



SINDH MASS TRANSIT AUTHORITY

**KARACHI MOBILITY PROJECT
YELLOW LINE BRT CORRIDOR**



ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

**DRAFT REPORT
VOLUME 1 OF 2**

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ENVIRONMENT IMPACT ASSESSMENT (EIA)

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ABBREVIATIONS

AP	Affected Persons
BRT	Bus Rapid Transit
BOQs	Bills of Quantities
BP	Bank Procedure
CBC	Cantonment Board Clifton
CBD	Central Business District
CBOs	Community Based Organizations
CCTV	Closed Circuit Television
CM	Centimeter
CNG	Compressed Natural Gas
CNIC	Computerized National Identity Card
CLRP	Compensation Livelihood Restoration Plan
CPLC	Citizens and Police Liaison Committee
CO ₂	Carbon Dioxide
Db (A)	decibels A
DHA	Defense Housing Authority
DMC	District Municipal Corporation
EA	Environmental Assessment
EIA	Environmental Impact Assessment
ES	Environmental and Social
ESIA	Environmental and Social Impact Assessment
EV	Electric Vehicle
EMP	Environmental Management Plan
FTC	Finance and Trade Centre
GBV	Gender Based Violence
GDP	Gross Domestic Production
GoS	Government of Sindh
GoP	Government of Pakistan
GRM	Grievance Redress Mechanisms
Hp	Horsepower
HSE	Health, safety, and environment
HIV	Human Immunodeficiency Virus
IEE	Initial Environmental Examination
IBRD	International Bank for Reconstruction and Development
JICA	Japan International Cooperation Agency
KCB	Karachi Cantonment Board
KDA	Karachi Development Authority
KSDP	Karachi Strategic Development Plan
KIDCL	Karachi Infrastructure Development Company Limited
KTIP	Karachi Strategic Development Plan 2020
KMC	Karachi Metropolitan Corporation
kWh	Kilo Watt Hour

KUTMP	Karachi Urban Transport Master Plan
KUTC	Karachi Urban Transport Corporation
LDA	Lyari Development Authority
LNG	Liquefied Natural Gas
KW&SC	Karachi Water & Sewerage Corporation
MGD	Million Gallons Per Day
MRT	Mass Rapid Transit
MW	Megawatt
M	Meter
M ²	Meter Square
M ³	Meter Cube
MM	Millimeter
NGO	Non-Governmental Organization
NIPA	National Institute of Public Administration
NOC	No Objection Certificate
NMT	Non-Motorized Transport
NOx	Oxides of Nitrogen
NRL	National Refinery Limited
NTC	National Telecom Corporation
OBDM	Operational Design and Business Model
OP	Operational Policy
PARCO	Pak-Arab Refinery Company
PAPs	Project Affected Persons
PCRs	Physical Cultural Resources
PCR	Project Completion Report
PGA	Peak Ground Acceleration
PHA	Provincial Housing Authority
PKR	Pak Rupee
PM	Particulate Matter
PPE	Personnel Protective Equipment
PRL	Pakistan Refinery Limited
PSO	Pakistan State Oil
PM ₁₀	Particulate Matter of 10 micrometer Diameter Particle Size
PM _{2.5}	Particulate Matter of 2.5 micrometer Diameter Particle Size
PSHA	Probabilistic Seismic Hazard Assessment
PS	Performance Standards
PTCL	Pakistan Telecommunication Company Ltd
ROW	Right of Way
SBCA	Sindh Building Control Authority
SEPA	Sindh Environmental Protection Agency
SIDCL	Sindh Infrastructure Development Company Limited
SSGC	Sui Southern Gas Company
SSP	Senior Superintendent of Police
SEQS	Sindh Environmental Quality Standards
SMTA	Sindh Mass Transit Authority
WB	World Bank

EXECUTIVE SUMMARY

Karachi is one of the largest and most populous metropolitan cities in the world with built-up areas comprising about 1,500 km². Karachi Strategic Development Plan 2020 (KSDP 2020) projected that the population of Karachi will be around 27.6 million by 2020. Karachi Transportation Improvement Project (KTIP) by Japan International Cooperation Agency (JICA), 2030 projected that the population of Karachi is expected to be 31.6 million by 2030. This would rank Karachi as the one of the biggest cities of the world.

One of the major challenges of the city is that it lacks a proper public transport system. The public transport availability in the last decade has not been able to keep pace with increasing population growth. The share of public transport has actually fallen due to insufficient investment in the sector. This has resulted in a shift of demand from public transport towards other modes of transport, such as motorcycles/private vehicles and informal Qingqi Rickshaws. Japan International Cooperation Agency (JICA) Person Trip Study-2005 establishes that in percentage terms Karachi's public transport represents only 4.5% of the total vehicle fleet. Public transport in Karachi serves about 42% of the passenger demand, and even though it does not have dedicated lanes or any other feasible traffic management solution. Private vehicles are 36% of the total vehicular traffic but carry only 21% of the passengers.

It is assessed by previous studies that the existing public transport system cannot serve the existing and incremental demand in an effective manner. Major problems associated with the system are: unnecessary travel delays, severe traffic congestion, economic and financial losses and environmental problems. Daily commuters face problems due to poor quality of service, sub-standard vehicles and clumsy routes. In addition, environmental degradation due to vehicular air and noise pollutions is touching alarming levels in the city.

