions under an earthen embankment format, with the first cutting through the creek to Clifton near the Dr Ziauddin Hospital (from where it will adopt an elevated expressway format once again) and terminate at the South Asia Port Terminal (SAPT) area to cater to traffic generating from the area. The other portion from Mai Kolachi will travel along the periphery of the creek adjacent to Bhutta Village, with the alignment terminating at Karachi Port at East Wharf (also in an elevated expressway format once back on land). An underpass is also proposed near the KE head office to allow for the continuous movement of traffic coming from Saudi Embassy towards Sunset Boulevard.

The proposed alignment for the project is highlighted below:



Figure 2.2 - Proposed Alignment of Expressway

The chosen alignment also minimizes land acquisition challenges, avoids dense built-up areas, and ensures smoother connectivity between Shahrah-e-Bhutto and Karachi Port's East Wharf, making it the most viable corridor for implementation from both technical and operational standpoints.

Given the expressway's design intent and the need to maintain traffic safety particularly in a mixed traffic scenario ramp provision has been limited to the start and end points (Jam Sadiq Flyover, East Wharf, and SAPT), along with a strategically located entry/exit ramp at Mai Kolachi Bypass to enhance network accessibility without compromising performance.

2.4 Geometric Design

The geometric design of the project emphasizes safe, smooth, and high-speed movement for WB-20 design vehicles under urban expressway operating conditions. It ensures appropriate sight distances transition curves, and superelevation for driver comfort.

This design also encompasses various elements, including horizontal and vertical alignments, cross sections, and intersections. Its primary goal is to create a roadway that ensures safe, efficient, and cost-effective traffic operations, all while considering aesthetic and environmental factors. The design process takes into account the characteristics of vehicles, drivers, and traffic flow.

By carefully considering the dimensions and layout of the highway, geometric design aims to optimize the road's performance and enhance the overall transportation experience. Horizontal alignments determine the road's curvature and alignment with the surrounding landscape, ensuring smooth and safe vehicle movement. Vertical alignments, on the other hand, control the road's elevation changes, such as hills and valleys, to provide a comfortable driving experience.

As such, based on the policy of geometric design 2011, the geometric design criteria for the project is provided below:

Table 2.1 - Geometric Design Criteria

Design Element	Specification-Roads	Specification-Interchanges
Design Speed	80 km/h	40 km/h
Roadway Classification	Urban Expressway	Urban Expressway
Design Vehicle	WB-20 (Container Truck)	WB-20 (Container Truck)
Design Manual References	Geometric Design Manual, AASHTO 2011	Geometric Design Manual, AASHTO 2011
Horizontal Curve Radius (Min)	280 meters	47 meters
Super elevation (Max)	4%	4%
Minimum Stopping Sight Distance	130 meters	50 meters
Tangent Runout Length	14 meters	10 meters
Maximum Gradient	4%	4%
Equivalent Maximum Relative Slope	1:200	1:143

2.4.1 Design Basis – Speed, Curvature, Elevation, & Gradient

2.4.1.1 Design Speed

Design Speed is a selected speed based on the various geometric features of the roadway. Conversely the geometric design features should correspond with the desired design speed. The selected design speed should be consistent with the speeds that drivers are likely to expect on a given highway facility. The Design Speed for the project on main carriageway was taken 80 KPH for roads and 40 KPH for interchanges.

2.4.1.2 Curve Radius

The minimum radius is a limiting value of curvature for a given design speed and is determined from the maximum rate of super elevation and the maximum side friction factor selected for design (limiting value of f). The Design Consultant studied the existing Geometry and had made improvements where required. Minimum radius at relevant design speed and maximum super elevation is taken as ≥ 280 meters for roads and ≥ 47 meters for interchanges.

2.4.1.3 Super Elevation

Super elevation is the banking of a roadway around a curve. The purpose of employing super elevation of the roadway cross section is to counterbalance the centrifugal force, or outward pull of a vehicle traversing a horizontal curve. Side friction developed between the tires, and the road surface also counterbalances the outward pull of the vehicle. A combination of these two concepts allows a vehicle to negotiate curves safety at higher speeds.

There are practical upper limits to the rate of super elevations on a horizontal curve.

- Maximum super elevation on the project is taken 4%

2.4.1.4 Gradient

Roads and streets should be designed with the aim of promoting consistent and efficient operation. One crucial aspect of this design is the consideration of grades or slopes. Grades play a significant role in facilitating the movement of road users. By adhering to this guideline, road designers can ensure that the slopes of the road are not excessively steep, allowing for smoother and safer travel for vehicles, pedestrians, and cyclists.

Maintaining a uniform and manageable grade throughout a road or street helps to enhance the overall user experience, improve vehicle performance, and reduce the likelihood of accidents or traffic congestion. Additionally, a well-designed road with appropriate grades can contribute to better fuel efficiency and reduced wear and tear on vehicles.

The desirable maximum taken for the project design is 4% to ensures container-carrying trucks maintain traction and fuel efficiency on elevated ramps.

2.4.2 Cross Section Elements & Design

2.4.2.1 Cross Section Elements

The following elements comprise the road cross sectional elements:

- **Width of Roadway:** Width of Roadway consist of travelled way width and shoulder width. These elements on the project road are as follows:
  - **Lane Width:** Lane width on the Project is 3.5m on typical elevated dual Carriageway Section (Main Expressway) and 3.65m on Boat Basin water body travelled way of the Project are provided.
  - **Shoulder Width:** Paved / TST shoulder is provided on both inner and outer edges of Boat Basin water body travelled way, a 0.5m wide inner shoulder and 3m outer shoulder is provisioned in the design
- **Cross Slope:** Cross slope across the entire width of the travelled way is generally provided for surface drainage. For main carriageway design, the cross slope on either side taken as 2.0%.

2.4.2.2 Design Cross Section

The design cross section details are provided below:

A. Typical Elevated Dual Carriageway Section

Component	Dimension
Carriageway	4 lanes (2 per direction) × 3.5 m = 14.0 m
Median Barrier	0.6 m (New Jersey Barrier)
Shy Distance	2 × 0.15 m = 0.3 m
Guardrails	2 × 0.6 m = 1.2 m
Total Width	**16.4 m**

B. Typical Elevated Single Carriageway Section

Component	Dimension
Carriageway	2 lanes × 3.35 m = 6.7 m
Shy Distance	2 × 0.15 m = 0.3 m
Guardrails	2 × 0.6 m = 1.2 m
Total Width	**8.2 m**

C. Boat Basin Water Body

Component	Dimension
Carriageway	2 lanes (1 per direction) × 3.65 m = 7.3 m
Inner Shoulder	0.5 m
Outer Shoulder	3.0 m
Median Barrier	0.6 m (New Jersey Barrier)
Guardrails	2 × 0.6 m = 1.2 m
Total Width	**14.9 m**

Figure 2.3 - Design Cross Section Details

This is also illustrated in the drawing below:

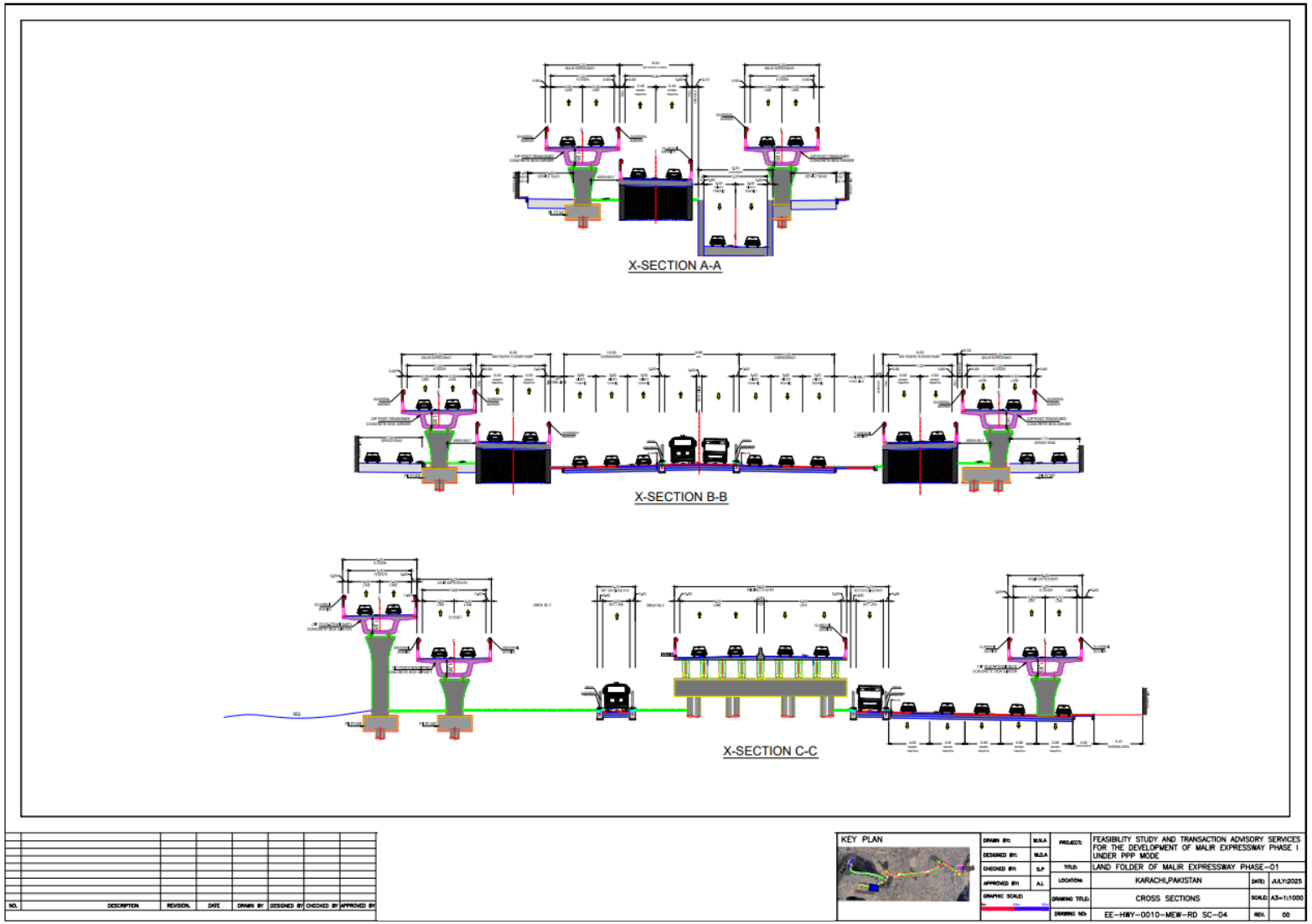


Figure 2.4 - Project Cross Section

2.4.3 Underpass Design

A grade separated, mixed traffic underpass is proposed at the junction of Sunset Boulevard and Gizri Boulevard, beneath the proposed elevated project, where this has been designed to accommodate local vehicular traffic and ensure uninterrupted flow at this key urban intersection.

The underpass has been designed with a speed of 30 km/h, making it appropriate for urban conditions and turning movements. The geometric layout provides safe vehicle maneuvering, adequate visibility, and efficient clearance in a confined right of way.

To make this possible however, the existing sunset boulevard flyover will be fully demolished to allow for the new structural and geometric configuration. Nevertheless, the development of this underpass will allow for:

- Reduced traffic at conflict points
- Improved circulation efficiency for local traffic
- Safe underpass operation without affecting freight traffic on the elevated expressway above

2.4.4 Safety Measures

The elevated expressway alignment passes through densely populated urban corridors, including Sunset Boulevard from Defence Morr to Submarine Chowk that consists of residential neighborhood which requires the following safety measures:

- **Reinforced Crash Barriers:** High-impact RCC crash barriers along deck edges.
- **Noise Reduction Barriers:** Installation of acoustic composite sound barriers (3.5m height) in proximity to residential blocks.
- **High Privacy Barriers:** Barriers (up to 4 meters high) along Sunset Boulevard and other sensitive zones. Designed to not only preserve visual privacy of adjacent homes but also shield upper floors of buildings from direct line of sign of expressway traffic.

2.5 Structural Design

The structural design, suitable design specifications and construction as per specifications are all important parameters to achieve the desired design life of structures.

The concept of influence line is used to analyze the moving track and tank load, which is then combined with other live loads and dead loads to come up with the entire shear force and bending moment envelope along the bridge. However, state of the art software like CSI Bridges, STAAD pro etc. have been used for analysis of relevant structures.

Once all the design loads had been determined, detailed computational designs were performed for reinforced concrete girders and concrete decks with respect to bridge design standards.

The entire structure of the Project consists mostly of an Elevated flyover, with a small portion being either at grade or on earthen embankment. The design approach followed for preliminary structural design of structures required in the project is mentioned below:

- **Elevated Structure:** Since this expressway is meant for heavy container traffic from Port to Shahrah-e-Bhutto, therefore the grade separated flyover has been proposed achieve a non- stop route to the heavy traffic throughout the day. The elevated structures are flyovers with a span of 35 to 40m having piers of 5.5 to 6m height. The proposed super structure is a combination of cast-in-place box girders and precast girders. The precast girders have

been proposed at locations where the construction of cast-in-place box girders is not possible due to several constraints like working space and traffic congestion.

- **Underpass:** An underpass has been proposed in the alignment for mix traffic crossing at a junction to avoid the intersection signal.
- **Earthen Embankment:** In the alignment, the route along the China Creek has been proposed which has been laid on the raised earthen embankment. The earthen embankment shall be raised from the existing ground level and 4m to 5m above the KPT chart datum creek to keep it operational at all times.

2.5.1 Design Codes & Standards

The design codes and standards followed are highlighted below:

Table 2.2 - Structural Design Codes & Standards

WPCHB (1967)	Government of West Pakistan Highway Bridges Code of Practice Highway Bridges 1967.
AASHTO (2012)	AASHTO LRFD Bridge Design Specification (For the design of all structural members ASD combination for the calculating length of pile).
BCP (2007)	Building Code of Pakistan.
ACI 318-08	Building Code Requirements for Reinforced.
	Concrete. American Concrete Institute.
ACI 301-95	Specifications for Structural Concrete.
	American Concrete Institute.
ASTM A-615	Specifications for Deformed and Plain Billet.
	Steel Bars for Concrete Reinforcement.
ASTM C-150	Specifications for Portland cement.
ACI-350 R	Environmental Engineering Concrete Structures.
ASTM C-33	Specifications for Concrete Aggregate.
UBC 1997	Uniform Building Code of USA.
ASTM C270	Standard Specification for Mortar for Unit Masonry.

2.5.2 Loads

Structures designed as per the above highlighted standards are able to withstand the following main loads and forces:

- Dead Loads
- Live Loads
- Impact/ Dynamic Allowance
- Vehicle Collision Force
- Wind Loads

- Longitudinal forces due to tractive/ braking effort of vehicles
- Earth pressure
- Earthquake forces
- Stream flow/ water load

2.5.3 Construction Materials

The following strengths of construction materials has been used for the purposes of the design:

2.5.3.1 Cement

The limiting value of sulphate in water being used should be less than 150 ppm. If it exceeds this value, then OPC cannot be used. Similarly, the limiting value of water-soluble chloride ion (Cl-) in concrete is 0.06 & 0.15 (by mass of cement) for pre-stressed and reinforced concrete.

2.5.3.2 Concrete

All structural concrete shall conform to AASHTO T-22, T-23 & T-24 as specified. Minimum compressive strengths as measured on cylinders at 28 days shall be as follows:

I. Concrete Class A1 (21 MPa) for barriers, approach slab and other reinforced concrete members except noted below.
II. Concrete Class A2 (24 MPa) for foundations, bearing plinths, shear keys, pile caps, abutments & retaining walls.
III. Concrete Class A3 (28 MPa) for piles, pier shafts, deck and diaphragms.
IV. Concrete Class D2 (42 MPa) for Precast, Cast-in-place girders unless otherwise specified.
V. Lean (1:4:8) mix.

2.5.3.3 Reinforcing Steel

Deformed billet steel bars (Grade-60 and Grade-40 conforming to ASTM A-615 or High yield deformed bars with minimum yield or characteristic strength of 425/460 N/mm2 conforming to BS 4461.

2.5.3.4 Prestressing Standards

Prestressing Steel will be seven-wire low relaxation strands Grade 270, conforming to ASTM A 416.

2.5.3.5 Structural Steel

All structural steel, plates, angles etc. conforming to ASTM A-36 Steel.

2.5.4 Foundation Design Parameters

The following criteria have been highlighted for the development of the foundation design:

- **Overturning** – The resultant of applied forces should lie within middle third of the base for normal loading conditions. Resultant of applied forces should lie within middle half of the base for exceptional loading conditions. Minimum factor of safety against overturning shall be 2.0 for footings on soil.

- **Sliding** - Minimum factor of safety against sliding shall be equal to 1.5. The factor of safety against sliding and overturning failure under seismic loading may be reduced to 75% of the factor of safety listed above.

2.6 Site Development Plan

The proposed project will be developed in a phase wise manner to ensure systematic progress and adherence to timelines and quality standrads, where the project is dividied into the following key phases:

2.6.1 Pre-Construction Phase: Assessments & Approvals

This initial phase involves site assessments, environmental impact studies, and obtaining the necessary permits and approvals from relevant authorities. A detailed survey of the topography and geotechnical conditions along the proposed expressway route will be conducted, and consultations with local communities will ensure transparency and address any concerns.

2.6.2 Construction Phase: Infrastructure Development

During the construction phase, portions of the alignment will be closed and built up as opposed to closing out the entire length of the alignment beforehand and subsequently carrying out construction works after.

Once construction is complete, a comprehensive testing and commissioning process will be undertaken including safety inspections.

2.6.3 Post-Construction Phase: Transitioning to Operations

After successful testing, the project will enter the operational phase. Maintenance protocols will be established to address any issues that may arise post-commissioning.

2.7 Site Security Measures

The following measures will be inbuilt into the project to ensure safety and security of the infrastructure being developed:

Access Control

- Install sturdy fencing around key entry points and work areas to prevent unauthorized access
- Utilize gates staffed by security personnel to monitor and control access.
- Implement strict ID checks for all personnel entering the site to ensure only authorized staff are present.

Surveillance and Monitoring

- Deploy high-resolution CCTV cameras to monitor critical areas
- Implement remote monitoring systems for real-time surveillance and alerts for suspicious activity.

Physical Barriers and Markings

- Clearly mark high-risk areas and areas with traffic diversions with warning signs
- Install guardrails near roads or walkways to prevent accidental entry into dangerous zones.

Regular Patrols and Security Personnel

- Employ trained security personnel to conduct regular patrols along the length of the alignment
- Establish a schedule for routine security checks and audits to identify and address potential vulnerabilities.

Emergency Response Plan

- Develop detailed emergency response plans for scenarios such as natural disasters, and security breaches.
- Provide first aid training to all personnel to ensure effective response to accidents.
- Maintain a list of emergency contacts, including local medical facilities and emergency services, easily accessible on-site.

Public Awareness and Community Engagement

- Conduct outreach programs to educate local communities about the project and associated risks.
- Emphasize the importance of reporting suspicious activities.
- Collaborate with local law enforcement to enhance community surveillance and response capabilities.

Incident Reporting and Analysis

- Establish clear channels for reporting security incidents or safety concerns.
- Conduct thorough investigations after any incidents to identify causes and implement corrective measures.

2.8 Project Construction Workforce & Construction Camps

2.8.1 Project Workforce

Estimating manpower demand is essential for effectively deploying personnel for the proposed project. This initiative will involve a range of labor types, including professional, administrative, skilled, and unskilled labor. During the construction phase, it is expected that 1000 workers will be required during construction activities.

2.8.2 Construction Camps

Specific construction camp sites have not yet been finalized; however, guidelines herein will ensure that the selection, establishment, and operation of these camps minimize negative impacts on the surrounding environment and communities. The contractor is responsible for identifying suitable construction camp sites, guided by the following criteria:

Land Acquisition & Resettlement

- Establishing contractor camps will not involve land acquisition or potential resettlement issues. If land needs to be rented, the contractor will negotiate terms directly with landowners, ensuring a written rental agreement is signed by both parties.

Distance from Settlements

- Camp sites should be located away from existing residential areas (if any) to minimize disturbances.
- A considerable buffer zone should also be maintained.

Proximity to Project Site

- Camp sites should be chosen close to the project area to ensure convenient access to main roads, facilitating efficient transportation of materials, machinery, and personnel.

Workforce Management

- Camp sites must not pose a threat to domestic or public water supplies, and care should be taken to prevent drainage from the camps from contaminating local water sources.
- The size of each camp site should be adequate to prevent overcrowding and ensure the availability of necessary facilities.
- Precautions should be taken to avoid damage to property, vegetation, irrigation systems, and drinking water supplies.
- Camp sites should be located in areas that are not prone to flooding and away from ecologically sensitive areas, such as wildlife habitats or protected lands.

Approval of Camp Sites

- The contractor, in consultation with the Supervision Consultant (SC), will select the final locations of the contractor camps. These locations will require approval from KDA prior to campsite development

In the absence of specific zoning laws in the area, the ideal scenario for contractors would be to set up camp at a suitable location within the project's designated premises, ensuring minimal disruption and efficient operations throughout the construction phase.

2.9 Utilities Consumption

2.9.1 Water Demand & Source

In this section, the water demand for construction and operational stages is assessed and reported, along with the potential source for this water, where potable water will be required for consumption purposes at the site, along with water for construction. Dedicated water supplies will be stored for firefighting purposes and emergency response needs adequately in line with the fire risk at the site during construction. operations.

The source of water during the **construction** phase will be from water tankers. The WHO defines between 50 and 100 litres of water per person per day[9] are needed to ensure that the most basic needs are met, and no health concerns arise. In this case, considering the average for the purposes of the project, where each worker will require 75 litres/day, the water consumption is estimated to be over 75,000 litres /day for 1000 construction workers.

2.9.2 Wastewater Generation

The estimated wastewater generation during the **construction phase** for 1000 workers is estimated at 60,000 litres/day[10] from the construction camps. Septic tanks will be constructed to provide primary treatment after which the wastewater will be discharged from the site.

2.9.3 Solid Waste Generation

Due to the construction activities, waste will be generated at the construction sites and contractor camps. The excavated materials will be reused where applicable for construction purposes. Solid waste generated during construction and camp operations shall be safely disposed of in the operating landfill site. Considering 0.5 kg/capita/day of solid waste generated, the estimated solid waste generation is considered to be 500 kg/day for 1000 workers during the construction phase.

[9] UN – Water Decade Programme on Advocacy and Communication and Water Supply and Sanitation Collaborative Council
[10] Design criteria of Public Health Engineering for Water Supply, Sewerage, and Stormwater Drainage (Domestic sewage generation = 80% of water consumed/ day)

3 Review of Pertinent Legislations

This chapter provides an overview of the policy framework and legsilation that applies to control the environmental and social ramifications arising from the proposed project implementation and operation. The project needs to comply with all the applicable environmental policies, laws, guidelines, and acts of the Government of Pakistan and the Government of Sindh.

3.1 Environmental & Social Regulatory Authorities in Sindh

The key provincial regulatory authorities that are tasked with implementing the applicable environmental and social policies are listed below:

Table 3.1 - Functions of Sindh's Environmental and Social Regulatory Authorities

Organization	Functions/ Role
Sindh Environmental Protection Agency (SEPA)	• Regulating environmental issues • Reviewing and checking environmental assessment reports prepared as per the legal requirements • Environmental approvals of the project • Ensuring compliance and reviewing the performance of environmental management plans implementation
Sindh Labor & Human Resources Department	Guaranteeing the rights of workers like the right to organize, the right to collective bargaining, participation in the affiars of the implementing agency, health & safety, minimum wags, compensation, etc. are followed in the project
Sindh Social Welfare Department & Women Development Department	• Transformation of the government into an organization that actively practices and promotes gender equality and women empowerment • Mainstreaming gender equality perspectives across public policies, laws, programs, and projects by departments and agencies of the government with a focus on women empowerment • Looking after various margnizalized segments of population such as persons living below the poverty line, people with disabilities, orphans, victims of violence (specially women) to ensure their welfare and support
Employees Old Age Benefit Institute (EOBI)	Ensure that workers are benefitted after retirement from the collected/ raised funds

3.2 Summary of Relevant Strategies, Policies, Acts & Legislations

A summary of the major relevant strategies, policies, Acts, and legislation pertinent to the project in the realm of environment and social is provided below:

Table 3.2 - National Laws & Legislations

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
1.	**National Climate Change Policy, 2021**	Pakistan developed its first National Climate Change Policy (NCCP) in 2012, which was updated in 2021. The focus of the NCCP-2021 is on adaptation and mitigation, with a major emphasis on nature-based solutions.	Relevant as it defines the different ways projects must inbuild sustainability into their design and development	Ensure that the project includes precursors for sustainability and sustainable development
2.	**National Conservation Strategy, 1992**	Pakistan National Conservation Strategy (NCS), which was approved by the Federal Cabinet in March 1992, is the principal policy document on environmental issues in the Country. The NCS outlines the Country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment.	The core areas that are relevant in the context of the proposed project are pollution prevention during construction and conserving biodiversity and forestry along with minimizing footprint of raw materials used for the project.	Ensure that the guidelines laid out therein are followed and implemented during the project.
3.	**National Climate Change Policy, 2021**	The policy highlights the vulnerabilities of various sectors to climate change and outlines appropriate adaptation measures. These measures cover sectors such as water, agriculture, forestry, coastal areas, biodiversity, and other vulnerable ecosystems. Despite Pakistan's small contribution to global greenhouse gas (GHG) emissions, its role as a responsible member of the global community in combating climate change is emphasized, particularly through mitigation efforts in energy, transport, forestry, and agriculture. Additionally, the policy incorporates disaster preparedness, capacity building, institutional strengthening, technology transfer, and international cooperation as important components.	Focuses on reducing GHG emissions, particularly in the energy and transport sectors, contributing to Pakistan's climate change commitments.	Ensure that the project is developed, prioritizing minimal GHG emissions and employing methods to reduce these to the extent possible
4.	**National Gender Policy Framework, 2022**	Ministry of planning, development and special initiatives, Government of Pakistan has launched National Gender Policy Framework on 8th March 2022 with an objective for year 2022-25 to accelerate progress towards equality between women and men by bringing gender equality goals and women's perspectives to the center of policy related decision making in all sectors. The Government of Pakistan aims to achieve a gender-	The policy is applicable to the project to ensure and encourage inclusion of all genders in all stages of the project and eliminate, discrimination, violence against women and girls in all its manifestations and removal of socio-cultural impediments that hinder travelling to desired places.	Ensure no discrimination is carried out in the employment of persons for the project

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
		responsive society where women and men equally contribute to, and benefit from development, and this shall be done through promotion of gender perspective in all policies and programs, understanding the prospective impact on women and men respectively, before rolling out the programs.		
5.	**Pakistan Climate Change Act, 2017**	The Prime Minister of Pakistan established Pakistan Climate Change Council which coordinates and supervises the enforcement of the provisions of the Act, monitor implementation of the international agreements relating to climate change, approve and monitor implementation of comprehensive adaptation and mitigation policies, strategies, plans, programs, projects and other measures formulated by the authority to meet Pakistan's international obligations, monitor the implementation of National Adaptation Plan and its constituent provincial and local adaptation action plans, approves guidelines for the protection and conservation of renewable and non-renewable resources, species, habitats and biodiversity adversely affected or threatened by climate change.	The Act is applicable to proposed project as the proposed project involves the solid waste management activities that may contribute to generation of greenhouse gases.	Requires compliance with local EPA and its requirements
6.	**Antiquities Act, 1975**	The Antiquities Act, 1975 (amended in 1990) states the following: "Ancient" is any object that is at least 75 years old. All accidental discoveries of artefacts must be reported to the Federal Department of Archaeology. The Government is the owner of all buried antiquities discovered on any site, whether protected or otherwise. All new construction within a distance of 200 feet from protected antiquities is forbidden. No changes or repairs can be made to a protected monument, even if it is owned privately, without approval of the responsible authorities; and The cultural heritage laws of Pakistan are uniformly applicable to all categories of sites regardless of their state of preservation and classification as monuments of national or world heritage.	Although no antiquity site has been identified within the proposed AoI. However, the law will be applicable to the Project mainly due to its two provisions: According to the law, any construction activity within 61 m or 200 ft. of protected antiquities, are prohibited. The provisions of this Act would also be applicable, if any accidental archaeological discoveries may occur during the excavation works for the construction of proposed Project.	Should there be an identified antiquity lying within 200 feet of one of the project sites, then approval must be obtained from the culture and heritage department. Further during project execution, on account of discovery of any archaeological remains, antiquities department to be intimated promptly.

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
7.	**Pakistan Penal Code, 1860**	The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions, and disposal of effluents.	The provisions of the Penal Code, 1860 are applicable to the Project in terms of penalties for effecting human lives and public property. It also addresses the control of noise, air emissions and effluent disposal.	Requires adherence to the law of the land, where it defines the need to comply with aspects affecting the environment and other humans.
8.	**Protection against Harassment of women at the workplace Act, 2010**	The Protection Against Harassment of Women at the Workplace Act (2010) refers to sexual harassment at the workplace.	This Act will be applicable to the Project if women are employed for the construction of the proposed Project.	Ensure that women are not harassed at workplaces.
9.	**Labor Laws as part of Constitution of Pakistan, 1973**	The Constitution of Pakistan contains a range of provisions with regards to labor rights, in particular: Article 11 of the Constitution prohibits all forms of slavery, forced labor and child labor. Article 17 provides a fundamental right to exercise the freedom of association and the right to form unions. Article 18 proscribes the right of its citizens to enter upon any lawful profession or occupation and to conduct any lawful trade or business. Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and Article 37(e) makes provision for securing just and human conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment. Labor law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labor laws. The labor laws are a comprehensive set of laws in Pakistan dealing with the following aspects:	The labor laws are relevant as it would deal with employment of labor for the construction of proposed Project. Following are the major labor laws which are applicable to the Project: Sindh Workers Compensation Act 2015 Sindh Minimum Wage Act 2015 Sindh Terms of Employment (Standing Orders) Act 2015 Sindh Bonded Labor System (Abolition) Act 2015 Sindh Payment of Wages Act 2015 Sindh Occupational Safety & Health Act 2017 Sindh Factories Act 2021	Requires that the labor regulations defined therein are complied with during project implementation.

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
		Contract of Employment. Termination of Contract. Working Time and Rest Time. Working hours. Paid Leave. Maternity Leave and Maternity Protection. Other Leave Entitlements. Minimum Age and Protection of Young Workers. Equality Pay Issues. Workers' Representation in the Enterprise. Trade Union and Employers Association Regulation; and Other Laws.		
10.	**Land Acquisition Act, 1894**	The primary law for acquisition of land for public purposes in Pakistan is the "Land Acquisition Act (LAA), 1894" (hereinafter referred as the Act). The land acquired under the Act vests in the province, and it is only thereafter that the province may transfer it to someone else. The Sindh Amendment 2009 of LAA 1894 specifically related to Section 16, Section 23, Section 24, and Section 28-A.	Neither land acquisition nor physical displacement is envisaged under this project.	No land acquisition is required under the project as the land is owned by the Government.
11.	**National Disaster Management Act, 2010**	National Disaster Management Act, 2010 was passed by Parliament of Pakistan in 2010. The Act applies to whole Pakistan. The Act was passed in backdrop of 2010 Floods in Pakistan and strengthens Disaster Management system.	This Act is applicable as proper mitigation measure will be adopted by technical consultant during design stage to offset any chances of flooding during torrential rains.	Requires that the project design take into account the previous intake and data on any national disasters.
12.	**Building Code of Pakistan, 2007**	The provision of Building Code of Pakistan shall apply for engineering design of building-like structure and related components. The construction in violation of the building code shall be deemed as violation of professional engineering work. Moreover, a certificate for the proposed action will be obtained from Provincial Building Control Authority.	These codes shall be used in structural design of building area components constructed under this proposed Project.	Requires that the codes defined therein are used in the construction of any buildings constructed for the project.

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
13.	**The Criminal Law (Third Amendment Act, 2011)**	The Criminal Law (Third Amendment) Act 2011 was passed by the Parliament in 2011 and assented by the President on 16th December 2011. The Act amended relevant sections in the Pakistan Penal Code and Code of Criminal Procedures. The Amendment criminalized a number of customary practices such as giving women or girls in marriage for settling a dispute), forced marriage, marriage with the Holy Quran and depriving women of inheriting property. All these offences are made non-compoundable and non-bailable under this Act.	This Act is applicable as the proposed project may involve the numbers of staff/worker having different religion, political affiliation, sect, color, caste, creed, ethnic background.	Requires that workers of all different backgrounds, religions, cultures are treated the same without any discrimination.
14.	**Gender Equality as part of the Constitution of Pakistan, 1973**	The Constitution of Pakistan contains a range of provisions regarding gender equality, in particular, provides the principle of equal rights and equal treatment to all citizens/ persons, without any distinction including on the basis of sex: Article 3 calls upon the State to eliminate all forms of exploitation. Article 4 provides for the right of individual to enjoy the protection of law and to be treated in accordance with the law. This applies to the citizens as well as "to every other person for the time being within Pakistan" without distinction. This article also clearly states that certain rights cannot be suspended. Article 25 ensures equality before the law and equal protection of the law and states that there shall be no discrimination on the basis of sex alone. Articles 25(3) and 26(2) allow the state to make special provisions for the protection of women and children. Articles 26 & 27 provide for equal access to public places and equality of employment in the public and private sector. Articles 11 & 37 (g) prohibit trafficking in human beings as well as prostitution. Article 32 makes special provisions for the representation of women in local Government. Article 34 directs the state to take appropriate measures to enable women to participate in all spheres of life and	The articles of laws Constitution of Pakistan are relevant as it would deal with employment of male and female labor having different religion, political affiliation, sect, colour, caste, creed, ethnic background for the construction of proposed Project.	Requires that persons are not discriminated against for jobs during project implementation.

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
		social activities. Article 35 asks the state to protect the marriage, the family, the mother, and the child. Article 37 (e) directs the state to make provisions for securing just and humane conditions of work ensuring that children and women are not employed in vocations unsuited to their age or sex, and for ensuring maternity benefits for women in employment. Articles 51 & 106 provide for the reservation of seats for women in the legislatures.		

Table 3.3 - Provincial Legislations & Legislations

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
1.	**Sindh Strategy for Sustainable Development, 2007**	The Sindh Strategy for Sustainable Development (SSSD) proposes a ten- year sustainable development agenda for Sindh. Its purpose is to highlight the ecological, economic and social issues of the province and to provide recommendations and strategic actions to address them. The strategy promotes the sustainable use of natural resources to achieve the objectives of poverty alleviation and social development through the participation of the people of Sindh. It is a live document, which should evolve with the changing scenario. The strategy would be reviewed and revised every three years, incorporating lessons learned during implementation.	The project through its development is aniticipated to ease traffic congestion and alllow for direct, unfettered movement of heavy traffic from ports to M-9, allowing for lesser traffic buildup and congestion on the main arterials of the city, including sunset boulevard, Shahrah-e-Faisal, MA Jinnah Road, etc.	Ensure that development carried out includes incorporation of sustainability to the extent possible
2.	**Sindh Drinking Water Policy, 2017**	This policy is to provide safely managed drinking water whose supply is adequate, well maintained and sustainable; and to enhance public awareness about health, nutrition and hygiene related to safe drinking water. The basic objective of this policy is to introduce legislative measures and regulations to create an enabling framework for safely managed drinking water supply, regulation of water usage, extraction, treatment transportation and distribution.	The project will employ a large workforce including use a considerable amount of water for the development of the project.	Requires that people employed under the project are provided with clean drinking water for safe consumption

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
3.	**Sindh Water Policy 2023**	The Sindh Water Policy outlines a comprehensive strategy aimed at addressing the pressing challenges surrounding water resources and their sustainable use. With increasing concerns over water scarcity, pollution, and climate change, this policy document seeks to establish a forward- looking framework that promotes efficient water management, conservation, and equitable distribution. The overarching goal of this policy is to ensure a secure water supply for present and future generations while preserving aquatic ecosystems and fostering socio-economic development.	Ensures the project's water usage is efficient and aligned with policy goals.	Ensures the project's water usage is efficient and aligned with policy goals.
4.	**1st Sindh Labour Policy, 2018**	1St Sindh Labour Policy was introduced in 2018. The Major focus of the 1st Sindh labour policy, 2018 is to ensure the health and safety of workers at work place with guaranteeing living wages for all. As labour laws are mostly male centric, but this policy will address women labour issues, which include equal opportunities and equal remuneration in line with the International Labour Organization (ILO) conventions.	The policy is applicable to the project since extensive labor will be employed for the project at various stages.	Ensure that labor dealing and handling is in line with the requirements of the policy.
5.	**The Sindh Local Government Act 2013, and Sindh Local Government (Amendment) Act, 2019**	Under the Sindh Local Government Act 2013, Chapter VI, land use planning; implementation of the building by-laws, management of environmental and helath hazards; food adulteration provision and maintenance of water supply schemes and public sources of drinking water, and mobilization of communities for the upgrade of local infrastructure (transportation, landscaping, and removal of encroachments) are the responsibilities of municipal corporations/ committees.	The Act is applicable to the proposed project due to its location within the city, along with its reliance on the use of public utilities and materials during construction.	Ensure that the project abides by the requirements laid out in the Act.
6.	**Sindh Environmental Protection Act, 2014**	Sindh Environmental Protection Agency as a part of Sindh Act No. VIII of 2014 prepared Sindh Environmental Protection Act (SEPA), 2014 which was passed by the provincial assembly of Sindh on 24th February 2014 and asserted by the Governor of Sindh on 19th March 2014 and notified on 20th March 2014. It is a fairly comprehensive legislation and provides legislative framework for protection, conservation, rehabilitation, and improvement of the environment. It contains concrete	The proposed Project is located in Sindh so it falls under the jurisdiction of the SEPA that will be the responsible authority for governing the environmental compliance of the project with local guidelines.	Prior to project construction, an Environmental Impact Assessment must be conducted against which an approval has to be obtained from the department.

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
		action plans and programs for the prevention of pollution and promotes sustainable development. Act has 11 parts with 37 Sections followed by sub-sections and clauses. Part VI is related to the environmental examinations and assessments while part X is related to the public participation.		
7.	**Sindh Environmental Assessment Regulations, 2021**	These regulations set out: • Key policy and procedural requirements for filing an EIA. • The purpose of environmental assessment. • The goals of sustainable development. • The requirement that environmental assessment be integrated with feasibility studies. • The jurisdiction of the Provincial EPA and Planning & Development (P&D) Departments. • The responsibilities of proponents. • Duties of responsible authorities. • Provides schedules of proposals that the Project requires either EC, IEE, or an EIA. • The environmental screening process of the projects under schedule I, II and III; and The procedure for the environmental approval for filing the case with the Sindh EPA for the granting of the NOC.	Defines the categories for different projects, where the type of study/ assessment required (Checklist, IEE, EIA) against each category of project is defined to fulfil local environmental compliance.	As per the categories defined, the following project falls into the category of an EIA based on: **Schedule III – Projects Requiring an EIA** *Category (E) – Transport* Sub-Category (6) – Construction of flyovers, underpasses, and bridges having total length more than 1 km
8.	**Sindh Environmental Quality Standards, 2016**	SEPA has formulated the Sindh Environmental Quality Standards (SEQS) as per Clause (g) of sub-section (1) of Section 6 of SEPA Act 2014. The SEQS were promulgated in 2016 which includes standards for liquid effluent, industrial gaseous emissions, ambient air, drinking water quality, noise levels and standards for motor vehicle exhaust, diesel vehicle, and petrol vehicles.	Defines acceptable standards for the construction and operation of different projects in Sindh with respect to ambient air quality, vehicular and exhaust emissions, drinking water quality, and effluent quality.	All projects to be implemented in Sindh must conform to SEQS during all the phases i.e., construction of the project.
9.	**Sindh Solid Waste Management Act, 2021**	The Sindh Solid Waste Management Act, 2021 enacted to establish a board for collection and disposal of all solid waste, to arrange effective delivery of sanitation services, to provide pollution free environment and to deal with other relevant matters. The Board established under the Act headed by the Chief Minister or his nominee and constitutes of thirteen other ex-officio members of other relevant departments.	This Act is applicable as the main Act of the implementing agency of the project. It will define the boundaries in which the project must take place, and continue operations in.	Defines that all waste generated from the project must be disposed off adequately, and identifies the party responsible

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
10.	**Sindh Cultural Heritage (Preservation) Act, 1994**	This provincial Act empowers the Government of Sindh to preserve and protect any premises or objects of archaeological, architectural, historical, cultural, or national interest in Sindh by declaring them protected. Karachi alone has over 200 buildings declared as "Protected Heritage" by the Government of Sindh.	If a site is declared as a protected heritage, then no work may take place within 200 feet of that area.	None of the sites protected under this law has been identified within the RoW/AoI of the proposed Project. Nevertheless, proponent will get NOC from Department of Culture, Tourism and Antiquities if any protected site is identified along the project.
11.	**Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020**	The Sindh Wildlife Protection, Preservation, Conservation & Management Act was enacted in September, 2020. The Act was passed to make provisions for protection, conservation, preservation, and sustainable use of wildlife for establishment, management and maintenance of protected areas in the Province of Sindh. The Act introduces the establishment of a Council for protection and the Conservation of Wildlife, and other measures which guarantee and protect the rights and ensure safety of wildlife in the Province of Sindh.	Project is located within Karachi, where there are no identified sites of ecological importance, or wildlife hotspots.	-
12.	**The Sindh Prohibition of Employment of Child Act, 2017**	Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines, or any other hazardous employment. In accordance with this Article, the Prohibition of Child Employment Act (PCEA) 2017 disallow child labor in Sindh. The PCEA defines a child as a person who has not completed his/her fourteenth years of age, and an adolescent means a person who has completed fourteenth year of age but has not completed eighteenth years of his age. No child shall be employed or permitted to work in any establishment including construction, but an adolescent can be employed or permitted to work under strict guidelines provided in the PCEA and rules. An adolescent shall not be employed in any hazardous work included in the schedule to the PCEA.	The relevance of this Act to the Project will be to prohibit child employment for construction of the proposed Project.	Ensure that persons hired to work on the project are above the legal working age of the country.
13.	**Sindh Factories Act, 2021**	The Act deals with regulations related to Project Area workers and workplace EHS requirements. The Factories Act also provides regulations with provision for general health and safety of the work force in their work area. Conditions are specified for clean workplace, toilets,	This Act is applicable for the Project workers as well as belonging community including men, adults, women, adolescent working in and near the construction industry (during	Requires that the occupational health and safety, along with labor regulations defined therein are complied with during project implementation.

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
		waste handling, provision of drinking water quality, worker health and hygiene etc. Under the Act, no occupier of a factory shall be allowed to start manufacturing process unless he has obtained factory registration certificate from the Directorate of Labor. The Act does not allow a child below the age of 14 years to work in a factory in any case. The new Law restricts the employment of contractual labor in manufacturing process. The amendment 2021 is specifically related to the provision of safe transportation facility to women workers, working hours and working periods of seasonal and whole year factories.	construction phase).	
14.	**Sindh EPA Hazardous Substances Rules, 2014**	The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. General safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are also described in these rules.	This rule is applicable to the proposed Project due to involvement of hazardous waste handling, use and disposal during different construction activities at the construction stage.	A separate approval must be obtained from the Sindh EPA if there is any permanent use of any of the hazardous substances that are listed in the Rules.
15.	**Sindh Minimum Wages Act, 2015**	To provide the regulation of minimum rates of wages and various allowances for different categories of workers employed in certain industrial and commercial undertakings and establishments.	This Act will be applicable to the Project to ensure that the minimum wages and allowances should be given to the Project labor (skill and unskilled employed for the construction of the proposed Project.	Requires that the project ensure that workers are not paid below the defined minimum wage.
16.	**Sindh Occupational Health & Safety Act, 2017**	The Act makes provisions for occupational safety and health conditions at all workplaces in the province for the protection of workers during work. Under the Act, an Occupational Safety and Health Council will be established in Sindh with secretary of Sindh government's Labor and Human Resources Department as its chairperson. The proposed council lays down penalties in case of death and injury due to violation. In case of death sub-section 01 of section 38 will accord 2 years' imprisonment or a fine of PKR 100,000 or both. Similarly, in case of	The Act applies in any Project situation where worker's rights and protections are enforced. This law is applicable to construction and Project workers and will be complied during construction and operation phases.	Requires that the occupational health & safety regulations defined therein are complied with during project implementation.

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
		injury the imprisonment may extend to six months or a fine up to PKR 20,000 or both.		
17.	**Sindh Bonded Labour System (Abolition) Act, 2015**	The Act is gender sensitive; an anti-discrimination clause is added to each new proposed Law in accordance with ILO requirement viz: "No discrimination shall be made on the basis of sex, religion, political affiliation, sect, colour, caste, creed, ethnic background in considering and disposing of issues relating to the enforcement of this Act". In all proposed Laws the cognizance has been changed from that of the Judicial Magistrate to the Presiding Officer Labor Courts who is a Session Judge.	This Act is applicable as the proposed project may involve the numbers of staff/worker having different religion, political affiliation, sect, colour, caste, creed, ethnic background.	Ensure that bonded labor is not allowed or utilized for the project
18.	**Sindh Transparency and Right to Information Act, 2016**	The purpose of this Act to provide transparency and freedom of information to ensure that all citizens have better access to public information, to make the government more accountable to citizens, to enforce the fundamental right to information in all matters of public importance, to ensure transparency in all Government matters. Transparency and access to information are essential principles of democracy which not only enable the citizens to hold the Government and their institutions accountable but also help in improving the system of governance.	This Act is applicable as the proposed Project is a public sector Project, where the workings of the project are to be made as transparent as possible.	Defines how the project must operate in a transparent manner to the public, where all details are to be made transparent should anyone enquire.
19.	**Sindh Differently Abled Persons (Employment, Rehabilitation and Welfare) (Amendment) Act, 2017**	The Act provides for the employment, rehabilitation, and welfare of differently able persons. The definition of "differently able" is any persons who on account of injury, disease, or congenital deformity, is challenged for undertaking any gainful profession or employment in order to earn his livelihood and includes a person who is blind, deaf, physically challenged or mentally challenged. In the Sindh Differently Able Persons (Employment, Rehabilitation and Welfare) Act, 2014 was amended and job quota was increased from two percent to five percent. The Act also waived admission fees at public educational institutions for people with disabilities as well as 75% of tuition fee, along with establishing reserved seats. Pakistan is a signatory of the United Nations Convention	This Act is applicable as the proposed project will involve serious occupation health and safety issues during construction phase and may cause serious injury to worker/staff causing permanent disability and differently able.	Requires differently abled persons are not discriminated against during project implementation for jobs.

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
		on the Rights of Persons with Disabilities (UNCRPD).		
20.	**Sindh Commission on the Status of Women Act, 2015**	The Act has enabled the government to constitute a Commission to be known as the Sindh Commission on the Status of Women, to exercise the powers to examine the policy, programs and other measures taken or to be taken by Government for gender equality, women's empowerment, political participation, representation, assess, implementation and make suitable recommendations to the concerned authorities. In addition, the Commission will be responsible to review all provincial laws, rules, and regulations prejudicial to the legitimate interest and rights of women and suggest accordingly.	This Act is applicable as the proposed project may involve numbers of female staff/workers as well as local resident women along the project corridor which are directly or indirectly linked with project activities.	Requires that women are not discriminated against for jobs during project implementation.
21.	**Sindh Resettlement & Rehabilitation Policy, 2023 (R&R Policy)**	The Sindh R&R Policy aims to provide a structured framework for addressing involuntary resettlement resulting from development projects in Sindh. It's primary objective is to ensure fair and timely compensation, proper relocation, and the restoration of livelihoods for project- affected persons (PAPs). The main requirements under the policy are: 1. **Resettlement Planning:** ○ **Resettlement Action Plan (RAP):** Develop a comprehensive RAP detailing the extent of displacement, compensation strategies, relocation sites, and support for livelihood restoration. 2. **Eligibility Criteria:** ○ **Affected Persons:** Recognize all individuals experiencing loss of land, assets, or access due to project activities, regardless of legal land ownership status. 3. **Compensation Framework:** ○ **Replacement Cost:** Compensate lost assets at full replacement cost without depreciation. ○ **Timely Disbursement:** Ensure compensation is provided before displacement occurs. 4. **Relocation Assistance:**	The project does not require any land acquisition, and neither were there any settlements that would be impacted during the development of the project.	No further requirements given that Policy is not applicable

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
		○ **Housing and Infrastructure:** Provide suitable housing options and access to essential services at relocation sites. ○ **Transitional Support:** Offer interim assistance to cover the period between displacement and the restoration of livelihoods. 5. **Livelihood Restoration:** ○ **Skill Development:** Facilitate training programs to enhance employment opportunities for PAPs. ○ **Financial Assistance:** Provide support to re-establish businesses or agricultural activities. 6. **Consultation and Participation:** ○ **Stakeholder Engagement:** Conduct meaningful consultations with PAPs, ensuring their input influences resettlement decisions. ○ **Information Disclosure:** Provide clear and accessible information about resettlement plans and entitlements. 7. **Grievance Redress Mechanism (GRM):** ○ **Accessible Channels:** Establish multiple avenues for PAPs to voice concerns or complaints. ○ **Timely Resolution:** Ensure grievances are addressed promptly and transparently. 8. **Monitoring and Evaluation:** ○ **Internal Monitoring:** Regularly assess the implementation of resettlement activities to ensure compliance with the RAP. ○ **External Audits:** Engage independent parties to evaluate the effectiveness of resettlement measures. The policy underscores the importance of minimizing displacement and, when unavoidable, ensuring that affected individuals receive adequate support to rebuild their lives with dignity. It aligns with international best		

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
		practices and legal frameworks to uphold the rights and well-being of displaced populations.		

Table 3.4 - International Treaties & Conventions

Sr. No	Policy/Plan	Description	Relevance to Project	Regulatory Requirement from Project
1.	**The Rio Declaration, 1992**	The Rio Declaration comprises 27 principles which address important issues such as; sustainable development to integrate environmental protection into the development process; common but differentiated responsibilities to conserve, protect, and restore the earth's ecosystems; public participation and information access at the national level, reduce and eliminate unsustainable patterns of production and consumption.	Relevant to the project as it lays down different aspects and matters pertaining to the environment that must be followed.	Follow the guidelines laid out in the declaration to the extent possible.
2.	**ILO Conventions**	C138 – Minimum Age Convention, 1973 (No. 138(Minimum age specified: 14 years	The project will employ an extensive work force, hence, it must be ensured that all workers hired comply with the guidelines.	Project to ensure that no workers are hired that are less than 14 years of age for any sort of works
3.	**1992 Climate Change Convention and Kyoto Protocol**	Pakistan ratified the Convention and the Kyoto Protocol was adopted at a Conference of the Parties to the UNFCCC in Kyoto, Japan in December 1997. The Kyoto Protocol is a protocol to reduce greenhouse gases that cause climate change.	Relevant to the project as civil works are planned extensively for the project, hence, there will be GHG emissions expected from the project.	Project must ensure that measures to cut down GHG emissions to the extent possible are employed.
4.	**Stockholm Convention on Persistent Organic Pollutants (POPs), 2004**	This convention seeks to protect human health and the enviornment from POPs as set out in Article 1, which are chemicals that remain intact in the environment for long periods, and become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife.	During project development, there will be a wide array of construction materials used.	During construction, it is to be ensured that the use of items that contribute towards POPs, directly or indirectly, are mitigated to the extent possible

3.3 International Guidelines

3.3.1 Asian Development Bank (ADB) Safeguard Policy Statement (SPS)

The following standards, manuals, and policy documents are relevant to this project in respect to the safeguard policy of the ADB:

- Safeguard Policy Statement (June 2009);
- Safeguard Requirements (SR) 1: Environment (2009);
- Safeguard Requirements (SR) 2: Involuntary Resettlement (2009);
- Safeguard Requirements (SR) 3: Indigenous Peoples (2009).

This document focuses on the environmental and social safeguards and complies with the requirements of the ADB with respect to the ESIA.

ADB's SPS sets out the objectives, principles, and delivery process of ADB's safeguard policy. The objectives of the ADB's safeguards are to:

a) Avoid adverse impacts of proejcts on the enviornment and affected people, where possible
b) Minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible, and
c) Help borrowers/ clients to strengthen their safeguard systems and develop the cpacity to manage environmental and social risks

Potential Borrowers and Clients of the ADB are expected to comply with SR1, 2, and 3 during both project preparation and project implementation. All three SRs include requirements for impact assessment, planning, and mitigation measures necessary to undertake throughout the project cycle in order to address adverse enviromental and social impacts.

3.3.1.1 Screening and Categorization through Rapid Environmental Assessment (REA) Checklist

All loans and investments under ADB are subject to categorization to determine environmental assessment requirements. Whilst there is no international funding currently envisaged for the project, however, to comply with GIIP, the ADB's E&S safeguard policies have been adopted for the project and its implementation.

Categorization has been undertaken for the project using the Rapid Environmental Assessment (REA) Checklist as per ADB SPS 2009, consisting of questions pertaining to (i) the sensitivity and vulnerability of environmental resources in the project area, and (ii) the potential for the project to cause cause significant adverse environmental impacts. Following categories as defined in the SPS 2009 will be applicabe for the project using the REA checklist.

Table 3.5 - ADB Project Categories (SPS 2009)

Category	Description	Requirement
A	The subproject is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. Also, if the footprints of the subproject lie inside the ecologically protected areas or encroached upon a tangible cultural heritage site, make the subproject fall in Category A.	A full scale environmental and social impact assessment (ESIA), including an Environmental and Social Management Plan (ESMP) are to be prepared by the borrower/ client.
B	The subproject's potential environmental impacts are less adverse and fewer in number	An Initial Enviornmental Examination (IEE), including an

	than those in category A. imapcts are site-specific, few of which, if any, are irreversible. Impacts can be readily addressed through mitigation measures.	ESMP, has to be prepared by the client/borrower.
C	The project is likely to have minimal or no adverse environmental impacts.	An EIA or IEE is not required, but ADB usually asks borrower/ clients to develop an ESMP to be submitted for implementation of mitigation measures of least significant impacts and monitoring of any residual impacts.

The REA checklist filled out for this project is attached as an annex to the report, where this project is categorized as a **Category A Project**.

3.3.2 IFC General EHS Guidelines

These guidelines are technical reference documents with general examples of Good International Industry Practices (GIIP). When one or more members of the World Bank Group are invovled in a project, these EHS Guidelines are applied as required by their respective policies and standards. These general EHS Guidelines are designed to be used together with the relevant industry sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors.

3.3.3 IFC Industry Specific Guidelines – EHS Guidelines for Toll Roads

These industry sector Guidelines are designed to be used together with the General EHS Guidelines, which provide guidance to users on common EHS issues, potentiall applicable to all industry sectors. These guidelines containt the performance levels and measures that are generally considered to be achievable in new projects/ facilities by existing technology at reasonable costs.

The EHS Guidelines for toll roads include inofrmation relevant to construction, operation, and maintenance of large, sealed road proejcts inlcuding associated bridges and overpasses. The document provides a summary of EHS issues associated with road proejcts, which occur during the construction and operation phase, along with recommendations for their management.

3.3.4 IFC Performance Standards on Social and Environmnetal Sustainability

The section below discuss the application of the IFC's Eight Performance Standards (PS) (PS1 to PS8) and associated directvies. Their requirements are tabulated beliw, where it additionally discuss the requirements relating to other guide notes from the World Bank:

Table 3.6 - Applicable IFC PS Objectives & Requirements

World Bank ESS Policy, Standards, Directive	Objectives	Requirements
PS1 Assessment and Management of Environmental and Social	Identify, assess, evaluate, and manage environmental and social risks and impacts in a manner consistent with the ESF. Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable groups, and they are not disadvantaged in sharing development benefits and opportunities	Under PS1, Environmental and Social instruments are to be prepared for the assignment, in accordance with national regulations and the ADB SPS as well as international best practices including WBG EHS Guidelines and EHS Guidelines for Toll Roads.

Risks and Impacts		Given that the project is not being directly funded by the Bank, this ESIA is still being prepared in light of the requirements of the Bank and shall be disclosed as per the policies of the local regulator, i.e., the Sindh EPA. Furthermore, following approval, the proponent will abide by the conditions stated in this ESIA report and the approval accorded by SEPA, against which monitoring and reporting & E&S performance will be carried out during implementation.
PS2 Labor and Working Conditions	Promote safety and health at work. Promote the fair treatment, non-discrimination, and equal opportunity of project workers. Protect project workers, with particular emphasis on vulnerable workers. Prevent the use of all forms of forced labor and child labor. Support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law. Provide project workers with accessible means to raise workplace concerns.	The requirements of PS 2 have been covered under this ESIA, and will be made a part of the bidding documents alongside this ESIA
PS 3 Resource Efficiency and Pollution Prevention and Management	Promote the sustainable use of resources, including energy, water, and raw materials. Avoid or minimize adverse impacts on human health and the environment caused by pollution from project activities. Avoid or minimize project-related emissions of short and long-lived climate pollutants. Avoid or minimize generation of hazardous and non-hazardous waste. Requires technically and financially feasible measures to improve efficient consumption of energy, water, and raw materials.	ESIA is being prepared under this project in which necessary pollution prevention and management measures along with waste management procedures is proposed. The procedure is prepared in accordance with national regulations, international standards and best practices including WBG EHS Guidelines for Toll Roads. Furthermore, project alternatives have also been analysed.
PS4 Community Health, Safety, and Security	Anticipate or avoid adverse impacts on the health and safety of project-affected communities during project life cycle from routine and non-routine circumstances. Promote quality, safety, and climate change considerations in infrastructure design and construction. Avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials. Have in place effective measures to address emergency events. Ensure that safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.	Under PS4, the potential health and safety risks and impacts associated with the Project are to be assessed, including the necessary mitigation measures in the ESIA to be prepared for the project. Items such as traffic management plans, community health and safety measures, emergency response preparedness plans, to mitigate all health and safety risks and impacts of the project during construction and operations of the project. Furthermore, risks and impacts from exposure to waste and other pollutants, traffic accidents, risk of fire and explosion, flooding and other climate change risks will be considered.

4 Analysis of Alternatives

4.1 Introduction

The screening of alternatives is a part of the ESIA process to select the best among all possible project options. The alternatives of a project are defined as the options that can help to meet the objectives of a project by different means including an alternative project site, technology or material, design or inputs.

Alternatives to the proposed project components include:

- The “no project” alternative
- Route alternatives
- Design alternatives

4.2 “No Project” Alternative

The Karachi Port, as it stands, faces rising cargo volumes and limited capacity, including the potentila of transporting the arrived cargo, ultimately which results in delays handling and increased logistic costs, and overall increased inefficiency. Port inefficiencies and weak back road connectivity increase the cost of moving goods, overall reducing competitiveness of Pakistani trade, adding to the cost of gods, and potentially slowing down economic growth.

Given Karachi’s role in Pakistan’s economy and trade, any delays or inefficiencies at the port directly impact national supply chains. Furthermore, with growing cargo volumes globally and larger vessel sizes, Karachi also faces a window of opportunity where it must upgrade now or risk being left behind, and potentially also lose out to surrounding regional competition in the form of more efficient ports in neighboring countries.

Currently, the government has acknowledged this problem and has set targets for reducing the average container retention time at the port, where it aims to reduce dwell time at ports by upto 70% to improve competitiveness.

Hence, the No Project Option is not feasible moving ahead if a solution is to be sought for the unfettered movement of heavy traffic from the port.

4.3 Route Alternatives

Freight routes in Karachi play a vital role in supporting the industrial activities. Key corridors include the Northern Bypass (M-10), which connects Karachi Port to the M-9 Motorway, and the National Highway (N-5), linking the city to the rest of the country. Major freight routes also pass through important roads such as Mauripur Road, Korangi Road, DHA, Clifton.

These routes serve prominent industrial zones including the Sindh Industrial and Trading Estate (SITE), Korangi Industrial Area, Landhi Industrial Area, and Port Qasim Industrial Zone. The figure highlights major industrial zones, ports, and the main truck stand of Karachi. These are critical traffic generators of heavy traffic.

Understanding their locations and trends is essential for planning efficient freight movement routes across the city.

There are four primary freight routes in Karachi that facilitate the movement of goods between Karachi Port and various exit points of the city.

- **Route 1** links the Karachi Port to the Link Road (Kathore Toll Plaza) via Korangi.
- **Route 2** connects Karachi Port to the Karachi Northern Bypass (KNBP) (M-10) Toll Plaza, forming part of the Karachi Northern Bypass.
- **Route 3** runs from Karachi Port to the Motorway (M-9) via Sohrab Goth.
- **Route 4** extends from the Karachi Port to the Link Road (Kathore Toll Plaza) through KNBP (M-10).

Among these, KNBP is the only freight corridor that allows 24-hour access for heavy vehicles, making it the most critical and unrestricted route. It is also the longest route, spanning approximately 79 km.

The other routes pass through dense urban zones such as SITE, Korangi, and Landhi industrial areas, using major roads like Shahrah-e-Pakistan, Sunset Boulevard, and Korangi Road. Due to alignment through congested areas, these routes operate under restricted hours, typically from 2200 to 0600 hours to minimize disruption to city traffic. These urban routes range from 54 km to 65 km in length and are essential links between the port and the city's industrial heartlands.

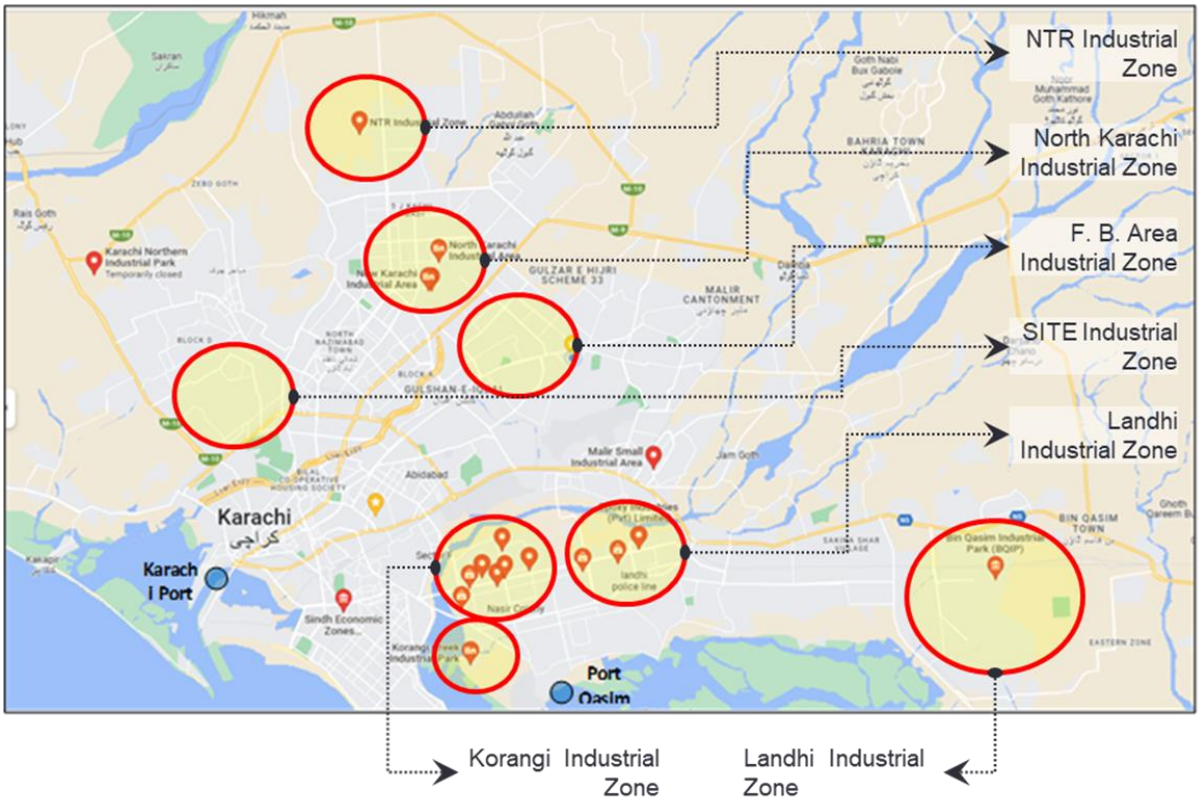


Figure 4.1 - Freight Routes of Karachi

This is where the Karachi Port to Qayumabad Corridor project is seen to provide a direct link to freight traffic destined for other parts of the country, originating from the Karachi Port and travelling through a dedicated elevated corridor to the under development Shahrah-e-Bhutto, which when completed, will provide uninterrupted access to the Karachi Hyderabad Motorway, M-9.

This final alignment emerged through a comprehensive, criteria-driven assessment that carefully weighed factors such as land availability, traffic flow efficiency, right-of-way constraints, integration with existing road networks, and potential conflicts with urban infrastructure. The selected

alignment strikes a balance between engineering feasibility, logistical practicality, and urban compatibility.

It also minimizes land acquisition challenges, avoids dense built-up areas, and ensures smoother connectivity between Shahrah-e-Bhutto and Karachi Port's East Wharf, making it the most viable corridor for implementation from both technical and operational standpoints.

4.4 Design Alternatives

4.4.1 Bridge Construction Methodologies

Bridge construction methodologies are primarily categorized into two types i.e. Precast and Cast-in-Place. Each method has distinct advantages and is selected based on project requirements, site conditions, and design considerations.

Pre-Cast Concrete Bridges

Pre-cast bridges involve manufacturing concrete components in a controleled factory environment, which are then transported and assembled at the construction site. This method offers several benefits:

- **Quality Control:** Factory conditions ensure consistent quality and precision in the manufacturing process.
- **Reduced Construction Time:** Precast elements can be produced simultaneously while site preparation is underway, leading to faster overall project completion.
- **Minimal On-Site Disruption:** Since most work is done off-site; there is less disturbance to the surrounding environment and traffic.
- **Aesthetics:** Manufacturing precast concrete components in a controlled factory environment allows the potential to use different combinations of colors and textures, including more visually pleasing smooth finishes.

However, pre-cast construction may have limitations in terms of transportation logistics and the need for specialized equipment to handle large components. Some particular challenges associated with this method are highlighted below:

- **Transportation Challenges:** Transporting large bridge components to the site can pose logistical challenges, especially for oversized or overweight elements, requiring specialized heavy-lifting equipment and careful planning.
- **Limited Design Flexibility:** Bridges that use multiple precast parts with the same specifications can have limitations in terms of design flexibility, whereas cast-in-place construction offers the capability to create irregularly shaped, unique, and complex structures.
- **Initial Cost:** Precast bridges may have higher upfront costs due to the need for specialized manufacturing facilities and transportation logistics. Many projects and precast components are needed to ensure sufficient profit from the initial investment.

Cast-in-Place Concrete Bridges

Cast-in-place may be regarded as the more traditional construction approach for concrete structures. This method involves pouring concrete directly into formwork on-site (also known as falsework), allowing for greater flexibility in design and construction.

The components may be cast in position, or alongside the final location and lifted or slid to place using specialist heavy-lifting equipment. Typical bridge components cast-in-place can include foundations, walls, footings, caissons, piers, pylons, columns, road decks, slabs, and beams.

- **Customization is Required:** Complex or unique designs can be more easily achieved.
- **Site Constraints Exist:** Limited access or space may make transporting large precast elements challenging.
- **Integration with Existing Structures:** Cast-in-place allows for seamless integration with adjacent infrastructure.
- **Adaptability to Site Conditions:** Casting concrete on site allows for real-time adjustments to account for the unexpected, such as ground conditions or environmental factors.
- **Durability:** The simpler and often monolithic structure of cast-in-place bridge sections involves less joints than those encountered with the precast method. This reduces the risk of joint deterioration and as a result ensures long-term structural integrity, particularly in high-traffic areas or areas prone to earthquakes.

Cast in place bridges also have their own challenges, however, where the main challenges include:

- **Longer Construction Time:** Due to the on-site casting and curing processes, cast-in-place construction typically requires more time than precast methods. Additionally, unfavorable weather can cause delays to the schedule.
- **Quality Control Challenges:** Ensuring consistent quality may be more challenging with on-site precast construction, as environmental factors and site conditions vary and can impact the curing and setting of concrete.
- **Site Disruptions:** Compared to prefabricated construction, cast-in-place activities can cause more lengthy disruption to traffic and nearby residents. More labor is required for both creating formwork and throughout the casting stage.

5 Description of the Environment

5.1 General

This section provides baseline data (physical, biological, and socio-economic parameters) related to the project area. Information provided is both quantitative and qualitative, based on primary and secondary data sources, collected during site visits and desk studies.

The baseline information alongsie relevant stakeholder consultation is required for scoping of potential environmental and social issues associated with the implementation of the project. On the basis of the baseline information, project interventions are assessed, and mitigation measures are proposed. The baseline information also helps to indicate specific issues to be monitored during project execution. A map of the project site is provided below:



Figure 5.1 - Location of the Project

The existing environmental conditions of the proposed project interventions have been considered within the boundaries of the AOI with respect to physical and ecological environment.

5.2 Reconnaissance & Field Visits

The E&S team conducted the reconnaissance visit of the project site and along the Right of Way. The major objective of the visits was to familiarize with the environment in general and to define the boundaries within which the perceieved impacts from each site would take place in – establish the AOI. Furthermore, stakeholder consultations and acquisition of secondary data/ infromation was also carried out for identification of impacts at the scoping stage.

For the primary data acquisition, the E&S team conducted detailed field visits throughout 2025 and 2026, where the main objective of these visits was to obtain detailed data on the existing physical,

ecological, and social aspects, along with the idetification of significant envrionmental and social impacts of the proposed project. The secondary data was collected from published sources/ reports and relevant departments which was also verified through visual observations and primary data where possible. The land use map of the site is provided below along with a description of the area:

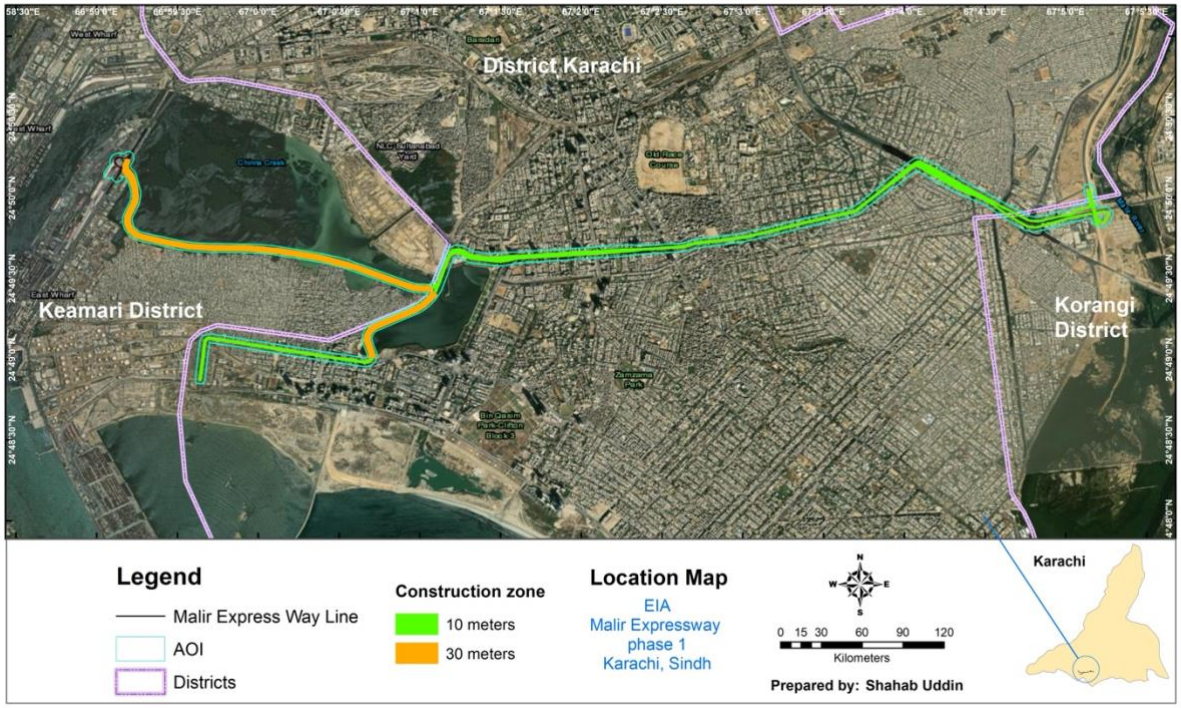


Figure 5.2 - Land Use Pattern of the Area

The expressway in almost its entirety passes through the heavily built up area of Karachi through the elevated format, with the tail end of the expressway travelling through Chinna Creek in the form of an earthen embankment.

5.3 Physical Environment

5.3.1 Topography

The topographical conditions along the length of the expressway are illustrated in the map below, where it can be seen that the expressway traverses through an area of relative medium to low elevation, and within the heart of the city, is surrounded on both sides by areas of higher elevation.

The topographical conditions of the site play an imporant role for consideration in the overall design of the project, where these are expanded on further below:

- **Flooding and Stormwater Management** – The city's flat, low lying terrain and poor drainage make it highly prone to urban flooding during monsoon and tidal surges. Incorporating the topography of the city and the RoW into the expressway's elevation, slope, and drainage systems design will allow for mitigation of impacts such as ponding, waterlogging, or diversion of runoff into surrounding communities.
- **Ground Stability & Settlement Risks** – Given that most of Karachi's coastal and creek zones comprise of soft alluvial or reclaimed soil, detailed topographical and geotechnical

mapping will aid in identifying areas prone to differential settlement, slope instability, and foundation falure, which are crucial for safe bridge and embankment design.

- **Hydrological and Ecological Connectivity** – The city's topography dictates the runoff of stormwater through the city's nullahs and drains, where poorly alignment embankments or piers can block natural flow paths, causing flooding, mangrove degradation, and potentially loss of aquatic habitats. A proper understanding of the terrain will allow for th incorporation of culverts, viaducts, and bridges that reinforce the natural hydrology of the area

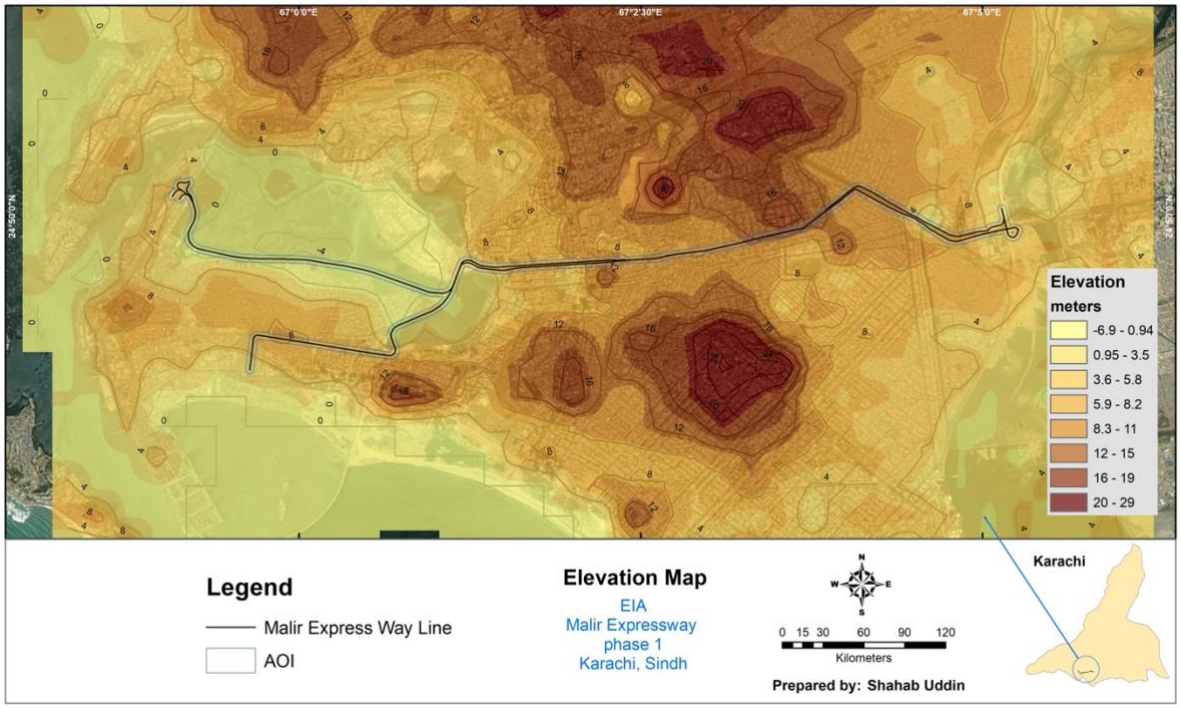


Figure 5.3 - Elevation Map of Project Site

5.3.2 Geology, Geomorpohology, & Soil

The geology of the proposed project area falls under NOGENE Rocks, MIOCENE Rock, OLIGONECE Rock i.e. Gaj Formation comprises of mainly marine shales and limestone, fossiliferous, topmost sandstone and shales estuarine with abundant molluscan and few vertebrate fauna, early miocene. The stratigraphy of this area mainly consists of sand, shale and conglomerate. Secondary geological studies in the area have revealed that the soil formations in this area are fresh and lightly weathered, recent and sub recent shoreline deposits. These deposits are derived from Gaj / Manchar formation of Lower Moicene to Middle / Upper Miocene to Pliocene age. Quarternary deposits are represented by an extensive Conglomerate which uncomfortably overlies the Manchar rocks and slightly overlaps on to the Gaj Series. The site specific geological map of the area is shown in the figure below.

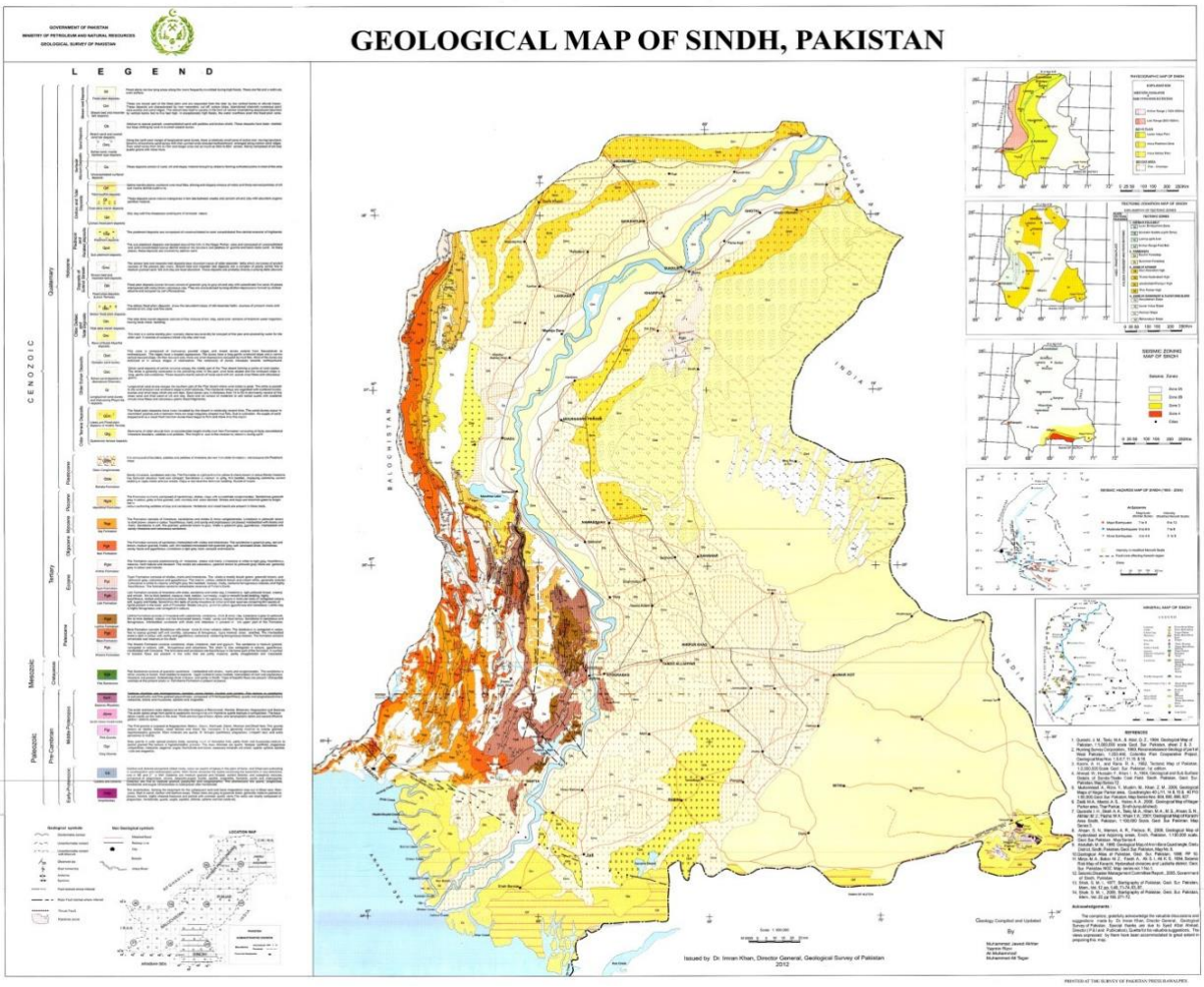


Figure 5.4 - Project Geological Map

Similalry, the soil composition map of the area is also provided below:

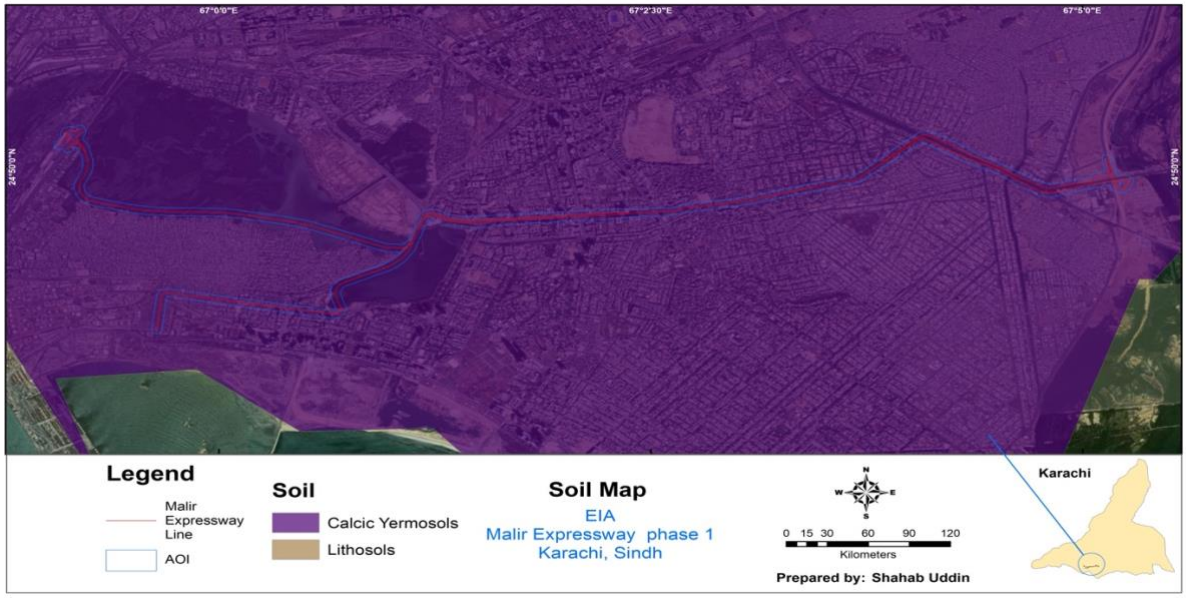


Figure 5.5 - Soil Composition Map of Project Area

The geological and soil conditions of the area also play an important part in dictating design of the project to avoid any unnecessary impacts from arising, where the major aspects are highlighted below:

- **Foundation Stability & Structural Integrity** – The city's suburface is comprised largely of loose alluvial deposits, silty sands, and coastal clays with variable bearing capacity. Without proper geological and geotechnical investigation, pile foundations and embankments may experience settlement, lateral spreading, or bearing failure, compromising the safety of the expressway and those living around it
- **Corrosive and Saline Soils** – Much of the city's coastal belt contains saline groundwater and sulfate/chloride rich soils, which can severely corrod reinforcement steel and concrete. Designing without addressing this can lead to rapid material deteriorration. Hence, sulfate resistant cement, protective coatings, and drainage layers must be incorporated into design specifications
- **Liqueifaction and seismic risk** – With the city lying in a moderate seismic zone with saturated sandy layers, the potential susceptibility to liquefaction during earthquakes is always present. To counter this, a proper geotechnical assessment is required to ascertain and ensure that design measures are incorporated to prevent sudden loss of bearing strength, and structural collapse during seismic events.
- **Soil & Rock types** - as hard bedrock provides stable foundations but may require more specialized drilling techniques, whereas soft soils, clayey, or sandy terrains require deeper pile foundations or soil stabilization methods.
- **Bearing Capacity** – the ability of the ground to support loads is influenced by geological conditions, affecting the type and depth of foundation.
- **Groundwater Levels** – High water tables in certain geological formations can weaken foundations and complicate construction.
- **Seismicity** – Seismic activity in the area along with the ground's potential reaction in this scenario will define further measures that need to be considered.