JICA carried out a detailed study for Karachi Transportation Improvement Project (KTIP) in 2009- 2012. The study recommended a comprehensive Urban Transport Master Plan that integrates roads and Mass Transit projects. KTIP study recommended two Mass Rapid Transit (MRT) lines (Blue and Brown) and six Bus Rapid Transit (BRT) lines (Green, Red, Yellow, Orange, Aqua, and Purple) besides revitalization of Karachi Circular Railway (KCR) on modern lines. The Yellow Line BRT corridor is one of the priority corridors identified by KTIP. The Yellow Line BRT corridor has been selected as the pilot project in Sindh. The general alignment of the Yellow Line BRT corridor has a generous Right of Way (ROW).

YELLOW LINE BRT CORRIDOR PROJECT

The project will have potential impacts on the existing public transport service providers, including owners, drivers and conductors of different type of vehicles, such as large buses, mini buses, and qingqi rickshaws.

ZONE OF INFLUENCE

The project Zone of Influence includes the following:

- Yellow Line BRT Main Corridor
- Depots (2 No.s)
- Off-Corridor Routes

Yellow Line BRT corridor passes through Districts of Korangi (Landhi Town, Korangi Town, and Shah Faisal Town), District South (Clifton Cantonment Board) and District Karachi East (Jamshaid Town, Karachi Cantonment Board). The Yellow Line BRT bus will operate from Dawood Chowrangi/Korangi 8000 Road to Shahrah-e-Quaideen upto Numaish Chowrangi. The corridor will mostly serve the residents of Landhi Korangi and employees working in the Landhi, Korangi and Port Qasim Industrial Areas.

The environmental impacts along the main alignment of BRT corridor are considered for approximately 50 m from edge of existing road on both sides of the alignment whereas for off-route networks 15 m from edge of the road in linear manner. The impacts for depots are considered in 15 m from the boundary in radial manner

PROPONENT OF THE PROJECT

The Sindh Mass Transit Authority (SMTA) is the proponent for the Yellow Line BRT corridor project. SMTA was established in 2016 by SMTA Act 2014. It has a province-wide jurisdiction and is responsible for the management and implementation of the Transport Master Plan 2030, developed with the assistance of JICA.

PROJECT INSTITUTIONAL ARRANGEMENT

A Project Director (PD) in the SMTA will be overall responsible for the project management. PD will lead the Project Management Team (PMT) comprising of different team members include (Environmental, Health Safety & Quality, and Social Development, Gender, and Community Specialists). SMTA will be responsible for various functions of the project regarding procurement, execution, supervision, monitoring, and project management. The team will also ensure the protection and promotion of environmental sustainability, health and safety standards, quality assurance, as well as social development, gender equality, and community welfare. The World Bank (WB) will provide technical and capacity building assistance to SMTA. Various contractor, Private Operator and Fare Collector companies will participate in the project implementation and operation of the Yellow Line BRT system. The supervision consultant will be responsible to supervise the implementation of the project and will be reporting to SMTA. Third party validation will be conducted by and independent consultant assigned to do so by SMTA.

REQUIREMENT OF ENVIRONMENTAL ASSESSMENT

Yellow Line BRT project lies in Schedule-III, Category E Transport sub category: 4 Mass Transit Projects of Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021. Thus, it requires to prepare Environmental Impact Assessment (EIA) report. As per WB's Safeguard Policies, the Yellow Line BRT corridor is a category B project. This Environmental and Social Impact Assessment (ESIA) report has been prepared to fulfill the requirements of SEPA 2014 and WB's Safeguard Policies.

PROJECT DEVELOPMENT OBJECTIVE

The project development aims to provide improved and secure mobility on selected corridors, increased accessibility for work and housing while facilitating women ridership in public transport. Moreover, it emphasizes climate change mitigation by transitioning from polluting to low-carbon transportation modes and by providing resilient transport infrastructure and increasing the capacity of authorities to deal with disaster situations. The project will also generate economic activity in the area.

PROJECT BENEFICIARIES

It is estimated that about 700,000 people will benefit from this project, particularly people living and working in Korangi Industrial Area. The project will improve the safe and secure accessibility of women and people with limited mobility to jobs and other economic activities. The project will also focus on climate change adaptation and mitigation measures and other environmental Co- Benefits by shifting road users from polluting transport modes (e.g. old, poorly maintained buses and motorcycles) to lower carbon modes (e.g. cleaner BRT buses and non-motorized transport), and by providing resilient transport infrastructure and increasing the capacity of authorities to deal with disaster situations.

IMPORTANCE OF THE YELLOW LINE BRT CORRIDOR

The Yellow Line BRT Corridor project, as a fundamental component of Karachi's Mass Transit Network, contemplates the operational and functional integration with other BRT corridors as follows:

- Common corridor (considered as the segment from Numaish to Merewether Tower) and Karachi's Central Business District (CBD) at Numaish transit hub,
- With Red BRT corridor at Kashmir Road intersection along Shahrah-e-Qaideen,
- With Green, Orange and Blue BRT corridors at Numaish BRT hub,
- With Brown (MRT) corridor at Singer Chowrangi along 8000 Road, and
- With KCR at Kala Pull on Korangi Road and Landhi Railway Station nearby Dawood Chowrangi in Landhi

ALIGNMENT OF YELLOW LINE BRT CORRIDOR

The Yellow Line BRT services will operate along segregated busways running adjacent to and on either side of the roadway median. In general, the busway will run at-grade, though in few locations, it will be grade separated. The removal of trees and plants will be compensated by planting trees along the corridor and other locations. The BRT lanes will utilize the existing road as much as possible. The existing road section features primarily three lanes of traffic in each direction with median separation and with occasional service road provision. The ROW width of the existing road ranges from 25 meters (corridor's eastern end at Future Colony) to 70-90 meters (8000 Road and certain sections along Korangi Road). Construction of the BRT lanes and associated facilities, including stations, pedestrian underpasses/bridges, depots and bus bays will not involve any land acquisition. The proposed bus stations and depots will use vacant government land.