5.3.3 Seismicity

According to a map created by the Pakistan Meteorological Department, the country is divided into 4 zones ranging in term of major, moderate, minor and negligible zones with respect to ground acceleration values based on expected ground acceleration.

- The areas surrounding Quetta, those along the Makran coast and parts of the KPK, and also along the Afghan border fall in Zone 4.
- The rest of the KPK lies in Zone 3, with the exception of southern parts of this province, which lie in Zone 2. The remaining parts of the Pakistani coastline also lie in Zone 3.
- The remaining parts of the country lie in Zone 2. According to this classification, the Project site would be placed in Zone 2A.

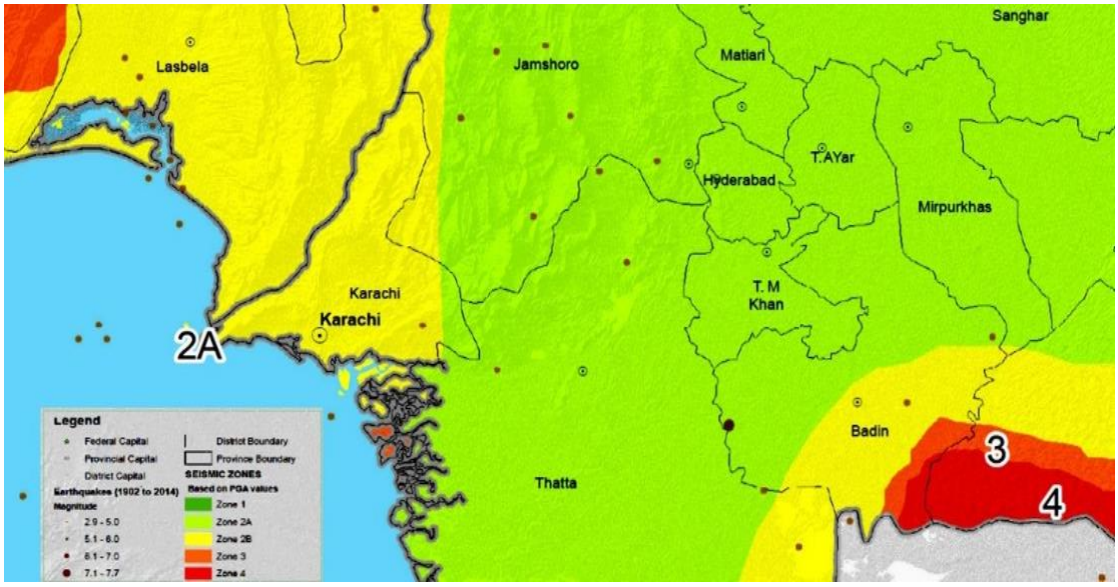


Figure 5.6 - Seismic Zones Data

Map data source(s): PMD, GSP, Pakistan Engineering Council – Prepared by Al Hasan Systems Private Limited

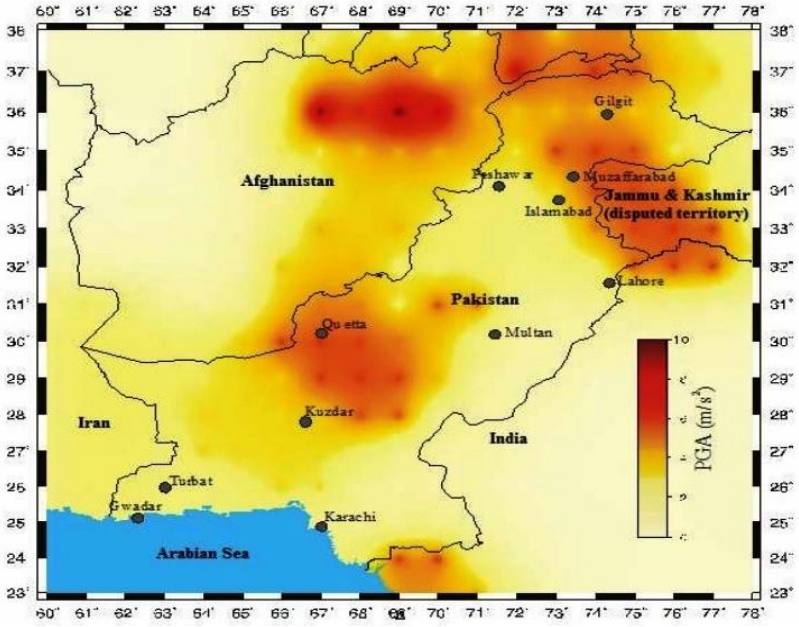


Figure 5.7 - Seismic Hazard for Pakistan in terms of Peak Ground Acceleration. (PGA) *PMD*

Seismic Monitoring and Early Tsunami Warning Centre - http://seismic.pmd.gov.pk/seismicnew/map2.html

Seismicity in the Karachi region is related to the pressure potential being built at the convergence of the three lithospheric plates: Indian, Arabian, and Eurasian at the Triple Junction formed by the intersection of Owen fracture zone, the Makran subduction zone and the Ornach-Nal fault. The Murray Ridge extends northward into Pakistan, to unite the Ornach-Nal-Chaman Fault system onshore, displaying a strike-slip boundary between the major tectonic plates of India and Eurasia.[11]

Karachi and its environs fall in the synclinorium, described earlier as being part of Indus deltaic region. Recession of the delta and its retreat towards the southeast dried up its numerous channels, estuaries and creeks that characterize the synclines and are part of the active faults.

[11] (Baloch, S.M. & Quirk, D.G., Mesozoic to Neogene Tectonism and Evolution of Murray Ridge, Pak. Jour. of Hydrocarbon Research, Islamabad, 13).

Tectonic instability of this region can be attributed to this large number of reverse and tear faults and the recently described wrench faults.[12]

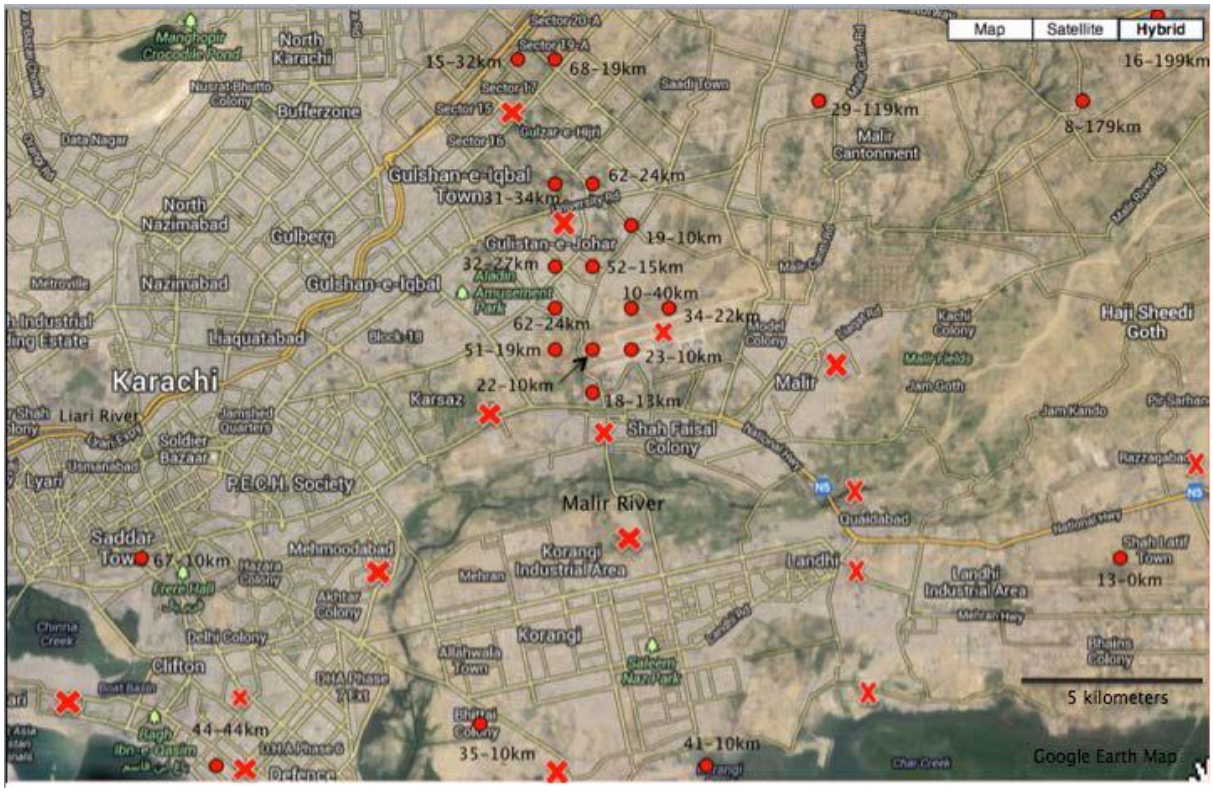


Figure 5.8 - Earthquake epicentre plots from 1902-2013

The first number refers to the list numbers whereas the second number represents depth of hypocenter in kilometers. The Red Crosses represent neighborhoods plagued by recurrent seismic activity, usually of low magnitude[13].

Sarwar and Alizai have compiled a list of earthquakes during the 1902-2013 period and also produced the above map that gives a distribution of hypocenters of earthquakes during the same period. From the distribution of hypocenters, it has been inferred that the entire Karachi Arc and surrounding areas are seismically active with hypocenters ranging in depth from 0-500 kilometers. From the depth of hypocenters, it is inferred that active deformation has taken place at multi-levels ranging from shallow to deep in the basement. Quite a few of the recent epicenters are found within or in close proximity to parts of Karachi that have faced recurrent earthquake activity.

Seismic activity in the region is the result of the triple junction as well as the Karachi Arc, located in southeastern Pakistan, as a large fold and thrust belt that shows Neogene thin-skinned eastward movement (Sarwar and DeJong, 1979; Schelling, 1999). Seismic activity in and around the region shows that the Karachi Arc has been active since long in prompting the eastward movement of the delta. It is possible that the movement is related to the rebound that takes place after mass shift. Sarwar has suggested that the eastward creep of Karachi Arc is directly related to active subsidence of the Hyderabad graben that underlies it and also defines the northern and southern limits of the Karachi Arc.[14]

[12] (Riding the mobile Karachi arc, Pakistan: Understanding tectonic threats Ghulam Sarwar and Anwar Alizai, Journal of Himalayan Earth Sciences 46(2) (2013) 9-24).
[13] (Source: Pakistan Meteorological Department, June 2013 & Ghulam Sarwar and Anwar Alizai, Journal of Himalayan Earth Sciences 46(2) (2013) 9-24)
[14] (Sarwar, G., 2004. Earthquakes and the Neo-Tectonic Framework of the Kutch-Hyderabad-Karachi Triple Junction Area, Indo-Pakistan. Pakistan Journal of Hydrocarbon Research, 14, 35-40).

It may be added that subsidence such as that on Southern coast of Sindh, occurs naturally as a result of plate tectonic activity above active faults, and in places where fluid is expelled from underlying sediments and is common at river deltas that may have receded. Earthquakes arise and result from the release of the force along the growth fault plane. As a result, many different growth faults are created as sediment loads shift basinward and landward.

5.3.4 Hydrology

There is no surface water available in Karachi except in natural storm water drains in monsoon season during and after rainfall. The partially treated sewage of Karachi goes into sea, through the drains or natural nullahs (natural drains).

Karachi's storm water drains connect to two seasonal rivers, the Lyari and the Malir. Both rise in the foothills of the Kirthar Range and run parallel to each other, 14-20 kilometers apart. Fifty-eight storm water drains (nullahs) carry water from their catchment areas to these two rivers. Over 600 smaller drains feed into these nullahs.

Some of the major drains are mentioned in the table below:

Table 5.1: List of Karachi's Storm water Drains

Lyari River (main natural drainage)	Aziz Bhatti Drain
Shershah Nullah	Mehmoodabad Drain
Baldia Drain	Noorani Chowrangi Drain
Haroonabad Drain	Nehre Khayyam Drain
Orangi Nullah (main natural drainage)	Soldier Bazar Drain
Mujahid Colony Drain	City Railway Station Drain
Gujjar Nullah (main natural drainage)	Pitcher Drain
Kalri Drain	

The proposed expressway traverses a highly urbanized coastal environment adjacent to Chinna Creek, an important tidal water body connected to the Karachi Harbour and the Arabian Sea. The hydrological regime within the project area is governed by a combination of tidal fluctuations, urban stormwater runoff, and limited freshwater inflows. Surface runoff from the surrounding urban catchments is conveyed through a network of drains and outfalls that ultimately discharge into Chinna Creek. The creek also supports extensive mangrove stands and intertidal mudflats, whose ecological functioning depends upon regular tidal exchange, sediment transport and saline water circulation.

Unlike natural river systems, the hydraulic behaviour of Chinna Creek is strongly influenced by semi-diurnal tidal cycles, making unrestricted tidal connectivity essential for maintaining water quality, sediment balance and flood conveyance. Existing drainage conditions are already constrained by rapid urbanization, inadequate maintenance of drainage infrastructure, solid waste accumulation and reduced natural flood storage capacity. Consequently, even moderate rainfall events can result in localized flooding, while extreme monsoon storms frequently overwhelm the city's drainage network.

The proposed project includes elevated viaducts, bridge crossings, embankment sections, drainage structures and associated infrastructure within this sensitive coastal environment. These components have the potential to modify existing hydraulic conditions if they restrict tidal exchange or alter natural drainage pathways.

5.3.5 Water Resources & Quality

Hydrogeologically, the city of Karachi lies in the Hub River Basin and the Malir River Basin. The Malir River Basin is drained by the Malir River and the Lyari River. The aquifer of Karachi is, therefore, mainly recharged by seepage from Hub River, Hub Dam as well as the Malir and the Lyari Rivers. The Hub River lies on the western frontier of Sindh and for some distance the boundary between Sindh and the Baluchistan provinces. It located about 30 km to the west of Karachi, along the Karachi- Lasbela boundary. It falls into the Arabian Sea near Cape Monze, with a total drainage course length of 336 km.

During the past several years, a number of pumping wells have been installed to meet requirements for the irrigation-water supply (to raise vegetables, fruits, dairy and poultry) and drinking-water supply for Karachi. Excessive pumping of groundwater and continuous lowering of water-table is likely to result in intrusion of seawater into the Malir Basin under natural seepage conditions and under artificially induced conditions of recharge of saline seawater in the coastal aquifer(s) of Karachi.

Five possible water-sources are contributing to the groundwater recharge in Karachi. The first possible source is the rainfall. As the city of Karachi suffers from deficit of precipitation (only rainfall), the contribution to shallow groundwater storage from rain is very little. However, rainfall in the hinterlands and other areas surrounding Karachi may significantly contribute to the groundwater flow-system. The two freshwater sources are the Hub Lake/Hub Dam and the Indus River. Water from Hub Dam and the Indus River, through Keenjhar Lake, is piped to various residential zones in Karachi for drinking and irrigation purposes. The spring water discharges into Malir River and Lyari River and the municipal/industrial waste effluents added to these rivers are also contributing to groundwater storage as a fourth recharge source. Seawater intrusion along Karachi coast is the fifth possible source.

Unexpected and record-breaking rainfall caused unprecedented urban flooding in Karachi on Thursday (August 27, 2020). Heavy showers battered the metropolis for hours, completely submerging all major thoroughfares and the seven underpasses of the city.

Among the worst hit areas of the city were the upscale Defence Housing Authority (DHA), Clifton and PECHS, where were completely submerged by rainwater.[15]

Water Supply & Sewerage System: The water supply and sewerage system are managed by Karachi Water Supply & Sewerage Board (KW&SB). Present water supply system of Karachi City has a supply capacity of about 650 MGD.

As of 2019, Karachi receives about 580 MGD, well below the demand of over 1,100 MGD.

Table 5.2 - Description of Water Supply Schemes for Karachi Bulk Water Supply

S. No	Description of Water Supply Schemes	Rated Supply (MGD)	Actual Supply (MGD)
1	Haleji Scheme	30	-
2	Greater Karachi (GK) Bulk Water Supply Scheme Stages I to IV	280	280
3	K-II Scheme	100	100
4	Additional Water Supply from GK BWS System	40	40
5	(To) Pakistan Steel	26	26
6	(To) Port Qasim Authority	7.5	7.5
7	K-III Scheme	100	100

[15] https://www.thenews.com.pk/

8	Hub Dam	10016	7017
Total		683	62318
Source: EA/KW&SB, Express Tribune, Wapda			

Karachi had been allotted 650 MGD from River Indus through Keenjhar-Gujjo Water Supply System. However, they actual supply is below 580 MGD. KW&SB had planned to revive Haleji Lake to supply 65 MGD to Karachi or to tap this capacity from Keenjhar-Gujjo canal system for supply to Karachi. So far, no substantial work on either of the projects have been reported. To meet the Karachi water demand, K-IV project was conceived in 2007 to supply 650 MGD additional water to Karachi. The project has been delayed several times, and the Phase-I of the project which was to supply about 260 MGD water to Karachi is yet to be completed.

As mentioned in the table above, the given water supply of 653 MGD may further be curtailed to about 406 MGD due to considerable losses in the water supply system [1920].

The sewerage catchment area which covers 18 towns in Karachi city is divided into three districts, namely: respective catchment area of T.P-1, T.P-2 and T.P-3. KW&SB formulated the Master Plan of the water supply and sewerage system in cooperation with JICA in 2008. However, most of the projects for rehabilitation and augmentation proposed in the Master Plan study, etc. have not been carried out due to financial constraint of KW&SB. Due its negligence to maintain and operationalize the treatment plants, not only municipal effluent but industrial effluent also is directly going into sea destroying marine life. It is estimated that the city's sewage (about 470MGD) and industrial waste (about 90MGD) are being dumped into the sea largely without treatment[21].

In January 2018, the Supreme Court appointed Honorable Justice Amir Hani Muslim, a retired Supreme Court judge, the new head of the water commission with a mandate to 'implement" the recommendations of the previous commission that the apex court had formed in December 2016 and which delivered its final report in February 2017 and was head by Justice Mohammad Iqbal Kalhoro. Treatment of sewage, a much-neglected issue, saw a revival under the commission. As of February 2017, all the three sewerage treatment plants of Karachi were dysfunctional, each had a capacity of about 50MGD. A fourth treatment plant has been planned to be set up in Korangi. Commission under Justice Amir Hani Muslim lasted till January 2019. In terms of sewage disposal and treatment, following achievements can be credited to the efforts of commission[222324];

- Rehabilitation work on TP-1 (SITE) is underway as the government plans to increase its current treatment capacity.
- TP2 (Mehmoodabad) is permanently closed because of a land-related dispute, so the government is setting up a 180MGD plant in Korangi instead (TP4) which should be operational by late 2020.
- TP3 (Mauripur) became functional last year. The provincial government first increased its capacity to 73MGD and is now taking it to 180MGD. These three plants will do primary and

[16] http://www.wapda.gov.pk/index.php/projects/water-sector/o-m/hub-dam
[17] Perpetual issue: Leaks in the system create water crisis in Karachi By Syed Ashraf Ali Published: September 15, 2019, in Express Tribune. https://tribune.com.pk/story/2056804/1-perpetual-issue-leaks-system-create-water-crisis/
[18] Losses unaccounted for.
[19] Water woes: Karachi goes thirsty as its water goes to waste By Syed Ashraf Ali Published: July 29, 2019, Express Tribune. https://tribune.com.pk/story/2023808/1-water-woes-karachi-goes-thirsty-water-goes-waste/
[20] Perpetual issue: Leaks in the system create water crisis in Karachi By Syed Ashraf Ali Published: September 15, 2019, in Express Tribune. https://tribune.com.pk/story/2056804/1-perpetual-issue-leaks-system-create-water-crisis/
[21] Panacea for Karachi's water woes? By Kazim Alam. Published in Dawn on Sep 09, 2019. https://www.dawn.com/news/1504238/panacea-for-karachis-water-woes
[22] Ibid
[23] Judicial commission submits its fifth report in SC by Mohammad Hussain Khan. Published in Dawn 12, 2018. https://www.dawn.com/news/1450835
[24] Water commission records improvement wants stakeholders to tap into its success. Express Tribune Dec 13, 2018. https://tribune.com.pk/story/1865552/1-water-commission-records-improvement-wants-stakeholders-tap-success/

secondary treatment of wastewater, which will let the KWSB discharge it into the sea in line with the National Environmental Quality Standards (NEQS)/SEQS.
- Five industrial effluent treatment plants are scheduled to be built in the SITE, Trans-Lyari, F.B, Landhi and Superhighway areas.

Water Quality: Report of commission of inquiry of February 2017 indicated that all the 7 filter plants of KW&SB are malfunctioning. The clarifiers at all the Filter Plants, which were acting as circular sedimentation tanks are non-functional. The water which was full of all contamination that includes turbidity, color, odor & taste, TDS, Hardness, Calcium, Sodium, Potassium, Chloride, Sulfate, Fluoride, Nitrate and Iron etc. in high volume was being supplied to the people of Karachi.

The analytical data compared with WHO and NEQS water quality standards demonstrated that out of 84 drinking water samples, 08 (10%) water samples were found unsafe for drinking due to presence of turbidity values beyond the safe limits (5 NTU). The maximum value for turbidity was measured as 24.4 NTU. One sample (1.2%) was found unfit for drinking due to presence of color, 09(11%) water samples were found unsafe due to presence of Total Dissolved Solids (TDS) contents beyond permissible limit (1000mg/l). Maximum concentration for TDS was recorded 3846 mg/l. 07 water samples (8%) were found unsafe for drinking purpose due to presence of hardness values beyond WHO permissible limit (500mg/l). The highest value for hardness was measured as 1100mg/l whereas 30mg/l as lowest. Eleven water samples (13%) were found unfit for human consumption due to presence of sodium content beyond the maximum permissible limit (200mg/l) recommended by WHO for human consumption. The highest value for sodium was measured as 835mg/l. Seven samples (8%) were found unfit for human consumption due to presence of sulfate content beyond the safe limit recommended by WHO (250mg/l). The highest value for sulfate was measured 440mg/l. Eight water samples (10%) were found unfit for human consumption due to presence of chloride ion concentration beyond maximum permissible limit (250mg/l) recommended by WHO for human consumption. The highest value for chloride was measured as 1483mg/l.

Fluoride content was found exceeding WHO limit (1.5mg/l) in 03 (2%) water samples. The highest concentration for fluoride was measured as 2.23mg/l. Two water samples (2%) were found contaminated with nitrate–nitrogen content beyond the safe limit (10mg/l) recommended by WHO for safe drinking water. The highest concentration for nitrate nitrogen was recorded 20.45mg/l. One sample (1.2%) was found polluted with iron content beyond the safe limit recommended by WHO (0.3mg/l).

Sixty Seven out of 84(80%) drinking water samples collected from surface and subsurface (ground water sources) used for drinking purpose were found unsafe for human consumption due to presence of Total coliforms (bacteriological contamination) beyond the WHO recommended values (0/100ml). 30(36%) water samples were found fecal contaminated i.e. presence of E. coli. The E. coli concentration lies in the range of 01 too numerous to count cfu / ml exceeding WHO limit recommended for drinking water (0/100ml). While, only seventeen water samples (20%) were found bacteriological safe for drinking purpose.

Overall data shows that out of 84 samples 67(80%) were found unsafe for drinking purpose, while only 17(20%) samples were found fit for human consumption for analyzed parameters under prescribed standards.

As per the fifth interim report of implementation commission, rehabilitation of filter plants was at an advance stage of procurement and work orders were expected to be issued [25].

[25] Judicial commission submits its fifth report in SC by Mohammad Hussain Khan. Published in Dawn 12, 2018. https://www.dawn.com/news/1450835

5.3.6 Solid Waste Management

Karachi city generates more than 10,000 ton / day of municipal solid waste and dumped at the landfill site without proper planning and segregation. Out of the total amount of municipal solid waste 60% of the total amount of municipal solid waste are dumped on the landfill site and rest of 40% remain on the street and did not collect from the towns.

Out of 18 former towns, only eleven towns such as, Gulshan, Gulberg, Gadap, Korangi, Liaquatabad, Landhi, Malir, North-Nazimabad, North Karachi, Shah Faisal and Bin Qasim towns dumped their garbage at the Jam Chakro landfill site and too much without any proper planning and segregation of the garbage. Rest of four towns dumped their waste at the Gond Pass landfill town near Hub River due to its being much near to the town as compared to Jam Chakro landfill site. Three towns of them i.e., Jamshed town, Saddar town and S.I.T.E town are those that dumped their waste at both landfill sites.

Out of the total municipal solid waste generated, 80% contains recyclable material and the remaining 20% is organic type waste. On the basis of analysis of the municipal solid waste, the study reveals that pH is slightly alkaline, moisture content is less than 50% and the amount of heavy metal like, Lead, Cadmium, Chromium and Nickel are beyond the permissible limits. They are responsible for casting adverse impacts on the environment as well as for contaminating groundwater in the vicinity of the landfill site sites through leaching formation.

The existing system of solid waste management in the city is inefficient and inadequate to cope with the present and future need of increasing solid waste quantities. There are no planned disposal sites for the city. The current practice of the illegal dumping of solid waste in and around the city has created a serious environmental and public health problem. For sustainable development, it is essential to establish sound, economical and technical methods of solid waste management.

The Sindh Solid Waste Management Board – SSWMB has been established under the Sindh Solid Waste Management Board Act 2014 for effective Integrated Solid Waste Management in Sindh including Karachi. SSWMB is embarking in garbage collection from door to door and construction of garbage transfer stations, material recovery facilities, construction of composting facilities and energy generation etc.

5.4 Climate

The climatic conditions of the area determine various factors in the development and operation of the expressway that would contribute towards design such as:

- **Material Durability & Structural Performance** – Karachi experiences high temperatures, intense solar radiation, and elevated humidity, where these conditions will impact the structure and potentially accelerate concrete cracking, asphalt softening, and steel corrosion. Incorporating a climate aware design will ensure use of heat resistant materials, proper expansion joints, and anti-corrosion measures to extend asset life.
- **Occupational & Community Health & Safety** – During project development and implementation, extreme heat and humidity pose occupational health risks such as heat stress and dehydration for workers, while high UV exposure requires scheduling and PPE considerations. Design and environmental management plans must integrate heat mitigation, rest cycles, and shading strategies to ensure safety.
- **Wind Load & Structural Stability** – karachi is prone to strong coastal winds and occasional cyclonic gusts, where these can exert significant lateral loads on elevated sections.

- **Climate Variability & Long Term Resilience** – Rising temperatures, increased rainfall intensity, and sea level rise due to climate change can affect drainage efficiency, expansion behavior, and pavement durability. Factoring climate projections into design helps ensure long term resilience, reduced maintenance costs, and compliance with limate adaptive infrastructure standards.

5.4.1 Temperature

The air temperature in Karachi Division and its coastal areas are generally moderate throughout the year due to presence of sea. Climate data generated by the meteorological station at Karachi Air Port represents climatic conditions for the region. The mean monthly maximum and minimum temperatures, recorded during the last 20 years in Karachi to describe the weather conditions are shown in Table 4.1(b) and 4.2 respectively. The Tables indicate that the mean monthly maximum temperature in Karachi ranged between 26.2°C and 36.0°C during the 2001-2020 periods, while the mean monthly minimum temperature ranged between 10.1ºC and 29.4°C. The annual mean maximum and mean minimum temperature during 2001-2023 periods were 33.1°C and 21.0°C, which indicates that there has been a slight but significant rise in the mean minimum temperature during the last 20 years.

Table 5.3 - Mean Monthly Maximum Temperatures (°C) in Karachi

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	27.2	29.6	33.1	34.6	35.1	34.9	32.2	32.3	33.1	36.0	33.5	30.4	32.7
2002	27.0	28.2	33.3	35.4	35.6	35.1	32.2	31.6	31.4	36.5	32.7	28.1	32.3
2003	27.6	28.5	32.4	36.6	35.7	34.9	34.1	32.6	32.5	37.0	32.2	28.3	32.7
2004	26.6	29.9	36.2	35.4	36.8	35.6	33.8	32.7	32.8	33.7	33.1	29.4	33.0
2005	24.9	26.3	31.5	35.3	35.4	36.0	33.2	32.2	34.2	35.2	33.1	28.4	32.1
2006	26.0	31.3	31.8	34.0	34.6	35.3	33.8	31.0	34.2	35.0	33.4	26.3	32.2
2007	26.9	29.4	31.4	37.7	36.0	36.4	N/A	N/A	N/A	N/A	N/A	N/A	33.0
2008	24.4	26.9	34.3	34.4	33.9	35.1	33.5	31.9	34.7	35.5	32.5	27.2	32.0
2009	26.2	29.8	33.0	36.0	36.8	35.7	34.5	33.0	32.8	35.9	33.0	28.6	32.9
2010	27.5	29.2	34	35.7	36.5	34.7	34.6	33.2	34.5	35.9	32.7	28	33.0
2011	26.9	28.5	33.2	35.8	35.3	35.3	34.2	32.8	32.9	N/A	N/A	N/A	N/A
2012	25.7	26.9	31.7	35.1	35.5	34.6	33.2	32.7	33.2	35.0	32.7	28.2	32.0
2013	26.7	28.0	33.3	34.0	35.1	36.5	33.8	32.1	33.0	35.7	32.3	28.3	32.4
2014	25.5	28.0	31.7	35.1	35.9	36.5	34.0	33.7	33.8	36.3	32.9	28.7	32.7
2015	26.3	28.9	31.5	35.9	36.0	37.7	34.1	32.3	34.6	35.8	33.0	28.6	32.9
2016	27.8	30.3	33.3	34.7	35.7	36.1	33.6	33.0	32.9	34.0	33.3	31.0	33.0
2017	25.4	30.2	32.8	35.5	36.2	36.3	33.1	33.8	33.4	36.6	32.3	28.2	32.8
2018	28.5	30.4	34.4	36.2	38.7	35.4	33.8	31.9	32.6	36.8	33.8	28.2	33.4
2019	26.3	26.8	31.3	35.4	36.0	37.2	34.7	32.5	35.7	35.8	31.5	27.1	32.5
2020	24.3	30.1	31.2	36.2	36.6	37.3	36.7	34.6	35	36	31.4	28.1	33.1
2021	26.6	31.3	34.6	37.3	37.5	36.1	34.5	32.6	36.3	34.8	34.0	27.6	33.6
2022	25.8	27.7	31.5	34.3	35.2	34.8	33.1	31.7	32.6	34.7	31.9	27.4	31.7
2023	25.6	30.9	33.3	34.5	35.5	35.9	35.0	31.4	34.4	35.1	33.0	29.4	32.8
2024	27.3	28.6	31.9	34.5	37.3	37.1	36.5	32.5	33.4	37.3	33.8	27.6	33.1
2025	27.2	30.4	34.7	37.2	36.5	35.6	34.3	33.0	32.4	35.3	31.8	29.2	33.1

Source: Pakistan Meteorological Department

Table 5.4 - Mean Monthly Minimum Temperatures (°C) in Karachi

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	11.5	14.9	19.6	23.8	28.1	29.0	27.1	26.5	25.9	24.4	18.6	15.8	22.1
2002	12.8	13.8	19.5	23.9	27.0	28.2	29.6	25.6	24.8	22.5	17.7	14.9	21.7
2003	12.7	16.9	19.8	24.2	26.5	28.2	23.6	27.0	25.3	20.9	15.2	12.0	21.0
2004	12.9	14.5	19.1	24.8	27.3	28.8	27.5	26.3	25.3	22.4	18.0	15.4	21.9
2005	12.3	11.3	20.3	23.0	26.4	28.3	27.2	26.6	26.6	22.9	18.9	13.0	21.4
2006	11.7	18.1	19.6	24.5	27.5	28.5	28.3	26.3	26.8	25.7	19.4	14.0	22.5
2007	13.0	17.3	19.7	24.7	27.6	28.6	N/A	N/A	N/A	N/A	N/A	N/A	21.8
2008	10.1	11.1	19.6	24.0	27.3	29.1	27.9	26.8	26.6	23.8	17.6	14.9	21.6

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	14.7	16.5	20.8	23.8	27.6	28.7	28.1	27.5	26.5	22.6	17.0	13.9	22.3
2010	12.2	14.7	21.3	25.1	28	28.2	28.3	27.2	25.8	23.9	17.4	11.1	21.9
2011	11	14.5	19.7	23.1	27.1	28.8	27.8	28.6	26.5	N/A	N/A	N/A	N/A
2012	11.2	11.9	19.1	24.5	27.2	28.0	27.9	26.9	26.4	22.7	18.6	14.2	21.5
2013	11.6	15.1	19.2	24.2	27.1	29.3	28.0	26.6	25.5	25.4	18.1	13.0	21.9
2014	9.9	13.1	18.9	24.4	27.0	29.2	28.3	27.1	26.8	23.3	19.5	13.1	21.7
2015	12.6	16.4	19.2	25.7	27.7	29.8	28.4	26.9	26.3	24.9	18.6	12.6	22.4
2016	14.8	14.9	21.7	24.6	27.9	27.9	28.1	27.1	26.4	24.0	17.1	15.5	22.5
2017	12.5	18.2	20.3	24.4	27.8	29.2	27.7	27.0	26.2	23.5	16.8	13.0	22.2
2018	12.9	15.8	20.9	25.3	27.7	28.8	28.1	26.3	25.5	23.0	19.3	13.1	22.2
2019	13.3	15.3	19.0	24.0	26.6	28.9	28.1	26.8	27.2	24.0	19.4	13.7	22.2
2020	10.8	15.3	19.1	24.7	27.7	29.7	29.4	28.1	27.3	22.7	16.0	12.5	21.9
2021	9.2	15.0	21.6	25.1	28.9	29.6	28.5	27.4	28.0	23.1	17.6	13.9	22.3
2022	10.4	12.7	17.6	22.3	25.9	27.9	27.4	26.1	25.2	21	15.9	11.6	20.3
2023	10.6	15.4	20.9	24.3	27.5	29.3	28.9	27.0	27.1	25.7	20.0	14.8	22.6
2024	13.6	16.8	19.7	24.8	28.1	30.0	30.3	27.5	27.0	26.3	21.9	12.6	23.2
2025	11.5	16.5	20.6	25.2	28.6	29.1	28.9	27.3	26.6	24.1	16.9	13.5	22.4
Source: Pakistan Meteorological Department													

5.4.2 Precipitation

The probability that precipitation will occur has been found to vary from different days of July and August at Karachi throughout the 1992-2012 period. Precipitation most likely occurs around August 4, in 35% of all days. Precipitation is least likely around April 27, occurring in 2% of all days.

Thunderstorms are the most severe type of precipitation observed during 38% days precipitation. They are most likely around August 12, when it is observed during 12% of all days. Drizzle is the most severe precipitation observed during 34% of those days with precipitation. It is most likely around July 30, when it is observed during 14% of all days. Moderate rain is the most severe precipitation observed during 22% of those days with precipitation. It is most likely around July 28, when it is observed during 8% of all days. When precipitation does occur, it is most often in the form of thunderstorms (40% of days with precipitation have at worst thunderstorms) and cloud burst, drizzle (36%), moderate rain (19%), and light rain (5%).

Table 5.5 - Monthly Amount of Precipitation (mm) at Karachi Airport

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	0.0	0.0	0.0	0.0	0.0	10.6	73.6	16.2	N/A	0.0	0.0	0.0	100.4
2002	0.0	2.4	0.0	0.0	0.0	N/A	N/A	52.2	N/A	0.0	0.5	0.4	55.5
2003	6.4	21.8	0.0	0.0	0.0	16.3	270.4	9.8	N/A	0.0	0.2	0.0	324.9
2004	13.7	0.0	0.0	0.0	0.0	N/A	3.0	5.6	N/A	39.3	0.0	4.3	65.9
2005	6.6	12.8	N/A	0.0	0.0	N/A	N/A	0.3	54.9	0.0	0.0	17.1	91.7
2006	N/A	0.0	N/A	0.0	0.0	0.0	66.2	148.6	21.9	0.0	3.1	61.3	301.1
2007	0.0	13.2	33.4	0.0	0.0	110.2	N/A	N/A	N/A	N/A	N/A	N/A	156.8
2008	8.0	Trace	1.1	0.0	0.0	0.0	54.0	37.5	Trace	0.0	0.0	21.0	121.6
2009	3.0	Trace	0.0	Trace	0.0	2.6	159.9	44.0	68.9	0.0	0.0	1.5	279.9
2012	0.2	0.0	0.0	0.0	0.0	Trace	Trace	*8.1*	121.0	0.0	0.0	22.8	152.1
2013	Trace	20.0	2.8	30.0	0.0	Trace	5.5	105.4	4.0	1.2	0.0	0.0	168.9
2014	Trace	0.0	12.4	0.0	1.3	Trace	1.1	9.9	1.4	0.0	4.6	0.0	30.7
2015	0.3	2.1	2.8	0.0	0.0	Trace	46.6	1.4	Trace	0.0	0.0	0.0	53.2
2016	3.1	0.0	Trace	0.0	0.0	65.8	1.9	96.9	Trace	0.0	0.0	0.0	167.7
2017	41.5	Trace	0.0	0.0	0.0	58.8	33.3	65.6	26.4	0.0	0.0	6.6	232.2
2018	Trace	Trace	0.0	0.0	0.0	Trace	Trace	0.8	Trace	0.0	0.0	Trace	0.8
2019	39.4	Trace	2.2	0.0	0.0	1.6	66.3	204	51.7	1.2	Trace	Trace	367.3
2020	Trace	2.6	0.5	0	0	Trace	101.2	366.8	Trace	0	3.1	0	474.2
2021	0.0	0.0	0.0	0.0	0.0	Trace	45.4	Trace	88.3	17.2	0.0	16.9	167.8
2022	6	9.8	11.7	4.4	0	5.5	85.5	67.4	19.9	1	1.8	4.4	217.4
2023	0.0	0.0	5.7	2.2	14.9	4.0	40.4	Trace	4.6	0.0	5.5	0.0	77.3
2024	2.2	60.6	12.3	15.1	0.0	0.5	67.1	159.4	0.6	12.0	0.0	0.0	329.8
2025	0.0	Trace	0.0	0.0	0.0	29.7	2.0	205.1	72.3	33.7	0.0	1.2	344.0
Source: Pakistan Meteorological Department													

5.4.3 Humidity

The relative humidity typically ranges from 25% (dry) to 70% (humid) over the course of a year, rarely dropping below 20% (very dry) and reaching as high as 90% (very humid).

Table 5.6 - Mean Monthly Relative Humidity (Mean) at 1200 UTC (%)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2014	25.0	27.0	35.0	47.0	57.0	61.0	64.0	61.0	60.0	36.0	36.0	31.0	45.0
2015	38.0	41.0	37.0	45.0	60.0	56.0	69.0	67.0	56.0	47.0	28.0	31.0	47.9
2016	46.0	25.0	41.0	47.0	60.0	60.0	68.0	70.0	63.0	57.0	34.0	38.0	50.8
2017	38.0	25.0	36.0	44.0	59.0	62.0	70.0	67.0	63.0	44.0	29.0	20.0	46.4
2018	36.0	37.0	33.0	45.0	46.0	65.0	65.0	68.0	63.0	40.0	32.0	30.0	46.7
2019	40.4	33.9	36.6	48.0	55.6	58.8	64.8	72.6	67.6	41.1	34.6	29.7	48.6
2020	29.9	28.1`	34.2	44.4	57.1	56.8	65	74.8	62.4	38.1	32.9	29.1	46.1
2021	31.3	34.1	41.2	43.3	54.3	60.3	67.5	64.5	63.0	46.5	27.6	38.7	47.7
2022	30.0	29.5	38.2	43.9	56.7	59.8	67	74.0	63.7	41.1	34.5	29.6	47.3
2023	25.5	42.2	39.3	46.7	57.7	62.4	67.8	71.0	59.5	54.9	32.5	28.7	49.0
2024	42.8	35.1	34.6	48.7	52.3	57.8	69.6	73.7	66.4	50.1	47.2	22.1	50.0
2025	26.8	33.6	27.9	44.2	58.6	63.3	64.2	68.0	68.2	33.5	31.2	30.2	45.8
Source: Pakistan Meteorological Department													

5.4.4 Wind Speed & Direction

The wind direction and speed between the summer and winter monsoon seasons are rather unsettled and large variations are noted both with respect to speed and direction.

The eleven years' wind velocity record (2001-2021) indicates that the velocity varies and ranges between 1.0 m/s to 13.7 m/s. The Tables below show the wind speed and direction respectively.

Table 5.7 - Wind Speed (m/s) at 12:00 UTS

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	2.6	3.4	4.3	5.6	7.5	8.1	6.8	7.3	5.5	3.7	2.0	2.4	4.9
2002	3.6	3.9	4.0	6.5	8.5	8.2	9.8	7.3	7.7	3.3	2.9	3.2	5.7
2003	4.0	5.0	5.4	5.2	7.7	8.8	6.7	7.1	6.0	3.2	3.1	3.0	5.4
2004	3.4	3.7	4.0	6.0	8.0	9.0	10.0	9.5	7.3	3.8	1.0	2.5	5.7
2005	3.6	4.2	4.8	5.1	7.1	7.5	9.0	6.9	6.4	3.9	2.0	1.5	5.2
2006	2.0	3.0	3.0	6.2	8.0	7.7	8.3	6.2	4.7	4.2	2.2	3.0	4.9
2007	2.0	3.7	4.0	4.0	6.0	6.3	N/A	N/A	N/A	N/A	N/A	N/A	4.3
2008	4.3	7.6	8.2	10.5	12.6	7.6	11.0	9.3	8.7	6.6	5.1	3.9	7.9
2009	7.0	7.2	7.9	9.3	9.8	9.7	9.5	9.3	9.1	6.1	5.0	3.9	7.8
2012	5.8	6.6	9.3	9.8	12.3	12.8	13.1	11.2	8.4	7.1	5.7	5.8	9.0
2013	5.2	6.9	9.0	10.3	11.5	10.8	12.0	11.2	10.3	7.7	5.1	4.5	8.7
2014	5.9	8.9	8.6	11.5	12.4	13.4	12.8	11.6	11.7	8.3	6.0	4.5	9.6
2015	6.9	10.3	10.1	11.5	12.8	12.3	13.7	12.3	10.5	8.7	5.6	5.8	10.0
2016	7.5	8.7	4.8	1.1	13.0	11.7	11.8	10.5	12.1	9.2	5.5	5.2	8.4
2017	7.0	8.0	10.8	12.1	12.8	11.5	12.1	10.3	8.7	8.5	5.4	7.4	6.9
2018	6.3	7.0	9.5	10.2	10.8	11.1	12.3	12.4	12.2	8.7	6.1	6.8	9.4

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2019	6.7	8.9	10.2	11.7	12.1	11.7	13.7	9.1	8.5	8.0	6.9	7.4	9.6
2020	9.0	9.4	10.5	10.5	13.3	10.9	10.1	8.9	9.4	7.3	6.2	5.5	9.1
2021	6.1	7.6	9.7	8.5	11.7	12.7	12.6	11.1	8.8	8.1	6.7	6.6	9.2
2022	6.1	8.0	9.5	8.8	11	11.2	12.6	11.3	8.8	7.1	5.6	5.1	8.7
2023	7.0	7.7	9.2	10.1	11.7	11.5	11.3	12.3	9.1	7.9	6.9	6.6	9.3
2024	7.1	7.1	8.1	9.9	10.1	11.3	10.0	10.2	9.5	7.2	6.8	6.3	8.6
2025	6.7	7.7	9.4	10.5	10.6	11.6	10.6	9.7	8.9	8.5	6.2	5.5	8.8
Source: Pakistan Meteorological Department													

Table 5.8 - Wind Direction at 12:00 UTS

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	S60W	N50W	S45W	S48W	S45W	S68W	S60W	S47W	S43W	S54W	S50W	S27W
2004	N27E	S46W	S53W	S49W	S52W	S54W	S54W	S62W	S56W	S47W	S45W	N86E
2005	N63E	S51W	S50W	S52W	S63W	S48W	S54W	S49W	S87W	S54W	S52W	N23W
2006	S48W	S62W	S50W	S57W	S64W	S60W	S67W	S78W	S51W	S53W	S49W	N79E
2007	S30W	S62W	S47W	S55W	S58W	S47W	S41W	S55W	S60W	S48W	S48W	N45E
2008	N45E	S47W	S54W	S51W	S52W	S39W	S50W	S52W	S46W	S39W	S38W	N
2009	N45E	S45W	S41W	S58W	S46W	S46W	S56W	S49W	S56W	S42W	S39W	S45E
2012	S3E	N56E	S62W	S46W	S61W	S51W	S66W	S51W	S53W	S41W	S41W	N9W
2013	N39W	S54W	S56W	S54W	S61W	S40W	S53W	S52W	S55W	S47W	S17W	N50W
2014	S72E	S54W	S43W	S46W	S46W	S45W	S54W	S48W	S85W	S45W	S49W	S45E
2015	S72E	S54W	S43W	S48W	S50W	S40W	S54W	S55W	S50W	S41W	S	S58W
2016	S43W	S36W	S48W	S54W	S54W	S45W	S48W	S36W	S51W	S45W	S43W	S36W
2017	S83E	S56W	S51W	S45W	S45W	S44W	S66W	S57W	S48W	S51W	S59W	N45E
2018	S39W	S39W	S46W	S51W	S50W	S45W	S45W	S48W	S46W	S46W	S42W	S18W
2019	S24W	S65W	S45W	S44W	S42W	S37W	S48W	S46W	S53W	S35W	N59E	N55E
2020	N31E	S12W	S52W	S55W	S49W	S44W	S47W	S55W	S47W	S38W	S4E	N35E
2021	S21W	S38W	S44W	S42W	S52W	S53W	S55W	S48W	S40W	S41W	S22E	S40E
2022	N31E	S43W	S42W	S45W	S46W	S45W	S47W	S59W	S44W	N56W	S45W	N45E
2023	S22E	S45W	S40W	S58W	S65W	S38W	S56W	S74W	S57W	S53W	S40E	S84E
2024	S3E	S8E	S50W	S51W	S41W	S45W	S54W	S72W	S57W	S27W	S40W	N41E
2025	S4E	S38W	S30W	S33W	S32W	S36W	S34W	S40W	S42W	S5E	S16W	S5W
Source: Pakistan Meteorological Department												

5.4.5 Urban Heat Island Effect

The term "heat island" describes built environment that are hotter than nearby natural areas. An urban heat island refers to a city or metropolitan area that is significantly warmer than its surrounding natural areas due to human activities. The temperature difference usually is larger at night than during the day and is most apparent when winds are weak. UHI is most noticeable during the summer and winter seasons. It is estimated that the annual mean air temperature of a city with 1 million or above inhabitants can be 1–3°C warmer than its surroundings. In the evening, the difference can be as high as 12°C. The heat island can affect communities by increasing

summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality.

The city of Karachi has been growing exponentially in terms of urbanization and population growth. The city hosts more than 22 million populations with a density of 4,115 persons per kilometer square (km2). The urban area density has increased from 233 km2 in 1947 with a population size of 0.4 million to 3,566 km^2 in 2004 with a population size of 14 million (Qureshi et al., 2008). Rapid urbanization and global warming have initiated UHI effect over the city. A strong incidence of UHI is generally associated with a severe heat wave hazard in terms of sensible temperature. UHI effect is the unique feature of the June 2015 heat wave in Karachi. It is expected that with growing global warming incidence and poor coping strategies, UHI would become a major health risk for the vulnerable segment of population in mega-cities around the globe such as Karachi.

Causes of Urban Heat Island Effect: The principal reason for the night time warming is the retention of short-wave solar radiation absorbed during the day time by the building material consisting of concrete and asphalt. These materials are commonly used in urban areas for pavement and roofs that have significantly different thermal and radiative properties compared to the surrounding rural areas. This causes a change in the energy balance of the metropolitan area, often leading to higher temperatures than surrounding rural areas. This energy is then slowly released during the night as a long wave radiation, making cooling a slow process. Because of this phenomenon, the minimum temperatures of Karachi remained extremely high during the heat-wave event.

There are several causes of an urban heat island effect in Karachi.

- Reduced and slow process of evapotranspiration due to shrinking green areas and spaces in the city. With a decreased amount of vegetation, the city loses the shade, cooling effect of trees and the removal of carbon dioxide.
- Geometric effects in terms of rising number of tall buildings are a significant contributing factor to urban heat island effect. Over the years, the number of tall buildings within the city has increased that provide multiple surfaces for the reflection and absorption of sunlight, and thus increasing the efficiency with which the city is heated. This is called the "urban canyon effect". Another effect of increased number of buildings is the blockage of wind, which also inhibits cooling by convection and pollution from dissipating.
- Waste heat from automobiles, air conditioning, industry, and other sources also contributes to the UHI. High levels of pollution in urban areas can also increase the UHI, as many forms of pollution change the radiative properties of the atmosphere.
- Aside from the effect on temperature, UHI can produce secondary effects on local meteorology, including the altering of local wind patterns and humidity, which have been discussed in the previous section. The UHI effect described above has been one of the major causes of unprecedented large number of heat related deaths in Karachi. Future climate scenarios suggest that the frequency of this kind of disasters may increase with the rise of temperature in future.

5.5 Environmental Monitoring

Environmental monitoring of ambient air, noise, drinking water, groundwater, waste water and surface water was conducted by a Sindh EPA approved environmental lab for ascertaining the environmental baseline conditions within the COI of the project. Monitoring locations are marked in Figure 5.14 and its results are discussed in the succeeding sections. The detailed monitoring reports are also attached as an annex to this report, where a map depicting the different areas where monitoring was carried out is provided below:

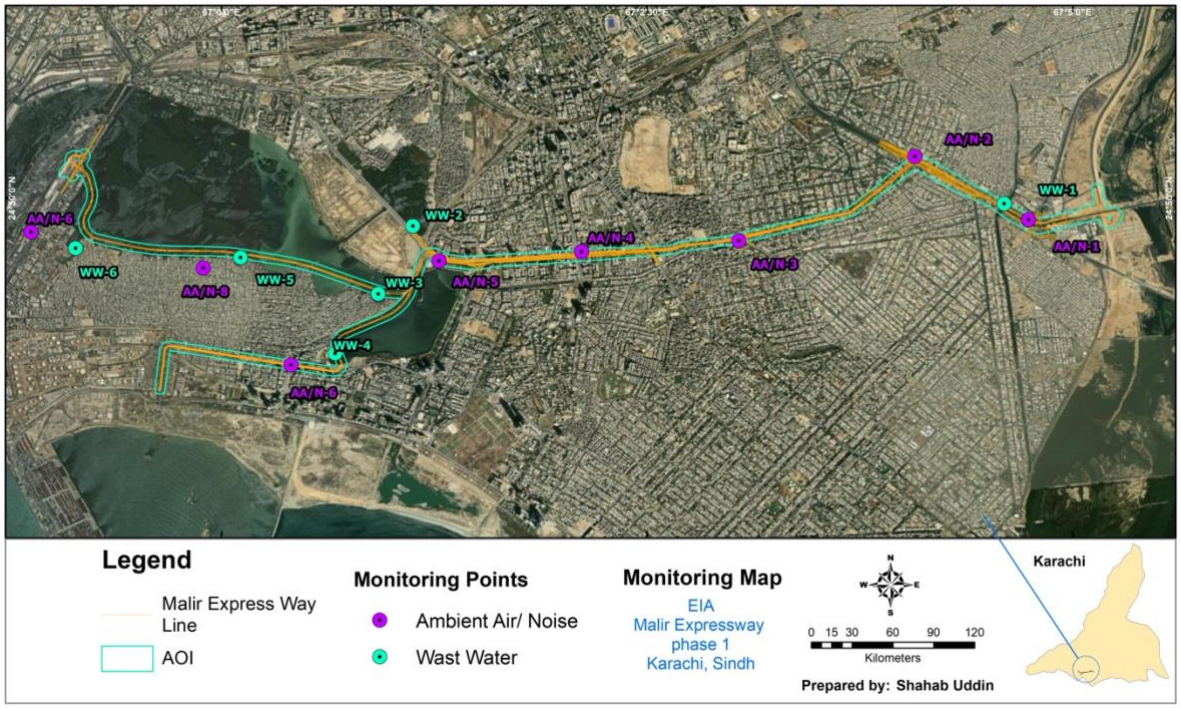


Figure 5.9 - Environmental Monitoring Points for Subject Project

5.5.1 Ambient Air Quality

For assessing the ambient air quality within the AOI, ambient air monitoring was conducted at 07 different locations based on receptors around the proejct area, so as to have a baseline against which further impacts can be assessed during the construction and operational phases. where the The monitoring locations and co-ordinates are provided below:

Table 5.9 - Ambient Air Quality & Noise Level Locations

S. No.	Area	Point No.	Co-ordinates	Rationale for Selection
1	At the KPT Flyover Area	AQ/N1	24°49'52.23"N 67° 4'44.50"E	To understand the existing airshed of where the expressway will originate from
2	Defence Morr, Main Korangi Road	AQ/N2	24°50'14.55"N 67° 4'4.44"E	To understand the existing airshed of the area
3	Near KE Head Office, Main Sunset Boulevard	AQ/N3	24°49'44.83"N 67° 3'2.41"E	To understand the existing airshed of the area
4	Submarine Chowk	AQ/N4	24°49'40.98"N 67° 2'6.97"E	To understand the existing airshed of the area
5	Mai Kolachi & Railway Crossing	AQ/N5	24°49'37.71"N 67° 1'16.68"E	To understand the existing airshed of the area
6	Main Ziauddin Hospital Roundabout, Clifton	AQ/N6	24°49'1.00"N 67° 0'24.56"E	To understand the existing airshed of the area
7	East Wharf at Karachi Port	AQ/N7	24°49'47.93"N 66°58'52.93"E	To understand the existing airshed of the area where the alignment is to terminate

The points chosen above correspond to different points along the route of the expressway. Monitoring was carried out at these points at different points of the year also to understand the temporal variations, where the results obtained from the monitoring are provided below:

Table 0.1 - Results from Ambient Air Monitoring

Parameter		CO	NO	NO_2	SO_2	O_3	PM_{10}	$PM_{2.5}$	SPM	Lead
Applicable Stringent Standards		5 µg/m³	40µg/m³	80ug/m³	20µg/m³	100µg/m³	150µg/m3	75µg/m³	500µg/m³	1.5µg/m³
Monitoring Points	Monitoring Period									
Average Values for AQ/N1	March 25	0.78	20.9	20.2	11.0	15.3	89.3	55.4	252.3	-
	May 26	0.84	21.5	19.5	34.2	16.4	109.7	38.6	374.5	-
Average Values for AQ/N2	March 25	0.81	23.7	20.5	12.0	22.2	95.6	47.1	246.1	-
	May 26	0.44	20.2	24.0	26.4	16.0	104.1	24.5	370.5	-
Average Values for AQ/N3	March 25	0.42	19.1	22.6	10.3	18.9	75.7	36.8	200.1	-
	May 26	0.28	14.8	11.0	8.8	20.6	110.5	54.8	233.3	-
Average Values for AQ/N4	March 25	1.02	23.8	30.2	13.7	21.8	111.3	44.2	247.8	-
	May 26	0.35	19.3	17.2	12.5	22.6	121.7	53.5	274.7	-
Average Values for AQ/N5	March 25	1.77	14.9	20.1	8.6	23.7	112.6	37.8	215.5	-
	May 26	0.32	26.2	12.5	10.5	17.3	98.7	42.2	264.7	-
Average Values for AQ/N6	March 25	1.03	24.6	16.5	113.5	26.3	113.5	45.0	224.1	-
	May 26	0.25	21.4	20.2	24.2	19.4	111.1	44.5	247.7	-
Average Values for AQ/N7	March 25	1.12	28.6	31.6	18.3	31.2	124.8	74.6	248.9	-
	May 26	0.96	14.9	11.0	31.5	16.8	122.3	38.3	34.58	-

*Note: Discussed in Chapter 03 of this ESIA Report

The monitoring results indicate that the corridor is already subject to a relatively high particulate pollution burden before project implementation. Consequently, construction activities have the potential to temporarily elevate PM_{10} and suspended particulate concentrations unless effective dust suppression and traffic management measures are implemented. Operational impacts on gaseous pollutants are expected to remain comparatively limited, as baseline concentrations of CO, NO, NO_2 and O_3 are well below the applicable standards. However, increases in heavy freight traffic could contribute to localized increases in particulate emissions, particularly near the port approaches, interchanges and areas of traffic congestion.

Overall, the baseline demonstrates that particulate matter (PM_{10} and SPM) is the critical pollutant for this corridor, where specialized mitigation measures should be adopted in these areas to ensure that any impacts that may be compounded are addressed and minimized accordingly.

5.5.2 Noise Levels

The area around the alignment of the project can mostly be considered as commercial as it passes through main roads and areas where commercial activities are taking place. However, given the presence of some residential patches along the alignment, the iseverity of the impacts in these patches will have to be dealt with using targetted mitigation measures.

In line with this, noise monitoring was carried out at the same locations where ambient air monitoring was carried out, and in the same monitoring regimes (twice at different times of the year) in order to obtain an idea of the noise levels along the entire length of the alignment. The results from the monitoring are provided below:

Table 0.2 - Results from Noise Levels Monitoring

Monitoring Point	Zone	Applicable Stringent Standards	Average Monitored Values (March 25)	Average Monitored Values (May 26)

		07:00 – 22:00	dB(A) Leq	
AQ/N1	Commercial	65	62.8	68.5
AQ/N2			64.3	65.6
AQ/N3			61.7	66.7
AQ/N4			62.9	63.6
AQ/N5			60.1	67.6
AQ/N6			64.4	67.9
AQ/N7			66.6	69.5

5.5.3 Water Quality

The surface water quality at different points of the alignment where it crosses any sort of water body was also assessed, the results from which are provided below.

The monitoring locations and co-ordinates are provided below:

Table 0.3 – Water Quality Sampling & Testing Locations

S. No.	Area	Point No.	Co-ordinates
1	At the KPT Flyover Area	WW1	24°49'52.23"N 67° 4'44.50"E
2	Defence Morr, Main Korangi Road	WW2	24°50'14.55"N 67° 4'4.44"E
3	Near KE Head Office, Main Sunset Boulevard	WW3	24°49'44.83"N 67° 3'2.41"E
4	Submarine Chowk	WW4	24°49'40.98"N 67° 2'6.97"E
5	Mai Kolachi & Railway Crossing	WW5	24°49'37.71"N 67° 1'16.68"E
6	Main Ziauddin Hospital Roundabout, Clifton	WW6	24°49'1.00"N 67° 0'24.56"E

The detailed results from the monitoring are attached as an annex to the report.

5.6 Existing Traffic Scenario

Detailed surveys were also carried out to understand the exisitng traffic situation in the areas where the expressway is proposed, where classified traffic volume count surveys, and network inventory surveys were carried out. Traffic surveys were concuted to collect detailed inofrmation ont raffic volumes across selected points within the study area. Classified Traffic Volume Count Surveys were carried out at five key locations, as identified in the figure below:

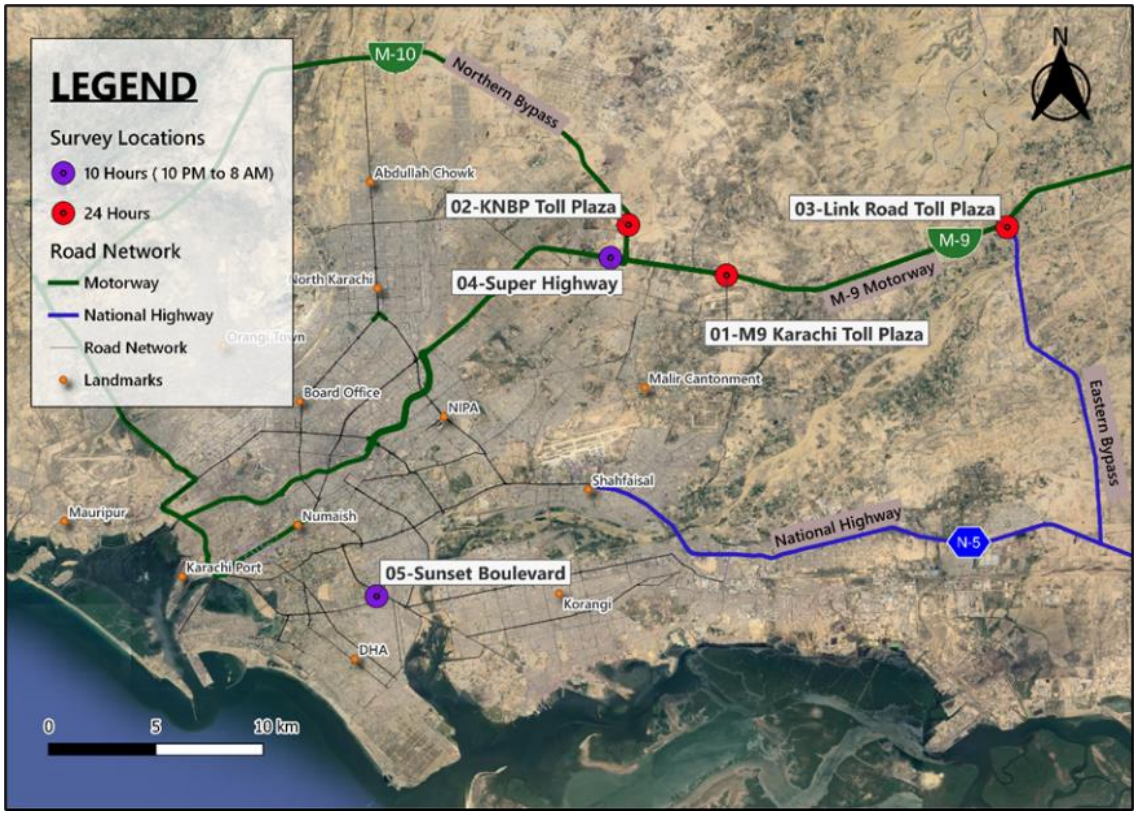


Figure 0.1 - Locations of Traffic Surveys

These surveys include Mid-Block Counts on major roads within the study area.

The types of vehicles for MBC surveys were classified into the following categories:

- Light freight vehicles (pickup trucks, Shehzore, Mazda, etc.)
- Single Unit Trucks (2 & 3 axle)
- Trailers (4,5,6 axle)

Traffic counting was continuously performed for 100% of all vehicle types in MBC surveys, where the findings from the survey are highlighted below:

Mid-Block Count 01 – Sunset Boulevard

The mid-block survey conducted on Sunset Boulevard Road captures the traffic volume between Main Korangi Road and Schon Circle. This data provides valuable information about the traffic flow along this road segment, enabling better understanding of the volume and patterns of vehicles traveling between the two locations. The survey findings were instrumental in assessing the potential of an expressway being developed along the road. The table below shows the actual numbers of traffic flow along the segment.



Figure 0.2 - Traffic Flows for Sunset Boulevard

Mid-Block Count 02 – M9 Motorways (Saima Villas)

The mid-block traffic count survey conducted along M9 Motorway served as a critical input for the expressway design process. The analysis of survey data highlighted key traffic patterns and peak flow trends, offering a data-driven approach for infrastructure planning.
The figure below illustrates the observed traffic volumes during peak hours and over the course of a typical day.



Figure 0.3 - Traffic Flows for M9 Motorway (Saima Villas)

Mid-Block Count 03 – M10 Toll Plaza

The mid-block count survey conducted at the M10 Toll Plaza. The analysis of the collected data revealed significant traffic patterns and trends, allowing for a comprehensive understanding of the traffic flow. The Figure below depicts the peak hour and daily traffic flows.



Figure 0.4 - Traffic Flows for M10 Toll Plaza

Mid-Block Count 04 – M9 Toll Plaza

Traffic data from the mid-block survey on M9 Toll Plaza. The findings exposed distinct trends in peak and daily traffic volumes, as visualized in the Figure below, supporting accurate modelling of flow dynamics and capacity requirements.



Figure 0.5 - Traffic Flows for M9 Toll Plaza

Mid-Block Count 05 – Kathore (M9-N5) Toll Plaza

The mid-block survey on Kathore Toll Plaza, relays information about the traffic flow between N5 National Highway and M9 Motorway. The data offers a clearer understanding of vehicular movement within this segment and supports the assessment of its suitability for a proposed expressway. The figure below presents the recorded traffic volumes.



Figure 0.6 - Traffic Flows for Kathore Junction

Table 0.1 - Traffic Counts from Mid-Block Survey

	Sunset Boulevard Road		M9 Motorway (Saima Villas)		M10 Toll Plaza		M9 Toll Plaza		Kathore (M9 – N5) Toll Plaza	
	Towards East	Towards Southwest	Towards East	Towards West	Towards North	Towards South	Towards East	Towards West	Towards Southeast	Towards Northwest
Morning Peak	862	1,288	1,656	1,022	343	218	1,304	698	223	175
Evening Peak	801	1,248	1,337	1,887	357	266	1,475	1,526	363	179
Total	**15,052**	**20,004**	**27,419**	**27,548**	**5,132**	**4,770**	**24,477**	**22,745**	**4,842**	**4,332**

5.7 Biotic Environment

In order to compile the biodiversity in the vicinity of the proposed project location, the data and information were obtained from secondary data from published literature and consultations with the concerned quarters.

Information regarding the field based (first hand) ecological profile of study area was gathered through desk study, consultations with concerned field formations of provincial departments of forestry, wildlife sectors and field visit to obtain the information regarding flora and fauna.

The ecological zone is included in Indus eco region which covers about 65% of the land area of Sindh Province. Being included in Indus eco region, the flora and fauna of the project site is linked with indo-malayan bio geographical origin. With regards to micro-ecological response, the flora and fauna of greater Karachi can be divided into the following three edaphic regions:

- The coastal landscape and the muddy coastal swamps;
- The costal sand dunes; and
- The barren undulating landscape of calcareous rocky terrain.

The above-mentioned contrasting edaphic conditions support different kinds of flora and fauna due to variable ecological conditions. The proposed project is located in barren undulating landscape with poor ecosystem which is deprived of healthy environment and reveals absence of food chain required for existence and survival of terrestrial fauna.

5.7.1 Habitat

In general, Karachi is an urban environment. The natural fauna and flora-based ecosystems and species are less significant and less in number. Due to disturbances and absence of favorable habitat, the faunal frequency is observed to be low in the project area. While on the other hand, it is important to note that the project area is adjacent to the coastline, therefore, few terrestrial grasses have been observed. However, the coastline is already facing serious environmental stresses, mainly due to untreated waste water flowing through Malir and Lyari River from various industries and the species are observed to be in deplorable conditions, with the short growth of Mangroves being a proof of this issue. The principal habitat type in the project area are arid hills and low lying sandy areas. Vegetation of the hill slopes and hillsides comprises mainly camelthorn (Prosopis spicigera), wild caper (Capparis Decidua) and large succulents such as Euphorbia caudicifolia. The sandy areas are typically vegetated with a sparse cover of small trees such as Acacia senegal, Zizyphus nummularia and Prosopis cineraria.

Based on the field evaluation and assessment, departmental consultation and secondary data sources, the proposed project area is categorized as “Modified Habitats” that contains a large proportion of nonnative species and human interference which has substantially modified the primary ecological functions and species composition of the project area.

5.7.2 Flora

The climatic conditions are harsh, further augmented by drought and land clearance activities on account of rapid urbanization, as a result, vegetation is sparse and scanty. As the project area is mostly passing through urban areas, so the soil is non-supportive to the flora to establish roots and chains, and mesquite (the invader species) is dominant and invaded the eco-system and is currently representing the mono culture which is not best indicator of biodiversity.

The native vegetation is of the desert scrub type comprising a wide variety of bushes and shrubs, including karir (capris aphylia), babul (Acacia nilotica), khor (Acacia senegal), khabar (Salvadora oleoides), kandi (Prosopsis senegal), kikar (Acacia arabica), lai (Tamarix gallica), tamarix aphylla, populus euphratica (willo or bahan), Aerua javanica, Maerva arenaria, Abutilou sp, Amaranthus viridis, Cordia gharaf, Rhazya sticta, karil (Capparis aphyila), acacia or siris (Acacia lebbek), papal (Ficus religiosa) and tamarind (Tamarindus indica).

The two principal habitat types on the course of Lyari and Malir Rivers to central areas of Karachi City District are arid hills, and low-lying sandy areas. Vegetation of the hill slopes and hillsides comprise mainly camelthorn (Prosopis spicigera), wild caper (Capparis decidua) and large succulents such as Euphorbia caudicifolia.

5.7.3 Fauna

Environments for flourishing of faunal species are not encouraging, on the other hand these are impoverished and degraded, resulting from non-availability of surface as well as groundwater and discharge of untreated wastewater into surface water bodies. This process has irreversibly reduced the biodiversity of the indigenous as well as introduced vegetation and hence it offers very little chance for the survival/growth of fauna in the macro environment of project area. There are even otherwise, no threatened species in the project area but the shrubs and sandy area is the habitat for mammals, birds and reptiles within or near the project site. Domestic livestock, particularly goats, sheep, and camels are found grazing in the suburban towns and rural settings.

There are a number of characteristic bird species that have adapted to the few of agricultural environment in nearby areas. These include indian roller, common mynah, pigeon, and house sparrow.

5.7.4 Protected Areas

There are no identified protected areas within the project area, or the project's Area of Influence.

5.8 Socio-Economic Environment

The socio-economic baseline data in this chapter identifies the existing socio-economic trends in the area and the potential impacts of the project providing the basis for the development of a Social Management Plan. The social baseline is divided into macro and microenvironment of the project area, where the macro-environment encompasses District South, Keamari and Korangi of Karachi, Sindh. The discussion on macro environment covers the administrative setup, demography, education and health profile of the area amongst other socio-economic factors.

International best practice for ESIA studies demands an alignment of the proposed project components with the applicable Sustainable Development Goals (SDGs) adopted by all UN Member States in 2015. The SDGs provide broad universal targets for reducing poverty, environmental degradation, injustice and important pillars of social upheaval that must be achieved by 2030. In March 2017, the global indicator framework was developed and agreed upon by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) to monitor progress towards the achievement of these indicators. Moreover, all member states, including Pakistan have developed national indicators linked to the global targets that provide the basis for a national effort of monitoring progress towards fulfillment of the indicators. The proposed project should be aligned with Goal 11 of the SDGs that requires all essential steps be taken to ensure development that is socially acceptable and environmentally sound.

5.8.1 Macro-Environment of Project Area

5.8.1.1 Administrative Context

Karachi, the capital of Sindh province, is the country's largest city and the main seaport. located along the Arabian Sea, northwest of the Indus River delta, Karachi is an important economic and cultural centre. Historically, it has been known by names like Caranjee, Currachee, and Kalachi-jo-Goth, meaning "the village of Kalachi." Over time, Karachi has grown into Pakistan's industrial, commercial, and financial hub, serving as a trade gateway to Afghanistan. The sprawling division of Karachi covers an area of 3,527 sq.km with the city's seven districts, namely, Karachi: Central, West, South, East, Keamari, Korangi and Malir.

The Sindh Local Government Act26 of 2013 establishes a framework for organizing local governance by dividing Local Councils in rural and urban areas. The rural areas have District Councils with Union Councils (with a population between 10,000 to 25,000) as their constituting units. Whereas the urban areas are divided into the local councils based on their population.

5.8.1.2 Demography

Karachi is ranked as the 12th most populous urban centre in the world. The city witnessed rapid urbanization over the past few 17 decades, with the urban population growing from 5 million in 1998 to 20.35 million in 2023. The population is highly diverse, 18 comprising various ethnicities, languages, and religious communities, contributing to the city's rich cultural landscape.

Table 0.2 - Population of Karachi & it's Districts

Name of Administrative Unit	Area S.Q Kilometres	Population Density Per S.Q Kilometres	Total Population of the Area	2017- 2023 Average Annual Growth rate
Karachi Division	3,527	5779.10	20,382,881	4.10
District Central	69	55,396.01	3,822,325	4.30
District East	139	28,213.97	3,921,742	5.32
District South	122	19,096.43	2,329,764	4.71
District West	370	7,241.57	2,679,380	4.35
District Keamari	559	3,700.27	2,068,451	2.07
District Korangi	108	28,971.95	3,128,971	3.29
District Malir	2,160	1,126.04	2,432,248	3.99
Source: Pakistan Bureau of Statistics (2023)				

According to the 2023 data, District South spans an area of 122 square kilometres with a population density of 19,096.43 people per square kilometre and a total population of 2,329,764, growing at an average annual rate of 4.71%, District Keamari spans an area of 559 square kilometre with a population density of 3,700.27 per square kilometre and a total population of 2,068,451 growing at an annual rate of 2.07 %. District Korangi spans an area of 108 square kilometres with a population density of 28,971.95 per square kilometres and a total population 3,128,971 growing at an annual rate of 3.29%.

The population of Karachi's districts has experienced significant changes between 2017 and 2023. Karachi Central, which had a population of 2,971,382 in 2017, saw an increase to 3,822,325 in 2023. Similarly, Karachi East's population rose from 2,875,315 to 3,921,742 over the same period.

[26] Government of Sindh. (2013). *Sindh Local Government Act, 2013*.

[2] Pakistan Institute of Legislative Development and Transparency. (2024). *Strengthening democracy and democratic institutions in Pakistan* (Publication No. 978-969-558-900-7). PILDAT. https://pildat.org/

Karachi South also witnessed growth, with its population climbing from 1,769,230 in 2017 to 2,329,764 in 2023. Karachi West, however, experienced a slight decrease, from 3,907,065 in 2017 to 2,679,380 in 2023. In contrast, Karachi Korangi saw a significant increase, with its population rising from 2,577,556 to 3,128,971. Karachi Malir also grew substantially, from 1,924,346 to 2,432,248. Additionally, Karachi Keamari, which wasn't part of the 2017 data, had a population of 2,068,451 in 2023. These changes reflect the dynamic growth patterns across the city's districts, with some areas expanding rapidly while others experienced slower growth or even a decline.

5.8.1.3 Ethnicity & Religion

Table 0.3 - Population of Religious Groups

District	Total Population	Muslim	Christian	Hindu	Ahmedi	Castes	Sikh	Parsi	Other
Central	3,822,325	3,756,578	48,464	12,084	1,556	100	159	53	1,394
East	3,921,742	3,719,921	121,401	61,184	2,819	406	441	328	7,156
South	2,329,764	2,186,415	38,342	96,486	349	2,286	651	952	4,283
West	2,679,380	2,619,785	50,192	7,744	361	105	603	222	368
Keamari	2,068,451	2,028,420	26,199	9,701	152	507	123	46	1,426
Korangi	3,128,971	3,003,914	107,008	13,579	2,406	317	180	50	522
Malir	2,432,248	2,333,721	44,015	38,028	617	2,162	439	5	749
Source: Pakistan Bureau of Statistic 2023									

The population distribution of religious groups across various districts, as per the Pakistan Bureau of Statistics (PBS) 2023, reveals distinct demographic compositions. In District South, the total population is 2,329,764, with Muslims constituting 2,186,415. The Hindu population (96,486) is notably larger here than in some other districts, alongside smaller numbers of Christians (38,342), Ahmadi (349), Sikhs (286), and Parsis (651). In District Keamari, the population of 2,068,451 is predominantly Muslim (2,028,420), with relatively few Christians (26,199) and Hindus (9,701), and even smaller numbers of other religious groups such as Ahmadi (152), Sikhs (123), and Parsis (46). Lastly, in District Korangi, with a population of 3,128,971, Muslims again make up the majority (3,003,914), with notable Christian (107,008) and Hindu (13,579) communities, and smaller numbers of other groups like Ahmadi (2,406), Sikhs (317), and Parsis (180). Across all districts, Muslims form the largest religious group, with minorities such as Christians, Hindus, and other religious groups also making up significant portions of the population.

5.8.1.4 Education

Education in Karachi reflects its status as Pakistan's largest urban and economic hub. The region is home to a wide range of educational institutions, catering to various levels of education from primary to higher education. For higher education, Karachi boasts prestigious universities such as the University of Karachi, Aga Khan University, and Dow University of Health Sciences, which attracts students from across the country.

Table 0.4 - District Summary; School, Enrolment, No. of Teachers

District Name	No. of Schools				Enrolment			Teacher		
	Boys	Girls	Mixed	Total	Boys	Girls	Total	Male	Female	Total
Central	145	80	102	327	39,984	48,391	88,375	1,559	3,453	5,012
East	89	43	48	180	25,528	28,135	53,663	957	2,301	3,261
South	21	38	79	138	22,193	31,137	53,330	792	1,940	2,732
West	25	16	138	179	20,403	22,676	43,079	599	871	1,470
Malir	133	80	320	533	36,832	33,477	70,309	1,462	1,479	2,941
Korangi	91	44	82	217	40,156	47,042	87,198	1,162	2,885	4,047
Keamari	25	22	155	202	21,946	22,573	44,519	758	859	1,617

Source: Sindh Education Management Information System (2023-2024)

The data from the SEMIS Census 2023-2024 provides a detailed overview of school infrastructure, enrolment, and teaching staff across various districts, South, Keamari, and Korangi all show a trend where female students outnumber male students, particularly in Keamari and South districts. South district has a total of 138 schools, divided into 21 boys' schools, 38 girls' schools, and 79 mixed-gender schools. The total enrolment in these schools is 53,330 students, with 22,193 boys and 31,137 girls. Keamari district has a total of 202 schools, comprising 25 boys' schools, 22 girls' schools, and 155 mixed-gender schools. The total enrolment across these schools is 44,519 students, with 21,946 boys and 22,573 girls. Korangi has 217 schools, divided into 91 boys' schools, 44 girls' schools, and 82 mixed-gender schools. The total student enrolment is 87,198, with 40,156 boys and 47,042 girls. In this district, the number of girls enrolled surpasses the number of boys, indicating that girls are slightly more represented in schools compared to boys.

5.8.1.5 Education

Karachi is home to a wide range of health facilities, offering both public and private healthcare services to meet the needs of its large population. Leading public hospitals such as the Civil Hospital Karachi and Jinnah Postgraduate Medical Centre provide comprehensive medical services. Private hospitals like Aga Khan University Hospital, Liaquat National Hospital, and Ziauddin Hospital are also known for their advanced facilities and quality care.

Table 0.5 - Health Facilities in Karachi Division

Health Facilities	**No**	**Beds**
Government Hospitals + Autonomous Bodies+ Other Health Centres	210	9,371
Dispensaries	57	10
M.C.H.C	21	23
T.B. Clinics	33	350
BHUs	33	66
RHCs	5	12
Unani Shifa Khana	3	
Leprosy Clinics	1	
Maternity Homes	5	
Trauma Center	3	
Urban Health Center	5	
Urban Health Unit	9	
Source: Development Department, Government of Sindh 2022		

Table 0.6 - Health Facilities in Karachi Division, 2019

District	**Hospital**	**Hospital Beds**	**Dispensaries**		**R.H Centers**		**TB Clinics**		**BHU**		**MCHC**	
	Civil, Specialized & Taluka & DHQ	Civil, Specialized & Taluka & DHQ	No	Beds	No	Beds	No	Beds	No	Beds	No	Beds
Central	5	313	2	0	-	-	13	0	2	0	2	5
East	2	400	2	0	-	-	10	108	4	-	2	-
Korangi	1	334	5	0	-	-	12	-	8	17	3	27
Malir	3	400	12	0	2	8	9	-	14	24	5	-
South	5	700	2	0	-	-	15	6	-	-	-	-
West	1	260	7	0	4	20	13	-	7	15	4	5
Source: SBOS, Government of Sindh (2020)												

5.8.1.6 Utilities

In Karachi, the water supply is managed by the Karachi Water and Sewerage Corporation (KWSC).