CONTRACTS FOR YELLOW LINE BRT CORRIDOR

There will be following three separate contracts for the construction and operation of the Yellow Line BRT Corridor:

Infrastructure Development	Bus Operation Services	Fare Collection & Information Technology (ITS) Services
Construct the Infrastructure of the Yellow Line BRT Corridor Project	Procure, Finance, Operate and Maintain Bus Operation Services of the Yellow Line BRT Corridor under Public Private Partnership (PPP) Mode	Revenue (Fare and Non-Fare) Collection Services and to Design, Build, Finance, Operate, Maintain and Transfer ITS Service of the Yellow Line BRT Corridor

YELLOW LINE BRT CORRIDOR INFRASTRUCTURE DETAIL

The major infrastructure for the Yellow Line BRT corridor Project includes:

- i) Roads (Dedicated and mixed),
- ii) Underpasses,
- iii) Flyovers
- iv) Bridges,
- v) Elevated U-Turns
- vi) Stations,
- vii) Pedestrian facilities (sidewalks, bridges/underpasses),
- viii) Depots.
- ix) Off Corridor Routes

YELLOW LINE BRT FLEET

Electric and Diesel Hybrid Buses will be used for Yellow Line BRT project. These buses are considered based on their fuel economy, emission reduction and safety purposes and based on the shortage of the Compressed Natural Gas (CNG) supply. Ordinary diesel-based bus travels 1.8 – 2.0 km per liter diesel consumed whereas diesel hybrid covers about 3.5 km per liter of diesel (42% less fuel consumption). The Yellow Line BRT fleet will consist of about 268 buses. About 8% (24) of the forecasted fleet will be accounted as fleet reserve.

Each bus of the Yellow Line BRT bus fleet will complete about 4 -5 round trips daily. Bus fare structure for the Yellow Line BRT system is proposed to be in the range of Rs. 15 – 55 per passenger on a distance-based scheme. The minimum fare of Rs. 15 will be for trips of up to 2 km. The value will increase proportionally every additional 2 km travelled by the passenger.

PROPOSED VEHICLE SCRAPPING PLAN

Karachi's public transport system operates with a considerably outdated and decaying fleet. Related to the fleet operating along the Yellow Line BRT corridor, for the most part, vehicles currently in operation would need to be scrapped before Yellow Line BRT Corridor launch operations. The proposed scrapping plan is underway by the Operational Design and Business Model (ODBM) consultant. As per the scrapping plan, the financial compensation will be provided to the owners of the old buses based upon the type and age of the bus to be scrapped. The Government of Sindh will pay compensation on the basis of 100% of the current market value of the vehicle. It will be a key element of the plan to ensure that the vehicles are scrapped as improper return of these vehicles in the system in competition with the BRT system will reduce the demand of the new system. Given the clear shortage in public transport supply in Karachi, an option can be proposed to transition the vehicles of phased out routes onto external catchment areas to alleviate underserved communities.

RELOCATION OF UTILITIES

M/s. Dar-al-Handasah and M/s. National Engineering Services Pakistan (Joint Venture) has been appointed to carry out the detail design and construction supervision of the Yellow Line BRT Corridor project. Following utilities exist at the proposed Yellow Line BRT corridor: Electrical cables/poles, Telephone cables/poles, storm water drains (at median and curbside), Water distribution pipelines, Sewage Lines, Gas pipelines, and Oil pipelines. The scope includes carrying out complete topographical, geotechnical and utility surveys supporting the design of all road, Non-Motorized Transport (NMT) and BRT facilities. A complete set of design drawings has been prepared within the Yellow Line BRT corridor's ROW including all existing utility lines and shared with all the concerned departments to obtain plans and estimated budget for relocation as per design needs.

ESTIMATED WORK FORCE

Estimated No. of workers for the construction of Yellow Line BRT project is 500 workers.

FINANCING AND IMPLEMENTATION SCHEDULE

Total financing of the project is US\$ 438.9 million. The contribution of World Bank and the Government of Sindh (GoS) is US\$ 382 million and US\$ 19 million respectively. The private sector's financial commitment amounts to US\$ 37.5 million. The procurement documents for hiring the detailed design/supervision consultant has been completed, while the process for hiring of contractors for various packages is under preparation.

POLICY FRAMEWORK

This section covers the laws, policies, regulations, and strategies related to the environmental and social aspects of the project. Furthermore, it is important to highlight that this project aligns with the IFC Performance Standards and adheres to relevant international treaties and conventions.