Additionally, the following entities play roles in special aspects of water and sanitation:

Sindh Local Government Department oversees municipal services, including water supply and sanitation in collaboration with KWSC and other 31 local government bodies, while the Sindh Solid Waste Management Board (SSWMB) manages solid waste collection and disposal. According to the 2023 Census, 97% of households in Karachi have access to improved drinking water.

The gas supply is managed by the Sui Southern Gas Company (SSGC) and the electricity supply is provided by the K-Electric (KE). 89% of the households in Karachi use Sui Gas as fuel for 33 cooking, 6% use firewood, 4% use LPG/LNG cylinders and 1% use other sources.

Sanitation services are managed by the KWSC, which is responsible for the city's sewerage system, including the collection, treatment, and disposal of wastewater, and SSWMB, which oversees municipal solid waste management, aiming to improve sanitation and public health in the city. According to Census 2023, 81% of households have a separate toilet system, of which 95% have flush toilets, 3% have non-flush toilets, and 1% of households have no toilets.

5.8.2 Micro-Environment of Project Area

5.8.2.1 Administrative Context

The proposed project aims to improve connectivity across Karachi. However, the route of the expressway passes through both commercial and residential areas, which could potentially cause disruption to local businesses and communities. The expressway will begin at East Wharf in Keamari Town, District Keamari, and continue through several key areas, including Saddar Town and Civil Lines in District South, and Korangi Town in District Korangi. The project is designed to enhance transportation efficiency and requires careful planning. The portions of the alignment that pass through different districts are highlighted below:

Table 0.7 - Administrative Context of Project Area

S.NO	District	Year of Establishment	Status on YOE	Areas	Alignment	Governed By
1	Keamari	2021	Created	Keamari town	3.7 km	Karachi Metropolitan corporation (KMC)
2	South	2011	Restored	Saddar town & Civil Lines	8 km	Karachi Metropolitan Corporation (KMC)
3	Korangi	2013	Created	Korangi town	0.80 km	Karachi Metropolitan Corporation (KMC)

5.8.2.2 Demography

As primary data could not be collected from Saddar, and Civil lines area secondary sources such as the Pakistan Bureau of Statistics (2023 - Census) have been used to provide essential information about their location, languages, utilities, and other key features.

Table 0.8 - Gender Wise Sub-Division Population

Gender	Saddar	%	Civil lines	%	Keamari	%
Male	85,965	53.94	265,482	55.25	243,063	53.80
Female	73,375	46.04	214,800	44.71	208,688	46.19
Transgender	23	0.01	198	0.04	50	0.01
Total	159,363	100	480,480	100	451,801	100
Source: Pakistan Bureau of Statistic 2023						

The table above presents the gender-wise population distribution for 2023 across three sub-divisions: Saddar, Civil Lines, and Keamari. In all three areas, males slightly outnumber females, while the transgender population remains minimal. Civil Lines has the highest overall population among the three.

Table 0.9 - Sub-Division Wise Area, Gender Ratio, Population Density, & Average HH Size (2023)

Sub Division	Area in SQ.KM	Gender ratio	Population Density per Sq.KM	Average HH Size
Saddar	35	117.16	4,553.23	5.5
Civil Lines	73	123.59	6,581.92	5
Keamari	50	116.47	9,036.02	6.5
Source: Pakistan Bureau of Statistic 2023				

The table provides key demographic and spatial indicators for Saddar, Civil Lines, and Keamari sub-divisions in 2023. Keamari has the highest population density and average household size, while Civil Lines covers the largest area. Gender ratios are slightly male-dominated across all three regions.

Table 0.10 - Sub-Division Wise Population by Religion

Sub-Division	Saddar	%	Civil lines	%	Keamari	%
Muslim	139,240	87.37	440,602	91.70	446,133	98.89
Christian	11,407	7.16	11,681	2.43	3,012	0.67
Hindu jati	7,877	4.94	26,139	5.44	1,712	0.38
Qadiani/Ahmadi	103	0.06	171	0.04	22	0.00
Scheduled Castes	29	0.02	85	0.02	3	0.00
Sikh	78	0.05	91	0.02	61	0.01
Parsi	501	0.31	126	0.03	2	0.00
Others	128	0.08	1,585	0.33	202	0.04
Total	159,363	100	480,480	100	451,147	100
Source: Pakistan Bureau of Statistic 2023						

The table shows the religious composition of Saddar, Civil Lines, and Keamari sub-divisions in 2023. Muslims form the overwhelming majority in all areas, especially in Keamari (98.89%). Saddar has the most religious diversity, including notable Christian, Hindu Jati, and Parsi populations.

5.8.2.3 Education

Several schools are located within the Area of Influence of the project area. Among the educational institutions in the area is ABSA College for the Deaf, located on Main Korangi Road, offering education from pre-primary to secondary and college levels, with an enrolment of 334 students.

HHS School, providing education from Nursery to O Levels, is situated directly under the corridor on Khayaban-e-Bedil Road. Cedar School, offering education from primary to A1 and A2 levels, is located under the corridor in Clifton Block 2. Nixor College, located in Clifton Block 1 under the corridor, offers both O and A Level education. Similarly, The Indus Academy, also situated under the project corridor on Khayaban-e-Bedil Road, provides O and A Level education.

Table 0.11 - Sub-Division Wise Literacy Rate | Population 10 years and above

Sub Division	Population & Literacy	Total	Male	Female	Transgender
Saddar	Population>=10	130,295	70,939	59,333	23
	Literate >=10	115,386	63,745	51,634	7
	Literate %	88.56	89.86	87.02	30.43
Civil Lines	Population>=10	392,734	219,634	172,902	198
	Literate >=10	332,845	189,852	142,894	99
	Literate %	84.75	86.44	82.64	50
Keamari	Population>=10	331,520	180,205	151,265	50
	Literate >=10	184,365	110,370	73,985	10
	Literate %	55.61	61.25	48.91	20
Source: Pakistan Bureau of Statistic 2023					

5.8.2.4 Health

The Health Facilities that fall within the Area of Influence of the project are defined here:

Table 0.12 - Health Facilities within AoI of Project

S.NO	Hospitals/Clinics	Type	District/Area
1	Ziauddin Hospital	Private	South, civil lines
2	Altamash Institute of Dental Medicine	Private	South, civil lines
3	Pak International Hospital	Private	South, civil lines
4	Qamar Ul Islam Hospital	Private	South, civil lines
5	Naseem Children Hospital	Private	South, civil lines

6 Anticipated Impacts & Mitigation Measures

6.1 Introduction

This chapter outlines the findings from the assessment of potential environmental and socio-economic impacts of the project and proposes appropriate mitigation measures. It includes the identification, analysis, prediction, significance, and characteristics of the impacts, as well as the proposed measures to prevent unacceptable adverse effects by incorporating necessary project modifications.

The chapter is a crucial component of the Environmental & Social Impact Assessment (ESIA), highlighting all significant impacts that may arise during the design, construction, and operation phases of the project. It also evaluates the environmental and social aspects identified through stakeholder consultations and the screening process, assessing their severity and recommending mitigation strategies based on these assessments. Additionally, residual impacts that may persist even after the implementation of mitigation measures are identified through professional judgment. The project proponent will adopt these measures to reduce, minimize, and compensate for negative impacts to the greatest extent possible.

6.2 Methodology for Impact Evaluation

The methodology adopted for the evaluation of the impacts included the following assessment tools, (i) project impact evaluation matrix and (ii) overlays. These tools were used to identify the significance and magnitude of the impact as well as the nature, reversibility, extent etc.

Project Impact Evaluation Matrix

The Impact Evaluation Matrix was developed by placing project activities along one axis (i.e. Y-axis), and on the other axis (i.e. X-axis) the different environmental parameters likely to be affected by the proposed project actions grouped into categories i.e. physical, ecological and socio-economic environment. For the impact assessment, project impact evaluation matrix was used by dividing the project action into different phases (design/pre-construction, construction and operational phases).

Overlays

In order to identify spatial based impacts, overlays were used. An overlay is based on a set of transparent maps, each of which represents the spatial distribution of an environmental characteristic (for example, land requirement, accessibility, etc.). Information for an array of variables such as land use, infrastructure, vegetation etc. was collected for the standard geographical units within the project's CoI, recorded on a series of maps, typically one for each variable. These maps were overlaid to produce a composite map. The resulting composite maps characterize the project area's land use, physical, social, ecological and other relevant parameters related to proposed intervention. The overlays maps used in this ESIA study for the preliminary quantification of the impacts specifically related to landuse, siting impacts, structure quantification, crossings, which were verified and validate through field investigation.

6.3 Notion of Significance for Impact Evaluation Matrix

The term “Environmental and Social Impact” or simply “Impact” covers the negative, adverse or harmful as well as positive, desirable or beneficial impacts of the project on environmental settings. Prediction of impacts of the proposed activity is based on factual data; however, the significance of these impacts involves a value judgment technique. The nature of the impacts may be categorized in terms of:

Direction - Positive or Negative
Duration - Long or Short Term
Effect - Direct or Indirect
Extent - Wide or Local

Impact significance depends on both the nature of the impact and on the sensitivity of the receptor. The more sensitive the receptor the greater will be the significance of impact from that proposed activity. For this ESIA, activities and nature of impact are combined with the sensitivity of the receptor to evaluate the significance of the impact. The significance of impact is characterized as very low, low, moderate, high and very high. Environmental issues having “moderate”, “high” and “very high” significance are provided with mitigation measures.

6.4 Impact Magnitude

The potential impacts of the subprojects have been categorized as major, moderate, minor or nominal based on consideration of the parameters such as i) duration of the effect; ii) 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 subprojects has been identified according to the categories outlined in Table 6.1.

Table 6.1: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Minimal
Duration of potential impact	Long term (beyond the project life)	Medium Term Lifespan of the project (within the project life span)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond next project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Environmental or social parameter needs a year or so with some responsesto come back to baseline	Baseline returns naturally or with limited response within a few months	Baseline remains constant
Legal standards and	Breaches national	Complies with limits given in national	Meets minimum	Not applicable

Parameter	Major	Moderate	Minor	Minimal
established professional criteria	standards and or international guidelines/obligations	standards but violates international lender guidelines in one or more parameters	national standard limits or international guidelines	
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

6.5 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. For each potential impact of the subprojects, sensitivity of the related receptor was determined using the criteria outlined in Table 6.2.

Table 6.2: Criteria for Determining Sensitivity

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

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the impact significance criteria matrix as shown below. Most of the potential impacts can be mitigated by implementation of various types of mitigation measures; however, some residual environmental impacts may remain after mitigation.

Magnitude of Impact	Sensitivity of Receptors			
	Very Sever (4)	Severe (3)	Mild (2)	Low (1)
Major (4)	16	12	8	4
Moderate (3)	12	9	6	3
Minor (2)	8	6	4	2
Minimal (1)	4	3	2	1

Score	Impact Significance
1	Negligible
2 – 4	Low
5 – 8	Medium
9 – 12	Substantial
> 12	High

6.6 Design Phase: Impacts and Mitigation Measures

Impacts during the design phase mainly relate to:

- Land acquisition, resettlement, and necessary approvals;
- Sensitive receptors (e.g., settlements, schools, protected areas) and existing infrastructure (e.g., roads, railways);
- Physical cultural resources

The mitigation measures focus on the careful selection of the expressway's right-of-way (ROW) to minimize or avoid impacts.

6.6.1 Land Acquisition, Resettlement, & Permitting

The expressway is situated and will pass through major existing roads of the city, hence, there is no land acquisition involved in the project. Similarly, given that the expressway will travel along the median of main roads, no removal/ destruction of residential/ commercial structures is involved that may involve any potential involuntary resettlement.

Furthermore, any relevant NOCs that the project requires from different departments for the execution of the project have been obtained and are attached to this report as an annex.

Mitigation Measures

No mitigation measures are required as there is no land acquisition and resettlement.

6.6.2 Physical, Cultural, & Religious Resources

The alignment for the expressway will pass through the median of already existing roads and areas, hence, there is no perceieved impact on any cultural resources or buildings.

Mitigation Measures

A Chance Find Procedures has been developed nevertheless and attached to this report, should there be any sort of cultural artefact or item discovered during construction works.

Alongside this, detailed consultations have been carried out with the Culture, Tourism, Antiquities, & Archives Department, Government of Sindh, regarding the presence of any such receptors along the RoW, where their feedback in the form of a letter is attached to the report as an annex.

6.6.3 Project Siting & Sensitive Receptors

The project will pass through major arteries of the city, traversing through residential and commercial areas, despit the optimization of the route to the extent possible. This will be a significant, irreversible impact.

Furthermore, given that the alignment passes through the city, there are a number of sensitive receptors that have been identified adjacent to the lenth of the corridor. These identified sensitive receptors all fall within the Area of Influence of the alignment, where they are highlighted below:

Table 6.3 - Sensitive Receptors along AOI

S. No.	Name	Location
1.	Naseem Chidlren's Hospital	Main Korangi Road, DHA Phase 1
2.	Al-Rehman Masjid	

3.	Pak International Hospital	
4.	Absa College for the Deaf	
5.	Defence Library	Sunset Boulevard
6.	Sahara Old Age Home	Sunset Boulevard
7.	Altamash Institute of Dental Medicine	Sunset Boulevard – Punjab Colony
8.	CBC Fire Station	Punjab Colony
9.	Chipa Welfare Center	Punjab Colony
10.	Edhi Centre	Khayaban-e-Jami
11.	ACF Animal Shelter	Khayaban-e-Jami
12.	Jamia Masjid Farooq-e-Azam	Boat Basin
13.	Ziauddin Hospital	Clifton Block 2
14.	College for Speech & Language	Clifton Block 1
15.	Happy Home School	
16.	Indus Academy	
17.	Nixor College	

The locations of these receptors with respect to the alignment is highlighted below:

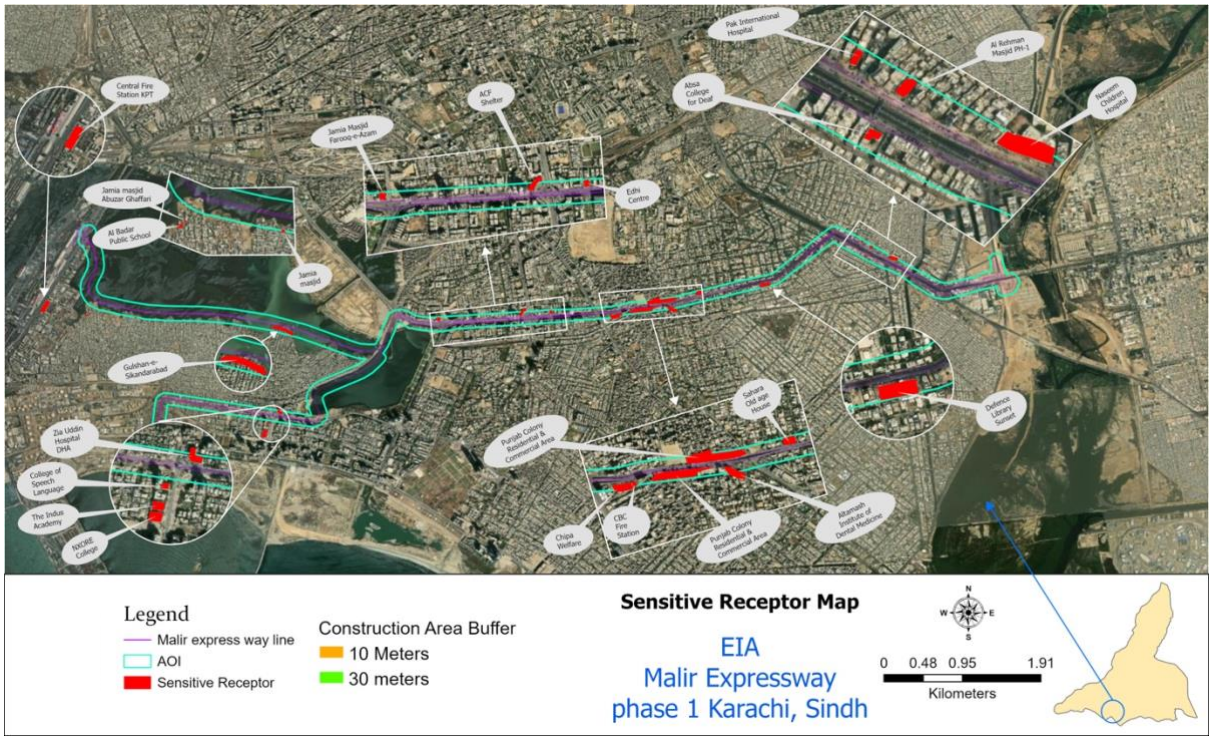


Figure 6.1 - Locations of Sensitive Receptors

These receptors and their sensitivity have been identified on the basis of their nature, the sort of people that can be found or come to these areas, and who may be more susceptible to the adverse impacts associated with the development.

Mitigation Measures

Whilst the route of the project has already been optimized and finalized in line with the different options available, the following mitigation measures must be adopted to minimize the severity of impacts faced by these sensitive receptors:

- Carry out awareness raising and information disclosure sessions prior to the initiation of any new section of the project on the proposed interventions including any closures and diversions.
- Carry out stakeholder consultations with these receptors once again prior to the development of the project to accuratley understand their needs (e.g. mobility, noise sensitivity, dust

sensitivity, etc.) and aim to incorporate measures highlighted into project design and implementation
- Develop a detailed traffic management plan in consultation with the local traffic police and in line with lessons learnt from similar traffic management plans developed and implementd in different parts of the city. Any closures/ diversions to be implemented should be developed in consultation with the locals, and implemented following disclosure to them.
- Ensure that the GRM of the project is disclosed in the area and prominently highlighted to allow for any grievances by affected persons to be highlighted and shared with the project developer. Subsequently, any such grievances raised to be addressed as required.

6.6.4 Renting/ Leasing Land

Land may be leased/ rented by the contractors for the development of construction camps, storage areas, workshops, equipment parking, and washing areas.

Mitigation Measures

- Land for this may be directly rented from private landowners by contractors. The provisions of the Land Acquisition Act (LAA), 1894 will not be involved as the acquisition of the land will be temporary and will be covered by short-term lease agreements between the landowners and Contractor. Rental terms should be negotiated to the satisfaction of the concerned landowners and the agreement should be in local language to make the process clear.
- As far as possible, waste/barren land i.e. areas not under agricultural or residential use and natural areas located at high elevation should be used for setting up the contractor camps.

6.6.5 Flora

The flora that will be disturbed by the project can be divided into 2 main categories:

1. Trees along the alignment that will be disrupted during the overhead bridge works
2. Mangroves that will be disrupted during the earthen embankment works in the Chinna Creek area (not all the mangroves in the area, but those along the periphery of the area where project interventions are proposed)

For the former, given that the project will travel along the median of major arteries of the city, where transmission lines and other such infrastructure exists, major impacts in terms of tree removals are not anticipated.

For the latter, a detailed mangrove assessment report has been carried out, which is attached to the annex, which highlights that approximately 423 mangroves will be impacted from the project works.

Mitigation Measures

For any terrestrial flora that are identified as requiring removal during the execution works, the following mitigation measures are proposed:

- Utmost effort shall be made to save as many trees as possible and minimize the loss of vegetation.
- As a principle, ten trees shall be planted in place of one tree cut down to compensate for the trees removed.

- The client shall implement the program with the help of Forest Department and with the consultation of concerned consultant ecologist.
- The Forest Department and agriculture department shall involve local communities for carrying out plantation.
- The indigenous trees most suited to the tract should be re-planted.

For the mangroves anticipated to be impacted under the project, the following mitigation measures have been proposed:

- As part of the mangrove assessment carried out, consultations were also carried out with the Forest Department following which compensation measures have been proposed to offset the impacts arising from mangrove removal (both in terms of physical removal and the ecosystem services that the mangroves provide in the area)

6.6.6 Relocation of Utilities

Utilities along the RoW of the corridor will be impacted from the project's development, including electrical ducts, water supply pipelines, sewerage networks, and fiber optic communication lines. A pictorial representation of the utilities along the corridor is also provided below:

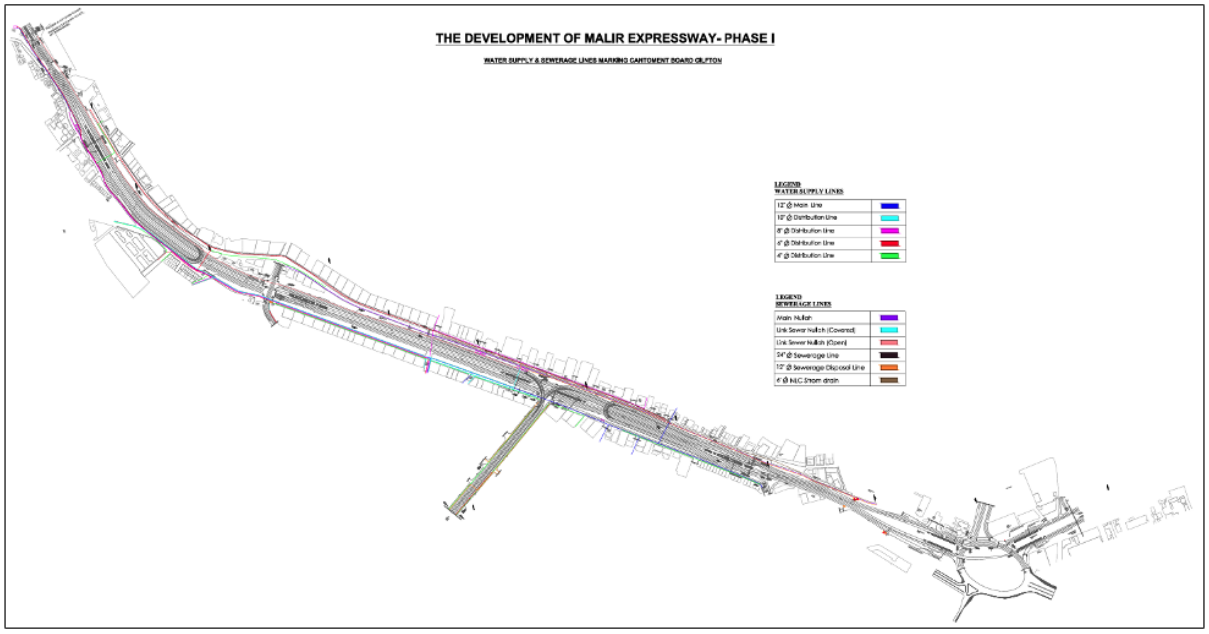


Figure 6.2 - Utility Layout Plan for the Project

Mitigation Measures

- Prior to commencement of construction works, any and all utilities will be shifted/ relocated to allow for continuous and uninterrupted supply to relevant persons downstream.
- Proponent to maintain constant communication with the utility agencies and to provide them with anything needed for this utility shifting.
- Proper compensation and restoration mechanism of public utilities will be considered prior to project development;
- The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned departments;

- Strengthening of utilities, wherever required;
- Timely public notification of unexpected disruption of services; and
- The Contractor shall in no instance excavate around or over live buried electrical cable or pressurized gas lines during the construction or allow such to be suspended across open excavations in a manner that, in the opinion of the Resident Engineer, threatens public or worker safety. Neither shall water lines be left suspended and unsupported across open excavations.

6.6.7 Resource Conservation

Resources involved in the construction of proposed Project would include water, fuel, and construction materials.

Excessive water consumption by the construction staff may stress water resources in the Project Area and in certain cases may disturb the existing water supplies in the Project Area. Construction material to be used for construction includes coarse aggregates, fine aggregates, asphalt, cement, lining material, earthworks, reinforced and structural steel etc. Almost all the materials to be used in the construction of proposed Project are non-renewable and therefore their efficient use is necessary for impact minimization.

Accordingly, the mitigation measures proposed for the project in line with the impacts identified above are highligted below:

Mitigation Measures

- Use water bowsers for construction works and treated water for drinking purpose;
- Plan for the provision/purchase of adequate insulation to reduce heat loss through batching plants;
- Reduction of wastage of water through training of workers involved in water use;
- Reuse of construction waste materials to be adopted wherever possible;
- Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment;
- Equipment and machinery should be well maintained;
- The equipment and machinery should be turned off when not in use;
- Regularly monitor CO and CO2 content of the flue gases to verify that combustion systems are using practical excess air volumes; and
- A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater, and solid waste volumes to the lowest levels.

6.6.8 GHG Emissions

Construction of the proposed project will require significant quantities of diesel for operation of generators, cranes, material-handling equipment, girder transportation and ancillary vehicles.

Fuel will be used to operate construction machinery. Efficient use of energy resources is important to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is important. A quantification of the overall fuel to be consumed under the project's development is also carried out and provided below:

Table 6.4 - Anticipated Diesel Consumption Quantities under Project

Category	Litres (total)

Generators - yard electrical power	2,671,500
Cranes & material handling	979,056
Girder transport - trollers (to site)	34,104
Ancillary / site service vehicles	117,000
TOTAL DIESEL CONSUMPTION	**3,801,660**

Based on the current construction estimates, approximately 3.80 million litres of diesel are expected to be consumed over the construction period. Application of a representative direct diesel combustion emission factor of approximately 2.51 kg CO_2e per litre results in estimated construction-related emissions of approximately 9,540 tonnes CO_2 equivalent (tCO_2e).

Diesel generators used for yard electrical power constitute the principal source, accounting for approximately 6,705 tCO_2e, or around 70% of the total fuel-related GHG emissions. Cranes and material-handling equipment contribute approximately 2,457 tCO_2e, while girder transportation and ancillary vehicles collectively contribute approximately 380 tCO_2e.

Accordingly, the mitigation measures proposed for the project in line with the impacts identified above are highligted below:

Mitigation Measures

To mitigate greenhouse gas emissions associated with the estimated 3.80 million litres of diesel consumption during construction, the project should adopt a clear avoidance–reduction–compensation hierarchy.

Priority should be given to reducing diesel use at source, particularly from generators, which represent the largest share of fuel consumption, through temporary grid connections where feasible, use of solar or hybrid solar-battery systems for site offices and low-load applications, correct generator sizing, automatic shutdown during low-demand periods, and strict controls on unnecessary idling.

Cranes, material-handling equipment and site vehicles should be modern, fuel-efficient and regularly maintained, with engine-idling restrictions, preventive maintenance, fuel-use monitoring and equipment-efficiency targets incorporated into contractor requirements.

Construction logistics should be optimized through coordinated delivery schedules, maximized vehicle load factors, reduced empty return trips, shorter haul routes, strategic siting of storage and casting areas, and consolidation of material movements.

Where technically and commercially feasible, lower-carbon fuels may also be considered, subject to demonstrated lifecycle benefits and sustainable sourcing. The contractor should maintain a monthly fuel and GHG inventory and target a measurable reduction in forecast diesel consumption, preferably of at least 15% against the current baseline.

Residual emissions that cannot reasonably be avoided should be addressed through compensatory measures such as tree plantations. Any carbon compensation programme should be additional to legally required ecological restoration and should be supported by transparent monitoring, verification and reporting of both avoided and residual emissions.

6.6.9 Seismicity

The Project Area is in Seismic Zone 2B, where 2B (upper limit of moderate damage) represents peak horizontal ground acceleration from 0.16 to 0.24 g. In this Zone, designing of various types

of structures should be done based on Peak Ground Acceleration (PGA). A low to moderate intensity earthquake impacting the Project site can adversely impact the development if adequate measures are not incorporated in design. This impact can be categorized as direct, medium, site-specific, short term, temporary, medium probability and reversible.

Mitigation Measures

The proposed road and the associated structures should be designed and constructed as per Seismic Building Code of Pakistan 2007 (SBC-07) to comply with minimum requirements for seismic safety of structures.

6.6.10 Climate Resilience

The proposed Karachi Port–Qayyumabad Expressway is located within one of Pakistan's most climate-vulnerable urban environments. Karachi has experienced a noticeable increase in the frequency and intensity of extreme climatic events, including prolonged heatwaves, short-duration high-intensity rainfall, urban flooding, coastal inundation, and sea-level rise. These hazards are expected to intensify over the operational life of the project due to climate change and therefore present significant risks to the long-term safety, functionality and durability of the proposed infrastructure. Given the project's location adjacent to Chinna Creek and the Arabian Sea, climate resilience has been integrated as a fundamental design consideration to ensure that the expressway remains operational under both current and projected future climatic conditions.

Temperature and Heat Stress

Karachi experiences some of the highest summer temperatures in Pakistan, with daytime temperatures frequently exceeding **40–45°C** and increasingly frequent heatwave events. Elevated temperatures can accelerate pavement deterioration, reduce the service life of expansion joints and bridge bearings, increase thermal stresses in structural components and adversely affect construction workers through heat stress and dehydration.

Reinforced concrete structures, high-performance concrete mixes, adequate expansion joint capacities and corrosion-resistant materials have been adopted to improve long-term durability. During construction, contractors should implement heat stress management programmes that include work scheduling during cooler periods of the day, provision of shaded rest areas, adequate drinking water, worker acclimatization programmes and emergency response procedures for heat-related illnesses.

Extreme Rainfall and Urban Flooding

Extreme rainfall and urban flooding represent the most significant climate-related hazards affecting Karachi's transport infrastructure. The city has experienced repeated flooding during recent monsoon seasons due to the combined effects of high-intensity rainfall, inadequate stormwater drainage, rapid urbanization and obstruction of natural drainage channels. Climate projections indicate that while annual rainfall may remain variable, the intensity of extreme rainfall events is likely to increase, placing additional pressure on existing drainage infrastructure.

The proposed project traverses several low-lying urban areas adjacent to Chinna Creek where flood susceptibility is already high. Consequently, the project drainage system has been designed using future climate projections and should accommodate at least the **1-in-100-year design storm**, together with an appropriate climate change allowance. Cross-drainage structures should be designed to maintain natural drainage pathways, while stormwater collection systems should include sufficient capacity to rapidly convey runoff during extreme rainfall events. Regular maintenance of drainage infrastructure, including desilting of culverts and catch pits before the monsoon season, will be essential to maintaining long-term hydraulic performance.

Sea-Level Rise and Coastal Flooding

The proximity of the proposed alignment to Chinna Creek and Karachi Harbour exposes parts of the project to future risks associated with sea-level rise, tidal flooding and storm surge events. Relative sea level along Pakistan's coastline is expected to continue rising throughout the design life of the expressway, increasing the frequency of tidal inundation and reducing the effectiveness of gravity drainage systems.

To enhance long-term resilience, finished road levels, bridge soffit elevations and drainage outfalls should be established using projected future tidal levels rather than present-day conditions. Drainage outfalls located within tidal influence should be fitted with flap gates or non-return valves to prevent tidal backflow during high tides and storm surges. Embankments adjacent to the creek should incorporate erosion protection measures such as riprap or articulated concrete blocks to minimise erosion during extreme events, while sufficient structural freeboard should be maintained above projected future flood levels.

Hydrological Resilience

The project includes embankment and bridge sections located adjacent to or crossing tidal water bodies. Any alteration to tidal exchange or natural drainage pathways could increase flood risk, modify sediment transport processes and reduce the ecological functioning of Chinna Creek. Climate resilience therefore depends not only on protecting the expressway itself, but also on ensuring that the project does not increase the vulnerability of surrounding communities and ecosystems.

Wind and Extreme Weather Events

Although tropical cyclones affecting Karachi remain relatively infrequent, recent years have seen an increase in the intensity of cyclonic systems within the Arabian Sea. Strong winds associated with severe storms may affect construction activities, lifting operations and temporary works.

The contractor should therefore prepare and implement severe weather response procedures, including defined wind-speed thresholds for crane operations, inspection of temporary structures following storm events, emergency evacuation procedures and rapid reinstatement plans following extreme weather events.

Operational Resilience

Maintaining operational reliability during extreme climatic events is a key objective of the project. During operation, resilience should be supported through routine inspection and maintenance of bridges, drainage systems, embankments and protective structures. Drainage infrastructure should be inspected and cleared before each monsoon season, while structural inspections should be undertaken following significant storm or flood events. Intelligent transport systems, emergency response protocols and temporary traffic management plans should be developed to safely manage traffic during periods of severe weather, flooding or other climate-related emergencies.

6.7 Construction Phase: Impacts and Mitigation Measures

6.7.1 Traffic Management

With the project passing through major arteries of the city, there will be considerable impact on the traffic of the area during development works.

Mitigation Measures

- Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the night-time to reduce traffic load and inconvenience to the local population;
- Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads;
- Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work; and
- Proper sign boards will be provided for smooth flow of traffic.
- Period of construction and area / location of construction site shall be informed to public in general and specifically to residents.
- Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays.
- Any complain launched by community member will be responded and appropriate action will be taken to avoid it in future.

A guide Traffic Management Plan (TMP) has been proposed in the annex, however, the contractor may take guidance from this TMP and prepare a detailed site specific TMP which will be implemented to avoid traffic accidents, jams/public inconvenience in the Project Area. This plan will be reviewed and approved by KDA prior to implementation.

6.7.2 Solid Waste Management

Typical solid waste generated during construction include waste concrete, steel scrap, wooden scaffolding, empty cement bags, excavated soil, wood remains etc. This waste has the potential to cause negative impact on the surroundings if not properly managed and disposed of. It may block nearby natural drainage channels that can ultimately cause localized flooding during monsoon season. Random storage of this waste may be injurious to the workers at the site as well. Windblown debris is a nuisance to the nearby settlements. Poor waste management practices would result in short term and long-term negative impacts on the aesthetics of the surrounding.

Mitigation Measures

- A Comprehensive Waste Management Plan for Construction phase should be developed;
- Construction sites should be equipped with temporary refuse bins, and construction wastes should be collected on a daily basis and contained in a temporary designated waste storage area on each site;
- Any hazardous waste should be separated and stored in areas clearly designated and labeled, and disposal in environmentally friendly manner;
- All type of wastes should be routinely collected from the designated area and disposed at designated waste disposal site(s); and
- Upon completion of activities at a construction site all solid wastes should be completely removed and the site should be re-contoured or prepared for natural re-vegetation.

Waste Segregation

- All hazardous waste if found shall be segregated from nonhazardous wastes at the point of generation of waste. During construction phase, suitable containers with following color coding shall be kept to collect and segregate common wastes at all facilities:

Waste material	Color code
Concrete/ Campsite Debris	Blue
Metal	Green
Plastic	White
Oily Rags	Black

Used Oil	Red
Rubbish/Trash	Yellow

Recycling

Recycling and reuse minimize the quantity of waste requiring disposal. Some of the wastes can be reused within the construction site while others can only be recycled. There is a great recycling potential for few of these wastes in the recycling market. Waste shall be sold to the third-party contractors/ companies, who have proper recycling facilities.

CC will suggest/recommend recycling of the paper, glass, plastic wastes in their respective processing units. Iron/steel waste would be sent to re-rolling mills.

Table 6.5 - Waste Management Options (Different Categories)

S#	Waste Type	Category	Disposal Options
1.	Septic Tank Sludge	Non-hazardous	Disposed in Landfill site.
2.	Excavation Material	Non-hazardous	Reuse for backfill
3.	Construction debris including Scrap	Non-hazardous	Recycle, reuse or sell to third party contractor.
4.	Metals	Non-hazardous	Store cuttings in designated area for reuse. Remove surplus materials and use them at other sites, where feasible.
5.	Concrete	Non-hazardous	Store unused concrete blocks for later reuse. Recycle, reuse or sell to third party contractor.
6.	Bricks	Non-hazardous	Reuse for footings and broken bricks.
7.	Plastic and vinyl	Non-hazardous	Recycle, reuse or sell to third party contractor.
8.	Corrugated Cardboard	Non-hazardous	Recycle, reuse or sell to third party contractor.
9.	Woods	Non-hazardous	Recycle
10.	Empty Drums and Containers	Non-hazardous	Disposed them off through recycler.
11.	Oil waste (fuel oil, transformer oil, switchgear oil)	Hazardous	Handled and disposed through incineration via EPA certified waste contractor hired by CC.
12.	PV modules	Hazardous	Send back to the supplier/equipment manufacturer for recycling/disposal.
13.	Sanitary Wastewater	Non-hazardous	Treat wastewater in septic tanks before disposal.
14.	Trash	Non-hazardous	1. Segregate glass, metal, plastic from trash. 2. Recycle all recyclable items. 3. Designed landfill.

6.7.3 Impact on Air Quality

6.7.3.1 Dust Emissions

Construction activities that may lead to dust generation include excavation; transportation and tipping of cut materials; handling and storage of aggregates in concrete plants; concrete batching;

site leveling and clearing of vegetation; and associated activities. The quantity of dust that may generate on a particular day of construction phase will depend on the magnitude and nature of activity and the atmospheric conditions prevailing on that day.

Mitigation Measures

Different options are available to control dust and exhaust pollution. They are listed below:

- The exposure of construction workers to dust should be minimized by provision of dust masks and mandating the workers to wear them.

Dust Reduction Measures

- Water should be sprinkled daily to wet all the expose surfaces.
- Use of water suppression for control of loose materials on paved or unpaved internal road surfaces. Oil and oil by-products are not recommended method to control dust[27].
- Truck loads should be covered with tarpaulin.
- Construction site, including soil and material piles at the site, should be adequately barricaded to avoid material escape, generation of dust.
- Ready-mix can be used in the stages of the project wherever and whenever required and deemed appropriate.
- Careful handling and working under moist conditions and monsoon season will be avoided as much as possible.

6.7.3.2 Exhaust Emissions

Major sources of exhaust emissions are standby diesel generators, material transport vehicles and emissions from construction machinery/earth moving equipment. Major exhaust emissions of concern are CO, SOx, NOx and Particulates. These emissions are injurious to human health in high concentration and can also cause vegetation damage by clogging the photosynthesis process in plants.

Mitigation Measures

- Construction machinery, vehicles should be properly tuned and kept in good working condition, minimizing exhaust and vehicular emissions.
- Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance of SEQS;
- Excessive engine idling will be discouraged and machinery causing excessive pollution (i.e., visible smoke/soot) will be banned from sites;
- Standby generators for power supply will be kept away from pathways and will be placed at locations where probabilities of human intervention are limited.

6.7.4 Noise Pollution

During the construction phase noise will be generated from the operation of heavy machinery and haulage of construction materials to and around construction sites and construction activities including concrete mixing, excavation, backup power generators for supply of electricity; use of pressure horn etc. These construction activities are expected to produce noise levels in the range of 80 – 95 dB and may cause discomfort to local residents.

[27] WBG EHS Guidelines

Table 6.6 - Typical Noise Levels of Construction Equipment

Clearing		**Structure Construction**	
Bulldozer	80	Crane	75-77
Front end loader	72-84	Welding generator	71-82
Jack hammer	81-98	Concrete mixer	74-88
Crane with ball	75-87	Concrete pump	81-84
		Concrete vibrator	76
Excavation and Earth Moving		Air compressor	74-87
Bulldozer	80	Pneumatic tools	81-98
Backhoe	72-93	Bulldozer	80
Front end loader	72-84	Cement and dump trucks	83-94
Dump truck	83-94	Front end loader	72-84
Jack hammer	81-98	Dump truck	83-94
Scraper	80-93	Paver	86-88
Grading and Compaction		**Landscaping and clean-up**	
Grader	80-93	Bulldozer	80
Roller	73-75	Backhoe	72-93
		Truck	83-94
Paving		Front and end loader	72-84
Paver	86-88	Dump truck	83-94
Truck	83-94	Paver	86-88
Tamper	74-77	Dump truck	83-94
Source: U.S. Environmental Protection Agency, Noise from Construction Equipment and Operations. Building Equipment and Home Appliance. NJID. December 31, 1971			

Mitigation Measures

- Machinery operation and high noise activities should be carefully planned and scheduled;
- To the extent practical, batching plants and construction areas should not be located within 500 meters of a settlement;
- Where that is not possible, high noise activities should cease between 22:00 and 06:00 hrs (Night time hours given in SEQS for Noise) at any construction site within 500 meters of a settlement, or if noise complaints are received from settlement residents.
- Vehicles and machinery will be equipped with silencers. Contractors will be required to fit noise shields on high noise construction machinery;
- Site labor working in high noise area such as where noise level exceeds 80 dB (A), will wear earplugs;
- Occupational health, safety and environmental procedures and Environmental management plan for proposed project would be followed.

6.7.5 Vibration Impacts

Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods used. The operation of construction equipment causes vibrations that spread through the ground and diminish in strength with travelled distance. During earthworks and excavations heavy machinery such as bulldozers, excavators, and loaders used for earthmoving can generate significant vibrations and it can have impact on nearby building structure. The predicted ground vibrations at various distances are shown in Table 6.6 for typical equipment that may be used during proposed construction.

Table 6.7 - Typical Vibration Levels at Distance (Peak mm/s)

Plant Item	Peak Vibration (mm/s), Distance from Source			
	10 m	20 m	50 m	100 m
Roller	7.0 to 8.0	3.8	1.5	0.8

Compactor	5.0 to 7.0	3.0	1.2	0.6
Dozer	2.5 to 4.0	1.6	0.7	0.3
Backhoe	1.0	0.5	0.2	0.1
Source: Environmental Noise Management Manual-Roads & Traffic Authority, NSW, Australia, 2001				

Based on the predicted peak vibration levels described in above table, it is expected that vibration would be barely perceptible at sensitive receiver locations within over 50m for most construction activities. According to British Standards of Noise and Vibration, humans are particularly sensitive to vibration with the threshold of perception typically being in the range of 0.14 to 0.3 mm/sec Peak Particle Velocity (PPV) and levels above this may cause annoyance. However, significantly higher levels than this can be tolerated for single short-term events and do not cause annoyance or disturbance to humans.

Mitigation Measures

- Vibration measurement will be carried out during construction phase by the contractor near the settlements in the AOI.
- Timing of the construction works to be conducted during the recommended operational hours, to reduce vibration levels in the AOI.
- The vibration from major construction activities such as excavation, compacting, drilling, etc. are considered intermittent and short-term, and likely to be tolerated if prior warning is given to potentially affected residents as and where they may be encountered along the route.
- The equipment operators to be made aware by the contractor of potential vibration issues problems and of techniques to minimize vibration effects during construction works.

6.7.6 Community Health & Safety

Community health and safety issues during the construction of proposed project may include dust, noise, and vibration from construction vehicle transit, and communicable disease associated with the influx of temporary construction labor. Significant community health and safety issues associated with road projects may also include:

- Pedestrian safety
- Traffic safety
- Emergency preparedness

The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents, etc. The proposed Project will also have potential of air (dust pollution), noise and vibration impacts on nearby community. Labor with different transmittable diseases (HIV/AIDS, COVID-19, etc.) may cause spread of those diseases in the residents of above-mentioned settlements along the project. The construction areas located near the residential/settlements may cause accident for the people moving near to these areas. Considering these consequences, this impact can be categorized as direct, moderate, site-specific, medium term, temporary, medium probability and irreversible.

Mitigation Measures

- Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, specifically those related to pedestrian facilities or bikeways;
- Setting of speed limits appropriate to the road and traffic conditions; and

- An emergency preparedness and response plan in coordination with the local emergency responders (e.g. Rescue 1299) to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills.
- Instruct foremen to strictly enforce the keeping out of non-working persons, particularly children, off work sites;
- Timely public notification on planned construction works;
- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links;
- Reducing the impacts of vector borne diseases on long-term health effect of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which include Prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to residential areas and by eliminating any unusable impounding of water;
- The communicable diseases of most concern during construction phase, such as HIV/AIDS, COVID-19 will be prevented by successful initiatives typically involving health awareness; education initiatives; training heath workers in disease treatment; immunization program and providing health services.

6.7.7 Soil Contamination

Construction activities such as clearing of earth, levelling, compaction, carpeting, pavement finishing will affect the existing soil condition in the CoI. During the rain, the eroded soil can mix with stagnant water to transform into slush, which can affect movement of vehicles and machinery and construction work as well as limit the movements of local people.

Heavy metals, oils, other toxic substances and debris from construction traffic and spillage may be absorbed by the soil at construction sites and get carried with runoff water. This process may trigger during the monsoon season when construction is in progress.

Whereas contamination of soil may be caused by oil and chemical spills at asphalt plant sites, workshop areas and equipment washing yards. This impact is, however, of temporary, site specific and low negative in nature.

Mitigation Measures

- All spoils should be disposed of at site designated by SSWMB or concerned department and the site should be restored back to its original conditions. Soils with hazardous waste leaks should be dealt with by SEPA certified contractors;
- Non-bituminous wastes from construction activities should be dumped in approved sites, in line with the legal prescriptions for dumpsites, and covered;
- Soil contamination by asphalt should be minimized by placing all containers in caissons;
- The Contractors will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination;
- Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals;

6.7.8 Occupational Health and Safety

The construction works involving earthworks, excavation, erecting structures, etc. poses an inherent risk of injury to labor from accidents. Poor housekeeping practices may lead to stagnant water as breeding grounds for insect vectors (causing malaria, dengue fever etc.). Hazards from

handling equipment, ergonometric stress, lifting heavy materials etc. may cause injury to the labor. Electrical equipment and substation pose electrocution hazard.

Mitigation Measures

Site-specific labor health and safety hazards are also critical to identify based on job safety analysis or comprehensive hazard or risk assessment. Health and safety management planning should include the adoption of a systematic and structured approach for prevention and control of physical, electrical, chemical, and biological health and safety hazards. Use of PPE should be made mandatory. Only trained and experience crane, forklift, etc. operators should be hired. CC shall ensure that Job Hazard Analysis (JHA) is performed prior to commencing jobs. It shall also be ensured that the JHA is reviewed after the following:

- Whenever work is stopped
- Every time work conditions or the job scope changes
- Persons working the job shall review and acknowledge the JHA by their signature

6.7.8.1 Crane and Lifting Operations

For all Crane & Lifting Operations CC shall ensure full compliance with standard operating procedures. CC shall develop a site-specific pre-lift checklist which includes the following at minimum:

- Crane rigging capacity adequately for load
- Condition of slings
- Rigging condition adequate for load
- Area of swing or travel unobstructed
- Multiple crane use
- Power line approach distance maintained
- Stability and footing
- Taglines and spotters
- Illumination and weather
- Signal operator
- Job hazard analysis and other permits

All lifting and rigging activities shall be supervised and conducted by a competent person or team, CC shall maintain a lifting gear registry for all lifting gear on-site inclusive of a listing of all lifting gear, copies of equipment certificates (manufacturer, safe working load, serial number) and the inspection/recertification frequency.

6.7.8.2 Forklifts and Non-Road Vehicles

CC should ensure forklift and non-road vehicles are fit for purpose and operated according to manufacturer's requirements. Only competent operators are permitted to operate forklifts and non-road vehicles.

At minimum, all forklifts and non-road vehicles shall be equipped with following equipment:

- Seat belts
- Horn
- Emergency Brake
- Wheel chock
- Labeled Controls

- Fire Extinguishers
- First Aid Kit
- Back-up Alarm

6.7.8.3 Scaffolding

CC is responsible to establish periodic inspection, certification and recertification program for scaffold works. Only qualified worker is authorized to erect, inspect and certify scaffold. All scaffolds should have a guardrail system on each open side, up to the access point. It should be equipped with toe boards having suitable access ladder.

6.7.8.4 Over-exertion

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries at construction site.

Mitigation Measures

Recommendations for their prevention and control include:

- Workers will be trained with lifting and materials handling techniques before the construction of the project, including the placement of weight limits above which mechanical assists or two-person lifts are necessary.
- Work site layout will be planned to minimize the need for manual transfer of heavy loads.
- Tools will be selected and work stations would be designed to reduce force requirements and holding times, which promote improved postures, including, where applicable, user adjustable work stations.
- Administrative controls, such as job rotations and rest or stretch breaks will be implemented into the work processes.

6.7.8.5 Slips and Falls

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction site.

Mitigation Measures

Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

- Good house-keeping practices, such as the sorting and placing loose construction materials in established areas, would be implemented.
- Excessive waste debris and liquid spills will be cleaned up regularly.
- Electrical cords and ropes will be located in common areas and marked corridors.
- Slip retardant footwear will be used.

6.7.8.6 Struck By Objects

Construction activities of the project may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities.

Mitigation Measures

Techniques for the prevention and control of these hazards include:

- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap.
- Temporary fall protection measures in scaffolds and out edges of elevated work surfaces would be used, such as hand rails and toe boards to prevent materials from being dislodged.
- Appropriate PPE such as safety glasses with side shields, face shields, hard hats, and safety shoes, would be worn.

6.7.8.7 Moving Machinery

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise.

Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving.

Mitigation Measures

Techniques for the prevention and control of these impacts include:

- The location of vehicle traffic, machine operation, walking areas, and controlling vehicle traffic will be planned and segregated through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic.
- The visibility of personnel will be ensured through the use of high visibility vests when working in or walking through heavy equipment operating areas as well as training of workers to verify eye contact with equipment operators before approaching the operating vehicle.
- Inspected and well-maintained lifting devices will be used that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

6.7.8.8 Electrocution Hazard

High voltage transmission lines may pose electrocution hazard for unauthorized person(s) attempting to climb the tower(s). An electrical hazard can be defined as a serious workplace hazard that exposes workers to any of the following:

- Burns
- Electrocution
- Shock
- Arc flash or arc blast
- Fire
- Explosions

List of potential electrical hazard at site is as follows;

- Improper grounding
- Exposed electrical parts
- Inadequate wiring
- Damaged insulation
- Overload circuits

- Damaged tools and equipment

Mitigation Measures

Detailed electrocution prevention measures are attached in Annex-E

- Use of ground-fault circuit interrupters
- Periodic inspection of extension cords and portable tools
- Use power tools and equipment as designed
- Proper lockout/tagout procedures will be followed
- Safety signs for electrical hazard will be placed
- Ensuring proper guarding of electrical equipment and facilities such as substation and switchgear

6.7.8.9 Other Site Hazards

- Construction of site may pose a risk of exposure to dust, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms.

Mitigation Measures

- Only authorized personal should be allowed at the construction site
- Identify and minimize, so far as reasonably practicable, the causes of potential hazards to workers, including communicable diseases such as HIV/AIDs and vector borne diseases;
- Avoid stagnation of water and initiate drainage/cleanup of stagnant water;
- Provide for the provision of appropriately stocked first-aid equipment at work sites;
- Provide for appropriate personal protective equipment (PPE) to minimize risks, such as but not limited to appropriate outerwear, boots and gloves; safety helmets;
- Provide training for workers for the use of PPE;
- WB Group's Environment, Health and Safety (EHS) Guidelines (attached at the end of this document) will be implemented;
- No bonded and child labor will be permitted at site;
- Major labor laws will be followed e.g., Minimum Wage, Harassment of women in the work place Hours of work, Overtime Payment.
- Also, laborers will be trained on appropriate interaction with local people especially women;
- Include procedures for documenting and reporting accidents, diseases, and incidents; and
- All safety precautions will be taken to address safety hazards for the nearby community. These precautions may include safety/warning signage, safety barrier around the construction site.
- Lighting provided for labor during night time work should be adequate.
- CC will include appropriate clauses to protect environment and public health. The sub-project ESMPs will be included in the bidding document;

Summary of Recommended Personal Protective Equipment According to Hazard		
Objective	**Workplace Hazards**	**Suggested PPE**
Eye and face protection	Flying particles, molten metal, liquid chemicals, gases or vapors, light radiation.	Safety Glasses with side-shields, protective shades, etc.

Head protection	Falling objects, inadequate height clearance, and overhead power cords.	Plastic Helmets with top and side impact protection.
Hearing protection	Noise, ultra-sound.	Hearing protectors (ear plugs or ear muffs).
Foot protection	Falling or rolling objects, pointed objects. Corrosive or hot liquids.	Safety shoes and boots for protection against moving & falling objects, liquids and chemicals.
Hand protection	Hazardous materials, cuts or lacerations, vibrations, extreme temperatures.	Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc.
Respiratory protection	Dust, fogs, fumes, mists, gases, smokes, vapors.	Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapors and gases). Single or multi-gas personal monitors, if available.
	Oxygen deficiency	Portable or supplied air (fixed lines). On-site rescue equipment.
Body/leg protection	Extreme temperatures, hazardous materials, biological agents, cutting and laceration.	Insulating clothing, body suits, aprons etc. of appropriate materials.
Source: IFC Environmental, Health, and Safety General Guidelines		

6.7.9 Wastewater Generation

Considerable wastewater will be generated from project activities and the activities at the construction camp.

Mitigation Measures

- Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks. Proper monitoring to check the compliance of SEQS will be carried out;
- Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit;
- Construction yards and material storage areas where vehicles operate or materials are stored should be established on well drained fill;
- Free-flowing points of discharge for storm water should be identified nearby the boundaries of materials storage/construction yards for gravity or pump-assisted dewatering and yard drainage;
- Local drainage channels should have sufficient capacity for handling discharge flows, with clear discharge points to open drainage courses;

- Water discharged to constructed drains should contain a minimum quantity of suspended solids;
- Drainage from fuel storage tank locations, refuelling areas, and equipment service areas should be segregated from other runoff; discharge should be routed through an oil/water separator; and
- Contractors will be required to observe drainage conditions during dewatering operations and storm events to assure positive drainage. If flooding occurs along roadways or in neighbourhoods, or community complaints arise, the contractor will undertake a combination of the above mitigation measures to minimize drainage and water quality impacts.

6.7.10 GHG Emissions

Greenhouse gas emissions contribute to global warming and other climate changes on both regional and global scales. During the construction phase, greenhouse gas (GHG) emissions (such as CO2, CH4, NOx, etc.) will result primarily from fuel combustion in construction vehicles, machinery, and temporary power generation units. The process of excavation, land clearing, and materials transport will also contribute to CO2 emissions. The use of diesel-powered equipment and the disturbance of soil and vegetation can lead to increased carbon emissions, both directly through fossil fuel use and indirectly through the reduction of carbon sequestration capacity of the disturbed land. Additionally, the development of the proejct will require energy-intensive processes, which could further increase emissions if the power supply is derived from fossil fuels.

Mitigation measures

- Employing energy-efficient and low-emission machinery, as well as transitioning to electric or hybrid vehicles for transport, can significantly reduce direct CO2 emissions.
- Minimizing land disturbance and adopting soil conservation practices can help preserve the carbon sequestration capacity of the area. Reforestation and replanting efforts post-construction can also help offset emissions.
- Streamlining the construction schedule and reducing idle time for machinery can minimize unnecessary fuel consumption and associated emissions.
- Implementing carbon offset initiatives, such as funding renewable energy projects or supporting local reforestation efforts, can help balance out the GHG emissions generated during construction.
- Regular maintenance of vehicles, plants, and machinery according to the manufacturer's specifications.
- Monthly visual inspections of vehicle and plant exhausts to detect excessive smoke emissions and take corrective action when needed.
- Installation of approved pollution control devices on equipment and machinery.
- Avoid over loading the transport vehicles to reduce emissions.
- Site vehicles and machinery will be switched off or throttled down when not in use.

6.7.11 Social and Cultural Conflicts

During the construction phase of the Project, conflicts may arise between labor force and local community. Use of local resources and products by the construction workers can generate stress on the local resources. Furthermore, difference in cultural values may also cause discomfort to residents. This impact is negative, local, low, short-term, and probable.

Mitigation Measures

- Local labor especially from nearby communities should be given preference for the construction works;

- Careful planning and training of work force to minimize disturbance to the local people;
- Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals; and
- Adequate training for the transitive workforce of the project (involved both in the construction process and in the commissioning) to regard the customs of the area so that the locals do not feel insecure.

6.7.12 Communicable Diseases

The health impacts that are envisaged to take place among employees, workers and local population of the proposed Project are discussed below:

For the implementation of Project activities, skilled and unskilled labor is required by the contractor. Mostly, skilled, and unskilled workers will be hired by the contractor on permanent and contract basics, belonging to different cultural backgrounds, which they utilize for different developmental projects. In this case, occurrence of communicable diseases like HIV/AIDs, COVID-19, respiratory diseases, and skin and eye infections are communal to take place during the execution of the proposed Project. This impact is negative and moderate in nature.

Mitigation Measures

- Proper checkup of skilled and unskilled workers before their hiring;
- Labor camp should be away from the residential area and workers' management plan should be formulated by Contractor to minimize the adverse impacts on local communities and workers;
- Trainings, and awareness campaigns should be conducted for workers and surrounding communities on awareness and prevention of HIV/AIDs.
- Workers should be educated for personal hygiene and the sanitation concerns, leading to communicable and non-communicable diseases;
- Water should not be allowed to stagnate even if clean, and measures should be taken to cover the area.

6.7.13 Influx of Labor

For the implementation of Project activities, skilled and unskilled labor is required by the contractor. Mostly, skilled, and unskilled workers will be associated with the contractor for long period of time, where they are required for the projects, and while other workers are hired from the different areas that belong to different cultural backgrounds. Social problems and conflicts that are associated with Labor Influx are as follows:

- Risk of social conflict: Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural, or ethnic differences, or based on competition for local resources. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other;
- Increased risk of illegitimate behavior and crime: The influx of workers and service providers into communities may increase the rate of crimes and a perception of insecurity by the local community. Such illegitimate behavior and crimes can include theft, physical assaults, substance abuse, sexual assault and human trafficking;
- Impacts on community dynamics: Depending on the number of incoming workers and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Pre-existing social conflict may intensify as a result of such changes;
- Increased burden on and competition for public service provision: The presence of construction workers and service providers (and in some cases family members of either

or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education, and social services. This is particularly the case when the influx of workers is not accommodated by additional and separate supply systems;

- Increased risk of communicable diseases and burden on local health services: The influx of people may bring communicable diseases to the Project Area, including sexually transmitted diseases (STDs), or the incoming workers may be exposed to diseases to which they have low resistance. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the Project's medical facility and instead go anonymously to local medical providers, this can result in an additional burden on local health resources;
- Local inflation of prices, accommodations, and rents: A significant increase in demand for goods and services due to labor influx may lead to local price hikes and crowding out of community consumers. Depending on Project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of residents; and
- Increase in traffic and traffic related accidents: Delivery of supplies for construction workers and the transportation of workers can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure.

This impact is negative and temporary in nature.

Mitigation Measures

- Labor camp(s) should be established away from residential population;
- Preference should be given to the local people to work with contractor, and contractor should hire maximum labor force from the Project Area because this will reduce the labor influx;
- Awareness should be created among the work force to ensure respect for local customs;
- Construction work should be completed within the stipulated time to move workers to next location;
- Labor force should be shuffled with the time;
- An effective GRM should be established for the Project to resolve all issues related to the community. Thus, progress regarding resolving the issues should be monitored closely;
- Create awareness among workers on proper sanitation and hygiene practices to endorse proper health and maintain good housekeeping practices at all Project sites;
- Provide adequate personal hygiene facilities in good condition with adequate supply of clean water;
- Make arrangements to treat the affected workers on time to control the movement of vector borne diseases;
- Sensitize workers and surrounding communities on awareness and prevention of COVID-19, HIV/AIDS and sexually transmitted infections (STI) through training, awareness campaigns and workshops during community meetings;
- Provide proper and free COVIID-19, HIV/AIDS and STI health screening and counseling for site workers and community members;
- Develop and enforce a strict code of conduct for workers to regulate behavior in the local communities;
- Take all sensible precautions to avoid illicit, vicious conduct by or amongst the Contractor's personnel, and to preserve unity and harmony, and protection of people and property on and near the sites;
- Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel;
- Site security preparations must be contained within the Bills of Quantities (BoQs) to avoid any delays which might be caused due to insecurity;

- Appropriate fencing, security check points, gates and security guards should be provided at the construction sites to ensure the security of all equipment, machinery and materials, as well as to secure the safety of site staff; and
- The Contractor must guarantee that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism and theft.

6.7.14 Child Labor

There are two basic conventions on child labor adopted by the ILO, and one adopted by the United Nations. The ILO Minimum Age Convention, 1973 (No. 138) and its accompanying Recommendation (No. 146) set the goal of elimination of child labor, and the basic minimum age for employment or work (in developing countries at 14 years of age or the end of compulsory schooling, whichever is higher; and 15 or the end of compulsory schooling for developed countries). The Convention sets a minimum age of 2 years younger for "light work," i.e., 12 and 13 years, respectively; and a higher minimum age for dangerous or hazardous work (basically 18 years of age, but 16 in certain circumstances). The Convention also has various other flexibility clauses.

Minimum Age for Employment or Work

- Ensure that child labor contrary to the convention is not used
- Define child labor as any work done by anyone under 14 years old, except for light work done by children 12 years and older.
- Ensure that no work is done by anyone of less than the school-leaving age, at least if schooling is available.
- Ensure that no work is likely to jeopardize the health, safety, or morals of young persons, either by its nature or the circumstances in which it is carried out, is done in the Project by anyone under 18 years of age.

Forms of Child Labor

Ensure that "worst forms" of child labor—for anyone under 18 years of age—are not used under any circumstances.
Direct activities to take immediate and effective measures to eliminate these worst forms of child labor.[28]

Inhabitants of the Project area have mix economic background and different sources of income. Children of low-income groups mostly involve themselves in different earning activities, as their parents prefer to get their children hired in small shops as helpers, and waiters in hotels for earning money, and supporting household livelihoods. However, the Sindh Restrictions on Employment of Children Act, 2017 prohibits the employment of children and restricts the employment of adolescents in certain occupations and processes such as construction industry, where whoever employs or permits a child (person under the age of 15 years) to work in an establishment shall be liable to punishment with imprisonment.

The child labor impact might arise during construction stage, as large number of skilled and unskilled labor will be required by the contractor for the construction activities of the proposed Project.

Mitigation Measures

[28] *ILO Core Labor Standards-Handbook*

The chance of hiring of underage workers for the Project activities will be minimized by adopting the following mitigation measures:

- Awareness should be created among the local communities about the adverse impacts of child labor. For the public awareness, meetings should be held in the Project Area, and announcements should be made using the available local platforms with the involvement of all sectors of the society;
- Contractor through contractual agreement should be bound to follow the labor standards, rules, and regulations during hiring the labor force. All activities should be monitored by the social and environmental staff of the implementing agency;
- Client and Supervision consultant should ensure that contractor shall have its employment policy in accordance with relevant act and labor policies in Sindh and Pakistan; and
- Contractor should ensure the presence of all persons at site are adults and have their proper identity cards with them.
- Reduce the health hazards and dangers to young persons in the workplace.

6.8 Operational and Maintenance Phase: Impacts and Mitigation Measures

6.8.1 Safety & Privacy

Due to passing through major parts of the city, and catering to port traffic, potential impacts from safety of vehicle movement on adjoining areas, along with privacy from vehicular movement will be significant impacts.

Mitigation Measures

To mitiagate these impacts, the following measures are proposed:

- Use of Reinforced High Impact RCC Crash Bariers Along deck edges
- Installation of accoustic composite sound barriers (3.5m in height) in proximity to residential blocks
- High Privacy barriers up to 4 m high in the residential areas such as sunset boulevard

6.8.2 Air Quality

Upon commencement of operations, the expressway will facilitate uninterrupted movement of freight traffic between Karachi Port and Shahrah-e-Bhutto, resulting in a significant increase in heavy goods vehicles using the dedicated corridor. Although the project is expected to reduce congestion and idling on existing urban roads, continuous operation of diesel-powered trucks will generate emissions of particulate matter ($PM_{2.5}$ and PM_{10}), nitrogen oxides (NO_x), carbon monoxide (CO), sulphur dioxide (SO_2) and greenhouse gases. Localized deterioration in air quality may occur near interchanges, tolling facilities and sections adjacent to residential areas, schools and hospitals. Increased deposition of dust and vehicle emissions may also affect nearby vegetation and public health if unmanaged.

Mitigation Measures

Air quality impacts should be minimized through the promotion of cleaner freight transport and efficient traffic operations. Traffic flow should be maintained through intelligent transport systems and incident management to reduce vehicle idling and stop-start traffic. The expressway should be regularly cleaned to minimize re-suspension of road dust, while landscaped buffers and roadside vegetation should be established where space permits to assist in trapping airborne

particulates. The project operator should coordinate with relevant authorities to encourage compliance with national vehicle emission standards, prohibit visibly smoking vehicles where legally permissible, and promote gradual adoption of cleaner fuels and lower-emission freight vehicles. Ambient air quality monitoring should be undertaken periodically at representative sensitive receptors to verify compliance with applicable standards.

6.8.3 Road Maintenace Works & Heavy Traffic

During the operational phase, different maintenance works will be carried out throughout the Project life. Laborers or staff involved in these maintenance works are exposed to health and safety issues. Poor implementation of HSE plans or noncompliance of personal protective equipment's (PPEs) can lead to personal injuries and accidents. Moreover, application of poorly maintained equipment's and material can lead to air pollution. The maintenance works can also cause traffic problems to the travelers. Lack of maintenance may also lead to ground water and soil pollution. The impact of noise will only be due to construction of the proposed Project as the settlement are nearby the road. This impact is temporary and minor adverse in nature.

Mitigation Measures

Important points to be addressed in the operational stage are as follows:

- Implementation of HSE Plans during the maintenance period;
- Strict implementation of personal protective equipment's PPEs;
- Use of high quality equipment and material by the contractor;
- Continuous improvements in the emergency plans;
- Placement of sign boards for traffic diversions and proper implementation of traffic diversion plans;
- Selection of suitable sites for contractor camps and implementation of all the related important protocols for the management of camp activities in order to avoid environmental and HSE issues;
- Understanding and training of staff on Operation and Maintenance Manual;
- Regular maintenance of engineering works;
- Maintain vegetated areas in adequate cover to meet the intended purpose(s);
- Conservation practices that limit particulate matter emissions should be incorporated into long-term maintenance plans;
- Blowing of pressure Horns by the vehicle will be strictly prohibited; and
- Continued public consultation and feedback on it.

6.8.4 Noise & Vibration

Operational traffic, particularly heavy container trucks, will generate continuous traffic noise arising from engines, exhaust systems, tyre-road interaction and braking activities. Elevated sections may increase the propagation of noise to surrounding residential developments because of their greater elevation above ground level. Vibration generated by heavy vehicles may also affect nearby buildings located immediately adjacent to bridge approaches, expansion joints and elevated structures.

Mitigation Measures

Noise impacts should be mitigated through installation of permanent acoustic barriers along sensitive residential sections, hospitals, educational institutions and other noise-sensitive receptors. The pavement surface should be maintained in good condition to reduce tyre-generated noise, while expansion joints should be designed and maintained to minimize impact noise from heavy vehicles. Routine maintenance should ensure that bridge decks remain smooth and free of

surface defects. Operational speed limits should be enforced to reduce excessive vehicle noise, and periodic operational noise monitoring should be undertaken to verify compliance with applicable environmental standards. Where monitoring identifies unacceptable noise levels, additional mitigation measures such as barrier extensions or pavement resurfacing should be implemented.

6.8.5 Community Health & Safety

The operational expressway will introduce high-speed freight traffic in close proximity to urban communities, increasing potential risks associated with vehicle collisions, hazardous cargo transport, emergency incidents and restricted access for pedestrians. Elevated structures may also present risks associated with falling debris or unauthorized access.

Mitigation Measures

Community health and safety should be enhanced through installation of continuous crash barriers, pedestrian fencing and controlled access along the expressway. Safe pedestrian crossings should be maintained beneath elevated structures where required, while unauthorized access to operational infrastructure should be prevented through appropriate fencing and surveillance. Emergency response procedures should be established for traffic accidents, hazardous material incidents and fire emergencies. Public awareness programmes should be conducted to educate surrounding communities regarding expressway safety and emergency reporting procedures.

6.8.6 Stormwater Management & Water Quality

Operation of the expressway will increase the extent of impervious surfaces, generating stormwater runoff containing suspended solids, hydrocarbons, heavy metals, tyre wear particles and other pollutants. If discharged untreated, runoff may adversely affect Chinna Creek. Poor maintenance of drainage systems may also increase localized flooding during intense rainfall events.

Mitigation Measures

Stormwater drainage systems should incorporate sediment traps, oil-water separators and catch pits to improve runoff quality before discharge. Drainage infrastructure should be inspected and cleaned routinely, particularly before and during the monsoon season, to maintain hydraulic capacity. Water quality monitoring should be undertaken periodically at major outfalls to detect any deterioration in receiving waters. Emergency spill response procedures should also be established to prevent accidental releases of fuels or hazardous substances into the drainage network.

6.8.7 Hydrology & Hydraulic Performance

Permanent bridge structures, embankments and drainage infrastructure may alter local hydraulic conditions if not adequately maintained. Accumulation of sediment beneath bridge spans or blockage of drainage channels could reduce hydraulic conveyance, increasing localized flood risk and affecting tidal exchange within Chinna Creek.

Mitigation Measures

Routine hydraulic inspections should be undertaken to monitor sediment accumulation, scour around bridge piers and drainage performance. Culverts and drainage channels should be desilted periodically to maintain design capacity, while erosion protection measures should be maintained along embankments and drainage outlets. Hydraulic performance should be reviewed following major rainfall or storm events to identify any changes requiring corrective action. Adaptive

management measures should be implemented where monitoring identifies reduced hydraulic efficiency.

6.8.8 Visual Impacts

The elevated expressway will permanently alter the visual character of the surrounding urban landscape. Elevated structures may introduce visual intrusion for nearby residential buildings and alter views of the coastal environment, while nighttime lighting may increase light spill into adjacent communities.

Mitigation Measures

Architectural treatments should be incorporated into bridge piers, retaining walls and elevated structures to improve visual integration with the surrounding urban environment. A comprehensive landscape plan should provide native tree planting and roadside vegetation wherever space permits to soften the visual appearance of the infrastructure. Lighting systems should be designed to minimize light spill through downward-directed luminaires and shielding, while routine maintenance should ensure that landscaped areas remain healthy and visually effective.

7 Stakeholder Consultations

7.1 Overview

Public consultation and information disclosure is an essential component of the Environmental & Social assessment process, recognized by development agencies and national governments alike. Similarly, to incorporate the views, concerns, and suggestions of project stakeholders and to provide them with sufficient opportunity to become part and parcel of the development process, the importance of stakeholder engagement throughout the project life cycle cannot be dismissed.

Stakeholder consultation presents an opportunity for mutual information-sharing and dialogue between the project proponent and stakeholders. An effective public consultation provides concrete suggestions that can help improve project design, resolve conflicts at an early stage, identify management solutions to mitigate potentially adverse consequences and enhance perceived positive impacts.

7.2 Consultation Objectives

Effective stakeholder engagement enhances project beneficiaries' role from "participants" to "enabling agents" that proactively provide insights to project planning and implementation. The stakeholder consultation process for this project has been designed to enhance the role of stakeholders and thereby contribute towards project success and sustainability. Specific tasks and purposes of consultations with stakeholders have been given in the table below.

Table 7.1 - Tasks & Purposes of Consultation

Task	Purpose of Consultation with Stakeholders
Need for consultation with the stakeholders	▪ To build trust to ensure sustained support for the proposed project and build resilience during the times of crisis. ▪ To learn about public concerns that need to be addressed and considered in designing of the project concept and preparing mitigation measures and programs. ▪ To learn about the strengths, skills, and organizational support that the stakeholders can bring to support project planning and implementation. ▪ To introduce the project and obtained their views and feedback on it, along with measures to incorporate to improve the project
Modes and benefits of consultation	▪ Listening and creating dialogue with stakeholders to keep the project tuned to public concerns early, to pre-empt breakdowns, and avoid mistrust in public confidence. ▪ Engaging the public as advocates for the project construction and to support the implementation of social, resettlement, and environment and health programs.

The specific objectives of the stakeholder engagement exercise carried out for the subject project include:

- Ensure all stakeholders are informed about the project's objectives, context, and scope, including the key design features of the project and potential environmental and social implications.
- Promote active engagement with all stakeholders to foster acceptance, ownership, and sustainability of the project. Ensure participation from diverse groups, irrespective of gender, ethnicity, income level, or ability, in an inclusive, transparent manner.

- Adopt an inclusive, participatory, and transparent approach towards stakeholder engagement that provides opportunities for engagement with relevant stakeholders of all backgrounds, regardless of gender, race, ethnicity, income class, and ability
- Benefit from local community knowledge for enhancing strategic interventions for public space design and infrastructure improvement, and
- Gather community feedback on potential impacts, such as environmental changes or livelihood disruptions, and develop practical solutions to address these concerns while enhancing project outcomes.

7.3 Stakeholder Identification & Analysis

The stakeholders for this project have been divided into two major categories which are outlined below:

- **Primary Stakeholders** – Persons, groups, and other entities within the project corridor of influence (COI) that are directly influenced (actually or potentially) by the project and/or have been identified as most susceptible to change associated with the project, and who need to be closely engaged with in identifying impacts and their significance, as well as in decision making
- **Secondary Stakeholders** – Individuals, groups, entities that may not experience direct impacts from the project but who consider or perceieve their interests as being affected by the project and/or who could affect the project and the process of its implementation in some way

Details regarding Primary stakeholders and their roles and responsibilities is represented in the table below:

Table 7.2 - Roles & Responsibilities of Primary Stakeholders

Project Stakeholder	Roles and Responsibilities
PTQ Expressway (Private) Limited	• Responsible for overall development and implementation of the proposed project.
Local Communities (Bhutta Village and Gulshan – e – Sikandarabad, District Keamari)	• Participate in project consultations and provide feedback on potential social, environmental, and economic impacts. • Share local knowledge to inform the project's design and implementation. • Support the project through community engagement, ensuring the concerns and interests of community members are addressed.
Local Communities and Businesses (Clifton, DHA Phase 1 & 2)	• Represent the interests of locals whose livelihoods may be impacted by the project.
Shahrah-e-Bhutto Team	• Ensure alignment with Phase 1 to maintain project continuity and efficiency. • Inform the team about the challenges faced during Phase 2, including land acquisition, resettlement concerns, and compensation disputes. • Document lessons learned from Phase 2 to enhance efficiency and sustainability in Phase 1.

Similalry, the roles and responsibilities of secondary stakeholders for the project are also provided below:

Table 7.3 - Roles & Responsibilities of Secondary Stakeholders

Project Stakeholder	Roles and Responsibilities
Sindh Environmental Protection Agency (SEPA)	• SEPA is the regulatory authority and mainly responsible for the development and implementation of the environmental policies and strategies in order to integrate the environmental issues and sustainable development approaches into the legal and regulatory frameworks as per Sindh Environmental Protection Act, 2014. • EPA Sindh is responsible for the approval of the proposed project prior to implementation.
Social Welfare Department	• Responsible for ensuring that the social impacts of the project on local communities are assessed and addressed. • Oversees fair compensation and rehabilitation measures for affected households.
Forest Department	• Enforces relevant forestry laws and regulations to mitigate ecological damage. • Prevents deforestation and degradation of natural ecosystems, including mangroves.
Karachi Water and Sewerage Corporation	• Assesses potential impacts on existing water infrastructure and pipelines. • Coordinates with project authorities to prevent damage to water supply networks. • Proposes alternative solutions if water distribution systems are disrupted.
KE	• Assesses potential risks to power lines, transformers, and other electrical facilities. • Coordinates with project authorities to prevent disruptions to electricity supply. • Proposes rerouting or mitigation measures if electrical infrastructure is affected. • Ensures compliance with KE's compensation criteria in case of infrastructure damage.
CBC	• Monitors environmental concerns, including waste management and pollution control. • Ensures compliance with local regulations and urban planning guidelines.
DHA	• Ensures the project aligns with DHA's zoning and urban planning regulations. • Coordinates with relevant authorities to mitigate disruptions to DHA infrastructure. • Reviews and approves any modifications affecting DHA-managed land or services.

7.4 Consultation and Participation Process

The project utilizes various methods of engagement that were employed as part of its continuous interaction with project stakeholders. For the engagement process to be effective and meaningful, a range of various techniques were applied that were specifically tailored to the identified stakeholder groups. For ascertaining the perceptions of different stakeholders about the project consultations/ meetings were carried out at following two levels:

• Consultations with Primary Stakeholders
• Consultations with Secondary Stakeholders

7.4.1 Consultations with Primary Stakeholders

In order to align with international standards and good practices, local level engagement was provided to all stakeholders. The main purpose of the exercise was to disseminate information to relevant stakeholders and solicit their feedback receieved at an early stage regarding potential issues and concerns based on the current project design and features.

Consultation meetings were conducted with identified stakeholders, where they were briefed about the background and scope of the project. Concerns and suggestions from the stakeholders was noted down by the team and pictures of the sessions were taken with the consent of the stakeholders. If the interviewees had any questions about the project, the team responded to their queries during the session.

Informal group discussions were also held as an additional tool for the assessment of the perceptions of the stakeholders about the project and potential impacts both positive and adverse likely to occur due to its implementation. Key Informant Interviews (KIIs) were conducted with project stakeholders to gather their perspectives on project implementation, and their feedback was formally documented.

7.4.2 Consultations with Secondary Stakeholders

Other interested parties, such as nongovernmental organizations and government departments were identified as key stakeholders and approached individually for consultations. These consultations were conducted through Key Informant Interviews (KIIs), allowing each department to provide detailed feedback and share their perspectives on various aspects of the project. This approach ensured that the views of all relevant stakeholders were considered in the project planning and implementation process creating a comprehensive understanding of their concerns, expectations, and recommendations.

7.4.3 Other Consultation/ Participation Methods

- **Letters** - The letters were the instrument used in order to facilitate the project planning process through good collaboration between the implementing entities and other stakeholders. Invitation letters were written to stakeholders for the consultation meetings.
- **Reports** - The reports used to monitor the project implementation and to keep informed the main stakeholders of the project.
- **E-mails** - To facilitate communication between implementing entities

7.5 Consultation Feedback & Analysis

7.5.1 Primary Stakeholders

The comments, concerns, and suggestions received from the primary stakeholders during the survey have been collated in this section. The comments solicited from the primary stakeholders were helpful in the screening of the potential environmental and social aspects of the project. The primary stakeholder consultations carried out are listed below:

Table 7.4 - Stakeholder Feedback from Primary Stakeholders

S#	Types of Consultation/ Meeting	Dates
1.	KIIs with local community of Bhutta Village	17th March 2025 – 18th March 2025
2.	Socio-Economic Baseline Survey of Bhutta Village	19th March 2025 – 20th March 2025
3.	KIIs with local community of Bhutta Village	19th March 2025 – 20th March 2025

4.	KIIs with Healthcare Facilities (Clifton, DHA Phase 1, Phase 2)	24th March 2025
5.	KIIs with Education Facilities (Clifton, DHA Phase 1, Phase 2)	24th March 2025
6.	KIIs with Welfare Centres (Clifton, DHA Phase 1, Phase 2)	24th March 2025
7.	KIIs with Religious Facilities (Mosques in Clifton, DHA Phase 1, Phase 2)	24th March 2025
8.	KIIs with Commercial Area (Clifton, DHA Phase 1, Phase 2)	25th March 2025
9.	KII with SEPA	26th March 2025
10.	KII with MEX Phase 2 Team	
11.	KII with KDA	23rd April 2025
12.	KII with Sindh Forest Department	26th March 2025
13.	KII with KWSC	25th March 2025
14.	KII with Human Settlement Department	26th March 2025
15.	KII with KE	25th March 2025
16.	KII with DHA	7th April 2025

The feedback obtained from these consultations is also highlighted below:

Table 7.5 - Stakeholder Feedback & Suggestions from Bhutta Village

S#	Name	Occupation	Comments/Feedback
1	Javaid	Pharmaceutical Worker	Javaid, a resident of the area for 20 years with a household of four, stated that the area lacks government-provided services, with residents relying on private clinics and private schools. Mosques are present in the community, but there are no activities related to the sea. The primary modes of transportation are public transport and motorbikes. Water quality is poor, and heavy vehicle traffic from the port causes significant noise pollution at night. He emphasized that residential properties should not be affected by the project and recommended that awareness sessions be conducted to inform the local community about the development. He also suggested that teams from Karachi Port Trust (KPT) and the Sindh Government be deployed to address community concerns regarding the potential risk to housing. Additionally, he identified the need for improved gas, water, and hospital services in the area.
2	Muhammad Rashid	General Store Owner	Rashid, a recent resident of Bhutta Village, reported that the area consists of thousands of households. His household comprises five members. He highlighted the high cost of water, stating that one gallon is priced at Rs. 50–60, as there is no government-provided water supply, and residents rely on private sources. There is no gas supply, and households depend on gas cylinders, which are expensive to refill. Mosques are present in the community, and there are no activities related to the sea. The primary modes of transportation are public transport and motorbikes. Water quality is poor, and heavy vehicle traffic from the port causes significant noise pollution at night. He emphasized that a lot of people in the area own their houses with no other property elsewhere, hence their households should not be affected in anyway. He also recommended that complaint boxes be set up in the area so residents can relay their concerns to the concerned authorities. Additionally, he identified the need for improved gas, water, and hospital services in the area as they are prone to Hepatitis due to low water quality.
3	Qasim Jan	Pan Shop Owner	Qasim Jan, a long-term resident of over 40 years, stated that the government does not provide any essential services in the area. While private clinics are available, their quality is inadequate. Madrassas and mosques are present, and private schools exist; however, the standard of education remains subpar. He also noted that residents have historically relied on boats to access mangroves for firewood, a common practice in the area. The primary modes of transportation are public transport and motorbikes. Water quality is poor and residents have to use gas cylinders to cook food.