NATIONAL LAWS, POLICIES AND STRATEGIES

The national laws, policies and strategies relevant for the environmental safeguard of the project activities include: National Climate Change Policy, 2021, Framework for Implementation of Climate Change Policy 2014-2030, Pakistan 1st Sindh Labour Policy, 2018, National Gender Policy Framework, 2022, National Action Plan for Covid-19 Pakistan, Sindh Strategy for Sustainable Development, 2007, Sindh Drinking Water Policy, 2017, Sindh water policy 2023 and Labor Laws as part of Constitution of Pakistan 1973.

PROVINCIAL LAWS, POLICIES AND STRATEGIES

The provincial laws, policies and strategies relevant for the environmental safeguard of the project activities include: Sindh Environmental Protection Act, 2014, Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021, Sindh Environmental

Quality Standards (SEQS), 2016 and Sindh Solid Waste Management Board (SSWMB) Act, 2014, The Sindh Local Government Act 2013, Sindh Wildlife Protection Act 2020, The Sindh Forest Act 2012, Sindh Occupational Safety and Health Act, 2017, Sindh Cultural Heritage (Preservation) Act, 1994, Sindh Workers Compensation Act, 2015 and Sindh Factories Act 2015, Sindh Minimum Wages Act, 2015.

WORLD BANK SAFEGUARD POLICIES

The proposed project triggers the World Bank safeguard policy of Environmental Assessment Operational Policy (OP) 4.01 Environmental Assessment, OP 4.04 Natural Habitats, OP 4.12 Involuntary Resettlement and Public Disclosure of Information, Bank Procedure (BP) 17.50

DESCRIPTION OF THE ENVIRONMENTAL BASELINE

The greatest height of the region is 76 m that gradually decreases to 1.5 m above mean sea level along the coastline. The topography of the project area ranges from 8-11 m.

The project area mainly consists of alluvial deposits up to the depth of 20.0 to 25.0 meters from Dawood Chowrangi to Malir River towards west. Bed rock present at the project location is of Gaj Formation of Lower Age Miocene. Gaj formation consists of shale with subordinate sandstone and limestone.

Malir River is the surface water body in project area. Currently, untreated sewerage is being drained into the Malir River bed. Solid waste, plastic bags and other trash is also being dumped into the river bed. During continuous and heavy rainfall in the catchment areas causes high flood levels in Malir River.

Groundwater table was encountered at a depth range of 0.76 to 0.91 meters below the existing ground level in four (04) out of total twenty-seven (27) boreholes drilled during the time of this investigation.

According to Building code of Pakistan, 2007 prepared by NESPAK, the project area falls in Seismic Zone 2B of Pakistan (moderate damage), and peak ground acceleration (PGA) from 0.16 to 0.24 g.

Landuse of the area is commercial, industrial, residential and River Malir also passes through the alignment. Landuse type of the project area are open area, built-up area, crossing bridge, footpath, graveyard, railway, river, road/track, road divider, stream/nullah and water pond.

BIOLOGICAL ENVIRONMENT

The project site is located in landscape with poor eco system. The urban ill planned growth has deprived healthy environment and reveals absence of food chain required for existence and survival of terrestrial fauna.

Tree cutting / deforestation causes an increase in carbon dioxide in the atmosphere that

harms the environment and living creatures like human beings, birds and animals, etc.

No major habitats of large and small animals, birds or reptiles within or near the Project site, except few species of birds and small mammals. i.e., *Corvus splendens*, *Passer domesticus*, *Acridotheros tristis*, and *Pycnonotus barbatus*.

The proposed project area does not support any fish species or aquatic biota. No Protect area was reported in proposed project ROW/Zol. No Endangered species of flora and fauna were reported

SOCIO-ECONOMIC ENVIRONMENT

The socioeconomic baseline was developed by covering the entire proposed project area i.e. Dawood Chorangi to Numaish and its adjacent communities that will be potentially benefitted by the Yellow Line BRT Corridor Project. Moreover, the project affected persons were also interviewed to determine the socioeconomic baseline. The socioeconomic aspect has been studied with respect to human and economic development and quality of life values of the population in the Project Area. This section deals with the social conditions of the Project Area. Baseline information was gathered from literature, study reports, district census reports of 2017 and through field surveys comprising interviews and meetings by the Consultants' ESIA team.

Karachi is the largest and most populated city in Pakistan and the 7th largest metropolitan city in the world. According to final results of the 2017 population census the population of Karachi was estimated at 16.02 million, which growing rate of 2.59 percent per year. Approximately 34% of Sindh's total population lives in Karachi. Karachi occupies the top position in the list of most populous cities of Pakistan.

Geographically, Karachi forms an important economic corridor of manufacturing and trade employment with the world and rest of the adjacent cities. In 2019, World Bank reported Pakistan's Gross Domestic Production (GDP) as \$278.22 billion out of which Karachi contributes 25% of Pakistan's total GDP. Karachi contributes 55% of the federal tax revenue. Karachi has two ports namely Karachi Port and Mohammed Bin Qasim Port. Karachi houses the largest number of industries (textile, garments, leather, leather garments, pharmaceutical, food, chemicals, printing packaging, auto manufacturing, steel etc.). There are also large & small-scale markets and malls all over Karachi City.

Potential Environmental Impacts were Identified at Pre- Construction Phase which will be considered during Infrastructure Design (Water Supply, Storm water and Wastewater Treatment), Seismic Hazard, Public utilities, Impacts on Land Use and Vegetation, Land Acquisition and Resettlement, Temporary Land Requirements and Impact on Community and Religious Structures.

Different activities will be carried out at construction sites, for instance; establishing Construction camp sites and Contractor Facilities, Influx of Labour, Excavations at construction sites, Operation of batching and asphalt plant etc.

Safety precautions will be implemented to protect the environment, workers and the surrounding community from various hazards, including dust from construction activities, stack emissions from generators, construction vehicles, and solid waste generation and discharge of sanitary wastewater from construction camps. Measures will also address soil contamination at construction and camp sites, noise control, traffic management, provision of parking spaces in narrower sections, mitigation of urban flooding, and minimizing the impact on local plant life.

During operations anticipated impacts include shift of land use, emissions from busses and generators, Solid waste from bus stops and depots, soil contamination from generators, Nuisance due to noise from generators and bus depot, Soil and water contamination due to disposal of untreated wastewater from washing area, risk of fire and other emergencies and climate change impacts including flooding in underpasses and different intersections at main corridor, Health impacts on passengers due to heat wave and Potential Impacts on Parking Spaces in Narrower Sections. Comprehensive mitigation measures have been suggested in environmental management plan.

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

INSTITUTIONAL ARRANGEMENT

Sindh Mass Transit Authority (SMTA): SMTA is the proponent of the Yellow Line BRT Corridor project. The overall responsibility of the environmental management of project during design, construction and operational phases rests with SMTA. SMTA has designated Project Director to take care of routine matters of the project and take actions and decisions to accomplish the project milestones. There will be a Project Management Team working under PD. To look after environment and social related issues, Environment and Social Cell will be established within the Project Management Team.

Party A (Infrastructure Development): Party A will be several Infrastructure Development Contractors, responsible for the development of Yellow Line BRT project infrastructure, including roads, bus stations, and bus depots. Overall responsibility of the Environmental Management Plan (EMP) implementation and compliance rests with Party A. Party A will be answerable to the Project Management Team for any noncompliance of the construction phase EMP.

Contractor: Party A will execute the infrastructure development through contractors. The Construction Phase Environmental Management Plan (CPEMP) will be prepared and appended with the tender document for the contractors.

Party B (Operator Company): Party B will be the operator company. This company will be responsible for the implementation of operational phase EMP at bus operations, bus stops and bus depots.

Environmental Consultant: The Project Management Team will have the leverage to hire environmental consultant for the preparation of environmental assessment and

environmental compliance reports. These reports will be submitted to SEPA and World Bank as per the requirement. During construction phase, Environmental Consultant (Construction Supervision Consultants for Environment) will also be hired to conduct trainings for all the key stakeholders involved in EMP implementation and to ensure EMP implementation.

Third Party Monitoring: The Third-Party Monitoring (TPM) will be carried out through independent environmental consultancy firm. The consultant firm will monitor the environmental parameters and conduct field surveys at the construction sites to evaluate compliance level by the contractors and the Party A (Infrastructure Development). TPM will also be carried out during operational phase of the project to ensure compliance of EMP by the Party B (Operator Company).

Sindh Environmental Protection Agency (SEPA): The Sindh Environmental Protection Agency will be responsible for granting No Objection Certificate (NOC) to the project proponent to start and operate the project.

World Bank: The World Bank is financing the infrastructure and capacity building components of the Yellow line BRT Corridor project. It is the World Bank's requirement that the funded projects comply with its environmental and social safeguard policies.

ENVIRONMENTAL MITIGATION AND MONITORING PLANS

Environmental Mitigation and Monitoring Plans for the construction and operational phases of the project are prepared, which will be followed by the stakeholders for the compliance of environmental safeguard requirements of the World Bank and SEPA.

CAPACITY BUILDING

Capacity building will be required for the stakeholders involved for the implementation, supervision, monitoring, evaluation, and reporting of the mitigation measures during construction and operational phases of the project components. The key stakeholders involved for the accomplishment of the environmental management of the Yellow Line BRT Corridor project will be trained on EMP such as Project Management Team SMTA, Infrastructure Development Company, Operator Company, Environmental Consultancy Firm, and Contractors.

TENTATIVE BUDGET

Total tentative budget for the environmental management of the project during construction is Rs. **267.6 Million** and operation phases (per annum) are about **Rs. 2.09 Million**.

CONSULTATION, DISCLOSURE & GRIEVANCE REDRESS MECHANISM

The objectives of stakeholder consultation were to contribute to the openness, transparency and dialogue. Special efforts were made to ensure that the communication with the public should be efficient and well balanced. The concerned stakeholder groups were identified to

participate in the assessment process. During stakeholder's consultations, information regarding project main features and its benefits were shared. The stakeholders' concerns on compensation, tree cutting, wildlife, livelihood support, and provision of public infrastructure, utilities and other civic facilities were raised and addressed accordingly.

Most of the comments of the participants were regarding relocation of commercial and residential structures as well regarding the shifting of the moveable businesses which will be affected due to widening of the road for Yellow Line BRT Corridor. The entire concerns were discussed in detail with the participants of the consultations and presented in the tabulated form in the following sections of the chapter along with possible remedial measures suggested by the participants.