S#	Name	Occupation	Comments/Feedback
			His primary concern with the project was not to affect the households of Bhutta Village. He also recommended that the project team should visit the area and hear the concerns of the residents first hand. He also suggested that complaint boxes should be placed nearby.
4	Muhammad Aftab	Labourer	Muhammad Aftab, a long-time resident whose family has owned their home since pre-partition, stated that many people in the area, including himself, work as laborers at KPT or China Port. He noted that due to the depletion of local wood resources, residents have now resorted to cutting mangroves for firewood. The primary modes of transportation are public transport and motorbikes. There is no gas supply, and households depend on gas cylinders, which are expensive to refill. He expressed concerns regarding the project passing over residential areas, highlighting that noise pollution, particularly at night, would significantly increase. He emphasized the need for project authorities to visit the community and address residents' concerns. He recommended the establishment of well-equipped hospitals in the area, as the only major healthcare facility primarily serves KPT employees and does not cater to the broader community.
5	Ameen – Ur - Rehman	Water Valve Operator	Ameen ur Rehman stated that the government does not provide any basic utilities in the area, and residents must rely entirely on private services. Gas is obtained through cylinders, which are costly to refill, while water is sourced through private tankers or other alternative means. For cooking, households either use gas cylinders or burn wood. In terms of transportation, residents primarily depend on motorcycles and public transport. As he is a resident of the area for 20 years and a homeowner, it was emphasized that his household must not be affected by the project. He strongly recommended that the route be altered to pass over the water rather than residential areas. He suggested the formation of a dedicated team to maintain communication with the local community and provide updates regarding potential compensation if the route remains unchanged. He also proposed the establishment of a campsite within a school or mosque to allow residents to formally document their concerns.
6	Irfan	LPG Business Owner	Mr. Irfan, a long-term resident, stated that the area was originally known as Bhutta Village but was referred to as Al Badr Society before Partition. He owns an LPG business and highlighted that while all basic facilities are available, they are entirely private and of poor quality. The Katchi community relies on the sea for fishing, but most residents only use it for cutting mangroves as firewood. Public transport, motorcycles, and rickshaws are the primary means of transportation. He expressed concerns over severe noise pollution caused by heavy traffic and port-related activities, as well as widespread air pollution from port emissions. Water supply through private tankers is unreliable. He

S#	Name	Occupation	Comments/Feedback
			emphasized fears of displacement due to the project and raised concerns about privacy being disturbed if the expressway passes directly over residential areas, worsening nighttime noise pollution. Mr. Irfan recommended altering the expressway route to run over water instead of residential areas. He urged project authorities to keep the community informed about final designs and construction progress. He also suggested deploying dedicated teams to address community concerns or installing complaint boxes. Additionally, he emphasized the urgent need for an RO water filtration plant in the area

Table 7.6 - Stakeholder Feedback & Suggestions from Gulshan-e-Sikandarabad

S#	Name	Occupation	Comments/Feedback
1	Qaiser Abbas	Pan Shop Owner	• The residents stated that there are only private schools and madrassas in the area, with no government schools available. • They reported the absence of hospitals and government clinics, relying solely on private clinics for healthcare. • Their primary modes of transportation include private rickshaws, motorcycles, and bicycles. • The area lacks government-provided utilities; residents use gas cylinders or firewood for cooking and depend on water tankers, costing approximately PKR 4,000–5,000 per month. • The locality faces significant environmental issues, including pollution and foul odors due to open waste dumping, garbage burning, and the incineration of materials like tires and wires, producing thick smoke. • Residents expressed strong opposition to the expressway crossing their community and did not agree with the proposed route alignment. They emphasized that they have lived in the area for decades and that their properties are their only assets. • A majority of residents stated that they do not seek resettlement compensation either; they simply do not want to be displaced. • Residents urged project teams and government officials to visit their area, listen to their concerns, form committees to clarify the impact on their structures, and conduct group sessions to engage them as primary stakeholders in the process.
2	Akhtar	Gardener	
3	Rafique Ahmed	Mason	
4	Mohsin	Painter	
5	Qasim Khan	Driver	
6	Adil	Vegetable Seller	
7	Abdul Sattar	Electrician	
8	Muhammad Akram	Wedding Hall Decorator	
9	Muhammad Azhar	Private Job	
10	Younas	Shopkeeper	
11	Farooq	Labourer	
12	Muhammad Bilal	Tailor	
13	Muhammad Riaz	Milk Shop Owner	

Table 7.7 - Stakeholder Feedback & Suggestions from DHA Phase 1, 2, and Clifton

S#	Name	Occupation	Comments/Feedback
1	Akbar Ali Rana	Founder of **Sahara Village Old Home**	• Mr. Akbar Ali Rana stated that he founded the old home in Karachi in 1985. The facility houses 400 mentally ill individuals, both male and female, and operates seven centers with a staff of 40–50 people. • Despite having NGO status, they receive no government support for utilities. They rely on water tankers, costing PKR 1.4 million per month, while their electricity bill from KE ranges between PKR 1.2–1.4 million. The government does not provide them with gas. • He supported the initiative, highlighting that Sunset Boulevard experiences heavy traffic congestion at night. Given Karachi's high population, he emphasized the need to divert heavy traffic and reduce dumper accidents. He also recommended dust control measures to minimize disturbance to residents along Sunset Boulevard.
2	Habib Jamali	General Secretary of **Sunset Boulevard Tower**	• Mr. Jamali stated that their building, established in 1985, contains nine shops and 16 offices. • Noise pollution is a major issue, especially at night due to heavy traffic. They rely on water tankers for supply and do not receive gas from the government. • He supported the initiative but emphasized the importance of ensuring that people along the road do not suffer livelihood losses. He also recommended the inclusion of a U-turn for traffic.
3	Rizwan	Manager at **Edhi Centre**	• Mr. Rizwan stated that they have been operating in the area for 30 years, collecting donations and provide emergency ambulance services. Their center employs around 15 people. • Noise levels are high at night due to heavy traffic from the main roads. Electricity and water are available, but no gas is provided. • He supported the project, emphasizing the need for a separate road for heavy traffic while ensuring that service roads remain open.
4	Zubair	In-charge at **Chhipa Welfare Centre**	• Mr. Zubair stated that they have been operating this center for 20 years, providing ambulance services with a team of six employees. • The area experiences high pollution levels, and noise pollution is significant at night due to heavy traffic. While utilities are available, they are privately managed. • He supported the project, considering it a good decision overall, but emphasized the need to manage dust and traffic congestion during the construction phase.
5	Yusuf Mughal	Committee Member of **Jamia Masjid Farooq – e-Azam**	• Mr. Mughal stated that the mosque was established before 1970 and provides Islamic education daily from 3 PM to 5 PM. • The area experiences significant noise and air pollution, and traffic congestion increases at night due to heavy vehicles. Utilities are available. • He expressed satisfaction with the project as it will separate heavy traffic into a dedicated corridor but emphasized the need to control dust and noise during the construction phase.

S#	Name	Occupation	Comments/Feedback
6	Farhan Ali	Employee at **Carpet Shop**	• Mr. Farhan stated that his workplace has been operating in the area for 30 years, specializing in carpets, wooden flooring, and window construction. • Water and electricity are available, but power outages occur due to load shedding. • He supported the project, considering it a good government initiative that will help reduce congestion, especially at night due to heavy traffic.
7	Tariq	Manager of **Shaheen Centre**	• Mr. Tariq stated that Shaheen Centre is a commercial building established in 1978, housing multiple offices, including ACF (an animal shelter). • Water is available in the area, but extreme traffic congestion occurs after 11 PM due to heavy vehicles on the main roads. • He supported the project, considering it a great initiative that should start as soon as possible to improve traffic conditions across the city.
8	Ayesha Chundrigar Foundation	No response	No response

Table 7.8 - Stakeholder Feedback & Suggestions from Educational Institutions

S#	Organization	Name	Designation	Comments/Feedback
1	ABSA College for the Deaf	Waseemuddin	Administrator	• Mr. Waseemuddin stated that their school, established in 1967 and run by the ABSA Trust, currently enrolls 350 deaf students. • Most students come from the Korangi area, while teachers travel from across the city. • As the students are deaf, they face challenges crossing the road, relying on school staff for assistance, as traffic police provide no support. • Students commute using public transport or private vans and must exercise caution while traveling. • With the construction of the Expressway, it is essential to ensure the safety of students crossing main roads, and a pedestrian bridge is recommended. • Measures should be taken to control dust and minimize its impact on students and staff. • Complaint boxes should be placed in the school during construction so concerns can be communicated to the relevant authorities.

S#	Organization	Name	Designation	Comments/Feedback
2	Beaconhouse School – Discovery Centre	Hafsa Awan	Head Mistress	• She stated that the school was established in 2004 and currently has approximately 470 students, offering education from Grade 1 to Grade 11, with students primarily coming from the Clifton and DHA areas. • She mentioned that while the water quality is just average, air and noise pollution are concerns due to school traffic, and she emphasized the need to minimize dust and noise pollution during the construction phase. • She recommended the construction of a pedestrian bridge for student safety and clarified that all students use private cars, eliminating the need for traffic police since school guards effectively manage congestion outside. • She acknowledged that the project is a good initiative that could reduce traffic congestion and make travel more efficient for the public, while also suggesting that a joint publication address be provided to all schools in the area to ensure they remain informed.
3	The Indus Academy	No response		• No response
4	Nixor College			

Table 7.9 - Stakeholder Feedback & Suggestions from Healthcare Facilities

S#	Organization	Name	Designation	Comments/Feedback
1	Altamash Institute of Dental Medicine	Imad Altamash	Director	• The representative stated that the Altamash Institute of Dental Medicine (AIDM) was established in 2000 as a dental healthcare and teaching institution. • At any given time, the institute accommodates hundreds of patients and provides education to approximately 400 undergraduate dental students. • AIDM offers a wide range of services including diagnostics, curative and surgical treatments, and dental radiology, including CT scans. • Patients travel from across Karachi—including areas such as Sohrab Goth, Clifton, and DHA—as well as from interior Sindh, other provinces, and even abroad to access the institute's services. • The management expressed serious concerns regarding the potential environmental and structural impacts of the KGTL project on their institution. These concerns include increased noise levels, air and

S#	Organization	Name	Designation	Comments/Feedback
				dust pollution, soil and water contamination, structural damage, and the effects of ground vibrations. • While acknowledging the broader benefits of the project—particularly its aim to ease city-wide congestion—they highlighted that the construction phase poses long-term disruptions to their daily operations. • To mitigate these risks, they strongly recommended the adoption of measures such as off-site prefabrication of project components, the provision of dedicated and unobstructed access routes, implementation of robust environmental protection protocols, coordination of traffic and construction activities, regular stakeholder engagement, and a firm commitment to timely project completion. • They concluded by expressing dissatisfaction with the current plans as presented, stating that the proposed mitigation measures were inadequate to address their operational concerns.
2	Ziauddin Hospital Clifton	No Response		No Response
3	Pak International Hospital			
4	Naseems Children Hospital			
5	Qamar Ul Islam Hospital			

Table 7.10 - Stakeholder Feedback & Suggestions from KDA & Shahrah-e-Bhutto Teams

S#	Organization	Comments/Feedback
1	KDA	Date: 23rd April, 2025 Respondent: Yousuf Iqbal, Senior Director, Traffic Engineering Bureau • Mr. Iqbal stated that the roads located beneath the proposed flyovers should be included in the project's improvement budget to ensure a cohesive and aesthetically pleasing overall design. • He emphasized that mangrove ecosystems must not be affected by the project under any circumstances. • In the event that existing infrastructure is damaged, he recommended implementing appropriate engineering solutions to provide alternatives.

S#	Organization	Comments/Feedback
		• Mr. Iqbal further highlighted that high-value properties should not be harmed. He pointed out that areas such as Gulshan-e-Sikandarabad and Bhutta Village are encroachments on illegal land. • He stressed that all relevant departments must issue No Objection Certificates (NOCs) prior to the commencement of any work. • Additionally, he noted that any damages arising from the project must be addressed through a structured compensation mechanism.
2	Shahrah-e-Bhutto Project Team	Date: 26th March, 2025 Respondent: Tanveer Bari, CFO • The project (phases 1 and 2) is based on the premise of the ring road, where these roads are increasingly being adopted throughout the world to allow for alleviation of traffic burden on major traffic arterials of the city by allowing traffic to surpass these arterials. • Phase 1 of the project would serve strategic importance in ensuring that maximum benefits are accrued from the phase 2 of the project also by allowing for people travelling from the Western parts of the city to circumvent the traffic of the city when travelling outside the metropolitan area of the city • Phase 1 of the project should not be limited to port traffic, and should instead serve all motor vehicles • The number of interchanges and their locations should be properly studied prior to implementation as these would have to be built within the heart of the city • The project should ensure it is developed with an emphasis on health and safety which is carried through into the operational phase (owing to its location and right of way through the city) • Alongside this, the project should also study the intricacies such as location and number of toll booths to avoid traffic buildup in the city and at the interchanges • For areas in the project where there is potential resettlement, the financial and time implications should be studied and a decision taken from there accordingly. • The Phase 1 Project should ensure that observations and findings from phase 2 of the project guide the development of phase 1 of the project to allow for minimal disruptions to the existing traffic in the area

7.5.2 Secondary Stakeholders

The comments, concerns, and suggestions received from the secondary stakeholders during the survey have been collated in this section, where these were helpful in the screening of the potential environmental and social aspects of the project.

Table 7.11 - Secondary Stakeholders Feedback & Suggestions

Stakeholder	Feedback & Suggestions
Sindh Environmental Protection Agency (SEPA)	Meeting Date: 26th March 2025 Respondent: Imran Sabir, Director • He emphasized that SEPA's primary role is to implement the SEPA Act of 2014 and promote environmental conservation across Sindh. • He explained that SEPA grants project approvals for a maximum of three years. If a project remains incomplete within this timeframe, the approval becomes void, requiring reapplication. • He highlighted that SEPA conducts review mechanisms and post-monitoring of projects, with non-compliance subject to action under Section 19. • He stated that the project is challenging and suggested using the Northern Bypass route as an alternative. If security concerns exist, he noted that they are solvable. • He questioned the availability of an alternative route, emphasizing that constructing a flyover on Sunset Boulevard is impractical due to its narrow width. • He stressed the need for a detailed analysis study before project construction begins. • He recommended studying Qayyumabad traffic patterns, as industrial traffic flows from that area. • He advised ensuring that KE power lines are not affected, citing the Green Line BRT project, where route modifications due to power line interference resulted in costs reaching billions.
Forest Department, Government of Sindh	Meeting Date: 26th March 2025 Respondent: Shahzad, Divisional Forest Officer • Mr. Shahzad stated that natural waterways should not be impacted in any way, as this could lead to the drying out of mangroves. • He emphasized that the government should provide compensation to settlements that will be affected by the project. • He recommended implementing solutions to protect biodiversity and marine life in the area. • He advised against completely cutting down any trees along the route and suggested replanting them elsewhere instead. • He acknowledged that the project is a good initiative, provided all environmental and social factors are properly considered
Karachi Water and Sewerage Corporation (KWSC)	Meeting Date: 25th March 2025 Respondent: Sikander Ali Zardari, Chief Engineer • Mr. Zardari confirmed that his department is aware of the project.

Stakeholder	Feedback & Suggestions
	• The department is responsible for supplying water across Karachi. • He emphasized that mangroves must not be damaged under any circumstances. • He stated that while the proposed route appears feasible, factors such as high tide and low tide along the creek must be carefully considered before construction. • Raised concerns about heavy traffic congestion in Korangi after 11 PM and questioned how industrial traffic from the Korangi SITE area would be managed. • Recommended constructing a flyover connecting to the Landhi area to facilitate traffic flow. • Stressed the importance of ensuring that public transportation and regular traffic are not disrupted during the construction phase. • Advised implementing dust control measures to mitigate pollution during construction.
Human Settlement Authority (Formerly known as the Sindh Katchi Abadis Authority)	Meeting Date: 26th March 2025 Respondent: Sheikh Bilal Hussain, Director • Mr. Hussain mentioned that their department was established in 1987 and is responsible for regularizing Katchi-Abadis. • He noted that Gulshan-e-Sikandarabad and Bhutta Village are not officially recognized by their department and are considered illegal settlements. • He emphasized that if these settlements are to be removed, proper policies must be followed, and adequate compensation should be provided. • He advised that dust emissions should be carefully managed during the project.
Karachi Electric (KE)	Meeting Date: 25th March 2025 Respondent: Bina Riaz, Deputy General Manager (Environment) • Ms. Riaz stated that their team is aware of the project but were not informed on the exact route. • She explained that their company provides electricity services to Karachi and some areas beyond in Sindh. • Initially, it appears that no major KE structures fall within the project's route, but a detailed analysis will be conducted to confirm this. • If any disruptions occur to KE's infrastructure, proper standards must be followed. • Any damage to KE's power lines must be compensated according to KE's established criteria. • She emphasized the need to keep all utility companies informed and engaged to ensure that critical infrastructure is not affected by the finalized route.
Social Welfare Department	Meeting Date: 25th March 2025 Respondent: Mehmood – Ur – Rehman, Director

Stakeholder	Feedback & Suggestions
	• Mr. Mehmood ur Rehman stated that the local communities and ecosystem will inevitably be impacted, urging caution in project planning. • He recommended conducting a detailed analysis to determine whether the project will genuinely benefit the public. • He cited the Orange Line as an example of ineffective infrastructure investment, highlighting that despite significant expenditure, it remains underutilized. • He questioned whether alternative routes had been considered, given that the proposed route already experiences heavy traffic congestion. • He expressed concerns regarding Sunset Boulevard, noting that it is a narrow road, and the addition of a flyover with supporting pillars could further reduce space for public traffic. • He emphasized the need to address dust pollution and carbon emissions during the construction phase. • He suggested utilizing the Northern Bypass instead, arguing that if an alternative route exists, the project may not be necessary.
Defence Housing Authority (DHA)	Meeting Date: 7th April 2025 Respondent: Brigadier Ayaz, Chief Engineer DHA Karachi • DHA and its team are already aware of the project, where the Project Director for the project and their team have made contact for a provisional approval for the project. In return, DHA has highlighted the need for carrying out detailed studies and investigations prior to the issuance of any sort of approval. • Mr Ayaz acknowledged the objective of the project, i.e. to provide a dedicated corridor for port traffic for goods for travel in different parts of the country (and not meant for Karachi) a direct route out of the city. • He stated that the project should ideally follow a rigorous analysis of alternatives (including but not limited to the development and dualization of the Northern Bypass and other feasible alternatives) prior to coming to the conclusion that this project is the most feasible option moving ahead. • Highlighted that the project holds the potential to be very disruptive given the area that it passes through and the sort of development that has been proposed. Furthermore, the corridors in question, i.e. Korangi Road, and Sunset Boulevard are major arteries where there is traffic congestion during many times of day, where it is unknown how and where this traffic will be diverted during the development of the expressway. • Underscored the need to carry out detailed options analyses and studies from multiple aspects and facets including traffic buildup and diversions, utility relocation, and overall impact on adjoining areas amongst many others.
Clifton Board Cantonment (CBC)	Meeting Date: 7th April 2025 Respondent: Mr. Adil, Senior Engineer Cantonment Board

Stakeholder	Feedback & Suggestions
	• Mr Adil highlighted that the CBC team was not aware of the project at this point in time, and prior to providing any information or guidelines, would need to study the route and subsequently carry out joint surveys with the project team to understand the impact from the project on CBC infrastructure including pipelines, sewage and stormwater network, road network, etc. • He stated that the project needs to form proper linkages with the department and work together to ensure that any impacts that can be addressed during design phase are done so accordingly and prior to implementation. • He underscored that CBC is available to aid in the development of the project as necessary as long as all requirements of CBC are fulfilled.
PTCL	No response

Some pictures from the consultations carried out are provided below:

Table 7.12 - Pictures from Consultations

		
Consultation with KE CHSEQ	Consultation with Human Settlement Authority	Consultation with Chief Engineer KWSC

		
Consultaiton with Forest Department	Consultation with Shahrah-e-Bhutto team	Consultation with Beaconhouse School Discovery Centre
		
Consultation with ABSA College for the Deaf	Consultation with Sahara Village Old Age Home	Consultation with Chhipa Welfare Team

7.6 Proposed Consultations Program

Stakeholder consultation and engagement is an ongoing process and will continue through the project's development as well as O&M phases. The ongoing consultation process should be scheduled on a structured frequency basis with stakeholders including but not limited to the concerned government and utility departments, and the community (including residential and commerical entities). The overarching goal of this continuous engagement is to support and facilitate the project and its implementation whilst reducing conflicts and addressing any issues as they arise.

Further consultations to be undertaken as part of the project ESIA process include another round of consultations with community members once the detailed design is finalized and site specific management plans are in the process of preparation e.g. the construction plan, the detailed traffic management plan, etc.

Once these are carried out and incorporated into the revised report, the report is to be disclosed as part of the Sindh EPA's scrutiny and approval process where this report will be published on the department's website, with a public hearing also called for the project to accord the public another chance to provide opinions on the project. This public hearing will be advertised in three different newspapers (english, urdu, and sindhi), where as per the directive of the department, the hearing will be carried out 10 days after the notification in the newspapers.

Folllowing approval from the Sindh EPA, the consultations will be carried out during the construction, and initially during the operational phases of the project along the project corridor. Ongoing stakeholder engagement activities will include:

- Ongoing community liaision during the implementation of the ESIA of the project and the measures contained therein;
- Formal and informal consultations with the communities;
- Ongoing reporting on progress on the implementation of environmental and social management measures identified during the ESIA process and recording of comments on the effectiveness of these measures;
- Updating communities and other stakeholders about project activities and recording comments on these; and
- Ongoing implementation of the greivance redress mechanism

Efforts will be made to maximize the consultations during project implementation, where the consultations will be carried out with the objectives to develop and maintain communication linkages between the project team and the stakeholders, provide key project information to stakeholders, and to solicit their views on the project and its potential or perceieved impacts, and to lastly ensure that the views and feedback of the stakeholders are incorporated into the project's implementation. The tentative framework for future consultations is also provided below:

Table 7.13 - Proposed Consultations Framework

Description	Target Stakeholders	Timing	Responsibility
• Public awareness campaigns/ information sharing sessions to share the ESIA with the communities and other stakeholders. • Location: various places in project area	Communities within project area, general public; and line departments/ agencies.	At the start of the site activities	PTQ Expresway (Private) Limited

Description	Target Stakeholders	Timing	Responsibility
• Establishment of GRM and Grievance Redress Committees (GRCs) • Location: various places in project area	• Communities at/around project area	Before commencement of project activities.	PTQ Expresway (Private) Limited
• Consultations with the communities during ESIA implementation • Location: various places in project area	• Communities at/around project area	During project implementation (quarterly)	PTQ Expresway (Private) Limited
• Grievance redressal • Location: various places in project area	• staff; consultants; relevant line departments; and communities.	Project implementation Stage	PTQ Expresway (Private) Limited
• Informal consultations and discussions. • Location: various places in project area	• Communities at/around project area	Project implementation Stage	PTQ Expresway (Private) Limited
• Consultations with the Communities during the Independent Monitoring • Location: various places in project area	• Communities at/around project area	Project Implementation Stage	Independent Monitor
• Consultation workshops to review ESIA implementation, any outstanding issues and grievances, views and concerns of communities; and actions needed to address them. • Location: site offices in project area.	• Communities at/around project area; relevant line department; relevant NGOs	Six-monthly during implementation phase	PTQ Expresway (Private) Limited

7.7 Information Disclosure Plan

The ESIA and the Urdu translation of its Executive Summary will be disclosed at the proponent's website, along with the Sindh EPA website once the report has been updated. The report will also be available at the offices of the proponent, SEPA, and the project site offices established by proponent, along with any other locations deemed necessary.

8 Grievance Redress Mechanism

A Grievance Redress Mechanism (GRM) has been proposed for this project to provide a timely, responsive, and effective system of resolving community or individual grievances related to project implementation. It is a multi-tiered process starting at the community level and ending at the client level. The multi-stage process will ensure that all stakeholders are involved in finding solutions to the grievances raised by the communities affected by the project. The GRM will help the Project management team to effectively collect and respond to key stakeholders' inquiries, suggestions, concerns, and complaints which, if left unresolved, may cause delays in project implementation, and prevent the delivery of project benefits.

8.1 Need for GRM

A GRM provides a predictable, transparent, and credible process to all parties, resulting in outcomes that are seen as fair, effective, and lasting. In the absence of a project specific GRM, PAPs will seek solutions to their grievances through other redress avenues that exist outside the project such as the existing judicial system or public administration. Engagement of such external problem-solving systems could lead to a lengthy process and not all PAPs will have ease of access and capacity to approach the external systems.

PAPs need quick relief for their problems, particularly when projects are likely to cause property loss and displacement which could push PAPs into a state of high vulnerability, insecurity, and impoverishment. The lack of establishment of GRM and its poor access or effectiveness could also create hostility amongst PAPs towards the project, which may hamper the smooth implementation of the project and its related activities and dampen its overall accomplishments. Delays in project implementation will increase government expenditures such as compensation to contractors for loss of work, and staff maintenance. Project delays can also affect the reputation of the implementing agencies.

8.2 Objectives

The purpose of the GRM is to outline the project's approach for accepting, assessing, resolving, and monitoring grievances from those affected by the project activities. If well handled, an effective feedback and grievance mechanism can help foster positive relationships and build trust with stakeholders. This GRM has been designed to promote dialogue, patient hearing to the PAPs, and problem solving as an intermediate way for stakeholders to discuss and resolve problems.

The project GRM has the following specific objectives:

- To be responsive to the needs of the complainants, who may also be project beneficiaries, by providing a channel for feedback and resolving grievances and disputes at various levels (Community, Contractor, and Client) in the project area;
- To provide an opportunity for the aggrieved party and the project implementers to resolve disputes in a short time before they escalate;
- To facilitate effective communication between the project and the affected parties;
- To enhance the project's legitimacy among stakeholders by resolving complaints, promoting transparency and accountability, deterring fraud and corruption by referring these to appropriate GRM; and
- To provide a platform that can ensure compliance with applicable Lender policies and GoP and GoS laws, policies, and regulations while respecting prevailing norms in the project area.

8.3 Scope

A complaint or grievance is an issue, concern, problem, or claim (perceived or actual) that an individual stakeholder or community group has related to project activities. The GRM can be used by parties or stakeholders living in the target areas or those that have a stake in the targeted areas that might have been inadvertently affected by the project activities and/or outcomes.

The mechanism does not impede access to judicial or administrative resolutions. This GRM will not address employee's grievances as other channels will exist to address such.

8.4 GRM Jurisdiction

This is a project specific GRM and applicable to solve the concerns of the stakeholders of the Project. The GRM will cover the project's operational areas, and will focus on specific activities financed under the Project.

8.5 Measures to Aid in Grievance Redressal

Grievances cannot be avoided entirely, but much can be done to reduce them to manageable numbers and reduce their harmful impacts on the project implementation. The Project team should be aware and accept that grievances do occur and that dealing with them is part of their work. PTQ Expressway (Private) Limited as the Implementing Agency (IAs) will do the following:

8.5.1 Create Awareness

The project will publicize the GRM in local or Urdu Language to all those who may wish to access it and provide adequate assistance for aggrieved parties who may face barriers of access, including language, literacy, awareness, distance, or fear of reprisal. All PAPs will be informed of their rights to raise grievances under the project. Pamphlets, banners, posters will be circulated and posted at key project sites/offices and at public facilities. The proponent website will also feature the GRM.

8.5.2 Provide sufficient and timely information to communities

Many grievances arise because of misunderstandings, lack of information or due to delayed, inconsistent and insufficient information. Accurate and adequate information about the project and its activities, plus an approximate implementation schedule, will be communicated to the communities, especially APs, regularly. Appropriate communication channels and means of communication will be used to ensure that relevant information (whether positive or negative) about social and environmental safeguard issues is made available in a timely manner, in all areas, in local languages and Urdu to affected people.

8.5.3 Conduct meaningful community consultations

The project will continue the process of consultation and dialogue throughout the implementation of the Project. Information, reporting on project progress, providing community members with an opportunity to express their concerns, clarifying, and responding to their issues, eliciting communities' views, and receiving feedback on interventions will benefit the communities and the project management.

The field-level staff and contractor employees will be provided with adequate information on the project such as project design, activities, implementing schedules, and institutional arrangements. Staff skills will be enhanced in effective communication, understanding community culture, dynamics and processes, negotiation, and conflict resolution. Building trust and maintaining good

rapport with the communities by providing relevant information on the project and responding effectively to the needs and concerns of the community members will help solve issues before they become grievances. It is also important that the field-level staff provide regular feedback on their interactions with the communities to the higher levels of the implementing agencies. Overall, good management of a project will also contribute to minimizing complaints.

8.6 Guiding Principles

8.6.1 GRM Principles

The proposed Project GRM will address any complaints and grievances arising during the entire implementation period of the project. Members of the communities may perceive risks to themselves or their property or have concerns about the environmental and social performance of the project. Any concerns or grievances should be addressed quickly and transparently and without retribution to the Complainant. This GRM will be guided by the following principles:

- **Simplicity and accessibility:** Procedures to file complaints and seek redress will be simple and easy to understand and grievances may be submitted through a range of means. All people in the target communities must have unrestricted access to the GRM. The affected persons shall be kept informed at each stage of the process.
- **Equity and Inclusivity:** No complaint is too big or small. All complainants regardless of their social standing, gender, ethnicity, age, political affiliation, religious affiliation will be given the opportunity to approach the GRM without prejudice.
- **Broad representation:** The GRM will allow for broad representation of any consultative body, including youth, women, and marginalized and vulnerable groups. Its design mustn't entrench existing power structures.
- **Gender sensitivity**: The design of the GRM will ensure that women and children have a safe means to air grievances. The project will be responsive to the needs of women including their complaints and grievances. A separate GBV GRM will respond to incidents of GBV and SEA that are reported.
- **Transparency and Accountability:** Members of the community or aggrieved parties have the right to information on the grievance mechanism, how to access it, who is responsible for handling their complaints and the potential outcome of the processes. The GRM system will be publicized to a broad audience at all levels and to various actors (beneficiaries, public, CSOs, media, government officials).
- **Timeliness:** All complaints received will be treated with the urgency and the attention they deserve. Minimum response times are included in these guidelines to ensure grievances are handled promptly.
- **Right of appeal**: The channels for appeal to the existing administrative and judicial systems will remain available if complainants are not satisfied with the resolution offered by GRM.

8.6.2 Eligibility

A complaint is considered valid and will be processed by the GRM whenever:

- It relates to an ongoing activity pertaining to the project;
- It is filed by project-affected individuals and/or communities, or their representatives, who believe that they are or may be directly and adversely affected by the project;
- The complainant is not a directly affected/beneficiary of the project, but the subject of the complaint affects him/her or their community;
- Complaints with inadequate details will not be rejected for lack of information; the project will seek additional information from the Complainant/s and then decide on eligibility.

8.7 Responsibilities under the GRM

Responsibilities related to the handling of the grievance redress rest with the PD, Deputy PD, Social Specialist/s, and Social Mobilizers. Other Project officials, consultants, and Contractor/s will play a role in grievance redress. At each Tier of the GRM, a Grievance Officer would be designated who will manage the Grievance Redress process. The core responsibilities of these key personnel are as follows:

8.7.1 Project Director

The PD's role in grievance redress will be to:

- Notify and establish GRM at community and consultant levels before the commencement of project activities to resolve issues;
- Provide oversight and chair the GR Committee at the client level;
- Provide necessary funds and assign staff to facilitate GRM operations;
- Coordinate the functions of GRM with external authorities, if required;
- Get contractors to pay compensation for damage and loss of property and livelihood caused during construction activity if any; and
- Approve capacity-building training for GRC members, staff, and contractors.

8.7.2 Social Specialist

The responsibility of Social Specialist as a Grievance Redress Officer (GRO)/Secretary at the Client level will be to:

- Act as the GRO/secretary on Grievance Redress issues at the Client level;
- Record, register, and sort grievances to determine eligibility and maintain grievance-related reports with support from the Project Monitoring & Evaluation Unit;
- Document the GRC proceedings, and decisions, and inform Complainant;
- Liaise with the GRC chairperson and provide him/her support in resolving grievances;
- Assist Project M&E in maintaining a GRM database on the status of grievance handling;
- Monitor the project activities of contractors and consultants on the redress of grievances; and
- Prepare monthly/quarterly progress reports on grievance handling and report the progress to Client.

8.7.3 Social Mobilizer(s)

The responsibilities of Contractor's Social Mobilizers (Male and Female) as a GRO/Secretary at the community level will be to:

- Function as the GRO to the GRC at the Community level;
- Liaise with the environment and social teams for grievance handling and redress;
- Create awareness of the GRM amongst all the stakeholders through public awareness activities;
- Record, register, and sort grievances at the field level;
- Conduct an initial assessment of grievances and field investigation at the community level;
- Monitor the progress of grievance handling by contractors;
- Refer grievances to the client that are not resolved at the community level; and
- Reporting the progress of grievance handling to client.

8.8 Implementation Mechanism

The GRM Value Chain depicted below outlines the 6 steps that are necessary to have a functional and effective GRM in place. These are highlighted below:

8.8.1 Step 1: Uptake (locations and channels)

A GRM should be located as close to the people as possible to be accessible to the PAPs including vulnerable groups. Project stakeholders and PAPs will be able to use a variety of channels to access GRM. It is important to identify and make provisions for different means of entry into the grievance redress process, as it helps to increase the access of APs to the GRM. The channels of presenting complaints could include presentation of complaints through community representatives/Jirga members, face-to-face meetings, phone, WhatsApp, and email communications, written complaints, etc. Complaints can be submitted by mail or by hand delivery to the Project office directly. Some potential methods are highlighted below:

1. By Phone: Community Level: XXXXXX Client: XXXXXX
2. By email: Client: XXXXXX
3. By Post: Client: XXXXXX
4. In person: Client: XXXXXX
5. Complaints/ suggestion box which will be placed on-site at suitable places.
6. A tab on the proponent website for those who choose to submit online.
7. Links: Facebook Link: XXXX Twitter handle XXXXX

8.8.2 Step 2: Sorting and processing

Complaints and feedback will be recorded by the social organizer at the client level and documented in a register or directly into a Grievance Log. The Environment and Social Unit will be responsible for dealing with each complaint and may approach other sections of the project after screening the issue and concern raised in the grievance, including following through with the proponet to arrive at a resolution, to resolve complaints within 30 days of receipt.

8.8.3 Step 3: Acknowledgement and follow-up

Receipt of grievances will be acknowledged as soon as possible and not later than 48 hours in writing. A reference number will be assigned to each complaint for tracking purposes. All grievances will be recorded in a complaint register which includes a reference number, date of the complaint, name of the complainant/s, gender, national identification number/s (if available), address of the complainant/s and summary of the complaint. Confidentiality will be provided if sought by the Complainants. All complaints will be tracked through a reference number, which will be communicated to the Complainant. In case grievance is assessed to be out of the scope of the GRM, the complainant will be informed in writing and the reasons stated therein.

Within seven (7) days of the date a complaint is submitted, the GRO will communicate with the complainant and provide information on the likely course of action and the anticipated timeframe for resolution of the complaint. If complaints are not resolved within 15 days, the GRO will provide an update about the status of the complaint/question to the complainant and record the status with a date.

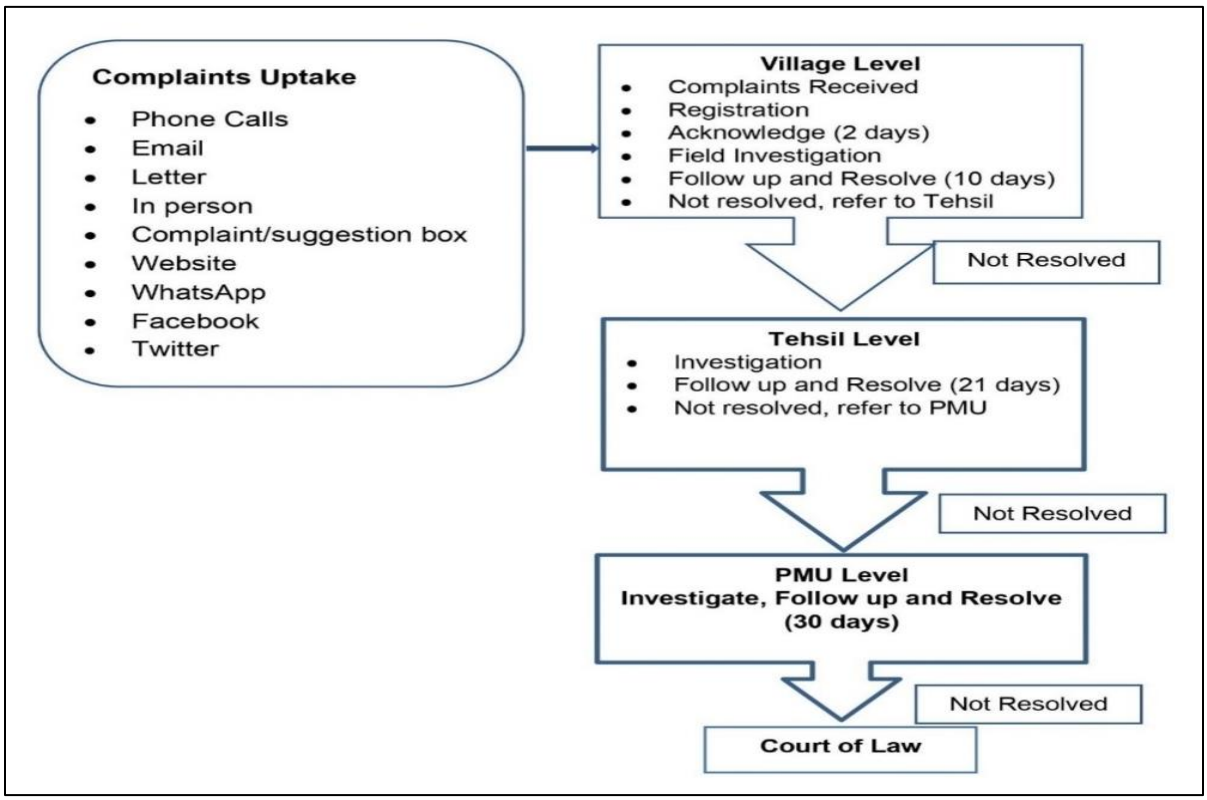


Figure 8.1: GRM Flow Chart

Once the grievance is received and recorded, the Tier 1 GRO shall identify the project personnel or contractor responsible for resolving the grievance. The department concerned will undertake an enquiry into the specifics of the grievance. Depending on the sensitivity of the issue, a site inspection can be undertaken to check the validity and severity of grievance. For this purpose, the department concerned will also undertake discussions with the aggrieved concerned and external stakeholders.

Based on the case investigation, the Chairperson of the Tier 1 GRC, in consultation with relevant departments and GRC, shall identify a suitable resolution to the issue. In case the issue is beyond the purview of the Tier 1 GRC, it should be escalated to the Tier 2 Consultant Level GRC. If, however, the Consultant level is not able to identify an adequate resolution for the grievance, the Complainant may choose to escalate the grievance to the Client (Tier 3) Grievance Redress Committee (GRC). The Tier 3 GRC will resolve the grievance within 30 working days.

The project will ensure that its GRM is neutral, and that its officials do not have a stake in the outcome of the investigation. Once the grievance is resolved and the same has been communicated to the complainant, the grievance shall be duly documented and closed in the grievance register with the approval of the Chairperson of a specific Tier of the GRM. At the end of the field investigation, the Grievance Officer will compile a Grievance Investigation Report (GIR) using a standard template to document the outcome of the investigation and final resolution. These instances shall then serve as references for any future grievances of a similar nature.

8.8.4 Step 4: Monitoring and Evaluation

Monitoring and evaluation are critical to the success of any GRM. Monitoring refers to the process of tracking grievances and assessing the extent to which progress is being made to resolve them. This will be accomplished by maintaining the grievance register and records of all steps taken to resolve grievances or otherwise respond to feedback and questions. The Project's M&E Section will design a simple GRM Management Information System (MIS). This can be easy-to-use, Excel

- based grievance registration and monitoring database in consultation with the GRO. The M&E Section will regularly review and update the Complaint/Grievance Register on a weekly basis to indicate resolved (closed-out) and unresolved cases, those pending with the Grievance Committee or other forums i.e. courts, tribunal etc.

The project monitoring and evaluation information system will also include indicators to measure grievance monitoring and resolution. These grievance redress indicators will be incorporated into project results frameworks. An effective GRM will allow projects to potentially address up to three of the proposed indicators: (i) grievances registered related to delivery of project benefits that are addressed in number and (%); (ii) grievances responded to and/or resolved within the stipulated service standards in number and (%); and (iii) project-supported organization(s) publishing periodic reports on GRM and how issues were resolved [including resolution rates] (Yes/No).

Monitoring will be conducted by the M&E Section using performance indicators, which will be presented on two different outputs: participation and effectiveness every 3 months (quarterly). For transparency, stakeholders will have an opportunity to track grievances as well. The client will prepare a report on a monthly basis using a list of existing and new grievances and share on its website and with stakeholders at all levels. The complaint, region/area and status of grievance handling will be made public. The client will prepare a monthly Report on the Grievance Redress issues of the Project in addition to reports. The GRC may review the nature of grievances represented and if grievances are repeated, recommend suitable changes in implementation procedures, and recommend these to the PD for consideration.

8.8.5 Step 5: Providing Feedback

This step involves informing the Complainants on how the complaint was resolved. Complainants will be informed of the proposed resolution in writing and if need be, the same can be explained over the telephone or in person. If the complainant is not satisfied with the resolution, he or she will be informed of further options, which would include pursuing remedies through the Lender, as described below, or through avenues afforded by Pakistan's legal system.

The written response will clearly outline the course of action of the project that has been undertaken to redress the grievances and the specific terminal date by which the recommended remedies shall be completed. Potential actions will include responding to a query or comment, providing users with a status update, and referring the grievance to another level of the system for further action. The project will take some action on every grievance and shall even give a hearing to the complainant who has filed an irrelevant complaint before formally closing it. The Affected Person shall provide a written response, agreeing or disagreeing with the proposed course of action within a minimum reasonable period after receiving the recommended actions.

The GRO, with assistance from the M&E Section, will ensure that the status of all complaints/grievances is kept current and will brief the PD primarily on a monthly basis or more frequently on a need basis on the status of all current complaints/grievances. On a monthly basis, the Grievance Officer and M&E Section will produce a summary status report that defines trends in the types of complaints and will send this report to the PD and other relevant officials of the Project. A bi-annual Gender-disaggregated qualitative review of a sample of complaints processed (ensuring variation such as type of complaint, resolution status, etc.) will also be undertaken to analyze the efficacy of the system. Regular monitoring of the grievance mechanism and its outcomes, particularly of trends and patterns, will be critical to the identification of systemic problems and the adoption of solutions accordingly.

8.9 Structure of GRM

A three-tier redress structure is planned to address all complaints in the Project.

Table 8.1: Composition, Roles and Timeframe for Grievance Close Out at each Level

Level	Chair	Secretary/ GRO	Members	Frequency of Meeting	Timeframe for Close-out
Tier 1- Contractor Level	Project Engineer, Proponent	Social Mobilizer	• Community Representative • Social Organizer Male • Social Organizer Female • Contractor representative • Design & Supervision Consultant (E&S) • Special Invitees (by invitation)	Weekly	10 days
Tier 2- Consultant Level	Project Manager, Proponent	Social Specialist	• Community Representative • Social Specialist • Environment Specialist • Contractor representative • Project Engineer, proponent • Design & Supervision Consultant • Special Invitees (by invitation)	Weekly	21 days
Tier 3- Client Level	Project Director	Social Specialist	• Project Director • DPD • Social Specialist- proponent • Environment Specialist proponent • Resident Engineer – Design and Supervision Consultants • Environment & Social Specialist Contractor representative	Bi-Monthly	30 days

Level	Chair	Secretary/ GRO	Members	Frequency of Meeting	Timeframe for Close-out
			• District Commissioner of Districts • Any other member Special Invitees (by invitation)		

8.9.1 First Tier - Contractor Grievance Redress Committee

Complaints can be received at the contractor/ community levels. The concerns of the Complainant will be examined at the first level through the involvement of the Affected Persons Committees (APCs), formed at the community level. The Social Mobilizers (male & female) will, act as focal persons to get the grievances recorded, investigated and discussed during APC meetings; facilitate the APs to Project issues in accordance with provisions of the ESMP and coordinate with the GRC to ensure that the APs recommendations will be implemented, and the grievances are addressed accordingly. If the grievance is not resolved at the village level it shall be raised at the field level.

Functions and key responsibilities of Contractor level Tier 1 GRC:

- Organize weekly meetings with the PAPs who have grievances to redress them;
- Ensure that follow-up actions in response to grievances are taken within an agreed timeframe. Report on outstanding/resolved grievances on a weekly basis to the Project Authority particularly serious cases;
- Coordinate through GRC-PIU with Government departments, at district, provincial and civil society organizations to resolve the grievances of the local communities;
- Ensure the availability of grievance registration forms (in Urdu & Sindhi) in the project area; and
- Decision to be taken within 10 days of receipt of complaint.

In addition, the Contractor GRC will ensure that those issues that cannot be solved at the community level are elevated to the GRC established under the chairmanship of the Project Manager at the Consultant level. The complainant may also request that the issue be transferred to the next level if he or she feels it is not being addressed.

8.9.2 Second Tier - Consultant Grievance Redress Committee (GRC)

If a grievance is not resolved at the first Level, the community GRC will elevate it to the Consultant level established under the chairmanship of the Project Manager from the client. Social mobilizers will be responsible for providing the required feedback to the relevant persons regarding the complaints and efforts made at community Level to resolve the issue.

Following the preliminary assessment, the PM will investigate the complaint through Social Specialist, who will share its facts finding report with PM in 15 days of receipt of complaint. After receipt of the fact-finding report, within the next 7 days the PM will convene its meeting with other members as provided above. However, if the complainant/ aggrieved persons are not satisfied with Consultnat GRC decision or if there are delays in resolution, the complainant can request the Committee to elevate the complaint to Tier 3 PIU GRC headed by the Project Director.

Functions and Key Responsibilities of Consultant level GRC are:

- Conduct bi-monthly meetings to address grievances not resolved at the community level;
- Ensure that handling of grievances is in accordance with national laws and GIIP procedures;
- Ensure that follow-up actions in response to grievances are taken within an agreed timeframe;
- Maintain a database of all registered grievances, along with details on the nature of the issues raised, the case history and actions taken;
- Report on outstanding/resolved grievances on a weekly basis to the chair particularly serious cases;
- Coordinate with Government departments, at district, provincial and national levels and civil society organizations to resolve the grievances of the local communities;
- Ensure the availability of grievance registration forms (in Urdu & Sindhi) in the project area; and
- Coordinate with community representatives on the efficacy and usefulness of grievance redress procedures and recommend changes, if any are required.

8.9.3 Third Tier – Client Level

If the complainant is not satisfied and the issue is not resolved at the field level, then the Social Specialist will forward the complaint to the client level for remedial measures and decisions/grievance (s) will be resolved accordingly.

Upon receipt of the complaint, the client will review the record and call the complaint/complainants to hear and record their concerns and initiate any further investigations (if required) for resolution of the complaint.

The client will decide regarding the complaint and inform the aggrieved person, and the community GRC, of the required execution on-ground and closure of the grievance process in 30 days. The Complainant may decide to take legal action or any other recourse if he/she is not satisfied with the resolutions due to the deliberations of the tiers of GRM. The detailed TORs of the GRC-PIU are as under:

i. The Tier 3-client level GRC will meet at least twice a month and more regularly as needed and shall convene its meeting on the availability of 60% of the quorum/committee members;
ii. The Project Director will ensure effective implementation of the Grievance Redress Mechanism (GRM) by establishing and notifying the Contractor (Tier 1) and at the Consultant Level (Tier 2);
iii. Ensure community outreach and information dissemination about the Project GRM;
iv. Ensure easy access to GRM for affected communities, especially for women and other vulnerable groups;
v. Provide a time-bound early, transparent, and fair resolution of social and environmental concerns linked to the project and provide timely responses to Complainants;
vi. The committee shall generate a monthly report on the proceedings and progress of Tier-3 GRC; and
vii. Maintain and update the GRM Database/Complaint Register.

9 Environmental & Social Management Plan

9.1 Introduction

ESMP is a tool for the implementation of all the suggested mitigation measures to make the project environmentally sustainable. It provides an overall approach for managing and monitoring the environmental, ecological, and socio-economic impacts arising out of the implementation of the proposed project, and describes the institutional framework and reporting mechanism to implement ESMP for the project.

9.2 Objectives of ESMP

The main objectives of the ESMP are:

- Provide project impacts along with the proposed mitigation measures, and a corresponding implementation phase;
- To ensure that all necessary corrective actions are carried out in time to counter any adverse environmental and social impact;
- To ensure the regular monitoring of those factors which may affect the safety of the environment under a systematic monitoring approach;
- Define the roles and responsibilities of the project Proponent and Contractor(s) in order to effectively communicate environmental and social issues among them;
- Provide a procedure for timely action in the face of unanticipated environmental situation;
- Identify training requirements at various levels including project Proponent, Contractor(s) and other parties involved;
- Provide a monitoring mechanism in the form of an environmental and social monitoring program, which includes monitoring parameters, monitoring frequency to ensure that all the mitigation measures are completely and effectively implemented;
- Provides estimation of environmental and social cost for the implementation of ESMP;
- Define the requirements necessary for documenting compliance with ESMP and communicating it to all the concerned regulatory agencies; and
- Provide other plans considering the project specific requirements.

9.3 Coverage of the ESMP

All activities ordained under the three stages of the proejct (pre-construction, construction, and operation) will be controlled and monitoried as per the guidelines of the ESMP.

9.4 Institutional Requirements

The institutional requirements for the construction and operation phases of the proposed project are elaborated upon in the following sections:

9.4.1 ESMP Implementation During Pre-Construction

The project, and the works therein, will be executed by the KDA team during the pre-construction phase. In the organizational hierarchy of the organization, the Director General (DG) will be overall responsible for the design and pre-construction aspects of the proposed project. The contractor

will be responsible for the implementation of all aspects of the project, inlcuding the E&S measures listed out in this report. The responsibilities of the contractor include the following:

- Engaging in collaborative efforts to monitor environmental and social compliance in the pre-construction phase
- Providing regular reports on the status of the environmental and social compliance to the DG
- Conducting assessments and implementing measures to address the long term environmental and social impacts of the proposed project
- Maintaining a productive partnership among relevant line departments and agencies identified in the stakeholders chapter to ensure ongoing collaboration

9.4.2 ESMP Implementation During Construction

The key stakeholders during the construction phase of the proposed project are KDA, SEPA, the Supervision Consultant (SC)/ Project Management Consultant (PMC), the Third Party Monitoring Consultant/ Independent Monitoring Consultant, and the Contractor. The roles and responsibilities of all these parties are highlighted below:

- KDA (CEO)
- KDA Traffic Bureau Head
- SC
- Third Party Monitoring Consultant
- Contractor's Staff

KDA will bound contractors through clauses in their contracts to implement the ESIA including ESMP, and other terms and conditions of the environmental approval issued by SEPA. The whole ESMP wil be included as a clause in the contractor's documents. Construction camps will be established after necessry approvals and submission of site specific ESMPs to be developed in light of the relevant agencies' requirements, prior to commencement of new works. The organizational setup for the implementation of the ESMP during construction is provided below:

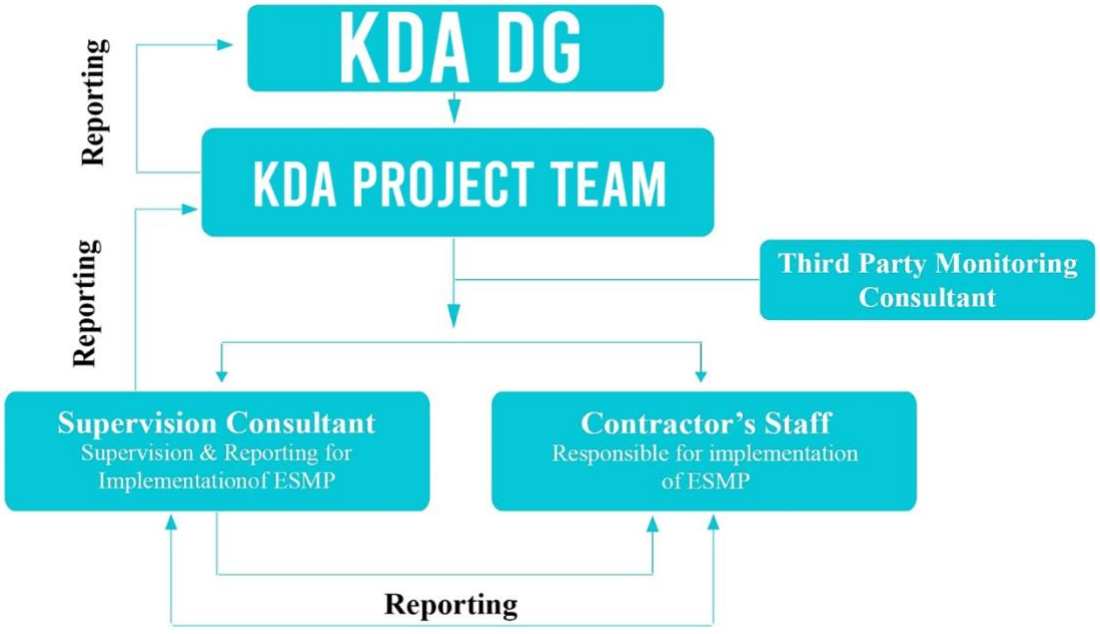


Figure 9.1 - Reporting Mechanism for ESMP

9.4.3 Roles & Responsibilities

a) SEPA

In accordance with the Sindh Environmental Protection Act of 2014, the responsibility for environmental protection and pollution control lies with SEPA (Sindh Environmental Protection Agency). SEPA is tasked with approving the Environmental Impact Assessment (EIA) and Initial Environmental Examination (IEE) for all development projects falling under their jurisdiction. Additionally, SEPA will conduct audits of the proposed sub-project activities as necessary, ensuring adherence to the protocols outlined in the Environmental and Social Management Plan (ESMP) and obtaining environmental approval.

b) DG KDA

The DG of KDA serves as the principal authority overseeing the project. As an executive head, the DG assumes responsibility for making crucial policy, administrative, and financial decisions to ensure the efficient and timely execution of the project in accordance with the approved framework and implementation schedules. In addition, the DG bears the overall responsibility for project implementation, including environmental and social management aspects, as well as the selection and engagement of contractors and consultants.

c) KDA Traffic Engineering Bureau Head

The head of the traffic engineering bureau at KDA, along with their team, will oversee the project's day to day activities and overall implementation. This team will be responsible for the overall implementation of the ESMP, and other related tasks. They will also be responsible for ensuring the ESMPs are included in the contractors' bidding documents, along with the implementation supervision. This team will also manage environmental and social aspects of the project activities, including arranging for environmental and social monitoring and preparing compliance reports for submission to the DG, and SEPA. The team will be responsible to ensure compliance of the ESMP during the construction phase. The team will also hire the services of an independent environmental and social consultancy firm for Third Party Monitoring.

Furthermore, they shall be responsible for:

- Ensuring the provision of necessary environmental and social training to relevant personnel.
- Ensuring compliance with all contractual obligations pertaining to environmental and social standards.
- Conducting regular site visits to construction sites to assess the environmental and social performance of the Contractor(s).
- Regularly checking the proper implementation of the Environmental and Social Management Plan (ESMP) during the construction phase.
- Reviewing monitoring reports on the progress of environmental and social activities.
- Ensuring that the Contractor implements additional measures recommended by the Supervising Consultant (SC) in environmental and social monitoring reports.
- Documenting and disclosing monitoring results, identifying corrective and preventive actions in periodic reports, and monitoring the progress of these actions towards desired outcomes.
- Assisting the Contractor in ensuring timely payments of negotiated prices.
- Providing assistance to the Contractor in obtaining necessary approvals from relevant departments.
- Overseeing compliance with all monitoring programs outlined in the ESMP.
- Maintaining effective communication with other relevant departments and stakeholders.

- Reporting the status of ESMP implementation to the Sindh Environmental Protection Agency (SEPA).

d) Third Party Monitoring Team

The Third Party Monitoring Process will involve the engagement of independent Environmental and Social specialists, where they will be responsible for monitoring environmental and social factors including conducting field surveys at the construction sites to assess the level of compliance. Their role will entail conducting external and independent monitoring of the ESMP implementation. The external monitoring agency will perform biannual, annual, and final evaluations of the ESMP and provide recommendations for necessary changes to the team at KDA. Roles and responsibilities of the Third Party Monitoring Team will include:

- Conduct autonomous monitoring at crucial sites throughout the construction phase and oversee the implementation of the Environmental and Social Management Plan (ESMP) within the project area.
- Track the Grievance Redress Mechanism (GRM) and ensure the resolution of complaints.
- Promptly notify the KDA project team of any significant impacts that arise during the construction process.
- Observe and revise or prepare corrective action plans as necessary.
- Monitor the implementation of the plans in collaboration with the Project Implementation Consultant.

e) Supervision Consultant (SC)

KDA will engage a Supervision Consultant to oversee the proposed project, where the firm will be responsible for preparing monthly monitoring and evaluation reports for the site, which will then be submitted to the KDA team. The KDA team will then review these reports, hold discussions with the consulting firm and finalize findings accordingly. Should contractors fail to comply with the requirements, the SC has the authority to halt activities or impose penalties according to contractual terms. The SC will provide the final versions of the monitoring and evaluation reports to the KDA team as part of the periodic reporting mechanism outlined in the upcoming section. The KDA will then submit these reports to the DG KDA for their review and necessary actions. Additionaly, the reports will also be submitted to the Sindh Environmental Protection Agency (SEPA) in accordance with the specfied frequency outlined in the “Environmental Approval” requirements for the construction phase. The roles and responsibilities of the SC will be as follows:

- Conduct a thorough review and provide approval for the contractor's management plans.
- Oversee and supervise the contractor's performance to ensure compliance with the Environmental and Social Management Plan (ESMP).
- Ensure that the day-to-day construction activities adhere to environmentally and socially responsible practices.
- Maintain close coordination with the contractor and the KDA project team.
- Develop training materials and implement training programs.
- Verify the implementation of mitigation measures recommended in the ESMP.
- Supervise and monitor environmental and social activities at the construction site.
- Organize periodic training programs and workshops on environmental and social aspects for the consultant's and contractor's staff.
- Prepare regular reports as specified in the ESMP.
- Propose any additional mitigation measures that may be necessary.

f) Construction Contractor

Contractors will be obligated to hire on-site Environmental and Social Experts who possess appropriate education and experience for the site. It will be the responsibility of the contractors to execute measures that prevent or minimize any negative environmental and social effects during the construction phase. Prior to commencing work, contractors must develop a site-specific Environmental and Social Management Plan (SSESMP) that outlines their approach to meeting the ESMP requirements for each site. This plan must be submitted for approval to both the KDA project team and the Supervision Consultant (SC). The Environmental and Social Experts employed by the contractors will be responsible for undertaking the following activities:

- Develop the Site-Specific Environmental and Social Management Plan (SSESMP) and secure approval from the Supervision Consultant (SC).
- Implement the mitigation measures outlined in the ESMP and SSESMP at each construction site.
- Contractors are contractually obligated to comply with all the specific and general provisions stated in the contract document.
- Provide appropriate Personal Protective Equipment (PPE) to workers and train them on its proper usage.
- Prepare and submit monthly, quarterly, biannual, annual, and final progress reports to the Supervision Consultant (SC).
- Immediately report any accidents, incidents, including environmental and social incidents, to the Supervision Consultant (SC) and KDA project team.
- Conduct environmental and health and safety training for workers and laborers.
- Coordinate with the Supervision Consultant (SC) and KDA project team.

Regardless of the number of contractors, each contractor will be mandated to have adequately qualified and experienced persons to function as environmental, social, and OHS specialists to work in close liaison with the SC and KDA.

9.4.4 ESMP Implementation During Operations

Once built, the project is not expected to have major impacts that will last the entirety of the operations phase. Initially, there may be some privacy or traffic related issues, however, once those are resolved, there are no residual impacts expected. Nevertheless, for this commissioning & O&M phase, the monitoring and compliance of the operational phase of the ESMP will be under the responsibilities of the engineers and managers at the expressway. The staff will be responsible for the following:

- Coordinating to monitoring environmental and social compliance during operations
- Advising on, and monitoring tree plantations at the project site
- Reporting on the O&M progress of environmental and social compliance to SEPA
- Assessing as well as mitigating the long term environmental and social impacts of the proposed project operation; and
- Sustaining a working partnership among SEPA, and other related public and private sector organizations

9.5 Environmental & Social Mitigation & Management Matrix

The Envrionmental and Social mitigation and management matrix is one of the central elements of the ESMP, where it will be used as the management tool for implementation of the above mentioned mitigation measures. The plan includes the following:

- Envisaged impacts as identified in the ESIA and their recommended mitigation measures

- The person/ organization directly responsible for adhering to or executing the required mitigation measures

Regardless of the different organizations being delegated responsibilities for execution and monitoring of the project, KDA will be the primary party responsible for ensuring the complete implementation of the ESMP. The following table provides information about all impacts anticipated from project activities during different phases. The contractor(s) will be responsible for the preparation of Site Specific Environmental and Social Management Plans (SSEMPs) on the same format as this ESMP along with site specific plans based on the guidelines provided in the annexures.

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		Design Phase			
1.	**Land Acquisition & Resettlement** The expressway is situated and will pass through major existing roads of the city, hence, there is no land acquisition involved in the project. Similarly, given that the expressway will travel along the median of main roads, no removal/ destruction of residential/ commercial structures is involved that may involve any potential involuntary resettlement. Nevertheless, any relevant NOCs needed from pertinent departments and agencies for carrying out project works, will be obtained prior to the project's commencement (e.g. DHA, CBC, etc.)	No mitigation measures are required as there is no land acquisition and resettlement.	-	KDA	-
2.	**Physical, Cultural Resources** The alignment for the expressway will pass through the median of already existing roads and areas, hence, there is no perceieved impact on any cultural resources or buildings.	A Chance Find Procedures has been developed nevertheless and attached to this report, should there be any sort of cultural artefact or item discovered during construction works.	• Record Register • Consultation record of Archaeological Department	KDA	KDA

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
3.	**Project Siting & Sensitive Receptors** The project will pass through major arteries of the city, traversing through residential and commercial areas, despit the optimization of the route to the extent possible. This will be a significant, irreversible impact. Furthermore, given that the alignment passes through the city, there are a number of sensitive receptors that have been identified adjacent to the lenth of the corridor. These receptors and their sensitivity have been identified on the basis of their nature, the sort of people that can be found or come to these areas, and who may be more susceptible to the adverse impacts associated with the development.	Whilst the route of the project has already been optimized and finalized in line with the different options available, the following mitigation measures must be adopted to minimize the severity of impacts faced by these sensitive receptors: • Carry out awareness raising and information disclosure sessions prior to the initiation of any new section of the project on the proposed interventions including any closures and diversions. • Carry out stakeholder consultations with these receptors prior to the development of the project to accuratley understand their needs (e.g. mobility, noise sensitivity, dust sensitivity, etc.) and aim to incorporate measures highlighted into project design and implementation • Develop a detailed traffic management plan in consultation with the local traffic police and in line with lessons learnt from similar traffic management plans developed	• Record of Consultations and consultation plan • Pictures from consultations	Construction Contractor	KDA

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		and implementd in different parts of the city. Any closures/ diversions to be • Ensure that the GRM of the project is disclosed in the area and prominently highlighted to allow for any grievances by affected persons to be highlighted and shared with the project developer. Subsequently, any such grievances raised to be addressed as required.			
4.	**Renting/ Leasing Land** Land may be leased/ rented by the contractors for the development of construction camps, storage areas, workshops, equipment parking, and washing areas.	• Land for this may be directly rented from private landowners by contractors. The provisions of the Land Acquisition Act (LAA), 1894 will not be involved as the acquisition of the land will be temporary and will be covered by short-term lease agreements between the landowners and Contractor. Rental terms should be negotiated to the satisfaction of the concerned landowners and the agreement should be in local language to make the process clear. • As far as possible, waste/barren land i.e. areas not under agricultural or residential use and natural areas located at	Compensation and land lease records	Contractor	KDA

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		high elevation should be used for setting up the contractor camps.			
5.	**Flora** The flora that will be disturbed by the project can be divided into 2 main categories: 1. Trees along the alignment that will be disrupted during the overhead bridge works 2. Mangroves that will be disrupted during the earthen embankment works For the former, a final tree survey will be carried out prior to project mobilization to understand the number of affected trees to understand the required compensatory plantation. For the latter, a detailed mangrove assessment report has been carried out, which is attached to the annex, which highlights that approximately 423 mangroves will be	• Utmost effort shall be made to save as many trees as possible and minimize the loss of vegetation. • As a principle, ten trees shall be planted in place of one tree cut down to compensate for the trees removed. • The client shall implement the program with the help of Forest Department and with the consultation of concerned consultant ecologist. • The Forest Department and agriculture department shall involve local communities for carrying out plantation. • The indigenous trees most suited to the tract should be re-planted.	• Conformation of design incorporation • Checks and audits of suitable place • Tree compensation record	Contractor , Design Consultant	KDA

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	impacted from the project works.				
6.	**Change in Hydraulic Regime** The earthen embankment portion of the alignment, which will stretch from Mai Kolachi area to Karachi Port may lead to some changes in the overall hydraulic regime and flooding characteristics of the surrounding area.	During the detailed design study to be carried out, a commensurate hydrology study should be carried out for the project and the surrounding areas to understand the changes to the hydraulic regime and potential flood risk. Subsequently, measures to minimze this risk to the extent possible should be incoporated in the project's design and implementation.	• Confirmation of design incorporation. • Audits and Checks	Contractor, Design Consultant	KDA
7.	**Relocation of Utilities** Utilities along the RoW of the corridor will be impacted from the project's development, including electrical ducts, water supply pipelines, sewerage networks, and fiber optic communication lines.	• Prior to commencement of construction works, any and all utilities will be shifted/ relocated to allow for continuous and uninterrupted supply to relevant persons downstream. • KDA to maintain constant communication with the utility agenceis and to provide them with anything needed for this utility shifting. • Proper compensation and restoration mechanism of public utilities will be considered prior to project development. • The provision in the design and budget for the relocation of the existing utility	• Confirmation of design incorporation. • Work order issuance after prior meeting and issuance of prior notification to public and concerned department. • Audits and Checks	Contractor, Design Consultant	KDA

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		infrastructures wherever required shall be finalized in consultation with the concerned departments; • Strengthening of utilities, wherever required; • Timely public notification of unexpected disruption of services; and • The Contractor shall in no instance excavate around or over live buried electrical cable or pressurized gas lines during the construction or allow such to be suspended across open excavations in a manner that, in the opinion of the Resident Engineer, threatens public or worker safety. Neither shall water lines be left suspended and unsupported across open excavations.			
8.	**Resource Conservation** Resources involved in the construction of proposed Project would include water, fuel, and construction materials.	• Use water bowsers for construction works and mineral water bottles/ ground water for drinking purpose; • Plan for the provision/purchase of adequate insulation to reduce	• Confirmation of design incorporation. • Audits and Checks	Contractor, Design Consultant	KDA

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Excessive water consumption by the construction staff may stress water resources in the Project Area and in certain cases may disturb the existing water supplies in the Project Area. Construction material to be used for construction includes coarse aggregates, fine aggregates, asphalt, cement, lining material, earthworks, reinforced and structural steel etc. Almost all the materials to be used in the construction of proposed Project are non-renewable and therefore their efficient use is necessary for impact minimization. Fuel will be used to operate construction machinery. Efficient use of energy resources is important to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is important. The impact is minor negative.	heat loss through batching plants; • Reduction of wastage of water through training of workers involved in water use; • Reuse of construction waste materials to be adopted wherever possible; • Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment; • Equipment and machinery should be well maintained; • The equipment and machinery should be turned off when not in use; • Regularly monitor CO and CO2 content of the flue gases to verify that combustion systems are using practical excess air volumes; and • A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater, and solid waste volumes to the lowest levels.			
9.	**Seismicity**	The proposed road and the associated structures should be designed and constructed as per	• Confirmation of design incorporation. • Audits and Checks	Contractor, Design Consultant	KDA

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	The Project Area is in Seismic Zone 2B, where 2B (upper limit of moderate damage) represents peak horizontal ground acceleration from 0.16 to 0.24 g. In this Zone, designing of various types of structures should be done based on Peak Ground Acceleration (PGA). A low to moderate intensity earthquake impacting the Project site can adversely impact the development if adequate measures are not incorporated in design. This impact can be categorized as direct, medium, site-specific, short term, temporary, medium probability and reversible.	Seismic Building Code of Pakistan 2007 (SBC-07) to comply with minimum requirements for seismic safety of structures.			
Construction Phase					
10.	**Traffic Management** With the project passing through major arteries of the city, there will be considerable impact on the traffic of the area during development works.	• Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the night-time to reduce traffic load and inconvenience to the local population; • Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary	• Vehicle maintenance record • Training record • Implementation of TMP • Regular visual observations	Contractor	IMC, KDA

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		congestions along the major roads; • Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work; and • Proper sign boards will be provided for smooth flow of traffic. • Period of construction and area / location of construction site shall be informed to public in general and specifically to residents. • Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays. • Any complain launched by community member will be responded and appropriate action will be taken to avoid it in future. A guide Traffic Management Plan (TMP) has been proposed in the annex, however, the contractor may take guidance from this TMP and prepare a detailed site specific TMP which will be implemented to avoid			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		traffic accidents, jams/public inconvenience in the Project Area. This plan will be reviewed and approved by KDA prior to implementation.			
11.	**Solid Waste Management** Typical solid waste generated during construction include waste concrete, steel scrap, wooden scaffolding, empty cement bags, excavated soil, wood remains etc. This waste has the potential to cause negative impact on the surroundings if not properly managed and disposed of. It may block nearby natural drainage channels that can ultimately cause localized flooding during monsoon season. Random storage of this waste may be injurious to the workers at the site as well. Windblown debris is a nuisance to the nearby settlements. Poor waste management practices would result in short term and long-term negative impacts on the aesthetics of the surrounding.	• A Comprehensive Waste Management Plan for Construction phase should be developed; • Construction sites should be equipped with temporary refuse bins, and construction wastes should be collected on a daily basis and contained in a temporary designated waste storage area on each site; • Any hazardous waste should be separated and stored in areas clearly designated and labeled, and disposal in environmentally friendly manner; • All type of wastes should be routinely collected from the designated area and disposed at designated waste disposal site(s); and • Upon completion of activities at a construction site all solid wastes should be completely removed and the site should be re-contoured or prepared for natural re-vegetation.	• Visual observation and photographic record. • Waste Management plan implementation	Contractor	KDA, IMC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
12.	**Impact on Air Quality – Dust Emissions** Construction activities that may lead to dust generation include excavation; transportation and tipping of cut materials; handling and storage of aggregates in concrete plants; concrete batching; site leveling and clearing of vegetation; and associated activities. The quantity of dust that may generate on a particular day of construction phase will depend on the magnitude and nature of activity and the atmospheric conditions prevailing on that day.	• The exposure of construction workers to dust should be minimized by provision of dust masks and mandating the workers to wear them. • Water should be sprinkled daily to wet all the expose surfaces. • Use of water suppression for control of loose materials on paved or unpaved internal road surfaces. Oil and oil by-products are not recommended method to control dust29. • Truck loads should be covered with tarpaulin. • Construction site, including soil and material piles at the site, should be adequately barricaded to avoid material escape, generation of dust. • Ready-mix can be used in the stages of the project wherever and whenever required and deemed appropriate. • Careful handling and working under moist conditions and monsoon	• Visual observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records • Water sprinkling records.	Contractor	KDA, IMC

[29] WBG EHS Guidelines

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		season will be avoided as much as possible.			
13.	**Impacts on Air Quality – Exhaust Emissions** Major sources of exhaust emissions are standby diesel generators, material transport vehicles and emissions from construction machinery/earth moving equipment. Major exhaust emissions of concern are CO, SOx, NOx and Particulates. These emissions are injurious to human health in high concentration and can also cause vegetation damage by clogging the photosynthesis process in plants.	• Construction machinery, vehicles should be properly tuned and kept in good working condition, minimizing exhaust and vehicular emissions. • Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance of SEQS; • Excessive engine idling will be discouraged and machinery causing excessive pollution (i.e., visible smoke/soot) will be banned from sites; • Standby generators for power supply will be kept away from pathways and will be placed at locations where probabilities of human intervention are limited.			
14.	**Noise** During the construction phase noise will be generated from the operation of heavy machinery and haulage of	• Machinery operation and high noise activities should be carefully planned and scheduled; • To the extent practical, batching plants and	• Physical observation • Regular environmental monitoring, sampling and testing reports	Contractor	KDA, IMC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	construction materials to and around construction sites and construction activities including concrete mixing, excavation, backup power generators for supply of electricity; use of pressure horn etc. These construction activities are expected to produce noise levels in the range of 80 – 95 dB and may cause discomfort to local residents.	construction areas should not be located within 500 meters of a settlement; • Where that is not possible, high noise activities should cease between 22:00 and 06:00 hrs (Night time hours given in SEQS for Noise) at any construction site within 500 meters of a settlement, or if noise complaints are received from settlement residents. • Vehicles and machinery will be equipped with silencers. Contractors will be required to fit noise shields on high noise construction machinery; • Site labor working in high noise area such as where noise level exceeds 80 dB (A), will wear earplugs; • Occupational health, safety and environmental procedures and Environmental management plan for proposed project would be followed.	Vehicle maintenance records		
15.	**Vibration**	• Vibration measurement will be carried out during			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods used. The operation of construction equipment causes vibrations that spread through the ground and diminish in strength with travelled distance. During earthworks and excavations heavy machinery such as bulldozers, excavators, and loaders used for earthmoving can generate significant vibrations and it can have impact on nearby building structure. The predicted ground vibrations at various distances are shown in Table 6.6 for typical equipment that may be used during proposed construction. Based on the predicted peak vibration levels described in above table, it is expected that vibration would be barely perceptible at sensitive receiver locations within over 50m for most construction activities. According to British Standards of Noise and Vibration, humans are particularly sensitive to	construction phase by the contractor near the settlements in the AOI. • Timing of the construction works to be conducted during the recommended operational hours, to reduce vibration levels in the AOI. • The vibration from major construction activities such as excavation, compacting, drilling, etc. are considered intermittent and short-term, and likely to be tolerated if prior warning is given to potentially affected residents as and where they may be encountered along the route. • The equipment operators to be made aware by the contractor of potential vibration issues problems and of techniques to minimize vibration effects during construction works.			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	vibration with the threshold of perception typically being in the range of 0.14 to 0.3 mm/sec Peak Particle Velocity (PPV) and levels above this may cause annoyance. However, significantly higher levels than this can be tolerated for single short-term events and do not cause annoyance or disturbance to humans.				
16.	**Community Health & Safety** Community health and safety issues during the construction of proposed project may include dust, noise, and vibration from construction vehicle transit, and communicable disease associated with the influx of temporary construction labor. Significant community health and safety issues associated with road projects may also include: • Pedestrian safety • Traffic safety • Emergency preparedness The construction activities and vehicular movement at	• Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, specifically those related to pedestrian facilities or bikeways; • Setting of speed limits appropriate to the road and traffic conditions; and • An emergency preparedness and response plan in coordination with the local emergency responders (e.g. Rescue 1299) to provide timely first aid response in the event of accidents and	• Implementation of HSE Plan • Use of PPEs • Community concerns record • Medical reports of worker	Contractor	KDA, IMC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents, etc. The proposed Project will also have potential of air (dust pollution), noise and vibration impacts on nearby community. Labor with different transmittable diseases (HIV/AIDS, COVID-19, etc.) may cause spread of those diseases in the residents of above-mentioned settlements along the project. The construction areas located near the residential/settlements may cause accident for the people moving near to these areas. Considering these consequences, this impact can be categorized as direct, moderate, site-specific, medium term, temporary, medium probability and irreversible.	hazardous materials response in the event of spills. • Instruct foremen to strictly enforce the keeping out of non-working persons, particularly children, off work sites; • Timely public notification on planned construction works; • Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links; • Reducing the impacts of vector borne diseases on long-term health effect of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which include Prevention of larval and adult propagation of vectors through sanitary			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		improvements and elimination of breeding habitat close to residential areas and by eliminating any unusable impounding of water; • The communicable diseases of most concern during construction phase, such as HIV/AIDS, COVID-19 will be prevented by successful initiatives typically involving health awareness; education initiatives; training heath workers in disease treatment; immunization program and providing health services.			
17.	**Soil Contamination** Construction activities such as clearing of earth, levelling, compaction, carpeting, pavement finishing will affect the existing soil condition in the CoI. During the rain, the eroded soil can mix with stagnant water to transform into slush, which can affect movement of vehicles and	• All spoils should be disposed of at site designated by SSWMB or concerned department and the site should be restored back to its original conditions. Soils with hazardous waste leaks should be dealt with by SEPA certified contractors; • Non-bituminous wastes from construction activities	• Visual observation and photographic record • Waste Management plan implementation	Contractor	KDA, IMC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	machinery and construction work as well as limit the movements of local people. Heavy metals, oils, other toxic substances and debris from construction traffic and spillage may be absorbed by the soil at construction sites and get carried with runoff water. This process may trigger during the monsoon season when construction is in progress. Whereas contamination of soil may be caused by oil and chemical spills at asphalt plant sites, workshop areas and equipment washing yards. This impact is, however, of temporary, site specific and low negative in nature.	should be dumped in approved sites, in line with the legal prescriptions for dumpsites, and covered; • Soil contamination by asphalt should be minimized by placing all containers in caissons; • The Contractors will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination; • Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals;			
18.	**Occupational Health & Safety** The construction works involving earthworks, excavation, erecting structures, etc. poses an inherent risk of injury to labor from accidents. Poor housekeeping practices may lead to stagnant water as breeding grounds for insect vectors (causing malaria,	Site-specific labor health and safety hazards are also critical to identify based on job safety analysis or comprehensive hazard or risk assessment. Health and safety management planning should include the adoption of a systematic and structured approach for prevention and control of physical, electrical, chemical, and biological health and safety	• Implementation of HSE Plan • Use of PPEs • Training Records • Work permits • Implementation of Emergency response plan and disaster management plan in	Contractor	KDA, IMC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	dengue fever etc.). Hazards from handling equipment, ergonometric stress, lifting heavy materials etc. may cause injury to the labor. Electrical equipment and substation pose electrocution hazard. **Crane & Lifting Operations** For all Crane & Lifting Operations CC shall ensure full compliance with standard operating procedures. CC shall develop a site-specific pre-lift checklist which includes the following at minimum: • Crane rigging capacity adequately for load • Condition of slings • Rigging condition adequate for load • Area of swing or travel unobstructed • Multiple crane use • Power line approach distance maintained • Stability and footing • Taglines and spotters • Illumination and weather	hazards. Use of PPE should be made mandatory. Only trained and experience crane, forklift, etc. operators should be hired. CC shall ensure that Job Hazard Analysis (JHA) is performed prior to commencing jobs. It shall also be ensured that the JHA is reviewed after the following: • Whenever work is stopped • Every time work conditions or the job scope changes • Persons working the job shall review and acknowledge the JHA by their signature • Workers will be trained with lifting and materials handling techniques before the construction of the project, including the placement of weight limits above which mechanical assists or two-person lifts are necessary. • Work site layout will be planned to minimize the need for manual transfer of heavy loads. • Tools will be selected and work stations would be	case of natural disaster occurrence		

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	• Signal operator • Job hazard analysis and other permits All lifting and rigging activities shall be supervised and conducted by a competent person or team, CC shall maintain a lifting gear registry for all lifting gear on-site inclusive of a listing of all lifting gear, copies of equipment certificates (manufacturer, safe working load, serial number) and the inspection/recertification frequency. **Forklifts & Non-Road Vehicles** CC should ensure forklift and non-road vehicles are fit for purpose and operated according to manufacturer's requirements. Only competent operators are permitted to operate forklifts and non-road vehicles. At minimum, all forklifts and non-road vehicles shall be equipped with following equipment:	designed to reduce force requirements and holding times, which promote improved postures, including, where applicable, user adjustable work stations. • Administrative controls, such as job rotations and rest or stretch breaks will be implemented into the work processes. • Good house-keeping practices, such as the sorting and placing loose construction materials in established areas, would be implemented. • Excessive waste debris and liquid spills will be cleaned up regularly. • Electrical cords and ropes will be located in common areas and marked corridors. • Slip retardant footwear will be used. • Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap.			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	• Seat belts • Horn • Emergency Brake • Wheel chock • Labeled Controls • Fire Extinguishers • First Aid Kit • Back-up Alarm **Scaffolding** CC is responsible to establish periodic inspection, certification and recertification program for scaffold works. Only qualified worker is authorized to erect, inspect and certify scaffold. All scaffolds should have a guardrail system on each open side, up to the access point. It should be equipped with toe boards having suitable access ladder. **Over Exerting** Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common	• Temporary fall protection measures in scaffolds and out edges of elevated work surfaces would be used, such as hand rails and toe boards to prevent materials from being dislodged. • Appropriate PPE such as safety glasses with side shields, face shields, hard hats, and safety shoes, would be worn. • Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap. • Temporary fall protection measures in scaffolds and out edges of elevated work surfaces would be used, such as hand rails and toe boards to prevent materials from being dislodged. • Appropriate PPE such as safety glasses with side shields, face shields, hard hats, and safety shoes, would be worn. • Use of ground-fault circuit interrupters			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	causes of injuries at construction site. **Slips Trips & Falls** Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction site. **Struck by Objects** Construction activities of the project may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities. **Moving Machinery** Vehicle traffic and use of lifting equipment in the movement of	• Periodic inspection of extension cords and portable tools • Use power tools and equipment as designed • Proper lockout/tagout procedures will be followed • Safety signs for electrical hazard will be placed • Ensuring proper guarding of electrical equipment and facilities such as substation and switchgear • Only authorized personal should be allowed at the construction site • Identify and minimize, so far as reasonably practicable, the causes of potential hazards to workers, including communicable diseases such as HIV/AIDs and vector borne diseases; • Avoid stagnation of water and initiate drainage/cleanup of stagnant water; • Provide for the provision of appropriately stocked first-aid equipment at work sites;			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving.	• Provide for appropriate personal protective equipment (PPE) to minimize risks, such as but not limited to appropriate outerwear, boots and gloves; safety helmets; • Provide training for workers for the use of PPE; • WB Group's Environment, Health and Safety (EHS) Guidelines (attached at the end of this document) will be implemented; • No bonded and child labor will be permitted at site; • Major labor laws will be followed e.g., Minimum Wage, Harassment of women in the work place Hours of work, Overtime Payment. • Also, laborers will be trained on appropriate interaction with local people especially women; • Include procedures for documenting and reporting accidents, diseases, and incidents; and • All safety precautions will be taken to address safety			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		hazards for the nearby community. These precautions may include safety/warning signage, safety barrier around the construction site.			
19.	**Wastewater Generation** Considerable wastewater will be generated from project activities and the activities at the construction camp.	• Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks. Proper monitoring to check the compliance of SEQS will be carried out; • Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit; • Construction yards and material storage areas where vehicles operate or materials are stored should be established on well drained fill; • Free-flowing points of discharge for storm water should be identified nearby the boundaries of materials storage/construction yards for gravity or pump-assisted	• Visual observation • Regular environmental monitoring, sampling and testing reports • Waste Management plan implementation	Contractor	KDA, IMC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		dewatering and yard drainage; • Local drainage channels should have sufficient capacity for handling discharge flows, with clear discharge points to open drainage courses; • Water discharged to constructed drains should contain a minimum quantity of suspended solids; • Drainage from fuel storage tank locations, refuelling areas, and equipment service areas should be segregated from other runoff; discharge should be routed through an oil/water separator; and • Contractors will be required to observe drainage conditions during dewatering operations and storm events to assure positive drainage. If flooding occurs along roadways or in neighbourhoods, or community complaints arise, the contractor will undertake a combination of the above mitigation			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		measures to minimize drainage and water quality impacts.			
20.	**GHG Emissions** Greenhouse gas emissions contribute to global warming and other climate changes on both regional and global scales. During the construction phase, greenhouse gas (GHG) emissions (such as CO2, CH4, NOx, etc.) will result primarily from fuel combustion in construction vehicles, machinery, and temporary power generation units. The process of excavation, land clearing, and materials transport will also contribute to CO2 emissions. The use of diesel-powered equipment and the disturbance of soil and vegetation can lead to increased carbon emissions, both directly through fossil fuel use and indirectly through the reduction of carbon sequestration capacity of the disturbed land. Additionally, the development of the proejct will require energy-intensive processes, which could further	• Employing energy-efficient and low-emission machinery, as well as transitioning to electric or hybrid vehicles for transport, can significantly reduce direct CO2 emissions. • Minimizing land disturbance and adopting soil conservation practices can help preserve the carbon sequestration capacity of the area. Reforestation and replanting efforts post-construction can also help offset emissions. • Streamlining the construction schedule and reducing idle time for machinery can minimize unnecessary fuel consumption and associated emissions. • Implementing carbon offset initiatives, such as funding renewable energy projects or supporting local reforestation efforts, can help balance out the GHG	• Regular environmental monitoring, sampling and testing reports • Vehicle inspection record • Plantation record	Contractor	KDA, IMC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	increase emissions if the power supply is derived from fossil fuels.	emissions generated during construction. • Regular maintenance of vehicles, plants, and machinery according to the manufacturer's specifications. • Monthly visual inspections of vehicle and plant exhausts to detect excessive smoke emissions and take corrective action when needed. • Installation of approved pollution control devices on equipment and machinery. • Avoid over loading the transport vehicles to reduce emissions. • Site vehicles and machinery will be switched off or throttled down when not in use.			
21.	**Social & Cultural Conflicts** During the construction phase of the Project, conflicts may arise between labor force and local community. Use of local resources and products by the construction workers can generate stress on the local resources. Furthermore,	• Local labor especially from nearby communities should be given preference for the construction works; • Careful planning and training of work force to minimize disturbance to the local people;	• Record register of all the issues and rational expectations desired by the local public; • Camp established away from the nearest community; Local	Contractor	KDA, IMC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	difference in cultural values may also cause discomfort to residents. This impact is negative, local, low, short-term, and probable.	• Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals; and • Adequate training for the transitive workforce of the project (involved both in the construction process and in the commissioning) to regard the customs of the area so that the locals do not feel insecure.	hired workforce; • Any complaint from the local community. • Approved OHS Plan, evidence of OHS trainings conducted. Accident/Incident reported. • Training records Health and safety manual • Contractor will implement the SOPs related to the Construction industry. • Health and safety manual.		
22.	**Communicable Diseases** The health impacts that are envisaged to take place among employees, workers and local population of the proposed Project are discussed below: For the implementation of Project activities, skilled and unskilled labor is required by the contractor. Mostly, skilled, and unskilled workers will be hired by the contractor on permanent and contract basics, belonging to different cultural backgrounds, which they utilize for different	• Proper checkup of skilled and unskilled workers before their hiring; • Labor camp should be away from the residential area and workers' management plan should be formulated by Contractor to minimize the adverse impacts on local communities and workers; • Trainings, and awareness campaigns should be conducted for workers and surrounding communities on			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	developmental projects. In this case, occurrence of communicable diseases like HIV/AIDs, COVID-19, respiratory diseases, and skin and eye infections are communal to take place during the execution of the proposed Project. This impact is negative and moderate in nature.	awareness and prevention of HIV/AIDs. • Workers should be educated for personal hygiene and the sanitation concerns, leading to communicable and non-communicable diseases; • Water should not be allowed to stagnate even if clean, and measures should be taken to cover the area.			
23.	**Influx of Labor** For the implementation of Project activities, skilled and unskilled labor is required by the contractor. Mostly, skilled, and unskilled workers will be associated with the contractor for long period of time, where they are required for the projects, and while other workers are hired from the different areas that belong to different cultural backgrounds. Social problems and conflicts that are associated with Labor Influx are as follows:	• Labor camp(s) should be established away from residential population; • Preference should be given to the local people to work with contractor, and contractor should hire maximum labor force from the Project Area because this will reduce the labor influx; • Awareness should be created among the work force to ensure respect for local customs; • Construction work should be completed within the	Minutes of meetings of community Consultation Dissemination relevant material.	Contractor	KDA, IMC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	• Risk of social conflict: Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural, or ethnic differences, or based on competition for local resources. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other; • Increased risk of illegitimate behavior and crime: The influx of workers and service providers into communities may increase the rate of crimes and a perception of insecurity by the local community. Such illegitimate behavior and crimes can include theft, physical assaults, substance abuse, sexual assault and human trafficking;	stipulated time to move workers to next location; • Labor force should be shuffled with the time; • An effective GRM should be established for the Project to resolve all issues related to the community. Thus, progress regarding resolving the issues should be monitored closely; • Create awareness among workers on proper sanitation and hygiene practices to endorse proper health and maintain good housekeeping practices at all Project sites; • Provide adequate personal hygiene facilities in good condition with adequate supply of clean water; • Make arrangements to treat the affected workers on time to control the movement of vector borne diseases; • Sensitize workers and surrounding communities on awareness and prevention of COVID-19, HIV/AIDS and sexually transmitted infections (STI)			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	• Impacts on community dynamics: Depending on the number of incoming workers and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Pre-existing social conflict may intensify as a result of such changes; • Increased burden on and competition for public service provision: The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education, and social services. This is particularly the	through training, awareness campaigns and workshops during community meetings; • Provide proper and free COVIID-19, HIV/AIDS and STI health screening and counseling for site workers and community members; • Develop and enforce a strict code of conduct for workers to regulate behavior in the local communities; • Take all sensible precautions to avoid illicit, vicious conduct by or amongst the Contractor's personnel, and to preserve unity and harmony, and protection of people and property on and near the sites; • Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel; • Site security preparations must be contained within the Bills of Quantities (BoQs) to avoid any delays which might be caused due to insecurity;			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	case when the influx of workers is not accommodated by additional and separate supply systems; • Increased risk of communicable diseases and burden on local health services: The influx of people may bring communicable diseases to the Project Area, including sexually transmitted diseases (STDs), or the incoming workers may be exposed to diseases to which they have low resistance. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the Project's medical facility and instead go anonymously to local medical providers, this can result in an additional burden on local health resources;	• Appropriate fencing, security check points, gates and security guards should be provided at the construction sites to ensure the security of all equipment, machinery and materials, as well as to secure the safety of site staff; and • The Contractor must guarantee that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism and theft.			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	• Local inflation of prices, accommodations, and rents: A significant increase in demand for goods and services due to labor influx may lead to local price hikes and crowding out of community consumers. Depending on Project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of residents; and Increase in traffic and traffic related accidents: Delivery of supplies for construction workers and the transportation of workers can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure Impact is temporary in nature				
24.	**Child Labor**	• Awareness should be created among the local communities about the	• Compensation record.	Contractor	KDA, IMC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	There are two basic conventions on child labor adopted by the ILO, and one adopted by the United Nations. The ILO Minimum Age Convention, 1973 (No. 138) and its accompanying Recommendation (No. 146) set the goal of elimination of child labor, and the basic minimum age for employment or work (in developing countries at 14 years of age or the end of compulsory schooling, whichever is higher; and 15 or the end of compulsory schooling for developed countries). The Convention sets a minimum age of 2 years younger for "light work," i.e., 12 and 13 years, respectively; and a higher minimum age for dangerous or hazardous work (basically 18 years of age, but 16 in certain circumstances). The Convention also has various other flexibility clauses. **Minimum Age for Employment or Work**	adverse impacts of child labor. For the public awareness, meetings should be held in the Project Area, and announcements should be made using the available local platforms with the involvement of all sectors of the society; • Contractor through contractual agreement should be bound to follow the labor standards, rules, and regulations during hiring the labor force. All activities should be monitored by the social and environmental staff of the implementing agency; • Client and Supervision consultant should ensure that contractor shall have its employment policy in accordance with relevant act and labor policies in Sindh and Pakistan; and • Contractor should ensure the presence of all persons at site are adults and have their proper identity cards with them.	Grievance redress record		

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	• Ensure that child labor contrary to the convention is not used • Define child labor as any work done by anyone under 14 years old, except for light work done by children 12 years and older. • Ensure that no work is done by anyone of less than the school-leaving age, at least if schooling is available. • Ensure that no work is likely to jeopardize the health, safety, or morals of young persons, either by its nature or the circumstances in which it is carried out, is done in the Project by anyone under 18 years of age. **Forms of Child Labor** Ensure that "worst forms" of child labor—for anyone under 18 years of age—are not used under any circumstances. Direct activities to take immediate and effective	• Reduce the health hazards and dangers to young persons in the workplace.			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	measures to eliminate these worst forms of child labor.[30] Inhabitants of the Project area have mix economic background and different sources of income. Children of low-income groups mostly involve themselves in different earning activities, as their parents prefer to get their children hired in small shops as helpers, and waiters in hotels for earning money, and supporting household livelihoods. However, the Sindh Restrictions on Employment of Children Act, 2017 prohibits the employment of children and restricts the employment of adolescents in certain occupations and processes such as construction industry, where whoever employs or permits a child (person under the age of 15 years) to work in an establishment shall be liable to punishment with imprisonment.				