SMTA will respond to concerns and grievances of project affected parties related to the environmental and social performance of the project in a timely manner. For this purpose, SMTA will propose and implement a Grievance Redress Mechanism (GRM). SMTA will establish a GRM to facilitate the resolution of community complaints and grievances regarding environmental and social issues occurred during different phases of the proposed project. Under this mechanism, a Grievance Redress Cell (GRC) will be established in the Project Management Team. There will be one focal person for GRM at each construction sites during construction phase. This member will be directly accessible to the community for the registration of complaints and their resolution. The established GRM will be communicated to the public and particularly the affected community through print and electronic media and during public consultations and community engagement events. This cell will maintain a Community Complaints Management Register (CCMR), at the site, for logging complaints and grievances. All written and oral grievances will be recorded in the Register. For operational phase GRM, the Operator Company will be responsible for maintaining community complaints in the CCMR and their resolution. Android based GRM Application (GRM App) will also be established and launched to make GRM effective, easy and accessible to everybody for lodging complaints.

CONCLUSION AND RECOMMENDATIONS

Karachi city is facing transport challenges. The public transport condition is day by day worsening and unable to cope with the fast-growing population of the city. Karachi is in dire need of a modern transport system for fast and convenient travelling. Many transportation improvement studies and master planning have identified these issues and recommended a Bus Rapid and Mass Rapid Transit system for the Karachi city.

Yellow Line BRT Corridor project is in line with the need of the Karachi's present and future public transit requirements. This project will result in significant positive impacts, not only on the city's urban environment but also making Karachi a livable and prospering city.

Yellow Line BRT Corridor project is also in compliant with the Government of Sindh and World Bank's policies and regulations, concerning environment, social impact, resettlement and compensation, and local administration.

The EIA report and Environmental Mitigation and Monitoring Plans provide the means for environmental management at all stages of the project. A clear right of way in the public domain allows the project to be built without any land acquisition. The project provides improved access between residential and business areas. In conjunction with other transport systems, the alignment serves the core of the city.

The deployment of modern hybrid technology-based buses, equipped with EURO III standard compliant engines, besides scrapping of old bus fleet of the city, will significantly contribute in improving urban environmental quality. Yellow Line BRT Corridor project has no long term adverse environmental impact. Once constructed and in operation, it will enhance its local environment and improve mobility for local communities. The project design incorporates measures for reducing the impact or footprint of the project. An extensive ITS and other interlinked systems assure enhanced bus movement and passenger safety.

The project will pose environmental impacts of minor to insignificant nature during construction and operational phases. Operational phase impacts are minor whereas construction phase impacts are insignificant, temporary and reversible, which can be easily managed and controlled.

Major issues arising during construction phase may be the traffic congestion, dust emission and health and safety concerns for the workers and community. Strict vigilance of the contractors for the implementation of CPEMP for traffic management, dust suppression and health and safety of the workers and community, by the SMTA and Infrastructure Development Company, will be the key for the successful completion of the project.

About 10,050 plants/trees may be disturbed due to the roadway preparation for developing the carriageway and stations. These trees will be replanted at specified and suitable locations, preferably within and outside the project boundaries to offset those disturbed. Relocation of trees will be preferred instead of removal.

A systematic approach for surveillance and monitoring for the implementation of Environmental Mitigation and Monitoring Plans by Project Management Team will be required. Follow up public consultation is intended to provide future input to the identification of environmental impacts during the construction phase. A GRM will be put into effect for project affected persons. The CPEMP will be incorporated into individual contract bidding documents.

1 INTRODUCTION

1.1 GENERAL

This document presents Environmental Impact Assessment (EIA) of the project entitled “Karachi Mobility Project (KMP), Yellow Line (YL) Bus Rapid Transit (BRT) Corridor” in line with requirement of Sindh Environmental Protection Agency (SEPA) for the environmental assessment of the proposed Yellow Line BRT Corridor project.

This section will outline background of Yellow Line BRT Corridor in context of the transportation situation in Karachi city and studies conducted to address the improvement of Transportation issues and Transport Administration in the city.

Moreover, this section describes the background of the Yellow Line Bus Rapid Transit (BRT) project regarding, the proponent, nature, size and location of the project and the approach and methodology to conduct Environmental Impact Assessment (EIA) of the project.

1.2 PROJECT BACKGROUND

Karachi is the commercial capital and industrial hub of Pakistan. The city consists of seven districts, six cantonments, and areas administered by the federal and provincial governments’ land-holding agencies such as Defense Housing Authority (DHA), Karachi Development Authority (KDA), Lyari Development Authority (LDA), and Malir Development Authority (MDA) etc. The city covers an area of approximately 3,527 km², resulting in very high population density in certain parts of the city.

Karachi is one of the largest and most populous metropolitan cities in the world with built-up areas comprising about 1,500 km². Karachi Strategic Development Plan 2020 (KSDP 2020) projected that the population of the city will be around 27.6 million by 2020. The study of Karachi Transportation Improvement Project (KTIP) by Japan International Cooperation Agency (JICA), 2030 estimated that the population of Karachi is expected to be 31.6 million by 2030. This would rank Karachi as the one of the biggest cities in the world.