[30] *ILO Core Labor Standards-Handbook*

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	The child labor impact might arise during construction stage, as large number of skilled and unskilled labor will be required by the contractor for the construction activities of the proposed Project.				
Operations Phase					
25.	**Safety & Privacy** Due to passing through major parts of the city, and catering to port traffic, potential impacts from safety of vehicle movement on adjoining areas, along with privacy from vehicular movement will be significant impacts.	To mitiagate these impacts, the following measures are proposed: • Use of Reinforced High Impact RCC Crash Bariers Along deck edges • Installation of accoustic composite sound barriers (3.5m in height) in proximity to residential blocks • High Privacy barriers up to 4 m high in the residential areas such as sunset boulevard	• Incopooration of Components • Visual Observations • Record of Consultations with community	Operator	
26.	**Air Quality** Most of the pollutant's levels decrease with the increase in vehicular speed and decrease in traffic congestions. With the construction of flyover, the traffic congestion will be reduced and the traffic passing through the flyover will move in	– Singh Environmental Protection Agency (SEPA) may set up system to monitor air quality along project area in accordance with Sindh Environmental Quality Standards (SEQS) for a specific period to record the quality of air during the operation phase.	• Visual observation • Regular environmental monitoring, sampling and testing reports.	Operator	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	a smooth flow; therefore, reducing the emission levels.	– Regular road maintenance to ensure good surface condition that will help in avoiding air pollution.			
27.	**Road Maintenance Works & Heavy Traffic** During the operational phase, different maintenance works will be carried out throughout the Project life. Laborers or staff involved in these maintenance works are exposed to health and safety issues. Poor implementation of HSE plans or noncompliance of personal protective equipment's (PPEs) can lead to personal injuries and accidents. Moreover, application of poorly maintained equipment's and material can lead to air pollution. The maintenance works can also cause traffic problems to the travelers. Lack of maintenance may also lead to ground water and soil pollution. The impact of noise will only be due to construction of the proposed Project as the settlement are nearby the road. This impact is temporary and minor adverse in nature.	• Implementation of HSE Plans during the maintenance period; • Strict implementation of personal protective equipment's PPEs; • Use of high quality equipment and material by the contractor; • Continuous improvements in the emergency plans; • Placement of sign boards for traffic diversions and proper implementation of traffic diversion plans; • Selection of suitable sites for contractor camps and implementation of all the related important protocols for the management of camp activities in order to avoid environmental and HSE issues; • Understanding and training of staff on Operation and Maintenance Manual; • Regular maintenance of engineering works;	• Road safety enforcement record • Challan / penalties record • Accident record • Audits and check regularly	Operator	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Maintain vegetated areas in adequate cover to meet the intended purpose(s); • Conservation practices that limit particulate matter emissions should be incorporated into long-term maintenance plans; • Blowing of pressure Horns by the vehicle will be strictly prohibited; and • Continued public consultation and feedback on it.			

9.6 Environmental & Social Monitoring Plan

Environmental and social monitoring plays a crucial role in providing timely and valuable information to project management and implementation agencies. In essence, monitoring involves regularly checking and balancing the progress of project activities and the achievement of developmental targets during construction and operation. It aids in promptly identifying, analysing, and addressing any obstacles that may arise. Specific environmental parameters, encompassing physical, ecological, and social aspects, are carefully selected, and subjected to quantitative analysis. The results of this analysis are then compared against established guidelines, standards, and pre-project conditions to assess the effectiveness of the Environmental and Social Management Plan (ESMP) and its implementation in mitigating impacts. The objectives of the environmental and social monitoring plan throughout the construction and operation phases are as follows:

- Monitor the actual impacts of the project on physical, ecological, and socio-economic receptors.
- Provide recommendations for mitigation measures in case of unforeseen impacts or when the impact level exceeds the anticipated level stated in the Environmental and Social Impact Assessment (ESIA).
- Ensure compliance with legal and community obligations, including safety measures during the construction and operation phases.
- Ensure the proper disposal of excess construction materials, solid waste, water, wastewater, and gaseous emissions.
- Evaluate the adequacy of the ESIA in relation to the project's predicted long-term impacts on the physical, ecological, and socio-economic environment of the area.
- Assess the effectiveness of the mitigation measures proposed in the Environmental and Social Management Plan (ESMP) and recommend improvements if necessary.
- Compile data on periodic incidents and accidents to support analyses aimed at minimizing future risks.

The KDA project team will hold responsibility for all monitoring activities to be conducted (compliance and effects monitoring). All findings and results will form part of the monitoring report to be shared with SEPA.

9.6.1 Compliance Monitoring

Compliance monitoring of the proposed project activities will serve as a tool to ensure that the environmental and social control measures identified are strictly adhered to during project execution. This will be conducted by the E&S staff of the SC. The goals of the compliance monitoring will be to:

- Observe the activities carried out by the contractor(s) or other individuals involved in the proposed project in a systematic manner.
- Ensure that the activities are in accordance with the Environmental and Social Management Plan (ESMP).
- Document and communicate the observations to the KDA project team for prompt corrective actions, if necessary.
- Maintain a record of all environmentally and socially significant incidents, along with the corresponding actions and corrective measures taken.
- Establish communication with the local communities, gather their opinions and concerns, and discuss them during monthly meetings.
- Prepare regular reports on the environmental and social performance of the proposed project.

9.6.2 Effects Monitoring

The Environmental and Social Impact Assessment (ESIA) takes into account the projected impacts of the proposed project using available information and the interconnectedness of various environmental and social factors. Mitigation measures are incorporated based on this assessment to ensure that the expected residual effects remain within acceptable thresholds. However, it is important to recognize that despite full implementation of mitigation measures, there is a possibility that the project's negative impacts may exceed predicted levels or acceptable limits. To address these concerns, an effects monitoring program will be implemented during the project activities, aiming to effectively manage environmental and social risks and uncertainties. The objectives of the effects monitoring program can be outlined as follows:

- To ensure that the impacts of the proposed project remain within acceptable thresholds, thereby establishing trust and confidence among the public.
- To promptly alert the project team about any unforeseen adverse impacts or sudden changes in impact trends, enabling swift corrective actions such as modifications to project activities or the implementation of additional mitigation measures.
- To provide information that assists in planning and controlling the timing, location, and intensity of specific project activities, with the aim of minimizing their effects.
- To support research and development efforts by documenting the effects of the proposed project, which can be used to validate impact prediction methods and enhance the accuracy of future project assessments.

The contractor(s) holds the primary responsibility for conducting effect monitoring under the supervision of the SC and the KDA team, covering the entire project. The effect monitoring program has been meticulously developed, taking into account the identified impacts outlined in Chapter-5. Some adjustments may be made to this program, including potential changes in frequency, based on insights gained from the project's one-year operation, documented in the Change Record

9.7 Training & Capacity Building

To strengthen the capabilities of both the Proponent and the Contractor, comprehensive training will be provided regarding the environmental and social aspects of the proposed project, implementation of mitigation measures, and the protocols and reporting mechanisms for monitoring.

In-house training will be conducted for the project staff, including the contractor, consultant, and the supervision staff of the Proponent. This training will consist of a one-day basic training and a one-day advanced training, focusing on the environmental and social considerations of development projects in general, as well as the specific implementation requirements and responsibilities of the KDA project team and the contractor staff in executing the environmental and social management and monitoring plan. The training protocols will encompass the following areas:

- Methods for monitoring air quality parameters and implementing measures to prevent or minimize air pollution, specifically from sources like haul trucks.
- Procedures for monitoring water quality parameters and implementing measures to prevent or minimize water pollution, particularly from wastewater effluent generated by workshops, machinery washing yards, and the use of harmful chemicals.
- Safe practices for waste management and disposal.
- Ensuring noise levels from construction machinery and equipment are within acceptable limits.
- General guidelines for maintaining cleanliness and good housekeeping.
- Addressing communicable diseases and implementing measures to prevent their spread.
- Safety measures to protect the workforce and local communities from hazards associated with construction activities.
- Enforcing the use of safety equipment by the workforce.
- Other environmental and social topics necessary for the effective implementation of the ESMP.

9.8 Communication & Documentation

Communication and documentation are essential features of the ESMP, where the key features are:

9.8.1 Data Recording & Maintenance

Standardized formats will be used for documenting information during environemntal and social monitoring, ensuring consistency and compatibility with the designed database. To streamline data entry, check boxes, will be incorporated wherever applicable. Additionally, a tracking system wil be established for each form to facilitate efficient management and organization of collected data.

9.8.2 Database

The database include the following information:

- Training Programs
- Staff Deployment
- Non-compliances
- Corrective Actions
- List of Environmental & Sovial Data on soil and land pollution
    - Disposal of waste

- Water resources
- Fuel oil and chemical spills
- Vegetation record
- Wastewater treatment records
- Noise pollution
- Air and dust pollution
- Socio-economic data
- Ecological sensitivities

9.8.3 Meetings & Reporting

During the construction phase, the SC will convene montlhy site meetings to address regular activities, non-compliance issues, and their corresponding corrective actions. Periodic reports, as outlined in the table below will be generated specifying the responsible individuals for report preparation and review. Furthermore, meeting minutes will be included in routine environmental and social reports to ensure comprehensive documentation:

Table 9.1 - Periodic Reporting Mechanism

S. No	Report Category	Prepared by	Submitted To	Reviewed by
1.	Monthly	Contractors' environmental and social staff	KDA	KDA / SC
2.	Quarterly	Contractors' environmental and social staff	KDA	KDA / SC
3.	Quarterly Environmental and Social Monitoring Report	SC	KDA	KDA / SC
4.	Quarterly External Environmental and Social Monitoring Report (SAEESMR)	Third Party Monitoring and Evaluation Consultant	KDA	KDA / SC
5.	Annual Report	Contractors' environmental and social staff	KDA	KDA / SC
6.	Completion Report	Contractors' environmental and social staff	KDA	KDA / SC

9.8.4 Photographic Records

Contractors will be required to maintain photographic documentation throughout the implementation of the project. This photographic record should encompass essential elements such as site photographs, road infrastructure, camp sites, monitoring activities, and more.

9.8.5 Non-Compliance of the ESMP

The successful implementation of the proposed ESMP relies on the collaboration of various stakeholders. The Contractor holds primary responsibility for ensuring the execution of the mitigation measures outlined in the ESMP, which will be included in the contractual agreements. The environmental mitigation costs will be factored into the overall project budget, and the Contractor will receive payment based on monthly compliance reports. However, failure to comply with the ESMP implementation and timely submission of compliance reports may result in deductions from the Contractor's payments allocated for environmental and social components. The compliance status of the ESMP will also be periodically submitted to SEPA for review, as mandated by their environmental approval requirements. Non-compliance may lead to the withdrawal of the environmental approval.

9.8.6 Review of Recorded Data

The SC and KDA will periodically review and examine all data and communications documented and maintained by the Contractor. Based on their assessment, appropriate actions and recommendations will be provided to the Contractor to enhance the quality of recording and documenting practices.

9.9 Contractor's Obligation & Management

The Contractor will bear primary responsibility for ensuring the effective implementation of the proposed mitigation measures outlined in the ESIA, including the Environmental and Social Management Plan (ESMP). The necessary details of the ESMP will be included in the bidding document and subsequently incorporated into the contract documents of the Contractor. The costs associated with environmental and social mitigation will be included in the overall project budget, and payments to the Contractor will be based on monthly compliance reports, actual work completed on-site, and resource allocation. Additionally, the Contractor will be accountable for developing and executing a site-specific ESMP, also known as the Contractor-ESMP, in accordance with the guidelines specified in the ESIA. Prior approval from the SC and KDA project team will be required for the Contractor's ESMP and all associated sub-plans. Furthermore, the Contractor will ensure the presence of Environmental and Social (E&S) staff on-site from the project's commencement, and the proposed organizational structure will be subject to dual approval from the SC and KDA.

ANNEX I - ENVIRONMENTAL MONITORING REPORTS

Ambient Air Quality Test Report

Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-A**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N1**	**24°49'52.23"N 67° 4'44.50"E**

Date	Time	CO (µg/m³)	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
21.03.2025	10:00	0.62	19.1	18.8	9.8	81.3	49.2	244.4	ND
	10:30	0.66	19.6	19.2	10.1	82.6	51.2	247.7	
	11:00	0.72	20.9	19.5	10.4	85.5	53.3	249.0	
	11:30	0.77	21.0	19.9	10.6	88.0	54.4	251.1	
	12:00	0.81	21.2	20.4	10.9	91.1	55.6	252.4	
	12:30	0.83	21.4	20.8	11.3	91.8	57.2	255.7	
	1:00	0.86	21.7	20.9	11.7	93.3	58.8	256.6	
	1:30	0.89	22.0	21.2	12.0	94.6	59.0	257.2	
	2:00	0.78	22.2	21.8	12.2	94.9	55.2	264.4	
	2:30	0.75	22.6	22.3	12.6	95.5	58.8	271.1	
	3:00	0.70	22.8	24.4	12.8	95.8	61.1	277.8	
	3:30	0.66	23.0	26.6	12.9	97.2	61.6	280.0	
	4:00	0.68	23.2	27.7	13.0	98.6	62.2	283.3	
	4:30	0.64	23.6	28.8	13.3	99.3	63.3	288.8	
	5:00	0.60	23.9	29.0	13.6	103.3	64.8	291.1	
	5:30	0.59	24.0	30.3	13.7	105.2	65.5	293.4	
	6:00	0.62	24.4	30.6	13.9	107.7	66.6	295.8	
MIN		**0.59**	**19.1**	**18.8**	**9.8**	**81.3**	**49.2**	**244.4**	
MAX		**0.89**	**24.4**	**30.6**	**13.9**	**107.7**	**66.6**	**295.8**	
AVG		**0.71**	**22.1**	**23.7**	**12.0**	**94.4**	**58.6**	**268.4**	
SEQS			**40**	**80**	**120**	**150**	**75**	**500**	**1.5**
LDL-Limits			**0**	**0**	**0**	**10**	**2.5**	**1**	**-**

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

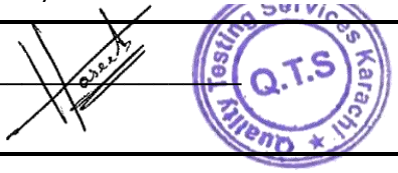
Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-A**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N-01**	**24°49'52.23"N 67° 4'44.50"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	0.78	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	08 Hours	20.9	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	08 Hours	20.2	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	08 Hours	11.0	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	15.3	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	08 Hours	89.3	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	08 Hours	55.4	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	08 Hours	252.3	500.0	1.0	
Lead (Pb)	µg/m³	08 Hours	BDL	1.5	-	ASS Method
Noise	dB(A)	08 Hours	62.8	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:**  **Name : Haseeb Arshad**

Ambient Air Quality Test Report

Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-B**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N2**	**24°50'14.55"N 67° 4'4.44"E**

Date	Time	CO (µg/m³)	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
22.03.2025	10:00	0.70	22.2	19.0	11.1	89.2	40.3	232.2	ND
	10:30	0.71	22.4	19.9	11.3	90.2	44.6	234.6	
	11:00	0.73	22.6	19.7	11.4	90.6	44.9	236.6	
	11:30	0.74	22.7	19.5	11.7	90.9	45.0	239.0	
	12:00	0.77	22.9	19.9	11.8	92.2	46.6	240.1	
	12:30	0.79	23.0	20.0	11.9	92.8	47.0	244.2	
	1:00	0.81	23.3	20.2	11.4	93.0	48.8	245.5	
	1:30	0.82	23.6	20.4	11.6	93.4	47.2	247.9	
	2:00	0.84	23.6	20.5	12.0	94.6	45.9	243.8	
	2:30	0.80	23.7	20.7	12.2	95.0	46.9	246.9	
	3:00	0.85	24.0	20.8	12.3	96.6	48.0	251.1	
	3:30	0.81	23.9	20.9	12.4	97.8	48.8	255.8	
	4:00	0.87	24.4	21.1	12.5	99.0	49.0	250.9	
	4:30	0.90	24.2	21.4	12.6	101.1	50.1	253.3	
	5:00	0.92	24.8	21.5	13.0	102.1	50.2	254.1	
	5:30	0.93	26.6	21.7	13.3	102.5	50.5	255.7	
	6:00	0.93	24.8	22.0	13.2	103.3	51.1	256.6	
MIN		0.7	22.2	19	11.1	89.2	40.3	232.2	
MAX		0.93	26.6	22	13.3	103.3	51.1	256.6	
AVG		0.81	23.7	20.5	12.0	95.6	47.1	246.1	
SEQS			40	80	120	150	75	500	1.5
LDL-Limits			0	0	0	10	2.5	1	-

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Ambient Air Quality Test Report

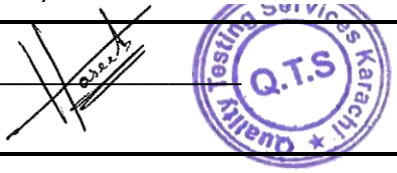
Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-B**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N-02**	**24°50'14.55"N 67° 4'4.44"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	0.81	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	08 Hours	23.7	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	08 Hours	20.5	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	08 Hours	12.0	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	22.2	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	08 Hours	95.6	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	08 Hours	47.1	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	08 Hours	246.1	500.0	1.0	
Lead (Pb)	µg/m³	08 Hours	BDL	1.5	-	ASS Method
Noise	dB(A)	08 Hours	64.3	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:**  **Name : Haseeb Arshad**

Ambient Air Quality Test Report

Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-C**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N3**	**24°49'44.83"N 67° 3'2.41"E**

Date	Time	CO (µg/m³)	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
23.03.2025	10:00	0.33	16.6	19.9	8.8	80.3	34.4	188.9	ND
	10:30	0.34	17.2	20.0	9.0	80.8	34.7	190.2	
	11:00	0.35	17.4	20.3	9.3	8.9	34.9	191.3	
	11:30	0.36	17.7	20.5	9.3	81.1	35.0	193.6	
	12:00	0.37	17.9	20.6	9.5	81.4	35.5	196.6	
	12:30	0.38	18.0	20.8	9.6	81.6	35.7	197.9	
	1:00	0.39	18.6	21.1	9.8	81.7	35.9	190.5	
	1:30	0.40	18.8	21.5	9.9	81.9	36.6	194.8	
	2:00	0.42	19.0	21.6	10.0	82.2	36.8	199.0	
	2:30	0.44	19.3	22.5	10.4	83.3	37.0	202.2	
	3:00	0.45	19.6	22.9	10.7	83.6	37.7	204.4	
	3:30	0.45	19.9	23.4	10.7	83.7	37.9	204.6	
	4:00	0.46	20.0	24.5	10.9	83.9	38.0	207.8	
	4:30	0.47	20.5	25.5	11.3	84.4	38.2	209.1	
	5:00	0.49	20.7	25.9	11.5	84.8	38.6	209.6	
	5:30	0.51	21.1	26.5	12.0	88.8	38.9	210.1	
	6:00	0.52	22.6	26.8	12.4	89.0	40.2	211.3	
MIN		0.33	16.6	19.9	8.8	8.9	34.4	188.9	
MAX		0.52	22.6	26.8	12.4	89	40.2	211.3	
AVG		0.42	19.1	22.6	10.3	75.7	36.8	200.1	
SEQS			40	80	120	150	75	500	1.5
LDL-Limits			0	0	0	10	2.5	1	-

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Ambient Air Quality Test Report

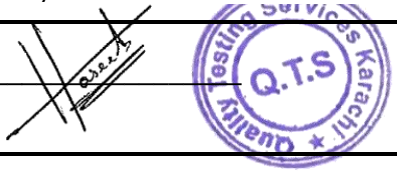
Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-C**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N-03**	**24°49'44.83"N 67° 3'2.41"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	0.42	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	08 Hours	19.1	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	08 Hours	22.6	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	08 Hours	10.3	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	18.9	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	08 Hours	75.7	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	08 Hours	36.8	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	08 Hours	200.1	500.0	1.0	
Lead (Pb)	µg/m³	08 Hours	BDL	1.5	-	ASS Method
Noise	dB(A)	08 Hours	61.7	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:**  **Name : Haseeb Arshad**

Ambient Air Quality Test Report

Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-D**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N4**	**24°49'40.98"N 67° 2'6.97"E**

Date	Time	CO (µg/m³)	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
24.03.2025	10:00	0.86	21.1	27.7	12.2	103.3	41.1	234.4	ND
	10:30	0.88	21.6	27.9	12.6	10.4.4	41.4	236.6	
	11:00	0.90	21.9	28.0	12.8	104.5	41.8	238.8	
	11:30	0.92	22.3	28.6	12.9	109.2	42.2	242.2	
	12:00	0.95	22.6	28.8	13.0	110.0	42.7	243.7	
	12:30	0.97	22.9	28.9	13.3	111.1	43.3	244.8	
	1:00	0.99	23.3	30.0	13.5	111.6	43.9	245.0	
	1:30	1.01	23.7	30.2	13.6	111.9	44.4	247.9	
	2:00	1.03	23.9	30.5	13.7	112.2	44.6	249.0	
	2:30	1.04	24.2	30.7	13.8	112.6	45.0	251.1	
	3:00	1.06	24.6	30.8	14.0	112.9	45.5	252.3	
	3:30	1.07	24.8	31.1	14.4	113.4	45.7	255.6	
	4:00	1.09	24.9	31.5	14.6	113.6	45.9	253.3	
	4:30	1.11	25.5	31.6	14.7	113.8	46.0	254.9	
	5:00	1.13	25.7	32.4	14.9	114.4	46.3	255.4	
	5:30	1.15	26.2	32.7	15.1	114.8	46.4	256.6	
	6:00	1.18	26.6	32.8	15.3	115.5	47.0	257.0	
MIN		0.86	21.1	27.7	12.2	103.3	41.1	234.4	
MAX		1.18	26.6	32.8	15.3	115.5	47	257	
AVG		1.02	23.8	30.2	13.7	111.3	44.2	247.8	
SEQS			40	80	120	150	75	500	1.5
LDL-Limits			0	0	0	10	2.5	1	-

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Ambient Air Quality Test Report

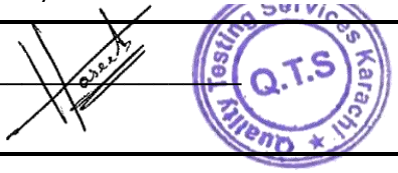
Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-D**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N4**	**24°49'40.98"N 67° 2'6.97"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	1.02	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	08 Hours	23.8	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	08 Hours	30.2	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	08 Hours	13.7	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	21.8	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	08 Hours	111.3	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	08 Hours	44.2	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	08 Hours	247.8	500.0	1.0	
Lead (Pb)	µg/m³	08 Hours	BDL	1.5	-	ASS Method
Noise	dB(A)	08 Hours	62.9	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:**  **Name : Haseeb Arshad**

Ambient Air Quality Test Report

Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-E**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N5**	**24°49'37.71"N 67° 1'16.68"E**

Date	Time	CO (µg/m³)	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
25.03.2025	10:00	0.71	13.3	18.8	6.6	107.2	34.4	211.1	ND
	10:30	0.72	13.5	18.9	6.9	109.9	35.0	212.3	
	11:00	0.73	13.7	19.0	7.3	110.0	35.5	210.9	
	11:30	0.74	13.9	19.3	7.8	110.3	35.8	213.3	
	12:00	9.76	14.0	19.4	7.9	110.5	36.0	213.6	
	12:30	0.78	14.4	19.5	8.2	111.1	36.6	214.4	
	1:00	0.81	14.6	19.7	8.4	112.2	36.9	214.9	
	1:30	0.82	15.7	19.9	8.6	112.6	37.0	214.7	
	2:00	0.85	14.8	20.0	8.8	112.8	37.3	215.3	
	2:30	0.88	15.0	20.2	9.0	113.3	37.7	215.5	
	3:00	0.90	15.2	20.4	9.2	113.7	37.9	216.6	
	3:30	0.92	15.5	20.9	9.4	114.4	40.0	216.9	
	4:00	0.91	15.6	21.1	9.6	114.7	40.3	217.0	
	4:30	0.93	15.8	21.3	9.7	114.9	40.5	217.7	
	5:00	0.94	16.0	21.4	9.9	115.5	40.7	218.8	
	5:30	0.96	16.2	21.5	10.3	115.9	40.8	219.0	
	6:00	0.98	16.4	21.6	10.4	116.6	41.1	220.8	
MIN		0.71	13.3	18.8	6.6	107.2	34.4	210.9	
MAX		9.76	16.4	21.6	10.4	116.6	41.1	220.8	
AVG		1.77	14.9	20.1	8.6	112.6	37.8	215.5	
SEQS			40	80	120	150	75	500	1.5
LDL-Limits			0	0	0	10	2.5	1	-

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Ambient Air Quality Test Report

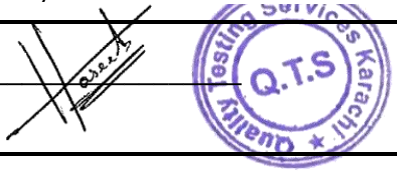
Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-E**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N5**	**24°49'37.71"N 67° 1'16.68"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	1.77	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	08 Hours	14.9	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	08 Hours	20.1	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	08 Hours	8.6	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	23.7	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	08 Hours	112.6	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	08 Hours	37.8	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	08 Hours	215.5	500.0	1.0	
Lead (Pb)	µg/m³	08 Hours	BDL	1.5	-	ASS Method
Noise	dB(A)	08 Hours	60.1	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:**  **Name : Haseeb Arshad**

Ambient Air Quality Test Report

Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-F**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N6**	**24°49'1.00"N 67° 0'24.56"E**

Date	Time	CO (µg/m³)	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
27.03.2025	10:00	0.88	20.8	24.4	13.3	110.0	39.9	220.2	ND
	10:30	0.90	20.9	24.8	13.6	111.1	40.0	220.6	
	11:00	0.93	21.1	25.0	13.7	112.2	40.4	221.1	
	11:30	0.94	21.6	25.5	14.9	112.4	40.8	221.5	
	12:00	0.96	21.7	2.7	15.0	112.5	41.1	221.7	
	12:30	0.99	21.9	25.9	16.6	112.8	42.2	221.8	
	1:00	1.01	22.2	26.0	16.8	113.0	43.3	223.3	
	1:30	1.05	22.6	26.6	16.9	113.9	44.5	223.9	
	2:00	1.08	22.8	26.8	17.0	113.5	44.8	224.0	
	2:30	1.09	23.0	27.0	17.2	114.0	45.5	224.4	
	3:00	1.10	23.5	27.4	17.3	114.4	46.7	224.7	
	3:30	1.14	23.8	27.8	17.6	111.9	47.8	224.9	
	4:00	1.17	24.4	27.9	17.8	113.3	47.9	225.7	
	4:30	1.18	25.5	28.8	18.0	113.7	48.8	225.8	
	5:00	1.19	26.6	28.9	18.8	115.8	49.0	226.6	
	5:30	1.20	27.0	29.0	18.8	116.6	50.4	227.0	
	6:00	1.22	27.8	30.2	19.0	117.9	51.1	230.8	
MIN		0.88	20.8	2.7	13.3	110	39.9	220.2	
MAX		1.22	27.8	30.2	19	117.9	51.1	230.8	
AVG		1.03	23.4	24.6	16.5	113.5	45.0	224.1	
SEQS			40	80	120	150	75	500	1.5
LDL-Limits			0	0	0	10	2.5	1	-

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

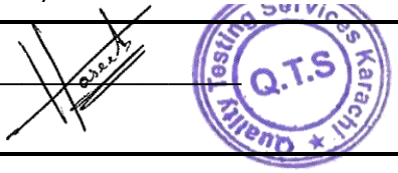
Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-F**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N6**	**24°49'1.00"N 67° 0'24.56"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	1.03	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	08 Hours	24.6	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	08 Hours	16.5	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	08 Hours	113.5	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	26.3	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	08 Hours	113.5	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	08 Hours	45.0	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	08 Hours	224.1	500.0	1.0	
Lead (Pb)	µg/m³	08 Hours	BDL	1.5	-	ASS Method
Noise	dB(A)	08 Hours	64.4.	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:**  **Name : Haseeb Arshad**

Ambient Air Quality Test Report

Project Name:	MEX , Phase -01	**Test Report No:**	QTS/MEX/25/2116-G
		Sample Duration:	08hr's
Sample Description:	Ambient Air Quality Test	**Location: AA/N7**	24°49'47.93"N 66°58'52.93"E

Date	Time	CO (µg/m³)	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
28.03.2025	10:00	0.92	26.6	28.8	15.5	121.3	40.4	244.6	ND
	10:30	0.97	26.9	29.0	16.0	121.4	40.7	244.9	
	11:00	0.99	26.8	29.9	16.7	121.7	41.1	245.5	
	11:30	1.03	27.0	30.3	17.0	121.8	41.4	246.6	
	12:00	1.05	27.7	30.6	17.7	122.2	41.7	246.9	
	12:30	1.08	27.8	30.8	17.8	123.3	41.9	247.7	
	1:00	1.09	27.9	31.2	17.9	123.7	42.2	248.9	
	1:30	1.11	28.2	31.3	18.6	123.9	43.0	243.7	
	2:00	1.14	28.5	31.6	18.8	124.4	343.8	240.0	
	2:30	1.15	28.6	31.9	18.9	124.6	43.9	246.2	
	3:00	1.17	28.9	32.3	19.0	125.9	44.0	247.1	
	3:30	1.19	29.0	32.6	19.3	126.0	44.6	251.1	
	4:00	1.22	30.0	32.8	19.5	126.5	44.7	255.5	
	4:30	1.23	30.2	33.0	19.6	127.0	44.9	255.8	
	5:00	1.26	30.4	33.6	19.9	128.8	45.0	255.9	
	5:30	1.27	30.6	33.9	20.0	129.3	45.6	256.1	
	6:00	1.29	30.9	34.0	20.3	129.9	45.8	257.2	
MIN		0.92	26.6	28.8	15.5	121.3	40.4	240	
MAX		1.29	30.9	34	20.3	129.9	343.8	257.2	
AVG		1.12	28.6	31.6	18.3	124.8	74.6	248.9	
SEQS			40	80	120	150	75	500	1.5
LDL-Limits			0	0	0	10	2.5	1	-

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

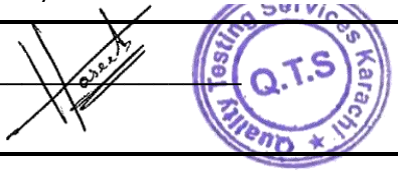
Project Name:	**MEX , Phase -01**	**Test Report No:**	**QTS/MEX/25/2116-G**
		Sample Duration:	**08hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N7**	**24°49'47.93"N 66°58'52.93"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	1.12	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	08 Hours	28.6	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	08 Hours	31.6	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	08 Hours	18.3	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	31.2	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	08 Hours	124.8	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	08 Hours	74.6	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	08 Hours	248.9	500.0	1.0	
Lead (Pb)	µg/m³	08 Hours	BDL	1.5	-	ASS Method
Noise	dB(A)	08 Hours	66.6	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:**  **Name : Haseeb Arshad**

Lab Report Ref. No.: QTS/MEX/2025/2111-A Reporting Date: 28/03/2025

Report to: Malir Express Way Project.

SAMPLE DESCRIPTION

Sample ID: Waste water:01
Sampling Method: APHA 1060-A & B
Sample Coordinate: 24°49'57.9"N 67°04'36.0"E
Sample Type: Grab Sample
Sample Collected/Submitted by: QTS Representative
Sample Receipt at QTS - Date: 22/03/2025

ANALYTICAL TEST REPORT

S.NO.	PARAMETERS TO BE ANALYZED	STANDARD SEQS	LDL	UNITS	RESULTS	TEST METHOD
1	Temperature	40	1.0	^{0}C	30	Thermometer
2	pH value	6-9	0.01	-	7.00	USEPA 150.1
3	Biochemical Oxygen Demand $(BOD)_5$ at 20^{0}C	200	0.1	mg/L	76	Hach 8043
4	Chemical Oxygen Demand (COD)	400	1.0	mg/L	134	Hach 8000
5	Total Suspended Solids (TSS)	200	1.0	mg/L	59	Hach 8006
6	Total Dissolved Solids (TDS)	3500	1.0	mg/L	1500	Hach 8160
7	Cyanide (as CN-) total	1	0.001	mg/L	0.028	Hach 8027
8	Ammonia (NH_3)	40	0.1	mg/L	25	Hach 10031
9	Cadmium	0.1	0.001	mg/L	BDL	ASTM D-3557
10	Chromium (trivalent & hexavalent)	1	0.01	mg/L	0.022	ASTM D-1687
11	Copper	1	0.01	mg/L	*1.4	Hach 8506
12	Lead	0.5	0.001	mg/L	BDL	ASTM D-3559
13	Nickel	1	0.001	mg/L	BDL	ASTM D-1886
14	Zinc	5	0.01	mg/L	0.17	USEPA 3500 Zn B
15	Oil & Grease	10	0.001	mg/L	0.54	APHA 5520-D
16	Fluoride (as F^-)	10	0.01	mg/L	0.22	USEPA 340.1
17	Phenolic compounds (as phenol)	0.1	0.001	mg/L	0.014	USEPA 420.1
18	Chloride (as Cl^-)	-	0.01	mg/L	743	Hach 8206
19	Mercury	0.01	0.001	mg/L	BDL	ASTM D-3223
20	Iron	8	0.01	mg/L	NIL	Hach 8008
21	An-ionic detergents (as MBAS)	20	0.001	mg/L	1.67	Method 5540 C
22	Manganese	1.5	0.1	mg/L	*6.24	Hach 8034
23	Boron	6	0.01	mg/L	0.32	ASTM D-3082
24	Barium	1.5	0.1	mg/L	*5	Hach 8014
25	Sulphate (SO_4^{-2})	-	1.0	mg/L	154	USEPA 375.4
26	Selenium	0.5	0.01	mg/L	BDL	ASTM D-3859
27	Total toxic metals	2	-	mg/L	0.015	-
28	Sulphide(S^{2-})	1	0.001	mg/L	0.26	Hach 8131
29	Silver	1	0.001	mg/L	BDL	ASTM D-3866
30	Arsenic	1	0.01	mg/L	0.022	Hach method
31	Chlorine	1	0.01	mg/L	BDL	Hach 80021

SEQS = Sindh Environmental Quality Standards
USEPA=United State Environmental Protection Agency method
Hach USA, method
BDL=Below Detection Limit
APHA-SM = American Public Health Association- Standard Methods for Water & Waste water Examination
LDL = Least Detectable Limit

Term & Condition:

- *This report is not valid for any negotiation.*
- *Report is valid for current batch (sample)*
- *The remaining portion of the sample will be discarded after 07 days unless otherwise instructed*
- *This report is intended only for your guidance & not for legal purpose or for advertisement.*

Comments:

Tested parameters are not within the permissible limits SEQS established for Industrial Effluent Water.

Sample Analyzed by: AFAQ AHMED

Signature of Laboratory In charge:
Name : Haseeb Arshad

Quality Testing Services Karachi Q.T.S

Lab Report Ref. No.: QTS/MEX/2025/2111-B Reporting Date: 28/03/2025
Report to: Malir Express Way Project.

SAMPLE DESCRIPTION

Sample ID: Waste water:02
Sampling Method: APHA 1060-A & B
Sample Type: Grab Sample
Sample Coordinate: 24°49'50.0"N 67°01'07.6"E
Sample Collected/Submitted by: QTS Representative
Sampling Date: 22/03/2025

ANALYTICAL TEST REPORT

S.NO.	PARAMETERS TO BE ANALYZED	STANDARD SEQS	LDL	UNITS	RESULTS	TEST METHOD
1	Temperature	40	1.0	^0C	30	Thermometer
2	pH value	6-9	0.01	-	7.18	USEPA 150.1
3	Biochemical Oxygen Demand $(BOD)_5$ at 20^0C	200	0.1	mg/L	176	Hach 8043
4	Chemical Oxygen Demand (COD)	400	1.0	mg/L	394	Hach 8000
5	Total Suspended Solids (TSS)	200	1.0	mg/L	109	Hach 8006
6	Total Dissolved Solids (TDS)	3500	1.0	mg/L	2,450	Hach 8160
7	Cyanide (as CN-) total	1	0.001	mg/L	0.022	Hach 8027
8	Ammonia (NH_3)	40	0.1	mg/L	22	Hach 10031
9	Cadmium	0.1	0.001	mg/L	BDL	ASTM D-3557
10	Chromium (trivalent & hexavalent)	1	0.01	mg/L	0.024	ASTM D-1687
11	Copper	1	0.01	mg/L	*1.5	Hach 8506
12	Lead	0.5	0.001	mg/L	BDL	ASTM D-3559
13	Nickel	1	0.001	mg/L	BDL	ASTM D-1886
14	Zinc	5	0.01	mg/L	0.13	USEPA 3500 Zn B
15	Oil & Grease	10	0.001	mg/L	0.55	APHA 5520-D
16	Fluoride (as F^-)	10	0.01	mg/L	0.27	USEPA 340.1
17	Phenolic compounds (as phenol)	0.1	0.001	mg/L	0.012	USEPA 420.1
18	Chloride (as Cl^-)	-	0.01	mg/L	1123	Hach 8206
19	Mercury	0.01	0.001	mg/L	BDL	ASTM D-3223
20	Iron	8	0.01	mg/L	NIL	Hach 8008
21	An-ionic detergents (as MBAS)	20	0.001	mg/L	1.63	Method 5540 C
22	Manganese	1.5	0.1	mg/L	*6.11	Hach 8034
23	Boron	6	0.01	mg/L	0.28	ASTM D-3082
24	Barium	1.5	0.1	mg/L	*16	Hach 8014
25	Sulphate (SO_4^{-2})	-	1.0	mg/L	177	USEPA 375.4
26	Selenium	0.5	0.01	mg/L	BDL	ASTM D-3859
27	Total toxic metals	2	-	mg/L	0.018	-
28	Sulphide(S^{2-})	1	0.001	mg/L	0.33	Hach 8131
29	Silver	1	0.001	mg/L	BDL	ASTM D-3866
30	Arsenic	1	0.01	mg/L	0.027	Hach method
31	Chlorine	1	0.01	mg/L	BDL	Hach 80021

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Hach USA, method
BDL=Below Detection Limit
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Comments:

Tested parameters are not within the permissible limits SEQS established for Industrial Effluent Water.

Sample Analyzed by: AFAQ AHMED

Signature of Laboratory In charge:
Name : Haseeb Arshad

Quality Testing Services Karachi Q.T.S

Lab Report Ref. No.: QTS/MEX/2025/2111-C Reporting Date: 28/03/2025
Report to: Malir Express Way Project.

SAMPLE DESCRIPTION

Sample ID: Waste water:04
Sampling Method: APHA 1060-A & B
Sample Type: Grab Sample
Sample Coordinate: 24°49'05.2"N 67°00'40.1"E
Sample Collected/Submitted by: QTS Representative
Sampling Date: 22/03/2025

ANALYTICAL TEST REPORT

S.NO.	PARAMETERS TO BE ANALYZED	STANDARD SEQS	LDL	UNITS	RESULTS	TEST METHOD
1	Temperature	40	1.0	^0C	29	Thermometer
2	pH value	6-9	0.01	-	7.27	USEPA 150.1
3	Biochemical Oxygen Demand $(BOD)_5$ at 20^0C	200	0.1	mg/L	*243	Hach 8043
4	Chemical Oxygen Demand (COD)	400	1.0	mg/L	*596	Hach 8000
5	Total Suspended Solids (TSS)	200	1.0	mg/L	144	Hach 8006
6	Total Dissolved Solids (TDS)	3500	1.0	mg/L	*9,550	Hach 8160
7	Cyanide (as CN-) total	1	0.001	mg/L	0.026	Hach 8027
8	Ammonia (NH_3)	40	0.1	mg/L	23	Hach 10031
9	Cadmium	0.1	0.001	mg/L	BDL	ASTM D-3557
10	Chromium (trivalent & hexavalent)	1	0.01	mg/L	0.022	ASTM D-1687
11	Copper	1	0.01	mg/L	*2	Hach 8506
12	Lead	0.5	0.001	mg/L	BDL	ASTM D-3559
13	Nickel	1	0.001	mg/L	BDL	ASTM D-1886
14	Zinc	5	0.01	mg/L	0.21	USEPA 3500 Zn B
15	Oil & Grease	10	0.001	mg/L	0.58	APHA 5520-D
16	Fluoride (as F^-)	10	0.01	mg/L	0.32	USEPA 340.1
17	Phenolic compounds (as phenol)	0.1	0.001	mg/L	0.022	USEPA 420.1
18	Chloride (as Cl^-)	-	0.01	mg/L	3,222	Hach 8206
19	Mercury	0.01	0.001	mg/L	BDL	ASTM D-3223
20	Iron	8	0.01	mg/L	NIL	Hach 8008
21	An-ionic detergents (as MBAS)	20	0.001	mg/L	1.77	Method 5540 C
22	Manganese	1.5	0.1	mg/L	*7.75	Hach 8034
23	Boron	6	0.01	mg/L	0.32	ASTM D-3082
24	Barium	1.5	0.1	mg/L	*27	Hach 8014
25	Sulphate (SO_4^{-2})	-	1.0	mg/L	132	USEPA 375.4
26	Selenium	0.5	0.01	mg/L	BDL	ASTM D-3859
27	Total toxic metals	2	-	mg/L	0.012	-
28	Sulphide(S^{2-})	1	0.001	mg/L	0.43	Hach 8131
29	Silver	1	0.001	mg/L	BDL	ASTM D-3866
30	Arsenic	1	0.01	mg/L	0.036	Hach method
31	Chlorine	1	0.01	mg/L	BDL	Hach 80021

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Hach USA, method
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Comments:

Tested parameters are not within the permissible limits SEQS established for Industrial Effluent Water.

Sample Analyzed by: AFAQ AHMED

Signature of Laboratory In charge:
Name : Haseeb Arshad

Quality Testing Services Karachi ★ Q.T.S

Lab Report Ref. No.: QTS/MEX/2025/2111-D
Reporting Date: 28/03/2025
Report to: Malir Express Way Project.

SAMPLE DESCRIPTION

Sample ID: Waste water:05
Sampling Method: APHA 1060-A & B
Sample Type: Grab Sample
Sample Coordinate: 24°49'38.9"N 67°00'06.8"E
Sample Collected/Submitted by: QTS Representative
Sampling Date: 22/03/2025

ANALYTICAL TEST REPORT

S.NO.	PARAMETERS TO BE ANALYZED	STANDARD SEQS	LDL	UNITS	RESULTS	TEST METHOD
1	Temperature	40	1.0	^{0}C	29.33	Thermometer
2	pH value	6-9	0.01	-	7.60	USEPA 150.1
3	Biochemical Oxygen Demand $(BOD)_5$ at 20^{0}C	200	0.1	mg/L	*378	Hach 8043
4	Chemical Oxygen Demand (COD)	400	1.0	mg/L	*854	Hach 8000
5	Total Suspended Solids (TSS)	200	1.0	mg/L	55	Hach 8006
6	Total Dissolved Solids (TDS)	3500	1.0	mg/L	*28,200	Hach 8160
7	Cyanide (as CN-) total	1	0.001	mg/L	0.22	Hach 8027
8	Ammonia (NH_3)	40	0.1	mg/L	28	Hach 10031
9	Cadmium	0.1	0.001	mg/L	BDL	ASTM D-3557
10	Chromium (trivalent & hexavalent)	1	0.01	mg/L	0.034	ASTM D-1687
11	Copper	1	0.01	mg/L	7	Hach 8506
12	Lead	0.5	0.001	mg/L	BDL	ASTM D-3559
13	Nickel	1	0.001	mg/L	BDL	ASTM D-1886
14	Zinc	5	0.01	mg/L	0.37	USEPA 3500 Zn B
15	Oil & Grease	10	0.001	mg/L	0.75	APHA 5520-D
16	Fluoride (as F^-)	10	0.01	mg/L	0.89	USEPA 340.1
17	Phenolic compounds (as phenol)	0.1	0.001	mg/L	0.039	USEPA 420.1
18	Chloride (as Cl^-)	-	0.01	mg/L	13,844	Hach 8206
19	Mercury	0.01	0.001	mg/L	BDL	ASTM D-3223
20	Iron	8	0.01	mg/L	NIL	Hach 8008
21	An-ionic detergents (as MBAS)	20	0.001	mg/L	2.34	Method 5540 C
22	Manganese	1.5	0.1	mg/L	*9.43	Hach 8034
23	Boron	6	0.01	mg/L	1.87	ASTM D-3082
24	Barium	1.5	0.1	mg/L	*34	Hach 8014
25	Sulphate (SO_4^{-2})	-	1.0	mg/L	278	USEPA 375.4
26	Selenium	0.5	0.01	mg/L	BDL	ASTM D-3859
27	Total toxic metals	2	-	mg/L	0.035	-
28	Sulphide(S^{2-})	1	0.001	mg/L	0.84	Hach 8131
29	Silver	1	0.001	mg/L	BDL	ASTM D-3866
30	Arsenic	1	0.01	mg/L	0.28	Hach method
31	Chlorine	1	0.01	mg/L	BDL	Hach 80021

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Comments:

Tested parameters are not within the permissible limits SEQS established for Industrial Effluent Water.

Sample Analyzed by: AFAQ AHMED

Signature of Laboratory In charge:
Name : Haseeb Arshad

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

Project Name:	Karachi Port to Qayyumabad Corridor Project	Test Report No:	QTS/MEX/26/5691-A
		Sample Duration:	24 hr's
Sample Description:	Ambient Air Quality Test	Location: AA/N1	24°49'52.23"N 67° 4'44.50"E

PARAMETERS								
Date	Time	NO ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	PM 10 ($\mu g/m^3$)	PM 2.5 ($\mu g/m^3$)	SPM ($\mu g/m^3$)	Lead ($\mu g/m3$)
13.05.2026	11:00	14.4	29.0	36.2	124	41	385	ND
	12:00	11.9	24.8	39.6	127	49	388	
	13:00	21.0	25.2	41.9	131	51	391	
	14:00	29.8	30.1	49.4	134	55	392	
	15:00	32.0	34.3	49.0	130	53	398	
	16:00	31.4	30.2	48.7	127	50	394	
	17:00	29.9	22.5	40.9	121	43	390	
	18:00	24.0	16.1	39.4	115	40	390	
	19:00	26.6	15.7	36.2	101	41	388	
	20:00	25.9	19.2	41.5	109	45	384	
	21:00	24.5	23.0	36.3	112	50	380	
	22:00	24.7	19.8	34.5	108	42	373	
	23:00	19.9	16.9	30.7	103	40	364	
14.05.2026	00:00	20.0	12.6	29.2	99	37	360	
	01:00	18.9	12.8	25.3	94	31	358	
	02:00	17.5	10.3	20.8	86	26	352	
	03:00	16.0	10.9	19.4	81	22	350	
	04:00	14.8	10.7	17.2	94	20	351	
	05:00	19.0	11.0	22.9	98	25	355	
	06:00	20.1	12.1	26.8	101	30	361	
	07:00	22.5	16.9	31.0	103	32	365	
	08:00	20.0	18.4	34.3	109	34	368	
	09:00	14.2	20.0	38.0	114	35	373	
	10:00	18.3	21.6	34.8	117	37	380	
MIN		11.9	10.3	17.2	81	20	350	ND
MAX		32	34.3	49.4	134	55	398	
AVG		21.5	19.5	34.2	109.7	38.6	374.5	
SEQS		40	80	120	150	75	500	1.5
LDL-Limits		0ppm	0ppm	0ppm	10$\mu g/m^3$	2.5$\mu g/m^3$	1 $\mu g/m^3$	-

Ambient Air Quality Test Report

Project Name:	**Karachi Port to Qayyumabad Corridor Project**	**Test Report No:**	**QTS/MEX/26/5691-A**
		Sample Duration:	**24 hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N-01**	**24°49'52.23"N 67° 4'44.50"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	**0.84**	5.0	0.0	Non-Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	24 Hours	**21.5**	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	**19.5**	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	**34.2**	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	**16.4**	130.0	0.0	Non-Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	24 Hours	**109.7**	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	24 Hours	**38.6**	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	**374.5**	500.0	1.0	
Lead (Pb)	µg/m³	24 Hours	**ND**	1.5	-	ASS Method
Noise	dB(A)	24 Hours	**68.5**	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:** _____ **Name : Haseeb Arshad**

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Ambient Air Quality Test Report

Project Name:	Karachi Port to Qayyumabad Corridor Project	Test Report No:	QTS/MEX/26/5691-B
		Sample Duration:	24 hr's
Sample Description:	Ambient Air Quality Test	Location: AA/N2	24°50'14.55"N 67° 4'4.44"E

PARAMETERS								
Date	Time	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
14.05.2026	11:30	22.2	19.0	21.6	108	24	381	
	12:30	27.9	20.2	26.0	112	29	385	
	13:30	26.2	21.8	28.9	114	34	389	
	14:30	24.7	20.0	30.8	120	39	392	
	15:30	29.9	15.3	34.0	124	34	390	
	16:30	28.0	19.5	31.9	121	30	394	
	17:30	27.8	20.8	32.0	114	28	391	
	18:30	25.0	21.0	32.8	125	25	390	
	19:30	22.6	25.3	34.3	118	24	389	
	20:30	24.8	22.7	32.1	112	28	375	
	21:30	20.0	20.0	29.2	108	30	373	
	22:30	20.2	24.9	25.8	102	26	364	
	23:30	19.6	26.0	23.0	98	22	358	
15.05.2026	00:30	16.0	28.6	20.6	94	20	351	ND
	01:30	14.7	26.9	21.5	92	19	343	
	02:30	14.9	29.0	19.8	85	16	340	
	03:30	12.8	30.6	22.0	77	16	348	
	04:30	12.4	28.5	26.2	79	18	352	
	05:30	13.5	26.7	22.0	82	19	356	
	06:30	14.6	24.4	20.6	86	17	362	
	07:30	15.2	25.5	21.8	102	18	366	
	08:30	18.8	29.2	24.0	108	21	368	
	09:30	14.7	28.6	25.3	110	23	370	
	10:30	17.3	25.4	27.4	116	22	374	
MIN		12.4	15.3	19.8	77	16	340	
MAX		29.9	30.6	34.3	125	39	394	
AVG		20.2	24.0	26.4	104.1	24.5	370.5	
SEQS		40	80	120	150	75	500	1.5
LDL-Limits		0ppm	0ppm	0ppm	10µg/m³	2.5µg/m³	1 µg/m³	-

Quality Testing Services Karachi Q.T.S

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Email: info@qts.com.pk

Ambient Air Quality Test Report

Project Name:	**Karachi Port to Qayyumabad Corridor Project**	**Test Report No:**	**QTS/MEX/26/5691-B**
		Sample Duration:	**24 hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N-02**	**24°50'14.55"N 67° 4'4.44"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	**0.44**	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	24 Hours	**20.2**	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	**24.0**	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	**26.4**	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	**16.0**	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	24 Hours	**104.1**	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	24 Hours	**24.5**	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	**370.5**	500.0	1.0	
Lead (Pb)	µg/m³	24 Hours	**ND**	1.5	-	ASS Method
Noise	dB(A)	24 Hours	**65.6**	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:** _____ **Name : Haseeb Arshad**

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Ambient Air Quality Test Report

Project Name:	Karachi Port to Qayyumabad Corridor Project	Test Report No:	QTS/MEX/26/5691-C
		Sample Duration:	24 hr's
Sample Description:	Ambient Air Quality Test	Location: AA/N3	24°49'44.83"N 67° 3'2.41"E

PARAMETERS								
Date	Time	NO ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SPM ($\mu g/m^3$)	Lead ($\mu g/m3$)
15.05.2026	11:00	11.4	8.8	6.6	89	46	212	ND
	12:00	11.8	9.0	6.8	93	49	213	
	13:00	12.2	9.2	6.9	94	42	215	
	14:00	12.6	9.5	7.1	97	44	218	
	15:00	12.7	9.7	7.3	99	45	222	
	16:00	12.9	9.9	7.5	101	47	226	
	17:00	13.0	10.1	7.7	102	49	227	
	18:00	13.3	10.2	7.9	104	53	229	
	19:00	13.7	10.4	8.0	107	55	231	
	20:00	13.8	10.6	8.3	109	56	233	
	21:00	14.3	10.7	8.5	111	58	235	
	22:00	14.7	10.8	8.8	113	59	236	
	23:00	15.0	11.1	9.0	116	51	237	
16.05.2026	00:00	15.2	11.3	9.3	118	53	239	
	01:00	15.5	11.5	9.5	119	60	240	
	02:00	15.7	11.8	9.7	120	64	241	
	03:00	16.0	12.0	9.9	123	61	242	
	04:00	16.2	12.2	10.2	126	68	246	
	05:00	17.1	12.3	10.3	124	61	255	
	06:00	17.3	12.5	10.5	121	69	249	
	07:00	17.7	12.6	10.7	118	60	246	
	08:00	18.0	12.8	10.9	116	56	239	
	09:00	18.2	13.0	10.6	119	52	233	
	10:00	17.8	13.1	9.9	120	59	236	
MIN		11.4	8.8	6.6	89	42	212	
MAX		18.2	13.1	10.9	126	69	255	
AVG		14.8	11.0	8.8	110.5	54.8	233.3	
SEQS		40	80	120	150	75	500	1.5
LDL-Limits		0	0	0	10	2.5	1	-

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Email: info@qts.com.pk

Ambient Air Quality Test Report

Project Name:	**Karachi Port to Qayyumabad Corridor Project**	**Test Report No:**	**QTS/MEX/26/5691-C**
		Sample Duration:	**24 hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N-03**	**24°49'44.83"N 67° 3'2.41"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	**0.28**	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	24 Hours	**14.8**	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	**11.0**	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	**8.8**	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	**20.6**	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	24 Hours	**110.5**	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	24 Hours	**54.8**	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	**233.3**	500.0	1.0	
Lead (Pb)	µg/m³	24 Hours	**ND**	1.5	-	ASS Method
Noise	dB(A)	24 Hours	**66.7**	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:** _____ **Name : Haseeb Arshad**

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Ambient Air Quality Test Report

Project Name:	Karachi Port to Qayyumabad Corridor Project	Test Report No:	QTS/MEX/26/5691-D
		Sample Duration:	24 hr's
Sample Description:	Ambient Air Quality Test	Location: AA/N4	24°49'40.98"N 67° 2'6.97"E

PARAMETERS								
Date	Time	NO ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	PM 10 ($\mu g/m^3$)	PM 2.5 ($\mu g/m^3$)	SPM ($\mu g/m^3$)	Lead ($\mu g/m3$)
18.05.2026	11:30	16.6	14.4	10.2	102	48	243	ND
	12:30	16.8	14.7	10.4	104	51	245	
	13:30	17.0	15.0	10.5	107	55	247	
	14:30	17.2	15.5	10.7	109	55	248	
	15:30	17.4	15.7	11.0	110	49	249	
	16:30	17.8	15.9	11.1	113	51	255	
	17:30	18.0	16.2	11.4	115	44	256	
	18:30	18.3	16.4	11.6	117	45	258	
	19:30	18.6	16.8	11.8	118	47	259	
	20:30	18.8	17.0	12.0	119	48	266	
	21:30	19.0	17.3	12.2	121	49	268	
	22:30	19.2	17.5	12.4	123	50	271	
	23:30	19.5	18.0	12.6	125	55	273	
19.05.2026	00:30	19.8	18.3	12.8	127	57	278	
	01:30	19.9	19.0	13.0	129	59	279	
	02:30	20.3	19.3	13.3	131	50	283	
	03:30	20.4	20.2	13.5	130	53	284	
	04:30	20.5	19.9	13.7	131	60	288	
	05:30	20.7	19.1	13.8	128	61	290	
	06:30	20.3	18.8	13.9	129	51	302	
	07:30	21.2	17.7	14.0	130	59	305	
	08:30	21.7	17.2	14.4	133	60	309	
	09:30	22.4	16.6	14.7	135	61	312	
	10:30	22.8	16.1	14.9	136	68	316	
MIN		16.6	14.4	10.2	102	44	243	
MAX		22.8	20.2	14.9	136	68	316	
AVG		19.3	17.2	12.5	121.7	53.5	274.7	
SEQS		40	80	120	150	75	500	1.5
LDL-Limits		0	0	0	1	2.	1	-

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Email: info@qts.com.pk

Ambient Air Quality Test Report

Project Name:	**Karachi Port to Qayyumabad Corridor Project**	**Test Report No:**	**QTS/MEX/26/5691-D**
		Sample Duration:	**24 hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N4**	**24°49'40.98"N 67° 2'6.97"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	**0.35**	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	24 Hours	**19.3**	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	**17.2**	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	**12.5**	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	**22.6**	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	24 Hours	**121.7**	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	24 Hours	**53.5**	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	**274.7**	500.0	1.0	
Lead (Pb)	µg/m³	24 Hours	**ND**	1.5	-	ASS Method
Noise	dB(A)	24 Hours	**63.6**	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:** _____ **Name : Haseeb Arshad**

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Ambient Air Quality Test Report

Project Name:	**Karachi Port to Qayyumabad Corridor Project**	**Test Report No:**	**QTS/MEX/26/5691-E**
		Sample Duration:	**24 hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N5**	**24°49'37.71"N 67° 1'16.68"E**

PARAMETERS								
Date	**Time**	**NO (µg/m³)**	**NO_2 (µg/m³)**	**SO_2 (µg/m³)**	**PM 10 (µg/m³)**	**PM 2.5 (µg/m³)**	**SPM (µg/m³)**	**Lead (µg/m3)**
19.05.2026	11:00	21.5	10.2	8.4	92	38	232	ND
	12:00	22.2	10.8	8.8	95	40	235	
	13:00	23.7	10.9	8.6	97	43	239	
	14:00	25.6	11.7	9.4	98	45	242	
	15:00	25.9	11.4	9.5	90	46	245	
	16:00	25.7	11.0	9.0	87	48	248	
	17:00	26.8	13.8	10.3	86	52	252	
	18:00	26.6	13.6	10.2	86	54	256	
	19:00	26.5	13.4	10.8	89	51	258	
	20:00	31.1	14.5	11.9	91	47	260	
	21:00	35.2	14.1	11.7	93	45	263	
	22:00	32.0	14.2	11.5	94	44	266	
	23:00	33.6	15.3	12.1	97	40	268	
20.05.2026	00:00	29.5	15.0	12.4	98	38	269	
	01:00	27.4	15.9	12.4	101	35	272	
	02:00	24.2	13.8	12.8	103	33	275	
	03:00	24.9	13.7	11.5	105	35	276	
	04:00	24.8	13.4	11.5	108	36	278	
	05:00	22.7	11.0	11.4	111	38	280	
	06:00	22.0	11.5	9.3	114	40	283	
	07:00	22.6	11.3	9.5	105	42	285	
	08:00	25.5	10.2	9.1	113	44	289	
	09:00	25.4	10.1	10.2	111	41	292	
	10:00	25.3	10.6	10.9	106	37	294	
MIN		21.5	10.1	8.4	86.0	33	232	
MAX		35.2	15.9	12.8	114	54	294	
AVG		26.2	12.5	10.5	98.7	42.2	264.7	
SEQS		40	80	120	150	75	500	1.5
LDL-Limits		0	0	0	10	2.5	1	-

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

Project Name:	**Karachi Port to Qayyumabad Corridor Project**	**Test Report No:**	**QTS/MEX/26/5691-E**
		Sample Duration:	**24 hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N5**	**24°49'37.71"N 67° 1'16.68"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m^3	08 Hours	**0.32**	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	$\mu g/m^3$	24 Hours	**26.2**	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	$\mu g/m^3$	24 Hours	**12.5**	80.0	0.0	
Sulphur Dioxide (SO_2)	$\mu g/m^3$	24 Hours	**10.5**	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	$\mu g/m^3$	01 Hour	**17.3**	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	$\mu g/m^3$	24 Hours	**98.7**	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	$\mu g/m^3$	24 Hours	**42.2**	75.0	2.5	
Suspended Particulate Matter (SPM)	$\mu g/m^3$	24 Hours	**264.7**	500.0	1.0	
Lead (Pb)	$\mu g/m^3$	24 Hours	**ND**	1.5	-	ASS Method
Noise	dB(A)	24 Hours	**67.6**	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:** **Name : Haseeb Arshad**

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Ambient Air Quality Test Report

Project Name:	Karachi Port to Qayyumabad Corridor Project	Test Report No:	QTS/MEX/26/5691-F
		Sample Duration:	24 hr's
Sample Description:	Ambient Air Quality Test	Location: AA/N6	24°49'1.00"N 67° 0'24.56"E

PARAMETERS								
Date	Time	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
21.5.2026	11:30	18.2	16.3	11.3	90	42	219	ND
	12:30	19.3	16.0	11.2	93	45	223	
	13:30	15.1	16.2	11.9	95	47	226	
	14:30	17.9	18.6	13.8	97	49	229	
	15:30	16.6	18.1	13.7	99	52	232	
	16:30	19.7	18.5	13.5	101	54	235	
	17:30	20.7	19.0	15.9	103	56	237	
	18:30	21.0	19.9	15.4	105	57	239	
	19:30	22.4	19.8	15.1	107	55	242	
	20:30	19.5	21.7	16.2	109	52	245	
	21:30	19.2	21.4	16.0	112	50	246	
	22:30	19.3	21.2	16.3	115	47	248	
	23:30	21.4	22.6	14.2	117	45	252	
22.05.2026	00:30	21.0	22.0	14.6	119	42	254	
	01:30	21.9	22.9	14.1	121	43	256	
	02:30	23.8	23.4	12.7	123	40	258	
	03:30	23.8	23.8	12.0	125	38	260	
	04:30	23.4	23.4	12.9	126	35	263	
	05:30	25.9	21.3	11.8	124	37	265	
	06:30	25.8	21.5	11.4	122	35	266	
	07:30	25.6	21.2	11.3	120	33	269	
	08:30	24.5	19.9	10.6	119	35	266	
	09:30	24.1	19.8	10.2	117	39	263	
	10:30	24.2	19.4	10.7	115	41	260	
MIN		15.1	16	10.2	90	33	219	
MAX		25.9	23.8	16.3	126	57	269	
AVG		21.4	20.2	24.2	111.1	44.5	247.7	
SEQS		40	80	120	150	75	500	1.5
LDL-Limits		0	0	0	1	2.	1	-

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

Project Name:	**Karachi Port to Qayyumabad Corridor Project**	**Test Report No:**	**QTS/MEX/26/5691-F**
		Sample Duration:	**24 hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N6**	**24°49'1.00"N 67° 0'24.56"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	**0.25**	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	24 Hours	**21.4**	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	**20.2**	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	**24.2**	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	**19.4**	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	24 Hours	**111.1**	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	24 Hours	**44.5**	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	**247.7**	500.0	1.0	
Lead (Pb)	µg/m³	24 Hours	**ND**	1.5	-	ASS Method
Noise	dB(A)	24 Hours	**67.9**	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:** _____ **Name : Haseeb Arshad**

Quality Testing Services Karachi Q.T.S

Quality TESTING SERVICES

EPA Certified Lab
EPA/LAB/Certificate/QTS-11/2013

BUREAU VERITAS Certification

QMS/III/018 WA	
Revision : 03	Date 14.01.2021

Ambient Air Quality Test Report

Project Name:	**Karachi Port to Qayyumabad Corridor Project**	**Test Report No:**	**QTS/MEX/26/5691-G**
		Sample Duration:	**24 hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N7**	**24°49'47.93"N 66°58'52.93"E**

PARAMETERS								
Date	**Time**	**NO (µg/m³)**	**NO_2 (µg/m³)**	**SO_2 (µg/m³)**	**PM 10 (µg/m³)**	**PM 2.5 (µg/m³)**	**SPM (µg/m³)**	**Lead (µg/m3)**
23.05.2026	11:00	22.4	16.0	26.8	134	46	355	ND
	12:00	21.9	14.8	29.0	137	47	358	
	13:00	20.0	15.2	31.5	141	49	361	
	14:00	19.8	10.1	39.0	144	50	364	
	15:00	12.0	13.3	39.0	140	50	368	
	16:00	11.4	13.2	40.7	137	51	364	
	17:00	09.9	12.5	40.9	131	50	361	
	18:00	10.0	10.1	44.4	135	50	360	
	19:00	12.6	10.7	46.2	121	46	358	
	20:00	15.9	09.2	44.5	119	44	354	
	21:00	14.5	10.0	39.0	116	40	340	
	22:00	14.7	09.8	35.9	118	39	343	
	23:00	09.9	06.9	33.7	123	36	344	
24.05.2026	00:00	10.0	10.6	30.2	109	33	340	
	01:00	08.9	10.8	26.3	104	32	338	
	02:00	07.5	11.3	25.8	106	29	332	
	03:00	11.0	08.9	22.4	111	26	330	
	04:00	12.8	08.7	20.2	104	25	331	
	05:00	16.0	10.0	24.9	108	24	325	
	06:00	19.1	10.1	23.8	111	24	321	
	07:00	19.5	11.9	22.0	113	25	325	
	08:00	18.0	08.4	22.3	119	30	338	
	09:00	19.2	10.0	20.5	124	36	343	
	10:00	20.6	12.6	24.8	127	39	350	
MIN		7.5	6.9	20.2	104	24	321	ND
MAX		22.4	16	46.2	144	51	368	
AVG		14.9	11.0	31.5	122.3	38.3	345.8	
SEQS		40	80	120	150	75	500	1.5
LDL-Limits		0ppm	0ppm	0ppm	10µg/m³	2.5µg/m³	1 µg/m³	-

Quality Testing Services Karachi Q.T.S

Office No.505, Anum Estate Building, Opposite Duty Free Shop, Main Shahrah-e-Faisal, Karachi.
Tel. No. 92-21-34311466, 92-21-34382860, 92-21-34321532, Fax. No. 92-21-34311467

Email: info@qts.com.pk

Ambient Air Quality Test Report

Project Name:	**Karachi Port to Qayyumabad Corridor Project**	**Test Report No:**	**QTS/MEX/26/5691-G**
		Sample Duration:	**24 hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: AA/N7**	**24°49'47.93"N 66°58'52.93"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m³	08 Hours	**0.96**	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m³	24 Hours	**14.9**	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	**11.0**	80.0	0.0	
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	**31.5**	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O_3)	µg/m³	01 Hour	**16.8**	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM_{10})	µg/m³	24 Hours	**122.3**	150.0	10.0	β Ray Absorption Method
Particular Matter ($PM_{2.5}$)	µg/m³	24 Hours	**38.3**	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	**345.8**	500.0	1.0	
Lead (Pb)	µg/m³	24 Hours	**ND**	1.5	-	ASS Method
Noise	dB(A)	24 Hours	**69.5**	75	35	SLM

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQS.

Sample Analyzed By: Ather Adil	**Signature of Laboratory Incharge:** _____ **Name : Haseeb Arshad**

Quality Testing Services Karachi Q.T.S

ANNEX II - MANGROVE DAMAGE ASSESSMENT & VALIDATION REPORT

Phone: 021-34400473

OFFICE OF THE
DIVISIONAL FOREST OFFICER
COASTAL FOREST DIVISION (RB)
KARACHI

No: G.II(b)/ 64 of 2025-26
Karachi, dated: 16.09.2025

To

Syed Omar Arif
Director
EMC Pakistan Pvt. Ltd.
Karachi.

SUBJECT: **ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT FOR THE DEVELOPMENT OF MALIR EXPRESSWAY – PHASE-I UNDER PPP MODE.**
REQUEST FOR REVIEW & VERIFICATION OF MANGROVE DAMAGE ASSESSMENT REPORT.

Reference: Your office letter dated 08.09.2025

With reference to the Mangrove Damage Assessment Report received through your above-referred letter, this is for verification and for suggesting the compensatory environmental value against the cutting of mangroves, along with the remedial measures to be adopted by the project.

In this regard, following a thorough review of the report, a field verification was conducted at Chinna Creek, Boat Basin, and Napier Mole Road, where the alignment of the Malir Expressway (Phase-I) intersects with mangrove habitats.

The physical inspection confirmed that construction activities—such as piling, embankment raising, and ramp development—will directly impact the mangrove vegetation within the assessed area of approximately 6,464 m². The enumeration of 423 mangrove trunks (*Avicennia marina*) recorded in the report was found to be broadly accurate. Furthermore, the observed spatial distribution and the compromised regeneration trends on-site corroborate the study's findings.

The mangrove trees affected at the site can be categorized into three main aspects. Direct damage will occur through the physical removal and clearance of mangroves at piling points and embankment zones, resulting in the uprooting of mature trees. Indirect damage is also anticipated, as construction activities may block and alter tidal channels, cause localized sedimentation, and restrict tidal flushing—ultimately leading to visible stress and die-back in adjacent mangrove patches. Furthermore, habitat fragmentation may arise, as elevated structures divide once continuous mangrove stands into smaller, isolated patches, thereby undermining ecological connectivity and reducing the overall resilience of the ecosystem.

The estimated cost for the removal of mangrove cover has been assessed at PKR 193,967/-, which shall be deposited into the Government Treasury at the time of removal as the determined value of mangrove wood.

The ecosystem services of mangroves in the Indus Delta and across South Asia have been valued at an average of US$ 4,200 per hectare per year. Based on this valuation, the economic cost of removing mangroves from the affected area (6,464 m² × US$ 4,200/ha/year

× 15 years) is estimated at US$ 40,725. It is recommended that this amount be allocated for the establishment of new mangrove plantations, the protection of existing plantations, and the implementation of community incentive programmes, as detailed in Annexure-A. The total funds are proposed to be utilized over a 10-year period, corresponding to the timeframe in which the restored mangrove ecosystem is expected to deliver its full range of ecological benefits.

Initially, the expenditure shall focus on plantation activities, followed by sustained investment in protection and maintenance through a community-based watch and ward system. This mangrove plantation shall be undertaken at an appropriate site within the Indus Delta under the supervision of the Sindh Forest Department.

(Shehzad Sadiq Gill)
DIVISIONAL FOREST OFFICER
COASTAL FOREST DIVISION (RB)
KARACHI

C.C:

- The Chief Conservator of Forests Sindh, Mangroves & Rangelands, Karachi.
- The Conservator of Forests, Mangrove Management Circle, Karachi.

ANNEXURE-I

(MITIGATION PLAN)

S. No.	Activity	Quantity (Hectare)	Estimated Cost (USD)	Remarks
1	Planting of Mangroves	50	15,000	Biological fencing etc.
2	Protection & Restocking for 15 years through community watch & ward system	50	20,000	Restocking and payment for watch & ward system
3	Community Mobilization & Incentive Programme	LS	5,725	Need based
		Total	**40,725**	

SEPTEMBER, 2025

ASSESSMENT OF MANGROVES AT RISK FROM MALIR EXPRESSWAY (MEW) PHASE-I ALIGNMENT

An area of 6,464 square meters, with varying densities of mangrove vegetation located in Chinna Creek, Boat Basin, and Napier Mole Road, falling within or in close proximity to the proposed alignment of the Malir Expressway, was assessed. The site largely comprised the edges of a water channel, exhibiting a semilunar, irregular shape. Comparative assessment tools were applied, and the results revealed consistent patterns across methods. A total of 423 mangrove trunks of varying sizes and spatial distribution were recorded within the area. Multiple ecological parameters were evaluated to derive a scientifically justifiable figure for environmental compensation.



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	Specific Risks	4
3	Extending ecological assessment of Mangroves	5
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Malir Expressway Phase-I: Project Outline, Mangrove Scope & Ecological Assessment

1. Project Outline

The Malir Expressway Phase-I is a proposed 12.5 km elevated 4-lane freight corridor in Karachi. It will connect Karachi Port's East Wharf with Malir Expressway Phase-II under a Public–Private Partnership (PPP) framework. The Karachi Development Authority is the implementing agency. The consortium includes KPMG (financial), Exponent Engineers (technical), EMC Pakistan (environmental), and NHS (legal). The project has a construction timeline of 2 years and a concession period of 25 years.

Alignment

The alignment begins at KPT Interchange (East Wharf) and traverses Korangi Road → Sunset Boulevard → Khayaban-e-Jami → Mai Kolachi Bypass → Boat Basin. A spur link crosses Chinna Creek to reach Napier Mole Road. The corridor terminates at Marine Promenade and Napier Mole Road. Critical environmental overlaps include mangrove stands at Chinna Creek, Boat Basin, and Napier Mole Road.

Objectives

- Dedicated freight corridor for port traffic
- Reduce congestion on urban roads in Clifton/DHA
- Replace outdated Sunset Boulevard Flyover
- Improve Karachi Port throughput
- Lower vehicular emissions by diverting heavy trucks from city roads

2. Scope with Respect to Mangroves

Introduction to Mangroves

Mangrove forests are vital ecosystems that provide critical services to both humans and biodiversity, offering habitat for species ranging from microorganisms to birds, fish, and mammals. They support local livelihoods through fuelwood and fodder, while playing a crucial role in marine food chains, shoreline stabilization, and protection against cyclones and tsunamis. Despite their importance, more than half of the world's mangrove habitats have been lost, largely due to human activities. Recognizing these threats, Karachi's mangroves were declared protected in 2010, and global frameworks such as UNFF, CITES, CBD, UNFCCC, and the Ramsar Convention have reinforced their conservation. These agreements, alongside national and community efforts, have slowed the rate of decline, yet the need for stronger, sustained action remains pressing. Mangroves thus stand as both an ecological shield and a critical livelihood source demanding urgent protection.

Coastal development projects often prioritize infrastructure at the expense of mangrove habitats, leading to repeated compromises on these fragile ecosystems. Several initiatives undertaken in recent years have affected mangroves to varying degrees, creating an

unhealthy situation marked by disputes and blame-shifting among government departments and society at large. To address this challenge, the Office of the Chief Conservator of Forests (Mangroves), Sindh of Forest Department**,** as the custodian of mangroves, has taken a proactive role by assisting project proponents in assessing ecological losses and formulating suitable compensatory plans.

Rationale

The project under consideration, titled "Assessment of Mangroves at Risk from Malir Expressway (MEW) Phase-I Alignment," is linked to a key initiative of the Karachi Development Authority. The Government of Sindh, under the Public–Private Partnership (PPP) mode, intends to implement the Malir Expressway Phase-I Project in Karachi to improve transit services and alleviate traffic congestion in the city.

Mangroves along Chinna Creek, Boat Basin, and Napier Mole Road fall within or in close proximity to the proposed alignment. These mangrove stands are of exceptional ecological significance, serving as natural barriers against coastal erosion, reducing the impact of storm surges, and acting as highly efficient carbon sinks. They also provide critical breeding and nursery grounds for fish, shrimp, and other marine life, thereby sustaining the livelihoods of coastal communities.

However, construction activities such as piling, embankment raising, and the development of ramps pose serious threats to these fragile ecosystems. Direct impacts include the physical removal or destruction of mangrove stands, while indirect impacts involve alteration of tidal flows, water quality degradation, and long-term habitat fragmentation. Such damage could lead to a decline in biodiversity, reduced carbon sequestration capacity, and increased vulnerability of the coastline to climate change-induced hazards. The cumulative repercussions would not only compromise environmental sustainability but also undermine the socio-economic resilience of local communities who depend on these ecosystems for their survival. Therefore, and this damage assessment study has been commissioned.

Environmental Services Compromised

Mangroves provide a wide range of vital ecosystem services that are critical for environmental sustainability and human well-being. They act as powerful carbon sinks, sequestering approximately 1,000 tons of CO_2 per hectare, thereby contributing significantly to climate change mitigation. In addition, they serve as natural fisheries nurseries, supporting the life cycles of shrimps, crabs, and fish, which are essential for coastal livelihoods and food security. Mangroves also play a crucial role in coastal defense by protecting shorelines against storms, erosion, and tidal surges, reducing the vulnerability of coastal communities. Furthermore, they enhance water quality through natural purification and sediment trapping processes, which help maintain healthier marine environments. Equally important, these ecosystems provide critical habitat for migratory birds and a diverse range of marine biodiversity, sustaining ecological balance and enhancing global biodiversity conservation.

Specific Risks

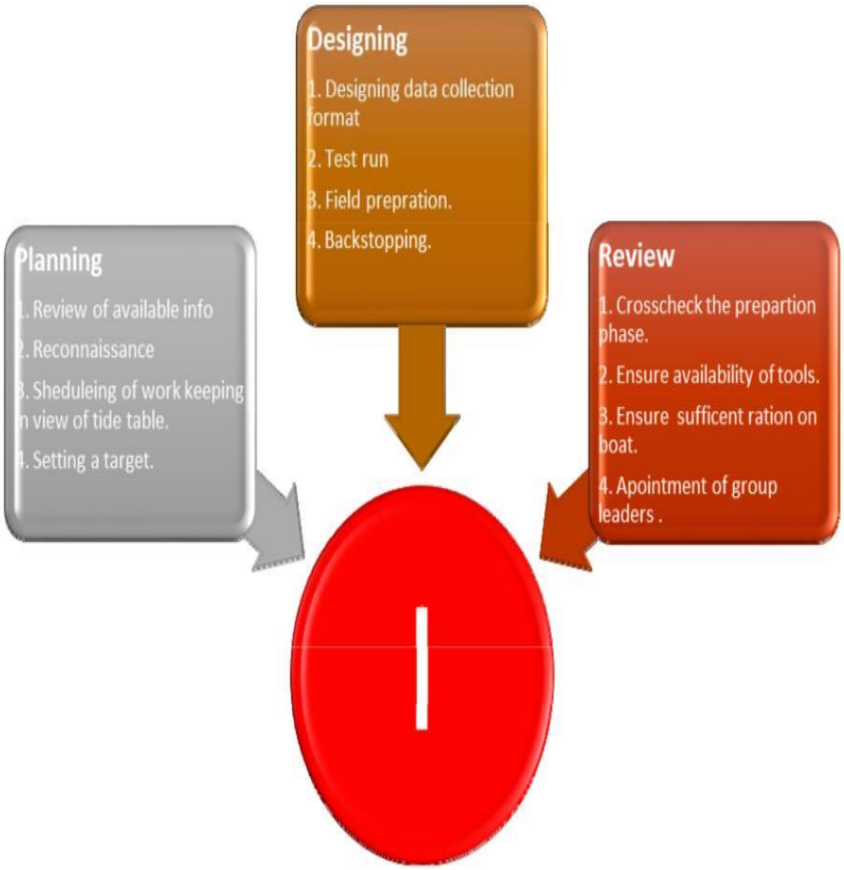
The construction of piles, embankments, and other physical barriers severely disrupts the intricate root systems of mangroves, which are essential for anchoring the plants, stabilizing soil, and providing habitat for aquatic life. Once damaged, these root networks lose their capacity to support regeneration, making the ecosystem more vulnerable to erosion and decline. In addition, such interventions disturb natural tidal flows and alter salinity gradients, both of which are critical for the survival of mangrove species. Even minor shifts in tidal circulation or salt levels can stress the trees, leading to gradual die-back and reduced forest cover. Runoff from construction sites and pollution caused by dredging activities compound this stress by introducing toxic substances and excessive sediments into the water, smothering roots and impairing the growth of young seedlings. Moreover, the placement of elevated structures fragments once-continuous mangrove habitats, isolating patches and disrupting ecological connectivity. This fragmentation diminishes the resilience of mangroves, restricts the movement of marine organisms, reduces nesting and feeding grounds for birds, and ultimately undermines the overall ecological balance and biodiversity that these ecosystems sustain.

3. Extending ecological assessment of Mangroves

The Process:

The process can broadly be categorized into technical and administrative components, which are further illustrated graphically for clarity and better understanding.





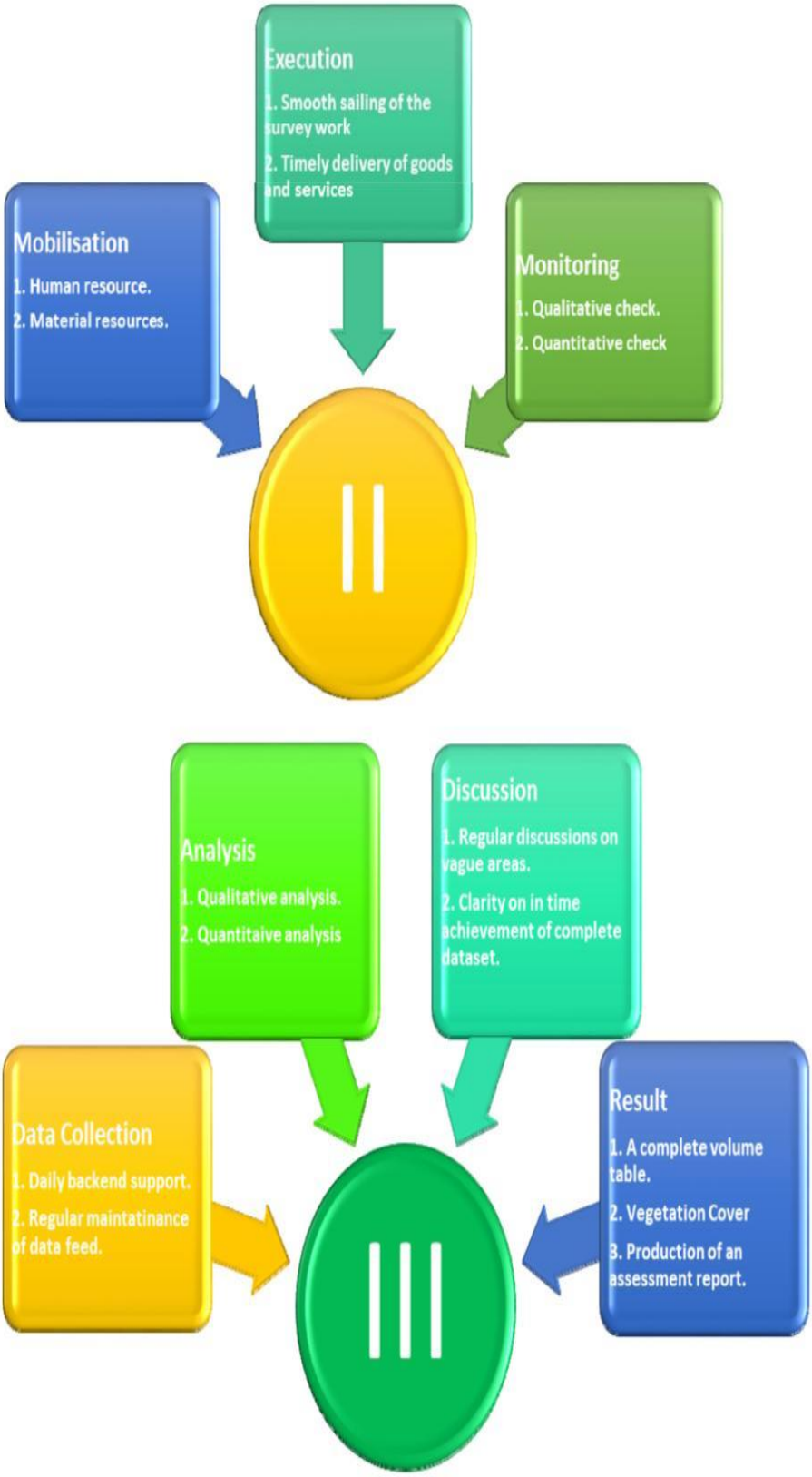

Execution
1. Smooth sailing of the survey work
2. Timely delivery of goods and services
Mobilisation
1. Human resource.
2. Material resources.
Monitoring
1. Qualitative check.
2. Quantitative check
II
Analysis
1. Qualitative analysis.
2. Quantitaive analysis
Discussion
1. Regular discussions on vague areas.
2. Clarity on in time achievement of complete dataset.
Data Collection
1. Daily backend support.
2. Regular maintatinance of data feed.
Result
1. A complete volume table.
2. Vegetation Cover
3. Production of an assessment report.
III



Fig 1: The satellite image of the study area

Methodology

Field Survey:

Several studies have been carried out on the mangroves, though most were designed with specific objectives. A few damage assessment studies were also undertaken; however, their scope remained limited. Moreover, these assessments were often conducted on unrealistic grounds, without adequately considering the intertidal dynamics and the challenging nature of the habitat, particularly the extensive mudflats.



Fig 2: Working condition in study area

Choice of Survey Method:

The assessment was conducted using a systematic plot sampling technique, commonly referred to as the quadrat method. Vegetation was classified into four distinct groups based on height, and data on DBH (Diameter at Breast Height) was collected for each group. In addition, the density and frequency of the classified groups were also recorded to ensure comprehensive analysis.



Fig 3: In situ discussions on tools & methods

Survey Tools and Data Collection:

In previous studies, samples were collected using the quadrat method (as shown in Fig. 4). However, given the challenging terrain and the asymmetrical shape of the study area, data in the present assessment was collected through a total count approach. Each trunk was individually marked and measured for height and DBH (Diameter at Breast Height). These datasets were then used to derive various phytosociological attributes, enabling the estimation of damage intensity and the establishment of a realistic basis for environmental compensation.



Fig 3: Data collection

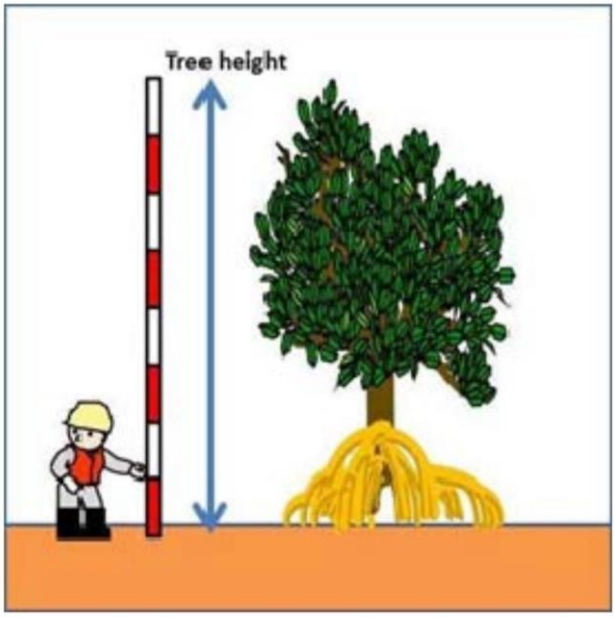


Fig 4: Measurement of tree height with measuring rod



Fig 5: Measurement method of trunk circumference (DBH)

The collected data was organized in tabulated form using the format shown below and subsequently entered into the system for computer-based analysis.

Data Sheet 1

S. #	Tree Tag	Girth in inches	Height in feet	DBH (Girth in cm)	H (Height in m)
1					

Data Sheet 2

Basal area BA (m^2)	V (Volume) m^3	V (Volume) Ft^3	Stacks	Truck Load	Fuelwood in mds

Conclusion:

The assessment covered an area of 6,464 square meters in Chinna Creek, Boat Basin, and Napier Mole Road, located within or near the proposed alignment of the Malir Expressway. The site, primarily along the edges of a semilunar, irregular water channel, was characterized by a monospecific aggregation of mangrove vegetation with physiographic forms ranging from erect to prostrate. A total of 423 mangrove trunks of varying sizes and spatial distribution were recorded, reflecting the traits of a climax community, though with a compromised regenerative trend that suggests limited natural recovery potential. Comparative assessment tools confirmed consistent findings, and multiple ecological parameters were analyzed to establish a scientifically sound basis for environmental compensation.

# of Trunks	DBH of Trees (in CM)	Height of Tree (in Feet)	Height of Tree (in Meters)	Basal Area (m^2)	Volume (m^3)	Volume (Ft^3)	Stacks	Truck Load	Fuelwood (in Mds)	Estimated Cost (in Rs.)
423	2,434.4	7,024	2,142.320	1.3065	3.6617	129.31	1.2931	1.6164	323.2784	193,967.06

Table 1: Wood volume to be compromised

The wood volume, calculated on the basis of DBH (Diameter at Breast Height) measurements, amounted to a cumulative total of 3.6617 cubic meters. This corresponds to an estimated 1.6164 truckloads of wood, or approximately 323.2784 mds of fuelwood. At a market rate of Rs. 600 per md, the total cost of the assessed fuelwood volume is estimated at Rs. 193,967/- (one hundred ninety-three thousand nine hundred sixty-seven only).

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Annex I- Visual record of assessment process

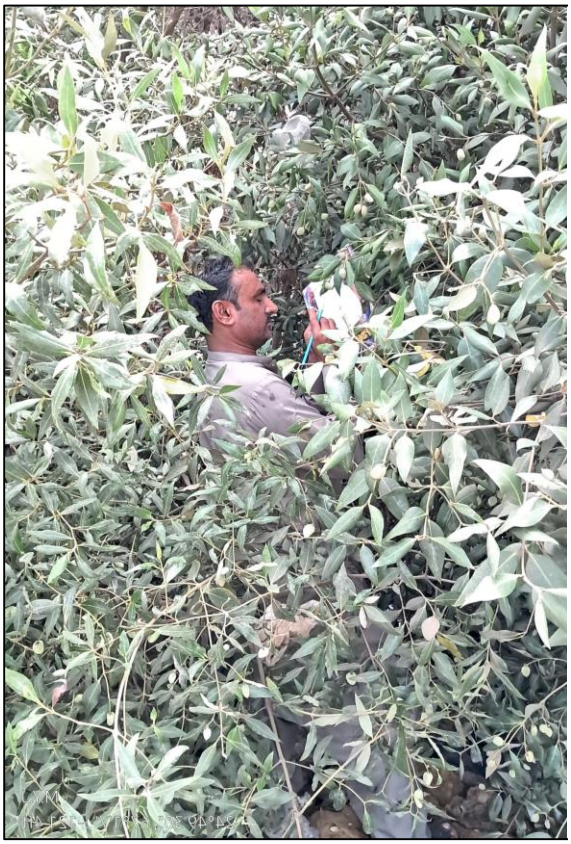













M.Y.J
24°49'28", 67°1'7", -128.0ft
08:54:15 am


M.Y.J
24°49'28", 67°1'7", -200.1ft
08:58:20 am

Annexure II Wood volume assessment metrics:

Inventory and assessment of *Avicennia marina* trees at risk on the Malir Expressway (Phase I) Route												
Sr.No	Tree Tag #	Girth of Trees (in CM)	DBH of Trees (in CM)	Height of Tree (in Feet)	Height of Tree (in Meters)	Basal Area (m^2)	Volume (m^3)	Volume (Ft^3)	Stacks	Truck Load	Fuelwood (in Mds)	Estimated Cost (in Rs.)
1	1	23	7.321	22	6.710	0.0042	0.0141	0.4988	0.0050	0.0062	1.2469	748.142
2	2	24	7.639	21	6.405	0.0046	0.0147	0.5184	0.0052	0.0065	1.2960	777.584
3	3	20	6.366	21	6.405	0.0032	0.0102	0.3600	0.0036	0.0045	0.9000	539.989
4	4	21	6.684	20	6.100	0.0035	0.0107	0.3780	0.0038	0.0047	0.9450	566.989
5	5	22	7.003	16	4.880	0.0039	0.0094	0.3319	0.0033	0.0041	0.8297	497.819
6	6	20	6.366	23	7.015	0.0032	0.0112	0.3943	0.0039	0.0049	0.9857	591.417
7	7	24	7.639	12	3.660	0.0046	0.0084	0.2962	0.0030	0.0037	0.7406	444.334
8	8	16	5.093	20	6.100	0.0020	0.0062	0.2194	0.0022	0.0027	0.5486	329.136
9	9	18	5.730	20	6.100	0.0026	0.0079	0.2777	0.0028	0.0035	0.6943	416.563
10	10	20	6.366	25	7.625	0.0032	0.0121	0.4286	0.0043	0.0054	1.0714	642.844
11	11	20	6.366	22	6.710	0.0032	0.0107	0.3771	0.0038	0.0047	0.9428	565.703
12	12	21	6.684	26	7.930	0.0035	0.0139	0.4914	0.0049	0.0061	1.2285	737.085
13	13	21	6.684	20	6.100	0.0035	0.0107	0.3780	0.0038	0.0047	0.9450	566.989
14	14	20	6.366	21	6.405	0.0032	0.0102	0.3600	0.0036	0.0045	0.9000	539.989
15	15	19	6.048	21	6.405	0.0029	0.0092	0.3249	0.0032	0.0041	0.8122	487.340
16	16	20	6.366	22	6.710	0.0032	0.0107	0.3771	0.0038	0.0047	0.9428	565.703
17	17	22	7.003	21	6.405	0.0039	0.0123	0.4356	0.0044	0.0054	1.0890	653.387
18	18	21	6.684	21	6.405	0.0035	0.0112	0.3969	0.0040	0.0050	0.9922	595.338
19	19	18	5.730	21	6.405	0.0026	0.0083	0.2916	0.0029	0.0036	0.7290	437.391
20	20	18	5.730	21	6.405	0.0026	0.0083	0.2916	0.0029	0.0036	0.7290	437.391
21	21	20	6.366	21	6.405	0.0032	0.0102	0.3600	0.0036	0.0045	0.9000	539.989
22	22	20	6.366	22	6.710	0.0032	0.0107	0.3771	0.0038	0.0047	0.9428	565.703
23	23	21	6.684	22	6.710	0.0035	0.0118	0.4158	0.0042	0.0052	1.0395	623.687
24	24	20	6.366	22	6.710	0.0032	0.0107	0.3771	0.0038	0.0047	0.9428	565.703
25	25	20	6.366	22	6.710	0.0032	0.0107	0.3771	0.0038	0.0047	0.9428	565.703
26	26	20	6.366	17	5.185	0.0032	0.0083	0.2914	0.0029	0.0036	0.7286	437.134
27	27	21	6.684	22	6.710	0.0035	0.0118	0.4158	0.0042	0.0052	1.0395	623.687
28	28	20	6.366	22	6.710	0.0032	0.0107	0.3771	0.0038	0.0047	0.9428	565.703
29	29	20	6.366	22	6.710	0.0032	0.0107	0.3771	0.0038	0.0047	0.9428	565.703
30	30	19	6.048	21	6.405	0.0029	0.0092	0.3249	0.0032	0.0041	0.8122	487.340
31	31	12	3.820	12	3.660	0.0011	0.0021	0.0741	0.0007	0.0009	0.1851	111.083
32	32	20	6.366	10	3.050	0.0032	0.0049	0.1714	0.0017	0.0021	0.4286	257.138
33	33	22	7.003	12	3.660	0.0039	0.0070	0.2489	0.0025	0.0031	0.6223	373.364
34	34	16	5.093	25	7.625	0.0020	0.0078	0.2743	0.0027	0.0034	0.6857	411.420
35	35	18	5.730	22	6.710	0.0026	0.0087	0.3055	0.0031	0.0038	0.7637	458.219
36	36	20	6.366	20	6.100	0.0032	0.0097	0.3429	0.0034	0.0043	0.8571	514.275
37	37	20	6.366	22	6.710	0.0032	0.0107	0.3771	0.0038	0.0047	0.9428	565.703
38	38	19	6.048	21	6.405	0.0029	0.0092	0.3249	0.0032	0.0041	0.8122	487.340
39	39	20	6.366	21	6.405	0.0032	0.0102	0.3600	0.0036	0.0045	0.9000	539.989
40	40	17	5.411	21	6.405	0.0023	0.0074	0.2601	0.0026	0.0033	0.6502	390.142
41	41	16	5.093	22	6.710	0.0020	0.0068	0.2414	0.0024	0.0030	0.6034	362.050
42	42	21	6.684	22	6.710	0.0035	0.0118	0.4158	0.0042	0.0052	1.0395	623.687
43	43	18	5.730	22	6.710	0.0026	0.0087	0.3055	0.0031	0.0038	0.7637	458.219

44	44	18	5.730	23	7.015	0.0026	0.0090	0.3194	0.0032	0.0040	0.7984	479.048
45	45	20	6.366	22	6.710	0.0032	0.0107	0.3771	0.0038	0.0047	0.9428	565.703
46	46	20	6.366	15	4.575	0.0032	0.0073	0.2571	0.0026	0.0032	0.6428	385.707
47	47	23	7.321	15	4.575	0.0042	0.0096	0.3401	0.0034	0.0043	0.8502	510.097
48	48	18	5.730	22	6.710	0.0026	0.0087	0.3055	0.0031	0.0038	0.7637	458.219
49	49	17	5.411	22	6.710	0.0023	0.0077	0.2725	0.0027	0.0034	0.6812	408.720
50	50	17	5.411	21	6.405	0.0023	0.0074	0.2601	0.0026	0.0033	0.6502	390.142
51	51	17	5.411	21	6.405	0.0023	0.0074	0.2601	0.0026	0.0033	0.6502	390.142
52	52	17	5.411	22	6.710	0.0023	0.0077	0.2725	0.0027	0.0034	0.6812	408.720
53	53	15	4.775	22	6.710	0.0018	0.0060	0.2121	0.0021	0.0027	0.5303	318.208
54	54	18	5.730	21	6.405	0.0026	0.0083	0.2916	0.0029	0.0036	0.7290	437.391
55	55	20	6.366	21	6.405	0.0032	0.0102	0.3600	0.0036	0.0045	0.9000	539.989
56	56	19	6.048	22	6.710	0.0029	0.0096	0.3404	0.0034	0.0043	0.8509	510.547
57	57	22	7.003	23	7.015	0.0039	0.0135	0.4771	0.0048	0.0060	1.1927	715.614
58	58	24	7.639	27	8.235	0.0046	0.0189	0.6665	0.0067	0.0083	1.6663	999.751
59	59	25	7.958	22	6.710	0.0050	0.0167	0.5893	0.0059	0.0074	1.4732	883.911
60	60	32	10.186	23	7.015	0.0081	0.0286	1.0094	0.0101	0.0126	2.5234	1514.027
61	61	19	6.048	10	3.050	0.0029	0.0044	0.1547	0.0015	0.0019	0.3868	232.067
62	62	17	5.411	10	3.050	0.0023	0.0035	0.1239	0.0012	0.0015	0.3096	185.782
63	63	21	6.684	17	5.185	0.0035	0.0091	0.3213	0.0032	0.0040	0.8032	481.940
64	64	20	6.366	10	3.050	0.0032	0.0049	0.1714	0.0017	0.0021	0.4286	257.138
65	65	18	5.730	12	3.660	0.0026	0.0047	0.1666	0.0017	0.0021	0.4166	249.938
66	66	19	6.048	12	3.660	0.0029	0.0053	0.1857	0.0019	0.0023	0.4641	278.480
67	67	20	6.366	12	3.660	0.0032	0.0058	0.2057	0.0021	0.0026	0.5143	308.565
68	68	24	7.639	12	3.660	0.0046	0.0084	0.2962	0.0030	0.0037	0.7406	444.334
69	69	25	7.958	15	4.575	0.0050	0.0114	0.4018	0.0040	0.0050	1.0044	602.666
70	70	19	6.048	17	5.185	0.0029	0.0074	0.2630	0.0026	0.0033	0.6575	394.513
71	71	20	6.366	18	5.490	0.0032	0.0087	0.3086	0.0031	0.0039	0.7714	462.848
72	72	24	7.639	16	4.880	0.0046	0.0112	0.3950	0.0039	0.0049	0.9874	592.445
73	73	20	6.366	17	5.185	0.0032	0.0083	0.2914	0.0029	0.0036	0.7286	437.134
74	74	23	7.321	18	5.490	0.0042	0.0116	0.4081	0.0041	0.0051	1.0202	612.116
75	75	25	7.958	22	6.710	0.0050	0.0167	0.5893	0.0059	0.0074	1.4732	883.911
76	76	18	5.730	21	6.405	0.0026	0.0083	0.2916	0.0029	0.0036	0.7290	437.391
77	77	24	7.639	21	6.405	0.0046	0.0147	0.5184	0.0052	0.0065	1.2960	777.584
78	78	22	7.003	23	7.015	0.0039	0.0135	0.4771	0.0048	0.0060	1.1927	715.614
79	79	20	6.366	23	7.015	0.0032	0.0112	0.3943	0.0039	0.0049	0.9857	591.417
80	80	19	6.048	23	7.015	0.0029	0.0101	0.3558	0.0036	0.0044	0.8896	533.754
81	81	22	7.003	21	6.405	0.0039	0.0123	0.4356	0.0044	0.0054	1.0890	653.387
82	82	20	6.366	15	4.575	0.0032	0.0073	0.2571	0.0026	0.0032	0.6428	385.707
83	83	18	5.730	22	6.710	0.0026	0.0087	0.3055	0.0031	0.0038	0.7637	458.219
84	84	17	5.411	18	5.490	0.0023	0.0063	0.2229	0.0022	0.0028	0.5573	334.408
85	85	20	6.366	23	7.015	0.0032	0.0112	0.3943	0.0039	0.0049	0.9857	591.417
86	86	21	6.684	23	7.015	0.0035	0.0123	0.4347	0.0043	0.0054	1.0867	652.037
87	87	15	4.775	21	6.405	0.0018	0.0057	0.2025	0.0020	0.0025	0.5062	303.744
88	88	18	5.730	22	6.710	0.0026	0.0087	0.3055	0.0031	0.0038	0.7637	458.219
89	89	22	7.003	22	6.710	0.0039	0.0129	0.4563	0.0046	0.0057	1.1408	684.501
90	90	18	5.730	22	6.710	0.0026	0.0087	0.3055	0.0031	0.0038	0.7637	458.219
91	91	16	5.093	25	7.625	0.0020	0.0078	0.2743	0.0027	0.0034	0.6857	411.420

92	92	20	6.366	18	5.490	0.0032	0.0087	0.3086	0.0031	0.0039	0.7714	462.848
93	93	22	7.003	20	6.100	0.0039	0.0117	0.4148	0.0041	0.0052	1.0371	622.273
94	94	21	6.684	29	8.845	0.0035	0.0155	0.5481	0.0055	0.0069	1.3702	822.133
95	95	21	6.684	18	5.490	0.0035	0.0096	0.3402	0.0034	0.0043	0.8505	510.290
96	96	21	6.684	22	6.710	0.0035	0.0118	0.4158	0.0042	0.0052	1.0395	623.687
97	97	21	6.684	24	7.320	0.0035	0.0128	0.4536	0.0045	0.0057	1.1340	680.386
98	98	21	6.684	25	7.625	0.0035	0.0134	0.4725	0.0047	0.0059	1.1812	708.736
99	99	23	7.321	25	7.625	0.0042	0.0160	0.5668	0.0057	0.0071	1.4169	850.161
100	100	23	7.321	25	7.625	0.0042	0.0160	0.5668	0.0057	0.0071	1.4169	850.161
101	101	20	6.366	23	7.015	0.0032	0.0112	0.3943	0.0039	0.0049	0.9857	591.417
102	102	17	5.411	25	7.625	0.0023	0.0088	0.3096	0.0031	0.0039	0.7741	464.455
103	103	24	7.639	25	7.625	0.0046	0.0175	0.6171	0.0062	0.0077	1.5428	925.696
104	104	18	5.730	25	7.625	0.0026	0.0098	0.3471	0.0035	0.0043	0.8678	520.704
105	105	23	7.321	21	6.405	0.0042	0.0135	0.4761	0.0048	0.0060	1.1902	714.136
106	106	20	6.366	25	7.625	0.0032	0.0121	0.4286	0.0043	0.0054	1.0714	642.844
107	107	25	7.958	21	6.405	0.0050	0.0159	0.5625	0.0056	0.0070	1.4062	843.733
108	108	18	5.730	21	6.405	0.0026	0.0083	0.2916	0.0029	0.0036	0.7290	437.391
109	109	20	6.366	21	6.405	0.0032	0.0102	0.3600	0.0036	0.0045	0.9000	539.989
110	110	22	7.003	23	7.015	0.0039	0.0135	0.4771	0.0048	0.0060	1.1927	715.614
111	111	12	3.820	20	6.100	0.0011	0.0035	0.1234	0.0012	0.0015	0.3086	185.139
112	112	8	2.546	20	6.100	0.0005	0.0016	0.0549	0.0005	0.0007	0.1371	82.284
113	113	10	3.183	20	6.100	0.0008	0.0024	0.0857	0.0009	0.0011	0.2143	128.569
114	114	15	4.775	21	6.405	0.0018	0.0057	0.2025	0.0020	0.0025	0.5062	303.744
115	115	20	6.366	22	6.710	0.0032	0.0107	0.3771	0.0038	0.0047	0.9428	565.703
116	116	17	5.411	21	6.405	0.0023	0.0074	0.2601	0.0026	0.0033	0.6502	390.142
117	117	20	6.366	21	6.405	0.0032	0.0102	0.3600	0.0036	0.0045	0.9000	539.989
118	118	20	6.366	21	6.405	0.0032	0.0102	0.3600	0.0036	0.0045	0.9000	539.989
119	119	156	49.656	22	6.710	0.1937	0.6497	######	0.2294	0.2868	57.3623	34417.365
120	120	16	5.093	27	8.235	0.0020	0.0084	0.2962	0.0030	0.0037	0.7406	444.334
121	121	20	6.366	23	7.015	0.0032	0.0112	0.3943	0.0039	0.0049	0.9857	591.417
122	122	19	6.048	27	8.235	0.0029	0.0118	0.4177	0.0042	0.0052	1.0443	626.580
123	123	16	5.093	23	7.015	0.0020	0.0071	0.2523	0.0025	0.0032	0.6308	378.507
124	124	17	5.411	23	7.015	0.0023	0.0081	0.2849	0.0028	0.0036	0.7122	427.299
125	125	20	6.366	18	5.490	0.0032	0.0087	0.3086	0.0031	0.0039	0.7714	462.848
126	126	17	5.411	25	7.625	0.0023	0.0088	0.3096	0.0031	0.0039	0.7741	464.455
127	127	19	6.048	18	5.490	0.0029	0.0079	0.2785	0.0028	0.0035	0.6962	417.720
128	128	15	4.775	12	3.660	0.0018	0.0033	0.1157	0.0012	0.0014	0.2893	173.568
129	129	18	5.730	20	6.100	0.0026	0.0079	0.2777	0.0028	0.0035	0.6943	416.563
130	130	20	6.366	20	6.100	0.0032	0.0097	0.3429	0.0034	0.0043	0.8571	514.275
131	131	16	5.093	18	5.490	0.0020	0.0056	0.1975	0.0020	0.0025	0.4937	296.223
132	132	19	6.048	20	6.100	0.0029	0.0088	0.3094	0.0031	0.0039	0.7736	464.134
133	133	20	6.366	20	6.100	0.0032	0.0097	0.3429	0.0034	0.0043	0.8571	514.275
134	134	20	6.366	23	7.015	0.0032	0.0112	0.3943	0.0039	0.0049	0.9857	591.417
135	135	22	7.003	22	6.710	0.0039	0.0129	0.4563	0.0046	0.0057	1.1408	684.501
136	136	21	6.684	20	6.100	0.0035	0.0107	0.3780	0.0038	0.0047	0.9450	566.989
137	137	15	4.775	20	6.100	0.0018	0.0055	0.1929	0.0019	0.0024	0.4821	289.280
138	138	23	7.321	20	6.100	0.0042	0.0128	0.4534	0.0045	0.0057	1.1335	680.129
139	139	15	4.775	21	6.405	0.0018	0.0057	0.2025	0.0020	0.0025	0.5062	303.744

140	140	21	6.684	21	6.405	0.0035	0.0112	0.3969	0.0040	0.0050	0.9922	595.338
141	141	16	5.093	21	6.405	0.0020	0.0065	0.2304	0.0023	0.0029	0.5760	345.593
142	142	14	4.456	12	3.660	0.0016	0.0029	0.1008	0.0010	0.0013	0.2520	151.197
143	143	18	5.730	20	6.100	0.0026	0.0079	0.2777	0.0028	0.0035	0.6943	416.563
144	144	16	5.093	20	6.100	0.0020	0.0062	0.2194	0.0022	0.0027	0.5486	329.136
145	145	20	6.366	20	6.100	0.0032	0.0097	0.3429	0.0034	0.0043	0.8571	514.275
146	146	16	5.093	10	3.050	0.0020	0.0031	0.1097	0.0011	0.0014	0.2743	164.568
147	147	14	4.456	10	3.050	0.0016	0.0024	0.0840	0.0008	0.0010	0.2100	125.997
148	148	13	4.138	10	3.050	0.0013	0.0021	0.0724	0.0007	0.0009	0.1811	108.641
149	149	10	3.183	10	3.050	0.0008	0.0012	0.0429	0.0004	0.0005	0.1071	64.284
150	150	10	3.183	8	2.440	0.0008	0.0010	0.0343	0.0003	0.0004	0.0857	51.428
151	151	17	5.411	17	5.185	0.0023	0.0060	0.2106	0.0021	0.0026	0.5264	315.829
152	152	15	4.775	21	6.405	0.0018	0.0057	0.2025	0.0020	0.0025	0.5062	303.744
153	153	9	2.865	11	3.355	0.0006	0.0011	0.0382	0.0004	0.0005	0.0955	57.277
154	154	10	3.183	11	3.355	0.0008	0.0013	0.0471	0.0005	0.0006	0.1179	70.713
155	155	5	1.592	7	2.135	0.0002	0.0002	0.0075	0.0001	0.0001	0.0187	11.250
156	156	7	2.228	12	3.660	0.0004	0.0007	0.0252	0.0003	0.0003	0.0630	37.799
157	157	10	3.183	12	3.660	0.0008	0.0015	0.0514	0.0005	0.0006	0.1286	77.141
158	158	10	3.183	11	3.355	0.0008	0.0013	0.0471	0.0005	0.0006	0.1179	70.713
159	159	10	3.183	12	3.660	0.0008	0.0015	0.0514	0.0005	0.0006	0.1286	77.141
160	160	10	3.183	12	3.660	0.0008	0.0015	0.0514	0.0005	0.0006	0.1286	77.141
161	161	11	3.501	12	3.660	0.0010	0.0018	0.0622	0.0006	0.0008	0.1556	93.341
162	162	11	3.501	15	4.575	0.0010	0.0022	0.0778	0.0008	0.0010	0.1945	116.676
163	163	9	2.865	12	3.660	0.0006	0.0012	0.0417	0.0004	0.0005	0.1041	62.484
164	164	14	4.456	16	4.880	0.0016	0.0038	0.1344	0.0013	0.0017	0.3360	201.596
165	165	13	4.138	14	4.270	0.0013	0.0029	0.1014	0.0010	0.0013	0.2535	152.097
166	166	13	4.138	15	4.575	0.0013	0.0031	0.1086	0.0011	0.0014	0.2716	162.961
167	167	10	3.183	12	3.660	0.0008	0.0015	0.0514	0.0005	0.0006	0.1286	77.141
168	168	14	4.456	14	4.270	0.0016	0.0033	0.1176	0.0012	0.0015	0.2940	176.396
169	169	9	2.865	8	2.440	0.0006	0.0008	0.0278	0.0003	0.0003	0.0694	41.656
170	170	14	4.456	11	3.355	0.0016	0.0026	0.0924	0.0009	0.0012	0.2310	138.597
171	171	14	4.456	15	4.575	0.0016	0.0036	0.1260	0.0013	0.0016	0.3150	188.996
172	172	13	4.138	10	3.050	0.0013	0.0021	0.0724	0.0007	0.0009	0.1811	108.641
173	173	13	4.138	9	2.745	0.0013	0.0018	0.0652	0.0007	0.0008	0.1630	97.777
174	174	13	4.138	10	3.050	0.0013	0.0021	0.0724	0.0007	0.0009	0.1811	108.641
175	175	20	6.366	19	5.795	0.0032	0.0092	0.3257	0.0033	0.0041	0.8143	488.562
176	176	20	6.366	25	7.625	0.0032	0.0121	0.4286	0.0043	0.0054	1.0714	642.844
177	177	20	6.366	25	7.625	0.0032	0.0121	0.4286	0.0043	0.0054	1.0714	642.844
178	178	18	5.730	23	7.015	0.0026	0.0090	0.3194	0.0032	0.0040	0.7984	479.048
179	179	14	4.456	12	3.660	0.0016	0.0029	0.1008	0.0010	0.0013	0.2520	151.197
180	180	14	4.456	8	2.440	0.0016	0.0019	0.0672	0.0007	0.0008	0.1680	100.798
181	181	11	3.501	8	2.440	0.0010	0.0012	0.0415	0.0004	0.0005	0.1037	62.227
182	182	16	5.093	8	2.440	0.0020	0.0025	0.0878	0.0009	0.0011	0.2194	131.654
183	183	12	3.820	10	3.050	0.0011	0.0017	0.0617	0.0006	0.0008	0.1543	92.570
184	184	13	4.138	11	3.355	0.0013	0.0023	0.0797	0.0008	0.0010	0.1992	119.505
185	185	13	4.138	16	4.880	0.0013	0.0033	0.1159	0.0012	0.0014	0.2897	173.825
186	186	8	2.546	15	4.575	0.0005	0.0012	0.0411	0.0004	0.0005	0.1029	61.713
187	187	15	4.775	17	5.185	0.0018	0.0046	0.1639	0.0016	0.0020	0.4098	245.888

188	188	17	5.411	17	5.185	0.0023	0.0060	0.2106	0.0021	0.0026	0.5264	315.829
189	189	18	5.730	18	5.490	0.0026	0.0071	0.2499	0.0025	0.0031	0.6248	374.907
190	190	17	5.411	12	3.660	0.0023	0.0042	0.1486	0.0015	0.0019	0.3716	222.938
191	191	12	3.820	9	2.745	0.0011	0.0016	0.0555	0.0006	0.0007	0.1389	83.313
192	192	12	3.820	10	3.050	0.0011	0.0017	0.0617	0.0006	0.0008	0.1543	92.570
193	193	13	4.138	12	3.660	0.0013	0.0025	0.0869	0.0009	0.0011	0.2173	130.369
194	194	13	4.138	14	4.270	0.0013	0.0029	0.1014	0.0010	0.0013	0.2535	152.097
195	195	17	5.411	20	6.100	0.0023	0.0070	0.2477	0.0025	0.0031	0.6193	371.564
196	196	20	6.366	20	6.100	0.0032	0.0097	0.3429	0.0034	0.0043	0.8571	514.275
197	197	18	5.730	16	4.880	0.0026	0.0063	0.2222	0.0022	0.0028	0.5554	333.250
198	198	15	4.775	12	3.660	0.0018	0.0033	0.1157	0.0012	0.0014	0.2893	173.568
199	199	13	4.138	10	3.050	0.0013	0.0021	0.0724	0.0007	0.0009	0.1811	108.641
200	200	18	5.730	13	3.965	0.0026	0.0051	0.1805	0.0018	0.0023	0.4513	270.766
201	201	13	4.138	12	3.660	0.0013	0.0025	0.0869	0.0009	0.0011	0.2173	130.369
202	202	13	4.138	10	3.050	0.0013	0.0021	0.0724	0.0007	0.0009	0.1811	108.641
203	203	15	4.775	20	6.100	0.0018	0.0055	0.1929	0.0019	0.0024	0.4821	289.280
204	204	13	4.138	16	4.880	0.0013	0.0033	0.1159	0.0012	0.0014	0.2897	173.825
205	205	10	3.183	12	3.660	0.0008	0.0015	0.0514	0.0005	0.0006	0.1286	77.141
206	206	13	4.138	12	3.660	0.0013	0.0025	0.0869	0.0009	0.0011	0.2173	130.369
207	207	11	3.501	10	3.050	0.0010	0.0015	0.0519	0.0005	0.0006	0.1296	77.784
208	208	20	6.366	13	3.965	0.0032	0.0063	0.2229	0.0022	0.0028	0.5571	334.279
209	209	21	6.684	16	4.880	0.0035	0.0086	0.3024	0.0030	0.0038	0.7560	453.591
210	210	17	5.411	17	5.185	0.0023	0.0060	0.2106	0.0021	0.0026	0.5264	315.829
211	211	18	5.730	18	5.490	0.0026	0.0071	0.2499	0.0025	0.0031	0.6248	374.907
212	212	18	5.730	18	5.490	0.0026	0.0071	0.2499	0.0025	0.0031	0.6248	374.907
213	213	20	6.366	19	5.795	0.0032	0.0092	0.3257	0.0033	0.0041	0.8143	488.562
214	214	20	6.366	19	5.795	0.0032	0.0092	0.3257	0.0033	0.0041	0.8143	488.562
215	215	20	6.366	20	6.100	0.0032	0.0097	0.3429	0.0034	0.0043	0.8571	514.275
216	216	20	6.366	20	6.100	0.0032	0.0097	0.3429	0.0034	0.0043	0.8571	514.275
217	217	21	6.684	21	6.405	0.0035	0.0112	0.3969	0.0040	0.0050	0.9922	595.338
218	218	21	6.684	23	7.015	0.0035	0.0123	0.4347	0.0043	0.0054	1.0867	652.037
219	219	21	6.684	20	6.100	0.0035	0.0107	0.3780	0.0038	0.0047	0.9450	566.989
220	220	22	7.003	20	6.100	0.0039	0.0117	0.4148	0.0041	0.0052	1.0371	622.273
221	221	23	7.321	21	6.405	0.0042	0.0135	0.4761	0.0048	0.0060	1.1902	714.136
222	222	24	7.639	21	6.405	0.0046	0.0147	0.5184	0.0052	0.0065	1.2960	777.584
223	223	24	7.639	22	6.710	0.0046	0.0154	0.5431	0.0054	0.0068	1.3577	814.612
224	224	25	7.958	19	5.795	0.0050	0.0144	0.5089	0.0051	0.0064	1.2723	763.378
225	225	23	7.321	18	5.490	0.0042	0.0116	0.4081	0.0041	0.0051	1.0202	612.116
226	226	23	7.321	19	5.795	0.0042	0.0122	0.4307	0.0043	0.0054	1.0769	646.123
227	227	24	7.639	19	5.795	0.0046	0.0133	0.4690	0.0047	0.0059	1.1725	703.529
228	228	23	7.321	18	5.490	0.0042	0.0116	0.4081	0.0041	0.0051	1.0202	612.116
229	229	24	7.639	19	5.795	0.0046	0.0133	0.4690	0.0047	0.0059	1.1725	703.529
230	230	25	7.958	19	5.795	0.0050	0.0144	0.5089	0.0051	0.0064	1.2723	763.378
231	231	24	7.639	18	5.490	0.0046	0.0126	0.4443	0.0044	0.0056	1.1108	666.501
232	232	17	5.411	15	4.575	0.0023	0.0053	0.1858	0.0019	0.0023	0.4645	278.673
233	233	12	3.820	13	3.965	0.0011	0.0023	0.0802	0.0008	0.0010	0.2006	120.340
234	234	12	3.820	12	3.660	0.0011	0.0021	0.0741	0.0007	0.0009	0.1851	111.083
235	235	10	3.183	9	2.745	0.0008	0.0011	0.0386	0.0004	0.0005	0.0964	57.856

236	236	12	3.820	10	3.050	0.0011	0.0017	0.0617	0.0006	0.0008	0.1543	92.570
237	237	13	4.138	10	3.050	0.0013	0.0021	0.0724	0.0007	0.0009	0.1811	108.641
238	238	12	3.820	9	2.745	0.0011	0.0016	0.0555	0.0006	0.0007	0.1389	83.313
239	239	12	3.820	9	2.745	0.0011	0.0016	0.0555	0.0006	0.0007	0.1389	83.313
240	240	12	3.820	10	3.050	0.0011	0.0017	0.0617	0.0006	0.0008	0.1543	92.570
241	241	22	7.003	13	3.965	0.0039	0.0076	0.2697	0.0027	0.0034	0.6741	404.478
242	242	23	7.321	13	3.965	0.0042	0.0083	0.2947	0.0029	0.0037	0.7368	442.084
243	243	23	7.321	12	3.660	0.0042	0.0077	0.2721	0.0027	0.0034	0.6801	408.078
244	244	23	7.321	13	3.965	0.0042	0.0083	0.2947	0.0029	0.0037	0.7368	442.084
245	245	20	6.366	15	4.575	0.0032	0.0073	0.2571	0.0026	0.0032	0.6428	385.707
246	246	20	6.366	15	4.575	0.0032	0.0073	0.2571	0.0026	0.0032	0.6428	385.707
247	247	20	6.366	16	4.880	0.0032	0.0078	0.2743	0.0027	0.0034	0.6857	411.420
248	248	21	6.684	17	5.185	0.0035	0.0091	0.3213	0.0032	0.0040	0.8032	481.940
249	249	21	6.684	13	3.965	0.0035	0.0070	0.2457	0.0025	0.0031	0.6142	368.543
250	250	22	7.003	13	3.965	0.0039	0.0076	0.2697	0.0027	0.0034	0.6741	404.478
251	251	21	6.684	10	3.050	0.0035	0.0054	0.1890	0.0019	0.0024	0.4725	283.494
252	252	22	7.003	13	3.965	0.0039	0.0076	0.2697	0.0027	0.0034	0.6741	404.478
253	253	15	4.775	14	4.270	0.0018	0.0038	0.1350	0.0013	0.0017	0.3375	202.496
254	254	17	5.411	13	3.965	0.0023	0.0046	0.1610	0.0016	0.0020	0.4025	241.517
255	255	18	5.730	13	3.965	0.0026	0.0051	0.1805	0.0018	0.0023	0.4513	270.766
256	256	19	6.048	12	3.660	0.0029	0.0053	0.1857	0.0019	0.0023	0.4641	278.480
257	257	20	6.366	18	5.490	0.0032	0.0087	0.3086	0.0031	0.0039	0.7714	462.848
258	258	18	5.730	17	5.185	0.0026	0.0067	0.2361	0.0024	0.0030	0.5901	354.079
259	259	18	5.730	17	5.185	0.0026	0.0067	0.2361	0.0024	0.0030	0.5901	354.079
260	260	17	5.411	18	5.490	0.0023	0.0063	0.2229	0.0022	0.0028	0.5573	334.408
261	261	18	5.730	18	5.490	0.0026	0.0071	0.2499	0.0025	0.0031	0.6248	374.907
262	262	18	5.730	17	5.185	0.0026	0.0067	0.2361	0.0024	0.0030	0.5901	354.079
263	263	19	6.048	17	5.185	0.0029	0.0074	0.2630	0.0026	0.0033	0.6575	394.513
264	264	19	6.048	19	5.795	0.0029	0.0083	0.2940	0.0029	0.0037	0.7349	440.927
265	265	18	5.730	18	5.490	0.0026	0.0071	0.2499	0.0025	0.0031	0.6248	374.907
266	266	20	6.366	20	6.100	0.0032	0.0097	0.3429	0.0034	0.0043	0.8571	514.275
267	267	18	5.730	19	5.795	0.0026	0.0075	0.2638	0.0026	0.0033	0.6596	395.735
268	268	18	5.730	18	5.490	0.0026	0.0071	0.2499	0.0025	0.0031	0.6248	374.907
269	269	15	4.775	19	5.795	0.0018	0.0052	0.1832	0.0018	0.0023	0.4580	274.816
270	270	16	5.093	18	5.490	0.0020	0.0056	0.1975	0.0020	0.0025	0.4937	296.223
271	271	14	4.456	18	5.490	0.0016	0.0043	0.1512	0.0015	0.0019	0.3780	226.795
272	272	20	6.366	18	5.490	0.0032	0.0087	0.3086	0.0031	0.0039	0.7714	462.848
273	273	18	5.730	17	5.185	0.0026	0.0067	0.2361	0.0024	0.0030	0.5901	354.079
274	274	18	5.730	15	4.575	0.0026	0.0059	0.2083	0.0021	0.0026	0.5207	312.422
275	275	14	4.456	15	4.575	0.0016	0.0036	0.1260	0.0013	0.0016	0.3150	188.996
276	276	13	4.138	14	4.270	0.0013	0.0029	0.1014	0.0010	0.0013	0.2535	152.097
277	277	17	5.411	18	5.490	0.0023	0.0063	0.2229	0.0022	0.0028	0.5573	334.408
278	278	17	5.411	19	5.795	0.0023	0.0067	0.2353	0.0024	0.0029	0.5883	352.986
279	279	17	5.411	18	5.490	0.0023	0.0063	0.2229	0.0022	0.0028	0.5573	334.408
280	280	17	5.411	19	5.795	0.0023	0.0067	0.2353	0.0024	0.0029	0.5883	352.986
281	281	19	6.048	18	5.490	0.0029	0.0079	0.2785	0.0028	0.0035	0.6962	417.720
282	282	19	6.048	18	5.490	0.0029	0.0079	0.2785	0.0028	0.0035	0.6962	417.720
283	283	19	6.048	19	5.795	0.0029	0.0083	0.2940	0.0029	0.0037	0.7349	440.927

284	284	20	6.366	18	5.490	0.0032	0.0087	0.3086	0.0031	0.0039	0.7714	462.848
285	285	20	6.366	17	5.185	0.0032	0.0083	0.2914	0.0029	0.0036	0.7286	437.134
286	286	18	5.730	17	5.185	0.0026	0.0067	0.2361	0.0024	0.0030	0.5901	354.079
287	287	18	5.730	18	5.490	0.0026	0.0071	0.2499	0.0025	0.0031	0.6248	374.907
288	288	18	5.730	17	5.185	0.0026	0.0067	0.2361	0.0024	0.0030	0.5901	354.079
289	289	20	6.366	18	5.490	0.0032	0.0087	0.3086	0.0031	0.0039	0.7714	462.848
290	290	20	6.366	18	5.490	0.0032	0.0087	0.3086	0.0031	0.0039	0.7714	462.848
291	291	20	6.366	19	5.795	0.0032	0.0092	0.3257	0.0033	0.0041	0.8143	488.562
292	292	17	5.411	19	5.795	0.0023	0.0067	0.2353	0.0024	0.0029	0.5883	352.986
293	293	17	5.411	20	6.100	0.0023	0.0070	0.2477	0.0025	0.0031	0.6193	371.564
294	294	17	5.411	20	6.100	0.0023	0.0070	0.2477	0.0025	0.0031	0.6193	371.564
295	295	17	5.411	20	6.100	0.0023	0.0070	0.2477	0.0025	0.0031	0.6193	371.564
296	296	16	5.093	15	4.575	0.0020	0.0047	0.1646	0.0016	0.0021	0.4114	246.852
297	297	16	5.093	15	4.575	0.0020	0.0047	0.1646	0.0016	0.0021	0.4114	246.852
298	298	16	5.093	15	4.575	0.0020	0.0047	0.1646	0.0016	0.0021	0.4114	246.852
299	299	13	4.138	12	3.660	0.0013	0.0025	0.0869	0.0009	0.0011	0.2173	130.369
300	300	13	4.138	12	3.660	0.0013	0.0025	0.0869	0.0009	0.0011	0.2173	130.369
301	301	12	3.820	12	3.660	0.0011	0.0021	0.0741	0.0007	0.0009	0.1851	111.083
302	302	12	3.820	15	4.575	0.0011	0.0026	0.0926	0.0009	0.0012	0.2314	138.854
303	303	12	3.820	15	4.575	0.0011	0.0026	0.0926	0.0009	0.0012	0.2314	138.854
304	304	17	5.411	17	5.185	0.0023	0.0060	0.2106	0.0021	0.0026	0.5264	315.829
305	305	17	5.411	16	4.880	0.0023	0.0056	0.1982	0.0020	0.0025	0.4954	297.251
306	306	17	5.411	16	4.880	0.0023	0.0056	0.1982	0.0020	0.0025	0.4954	297.251
307	307	18	5.730	18	5.490	0.0026	0.0071	0.2499	0.0025	0.0031	0.6248	374.907
308	308	18	5.730	18	5.490	0.0026	0.0071	0.2499	0.0025	0.0031	0.6248	374.907
309	309	18	5.730	17	5.185	0.0026	0.0067	0.2361	0.0024	0.0030	0.5901	354.079
310	310	15	4.775	17	5.185	0.0018	0.0046	0.1639	0.0016	0.0020	0.4098	245.888
311	311	15	4.775	15	4.575	0.0018	0.0041	0.1446	0.0014	0.0018	0.3616	216.960
312	312	15	4.775	14	4.270	0.0018	0.0038	0.1350	0.0013	0.0017	0.3375	202.496
313	313	16	5.093	14	4.270	0.0020	0.0043	0.1536	0.0015	0.0019	0.3840	230.395
314	314	20	6.366	17	5.185	0.0032	0.0083	0.2914	0.0029	0.0036	0.7286	437.134
315	315	17	5.411	10	3.050	0.0023	0.0035	0.1239	0.0012	0.0015	0.3096	185.782
316	316	12	3.820	8	2.440	0.0011	0.0014	0.0494	0.0005	0.0006	0.1234	74.056
317	317	20	6.366	16	4.880	0.0032	0.0078	0.2743	0.0027	0.0034	0.6857	411.420
318	318	25	7.958	20	6.100	0.0050	0.0152	0.5357	0.0054	0.0067	1.3393	803.555
319	319	18	5.730	10	3.050	0.0026	0.0039	0.1389	0.0014	0.0017	0.3471	208.282
320	320	17	5.411	12	3.660	0.0023	0.0042	0.1486	0.0015	0.0019	0.3716	222.938
321	321	10	3.183	7	2.135	0.0008	0.0008	0.0300	0.0003	0.0004	0.0750	44.999
322	322	8	2.546	6	1.830	0.0005	0.0005	0.0165	0.0002	0.0002	0.0411	24.685
323	323	18	5.730	15	4.575	0.0026	0.0059	0.2083	0.0021	0.0026	0.5207	312.422
324	324	17	5.411	13	3.965	0.0023	0.0046	0.1610	0.0016	0.0020	0.4025	241.517
325	325	15	4.775	10	3.050	0.0018	0.0027	0.0964	0.0010	0.0012	0.2411	144.640
326	326	16	5.093	12	3.660	0.0020	0.0037	0.1317	0.0013	0.0016	0.3291	197.482
327	327	18	5.730	14	4.270	0.0026	0.0055	0.1944	0.0019	0.0024	0.4860	291.594
328	328	14	4.456	11	3.355	0.0016	0.0026	0.0924	0.0009	0.0012	0.2310	138.597
329	329	10	3.183	9	2.745	0.0008	0.0011	0.0386	0.0004	0.0005	0.0964	57.856
330	330	22	7.003	18	5.490	0.0039	0.0106	0.3734	0.0037	0.0047	0.9334	560.046
331	331	22	7.003	19	5.795	0.0039	0.0112	0.3941	0.0039	0.0049	0.9853	591.160

332	332	25	7.958	21	6.405	0.0050	0.0159	0.5625	0.0056	0.0070	1.4062	843.733
333	333	17	5.411	14	4.270	0.0023	0.0049	0.1734	0.0017	0.0022	0.4335	260.095
334	334	15	4.775	13	3.965	0.0018	0.0035	0.1254	0.0013	0.0016	0.3134	188.032
335	335	19	6.048	16	4.880	0.0029	0.0070	0.2475	0.0025	0.0031	0.6188	371.307
336	336	15	4.775	11	3.355	0.0018	0.0030	0.1061	0.0011	0.0013	0.2652	159.104
337	337	14	4.456	8	2.440	0.0016	0.0019	0.0672	0.0007	0.0008	0.1680	100.798
338	338	16	5.093	14	4.270	0.0020	0.0043	0.1536	0.0015	0.0019	0.3840	230.395
339	339	18	5.730	16	4.880	0.0026	0.0063	0.2222	0.0022	0.0028	0.5554	333.250
340	340	14	4.456	10	3.050	0.0016	0.0024	0.0840	0.0008	0.0010	0.2100	125.997
341	341	15	4.775	11	3.355	0.0018	0.0030	0.1061	0.0011	0.0013	0.2652	159.104
342	342	25	7.958	20	6.100	0.0050	0.0152	0.5357	0.0054	0.0067	1.3393	803.555
343	343	22	7.003	19	5.795	0.0039	0.0112	0.3941	0.0039	0.0049	0.9853	591.160
344	344	15	4.775	12	3.660	0.0018	0.0033	0.1157	0.0012	0.0014	0.2893	173.568
345	345	18	5.730	15	4.575	0.0026	0.0059	0.2083	0.0021	0.0026	0.5207	312.422
346	346	20	6.366	17	5.185	0.0032	0.0083	0.2914	0.0029	0.0036	0.7286	437.134
347	347	20	6.366	15	4.575	0.0032	0.0073	0.2571	0.0026	0.0032	0.6428	385.707
348	348	27	8.594	17	5.185	0.0058	0.0150	0.5311	0.0053	0.0066	1.3278	796.677
349	349	25	7.958	19	5.795	0.0050	0.0144	0.5089	0.0051	0.0064	1.2723	763.378
350	350	22	7.003	17	5.185	0.0039	0.0100	0.3526	0.0035	0.0044	0.8816	528.932
351	351	15	4.775	10	3.050	0.0018	0.0027	0.0964	0.0010	0.0012	0.2411	144.640
352	352	14	4.456	7	2.135	0.0016	0.0017	0.0588	0.0006	0.0007	0.1470	88.198
353	353	20	6.366	15	4.575	0.0032	0.0073	0.2571	0.0026	0.0032	0.6428	385.707
354	354	15	4.775	11	3.355	0.0018	0.0030	0.1061	0.0011	0.0013	0.2652	159.104
355	355	20	6.366	16	4.880	0.0032	0.0078	0.2743	0.0027	0.0034	0.6857	411.420
356	356	14	4.456	11	3.355	0.0016	0.0026	0.0924	0.0009	0.0012	0.2310	138.597
357	357	10	3.183	6	1.830	0.0008	0.0007	0.0257	0.0003	0.0003	0.0643	38.571
358	358	22	7.003	16	4.880	0.0039	0.0094	0.3319	0.0033	0.0041	0.8297	497.819
359	359	20	6.366	16	4.880	0.0032	0.0078	0.2743	0.0027	0.0034	0.6857	411.420
360	360	17	5.411	14	4.270	0.0023	0.0049	0.1734	0.0017	0.0022	0.4335	260.095
361	361	14	4.456	8	2.440	0.0016	0.0019	0.0672	0.0007	0.0008	0.1680	100.798
362	362	15	4.775	9	2.745	0.0018	0.0025	0.0868	0.0009	0.0011	0.2170	130.176
363	363	20	6.366	16	4.880	0.0032	0.0078	0.2743	0.0027	0.0034	0.6857	411.420
364	364	17	5.411	14	4.270	0.0023	0.0049	0.1734	0.0017	0.0022	0.4335	260.095
365	365	18	5.730	13	3.965	0.0026	0.0051	0.1805	0.0018	0.0023	0.4513	270.766
366	366	17	5.411	14	4.270	0.0023	0.0049	0.1734	0.0017	0.0022	0.4335	260.095
367	367	18	5.730	13	3.965	0.0026	0.0051	0.1805	0.0018	0.0023	0.4513	270.766
368	368	12	3.820	8	2.440	0.0011	0.0014	0.0494	0.0005	0.0006	0.1234	74.056
369	369	8	2.546	6	1.830	0.0005	0.0005	0.0165	0.0002	0.0002	0.0411	24.685
370	370	15	4.775	9	2.745	0.0018	0.0025	0.0868	0.0009	0.0011	0.2170	130.176
371	371	9	2.865	7	2.135	0.0006	0.0007	0.0243	0.0002	0.0003	0.0607	36.449
372	372	16	5.093	11	3.355	0.0020	0.0034	0.1207	0.0012	0.0015	0.3017	181.025
373	373	18	5.730	13	3.965	0.0026	0.0051	0.1805	0.0018	0.0023	0.4513	270.766
374	374	10	3.183	5	1.525	0.0008	0.0006	0.0214	0.0002	0.0003	0.0536	32.142
375	375	12	3.820	7	2.135	0.0011	0.0012	0.0432	0.0004	0.0005	0.1080	64.799
376	376	20	6.366	15	4.575	0.0032	0.0073	0.2571	0.0026	0.0032	0.6428	385.707
377	377	22	7.003	18	5.490	0.0039	0.0106	0.3734	0.0037	0.0047	0.9334	560.046
378	378	21	6.684	16	4.880	0.0035	0.0086	0.3024	0.0030	0.0038	0.7560	453.591
379	379	15	4.775	10	3.050	0.0018	0.0027	0.0964	0.0010	0.0012	0.2411	144.640

380	380	22	7.003	17	5.185	0.0039	0.0100	0.3526	0.0035	0.0044	0.8816	528.932
381	381	25	7.958	20	6.100	0.0050	0.0152	0.5357	0.0054	0.0067	1.3393	803.555
382	382	16	5.093	12	3.660	0.0020	0.0037	0.1317	0.0013	0.0016	0.3291	197.482
383	383	15	4.775	8	2.440	0.0018	0.0022	0.0771	0.0008	0.0010	0.1929	115.712
384	384	18	5.730	11	3.355	0.0026	0.0043	0.1527	0.0015	0.0019	0.3818	229.110
385	385	20	6.366	14	4.270	0.0032	0.0068	0.2400	0.0024	0.0030	0.6000	359.993
386	386	20	6.366	16	4.880	0.0032	0.0078	0.2743	0.0027	0.0034	0.6857	411.420
387	387	20	6.366	17	5.185	0.0032	0.0083	0.2914	0.0029	0.0036	0.7286	437.134
388	388	18	5.730	15	4.575	0.0026	0.0059	0.2083	0.0021	0.0026	0.5207	312.422
389	389	23	7.321	20	6.100	0.0042	0.0128	0.4534	0.0045	0.0057	1.1335	680.129
390	390	25	7.958	20	6.100	0.0050	0.0152	0.5357	0.0054	0.0067	1.3393	803.555
391	391	20	6.366	18	5.490	0.0032	0.0087	0.3086	0.0031	0.0039	0.7714	462.848
392	392	19	6.048	18	5.490	0.0029	0.0079	0.2785	0.0028	0.0035	0.6962	417.720
393	393	20	6.366	15	4.575	0.0032	0.0073	0.2571	0.0026	0.0032	0.6428	385.707
394	394	21	6.684	17	5.185	0.0035	0.0091	0.3213	0.0032	0.0040	0.8032	481.940
395	395	14	4.456	8	2.440	0.0016	0.0019	0.0672	0.0007	0.0008	0.1680	100.798
396	396	22	7.003	20	6.100	0.0039	0.0117	0.4148	0.0041	0.0052	1.0371	622.273
397	397	13	4.138	10	3.050	0.0013	0.0021	0.0724	0.0007	0.0009	0.1811	108.641
398	398	9	2.865	6	1.830	0.0006	0.0006	0.0208	0.0002	0.0003	0.0521	31.242
399	399	18	5.730	13	3.965	0.0026	0.0051	0.1805	0.0018	0.0023	0.4513	270.766
400	400	20	6.366	16	4.880	0.0032	0.0078	0.2743	0.0027	0.0034	0.6857	411.420
401	401	17	5.411	12	3.660	0.0023	0.0042	0.1486	0.0015	0.0019	0.3716	222.938
402	402	23	7.321	20	6.100	0.0042	0.0128	0.4534	0.0045	0.0057	1.1335	680.129
403	403	17	5.411	15	4.575	0.0023	0.0053	0.1858	0.0019	0.0023	0.4645	278.673
404	404	14	4.456	11	3.355	0.0016	0.0026	0.0924	0.0009	0.0012	0.2310	138.597
405	405	21	6.684	18	5.490	0.0035	0.0096	0.3402	0.0034	0.0043	0.8505	510.290
406	406	16	5.093	13	3.965	0.0020	0.0040	0.1426	0.0014	0.0018	0.3566	213.939
407	407	18	5.730	15	4.575	0.0026	0.0059	0.2083	0.0021	0.0026	0.5207	312.422
408	408	13	4.138	10	3.050	0.0013	0.0021	0.0724	0.0007	0.0009	0.1811	108.641
409	409	22	7.003	18	5.490	0.0039	0.0106	0.3734	0.0037	0.0047	0.9334	560.046
410	410	14	4.456	11	3.355	0.0016	0.0026	0.0924	0.0009	0.0012	0.2310	138.597
411	411	15	4.775	13	3.965	0.0018	0.0035	0.1254	0.0013	0.0016	0.3134	188.032
412	412	18	5.730	16	4.880	0.0026	0.0063	0.2222	0.0022	0.0028	0.5554	333.250
413	413	15	4.775	12	3.660	0.0018	0.0033	0.1157	0.0012	0.0014	0.2893	173.568
414	414	21	6.684	18	5.490	0.0035	0.0096	0.3402	0.0034	0.0043	0.8505	510.290
415	415	25	7.958	20	6.100	0.0050	0.0152	0.5357	0.0054	0.0067	1.3393	803.555
416	416	23	7.321	20	6.100	0.0042	0.0128	0.4534	0.0045	0.0057	1.1335	680.129
417	417	20	6.366	17	5.185	0.0032	0.0083	0.2914	0.0029	0.0036	0.7286	437.134
418	418	15	4.775	13	3.965	0.0018	0.0035	0.1254	0.0013	0.0016	0.3134	188.032
419	419	12	3.820	10	3.050	0.0011	0.0017	0.0617	0.0006	0.0008	0.1543	92.570
420	420	21	6.684	19	5.795	0.0035	0.0102	0.3591	0.0036	0.0045	0.8977	538.639
421	421	17	5.411	15	4.575	0.0023	0.0053	0.1858	0.0019	0.0023	0.4645	278.673
422	422	16	5.093	14	4.270	0.0020	0.0043	0.1536	0.0015	0.0019	0.3840	230.395
423	423	13	4.138	10	3.050	0.0013	0.0021	0.0724	0.0007	0.0009	0.1811	108.641
Total		**7,648**	**2,434.4**	**7,024**	**2,142.320**	**1.3065**	**3.6617**	**129.31**	**1.2931**	**1.6164**	**323.2784**	**193,967.06**

ANNEX III -
CODE OF CONDUCT FOR WORKERS

Code of Conduct for Workers

I, _____, acknowledge that preventing any misconduct as stipulated in this code of conduct, including sexual exploitation and abuse (SEA), sexual harassment (SH), and child abuse/exploitation are important. Any activity, which constitute acts of gross misconduct are therefore grounds for sanctions, penalties or even termination of employment. All forms of misconduct are unacceptable be it on the work site, the work site surroundings, or at worker's camps. Prosecution of those who commit any such misconduct will be pursued as appropriate. I agree that while working on this project, I will:

1. Consent to security background check;
2. Treat women, children (persons under the age of 18) and persons with disability with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, birth or other status;
3. Not use language or behavior towards men, women or children/learners that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate;
4. Carry out his/her duties competently and diligently;
5. comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety and well-being of other Contractor's Personnel and any other person;
6. maintain a safe working environment including by:
   a. ensuring that workplaces, machinery, equipment and processes under each person's control are safe and without risk to health;
   b. wearing required personal protective equipment;
   c. using appropriate measures relating to chemical, physical and biological substances and agents; and
   d. following applicable emergency operating procedures.
7. report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and danger to his/her life or health;
8. treat other people with respect, and not discriminate against specific groups such as women, people with disabilities, migrant workers or children;
9. not engage in any form of sexual harassment including unwelcome sexual advances, requests for sexual favors, and other unwanted verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
10. Not participate in sexual activity with children/learners—including grooming or through digital media. Mistaken belief regarding the age of a child and consent from the child is not a defense;
11. Not exchange money, employment, goods, or services for sex, with community members including sexual favors or other forms of humiliating, degrading or exploitative behavior;
12. Attend trainings related to HIV and AIDS, SAE/SH, occupational health and any other relevant courses on safety as requested by my employer
13. Report to the relevant committee any situation where I may have concerns or suspicions regarding acts of misconduct by a fellow worker, whether in my company or not, or any breaches of this code of conduct provided it is done in good faith;
14. Regarding children (under the age of 18):
    a. Refrain from hiring children for domestic or other labor, which is inappropriate given their age, or developmental stage, which interferes with their time available for

education and recreational activities, or which places them at significant risk of injury.

b. Comply with all relevant local legislation, including labor laws in relation to child labor.

15. Refrain from any form of theft for assets and facilities including from surrounding communities.
16. Remain in designated working area during working hours;
17. Refrain from possession of alcohol and illegal drugs and other controlled substances in the workplace and being under influence of these substances on the job and during workings hours;
18. Follow prescribed environmental occupation health and safety standards;
19. Channel grievances through the established grievance redress mechanism.

I understand that the onus is on me to use common sense and avoid actions or behaviors that could be construed as misconduct or breach this code of conduct.

I acknowledge that I have read and understand this Code of Conduct, and the implications have been explained with regard to sanctions on-going employment should I not comply.

Signed by: _____

Signature: _____

Date: _____

For the Employer/Contractor

Signed by: _____

Signature: _____

1. Date: _____

ANNEX IV - GUIDELINE WASTE MANAGEMENT PLAN

CONSTRUCTION WASTE MANAGEMENT PLAN

Construction waste material consists mainly of concrete, masonry, limestone, sandstone, metal, and wood, depending on the construction type. In building waste, a larger percentage of paper, plastic, etc. is expected due to packaging materials and the wood retired from formwork and scaffolding. This is in addition to significant amounts of concrete, masonry and metal materials.

1.0 Origins and Causes of Construction Waste

Origins of waste	Causes of waste
Contractual	▪ Errors in contract documents ▪ Contract documents incomplete at commencement of construction
Design	▪ Design changes ▪ Design and detailing complexity ▪ Design and construction detail errors ▪ Unclear/unsuitable specification ▪ Poor coordination and communication (late information, last minute client requirements, slow drawing revision and distribution)
Procurement	▪ Ordering errors (i.e., ordering items not in compliance with specification) ▪ Over allowances (i.e., difficulties to order small quantities) ▪ Supplier errors
Transportation	▪ Damage during transportation ▪ Difficulties for delivery vehicles accessing construction sites ▪ Insufficient protection during unloading ▪ Inefficient methods of unloading
On-site Management and Planning	▪ Lack of on-site waste management plans ▪ Improper planning for required quantities ▪ Delays in passing information on types and sizes of materials and components to be used ▪ Lack of on-site material control ▪ Lack of supervision
Material storage	▪ Inappropriate site storage space leading to damage or deterioration ▪ Improper storing methods ▪ Materials stored far away from point of application
Material handling	▪ Materials supplied in loose form ▪ On-site transportation methods from storage to the point of application ▪ Inadequate material handling
Site operation	▪ Accidents due to negligence ▪ Unused materials and products ▪ Equipment malfunction ▪ Poor craftsmanship

Origins of waste	Causes of waste
	▪ Use of wrong materials resulting in their disposal ▪ Time pressure ▪ Poor work ethics
Residual	▪ Waste from application processes (i.e., over preparation of mortar) ▪ Off-cuts from cutting materials to length ▪ Waste from cutting uneconomical shapes ▪ Packaging
Other	▪ Weather ▪ Vandalism ▪ Theft

2.0 Construction Waste Management Plan

1) Waste Management Goals

To establish that this project shall generate at least 50% less waste into landfills and the processes shall be employed to ensure that this goal is met. These shall include prevention of damage to materials to be incorporated into the work due to mishandling, improper storage, contamination, inadequate protection or other factors as well as minimizing poor quantity estimation, as well as through building design.

2) Responsibility

- The Project Director shall be responsible for the implementation of the administrative portions of this program, including the notification of subcontractor management, the training of the site supervisor and the onsite posting of this plan.
- The site supervisor will be responsible for the implementation of the onsite portions of this program including the training of subcontractor personnel.

3) Waste Prevention Planning

- In addition to other requirements specified herein it is a requirement for the work of this project that the contractor comply with the applicable city waste disposal requirements.
- Of the inevitable waste that is generated, the waste materials designated in this specification shall be salvaged for reuse and or recycling where practical and possible.
- Project Construction Documents: The General Contractor will contractually require all subcontractors to comply with these recycling guidelines. A copy of this “Construction Waste Management Plan” will accompany all subcontractor agreements and require subcontractor participation.
- The “Construction Waste Management Plan” shall be implemented and executed as follows and as on the chart:
  - Salvageable materials will be diverted from disposal where feasible.
  - There will be a designated area on the construction site reserved for materials that can be recycled.
  - Areas shall be marked to designate what recycle materials are to be stored there.
  - Hazardous waste will be managed by a licensed hazardous waste vendor.

4) Communication & Education Plan

- This Construction Waste Management Plan will be posted onsite.

- Each subcontractor will be made aware of the intent of this project with respect to reduction of waste and recycling.
- Onsite recycling containers and/or areas will be plainly marked.
- The subcontractor will be expected to make sure all their crews comply with the Waste Management Plan.
- All recycling containers/areas will be clearly marked.
- Lists of acceptable/unacceptable materials will be posted at the site.
- All subcontractors will be informed in writing of the importance of non-contamination with other materials or trash.

5) Motivation Plan

The General Contractor will conduct a pre-award meeting for subcontractors. Subcontractors under consideration will be required to attend the meeting to review project goals and requirements with the project team. Attendance will be a prerequisite for award of subcontracts. This document will be an attachment to every subcontract. Copies of the attachment will be posted prominently at the job site.

6) Expected Project Waste, Disposal, and Handling

The following chart identifies waste materials expected on this project, their expected disposal methods and handling procedures. New items may be added as needed.

Material	Quantity	Disposal Method	Handling Procedure
Land clearing debris		Keep separate for reuse and or wood sale. Separate topsoil and rock for future landscaping use.	Keep separated in designated areas onsite.
Clean dimensional wood and palette wood		Keep separate for reuse by on-site construction or by site employees for either heating stoves or reuse in home projects. May be offered to public.	Keep separated in designated areas onsite.
Plywood, OSB, particle board		Reuse onsite when possible, landfill or recycle off site.	Keep separated in designated areas onsite. Place in “Trash” container.
Painted or treated wood		Reuse, off site recycle, landfill.	Keep separated in designated areas onsite. Place in “Trash” container.
Concrete		Recycle when possible.	
Concrete Masonry Units		Keep separate for re-use by on-site construction or by site employees.	Keep separated in designated areas onsite.

Material	Quantity	Disposal Method	Handling Procedure
Metals		Recycle off site when possible. Separate copper wire when possible.	Keep separated in designated areas onsite. Place in "Metals" container.
Paint		Reuse onsite.	Keep separated in designated areas onsite
Insulation		Reuse, landfill.	
Flooring		Reuse, landfill.	
Carpet and pad		Reuse or recycle with carpet manufacturer	
Glass		Glass Bottles: recycle locally.	Keep separated in designated areas onsite.
Plastics		Plastic Bottles: recycle locally; be aware of plastics that are acceptable to recycle facility.	Keep separated in designated areas onsite.
Beverage		Recycle locally	Keep separated in designated areas onsite.
Cardboard		Recycle locally	Keep separated in designated areas onsite.
Paper and newsprint		Recycle locally	Keep separated in designated areas onsite.

7) Waste Disposal Company

To be determined

a) Contact:

8) Recycle Hauler

To be determined

b) Contact:

c) Some or all recycle may be hauled by the builder.

9) Possible Recycle Locations and Acceptable Materials

i) Coordinate with companies which are registered with local Municipality that accept materials for recycle; and

ii) Using the above as a resource, a list will be kept indicating local opportunities for recycle of expected materials. New locations should be added as needed.

ANNEX V - GUIDELINE WATER & WASTEWATER MANAGEMENT PLAN

GUIDELINE WATER & WASTEWATER MANAGEMENT PLAN

INTRODUCTION

This plan outlines the measures that can improve conditions of sanitation at construction sites during construction phase.

1. PURPOSE OF THE PLAN

The plan intends to ensure sanitation including the control of water supplies, excrete and wastewater disposal, refuse disposal, vectors of diseases, housing conditions, food supplies and handling, atmospheric conditions, and the safety of the working environment.

2. MANAGEMENT OF SANITATION DURING CONSTRUCTION PHASE

i) Responsibility

The Health and Safety Inspector designated by construction contractor shall also inspect sanitation conditions and ensure safe working environment for workers.

ii) Location of Camp Sites

The accommodation and ancillary facilities for labor shall be constructed and maintained to standards and scales approved by the Resident Engineer.

The camps must be located such that the drainage from and through the camps shall not endanger any domestic or public water supply.

All sites must be managed to avoid ditches and depressions to minimize nuisance due to stagnant water.

iii) Water Supply

An adequate and convenient water supply, approved by the appropriate health authority, must be provided in each camp for drinking, cooking, bathing and laundry purposes.

Potable water supply systems for labor camps occupants shall meet the drinking water quality standards of SEQS, 2016. In addition, the design of water system facilities shall be based on the suppliers Engineer's estimates of water demands. The drinking water must be monitored regularly for drinking water quality parameters.

At all construction camps and other workplaces, good and sufficient water supply shall be provided and maintained to eliminate chances of waterborne diseases to ensure the health and hygiene of the workers.

iv) Toilet Facilities and Hygiene

According to health and safety guidelines OR-OSHA number of toilets required at construction site is as one toilet for 20 workers. **Table 1** shows the number of toilets required in accordance with the number of employees at construction site. The total numbers of employees at construction site are estimated to be 220 persons.

Table 1: Number of Toilets Required for Employees at Construction Site

No. of Employees	No. of Toilets and Urinals by OSHA	Total No. Toilets and Urinals Required at Construction Site
Up to 20 Employees	1 Toilet	5 Toilets
Up to 40 Employees	1 Urinal	2 Urinals

Within the premises of every workplace, toilets and urinals shall be provided in an accessible place, and the accommodation, separately for each of these, as per standards prevailing in the province and country.

Toilet facilities adequate for the capacity of the camp must be provided. Each toilet room must be located, so as to be accessible.

A toilet room must be located within 200 feet of the camp. No toilet may be closer than 100 feet to kitchen and sleeping area.

These toilets must be distinctly marked by signs printed in native language of the persons occupying the camp, or marked with easily understood pictures or symbols.

Urinals troughs in privies must drain freely into the pit or vault, and the construction of this drain must be such as to exclude flies and rodents from the pit.

Proper facility for hand washing and other cleaning activities to be provided as follows:

- Provide individual hand towels from a sanitary dispenser and receptacles for disposing of waste towels;
- Providing hand soap and industrial hand cleaner for removing paints and other contaminants;
- Prohibited use of gasoline or solvent for hand washing; and
- Keep the floor of facilities dry to prevent spills and falls.

v) Waste Disposal

The sewage system for the camp must be designed, built and operated in compliance with the relevant legislation so that no health hazard occurs and no pollution to the air, ground or adjacent watercourse takes place.