1.1.2 Transportation Issues of the Karachi

The city has approximately 10,000 kilometers of roads, with local roads accounting for 93 percent and highways and arterial roads for less than 5 percent of the total length. Karachi has also six arterial or trunk roads that extend radially from the central area. There are nearly 13.5 million motorized trips made each day within the city, of which about 42 percent are made by public and 58 percent by private transport. There were 3.6 million registered vehicles in Karachi as of mid-2015 (over 30 percent of the national total), and private vehicles mainly motorcycles and cars constitute about 84 percent of total registered vehicles, while public transport accounts for 4.5 percent of the total registered vehicles. With growth rates for private vehicles at over 4 percent, there are now over 1,000 new vehicles added to the streets of the city each day. There were over 12,000 public transport vehicles (including buses, minibuses, and coaches) serving 267 routes in the city. There are over 12,000 public transport vehicles (including buses, minibuses, and coaches) serving 267 routes in the city. Since 2010, the number of minibuses has decreased from about 22,000 to less than 10,000

in 2017.¹

The major challenge of the city is that it lacks a proper public transport system and commuting around the city. The public transport availability in the last decade has not been able to keep pace with increasing population and the share of public transport has actually fallen due to insufficient investment and interest in this sector.

Significant investments in the development of road infrastructure have also not been able to address the traffic problem in the city adequately. Hence, Transport and Mass Transit Department (TMTD) is aggressively pursuing plans for improving and upgrading the public mass transit system in the city.

The share of public transport has reduced during the last decade due to insufficient investment in the sector. This has resulted in a shift of demand from public transport towards other modes of transport, such as motorcycles/private vehicles and informal Qingqi Rickshaws, despite increase in the petroleum prices. As per JICA's Person Trip Study, 2005, Karachi's public transport makes up only 4.5% of the total vehicle fleet but serves about 42% of the passenger demand, and yet it does not have dedicated lanes or any other feasible traffic management solution. However, private vehicles are 36% of the total vehicular traffic but carry only 21% of the passengers.

1.1.3 Studies for the Improvement of Karachi Transportation

It has been established, through a number of studies, that the existing public transport system cannot serve the existing and incremental demand in an effective manner and there are a number of problems associated with the system, including unnecessary travel delays, severe traffic congestion, economic and financial losses and environmental problems. Daily commuters face problems due to poor quality of service, sub-standard vehicles and unplanned routes. In addition, environmental degradation due to noise and air pollution and vehicular exhausts is touching alarming levels in the city.

Karachi Mass Transit Study (KMTS) in 1990 resulted in an adoption of a 20-year Mass Transit Plan for Karachi. It consisted of 87.4 km network of transit ways in six major corridors of Karachi, in addition to the recommendations for immediate reforms in bus transit sector, institutional and training needs.

The first priority corridor was accepted to be developed as a Light Rail Line (LRT). Despite major efforts, the implementation could not be materialized due to various externalities.

Recent efforts have been concentrated more on BRT system planning studies and revitalization of Karachi Circular Railways (KCR). The Karachi Strategic Development Plan (KSDP 2020) adopted by the City District Government of Karachi (CDGK) recommended Rail Mass Transit (RMT) and BRT system to comprise the future network for urban transport mobility.

JICA carried out a detailed study for Karachi Transportation Improvement Project (KTIP) in 2009- 2012 and recommended a comprehensive Urban Transport Master Plan that integrates roads and Mass Transit projects.

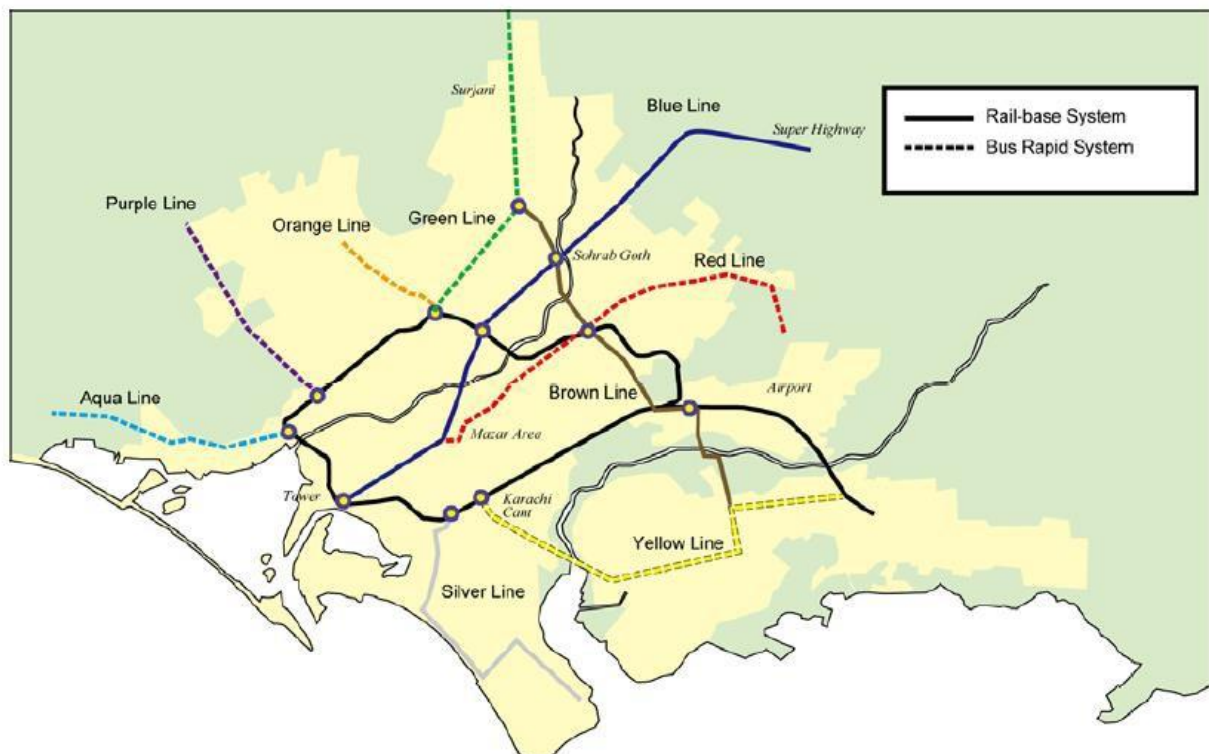
¹ Transforming Karachi into a Livable and Competitive Megacity
<http://dx.doi.org/10.1596/978-1-4648-1211-8>