Garbage bins must be provided in the camps and regularly emptied and the garbage disposed of in a hygienic manner.

Unless otherwise arranged for by the local sanitary authority, arrangement for disposal of excreta should be done in the already existing sewerage system in the area.

On completion of the works, all such temporary structures shall be cleared away, all rubbish burnt, excreta tank and other disposal pits or trenches filled in and effectively sealed off and the outline site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the engineer.

vi) Maintenance of Sanitary Facility

Proper maintenance of toilets and other sanitary facilities should assure by health and safety inspector. Toilets and other sanitary facilities shall be cleaned at least four times daily and at least twice during working hours and kept in a strict sanitary condition. Receptacles shall be tarred inside and outside at least once a year.

All buildings, rooms and equipment and the grounds surrounding them shall be maintained in a clean and operable condition, and be protected from rubbish accumulation.

All necessary means shall be employed to eliminate and control any infestations of insects and rodents within all parts of any labor camp.

3. Management of Sanitation During Operational Phase:

A proper sanitation plan is to be adopted for maintaining the hygienic conditions during the operational phase of the project. These includes

- Site Clearance;
- Sewage Pipe Clearing, and
- Solid Waste Management.

i) Site Clearance

The construction contractor shall assure the clearance of construction machinery, vehicle and other equipment used during the construction period after the completion of the project.

ii) Solid Waste Management

Municipal solid waste and medical waste produced along the road should be collected and managed properly by the concerned department. Waste bins should be placed along the road side; regular cleaning of the road should be carried out using mechanical sweepers and at least two to four sweepers should be deputed for the whole proposed road to assure regular cleaning.

iii) Awareness and Training

A training and awareness sessions shall be conducted for workers before commencement of the Project. The implementation of sanitation plan would be more effective if the importance of hygiene; sanitation and safety are known to the workers.

ANNEX VI - GUIDELINE OCCUPATIONAL HEALTH & SAFETY PLAN

GUIDELINE OCCUPATIONAL HEALTH AND SAFETY PLAN

Occupational Health and Safety covers all personnel working under the project and will be in line with the World Bank EHS guidelines on health and safety.

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at sites associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

The following sections will be implemented during the construction phase to address and ensure workers' health and safety.

1.1 SCREENING AND REGULAR UNANNOUNCED CHECKING OF WORKERS

As per the procedure for hiring workers, all contractors and labor agencies are required to make all prospective workers undergo medical tests to screen for diseases and sicknesses, prior to selection and employment of any worker. The contractor is also responsible for ensuring that no worker who has a criminal record is employed at the project site. It will be ensured that all workers undergo medical tests to screen diseases at source and at sites in consultation with the designated Health Officer.

In addition to this, the Project Management will also undertake sudden, unannounced checks on workers to look for diseases such as COVID-19, HIV, STDs, and hepatitis and take necessary steps as mandated by the Contractual agreement between the Contractor and the Worker(s).

1.2 MINIMIZING HAZARDS AND RISKS AT THE WORKPLACE

To ensure safety at all work sites, the following will be carried out:

i. Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful.
ii. Construction of barricades around construction sites and deep excavated pits, to cordon off and deter entry of unauthorized personnel and workers into these areas.
iii. Providing a safe storage site/area for large equipment such as power tools and chains, to prevent misuse and loss.
iv. Proper Housekeeping: Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse. Brick stacks will not be more than 7 feet in height and for concrete blocks they will not be more than 6 feet high.
v. Removing all scrap timber, waste material and rubbish from the immediate work area as the work progresses.
vi. Where scaffolds are required, ensuring that each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it. The platform/scaffold plank shall be at least 15 inches wide and 1.5 inches thick. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope. Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer and shall be

constructed and loaded in accordance with that design. Where scaffolds are not provided, safety belts/safety nets shall be provided;

vii. Ensure that all ramps or walkways are at least 6 feet wide, having slip resistance threads and not inclined at more than a slope of 1 vertical and 3 horizontal.

viii. Stacking away all excavated earth at least 2 feet from the pit to avoid material such as loose rocks from falling back into the excavated area and injuring those working inside excavated sites.

ix. Constructing support systems, such as bracing to adjoining structures that may be endangered by excavation works nearby.

x. Only a trained electrician to construct, install and repair all electrical equipment to prevent risks of electrical shocks and electrocution.

xi. Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

1.3 PROVISION OF PERSONAL PROTECTIVE EQUIPMENT

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for each Contractor. Depending on the nature of work and the risks involved, contractors must provide without any cost to the workers, the following protective equipment:

i. High visibility clothing for all personnel during road works must be mandatory.

ii. Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects.

iii. Safety belt shall be provided to workers working at heights (more than 20 ft) such as roofing, painting, and plastering.

iv. Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.

v. Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise.

vi. Eye and face protection equipment shall be provided to all welders to protect against sparks.

vii. Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor.

viii. Safety nets shall be provided when workplaces are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical.

The specific PPE requirements for each type of work are summarized below.

Table 1: PPE Requirement List

Type of Work	PPE
Elevated work	Safety helmet, safety belt (height greater than 20 ft), footwear for elevated work.
Handling work safety	Helmet, leather safety shoes, work gloves.
Welding and cutting work	Eye protectors, shield and helmet, protective gloves.
Grinding work	Dust respirator, earplugs, eye protectors.
Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical proof clothing, air-lined mask, eye protectors.
Wood working	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Blasting	Hard hat, eye and hearing protection.
Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection.
Quarries	Hard hat, eye protectors, hearing protection, safety footwear, leather

Type of Work	PPE
	gloves and dust respirator.

1.4 PROCEDURES TO DEAL WITH EMERGENCIES SUCH AS ACCIDENTS, SUDDEN ILLNESS AND DEATH OF WORKERS

First aid kits will be made available at all times throughout the entire construction period by the respective contractors. This is very important, because most work sites will be at some distance from the nearest hospital. In addition to the first aid kits, the following measures should be in place:

i. Provision of dispensaries by the individual EPC contractor.
ii. A vehicle shall be on standby from the Project Office so that emergency transportation can be arranged to take severely injured/sick workers to the nearest hospital for immediate medical attention.
iii. A designated Health Officer/worker for the Project will be identified as a focal person to attend to all health and safety related issues. This employee's contact number will be posted at all work sites for speedy delivery of emergency services. The focal person shall be well versed with the medical system and facilities available at the hospital.
iv. Communication arrangements, such a provision of radios or mobile communication for all work sites, for efficient handling of emergencies, will be made.

1.5 RECORD MAINTENANCE AND REMEDIAL ACTION

The Project Management will maintain a record of all accidents and injuries that occur at the work site. This work will be delegated by the contractor to the site supervisor and regularly reviewed every quarter by project management. Reports prepared by the contractor shall include information on the place, date and time of the incident, name of persons involved, cause of incident, witnesses present and their statements. Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the contractor to undertake certain mitigative actions to change any unsafe or harmful conditions.

1.6 COMPENSATION FOR INJURIES AND DEATH

Any casualty or injury resulting from occupational activities should be compensated as per the local labor laws of Pakistan. Where compensation is sought by the injured party, proper procedures for documentation of the case will be followed, including a detailed report on the accident, written reports from witnesses, report of the examining doctor and his/her recommendation for treatment. Each individual contractor will be responsible for ensuring compensation for the respective workers.

1.7 AWARENESS PROGRAMS

The Project management will undertake awareness programs through posters, talks, and meetings with the contractors to undertake the following activities:

i. Dissemination sessions will clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS, COVID-19), work site health and safety, waste management (waste separation, recycling, and composting), and the illegality of poaching.
ii. Make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment.

1.8 NOMINATION OF A HEALTH AND SAFETY FOCAL PERSON

Within each site (especially if different sites are being implemented by different contractors), a Health and Safety Focal Person will be appointed. The Terms of Reference for the focal person will mainly be as follows:

i. Function as the focal person/representative for all health and safety matters at the workplace;
ii. Responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues;
iii. Be the link between the contractor and all workers and submit grievances of the workers to the contractor and instructions/directives on proper health care and safety from the contractors back to the workers;
iv. Ensure that all workers are adequately informed on the requirement to use Personal Protective Equipment and its correct use;
v. Also responsible for the first aid kit and making sure that the basic immediate medicines are readily available.

1.9 SUGGESTED CONTENTS OF OCCUPATIONAL HEALTH AND SAFETY PLAN

The suggested contents of Occupational Health and Safety Plan to be developed by the Contractor(s) are described below:

a Purpose
b Scope of Application
c Complying Basis
d Occupational Health and Safety Objectives
e Organization and Responsibility
  - Contractor's Project Manager
  - HSE Management Department of the Contractor(s)
  - Medical Treatment Room of the Contractor(s)
  - Subcontractor's Project Manager
  - Subcontractor's HSE Managers
  - Occupational Health and Safety
  - Community Health and Safety
f Health Plan
  - Labour Protection
  - Sanitary Epidemic Prevention
g Safety Plan
  - Summary
  - Qualification Review
  - Safety Training
  - Construction Plans and Documents
  - Control Measures
  - Monitoring Measures
  - Management of the Key Safety Accidents
h Public Security Plan
i Local Community Health and Safety

ANNEX VII - GUIDELINE EMERGENCY PREPAREDNESS & RESPONSE PLAN

GUIDELINE EMERGENCY PREPAREDNESS AND RESPONSE PLAN

1.1 PURPOSE

The purpose of this Emergency Response Procedure is to provide measures and guidance for the establishment and implementation of emergency preparedness plans for the project. The aim of the Emergency Response Procedure is to:

i. Ensure all personnel and visitors to the office/job sites are given the maximum protection from unforeseen events.
ii. Ensure all personnel are aware of the importance of this procedure to protection of life and property.

1.2 EMERGENCY PREPARATION AND RESPONSE MEASURE SCOPE

The emergency management program is applied to all Project elements and intended for use throughout the Project life cycle. The following are some emergencies that may require coordinated response.

i. Construction Accident
ii. Road & Traffic Accident
iii. Hazardous material spills
iv. Structure collapse or failure
v. Trauma or serious illness
vi. Sabotage
vii. Fire
viii. Environmental Pollution
ix. Loss of person
x. Community Accident

1.3 RESPONSIBILITIES

The detailed roles and responsibilities of certain key members of the Emergency Response team available to assist in emergency are provided in **Table 1** below.

Table 1: Emergency Response Team

Action Group	Responsibility
Emergency Coordinator	▪ Overall control of personnel and resources. ▪ The Emergency Coordinator will support and advise the Site Safety Supervision as necessary. ▪ Serves as public relations spokes persons, or delegates to some staff member the responsibility for working with news media regarding any disaster or emergency. Also assure proper coordination of news release with appropriate corporate staff or other designated people.
Site Safety Supervision (Emergency Commander)	▪ Overall responsibility for activating emergency plan and for terminating emergency actions. ▪ Be alternative of emergency response chairpersons. ▪ Disseminates warnings and information as required to ensure all people in the immediate area have been warned and evacuated either by alarms or by word of mouth. ▪ Supervise the actions of the Emergency Response Team to ensure all persons are safe from the danger. ▪ Notify outside authorities if assistance is required. ▪ Carries the responsibility for coordinating actions including other organizations in accordance with the needs of the situation.

Action Group	Responsibility
	▪ Ensure maximum co-operation and assistance is provided to any outside groups called to respond to an emergency. ▪ Establish and appoint all emergency organization structure and team. ▪ Assures adequate delegation of responsibilities for all key positions of assistants on the Project to assist with any foreseeable emergency. ▪ Ensure resources available to purchase needed emergency response equipment and supplies. ▪ Assures that all persons on the Emergency Response Team aware and fully understand their individual responsibilities for implementing and supporting the emergency plan. ▪ Establish the emergency drill schedule of all identified emergency scenarios, track the status and evaluate the emergency. ▪ The Emergency Commander shall ensure that senior management personnel have been reported of the emergency as soon as practical after the event.
Security Team	▪ Ensure that the exit route is regularly tested and maintained in good working order. ▪ Maintain station at the security gate or most suitable location to secure the area during any emergency such that only authorized personnel and equipment may enter, prevent access to the site of unauthorized personnel. ▪ Assist with strong/activation of services during an emergency. ▪ Ensure vehicles and obstructions are moved to give incoming emergency vehicles access to the scene, if ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct any incoming emergency service to the site of emergency.
Rescue & Medical Team	▪ Protect the injured from further danger and weather. ▪ Provide treatment to the victim(s) to the best of their ability by first aid and then transfer to hospital. ▪ Remain familiar with the rescue activities and rescue apparatus. ▪ Assist outside medical services personnel when they arrive
General Administration Team	Response to support any requested general facilities for assisting Emergency Response Team in their work.
Government Relation Team	▪ Coordinate with local government on a matter of concerned in the emergency response plan to liaise with local officers in their affair for support Emergency Response Team. ▪ Coordinate emergency plan with the government authorities, local community.
Environment Team	In case of emergency related to the environmental pollution such as the chemical spill, oil spill into the ambient, the environment team will support the technical advice to control and mitigate the pollution until return to the normal situation.
Department Heads	▪ Call up of personnel into the safe location for protective life and property. ▪ Take immediate and appropriate action while Emergency Response Team is being mobilized. ▪ Keep in touch with the Emergency Commander ▪ Control and supervise operators and contractors on the implementation of this procedure, with consultation with Safety Team as necessary. ▪ Provide and maintain emergency equipment of their responsible areas.

Action Group	Responsibility
Other Staff and Employees	▪ All other staff and employees will remain at their workstations or assembly point unless directed otherwise from Emergency Response Team. ▪ Each supervisor will ensure that all members of his work group are accounted for and keep in touch with each of their Department Head.

1.4 PROCEDURE

Emergency situation and injuries to person can occur at any time or place either on Project site or elsewhere. The most two common types of emergencies on site are fire and serious accident.

Figure 3.1 Emergency Procedures for Fire

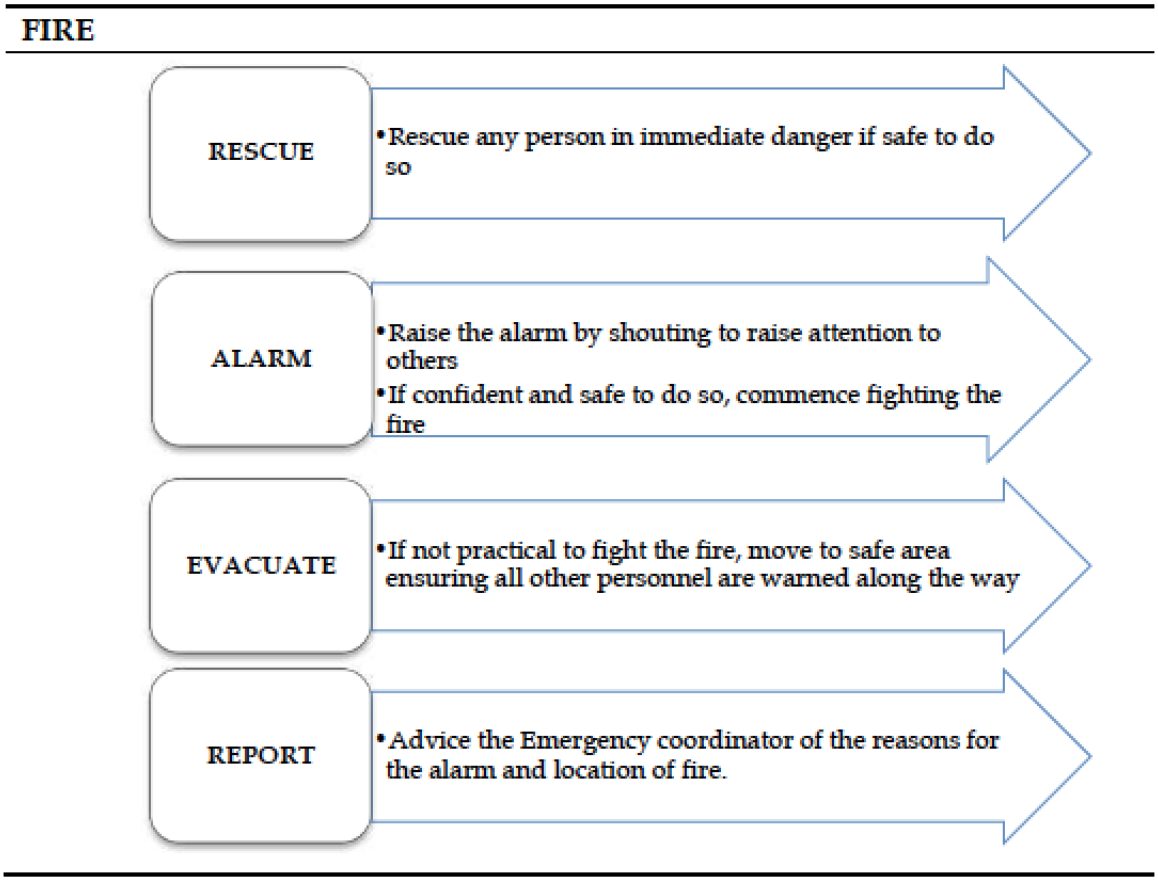
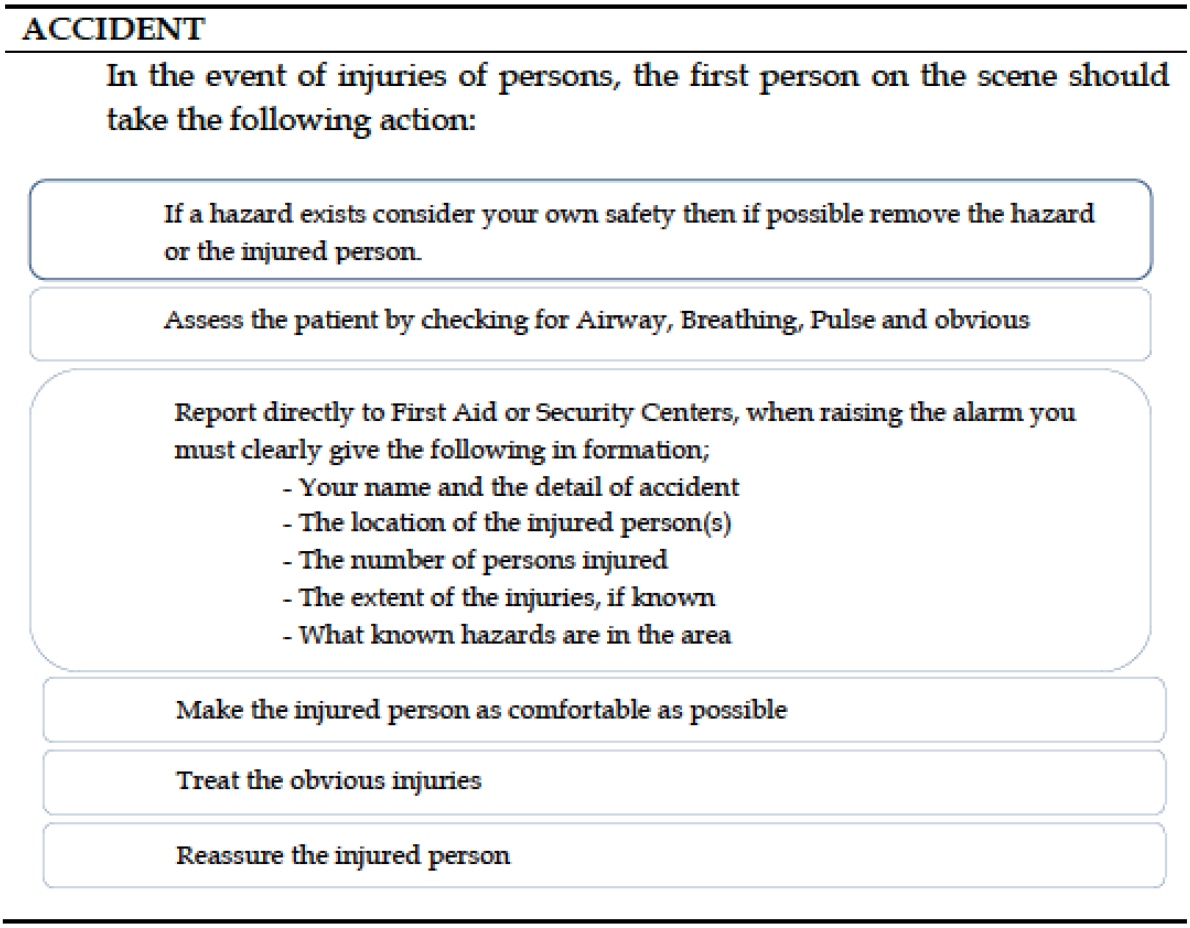


Figure 3.2 Emergency Procedures for Serious Accident



3.5 COMMUNICATION WITH AUTHORITIES / PRESS AT SITE

In the event of an accident or incident, only senior staff is permitted to give factual information to the authorities for resource of liability exposure. The press must be avoiding politely, at all costs, with the terse comment that “the matter is under investigation and relevant information when available will be provided by our Head Office” Do not ever give your opinion or story.

1.5 FIRST AID PERSONS

Upon advice of medical emergency, make immediate assessment to response required and if necessary, advise security to summon ambulance or medical assistance, the qualified first aid attendant should also,

- Provide treatment to the victim(s) to the best of his/her ability.
- Ensure the safety of victims by ceasing any work activity in the area.
- Protect the injured from further danger and weather.
- Assist medical services personnel when they arrive.

1.6 GENERAL ADMINISTRATION TEAM

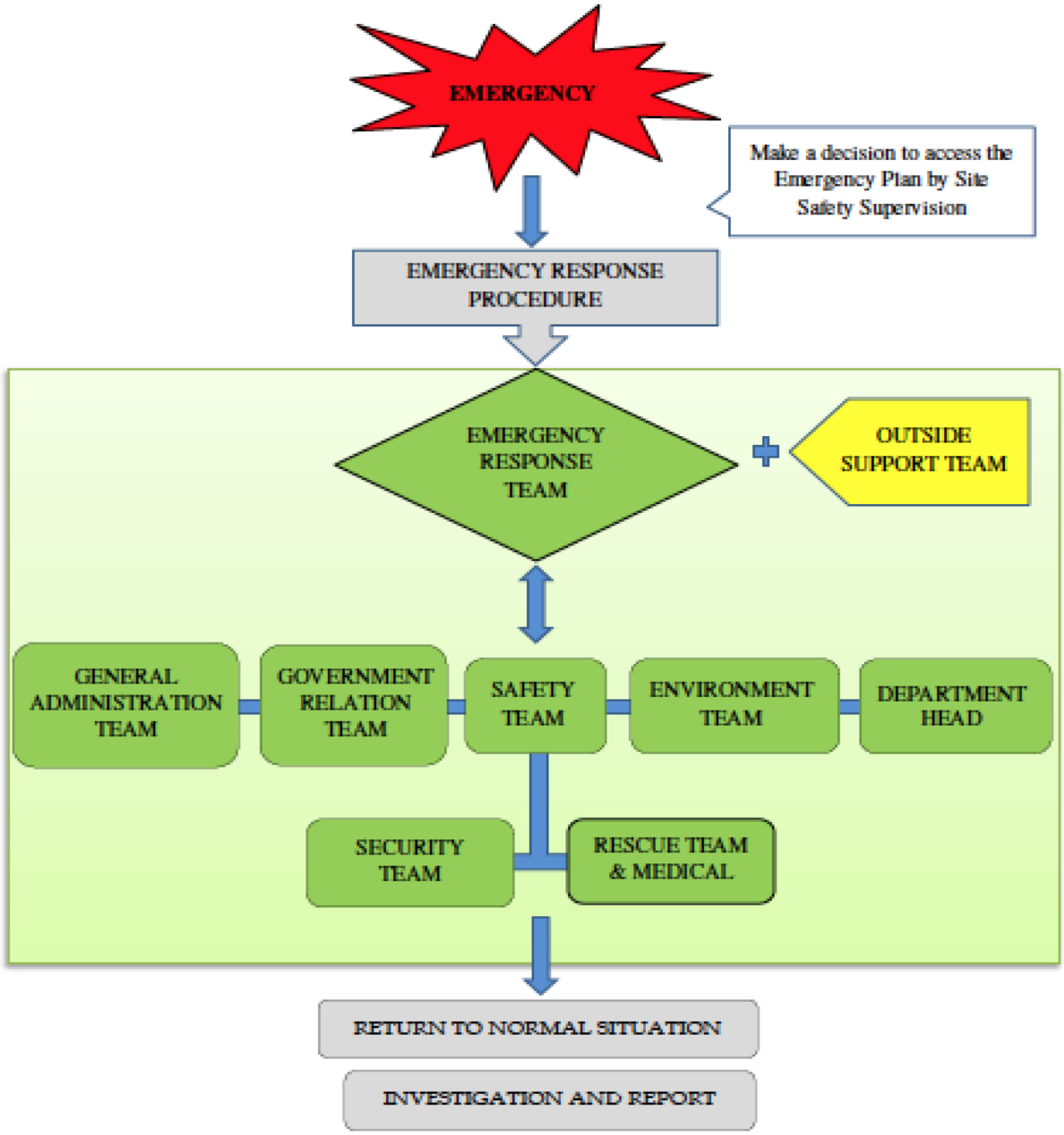
Upon advice of medical emergency, maintain contact with first aid personnel and summon ambulance if required.

1.7 SECURITY TEAM

- If ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct vehicle closest to the scene.
- Prevent access to the site of unauthorized personnel (press, etc.).

1.8 EMERGENCY COORDINATOR

- The Emergency Coordinator shall assist emergency personnel at the scene as required through allocation of company resources.
- The Emergency Coordinator shall ensure next-of-kin are properly notified as soon as possible and give whatever company support and assistance is necessary to assist them bundle the situation
- The Emergency Coordinator shall ensure that senior management personnel are advised of the emergency as soon as practical after the event.



Note: Name of contact person and call number from Owner/Contractor to be determined.

1.9 INCIDENT AND ACCIDENT REPORT

Section A: Identification Data

Report No:	Date of Reported:	Reporter:	Sign:
Job Title:		Company Name:	

Section B: Violence Rate

Accident Violence: ☐ 01-Death ☐ 02-Serious Injury ☐ 03-Lost Time Injury ☐ 04-First Aid ☐ 05- Not Injury ☐ 06-Near Miss

Property Damage Cost: ☐ 1-2,000 USD ☐ 2,001-10,000 USD ☐ 10,001-50,000 ☐ > 50,001

Section C: Environmental Impact

Affected area	☐ Construction area	☐ Public area	
Receptor	☐ None	☐ Workers	☐ Community
Type of pollution	☐ Physical	☐ Chemical	☐ Biological
Toxicity	☐ Non-toxic	☐ Low - toxic	☐ High - toxic
Return to Normal	☐ 1 day	☐ 1 day to 1 week	☐ ≥ 1 week
Cumulative impact	☐ Non-cumulative	☐ Cumulative	

Section D: Injured/Illness Employee

1.Name:	Sex:	Date of Birth: Month	Day	Year	Age:	Regular Job Title:	Experience: In this job title Years	Weeks	In this Project Years	Weeks
	☐ Male ☐ Female									

Site:	Company:	Reference:	Phone No:	Social Security Numbe

Part of Body Injured or Affected:

☐ Head	☐ Hands	☐ Face	☐ Nose
☐ Eyes	☐ Legs	☐ Teeth	☐ Neck
☐ Trunk	☐ Toes	☐ Elbow	☐ Shoulder
☐ Back	☐ Ankle	☐ Wrist	☐ Foot
☐ Arms	☐ Thump	☐ Fingers	☐ Internal

Remark: .....

Nature of Injury or Illness:

☐ Laceration	☐ Amputation	☐ Puncture	☐ Fracture
☐ Strain & Sprain	☐ Burns	☐ Contusion	☐ Dry Heat Friction
☐ Hernia	☐ Foreign Body	☐ Chemical	☐ Contamination
☐ Skin (Occupationnel)	☐ Rash	☐ Irritation	

Remark: .....

2.Name:	Sex:	Date of Birth: Month	Day	Year	Age:	Regular Job Title:	Experience: In this job title Years	Weeks	In this Project Years	Weeks
	☐ Male ☐ Female									

Site:	Company:	Reference:	Phone No:	Social Security Numbe

Part of Body Injured or Affected:

☐ Head	☐ Hands	☐ Face	☐ Nose
☐ Eyes	☐ Legs	☐ Teeth	☐ Neck
☐ Trunk	☐ Toes	☐ Elbow	☐ Shoulder
☐ Back	☐ Ankle	☐ Wrist	☐ Foot
☐ Arms	☐ Thump	☐ Fingers	☐ Internal

Remark: .....

Nature of Injury or Illness:

☐ Laceration	☐ Amputation	☐ Puncture	☐ Fracture
☐ Strain & Sprain	☐ Burns	☐ Contusion	☐ Dry Heat Friction
☐ Hernia	☐ Foreign Body	☐ Contamination	☐ Chemical
☐ Skin (Occupationnel)	☐ Rash	☐ Irritation	

Remark: .....

Section E: Accidents/incident Details

Date Accident/Incident Occurred:	Time Accident/Incident Occurred:	Exact Location of the Accident / Incident:

Details of the actual Job Being done at the time:

Details of Accident / Incident / What actually happened?

Section F: Accident Cause (Basic cause mark X / Contributing cause, if any mark O)

UNSAFE CONDITIONS		UNSAFE ACTS	
1	☐ Inadequately Guarded	1	☐ Operating Without Authority / Training
2	☐ Unguarded	2	☐ Operating at Unsafe Speed
3	☐ Defective Tools, Equipment, or Subetance	3	☐ Marking SHE Device Inoperative
4	☐ Unsafe Design or Construction	4	☐ Using Unsafe Equipment or Equipment Unsafely
5	☐ Hazardous Arrangement	5	☐ Unsafe Loading, Placing, Mixing
6	☐ Unsafe Illumination	6	☐ Taking Unsafe Position
7	☐ Unsafe Ventilation	7	☐ Working on Moving or Dangerous Equipment
8	☐ Unsafe Clothing	8	☐ Distraction, Teasing, Horse Play
9	☐ Insufficient Instruction	9	☐ Failure to use Personal Protective Devices
10	☐ Lack of system of work	10	☐ Lack of effective instruction or supervision

Why was the unsafe act committed? _____ Why did the unsafe condition exist? _____

Section G: Guide to Corrective Action (Base on the cause checked above, I am taking the following corrective action)

UNSAFE ACT	UNSAFE CONDITION	If Supervisor can't handle, then recommend to
☐ Stop the Behaviour	☐ Remove	☐ Site Engineer, or
☐ Study the job	☐ Guard	☐ Site Manager, or
☐ Instruct (tell-show-try-check)	☐ Warn	☐ Project Manager, or
☐ Follow Up	☐ Supervisory Training	☐ Safety Committee
☐ Enforce		

Detail below any immediate remedial actions that have been taken:

Detail below any corrective and preventative actions that could be taken to prevent future re-occurrence:	Responsible	Completion Date

Section H: Witness Statement	
Witness Name	**Interviewer Name**

Section I: Reviewed & Recommend by			
Recommendation:			
Reviewed By:	Position:	Signature:	Date:

Remarks : If Accident or Incident happened with lost time injury and affected to the publicity must further report to Safety Department;
: First Aid Cases will not applicable to this form;
: The accident report shall submit to Safety Department within 3 days
: Attached the photograph or sketch the location of accident / incident;

1.10 SUGGESTED CONTENTS OF EPRP

The Contractor should prepare the EPRP based on the guidelines provided in the above sections. The suggested structure of the EPRP is listed below:

1. Purpose
2. Applicable Scope
3. Preparation Basis
4. Emergency Response System
   - 4.1 Generals
   - 4.2 Emergency Response System
   - 4.3 Responsibilities
5. Major Safety Risks
6. Precautionary Measures
   - 6.1 Training and Exercise
   - 6.2 Hazard Source Monitor
   - 6.3 Alert Action
   - 6.4 Management Measures
7. Control Measures
   - 7.1 Response
   - 7.2 Response Procedures
   - 7.3 Emergency Response
   - 7.4 Emergency Completion and Restoration
8. Emergency Response Report and Settlement
9. Supporting Measures
   - 9.1 Communication
   - 9.2 Emergency Team
   - 9.3 Funding for Emergency
   - 9.4 Provisions and Resources
10. Records

ANNEX VIII - GUIDELINE TRAFFIC MANAGEMENT PLAN

GUIDELINE TRAFFIC MANAGEMENT PLAN

1. Need for Plan

During the construction period of the project, considerable vehicular movement carrying large amounts of material and machinery is expected. This will definitely interrupt the local traffic and is therefore important to manage the traffic to avoid the nuisance to local residents in terms of noise, dust, congestion and inconvenience.

2. The plan

The objective of Traffic Management Plan (TMP) is to define the requirements that should be implemented to mitigate any potential negative risks to the environment, workers or the community resulting from construction traffic.

The TMP will advise and inform site Contractors and external suppliers of equipment and materials of access and entry points along with other key information such tipping areas and wash-out areas. It is intended to compliment and work alongside relevant EMP. The TMP will be classed as “live” and therefore be subjected to updates as required.

The Contractor, at the time of the execution of the project, will prepare a comprehensive TMP in coordination with local authorities, NHA, emergency services and local administrative department. NHA and SC will review and approve the Contractor’s TMP. The Contractor’s TMP shall include following mitigation measures during its preparation:

- Undertake a road conditions assessment prior to and following the peak construction period, to assess any damage to road infrastructure that can be attributed to Project development.
- Repair damage as appropriate or enter into a voluntary agreement with the relevant roads authority to reimburse the cost of any repairs required to the public road network as a result of the Project.
- Spoil dumpsites located close to project site to minimize journey distance and limit movements to site access roads.
- Construction of worker accommodation on site to reduce light vehicle movements relating to travel to/ from the site.
- Provision of bus/minibus services for personnel living in nearby settlements.
- Movements of construction workers will be planned to avoid the busiest roads and times of day when traffic is at its greatest.
- Schedule deliveries and road movements to avoid peak periods.
- Driver training for HGV drivers and refresher course every six months for project drivers.
- Run a safety campaign to improve the people’s knowledge of the traffic hazard on their roads, public information and other activities to address the issues.
- Run a pedestrian awareness programme.
- Temporary signage

The traffic management plan for the project corridor is provided below.

3. Other Recommendations

It is important to manage public access routes during construction because it can cause delay to local traffic and create a safety hazard both on and offsite. People working and living near the tower sites would be annoyed by the emissions, noise and visual intrusion of queuing vehicles. Some important factors involved in access routes and site traffic are as follows:

3.1. Public Access Routes

The use of public road for site access may be restricted in terms of:

- Vehicle size, width and type of load
- Time limits
- Parking
- Pedestrian conflicts

Contractor should have consultation with the local police or local authority to address these issues and to effectively manage them before the beginning of the construction.

3.2. Site Workers Traffic

Site personnel should not be permitted to park vehicles right on the road; this will lead to disruption in material deliveries. Designated parking areas with appropriate parking space will be needed for this purpose; any plain area near construction site can be used for this purpose.

3.3. Site Rules

- Access to and from the site must be only via the specified entrance.
- On leaving the site, vehicles must be directed to follow the directions given.
- Drivers must adhere to the site speed limits.
- All material deliveries to site must keep allocated time limits.
- No material or rubbish should be left in the loading-unloading area.
- Develop a map for alternate routes showing material delivery services.
- Assign designated personnel on site to receive deliveries and to direct the vehicles.
- Monitor vehicle movement to reduce the likelihood of queuing or causing congestion in and around the area.
- Project vehicles should have a unanimous badge or logo on windscreen displaying that they belong to the project.

4. Contractor’s Obligation

The traffic management plan of the Contractor should be safe enough and widening of any access roads and construction of the detours (as applicable and practical) must be completed prior to start of project construction activities so that heavy vehicular transportation for construction activities do not hinder the normal course of traffic lanes. Contractor must ensure

that road closures are carried out by a competent person. The Contractor obligation must include the display of traffic signs according to the need to divert the traffic volume and to guide the road users in advance. The traffic sign, traffic light should be placed from any diverting route or road marking.

The Contractor should consider the environmental and social impacts of the traffic during construction. It will be sole responsibility of the Contractor to implement a plan which produces minimum nuisance to the local people and to the environment. Safety of the people should be given due importance. It will be under Contractor obligation to notify the traffic management plan and its later changes to SC, NHA, emergency services and Traffic Police, and also publish weekly programme in the local newspaper.

ANNEX IX - GUIDELINE RESOURCE CONSERVATION PLAN

Guideline Resource Conservation Plan

1. Introduction:

Sustainable development calls for the need to conserve resources, especially the non-renewable resources.

2. Objective of the plan:

The Resource Conservation Plan is intended to make an effort towards achieving sustainable development. The objective of the resource conservation plan is to:

- Minimize the use of natural resources; and
- Mitigate/ prevent pollution contaminating the natural resources.

3. Planning:

Careful estimations of quantities of material, fuel, water and energy required directly or indirectly shall be done to avoid excessive or unnecessary wastage of these materials. In addition to this, pollution prevention strategies shall also be devised to prevent contamination of resources.

- The estimations include the following:
    1. Estimation of construction material required for the project
    2. Estimation of fuel consumption for construction machinery, construction vehicles and generators etc.
    3. Estimations of the energy requirements during all the stages of the project
    4. Estimations of water consumption for construction activities and construction camp sites.
- Strategies shall be planned to reduce loads on the identified resources to be consumed;
- Best management practices shall be devised to control or reduce pollution resulting from the activities during different stages of the project; and
- An inspector shall be assigned responsibility to oversee the ongoing activities to check the compliance of the planned strategies.

4. Execution of the plan:

The planned strategies shall be implemented to conserve the natural resources including but not limited to the following:

Material

- Material supplied shall be in conformance with the estimated quantities and excess material shall be returned to the supplier;
- Material wastage shall be avoided by using best management practices;
- Waste produced during the project execution shall be disposed off safely to the designated disposal sites through approved contractors; and
- Reuse of the materials shall be appreciated.

Fuel/Energy

- Reduce trips and optimize routes to and from the construction site for all kinds of activities;
- Regular maintenance of equipment and vehicles to avoid leaks and sustain efficient fuel consumption;
- Switch off/plug off idle equipment and vehicles to avoid wastage of fuel;
- Minimize warm up time, unnecessary acceleration and deceleration of the construction equipment and vehicles;
- Avoid unnecessary burning of fuel for cooking in construction camps;
- Avoid unnecessary heating/cooling systems during extreme weathers;
- Construction shall start in early hours of the day to avoid heat in summers and utilization of day light; and
- Alternate energy sources shall be considered for electricity generations during construction and operation to conserve fossil fuel as it is non-renewable resource.

Water

- Avoid using potable water for sprinkling, curing and washing of equipment/vehicles. Surface water or treated effluent can be used instead;
- Wastage of water should be controlled through providing proper valves and through controlling pressure of the water;
- Unnecessary equipment washings should be avoided;
- Awareness amongst workers shall be raised to conserve water and immediately report for any leaks detected; and
- Ensure protection of canal water from contamination resulting from construction activities.

Pollution:

- Emissions shall be reduced/controlled as far as possible and direct discharges to air shall be avoided by strictly adhering to the mitigation measures outlined in ESIA report;
- Waste water shall not be discharged directly into the canal and must be managed as per the recommendations presented in ESIA; and
- Construction & demolition waste and municipal solid waste shall not be dumped/ burnt openly and shall be handled according to the preventative measure given in ESIA study.

5. Checking and Corrective Actions

The proponent shall bind the construction contractor through contract agreement to comply with the strategies outlined in the Resource Conservation Plan. The proponent shall also appoint an Inspector who shall monitor the daily onsite activities and shall report any issues/ concerns raised in relation to Resource Conservation Plan. The inspector shall recommend adequate corrective actions to mitigate the issues raised.

ANNEX X - CHANCE FIND PROCEDURES

ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

1. BACKGROUND

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the project area and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

The Antiquities Act, 1975, protects archaeological sites, whether on Provincial Government owned or private land. They are non-renewable, very susceptible to disturbance and are finite in number. Archaeological sites are an important resource that is protected for their historical, cultural, scientific and educational value to the general public and local communities. Impacts to archaeological sites must be avoided or managed by development proponents. The objectives of this 'Archaeological Chance Find Procedure' are to promote preservation of archaeological data while minimizing disruption of construction scheduling It is recommended that due to the moderate to high archaeological potential of some areas within the project area, all on site personnel and contractors be informed of the Archaeological Chance Find Procedure and have access to a copy while on site.

2. POTENTIAL IMPACTS TO ARCHAEOLOGICAL SITES

Developments that involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.

3. RELEVANT LEGISLATION

It ensures the protection, preservation, development and maintenance of antiquities in the provinces of Pakistan. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the relevant provincial governments to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, any archaeological discovery made during the course of the project.

4. REMEDIES AND PENALTIES

The Antiquities Act, 1975 provides for heritage inspection or investigation orders, temporary protection orders, civil remedies and penalties to limit contraventions. These powers provide:

''A contravention of any provision of this Act or the rules shall, where no punishment has been specifically provided be punishable with rigorous imprisonment for a term which may extend to two years, or with fine up to rupees ten hundred thousand, or with both. ''

5. ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

If you believe that you may have encountered any archaeological materials, stop work in the area and follow the procedure below:

The following 'chance-find' principles will be implemented by the contractor throughout the construction works to account for any undiscovered items identified during construction works:

i. Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance.
ii. Should any potential items be located, the site supervisor will be immediately contacted and work will be temporarily stopped in that area.

iii. If the site supervisor determines that the item is of potential significance, an officer from the Department of Archaeology (DoA) will be invited to inspect the site and work will be stopped until DoA has responded to this invitation.
iv. Work will not re-commence in this location until agreement has been reached
v. between DoA and NTDC as to any required mitigation measures, which may include excavation and recovery of the item.
vi. A precautionary approach will be adopted in the application of these procedures.

6. DETAILED PROCEDURAL STEPS

- If the Director, department of Archaeology receives any information or otherwise has the knowledge of the discovery or existence of an antiquity of which there is no owner, he shall, after satisfying himself as to the correctness of the information or knowledge, take such steps with the approval of the Government, as he may consider necessary for the custody, preservation and protection of the antiquity.
- Whoever discovers, or finds accidentally, any movable antiquity shall inform forth with the Directorate within seven days of its being discovered or found.
- If, within seven days of his being informed, the Director decides to take over the antiquity for purposes of custody, preservation and protection, the person discovering or finding it shall hand it over to the Director or a person authorized by him in writing.
- Where the Director decides to take over an antiquity, he may pay to the person by whom it is handed over to him such cash reward as may be decided in consultation with the Advisory Committee.
- If any person, who discovers or finds any movable antiquity contravenes the provisions of the Act, he shall be punishable with imprisonment for a term which may extend to five (05) years, or with fine not less than fifteen hundred thousand rupees or with both and the Court convicting such person shall direct that the antiquity in respect of which such contravention has taken place shall stand forfeited to Government.
- The Director or any officer authorized by him with police assistance may, after giving reasonable notice, enter into, inspect and examine any premises, place or area which or the sub-soil of which he may have reason to believe to be, or to contain an antiquity and may cause any site, building, object or any antiquity or the remains of any antiquity in such premises, place or area to be photographed, copied or reproduced by any process suitable for the purpose.
- The owner or occupier of the premises, place or area shall afford all reasonable opportunity and assistance to the Director.
- No photograph, copy of reproduction taken or made shall be sold or offered for sale except by or with the consent of the owner of the object of which the photograph, copy or the reproduction has been taken or made.
- Where substantial damage is caused to any property as a result of the inspection, the Director shall pay to the owner thereof reasonable compensation for the damage in consultation with the Advisory Committee.
- If the Director after conducting an inquiry, has reasonable grounds to believe that any land contains any antiquity, he may approach the Government to direct the Revenue Department to acquire such land or any part thereof and the Revenue Department shall thereupon acquire such land or part under the Land Acquisition Act, 1894 (I of 1894), as for a public purpose.

ANNEX XI - TRAFFIC IMPACT ASSESSMENT REPORT

TRAFFIC IMPACT ASSESSMENT (TIA)

KARACHI PORT TO QAYUMABAD CORRIDOR PROJECT (KPQC)

Traffic Impact Assessment Report

January 2026



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EXECUTIVE SUMMARY

ES-1 Introduction

The Karachi Port to Qayumabad Corridor Project (KPQC) is a strategically significant urban transport infrastructure initiative proposed to improve freight mobility and regional connectivity between Karachi Port and the Shahrah-e-Bhutto/Malir Expressway Corridor. The project has been conceived to address existing freight transportation constraints associated with Karachi Port operations and to provide a dedicated high-capacity corridor for movement of containerized cargo, industrial traffic and regional logistics vehicles.

The proposed corridor is approximately 15.4 km long and comprises a four-lane access-controlled toll expressway connecting Karachi Port with Qayumabad and the Jam Sadiq Interchange area. The project will significantly improve connectivity between port facilities and the regional highway network while reducing dependence on longer routes currently utilized by freight traffic.

The project is being developed by PTQ Expressway (Private) Limited and will be implemented under a Public Private Partnership (PPP) framework.

ES-2 Project Objectives

The principal objectives of the project are to:

- Improve direct connectivity between Karachi Port and the regional motorway network.
- Reduce travel time for freight and logistics traffic.
- Improve operational efficiency of Karachi Port.
- Facilitate industrial traffic originating from Korangi, Landhi and Port Qasim industrial areas.
- Reduce congestion on existing urban roads.
- Improve road safety through provision of an access-controlled facility.
- Reduce fuel consumption and vehicular emissions.
- Support long-term economic growth through enhanced logistics efficiency.

ES-3 Project Description

The proposed Karachi Port to Qayumabad Corridor Project consists of a four-lane access-controlled expressway with access / exit ramps, interchanges and tolling infrastructure.

Major project features include:

Parameter	Description
Project Length	Approximately 15.4 km (Karachi Port to Jam Sadiq Bridge)
Facility Type	Urban Access Controlled Expressway
Configuration	Four Lane Dual Carriageway

Parameter	Description
Design Speed	80 km/h
Interchange Design Speed	40 km/h
Design Vehicle	WB-20 Container Truck
Number of Toll Plazas	3
Number of Ramps	6
Estimated Project Cost	PKR 64.2 Billion
Construction Duration	24–30 Months

The alignment extends from Karachi Port and East Wharf facilities through the Mai Kolachi corridor, Boat Basin area, Sunset Boulevard, Korangi Road and Jam Sadiq Interchange area before connecting with the regional expressway network.

ES-4 Existing Traffic Conditions

Traffic surveys conducted for the project indicate substantial heavy vehicle movements associated with Karachi Port and industrial activities within Karachi.

The study identified the following primary freight generators:

- Karachi Port
- South Asia Pakistan Terminal (SAPT)
- Korangi Industrial Area
- Landhi Industrial Area
- Port Qasim Industrial Zone
- SITE Industrial Area

Existing freight traffic is presently required to utilize indirect routes, resulting in increased travel distances, travel times and operating costs.

Traffic counts were undertaken at strategic locations including:

- Jam Sadiq Bridge
- Estate Avenue
- M10 Northern Bypass Corridor
- Shershah Area
- Mid-Section M10

Traffic survey results indicate significant potential demand for a dedicated freight corridor linking Karachi Port with the regional expressway network.

ES-5 Traffic Demand Assessment

Traffic demand estimation was undertaken using traffic count surveys, number plate surveys and corridor demand forecasting techniques.

Three operational scenarios were evaluated to estimate potential utilization of the proposed corridor.

Scenario	Heavy Vehicles per Day
Scenario 1	11,638
Scenario 2	12,470
Scenario 3	13,303

Scenario 3 represents the highest and most conservative traffic demand condition and has therefore been adopted as the design scenario for this Traffic Impact Assessment.

The adopted demand scenario indicates that approximately 13,303 heavy vehicles per day are expected to utilize the proposed corridor under future operating conditions.

ES-6 Construction Phase Impacts

Construction activities are expected to continue for approximately 24 to 30 months.

Major construction activities include:

- Utility relocation
- Earthworks
- Piling operations
- Pier construction
- Superstructure erection
- Ramp construction
- Toll plaza development
- Pavement works

Potential construction-related impacts include:

- Temporary traffic delays
- Increased construction vehicle movements
- Lane occupancy requirements
- Temporary access restrictions

• Increased risk of traffic conflicts

Appropriate mitigation measures have been identified through the Construction Traffic Management Plan.

ES-7 Operational Benefits

The proposed corridor is expected to generate substantial transportation and environmental benefits.

Key benefits include:

• Reduction in freight travel times.

• Reduced traffic congestion on existing urban roads.

• Improved port efficiency.

• Reduced freight operating costs.

• Improved accessibility to industrial zones.

• Reduced fuel consumption.

• Reduced greenhouse gas emissions.

• Improved road safety.

The project will also provide long-term economic benefits through enhanced logistics performance and reduced transportation costs.

ES-8 Conclusions

Based on the available traffic surveys, demand forecasts and engineering assessments, the Karachi Port to Qayumabad Corridor Project is considered technically feasible and operationally justified.

The project will provide significant transportation, economic and environmental benefits through direct connectivity between Karachi Port and the regional highway network.

Potential construction phase impacts are temporary and can be effectively mitigated through implementation of the proposed Construction Traffic Management Plan.

The Traffic Impact Assessment concludes that the proposed project is expected to contribute positively to regional mobility, freight efficiency and sustainable urban transport development within Karachi.

CHAPTER 1

INTRODUCTION

1.1 Background

Karachi is Pakistan's largest metropolitan city and serves as the country's principal economic and maritime gateway. The city accommodates the country's two major seaports, namely Karachi Port and Port Qasim, which collectively handle a significant proportion of Pakistan's international trade. Growth in port activities, industrial development and increasing freight movement have resulted in substantial pressure on Karachi's urban road network.

The movement of heavy vehicles between Karachi Port and industrial areas such as Korangi, Landhi, SITE and Port Qasim currently depends upon a combination of urban arterial roads and indirect regional routes. These routes are frequently subjected to congestion, operational restrictions, traffic conflicts and increased travel times.

To improve freight mobility and support future logistics demand, the Karachi Port to Qayumabad Corridor Project (KPQC) has been proposed as a dedicated access-controlled expressway facility connecting Karachi Port directly with the Shahrah-e-Bhutto and Malir Expressway corridor.

The proposed project is expected to play a vital role in improving freight transportation efficiency, reducing logistics costs and supporting sustainable economic growth within Karachi and the wider region.

1.2 Project Proponent

The Karachi Port to Qayumabad Corridor Project is being developed by:

PTQ Expressway (Private) Limited

The project is proposed under a Public Private Partnership (PPP) framework and is intended to provide long-term transportation infrastructure to support freight and logistics operations associated with Karachi Port and surrounding industrial zones.

1.3 Purpose of the Traffic Impact Assessment

This Traffic Impact Assessment (TIA) has been prepared to evaluate the potential transportation impacts associated with the proposed Karachi Port to Qayumabad Corridor Project.

The assessment has been undertaken to:

- Evaluate existing traffic conditions within the project influence area.
- Assess future traffic demand expected to utilize the proposed facility.
- Determine potential construction phase traffic impacts.
- Evaluate operational phase traffic performance.
- Assess impacts on surrounding road networks.

• Develop appropriate mitigation measures.

• Prepare a Construction Traffic Management Plan (TMP).

• Support Environmental Impact Assessment (EIA) requirements for submission to Sindh Environmental Protection Agency (SEPA).

1.4 Objectives of the Study

The primary objectives of this Traffic Impact Assessment are:

Traffic Objectives

• Determine existing traffic characteristics.

• Evaluate freight movement patterns.

• Assess corridor demand.

• Estimate future traffic volumes.

• Assess level of service of the proposed facility.

Environmental Objectives

• Assess traffic-related environmental impacts.

• Evaluate emission reduction benefits.

• Evaluate fuel consumption reduction.

• Assess community accessibility impacts.

• Identify mitigation measures.

Planning Objectives

• Support detailed design development.

• Support environmental approval requirements.

• Support investment and financing decisions.

• Support long-term transportation planning.

1.5 Need for the Project

Existing Transportation Challenges

At present, freight traffic associated with Karachi Port experiences several operational challenges including:

• Long travel distances.

• Congested urban roadways.

• Time restrictions on heavy vehicle movement.

• Increased operating costs.

• Reduced logistics efficiency.

• Increased fuel consumption.

• Environmental impacts associated with congestion.

Heavy vehicles destined for industrial zones and regional highway networks are often required to utilize indirect routes through M10, Northern Bypass and other congested urban corridors.

These conditions result in:

• Increased travel times.

• Increased transportation costs.

• Reduced competitiveness of logistics operations.

• Increased traffic conflicts.

• Reduced road safety.

The proposed corridor has therefore been conceived as a strategic freight mobility improvement project.

1.6 Project Need Assessment

The need for the project is supported by the following considerations:

Port Growth

Karachi Port remains one of Pakistan's most important economic assets. Future increases in port throughput will generate additional freight demand requiring efficient transportation infrastructure.

Industrial Growth

Industrial development within:

• Korangi Industrial Area

• Landhi Industrial Area

• SITE Industrial Area

• Port Qasim Industrial Zone

will continue to increase freight traffic demand.

Freight Efficiency

Provision of a direct corridor will significantly improve freight movement efficiency by reducing travel times and distances.

Regional Connectivity

The project will strengthen connectivity between:

• Karachi Port

• Shahrah-e-Bhutto

- Malir Expressway
- M9 Motorway
- National Highway Network

1.7 Scope of Assessment

The scope of this Traffic Impact Assessment includes:

Existing Conditions Assessment

- Road network inventory.
- Traffic survey review.
- Existing traffic volume analysis.
- Vehicle composition analysis.

Future Traffic Assessment

- Traffic demand forecasting.
- Future traffic assignment.
- Operational performance assessment.

Construction Assessment

- Construction traffic generation.
- Construction vehicle routing.
- Work zone impacts.
- Traffic management requirements.

Environmental Assessment

- Traffic-related air quality impacts.
- Noise implications.
- Community accessibility impacts.
- Road safety considerations.

1.8 Study Area

The study area includes the proposed corridor alignment and surrounding transportation network likely to experience traffic impacts during construction and operation.

Major locations considered within the study area include:

- Karachi Port
- East Wharf

- SAPT Terminal
- Mai Kolachi Road
- Boat Basin
- Sunset Boulevard
- Korangi Road
- Qayumabad
- Jam Sadiq Interchange Area
- Shahrah-e-Bhutto Corridor
- Malir Expressway Corridor

The influence area extends beyond the immediate alignment to include roads that may experience changes in traffic demand as a result of project implementation.

1.9 Methodology

The assessment methodology adopted for this study comprises the following activities:

Phase 1 – Data Collection

- Review of traffic surveys.
- Review of demand studies.
- Review of project design information.
- Review of available planning documentation.

Phase 2 – Existing Conditions Analysis

- Traffic volume analysis.
- Vehicle composition assessment.
- Freight movement analysis.

Phase 3 – Demand Forecasting

- Demand estimation.
- Traffic growth analysis.
- Scenario evaluation.

Phase 4 – Impact Assessment

- Construction phase assessment.
- Operational phase assessment.
- Environmental assessment.

Phase 5 – Mitigation Planning

- Traffic management measures.
- Construction management measures.
- Operational recommendations.

1.10 Applicable Standards and Guidelines

The assessment has been undertaken with reference to:

- AASHTO Geometric Design Guidelines.
- Highway Capacity Manual (HCM).
- National Highway Authority (NHA) Standards.
- Sindh Environmental Protection Agency (SEPA) Requirements.
- International Traffic Engineering Practices.
- Relevant transportation planning guidelines applicable to urban expressway projects.

1.11 Report Structure

This report is organized into the following chapters:

Chapter 1 – Introduction

Chapter 2 – Project Description

Chapter 3 – Existing Road Network and Traffic Conditions

Chapter 4 – Traffic Survey Methodology

Chapter 5 – Existing Traffic Analysis

Chapter 6 – Traffic Demand Forecasting

Chapter 7 – Construction Phase Traffic Impact Assessment

Chapter 8 – Construction Traffic Management Plan

Chapter 9 – Operational Phase Traffic Impact Assessment

Chapter 10 – Environmental Traffic Assessment

Chapter 11 – Conclusions and Recommendations

The report has been prepared to support the Environmental Impact Assessment process and provide a comprehensive understanding of transportation impacts associated with the proposed project.

CHAPTER 2

PROJECT DESCRIPTION

2.1 Introduction

The Karachi Port to Qayumabad Corridor Project (KPQC) is a strategic urban transport infrastructure project proposed to improve freight connectivity between Karachi Port and the regional highway network through a dedicated access-controlled expressway facility.

The project has been conceived to address existing transportation challenges associated with freight movement originating from Karachi Port and surrounding industrial areas. The proposed facility will provide a direct, high-capacity and efficient transportation corridor for containerized cargo and heavy vehicle traffic while reducing pressure on the existing urban road network.

The project forms part of a broader transportation strategy aimed at enhancing logistics efficiency, supporting economic development and improving freight mobility within Karachi.

2.2 Project Location

The project is located within Karachi, Sindh Province, Pakistan.

The alignment extends from Karachi Port and East Wharf facilities through central and southern Karachi before connecting with the Qayumabad and Jam Sadiq Interchange area.

The project traverses several major transportation corridors and commercial districts and provides connectivity between port facilities, industrial zones and regional transportation infrastructure.

The corridor serves as a critical link between:

- Karachi Port
- South Asia Pakistan Terminal (SAPT)
- East Wharf
- Mai Kolachi Road
- Boat Basin Area
- Sunset Boulevard
- Main Korangi Road
- Qayumabad Area
- Jam Sadiq Interchange
- Shahrah-e-Bhutto Corridor
- Malir Expressway

2.3 Project Rationale

Karachi Port serves as one of Pakistan's principal maritime gateways and handles a significant proportion of the country's international trade.

Despite its strategic importance, freight movement from the port is constrained by:

- Congested urban roads.
- Time restrictions on heavy vehicles.
- Indirect travel routes.
- High transportation costs.
- Safety concerns.
- Environmental impacts associated with congestion.

The proposed Karachi Port to Qayumabad Corridor Project has therefore been developed to provide a direct connection between Karachi Port and the regional highway network.

The project is expected to significantly improve freight movement efficiency while reducing congestion on existing transportation corridors.

2.4 Project Components

The proposed project comprises several major infrastructure components including:

Mainline Expressway

A four-lane dual carriageway access-controlled expressway providing uninterrupted traffic flow.

Elevated Structures

Elevated sections designed to minimize land acquisition requirements and reduce interference with existing urban development.

Interchanges

Grade-separated interchanges providing safe and efficient connectivity between the expressway and surrounding road network.

Entry and Exit Ramps

Dedicated ramps facilitating traffic movement to and from the corridor.

Toll Collection Facilities

Modern toll plazas designed to support efficient traffic operations and revenue collection.

Traffic Management Systems

Intelligent transportation system (ITS) components for traffic monitoring and management.

2.5 Project Design Characteristics

The principal design parameters adopted for the project are summarized below.

Table 2.1 — Project Design Characteristics

Parameter	Value
Project Length	Approximately 15.4 km
Facility Type	Access Controlled Expressway
Carriageway Configuration	Four Lane Dual Carriageway
Design Speed (Mainline)	80 km/h
Design Speed (Interchanges)	40 km/h
Design Vehicle	WB-20 Container Truck
Number of Toll Plazas	3
Number of Ramps	6
Construction Duration	24–30 Months
Estimated Project Cost	PKR 64.2 Billion

2.6 Geometric Design Criteria

The project has been planned in accordance with internationally recognized geometric design standards.

Table 2.2 — Mainline Geometric Design Criteria

Design Element	Value
Design Speed	80 km/h
Horizontal Curve Radius (Minimum)	280 m
Maximum Superelevation	4%
Minimum Stopping Sight Distance	130 m
Tangent Runout Length	14 m
Maximum Gradient	3%
Minimum Gradient	0.2%
Embankment Side Slope	1.5H:1V

Table 2.3 — Interchange Design Criteria

Design Element	Value
Design Speed	40 km/h
Minimum Horizontal Radius	47 m
Maximum Superelevation	4%

Design Element	Value
Minimum Stopping Sight Distance	50 m
Tangent Runout Length	10 m
Maximum Gradient	4%
Minimum Gradient	0.2%

2.7 Design Vehicle

The design vehicle adopted for the project is the WB-20 container truck.

The WB-20 vehicle represents the typical freight vehicle expected to utilize the corridor and is consistent with the operational requirements of Karachi Port and associated logistics facilities.

Selection of this design vehicle ensures that:

• Horizontal geometry is adequate.

• Vertical clearances are sufficient.

• Ramp geometry accommodates freight traffic.

• Intersections and toll facilities are properly designed.

2.8 Tolling System

The project is proposed as a toll facility.

The tolling system is intended to support:

• Sustainable operation and maintenance.

• Infrastructure financing.

• Efficient traffic management.

• Long-term asset management.

A total of three toll plazas are proposed along the corridor.

The final tolling strategy will be determined during detailed design and operational planning stages.

Electronic toll collection systems may be considered to reduce delays and improve operational efficiency.

2.9 Traffic Operations Philosophy

The proposed corridor has been designed to function as a high-capacity freight-oriented expressway.

Key operational objectives include:

• Free-flow traffic operations.

• Reduced travel times.

- Enhanced freight mobility.
- Improved road safety.
- Efficient toll operations.
- Reduced congestion.
- Improved reliability of travel.

The project is expected to operate under controlled-access conditions, minimizing interruptions to traffic flow.

2.10 Construction Strategy

Construction of the project is anticipated to require approximately 24 to 30 months.

Major construction activities are expected to include:

Site Preparation

- Utility relocation.
- Site clearance.
- Temporary traffic arrangements.

Foundation Construction

- Piling works.
- Pile cap construction.
- Foundation excavation.

Substructure Construction

- Pier construction.
- Retaining walls.
- Structural supports.

Superstructure Construction

- Girder erection.
- Deck slab construction.
- Launching operations.

Road Works

- Pavement construction.
- Drainage works.
- Road furniture installation.

Toll Plaza Construction

- Toll booths.
- Administrative buildings.
- ITS infrastructure.

2.11 Construction Traffic

Construction activities will generate temporary increases in traffic volumes due to movement of:

- Concrete transit mixers.
- Dump trucks.
- Excavators.
- Mobile cranes.
- Reinforcement delivery vehicles.
- Low-bed trailers.
- Construction workforce transport.

These impacts are assessed in detail within subsequent chapters of this report.

2.12 Anticipated Project Benefits

Implementation of the Karachi Port to Qayumabad Corridor Project is expected to generate significant transportation benefits.

Freight Benefits

- Reduced travel times.
- Improved reliability.
- Lower logistics costs.
- Increased port efficiency.

Traffic Benefits

- Reduced congestion.
- Improved traffic flow.
- Reduced vehicle operating costs.
- Enhanced connectivity.

Environmental Benefits

- Reduced fuel consumption.
- Reduced emissions.
- Reduced traffic delays.

• Improved air quality.

Economic Benefits

• Increased productivity.

• Improved competitiveness.

• Enhanced trade facilitation.

• Support for industrial growth.

2.13 Summary

The Karachi Port to Qayumabad Corridor Project represents a strategically important transportation investment intended to improve freight mobility and strengthen connectivity between Karachi Port and the regional transportation network.

The project incorporates modern expressway design principles, tolling infrastructure and freight-oriented operational characteristics to provide a high-capacity corridor capable of accommodating future transportation demand.

The following chapters present an assessment of existing traffic conditions, survey methodology, demand forecasting and transportation impacts associated with the proposed development.

CHAPTER 3

EXISTING ROAD NETWORK AND TRAFFIC CONDITIONS

3.1 Introduction

A comprehensive understanding of existing traffic conditions is essential for evaluating the potential impacts and benefits of the proposed Karachi Port to Qayumabad Corridor Project (KPQC). This chapter presents an assessment of the existing road network, freight movement patterns, traffic characteristics and traffic survey findings within the project influence area.

The assessment is based upon traffic count surveys, number plate surveys and demand estimation studies undertaken for the project corridor.

The purpose of this chapter is to:

- Establish existing traffic conditions.
- Identify major traffic generators.
- Assess existing freight movement patterns.
- Evaluate current traffic demand.
- Identify operational deficiencies within the existing network.
- Provide baseline information for future traffic forecasting.

3.2 Existing Transportation Network

The project influence area is located within the southern and eastern sectors of Karachi and consists of a complex urban transportation network serving commercial, industrial and port-related activities.

The road network within the study area includes:

Primary Corridors

- Mai Kolachi Road
- Korangi Road
- Sunset Boulevard
- M10 Northern Bypass
- Shahrah-e-Bhutto Corridor
- Malir Expressway

Port Access Corridors

- East Wharf Road
- SAPT Access Roads
- Port Internal Road Network

Major Intersections

- Jam Sadiq Bridge Area
- Qayumabad Area
- Boat Basin Area
- Mai Kolachi Interchange Area
- Korangi Road Junctions

These facilities collectively accommodate freight traffic, passenger traffic and industrial traffic movements associated with Karachi's economic activities.

3.3 Existing Traffic Characteristics

The transportation system within the study area carries a mixture of traffic types including:

Freight Traffic

- Container Trucks
- Two-Axle Trucks
- Three-Axle Trucks
- Four-Axle Trucks
- Five-Axle Trucks
- Six-Axle Trucks

Passenger Traffic

- Cars
- Jeeps
- Vans
- Pickups

Public Transport

- Buses
- Mini Buses
- Coaches

Motorcycles

Motorcycles constitute a substantial portion of local urban traffic, although their impact on freight demand assessment is comparatively limited.

The dominant transportation characteristic within the project influence area is heavy freight traffic associated with port and industrial activities.

3.4 Traffic Survey Program

Traffic surveys were undertaken to determine:

- Existing traffic volumes.
- Vehicle classifications.
- Freight movement characteristics.
- Corridor demand.
- Future corridor utilization potential.

The survey program included:

Traffic Count Surveys

Traffic counts were conducted using video-based survey techniques.

Number Plate Surveys

Number plate surveys were undertaken to determine vehicle origins and destinations.

Demand Assessment Surveys

Traffic data was analyzed to estimate future utilization of the proposed corridor.

3.5 Survey Locations

Traffic surveys were undertaken at strategic locations selected to capture freight traffic movements associated with Karachi Port and surrounding industrial areas.

Table 3.1 — Traffic Survey Locations

Location ID	Survey Location
Location 01	M10 Mid-Section
Location 02	Estate Avenue to M10
Location 03	Jam Sadiq Bridge
Location 04	M10 (Shershah to M9)

These locations were selected because they represent key freight movement corridors and provide a reliable indication of future corridor demand.

3.6 Jam Sadiq Bridge Traffic Survey

Jam Sadiq Bridge represents one of the most important freight movement corridors within the study area.

Three-day traffic surveys were conducted to assess existing truck movements.

Table 3.2 — Average Daily Truck Volumes at Jam Sadiq Bridge

Vehicle Type	Average Daily Volume
2 Axle Trucks	4,886
3 Axle Trucks	2,564
4 Axle Trucks	1,677
5 Axle Trucks	150
6 Axle Trucks	211
Total	9,488

The results indicate substantial heavy vehicle demand currently utilizing the corridor.

The dominance of two-axle and three-axle trucks suggests significant freight movement associated with urban logistics and port operations.

3.7 Estate Avenue Traffic Survey

Traffic counts were undertaken at Estate Avenue to evaluate freight traffic moving between Karachi Port and the Northern Bypass corridor.

Table 3.3 — Estate Avenue Daily Truck Volumes

Vehicle Type	Daily Volume
2 Axle Trucks	2,923
3 Axle Trucks	1,350
4 Axle Trucks	1,572
5 Axle Trucks	333
6 Axle Trucks	946
Total	7,123

Survey results indicate significant port-related freight movement utilizing the corridor.

The high proportion of heavy multi-axle trucks reflects containerized freight traffic associated with port operations.

3.8 M10 Mid-Section Survey

Traffic surveys conducted at the M10 Mid-Section provide important information regarding regional freight traffic movements.

Table 3.4 — Average Daily Truck Volumes at M10 Mid-Section

Vehicle Type	Daily Volume
2 Axle Trucks	1,152
3 Axle Trucks	1,274
4 Axle Trucks	1,030
5 Axle Trucks	257
6 Axle Trucks	922
Total	4,636

The survey indicates significant utilization of the M10 corridor by freight traffic traveling between Karachi Port and regional destinations.

3.9 Number Plate Survey Analysis

Number plate surveys were undertaken to determine the proportion of freight traffic originating from Karachi Port and subsequently utilizing the Northern Bypass corridor.

Table 3.5 — Percentage of Traffic Originating from Karachi Port

Vehicle Type	Percentage
2 Axle Trucks	13%
3 Axle Trucks	26%
4 Axle Trucks	37%
5 Axle Trucks	29%
6 Axle Trucks	32%
Overall Average	28%

The survey confirms that a substantial proportion of freight traffic currently using indirect routes is associated with Karachi Port activities.

3.10 Existing Freight Movement Patterns

The analysis indicates that existing freight traffic is generated primarily by:

Karachi Port

Containerized cargo movement.

SAPT Terminal

Import and export container traffic.

Korangi Industrial Area

Industrial goods transportation.

Landhi Industrial Area

Manufacturing and logistics traffic.

SITE Industrial Area

Regional freight transportation.

Port Qasim Industrial Zone

Industrial and commercial freight movement.

These facilities collectively generate substantial truck traffic demand requiring efficient regional connectivity.

3.11 Existing Traffic Constraints

Several transportation constraints currently affect freight movement within the project influence area.

Traffic Congestion

Frequent congestion occurs at:

- Boat Basin Area
- Mai Kolachi Corridor
- Korangi Road
- Qayumabad Area
- Jam Sadiq Bridge

Travel Time Delays

Freight vehicles often experience delays due to:

- Congested intersections.
- Traffic signals.
- Mixed traffic operations.
- Peak-hour congestion.

Operational Restrictions

Heavy vehicle movement restrictions during daytime periods reduce operational efficiency and increase transportation costs.

Safety Issues

Interactions between heavy vehicles and local traffic create potential safety concerns.

3.12 Existing Vehicle Composition

The traffic studies indicate that freight traffic within the study area is dominated by:

Table 3.6 — Existing Heavy Vehicle Composition (Scenario 3)

Vehicle Type	Volume
2 Axle Trucks	5,536
3 Axle Trucks	3,509
4 Axle Trucks	2,509
5 Axle Trucks	352
6 Axle Trucks	1,398
Total	13,303

The data demonstrates that two-axle and three-axle vehicles constitute the largest share of freight traffic demand.

3.13 Existing Traffic Demand Assessment

Based on the traffic surveys and demand estimation studies, the existing corridor exhibits strong freight transportation demand.

Three demand scenarios were developed.

Table 3.7 — Traffic Demand Scenarios

Scenario	Heavy Vehicles per Day
Scenario 1	11,638
Scenario 2	12,470
Scenario 3	13,303

Scenario 3 represents the highest demand condition and is considered the most appropriate planning scenario for assessment of future corridor performance.

3.14 Existing Level of Service

Based on observed traffic volumes and congestion patterns, several locations within the study area currently operate under constrained conditions during peak traffic periods.

Key bottlenecks include:

- Jam Sadiq Bridge Area
- Mai Kolachi Corridor
- Korangi Road
- Boat Basin Area
- Qayumabad Area

The proposed corridor is expected to alleviate pressure on these facilities by providing an alternative high-capacity route for freight traffic.

3.15 Summary

The traffic surveys confirm the existence of substantial freight transportation demand within the project influence area.

Karachi Port, SAPT Terminal, Port Qasim and surrounding industrial areas generate significant truck traffic requiring efficient regional connectivity.

Traffic volumes observed during the surveys indicate strong justification for development of a dedicated freight-oriented expressway corridor.

The findings presented in this chapter establish the baseline conditions used for future traffic forecasting and impact assessment presented in subsequent chapters.

CHAPTER 4

TRAFFIC SURVEY METHODOLOGY

4.1 Introduction

Traffic surveys constitute the foundation of any Traffic Impact Assessment and are essential for understanding existing transportation conditions, traffic demand characteristics and future transportation requirements.

A comprehensive traffic survey program was undertaken to evaluate existing freight traffic patterns, vehicle composition and corridor utilization associated with Karachi Port and surrounding industrial areas. The collected data forms the basis for traffic demand estimation, forecasting and operational impact assessment presented in subsequent chapters of this report.

The survey program was specifically designed to identify the volume and composition of heavy vehicle traffic that may potentially utilize the proposed Karachi Port to Qayumabad Corridor Project (KPQC).

4.2 Objectives of Traffic Surveys

The principal objectives of the traffic survey program were to:

Existing Traffic Assessment

- Determine existing traffic volumes.
- Determine heavy vehicle composition.
- Identify traffic distribution patterns.
- Assess existing corridor utilization.

Freight Movement Assessment

- Determine freight traffic demand.
- Identify truck movement characteristics.
- Evaluate port-related traffic.
- Assess industrial area traffic.

Traffic Forecasting Support

- Establish baseline traffic conditions.
- Support future demand forecasting.
- Support capacity assessment.
- Support operational analysis.

Toll Planning Support

- Support toll plaza planning.

• Assist in financial modelling.

• Support revenue estimation studies.

4.3 Survey Approach

The traffic survey methodology adopted for the project was based on internationally accepted transportation engineering practices.

The overall survey process included:

Stage 1

Project reconnaissance and survey planning.

Stage 2

Selection of survey locations.

Stage 3

Installation of survey equipment.

Stage 4

Traffic data collection.

Stage 5

Video extraction and processing.

Stage 6

Traffic classification and verification.

Stage 7

Data validation and analysis.

Stage 8

Traffic demand estimation.

The methodology ensured collection of reliable and representative traffic data for assessment of existing and future traffic conditions.

4.4 Survey Locations

Survey locations were selected to capture the principal freight movement corridors associated with Karachi Port and surrounding industrial zones.

The selected locations were considered representative of existing truck movements and future corridor demand.

Table 4.1 — Traffic Survey Locations

Location ID	Location Description	Survey Type
Location 01	M10 Mid-Section	Traffic Count

Location ID	Location Description	Survey Type
Location 02	Estate Avenue to M10	Traffic Count
Location 03	Jam Sadiq Bridge	Traffic Count
Location 04	M10 (Shershah to M9)	Traffic Count
Additional Locations	Northern Bypass Interface	Number Plate Survey

The selected locations provided comprehensive coverage of freight traffic movements associated with Karachi Port and regional transportation corridors.

4.5 Traffic Count Survey Methodology

Traffic count surveys were conducted using video-based recording techniques.

This approach was selected because it provides:

- Continuous monitoring.
- High data accuracy.
- Permanent record of traffic conditions.
- Reduced field personnel requirements.
- Enhanced data verification capability.

Video-based traffic surveys are widely accepted within transportation engineering practice and provide a reliable basis for traffic volume assessment.

4.6 Equipment Used

The following equipment was utilized during survey execution:

Traffic Survey Equipment

- High-definition video cameras.
- Mounting brackets.
- Portable power supplies.
- Data storage devices.
- Survey control sheets.

Data Processing Equipment

- Computer workstations.
- Video processing software.
- Spreadsheet software.
- Quality control tools.

The equipment was selected to ensure reliable recording and processing of traffic information.

4.7 Survey Duration

Traffic counts were undertaken over multiple days to ensure representative traffic conditions.

Survey durations included:

Jam Sadiq Bridge

Three-day continuous traffic survey.

Estate Avenue

Seven-day traffic survey.

M10 Mid-Section

Seven-day traffic survey.

M10 Corridor

Four-day traffic survey.

The selected durations were considered adequate for capturing normal freight traffic variations.

4.8 Traffic Classification System

Traffic was classified according to vehicle type to facilitate accurate demand estimation and future forecasting.

Table 4.2 — Vehicle Classification Categories

Vehicle Type	Classification
2 Axle Truck	Heavy Vehicle
3 Axle Truck	Heavy Vehicle
4 Axle Truck	Heavy Vehicle
5 Axle Truck	Heavy Vehicle
6 Axle Truck	Heavy Vehicle
Cars	Light Vehicle
Vans	Light Vehicle
Pickups	Light Vehicle
Buses	Public Transport
Mini Buses	Public Transport

The heavy vehicle categories were the primary focus of the assessment due to the freight-oriented nature of the proposed project.

4.9 Survey Execution Procedure

Traffic surveys were executed following a structured process.

Step 1 – Site Reconnaissance

Survey teams visited each location to:

• Assess visibility.

• Evaluate traffic movements.

• Identify suitable camera mounting locations.

Step 2 – Camera Installation

Video cameras were installed at elevated positions capable of capturing:

• All traffic lanes.

• Turning movements.

• Vehicle classifications.

• Traffic direction.

Step 3 – Recording

Continuous video recording was undertaken during the designated survey period.

Step 4 – Data Extraction

Recorded footage was downloaded and transferred to processing teams.

Step 5 – Classification

Vehicles were classified according to axle configuration and vehicle type.

Step 6 – Quality Review

All processed data underwent verification and validation.

4.10 Number Plate Survey Methodology

Number plate surveys were conducted to determine vehicle origin-destination characteristics.

The methodology included:

Field Survey

Survey personnel recorded:

• Vehicle registration numbers.

• Vehicle classifications.

• Travel direction.

Data Processing

The recorded information was analyzed to determine:

- Port-generated traffic.
- Industrial area traffic.
- Through traffic.
- Corridor utilization characteristics.

This methodology allowed identification of vehicles likely to divert to the proposed corridor.

4.11 Data Processing Methodology

Following completion of field surveys, the collected data underwent processing and analysis.

The processing methodology included:

Video Review

Review of all recorded footage.

Vehicle Enumeration

Counting of individual vehicle classes.

Data Verification

Cross-checking of traffic volumes.

Data Tabulation

Compilation of survey results into standardized traffic tables.

Statistical Review

Assessment of consistency and reliability.

4.12 Quality Assurance Procedures

Several quality assurance measures were implemented to ensure reliability of survey results.

Field Verification

Regular inspection of equipment during surveys.

Data Verification

Independent review of processed traffic counts.

Consistency Checks

Comparison of survey results between locations.

Supervisor Review

Final validation by transportation engineering personnel.

These procedures ensured that survey results accurately represented existing traffic conditions.

4.13 Traffic Demand Estimation Methodology

Traffic demand estimation was undertaken using a scenario-based approach.

The methodology involved:

Step 1
Identification of truck traffic currently utilizing Jam Sadiq Bridge.

Step 2
Identification of traffic moving through M10 and Northern Bypass.

Step 3
Determination of traffic associated with Karachi Port.

Step 4
Assessment of SITE and industrial area traffic.

Step 5
Development of alternative demand scenarios.

Step 6
Selection of the most representative planning scenario.

This approach enabled estimation of traffic volumes likely to utilize the proposed corridor following implementation.

4.14 Assumptions

The traffic demand assessment was based on several planning assumptions.

Assumption 1
Truck traffic currently utilizing Jam Sadiq Bridge will largely transfer to the proposed corridor.

Assumption 2
Traffic originating from Karachi Port will utilize the proposed corridor due to reduced travel distance and travel time.

Assumption 3
A significant proportion of SITE and industrial area traffic will utilize the proposed facility.

Assumption 4
Future port growth will increase freight traffic demand.

Assumption 5
Improved operational conditions will attract additional freight traffic to the corridor.

These assumptions are considered reasonable for planning-level traffic assessment.

4.15 Limitations of the Assessment

The assessment has been undertaken using the best available information.

Potential limitations include:

• Future economic conditions.

• Future port activity levels.

• Changes in freight movement regulations.

• Future industrial growth patterns.

• Future transportation network changes.

These uncertainties are common to transportation planning studies and have been addressed through use of multiple demand scenarios.

4.16 Summary

The traffic survey program provides a comprehensive and reliable database for assessment of existing and future transportation conditions within the project influence area.

The survey methodology incorporates traffic count surveys, number plate surveys and demand estimation procedures consistent with accepted transportation engineering practice.

The resulting database provides a sound foundation for traffic forecasting, impact assessment and development of mitigation measures presented in subsequent chapters of this report.

The following chapter presents detailed analysis of existing traffic conditions and freight demand within the study area.

CHAPTER 5

EXISTING TRAFFIC ANALYSIS

5.1 Introduction

This chapter presents a detailed analysis of existing traffic conditions within the study area based on traffic surveys, vehicle classification counts, freight movement studies and demand assessment exercises undertaken for the Karachi Port to Qayumabad Corridor Project (KPQC).

The objective of the analysis is to establish a reliable baseline against which future traffic forecasts and project impacts can be assessed.

The chapter evaluates:

• Existing traffic demand.

• Vehicle composition.

• Freight movement characteristics.

• Existing corridor utilization.

• Existing transportation deficiencies.

• Existing operational conditions.

The findings presented herein form the basis for future demand forecasting and operational assessment.

5.2 Existing Traffic Demand

Traffic survey results indicate substantial freight movement associated with Karachi Port and surrounding industrial areas.

The assessment identified three potential demand scenarios representing different levels of corridor utilization.

Table 5.1 — Heavy Vehicle Demand Scenarios

Scenario	Heavy Vehicles Per Day
Scenario 1	11,638
Scenario 2	12,470
Scenario 3	13,303

Scenario 3 represents the highest demand condition and has been adopted as the planning and design scenario for the Traffic Impact Assessment.

The estimated demand confirms the strategic importance of the proposed corridor in accommodating freight movement between Karachi Port and the regional transportation network.

5.3 Existing Vehicle Composition

The vehicle composition analysis indicates that freight traffic within the corridor is dominated by heavy commercial vehicles.

Table 5.2 — Existing Heavy Vehicle Composition – Scenario 3

Vehicle Type	Daily Volume
2 Axle Trucks	3,509
3 Axle Trucks	5,536
4 Axle Trucks	2,509
5 Axle Trucks	352
6 Axle Trucks	1,398
Total Heavy Vehicles	13,304

The results indicate that 2-Axle and 3-Axle trucks constitute the majority of freight traffic demand.

These vehicle classes are primarily associated with:

• Containerized cargo movement.

• Industrial freight transportation.

• Port-related logistics operations.

• Regional goods distribution.

The presence of significant numbers of multi-axle vehicles confirms the corridor's importance for heavy freight transportation.

5.4 Existing Traffic Composition

The broader traffic composition includes both freight traffic and passenger vehicles.

Table 5.3 — Existing Traffic Composition – Scenario 3

Vehicle Category	Daily Volume
Cars, Jeeps, Vans & Pickups	18,209
Minibuses & Coaches	976
Buses	325
2 Axle Trucks	3,509
3 Axle Trucks	5,536
4 Axle Trucks	2,509
5 Axle Trucks	352

Vehicle Category	Daily Volume
6 Axle Trucks	1,398
Total Traffic	32,814

The data indicates that although passenger vehicles represent the largest single category, freight traffic forms a substantial component of overall corridor demand.

This finding supports the development of a dedicated freight-oriented expressway.

5.5 Passenger Car Unit (PCU) Analysis

To assess traffic operating characteristics, heavy vehicles were converted into Passenger Car Units (PCUs).

The analysis indicates the following demand levels:

Table 5.4 — Existing Demand in PCUs

Scenario	Demand (PCUs/Day)
Scenario 1	35,461
Scenario 2	38,123
Scenario 3	40,787

The adopted planning scenario indicates a demand level approaching 41,000 PCUs per day.

This level of demand demonstrates the need for additional transportation capacity within the corridor.

5.6 Peak Hour Analysis

Peak-hour traffic demand was estimated using standard transportation planning factors.

The analysis assumed:

Peak Hour Factor (K)

K = 0.10

Directional Distribution Factor (DD)

60%

Lane Distribution Factor (DL)

1.0

The resulting analysis indicates that substantial capacity is required to accommodate future freight demand under acceptable operating conditions.

5.7 Existing Freight Movement Characteristics

The freight movement analysis identified several key transportation patterns.

Karachi Port Generated Traffic

A significant proportion of truck traffic originates from Karachi Port and associated terminals.

SAPT Terminal Traffic

Containerized cargo movements generate substantial demand for regional connectivity.

Industrial Traffic

The following industrial areas contribute significantly to freight demand:

- Korangi Industrial Area
- Landhi Industrial Area
- SITE Industrial Area
- Port Qasim Industrial Zone

Regional Freight Traffic

Additional truck traffic utilizes the corridor for movement between Karachi and regional destinations.

5.8 Existing Freight Movement Routes

At present, freight traffic utilizes a combination of urban and regional transportation routes.

Existing Freight Route

Karachi Port

↓

East Wharf

↓

Mai Kolachi Road

↓

Urban Road Network

↓

M10 Northern Bypass

↓

Regional Highway Network

This route involves:

- Increased travel distance.
- Additional travel time.
- Congestion delays.
- Higher operating costs.

The proposed KPQC project is expected to provide a more direct and efficient alternative.

5.9 Jam Sadiq Bridge Analysis

Jam Sadiq Bridge represents one of the most important freight movement locations within the study area.

Traffic survey results indicate:

Table 5.5 — Jam Sadiq Bridge Truck Traffic

Vehicle Type	Daily Volume
2 Axle Trucks	4,886
3 Axle Trucks	2,564
4 Axle Trucks	1,677
5 Axle Trucks	150
6 Axle Trucks	211
Total	9,488

The survey demonstrates that Jam Sadiq Bridge currently serves as a major freight corridor and therefore represents a key justification for development of the proposed project.

5.10 Estate Avenue Analysis

Estate Avenue traffic surveys indicate substantial truck traffic movement between industrial areas and regional transportation corridors.

Table 5.6 — Estate Avenue Truck Traffic

Vehicle Type	Daily Volume
2 Axle Trucks	2,923
3 Axle Trucks	1,350
4 Axle Trucks	1,572
5 Axle Trucks	333
6 Axle Trucks	946
Total	7,123

The corridor currently accommodates significant freight demand associated with industrial and logistics activities.

5.11 M10 Traffic Analysis

Traffic surveys conducted on the M10 corridor indicate substantial utilization by heavy vehicles.

Table 5.7 — M10 Mid-Section Truck Traffic

Vehicle Type	Daily Volume
2 Axle Trucks	1,152
3 Axle Trucks	1,274
4 Axle Trucks	1,030
5 Axle Trucks	257
6 Axle Trucks	922
Total	4,636

These results demonstrate the importance of regional freight transportation corridors and highlight the benefits of providing a direct connection to Karachi Port.

5.12 Existing Capacity Constraints

The analysis identified several capacity constraints affecting traffic operations.

Congested Intersections

The following locations experience recurring congestion:

- Boat Basin
- Mai Kolachi Road
- Korangi Road
- Qayumabad
- Jam Sadiq Area

Freight Delays

Heavy vehicles experience delays due to:

- Traffic signals.
- Mixed traffic conditions.
- Restricted operating hours.
- Congested intersections.

Travel Time Reliability

Existing routes provide limited travel time reliability due to fluctuating traffic conditions.

5.13 Existing Road Safety Considerations

Existing freight movement routes involve interaction between heavy vehicles and local traffic.

Potential safety concerns include:

• Heavy vehicle conflicts.

• Lane changing movements.

• Mixed traffic operations.

• Congestion-related incidents.

Provision of a dedicated expressway facility is expected to reduce these conflicts and improve overall transportation safety.

5.14 Existing Level of Service Assessment

Based on observed traffic conditions, several locations within the study area are currently operating under constrained conditions.

Locations Experiencing Capacity Stress

• Jam Sadiq Bridge

• Boat Basin Area

• Mai Kolachi Corridor

• Korangi Road

• Qayumabad Area

Traffic conditions at these locations are expected to deteriorate further as freight demand continues to increase.

The proposed project will provide additional network capacity and reduce pressure on these corridors.

5.15 Existing Traffic Issues

The principal transportation issues identified during the assessment include:

Issue 1

Lack of direct connectivity between Karachi Port and the regional highway network.

Issue 2

High travel times for freight traffic.

Issue 3

Congestion on existing urban roads.

Issue 4

Operational restrictions on heavy vehicle movement.

Issue 5

Increased fuel consumption.

Issue 6

Higher transportation costs.

Issue 7

Road safety concerns associated with mixed traffic operations.

5.16 Summary

The existing traffic analysis confirms substantial freight transportation demand within the project influence area.

Traffic surveys indicate that Karachi Port, SAPT, industrial areas and regional freight traffic collectively generate significant heavy vehicle movements requiring improved transportation infrastructure.

The existing network experiences congestion, travel delays, operational restrictions and safety concerns that adversely affect freight mobility.

The proposed Karachi Port to Qayumabad Corridor Project provides an opportunity to address these issues through development of a dedicated access-controlled expressway facility capable of accommodating future transportation demand.

The following chapter presents future traffic demand forecasting and projected corridor utilization under future operating conditions.

CHAPTER 6

TRAFFIC DEMAND FORECASTING AND FUTURE TRAFFIC CONDITIONS

6.1 Introduction

Traffic forecasting is a fundamental component of the Traffic Impact Assessment process and provides the basis for evaluating future operational performance of the proposed Karachi Port to Qayumabad Corridor Project (KPQC).

The purpose of traffic forecasting is to estimate future traffic volumes likely to utilize the proposed corridor and determine whether the proposed infrastructure will provide sufficient capacity throughout its design life.

This chapter presents:

- Forecasting methodology.
- Traffic growth assumptions.
- Future traffic demand projections.
- Peak hour traffic forecasts.
- Capacity assessment.
- Future operational conditions.
- Design year traffic estimates.

The results provide justification for the proposed four-lane access-controlled expressway configuration.

6.2 Forecasting Methodology

Future traffic demand was estimated using a planning-level forecasting methodology based on:

Existing Traffic Conditions

Existing traffic survey data provides the baseline traffic demand.

Freight Demand Growth

Future growth in freight movement associated with Karachi Port and industrial development was considered.

Port Growth

Expected increases in cargo handling activities were considered.

Industrial Development

Growth within industrial zones was incorporated into the assessment.

Improved Corridor Accessibility

Additional traffic expected to utilize the corridor due to improved travel conditions was considered.

Traffic Diversion

Traffic currently utilizing indirect routes was assumed to transfer to the proposed corridor.

6.3 Base Year Traffic

The adopted base year demand is derived from the traffic demand assessment.

Table 6.1 — Adopted Base Year Traffic

Scenario	Heavy Vehicles per Day
Scenario 1	11,638
Scenario 2	12,470
Scenario 3	13,303

For planning purposes, Scenario 3 has been adopted as the design scenario.

The adopted base year traffic volume therefore equals:

13,303 Heavy Vehicles per Day

6.4 Traffic Growth Assumptions

Future traffic demand has been projected using a compound annual growth rate.

The following considerations support the selected growth rate:

Port Expansion

Future increases in containerized cargo movement.

Industrial Growth

Expansion of industrial activities within Karachi.

Economic Development

Long-term growth in trade and logistics demand.

Improved Connectivity

Attraction of traffic to the proposed corridor due to reduced travel times.

Logistics Sector Growth

Continued expansion of freight transportation services.

Based on these considerations, a growth rate of:

5% per annum

has been adopted for planning purposes.

This growth rate is considered appropriate for a strategic freight transportation corridor.

6.5 Forecast Years

Traffic demand has been forecast for the following assessment years:

Opening Year

2026

Medium-Term Assessment

2031

Long-Term Assessment

2036

These forecast years provide an indication of corridor performance over the planning horizon.

6.6 Future Traffic Demand

The future heavy vehicle demand was calculated using compound growth assumptions.

Table 6.2 — Future Heavy Vehicle Demand Forecast

Year	Heavy Vehicles per Day
2023 Base Year	13,303
2024	13,968
2025	14,666
2026 Opening Year	15,399
2031	19,650
2036	25,090

The results indicate substantial growth in freight traffic demand throughout the assessment period.

6.7 Future Vehicle Composition

The future vehicle composition is expected to remain generally consistent with existing traffic characteristics.

Table 6.3 — Forecast Vehicle Composition

Vehicle Type	Percentage
2 Axle Trucks	26%
3 Axle Trucks	42%
4 Axle Trucks	19%
5 Axle Trucks	3%
6 Axle Trucks	10%

The continued dominance of 2-Axle and 3-Axle trucks reflects existing freight transportation patterns associated with Karachi Port and industrial areas.

6.8 Peak Hour Traffic Forecast

Peak-hour traffic demand was estimated using standard transportation engineering assumptions.

Adopted Parameters

Parameter	Value
K Factor	0.10
Directional Distribution Factor	0.60
Lane Distribution Factor	1.00

The resulting peak-hour forecasts are presented below.

Table 6.4 — Future Peak Hour Traffic Forecast

Year	Peak Hour Heavy Vehicles
2026	1,540
2031	1,965
2036	2,509

These values represent the estimated peak-hour freight traffic demand expected to utilize the corridor.

6.9 Passenger Car Unit Analysis

To evaluate operational performance, future traffic demand was converted into Passenger Car Units (PCUs).

Table 6.5 — Future Demand in PCUs

Year	Estimated PCUs/Day
2026	47,170
2031	60,194
2036	76,900

The results indicate increasing demand throughout the planning horizon.

6.10 Future Traffic Distribution

Future traffic utilizing the corridor is expected to originate from:

Karachi Port

Containerized cargo traffic.

SAPT Terminal

Import and export freight.

Korangi Industrial Area

Industrial freight transportation.

Landhi Industrial Area

Commercial and industrial traffic.

SITE Industrial Area

Regional logistics traffic.

Port Qasim

Industrial freight movement.

Regional Highway Network

Through freight traffic.

The proposed corridor will provide direct connectivity between these traffic generators and the regional road network.

6.11 Capacity Assessment

A preliminary capacity assessment was undertaken to determine whether the proposed four-lane expressway configuration is sufficient to accommodate future demand.

Available Capacity

A four-lane access-controlled expressway provides substantial capacity under free-flow conditions.

The adopted operational assumptions indicate:

Expressway Capacity

Approximately 4,400 PCUs per hour

under ideal operating conditions.

The projected demand remains within acceptable operational limits throughout the planning horizon.

6.12 Level of Service Assessment

The anticipated operational performance of the corridor is summarized below.

Table 6.6 — Future Level of Service Assessment

Year	Expected LOS
2026	LOS B

Year	Expected LOS
2031	LOS B/C
2036	LOS C

The results indicate that the proposed corridor is expected to operate at acceptable levels of service throughout the planning period.

6.13 Travel Time Benefits

One of the primary objectives of the project is reduction of freight travel time.

The proposed corridor will:

• Reduce travel distance.

• Minimize delays.

• Reduce intersection stops.

• Improve reliability.

Estimated Travel Time Savings

15–25 Minutes per Trip

depending upon origin, destination and prevailing traffic conditions.

The resulting operational improvements are expected to generate substantial economic benefits.

6.14 Vehicle Operating Cost Benefits

The project is expected to reduce:

• Fuel consumption.

• Tire wear.

• Vehicle maintenance costs.

• Driver operating costs.

Estimated Fuel Savings

10–15%

per freight trip.

These benefits contribute significantly to the overall economic viability of the project.

6.15 Future Network Benefits

The project will provide several broader transportation benefits.

Freight Efficiency

Improved logistics performance.

Port Efficiency

Improved cargo movement.

Industrial Accessibility

Enhanced connectivity to industrial areas.

Reduced Congestion

Diversion of heavy vehicles from urban roads.

Improved Safety

Reduced interaction between freight and local traffic.

Environmental Benefits

Reduced emissions and fuel consumption.

6.16 Design Year Justification

The traffic forecasts indicate that future freight demand will continue to increase throughout the planning horizon.

The proposed four-lane access-controlled expressway provides sufficient capacity to accommodate forecast traffic demand while maintaining acceptable operational performance.

The proposed facility is therefore considered appropriate from a traffic planning perspective and adequately sized for the projected demand.

6.17 Summary

Traffic forecasting indicates strong future demand for the Karachi Port to Qayumabad Corridor Project.

The adopted design scenario forecasts growth from approximately 13,303 heavy vehicles per day to approximately 25,090 heavy vehicles per day by the year 2036.

The proposed four-lane expressway provides sufficient capacity to accommodate projected traffic demand while maintaining acceptable levels of service.

The forecast results demonstrate that the project is justified from both transportation and operational perspectives and will provide substantial benefits to freight movement, industrial accessibility and regional connectivity.

The following chapter presents the Construction Phase Traffic Impact Assessment and evaluates temporary impacts associated with project implementation.

CHAPTER 7

CONSTRUCTION PHASE TRAFFIC IMPACT ASSESSMENT

7.1 Introduction

Construction of the Karachi Port to Qayumabad Corridor Project (KPQC) will involve significant civil engineering activities over an estimated construction period of 24 to 30 months. During this period, temporary impacts on the existing transportation network are expected due to movement of construction vehicles, transportation of materials, temporary traffic diversions and work-zone activities.

This chapter evaluates the potential traffic impacts associated with project construction and identifies mitigation measures required to minimize disruption to road users and surrounding communities.

The assessment has been undertaken in accordance with accepted traffic engineering practices and environmental assessment requirements.

7.2 Construction Overview

The proposed project comprises a combination of elevated and at-grade infrastructure extending approximately 15.4 km between Karachi Port and the Qayumabad/Jam Sadiq Interchange area.

Major construction activities will include:

Preliminary Works

- Mobilization.
- Site establishment.
- Utility relocation.
- Survey and setting out.

Foundation Works

- Pile installation.
- Pile cap construction.
- Excavation works.

Structural Works

- Pier construction.
- Pier head construction.
- Girder erection.
- Segment launching.

Roadway Works

- Pavement construction.

• Drainage installation.

• Road furniture installation.

Toll Infrastructure

• Toll plaza construction.

• ITS installation.

• Communication systems.

These activities will generate temporary traffic impacts throughout the construction period.

7.3 Construction Traffic Characteristics

Construction traffic will consist primarily of heavy vehicles transporting construction materials, equipment and workforce personnel.

The anticipated vehicle categories include:

Material Transport Vehicles

• Dump trucks.

• Transit mixers.

• Reinforcement delivery trucks.

• Aggregate carriers.

Equipment Transport Vehicles

• Low-bed trailers.

• Heavy haulage vehicles.

• Mobile cranes.

• Equipment carriers.

Workforce Transport

• Staff buses.

• Vans.

• Pickups.

• Utility vehicles.

The majority of construction traffic is expected to be associated with movement of concrete, aggregates, reinforcement steel and structural components.

7.4 Estimated Construction Traffic Generation

Based on the scale of the project and industry experience from similar infrastructure projects, the anticipated construction traffic generation is summarized below.

Table 7.1 — Estimated Construction Traffic Generation

Vehicle Type	Estimated Trips per Day
Dump Trucks	350
Concrete Transit Mixers	120
Low-Bed Trailers	30
Pickups	60
Staff Buses	25
Equipment Carriers	20
Total	605

These estimates represent peak construction activity conditions and may vary depending on construction stage and work methodology.

7.5 Construction Haul Routes

Construction traffic is expected to utilize existing arterial roads and freight corridors connecting the project alignment with material sources and logistics facilities.

Primary haul routes are anticipated to include:

Route 1

Port Area

↓

Mai Kolachi Road

↓

Project Alignment

Route 2

Korangi Road

↓

Qayumabad

↓

Project Alignment

Route 3

M10 Northern Bypass

↓

Jam Sadiq Area

↓

Project Alignment

Selection of final haul routes will be coordinated with traffic authorities and relevant stakeholders.

7.6 Construction Work Zones

Temporary work zones will be established along various sections of the alignment.

These work zones may involve:

• Lane occupation.

• Shoulder closures.

• Temporary diversions.

• Temporary traffic control measures.

Work zones will be implemented progressively to minimize disruption to existing traffic operations.

7.7 Construction Phase Impact Assessment

Potential construction impacts have been evaluated in terms of traffic operations, safety and accessibility.

Traffic Flow Impacts

Temporary reductions in road capacity may occur due to:

• Lane closures.

• Equipment operations.

• Material deliveries.

• Temporary diversions.

Delay Impacts

Traffic delays may occur during:

• Peak construction activities.

• Girder erection operations.

• Utility relocation works.

• Ramp construction activities.

Accessibility Impacts

Temporary impacts on access to adjacent properties and businesses may occur during construction.

Appropriate mitigation measures will be implemented to maintain reasonable access.

7.8 Sensitive Locations

Several locations along the project corridor are expected to experience higher levels of construction-related traffic impacts.

Table 7.2 — Sensitive Locations and Impact Levels

Location	Impact Level
Boat Basin	High
Sunset Boulevard	High
Mai Kolachi Road	Medium to High
Korangi Road	Medium
Jam Sadiq Area	High
Port Access Roads	Medium

These locations will require enhanced traffic management measures during construction.

7.9 Lane Closure Assessment

Temporary lane closures may be required during certain construction activities.

Potential activities requiring lane occupation include:

• Pier construction.

• Girder erection.

• Utility relocation.

• Ramp construction.

• Pavement works.

Lane closures will be minimized wherever practicable and scheduled during off-peak periods.

7.10 Night-Time Construction Activities

Certain activities may be undertaken during night-time hours to minimize traffic disruption.

These activities may include:

• Segment launching.

• Girder erection.

• Utility crossings.

• Traffic switching operations.

Night-time construction will reduce impacts on daytime traffic while maintaining project progress.

7.11 Construction Phase Road Safety Assessment

Construction activities introduce additional safety risks due to interaction between road users and work-zone operations.

Potential safety concerns include:

Traffic Conflicts

Interaction between construction vehicles and public traffic.

Reduced Lane Widths

Temporary narrowing of available roadway.

Speed Variations

Differences in vehicle speeds approaching work zones.

Worker Safety

Exposure of construction personnel to traffic hazards.

Appropriate safety measures will be implemented throughout construction.

7.12 Emergency Access Considerations

Maintenance of emergency access is a critical requirement throughout project implementation.

The Contractor shall ensure:

- Continuous emergency vehicle access.
- Coordination with emergency services.
- Availability of alternative routes.
- Rapid incident response procedures.

Emergency access shall be maintained at all times.

7.13 Environmental Traffic Impacts During Construction

Traffic-related environmental impacts may include:

Air Quality Impacts

- Vehicle exhaust emissions.
- Dust generation.

Noise Impacts

- Construction equipment.
- Heavy vehicle movements.

Community Impacts

- Temporary inconvenience.
- Access restrictions.

These impacts are expected to be temporary and manageable through implementation of mitigation measures.

7.14 Construction Impact Matrix

Table 7.3 — Construction Traffic Impact Matrix

Impact	Magnitude	Duration	Significance
Traffic Delays	Medium	Temporary	Moderate
Lane Closures	Medium	Temporary	Moderate
Access Restrictions	Low	Temporary	Minor
Construction Vehicle Traffic	High	Temporary	Moderate
Road Safety Risks	Medium	Temporary	Moderate
Emergency Access Constraints	Low	Temporary	Minor

The assessment indicates that all identified impacts can be effectively managed through implementation of appropriate traffic management measures.

7.15 Mitigation Measures

The following mitigation measures are recommended:

Traffic Management

• Implement approved traffic diversion plans.

• Maintain minimum lane availability.

• Install advance warning signage.

• Deploy trained traffic marshals.

Construction Scheduling

• Undertake major activities during off-peak periods.

• Schedule girder launching during night-time hours.

• Minimize simultaneous work zones.

Public Information

• Notify affected stakeholders.

• Provide advance warning of traffic changes.

• Maintain communication with local authorities.

Safety Measures

- Install barriers and delineators.
- Implement reduced speed zones.
- Provide adequate lighting.
- Maintain emergency access routes.

7.16 Residual Impacts

Following implementation of the recommended mitigation measures, residual traffic impacts are expected to be:

Traffic Operations

Minor to Moderate

Safety

Minor

Accessibility

Minor

Environmental Impacts

Minor

The overall residual impact level is considered acceptable for a project of this scale and significance.

7.17 Summary

Construction of the Karachi Port to Qayumabad Corridor Project will generate temporary traffic impacts associated with construction vehicle movements, work-zone operations and lane occupation activities.

The most sensitive locations include Boat Basin, Sunset Boulevard, Mai Kolachi Road and the Jam Sadiq area.

Implementation of appropriate traffic management measures, construction scheduling strategies and safety controls will ensure that impacts remain manageable throughout the construction period.

The assessment concludes that construction-related traffic impacts are temporary in nature and can be effectively mitigated through implementation of the Construction Traffic Management Plan presented in the following chapter.

CHAPTER 9

OPERATIONAL PHASE TRAFFIC IMPACT ASSESSMENT

9.1 Introduction

This chapter presents an assessment of traffic operations and transportation impacts anticipated following commissioning of the Karachi Port to Qayumabad Corridor Project (KPQC).

The analysis evaluates the performance of the proposed expressway under future traffic conditions and examines the extent to which the project will improve freight mobility, reduce congestion, enhance road safety and support economic development.

The operational assessment has been undertaken using projected traffic demand, corridor characteristics and anticipated traffic diversion patterns.

9.2 Operational Scenario

Upon completion, the Karachi Port to Qayumabad Corridor Project will operate as a four-lane access-controlled toll expressway designed to accommodate freight and mixed traffic movements between Karachi Port and the regional transportation network.

The facility will provide:

• Direct connectivity to Karachi Port.

• Improved access to industrial areas.

• Reduced travel distances.

• Reduced travel times.

• Improved freight movement reliability.

• Enhanced road safety.

The project will operate continuously throughout the day, providing an alternative to existing congested routes.

9.3 Forecast Operational Demand

Traffic forecasts indicate significant utilization of the proposed facility.

Table 9.1 — Forecast Heavy Vehicle Demand

Year	Heavy Vehicles per Day
2026	15,399
2031	19,650
2036	25,090

The projected demand demonstrates the strategic importance of the corridor and confirms the need for additional transportation capacity.

9.4 Traffic Diversion Benefits

The project will attract traffic currently utilizing indirect and congested routes.

Primary sources of diverted traffic include:

Karachi Port Traffic
Freight traffic currently utilizing:

- Mai Kolachi Road
- M10 Corridor
- Northern Bypass

Industrial Area Traffic
Traffic originating from:

- Korangi Industrial Area
- Landhi Industrial Area
- SITE Industrial Area
- Port Qasim Industrial Zone

Regional Freight Traffic
Heavy vehicles accessing:

- M9 Motorway
- National Highway Network
- Northern Bypass

Diversion of these vehicles to the proposed corridor will improve traffic conditions on surrounding roads.

9.5 Travel Time Savings

One of the principal benefits of the project is reduction in travel time.

The existing route requires freight traffic to travel through congested urban roads and indirect highway connections.

The proposed corridor provides:

Existing Route
Karachi Port

↓

Urban Road Network

↓

Northern Bypass

↓

Regional Highway Network

Proposed Route

Karachi Port

↓

KPQC Expressway

↓

Jam Sadiq Interchange

↓

Shahrah-e-Bhutto Corridor

↓

Regional Highway Network

Estimated Travel Time Savings

15–25 Minutes Per Trip

depending upon destination and traffic conditions.

9.6 Travel Distance Reduction

The project is expected to reduce travel distance for a substantial proportion of freight traffic.

Estimated Distance Reduction

10–15 Kilometers Per Trip

The reduction in travel distance contributes directly to:

• Lower operating costs.

• Reduced fuel consumption.

• Reduced vehicle emissions.

• Improved logistics efficiency.

9.7 Level of Service Assessment

Future operational performance has been evaluated using forecast traffic volumes and available corridor capacity.

Table 9.2 — Forecast Level of Service

Year	Level of Service
2026	LOS B
2031	LOS B/C
2036	LOS C

The results indicate that the proposed four-lane expressway will operate within acceptable service levels throughout the planning horizon.

Traffic operations are expected to remain stable even under future growth conditions.

9.8 Capacity Utilization Assessment

The projected traffic demand remains below the practical capacity of the proposed expressway.

Table 9.3 — Capacity Utilization Assessment

Year	Utilization Level
2026	Moderate
2031	Moderate
2036	Moderate to High

The available capacity is considered sufficient to accommodate forecast demand without significant operational degradation.

9.9 Freight Mobility Improvements

The project will significantly improve freight mobility within Karachi.

Expected Improvements

- Faster movement of containerized cargo.
- Improved reliability of freight operations.
- Reduced congestion delays.
- Improved connectivity to industrial areas.
- Reduced logistics costs.

These benefits will strengthen Karachi’s role as Pakistan’s primary logistics and trade hub.

9.10 Port Connectivity Benefits

The project will improve operational connectivity between Karachi Port and the regional highway network.

Key Benefits

• Faster evacuation of containers.

• Improved access to terminals.

• Reduced queuing and delays.

• Enhanced cargo movement efficiency.

• Improved logistics performance.

The corridor will therefore contribute directly to improved port operations.

9.11 Road Safety Assessment

The project is expected to generate significant road safety benefits.

Existing Conditions

Under existing conditions, heavy vehicles interact extensively with local traffic, resulting in:

• Traffic conflicts.

• Reduced operating speeds.

• Safety risks.

Future Conditions

The proposed corridor will:

• Separate freight traffic from local traffic.

• Reduce conflict points.

• Improve geometric standards.

• Improve traffic flow.

• Reduce accident exposure.

Overall, the project is expected to contribute positively to transportation safety.

9.12 Environmental Traffic Benefits

The project is expected to generate several environmental benefits associated with improved traffic operations.

Air Quality Benefits

Reduced congestion and reduced travel distance will lower:

• Carbon dioxide emissions.

• Nitrogen oxide emissions.

• Particulate matter emissions.

Fuel Consumption Benefits

Estimated fuel savings:

10–15%

per freight trip.

Noise Benefits

Reduced stop-start traffic conditions are expected to reduce traffic-related noise in several urban areas.

9.13 Economic Benefits

The transportation improvements generated by the project will provide broader economic benefits.

Logistics Sector Benefits

- Reduced freight costs.
- Improved delivery reliability.
- Increased operational efficiency.

Industrial Sector Benefits

- Improved market access.
- Reduced transportation costs.
- Improved competitiveness.

Regional Benefits

- Enhanced trade facilitation.
- Increased economic productivity.
- Support for future investment.

9.14 Impact on Existing Road Network

The project is expected to reduce pressure on several existing transportation corridors.

Corridors Expected to Benefit

- Mai Kolachi Road.
- Korangi Road.
- Jam Sadiq Area.
- Qayumabad Area.
- Northern Bypass Connections.

Diversion of freight traffic to the proposed corridor will improve operating conditions on these facilities.

9.15 Operational Risk Assessment

Table 9.4 — Operational Risk Assessment

Risk	Probability	Severity	Risk Level
Traffic Congestion	Low	Medium	Low
Toll Plaza Delays	Medium	Low	Low
Traffic Incidents	Medium	Medium	Medium
Emergency Events	Low	High	Medium
Future Traffic Growth	Medium	Medium	Medium

Appropriate operational management measures will be required to address these risks.

9.16 Intelligent Transportation Systems (ITS)

To maximize operational efficiency, implementation of Intelligent Transportation Systems is recommended.

Potential ITS measures include:

• CCTV monitoring.

• Variable Message Signs (VMS).

• Traffic monitoring systems.

• Electronic toll collection.

• Incident detection systems.

These measures will improve operational performance and safety.

9.17 Operational Impact Matrix

Table 9.5 — Operational Impact Assessment Matrix

Impact Category	Impact Significance
Freight Mobility	Major Positive
Travel Time	Major Positive
Port Connectivity	Major Positive
Road Safety	Moderate Positive
Fuel Consumption	Moderate Positive
Air Quality	Moderate Positive
Economic Development	Major Positive

The overall operational impact of the project is strongly positive.

9.18 Summary

The operational assessment demonstrates that the Karachi Port to Qayumabad Corridor Project will provide substantial transportation benefits through improved freight mobility, reduced travel times and enhanced connectivity between Karachi Port and the regional highway network.

Forecast traffic volumes indicate strong demand for the facility while capacity assessments confirm that the proposed four-lane configuration is sufficient to accommodate future traffic growth.

The project is expected to improve port efficiency, reduce congestion, enhance road safety and contribute positively to regional economic development.

Overall, the operational impacts of the project are considered highly beneficial and support implementation of the proposed corridor.

The following chapter evaluates the environmental traffic impacts associated with project construction and operation.

CHAPTER 10

ENVIRONMENTAL TRAFFIC ASSESSMENT

10.1 Introduction

This chapter evaluates the environmental impacts associated with traffic conditions during both the construction and operational phases of the Karachi Port to Qayumabad Corridor Project (KPQC).

Traffic-related environmental impacts are an important consideration within the Environmental Impact Assessment (EIA) process because transportation activities can influence air quality, noise levels, greenhouse gas emissions, community accessibility and overall environmental quality.

The objective of this chapter is to:

- Identify potential traffic-related environmental impacts.
- Assess the significance of these impacts.
- Evaluate environmental benefits associated with improved traffic operations.
- Develop appropriate mitigation measures.
- Support environmental decision-making.

10.2 Environmental Baseline Conditions

The project corridor traverses a highly urbanized environment characterized by:

Commercial Areas

- Boat Basin
- Mai Kolachi Corridor

Residential Areas

- Clifton Vicinity
- Defence Influence Area
- Qayumabad Vicinity

Industrial Areas

- Korangi Industrial Area
- Landhi Industrial Area
- SITE Industrial Area

Port Facilities

- Karachi Port
- East Wharf

• SAPT Terminal

Existing environmental conditions are influenced by substantial traffic volumes, freight movement and urban development activities.

10.3 Traffic-Related Environmental Receptors

Environmental receptors potentially affected by transportation activities include:

Residential Areas

Residents living adjacent to transportation corridors.

Commercial Areas

Businesses dependent upon uninterrupted accessibility.

Educational Facilities

Schools and educational institutions located near project influence areas.

Healthcare Facilities

Hospitals and clinics requiring reliable accessibility.

Public Infrastructure

Transportation facilities and public utilities.

These receptors have been considered during assessment of potential impacts.

10.4 Construction Phase Environmental Impacts

Construction activities will generate temporary environmental impacts associated with traffic and transportation operations.

Potential impacts include:

Increased Construction Vehicle Traffic

Movement of heavy construction vehicles.

Temporary Congestion

Localized traffic delays.

Increased Fuel Consumption

Associated with construction activities.

Dust Generation

Construction vehicle movement on unpaved surfaces.

Noise Generation

Heavy equipment and vehicle operations.

The impacts are temporary and limited to the construction period.

10.5 Construction Phase Air Quality Impacts

Construction-related traffic can contribute to localized air quality impacts through vehicle exhaust emissions and dust generation.

Potential pollutants include:

Carbon Monoxide (CO)
Generated through vehicle operations.

Nitrogen Oxides (NOx)
Produced by diesel-powered equipment.

Particulate Matter (PM10)
Associated with vehicle movement and earthworks.

Fine Particulate Matter (PM2.5)
Generated by combustion processes.

The magnitude of impacts is expected to vary according to construction activity levels.

10.6 Construction Phase Noise Impacts

Construction traffic will generate temporary increases in noise levels.

Primary noise sources include:

- Dump trucks.
- Transit mixers.
- Cranes.
- Construction equipment.
- Material delivery vehicles.

Noise impacts are expected to be temporary and localized.

Night-time activities should be carefully managed to minimize disturbance to nearby communities.

10.7 Construction Phase Community Impacts

Temporary impacts on surrounding communities may include:

Traffic Delays
Temporary inconvenience to road users.

Accessibility Restrictions
Temporary changes in access arrangements.

Increased Heavy Vehicle Presence
Higher construction traffic volumes.

Visual Impacts

Temporary work-zone infrastructure.

The implementation of the Construction Traffic Management Plan will substantially reduce these impacts.

10.8 Construction Phase Environmental Mitigation Measures

The following measures are recommended:

Air Quality Management

- Regular water spraying.
- Vehicle maintenance.
- Dust suppression measures.
- Covered transport of fine materials.

Noise Management

- Equipment maintenance.
- Noise control measures.
- Scheduling of noisy activities.
- Community notification.

Traffic Management

- Traffic diversions.
- Traffic marshals.
- Advance warning signage.
- Off-peak construction scheduling.

These measures are expected to reduce environmental impacts to acceptable levels.

10.9 Operational Phase Environmental Assessment

Following completion of construction, the project is expected to generate significant environmental benefits due to improved traffic operations.

Key operational improvements include:

- Reduced congestion.
- Reduced travel distance.
- Improved traffic flow.
- Reduced vehicle idling.
- Reduced stop-and-go conditions.

These improvements are expected to positively influence environmental performance.

10.10 Operational Air Quality Benefits

The proposed corridor is expected to reduce vehicle emissions through improved traffic efficiency.

Benefits Include

- Reduced travel times.
- Reduced congestion.
- Reduced vehicle idling.
- Reduced fuel consumption.

Pollutants Expected to Reduce

- Carbon Dioxide (CO_2)
- Nitrogen Oxides (NOx)
- Sulphur Oxides (SOx)
- Particulate Matter (PM10)
- Fine Particulate Matter (PM2.5)

The overall impact on air quality is expected to be positive.

10.11 Greenhouse Gas Emissions

Transportation activities are a significant source of greenhouse gas emissions.

The proposed project is expected to contribute to emission reductions through:

Reduced Travel Distances

Estimated reduction:

10–15 km per trip.

Reduced Travel Times

Estimated reduction:

15–25 minutes per trip.

Reduced Fuel Consumption

Estimated reduction:

10–15%.

These improvements will contribute to reduced greenhouse gas emissions over the operational life of the project.

10.12 Fuel Consumption Assessment

Existing freight routes involve:

- Longer travel distances.

• Congestion delays.

• Stop-start traffic conditions.

The proposed corridor will improve operational efficiency and reduce fuel consumption.

Expected Fuel Savings

10–15%

per freight trip.

The resulting reduction in fuel usage will provide both environmental and economic benefits.

10.13 Noise Impact Assessment

The operational phase is expected to influence traffic-related noise conditions.

Positive Effects

• Reduced congestion.

• Smoother traffic flow.

• Reduced vehicle acceleration and braking.

Potential Concerns

• Increased traffic concentration near corridor approaches.

• Increased traffic volumes at toll plazas.

Overall, operational noise impacts are expected to be manageable through appropriate design and operational controls.

10.14 Community Accessibility Assessment

The project is expected to improve accessibility for several user groups.

Freight Operators

Improved regional connectivity.

Industrial Areas

Improved access to markets and logistics facilities.

Port Users

Improved access to port infrastructure.

Regional Traffic

Improved connectivity to regional transportation corridors.

The project is therefore expected to provide positive accessibility benefits.

10.15 Road Safety and Environmental Benefits

Traffic safety improvements provide indirect environmental benefits through reduction in incidents and congestion.

Expected benefits include:

Reduced Conflict Points
Separation of freight traffic from local traffic.

Reduced Congestion
Improved traffic operations.

Reduced Incident Risk
Improved geometric standards.

Improved Emergency Access
Enhanced transportation reliability.

These improvements contribute positively to environmental quality and community well-being.

10.16 Environmental Impact Matrix

Table 10.1 — Environmental Impact Assessment Matrix

Impact Category	Construction Phase	Operational Phase
Air Quality	Moderate Negative	Moderate Positive
Noise	Moderate Negative	Minor Positive
Fuel Consumption	Minor Negative	Major Positive
GHG Emissions	Minor Negative	Major Positive
Community Accessibility	Minor Negative	Moderate Positive
Road Safety	Minor Negative	Major Positive
Traffic Efficiency	Minor Negative	Major Positive

The assessment indicates that long-term operational benefits significantly outweigh temporary construction impacts.

10.17 Environmental Significance Assessment

Construction Phase
Temporary impacts are expected to be:

- Localized.
- Short-term.
- Reversible.

• Manageable.

Operational Phase

Operational impacts are expected to be:

• Long-term.

• Positive.

• Regionally beneficial.

• Sustainable.

Overall environmental significance is considered positive.

10.18 Cumulative Environmental Benefits

The project contributes to broader transportation and environmental objectives by:

• Improving logistics efficiency.

• Supporting economic growth.

• Reducing traffic congestion.

• Reducing vehicle emissions.

• Improving road safety.

• Supporting sustainable transportation development.

These cumulative benefits strengthen the overall justification for project implementation.

10.19 Monitoring Requirements

The following monitoring activities are recommended:

Construction Phase

• Traffic monitoring.

• Dust monitoring.

• Noise monitoring.

• Public complaint tracking.

Operational Phase

• Traffic volume monitoring.

• Travel time monitoring.

• Road safety monitoring.

• Emission reduction assessment.

Regular monitoring will ensure continued environmental compliance and operational effectiveness.

10.20 Summary

The Environmental Traffic Assessment indicates that the Karachi Port to Qayumabad Corridor Project will generate temporary construction-related environmental impacts associated with traffic operations, construction vehicle movements and work-zone activities.

These impacts can be effectively mitigated through implementation of the Construction Traffic Management Plan and recommended environmental management measures.

During operation, the project is expected to provide substantial environmental benefits through reduced travel times, reduced congestion, reduced fuel consumption and lower vehicle emissions.

The assessment concludes that the long-term environmental benefits of the project significantly outweigh the temporary construction-related impacts and that the project is environmentally acceptable from a transportation perspective.

The following chapter presents the overall conclusions and recommendations of the Traffic Impact Assessment.

CHAPTER 11

CONCLUSIONS AND RECOMMENDATIONS

11.1 Introduction

This Traffic Impact Assessment (TIA) has been undertaken to evaluate the transportation implications of the proposed Karachi Port to Qayumabad Corridor Project (KPQC), a strategically important urban expressway intended to improve connectivity between Karachi Port and the regional highway network.

The assessment has considered existing traffic conditions, freight movement characteristics, future traffic demand, construction phase impacts, operational performance and environmental considerations associated with the proposed development.

The study has been prepared using available traffic surveys, demand forecasting studies, project planning information and accepted transportation engineering practices.

The findings of this report demonstrate that the proposed project will provide substantial transportation, economic and environmental benefits while supporting the long-term mobility requirements of Karachi.

11.2 Summary of Existing Conditions

The traffic surveys and transportation studies undertaken for the project indicate that the existing road network experiences significant freight-related traffic demand generated by Karachi Port and surrounding industrial areas.

The assessment identified the following key transportation characteristics:

Freight Demand

The project corridor currently accommodates substantial freight traffic generated by:

- Karachi Port
- SAPT Terminal
- Korangi Industrial Area
- Landhi Industrial Area
- SITE Industrial Area
- Port Qasim Industrial Zone

Existing Traffic Volumes

The demand assessment identified heavy vehicle demand ranging between:

11,638 and 13,303 Heavy Vehicles per Day

under various operational scenarios.

Existing Constraints

The current transportation network experiences:

• Traffic congestion.

• Long travel times.

• Indirect freight routes.

• Increased logistics costs.

• Operational restrictions on heavy vehicles.

• Road safety concerns.

The existing conditions clearly demonstrate the need for improved freight transportation infrastructure.

11.3 Summary of Forecast Traffic Conditions

Future traffic forecasts indicate continued growth in freight transportation demand associated with:

• Port expansion.

• Industrial development.

• Economic growth.

• Increased logistics activity.

The adopted planning scenario forecasts heavy vehicle demand increasing from approximately:

13,303 Heavy Vehicles per Day

to approximately

25,090 Heavy Vehicles per Day

by the year 2036.

The projected increase in demand confirms the strategic need for additional transportation capacity within the corridor.

11.4 Traffic Engineering Conclusions

Based upon the traffic analysis undertaken, the following conclusions are reached:

Conclusion 1

The proposed Karachi Port to Qayumabad Corridor Project is technically justified from a transportation planning perspective.

Conclusion 2

The proposed four-lane access-controlled expressway provides sufficient capacity to accommodate forecast traffic demand throughout the planning horizon.

Conclusion 3

The corridor will significantly improve connectivity between Karachi Port and the regional transportation network.

Conclusion 4

The project will reduce freight travel times, improve reliability and reduce logistics costs.

Conclusion 5

The corridor will improve overall transportation efficiency and network performance within Karachi.

11.5 Construction Phase Conclusions

Construction activities will generate temporary traffic impacts associated with:

- Construction vehicle movements.
- Lane occupation.
- Temporary diversions.
- Work-zone operations.

The assessment indicates that:

Traffic Impacts

Temporary and manageable.

Road Safety Risks

Manageable through implementation of approved traffic control measures.

Accessibility Impacts

Temporary and localized.

Environmental Impacts

Temporary and reversible.

The proposed Construction Traffic Management Plan (TMP) provides an effective framework for minimizing these impacts.

11.6 Operational Phase Conclusions

The operational assessment indicates that the completed facility will provide significant transportation benefits.

Travel Time Benefits

Estimated travel time reductions of:

15–25 Minutes Per Trip

for freight vehicles.

Distance Reduction

Estimated travel distance reductions of:

10–15 Kilometers Per Trip

for a substantial proportion of freight traffic.

Fuel Consumption Benefits

Estimated reduction of:

10–15%

per freight trip.

Capacity Benefits

The facility will provide additional network capacity while maintaining acceptable Levels of Service.

Freight Mobility Benefits

Improved access to:

- Karachi Port.
- Industrial areas.
- Regional transportation corridors.

The operational impacts of the project are therefore considered strongly positive.

11.7 Environmental Conclusions

The Environmental Traffic Assessment indicates that:

Construction Phase

Environmental impacts are:

- Temporary.
- Localized.
- Reversible.
- Mitigable.

Operational Phase

Environmental impacts are predominantly positive and include:

- Reduced traffic congestion.
- Reduced fuel consumption.
- Reduced greenhouse gas emissions.
- Improved traffic flow.
- Improved road safety.

The long-term environmental benefits significantly outweigh temporary construction-related impacts.

11.8 Economic and Strategic Benefits

Implementation of the project will contribute positively to:

Freight Transportation

- Reduced logistics costs.
- Improved reliability.
- Improved operational efficiency.

Port Operations

- Faster cargo movement.
- Improved accessibility.
- Improved throughput efficiency.

Industrial Development

- Improved connectivity.
- Reduced transportation costs.
- Enhanced competitiveness.

Regional Economy

- Increased productivity.
- Improved trade facilitation.
- Support for future economic growth.

The project is therefore considered strategically important for Karachi and the wider national economy.

11.9 Recommended Conditions for Project Implementation

The following conditions are recommended for successful implementation of the project.

Condition 1

Implementation of the Construction Traffic Management Plan throughout the construction period.

Condition 2

Approval of temporary traffic diversion plans by relevant traffic authorities prior to implementation.

Condition 3

Maintenance of emergency access routes at all times.

Condition 4

Provision of adequate traffic control devices and signage.

Condition 5

Implementation of road safety measures at all work zones.

Condition 6

Coordination with Karachi Traffic Police and relevant stakeholders.

Condition 7

Implementation of environmental mitigation measures identified in the EIA.

Condition 8

Monitoring of traffic operations during both construction and operation phases.

11.10 Traffic Monitoring Recommendations

A traffic monitoring program should be established to assess operational performance following project commissioning.

Recommended Monitoring Activities

Traffic Volumes

Annual traffic counts.

Travel Times

Periodic travel time surveys.

Road Safety

Accident monitoring.

Toll Operations

Operational performance monitoring.

Environmental Performance

Assessment of traffic-related emissions and fuel consumption benefits.

Monitoring results should be reviewed periodically to support future transportation planning.

11.11 Residual Impact Assessment

Following implementation of the recommended mitigation measures:

Construction Phase Residual Impacts

Minor to Moderate.

Operational Phase Residual Impacts

Predominantly Positive.

No significant adverse residual transportation impacts are anticipated.

11.12 Overall Professional Opinion

Based upon:

- Existing traffic conditions.
- Traffic survey findings.
- Demand forecasting.
- Capacity assessment.
- Construction impact assessment.
- Operational assessment.
- Environmental assessment.

it is the professional opinion of the Consultant that the proposed Karachi Port to Qayumabad Corridor Project is:

Technically Feasible

Operationally Justified

Environmentally Acceptable

Economically Beneficial

Strategically Important
for the future transportation development of Karachi.

11.13 Final Recommendation

The Traffic Impact Assessment concludes that the Karachi Port to Qayumabad Corridor Project will provide substantial long-term transportation, environmental and economic benefits through improved freight mobility and enhanced connectivity between Karachi Port and the regional transportation network.

The temporary impacts associated with project construction can be effectively managed through implementation of the recommended Construction Traffic Management Plan and associated mitigation measures.

Accordingly, it is recommended that the project may proceed to detailed design, environmental approval and implementation subject to compliance with the mitigation measures, monitoring requirements and recommendations presented in this report.

Prepared By:
EA Consulting (Private) Limited

For:
PTQ Expressway (Private) Limited

Submitted To:
Sindh Environmental Protection Agency (SEPA)

Karachi, Sindh, Pakistan

June 2026

REFERENCES

The preparation of this Traffic Impact Assessment has been based upon the following documents, standards and technical references:

Project Documents

Karachi Port to Qayumabad Corridor Project – Request for Proposal (RFP) Documents.

Karachi Port to Qayumabad Corridor Project – Traffic Demand Assessment Report.

Karachi Port to Qayumabad Corridor Project – Traffic Survey Report.

Karachi Port to Qayumabad Corridor Project – Design Criteria and Geometric Design Parameters.

PPP Transaction Documents and Supporting Technical Studies.

Standards and Guidelines

AASHTO – A Policy on Geometric Design of Highways and Streets.

Highway Capacity Manual (HCM).

National Highway Authority (NHA) Highway Design Standards.

Sindh Environmental Protection Agency (SEPA) Environmental Assessment Guidelines.

Pakistan Environmental Protection Act.

International Best Practices in Traffic Impact Assessment.

International Best Practices in Construction Traffic Management.

ABBREVIATIONS

Abbreviation	Description
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
CO	Carbon Monoxide
CO_2	Carbon Dioxide
EIA	Environmental Impact Assessment
HCM	Highway Capacity Manual
ITS	Intelligent Transportation System
KPQC	Karachi Port to Qayumabad Corridor Project
LOS	Level of Service
NHA	National Highway Authority
NOx	Nitrogen Oxides
PCU	Passenger Car Unit
PM10	Particulate Matter
PM2.5	Fine Particulate Matter
PPP	Public Private Partnership
SAPT	South Asia Pakistan Terminal
SEPA	Sindh Environmental Protection Agency
TIA	Traffic Impact Assessment
TMP	Traffic Management Plan
WB-20	Design Truck Vehicle

DEFINITIONS

Access-Controlled Expressway

A highway facility where access is regulated through designated entry and exit points.

Level of Service (LOS)

A qualitative measure describing traffic operational conditions and user comfort.

Passenger Car Unit (PCU)

A unit used to convert different vehicle classes into equivalent passenger car values.

Peak Hour

The one-hour period during which maximum traffic demand occurs.

Traffic Impact Assessment (TIA)

A study undertaken to assess the transportation impacts associated with a proposed development or infrastructure project.

Traffic Management Plan (TMP)

A document defining measures required to manage traffic safely during construction activities.

APPENDIX A — Traffic Survey Data

Include:

- Jam Sadiq Bridge Traffic Counts
- Estate Avenue Traffic Counts
- M10 Traffic Counts
- Vehicle Classification Tables
- Number Plate Survey Data
- Daily Traffic Summary Tables

Table 1: Traffic Count Survey Data - Jam Sadiq Bridge - 24 hours

TRAFFIC VOLUME COUNT AT JAM SADIQ BRIDGE – 24 hours								
TRAFFIC EXPECTED TO BE TRANSFERRED TO MALIR EXPRESSWAY PHASE 1 DIRECTLY								
Location	Day	Direction	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
Jam Sadiq Bridge	1	Towards Brooks Ch	2321	1128	1034	59	136	4678
		From Brooks Ch	2602	1250	663	129	88	4732
	2	Towards Brooks Ch	2244	1463	907	41	122	4777
		From Brooks Ch	2449	1432	695	42	63	4681
	3	Towards Brooks Ch	2228	1198	1046	58	144	4674
		From Brooks Ch	2814	1221	685	122	80	4922
Three Day Total			14658	7692	5030	451	633	28464
Three Day Average			4886	2564	1677	150	211	9488

Table 2: Traffic Count Survey Data - Shersha (Port to Northern Bypass) - 24 hours

TRAFFIC VOLUME COUNT AT SHERSHA (FROM PORT TO NORTHERN BY-PASS) – 24 hours								
Location	Day	Direction	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
Shershah	14-Mar	To M10	1606	709	827	187	595	3924
	15-Mar	To M10	1597	784	740	199	531	3851
	16-Mar	To M10	1569	687	865	175	449	3745
	17-Mar	To M10	1399	766	813	130	512	3620
	18-Mar	To M10	1714	737	988	199	502	4140
	19-Mar	To M10	676	444	603	125	318	2166
	20-Mar	To M10	1670	597	666	150	403	3486
Seven Day One Direction's Total			10231	4724	5502	1165	3310	21446
Seven Day Both Directions' Total			20462	9448	11004	2330	6620	21008
Daily Average			2923	1350	1572	333	946	7123

Table 3: Day-time Traffic Count Survey Data - Shersha (Port to Northern Bypass) - 12 hours

AVERAGE DAY TIME TRAFFIC VOLUME COUNT AT SHERSHA (FROM PORT TO NORTHERN BY-PASS) – 12 hours day time								
Location	Day	Direction	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
Shershah 12 HOURS	14-Mar	To M10	1107	345	353	79	290	2174
	15-Mar	To M10	1102	374	319	81	259	2135
	16-Mar	To M10	1020	338	386	103	210	2057
	17-Mar	To M10	875	335	289	59	229	1787
	18-Mar	To M10	1115	357	463	107	255	2297
	19-Mar	To M10	412	191	335	62	197	1197
	20-Mar	To M10	1127	322	339	85	247	2120
Seven Day One Direction's Total			6758	2262	2484	576	1687	11647
Seven Day Both Directions' Total			13516	4524	4968	1152	3374	11593
Daily Average			1931	646	710	165	482	3933
DAILY FACTOR			1.514	2.088	2.215	2.023	1.962	1.811

Source: Traffic Survey for Malir Expressway Phase-I

Table 4: Day-time Traffic Count Survey Data – M10 (Shersha to M9)

AVERAGE DAY TIME TRAFFIC VOLUME COUNT AT M10 - FROM SHERSHAH TO M9								
Location	Day	Direction	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
M10 - FROM SHERSHAH TO M9 12 HOURS	17-Mar	To M10	67	154	174	63	187	645
	18-Mar	To M10	62	134	183	70	187	636
	19-Mar	To M10	45	89	167	52	177	530
	20-Mar	To M10	94	105	147	29	183	558
04 Day One Direction's Total			268	482	671	214	734	2369
04 Day Both Directions' Total			536	964	1342	428	1468	4738
Daily Average			134	241	336	107	367	1185

Table 6: Day-time Traffic Count Survey Data – M10 (Mid-Section)

AVERAGE DAY TIME TRAFFIC VOLUME COUNT AT M10 - MID SECTION								
Location	Day	Direction	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
M10 - MID SECTION 12 HOURS	14-Mar	To M10	205	298	195	18	194	910
	15-Mar	To M10	205	213	183	20	188	809
	16-Mar	To M10	159	187	200	7	222	775
	17-Mar	To M10	157	164	177	68	192	758
	18-Mar	To M10	148	147	185	74	196	750
	19-Mar	To M10	167	194	189	52	179	781
	20-Mar	To M10	202	137	177	82	196	794
Seven Day One Direction's Total			1243	1340	1306	321	1367	4783
Seven Day Both Directions' Total			2486	2680	2612	642	2734	4667
Daily Average			355	383	373	92	391	1593
DAILY FACTOR			3.244	3.328	2.761	2.804	2.361	2.909

Table 5: Traffic Count Survey Data – M10 (Mid-Section)

TRAFFIC VOLUME COUNT AT M10 - MID SECTION – 24 hours								
Location	Day	Direction	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
M10 - MID SECTION	14-Mar	To M10	624	750	555	125	500	2554
	15-Mar	To M10	575	716	491	114	557	2453
	16-Mar	To M10	545	636	570	87	524	2362
	17-Mar	To M10	592	676	556	132	398	2354
	18-Mar	To M10	539	653	602	103	455	2352
	19-Mar	To M10	486	495	333	85	315	1714
	20-Mar	To M10	671	534	499	254	478	2436
Seven Day One Direction's Total			4032	4460	3606	900	3227	13789
Seven Day Both Directions' Total			8064	8920	7212	1800	6454	13671
Daily Average			1152	1274	1030	257	922	4636

Source: Traffic Survey for Malir Expressway Phase-I

APPENDIX B — Traffic Demand Forecast Tables

4.1 SCENARIO 1

Using the Total Truck Traffic of Jam Sadiq Bridge and Day time traffic coming from port to M10 the Demand in Scenario 1 has been estimated. Following are the traffic volumes:

Table 24: Travel Demand Estimation Table - Scenario 01

Travel Demand Estimation Scenario 1 - Traffic from Jam Sadiq (24 hrs) and Northern By-pass Port Traffic Only

Location	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
Jam Sadiq (24hrs)	4886	2564	1677	150	211	9488
Northern By-pass Port Traffic Only (12 hrs)	17	63	123	31	118	352
Total Demand	4903	2627	1800	181	329	9840

4.2 SCENARIO 2

Using the Total Truck Traffic of Jam Sadiq Bridge and Day time traffic coming from port to M10 and site to M10 the Demand in Scenario 2 has been estimated. Following are the traffic volumes:

Table 25: Travel Demand Estimation Table - Scenario 02

Travel Demand Estimation Scenario 2 - Traffic from Jam Sadiq (24 hrs) and Northern By-pass Port Traffic (12hrs) and Site Area (12hrs)

Location	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
Jam Sadiq (24hrs)	4886	2564	1677	150	211	9488
Northern By-pass Port Traffic Only (12 hrs)	17	63	123	31	118	352
Northern By-pass Site Traffic (12 Hours)	117	178	212	76	249	833
Total Demand	5020	2805	2012	257	578	10673

4.3 SCENARIO 3

Using the Total Truck Traffic of Jam Sadiq Bridge and Day time traffic coming from port to M10 and 24 hour traffic from site to M10 the Demand in Scenario 3 has been estimated. Following are the traffic volumes:

Table 26: Travel Demand Estimation Table - Scenario 03

Travel Demand Estimation Scenario 3 - Traffic from Jam Sadiq (24 hrs) and Northern By-pass Port Traffic (12hrs) and Site Area (24hrs)

Location	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
Jam Sadiq (24hrs)	4886	2564	1677	150	211	9488
Northern By-pass Port Traffic Only (12 hrs)	17	63	123	31	118	352
Northern By-pass Site Traffic (24 hrs)	235	356	425	152	497	1665
Total Demand	5137	2983	2225	333	827	11505

Table 27: Situational Analysis Traffic Count Data Table

Northern By-pass						
Location	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
Northern bypass 2018 traffic	1181	1371	1001	210	1137	4900
Northern bypass Expected Traffic 2023	1550	1800	1314	276	1493	6433
Existing Traffic of Northern By-Pass	1152	1274	1030	257	922	4636
Addition Demand to be added	398	526	284	19	571	1798

4.5 FINALIZED DEMAND OF EACH SCENARIO

After addition of the above demand in each scenario, following results were tabulated:

Table 28: Finalized Demand Data Table of Each Analysis Scenario

Demand Analysis Final Results						
Scenarios n	2 Axle Truck	3 Axle Truck	4 Axle Truck	5 Axle Truck	6 Axle Truck	Total
Scenario 1	5301	3152	2084	200	900	11638
Scenario 2	5418	3331	2296	276	1149	12470
Scenario 3	5536	3509	2509	352	1398	13303

Traffic Demand Scenarios

Scenario	Daily Heavy Vehicles
Scenario 1	11,638
Scenario 2	12,470
Scenario 3	13,303

Future Traffic Forecast

Year	Daily Heavy Vehicles
2026	15,399
2031	19,650
2036	25,090

APPENDIX C —Traffic Management Plan

A comprehensive Traffic Management Plan will be prepared at the time of construction and will include:

- Traffic Diversion Plans
- Work Zone Layouts
- Temporary Signage Layouts
- Emergency Response Procedures
- Traffic Marshal Deployment Plan

APPENDIX D — Project Design Information

- Project Design Summary

Parameter	Value
Project Length	15.4 km
Design Speed	80 km/h
Ramp Design Speed	40 km/h
Toll Plazas	3
Ramps	6
Design Vehicle	WB-20
Estimated Cost	PKR 64.2 Billion
Construction Duration	24–30 Months

APPENDIX E — Project Alignment Information

Appendix E is presented separately and includes:

- Route Alignment Drawings
- Location Maps
- Corridor Maps
- General Arrangement Drawings

APPENDIX F — Traffic Survey Photographs







Figure 2: Traffic Count Survey Execution Activity - Camera Mounted to record Traffic Data at Various Survey Locations

CONSULTANT CERTIFICATION

Consultant's Declaration

EA Consulting (Private) Limited hereby certifies that this Traffic Impact Assessment has been prepared using available project information, traffic survey data, engineering standards and professional transportation planning practices. The findings and recommendations presented in this report represent the Consultant's professional opinion based upon information available at the time of preparation.

Prepared By:

- EA Consulting (Private) Limited
- Date: June 2026

— END OF REPORT —

ANNEX XII - PROJECT NOCS

NO. D.D(Admn)/D. G (A&A)/CTA&AD/Malir-Express-way/2025/2659

Government of Sindh
Directorate General of Antiquities & Archaeology
Culture, Tourism, Antiquities & Archives Department
House No. C-82, Block-02, Clifton, Karachi.

Karachi, dated 23rd of July, 2025

To,

Mr. Mohibullah Jafri,
Senior Director,
Traffic Engineering Bureau,
Karachi Development Authority,
Karachi.

SUBJECT: **FEASIBILITY STUDY AND TRANSACTION ADVISORY SERVICES FOR DEVELOPMENT OF MALIR EXPRESSWAY PROJECT PHASE-I (UNDER PUBLIC PRIVATE PARTNERSHIP MODE).**

I am directed to refer to your letter No. Se.Dir/TEB/KDA/2025/20 dated 04-07-2025 on the subject matter and to enclose herewith a list of heritage buildings falls under the jurisdiction of District Malir, Karachi which are protected heritage under the Sindh Cultural Heritage (Preservation) Act, 1994. **(copy enclosed)**

02. It is imperative to bring to your attention that if any of these protected monuments or heritage sites are located near or along the proposed alignment of the Malir Expressway Project (Phase-I), it is essential that these may be preserved and safeguarded, in order to avoid any destruction, alteration, or vandalism of any kind should occur to these sites during the course of development and execution of the project.

03. Your cooperation in ensuring the safety and preservation of these historical assets is earnestly solicited.

23/07/2025

(ABID HUSSAIN CHANDIO)
Deputy Director (Admn)

Copy forwarded for information and taking necessary action to:

1. P.S to the Secretary, CTA&AD, Govt. of Sindh, Karachi.
2. P.A. to the Director General (Antiquities & Archaeology) CTA&AD, Govt. of Sindh, Karachi.
3. Office/Master File

DIRECTOR GENERAL OF ANTIQUITIES & ARCHAEOLOGY C-82 Block-2 Clifton Karachi

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DISTRICT MALIR (KARACHI)				
1.	Unknown	--	Darsano Channo Malir.	
2.	Amadhi / Grave Of Bhao Molram And Assu Wanyo	--	Molram Compound, Mohabbat Nagar Assu Goth Malir.	
3.	Ansari Building	5/A.B	Assu Village, Malir City, Karachi..	
4.	Archaeological Site, Stonehenge, Stone Circle And Old Graveyard.	--	Sohai Nala Hill Torrents Deh Khadeji, DHA City, UC Chohar, Gadap.	
5.	Archaeological Site Allah Dino / Allah Dino.	--	Near Malir, Damloti, Deh Kharkharo, 40 KM From Karachi City.	
6.	Asahabi Waro Muqam	--	Left Bank Of Malir River Near Nabi Bakhsh Bikik And Faqeer Mohammad Baloch Goth Malh, Deh Chuhar, UC Chuhar.	
7.	Atta Catering Building	--	Main National Highway Near K-Electric Office Malir City.	
8.	Baloch Graveyard	--	Near Ramzan Joghi Village,Memon Goth Road Close To Thado Nadi.	
9.	Chowkandi Graveyard	--	Near Dawood Shoro Village, Deh Khanto.	
10.	Contracted Buriel Graves /	--	This Archeaological Site Located Near Gul Mohammd Kanro Village, Deh Tarrari UC.	
11.	Damlotti Water Tank	--	Damlotti No. 3 And 6, Deh Kharkharo, Malir, Karachi..	
12.	Damlotti Water Well / Damlotti Water Works	--	Right Bank Of Malir River, From Road To Memon Goth, Deh Kharkharo, Bazar, Deh Malh And Deh Amilano.	
13.	Damlotti Well No.06, Pumping Room	--	Near Jummah Jokhio Goth, Damlotti No.6, Deh Kharkharo.	
14.	Damlotti Well No.7 / Damlotti Water Works	--	Damlotti Well No.7, Jumma Goth, Deh Kharkharo.	
15.	Deh Gohar Stone Carving Graving Graveyard/ Romi, Ghariyoo	--	Inside Boundary Wall Of IT City, Land Education City, Darsano Chano To Link Road, Deh Chohar, UC Chohar.	
16.	Dher Waro Maqam	--	Near Haji Adam Rind Ghot, Dher Shareef,	

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			Deh Chohar, UC Chohar.	
17.	Doonhee Waro Muqam	--	Located South East Of Port Qasim In Sodagar Creek Near Rehri Mian Village.	
18.	Gallery Control System & Chambers	--	Three Main Chambers On Control System, Near Damlotti Bungalow And Others Chamber From Link Road, Well No.8, Via Malir Cantt To Islamia.	
19.	Gohar Ban Archaeological Site And Stone Graves	--	Deh Kathore, Right Bank Of Malir River, 1 KM From Northern Side Of Super Highway, UC Kathore.	
20.	Haalo Tabarrko Island	--	Left Bank Of Gharo Creek, Near Coal Plant Of Port Qasim.	
21.	Haji Notak Wari Roomi/ Roomi	--	Near Rozi Gonder And Noshervan Gondar Village, Left Bank Of Thado River.	
22.	Imam Bux Village Graveyard/ Roomi	--	Two KM Towards East Of Imam Bux Vilage, Near Khar Wildlife Centre Building.	
23.	Inspection Bungalow Malir / Malir Bungalow	--	Damlotti Road Near Memon Goth, Right Bank Of Malir River, Deh Kharkharo.	
24.	Juma Kachelo Village, Rock Carving Graveyard/ Ghariyoo	--	Near Juma Kachelo Village, Right Of Jarando River, Deh Kathore.	
25.	Kaafran Joon Qabroon		Moaidan At Right Side Of Gadap Kand Road, South Of Gadap City.	
26.	Kand Wari Roomi (Rock Carving Graveyard) / Stone Row And Monolith.	--	Deh Kand, U.C Moaidan 135 KM From North Of Karachi.	
27.	Kand Wari Roomi/ Stone Row And Monolith.	--	Deh Kand, U.C Moaidan 135 KM From North Of Karachi.	
28.	Link Road Wariyoon Ghariyoon/ Damlotti Graves.	--	Link Road, Right Bank Malir River Near Damlotti No. 8.	
29.	Malir Bungalow New / White House	--	Damlotti Road, Behind Memon Goth, Deh	

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			Kharkharo Malir, Karachi.	
30.	Malir Mandir (Temple)	--	Assu Village, National Highway Malir.	
31.	Malir Railway Station	--	Malir City	
32.	Malir Wari Gharhi	--	Port Qasim, Industrial Area, Ghaghar Port Qasim Road, Deh Pipri, Malir.	
33.	Manak Wari Gharri	--	Port Qasim, Industrial Area, Ghaghar Port Qasim Road, Deh Pipri, Malir.	
34.	Matara's Stone Carved Graves, Stone Circle And Unusual Size Grave / Matara's Graves And As-Haabi.	--	At The Top Of Narathar Hill, Deh Narathar, Gadap Road.	
35.	Mello Bhuti Archaeological Site/ Usman Bagh Waro Muqam.	--	Near Usman Baloch Bagh, Right Bank Of Mello Hill Stream, Deh Bholhari UC Gadap.	
36.	Mokhi Jo Maikhano/ Kafaran Ja Ghar	--	Southern Side Of Narathar Hill One KM East Of Sohrab Faqeer Village, Deh Narathar.	
37.	Mokhi's Dargah/ Mai Mokhi	--	Near Babu Patni Village	
38.	Mubarak Manzil	--	National Highway, Deh Thano.	
39.	Muhammad Shah Graveyard And Menhirs Kand/Rohee And Muqam	--	Muhammad Shah Graveyard Gadap Kand Road Bordering Wand Kand.	
40.	Murredke Degh / Stone Circle.	--	Raza Mohammad Village	
41.	Narathar Hill Menhir Stone Circle And Graveyard / Ali Shah Waro Muqaam.	--	South West Narathar Hill, Deh Narathar On Old Track Of Kech Sindh.	
42.	Peer Kohi Dargah / Part Of Saazen Chowkandi.	--	National Highway Peer Kohi Dargah, Near Shafi Goth Graveyard, Deh Khanto, Malir.	
43.	Peer Majno Graveyard	--	Peer Majno Graveyard, Deh Ghaghar Port Qasim Industrial Area.	
44.	Petroglyph On The Bank Of Thaddo River/ Chitt	--	Near Thado Dam, Deh Bhulhari, UC Gadap.	
45.	Rashan Office Building / Ghulam Hussain Khuwaja Building.	--	Assu Village, Malir City, Karachi.	
46.	Rato Kote	--	Rato Kote Is Located Phitti	

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			Creek Near Ibrahim Hydri Village, Indus Delta.	
47.	Rest House / Education Department Office.	--	Assu Village, Malir City, Karachi..	
48.	Saazen Chowkandi / Baghar Wala / Keryen Wari	--	National Highway, Behind Abdul Majeed Sindhi Society, Deh Khanto, District Malir.	
49.	Shree Ram Wari Building 1883 / Rambari Building And Remani Centre.	--	Main Memon Goth Road, Malir City Opp: Mona Brohi Market.	
50.	Stone Carved Graves	--	At The Gadap Road, Part Of Narathar Hill.	
51.	Stone Circle (Kotro) / Hadiro And Kote.	--	Deh Wan Kand, U.C Moaidan.	
52.	Stone Circle Hadi Bux Gabol Village / Kafar Kot.	--	Near Hadi Bux Gabol Village, Deh Kathore.	
53.	Stonehenge Megalithic Monument/ Stone Row And Monolith	--	Two KM In South From Thohar Kanro Village.	
54.	Tor War Roomi Neat Bijar Buthi.	--	Deh Tor And Bijar Buthi, Right Band Of Lat River.	
55.	Unknown (Stone Carving Graves).	--	Poultry State Deh Kharkharo.	
56.	Unknown Stone Carving Grave / Ghari.	--	Near Tori Hill Stream, Faiz Mohammad Burro Goth, Kathore Mole Road Deh Kathore UC Kathore.	
57.	Waghoo Dhar (Crocodile Hole)/ Chashma Goth.	--	Chashma Village, Rehri Ibrahim Hydari Road Near Eliyas Jut Village, Korangi Fish Horbor.	
58.	Yousif Shah Graveyard Gharri's.	--	Yousif Shah Graveyard Near Yousif Shah Dargah, Darsano Chano.	

23/07/2025

DIRECTORATE GENERAL OF ANTIQUITES & ARCHAEOLOGY
C-82 Block-2 Clifton Karachi

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AEE (TCO)

To,
Traffic Engineering Department,
Karachi Development Authority,
Karachi.

WITHOUT PREJUDICE
Ref#HOD/TM/25/102
Date: October 27, 2025

Attention: Mr. Junaid Ahmed Siddiqui (Superintending Engineer (Dev.)

Subject: FEASIBILITY STUDY AND TRANSACTION ADVISORY SERVICES FOR THE DEVELOPMENT OF MALIR EXPRESSWAY PROJECT PHASE-I (KARACHI PORT TRUST TO QAYUMABAD CORRIDORE PROJECT) (UNDER PUBLIC PRIVATE PARTNERSHIP MODE).

Traffic Engineering Bureau Received 492 Dispatched on 30/10/2025 Karachi Development Authority

Reference:
1. Your Letter No. Sr.Dir/TEB/KDA/2025/32 Dated Sept 12, 2025
2. KE Ref# HOD/TM/25/70 Dated Sept 05, 2025
3. KE Ref# HOD/TM/25/56 Dated Aug 11, 2025
4. KE Ref# HOD/TM/25/52 Dated: August 1, 2025
5. Your Letter No. Sr. Dir/TEB/KDA/2025/30 Dated July 30th, 2025
6. Meeting with K-Electric Ltd EHT team Dated July 22, 2025
7. KE Ref# PA&GR/2025/44 Dated July 18th, 2025
8. Your Letter No. Sr. Dir/TEB/KDA/2025/25/L Dated July 4th, 2025
9. KE Ref# HOD/TM/2025/76 Dated September 16th, 2025
10. Your Letter No. SE(Dev.)/ED/KDA/2025/160 Dated October 03th, 2025

Dear Sir,

Thank you for your letter detailing the para-wise response from the Malir Expressway Project Phase-I team. We appreciate the clarification and commit to timely cooperation for the smooth implementation of this important initiative. Our responses are as follows:

Response to Para A: We understand the project is at the Transaction Advisory stage and that limited right-of-way constrains multiple alignment options, keeping the preliminary drawings substantially unchanged.
However, the first joint survey confirmed numerous areas where K-Electric's EHT overhead and underground infrastructure lies, where complete relocation or shifting is not practically or technically feasible (Regarding distribution network, please take up separately, as agreed, with concerned team).
The complexity of these interfaces, especially concerning the EHT infrastructure, requires expert analysis. Therefore, the feasibility of relocation/shifting and any design suggestions can only be reliably confirmed and advised upon following a comprehensive study and report from a qualified technical consultant. Since the EHT infra-structure is already in service and no interruption can be afforded, we advise the Transaction Advisors to take our infrastructure requirements into account to ensure compliance with applicable safety codes and standards. The shifting / relocation of these, if find possible, will on deposit work basis, chargeable to MEW.

Response to Para B: We note the Government of Sindh's clarification that K-Electric is responsible for hiring and managing the technical consultant & being the subject expert, KE will submit the final report for information to Government of Sindh. Please acknowledge that the costs for engaging the consultant and the estimated cost of relocation/shifting of infra-structure works shall be borne by the Government of Sindh on a cost-deposit basis.
Given the critical nature and huge stakes of this mega project, it is essential that we hire an extremely qualified, competent, and experienced technical consultant, as the foundation of the project's infrastructure interface rests on their report. **We are currently obtaining quotations and conducting due diligence for consultant. We shall share the completed details including the consultant's name, their comprehensive proposal, and associated cost estimates accordingly for subsequent payment processing and project assessment.**

Response to Para C: Noted with thanks.

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Response to Para D: The Terms of Reference for Consultant is herewith attached/shared for information. Please share your concurrence to move ahead.

We look forward to a continued collaborative engagement to facilitate this important development project.

Thanks & Regards,

27/10

Director Transmission Maintenance
K-Electric Ltd
+92 21 387 09132 (Ext: 7853)

28/10/25

Lead Public Affairs & Government Relations
K-Electric Ltd
+92 387 09132 (Ext: 8808)

DA/ As above - TOR

CC:

- KE Internal Functions.
- The Director General, PPP Unit, Finance Department, GoS, Karachi,
- The Focal Person, Malir Express Project, KDA, Karachi.
- The PS to the Secretary, Local Govt & HTP Department, Go5, Karachi.
- The Director General (Technical Services), KMC, Karachi.
- Mr. Sajjad Gilal, Director Finance, PPP Unit, GOS, Karachi.
- The GM BF Transmission KE Karachi.

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KGTML

PART OF
AD PORTS GROUP

The Secretary
Karachi Port Trust (KPT)
Eduljee Dinshaw Road
Karachi

KGTML/KPT/08-11/2025
November 14, 2025

Subject: **REQUEST FOR ISSUANCE OF NOC TO KDA, MALIR EXPRESSWAY PROJECT – PHASE I INTERCHANGE WITHIN KGTML OPERATIONAL AREA**

Dear Sir

We refer to the Feasibility Study and Transaction Advisory Services for the Development of the Malir Expressway Project – Phase I (the "Project"), undertaken by the Karachi Development Authority (KDA) in collaboration with the Public Private Partnership Unit, Finance Department, Government of Sindh.

As you are aware, the Project is of significant strategic and economic importance, aimed at reducing traffic congestion, improving freight mobility, and establishing an efficient and direct connectivity corridor between Karachi Port / KGTML (East Wharf) and the Malir Expressway ("MEW") Phase I at the Jam Sadiq Interchange.

KDA had appraised us that KPT has already granted an NOC for conducting feasibility surveys in certain areas falling under its administrative jurisdiction. However, certain portions of the proposed alignment interface with areas that fall within KGTML's operational domain under KPT's overarching jurisdiction. We appreciate KPT's proactive engagement and guidance to government officials to coordinate with KGTML for alignment with our master plan. Following multiple joint sessions, KGTML and government stakeholders have finalized the proposed interchange sketch within KGTML's operational area. For ease of reference, the sketch is enclosed herewith, reflecting the entrance/exit design relevant to KGTML's access.

In order to ensure that the work is completed smoothly and in a timely manner, we respectfully request that KPT issue a specific NOC permitting KDA and its appointed consultants for inclusion of the said interchange in the overall master planning of MEW Phase-I project within the relevant land area presently under KPT's ownership and forming part of KGTML's allotted operational limits.

We appreciate that the Project is directly aligned with KPT's broader objective of strengthening port connectivity, trade facilitation, and logistics integration for Karachi. We therefore request your kind support in issuing the NOC along with acknowledgment of the proposed interchange sketch, at the earliest convenience.

* * * * *

For on behalf of
Karachi Gateway Terminal Multipurpose (Private) Limited

Muhammad Rehan Hanif
Company Secretary

Encl. Proposed sketch of the Malir Expressway

Copy to:
- Chairman - KPT
- Senior Director, Traffic Engineering Bureau, KDA
- Traffic Manager - KPT
- Chief Executive Officer, KGTML

Karachi Gateway Terminal Multipurpose (Private) Limited
Berths 6 to 10, East Wharf, Karachi Port,
Karachi – 75620, Pakistan
KGTL.com.pk

Tel +92 21 111 115 485
Fax +92 21 3285 4815
info@KGTL.com.pk

No. PPP-Node/KPQ/2025/02/01

GOVERNMENT SINDH
LOCAL GOVERNMENT & HOUSING TOWN PLANNING DEPARTMENT

Karachi, dated the 05th November 2025

PPP NODE No. 514 05/11/25

To,

Mr. Navaid Ur Rehman
Additional Director (Plans & Contracts)
Engineering Branch,
Pakistan Defence Offices Housing Authority (PDOHA),
Karachi

SUBJECT: **KARACHI PORT TO QAYUMABAD CORRIDOR PROJECT – PROVISIONAL NO OBJECTION CERTIFICATE (NOC).**

REF: i) Letter No. DHA/EDB/Plan/2025 dated: 31st October 2025
ii) Letter No. Dir.(Admin)/ED/KDA2025-26/ dated 04TH November 2025

Reference is made to your above referred letter, along with the enclosed Provisional No Objection Certificate (NOC) issued by the Pakistan Defence Officers Housing Authority (PDOHA), Karachi, in favor of the Government of Sindh (GoS) for the Development of Malir Expressway Project (Phase-I), now referred to as *"Karachi Port to Qayuamabad Corridor Project"* under Public Private Partnership (PPP) Mode.

2. The Local Government & Housing Town Planning, Government of Sindh (the 'Department') through Karachi Development Authority (KDA) (the 'Procuring Agency') hereby acknowledges the receipt and acceptance of the said Provisional NOC along with the terms and conditions stipulated therein, including: (copy attached)

i. The responsibility of PDOHA for the operation and maintenance of Sunset Boulevard throughout the concession period, and

ii. The annual payment to PDOHA of PKR 100.000,000/- (Rupees One Hundred Million) or 10% of GoS's windfall revenue share from the Project, whichever is higher, during the concession period.

3. The Department appreciates the cooperation extended by DHA Karachi and requests that, in light of the above acknowledgment and acceptance of the stated terms and conditions, the Final No Objection Certificate (NOC) for the project may kindly be issued at the earliest convenience to facilitate further necessary processing.

4. This is for your kind information and further necessary action at the earliest convenience please.

05/11/2025

Usman Ali Ahmed
Assistant Director Technical – I
PPP Node, LGD

C.C. to:

1. Principal Secretary to Chief Minister Sindh, Karachi
2. PS to Chief Secretary, Government of Sindh, Karachi
3. PS to Chairman Planning & Development Department, GoS, Karachi
4. PS to Secretary Finance, Finance Department, GoS, Karachi
5. PS to Secretary, Local Government & HTP Department, GoS, Karachi.
6. PS to Special Secretary, Local Government & HTP Department, GoS, Karachi.
7. PS to Director General, PPP Unit, Finance Department, GoS, Karachi
8. PS to Director General, Karachi Development Authority, GoS, Karachi
9. Project Director, Karachi Development Authority, Karachi
10. Brgd. Staff, HQ PCIC 5 Corps, Karachi
11. Office record

Usman Ali Ahmed
Assistant Director Technical – I
PPP Node, LGD

OFFICE OF THE DIRECTOR (ADMIN)
ENGINEERING DEPARTMENT
KARACHI DEVELOPMENT AUTHORITY

4th Floor, Civic Centre, Gulshan-e-Iqbal, Karachi- Phone # 021-99230653

NO.Dir(Admin)/ED/KDA2025-26/1031/2 /Karachi, Dated: 04/11/2025

To,
Secretary,
Local Government Department,
Government of Sindh,
Karachi

SUBJECT: **ACKNOWLEDGMENT OF PROVISIONAL NO OBJECTION CERTIFICATE FOR MALIR EXPRESSWAY PROJECT (PHASE-I), UNDER PPP MODE.**

REF'NCE: ***NO.PPP-Node/KPQ/2025/02/01, Dated: 04th November 2025***

In reference to the above cited letter, the Karachi Development Authority (KDA) acknowledges the receipt of the Provisional No Objection Certificate (NOC) issued by the Pakistan Defense Officers Housing Authority (PDOHA), Karachi to the Local Government Department for the development of the Malir Expressway Project (Phase-I), now referred to as *"Karachi Port to Qayumabad Corridor Project"*.

The department hereby confirms acknowledgment of the contents of the said Provisional NOC and conveys that Karachi Development Authority (KDA) will process the same in accordance with the terms and conditions prescribed therein.

Director (Admin)
Engineering Department
Karachi Development Authority

Copy to:

1. *Special Secretary, Local Government Department, Government of Sindh.*
2. *Chief Engineer (Dev.), Engineering Department, KDA*
3. *PS to Director General, KDA*
4. *Office Record File*

Pakistan Defence Officers Housing Authority Karachi

2/B East Street, Phase-I, DHA, Karachi-75500 (Pakistan)
Phones: 021-9266874 UAN – 111-589-589 Ext 2109 Fax: 35886406

In reply, please quote
DHA/EDB/Plan/2025

31 Oct 2025

To: **The Secretary,**
Local Government & Housing Town Planning Department,
Government of Sindh,
Karachi, Sindh.

Subject: <u>FEASIBILITY STUDY AND TRANSACTION ADVISORY SERVICES FOR THE DEVELOPMENT OF MALIR EXPRESSWAY PROJECT (PHASE-I), UNDER PUBLIC PRIVATE PARTNERSHIP MODE, PROVISIONAL NO OBJECTION CERTIFICATE.</u>

1. Reference your correspondence regarding the subject cited above. It is stated that DHA Karachi has issued the Provisional No Objection Certificate (NOC) for the Development of Malir Expressway Project (Phase-I) under PPP Mode, attached herewith as Annexure (A).

2. It is requested that the acknowledgement of the said Provisional NOC may kindly be issued by the Government of Sindh and forwarded to DHA Karachi for record and further necessary processing.

3. Forwarded for further necessary action and compliance, please.

Navaid Ur Rehman
Addl Dir (Plans & Contracts)
Engr Branch

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