KTIP study recommended two Mass Rapid Transit (MRT) lines (Blue and Brown) and six BRT lines (Green, Red, Yellow, Orange, Aqua, and Purple) besides revitalization of KCR on modern lines. The planned Mass Transit Corridors' alignments are illustrated in Figure 1.1 as per KTIP Master Plan.

The Yellow BRT is one of the priority corridors identified by JICA and has been selected as the pilot project in Sindh, as the BRT system route has a wide corridor and, consequently, there is no Right of Way (ROW) bottlenecks within this corridor.

The Mass Transit Cell (MTC), Transport and Mass Transit Department (TMTD), in association with the Public Private Partnership (PPP) Unit, Government of Sindh (GoS), initiated the feasibility study and preliminary design of one of the six BRT corridors, the "Yellow BRT", in February 2013.

The Government of Pakistan (GoP) has financed the Green BRT Corridor Project which is being implemented by Sindh Infrastructure Development Company Limited (SIDCL) previously Karachi Infrastructure Development Company Limited (KIDCL). Its infrastructure is almost completed and SIDCL has involved private sector in operating its bus and other services. SIDCL has also procured fleet, installed ITS system and operating Orange line BRT. The GoS has financed the Orange BRT Corridor (infrastructure), essentially a feeder to the Green corridor, which facilitates its ridership. Sindh Mass Transit Authority (SMTA) is the implementation agency for Orange BRT infrastructure Corridor and Red Line.



Source: KTIP Master Plan, JICA

Figure 1.1: Planned Mass Transit Corridors

A Joint Venture of M/s Dar Al Handasah Pvt. Ltd. (DAR) and National Engineering Services Pakistan Pvt. Ltd. was appointed by Sindh Mass Transit Authority (SMTA) for detailed

design and Environmental Impact Assessment for the Yellow BRT corridor. The project is funded by World Bank Group.

1.2.1 Transport Administration in Karachi

Multiple government departments and authorities are dealing with transport in the city with little coordination among them. Various bodies such as the National Highway Authority, GoS, Karachi Metropolitan Corporation (KMC), Karachi Development Authority (KDA), Defence Housing Authority (DHA), and cantonments, administer roads in Karachi. KMC is responsible for the administration of over 40 percent of roads in the city. TMTD is the principal planning, regulatory, and implementing body of GoS responsible for dealing with all urban transport matters at the provincial level. Currently, responsibilities for major roads transport and traffic management within the city are shared between KMC and KDA. Fares for public transport are regulated by TMTD under GoS. The District Regional Transport Authority (DRTA) issues route permission for public transport in Karachi. However, the decision making for the permission is governed by a board, with representation from the police, city government, and Provincial Transport Authority and DRTA. The public-private partnership (PPP) unit of the GoS is also assisting TMTD in the development of mass transit initiatives in Karachi. ^{Error!}

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1.3 YELLOW LINE BRT CORRIDOR PROJECT

The Yellow Line BRT Corridor Project is a public transport system which uses buses to provide faster, more efficient and comfortable service than the ordinary bus service. Buses generally run on segregated lanes with no interference from mixed traffic. BRT is the way forward for urban mobility which offers next level of mass transit after bus transit, reduces emissions, reduces traffic volumes, offers safe, reliable and comfortable transport, provides saving in travel time offers employment opportunities, attracts investment, and creates a new culture of public transport travel and change in land use. However, the project will have potential negative impacts on the existing public transport service providers, including owners, drivers and conductors of different type of vehicles, such as large buses, mini buses, and qingqi, rickshaws.

1.4 NATURE, SIZE AND LOCATION OF THE PROJECT

Yellow Line BRT Corridor passes through the districts of Korangi (Landhi Town, Korangi Town, Shah Faisal Town), District South Karachi (DHA and Clifton Cantonment Board) Karachi East (Jamshaid Town, Karachi Cantonment Board).

The Yellow Line BRT Corridor services will operate from Dawood Chowrangi/Korangi 8000 Road, Abbasi Shaeed Road, Shahrah.e.Faisal, Shahrah-e-Qaideen Road to Numaish Chowrangi. The Yellow Line BRT will mostly serve the residents of Landhi / Korangi Areas and employees working in the Landhi, Korangi and Port Qasim Industrial Areas. Length of the Corridor is 21 kms. The description of the BRT corridor is as under:

Main Corridor	
Segment-1	Dawood Chowrangi to Future Colony
Segment-2	Korangi (8000) Road along Korangi Industrial Area
Segment-3	Jam Sadiq Bridge over the Malir River
Segment-4	Jam Sadiq Bridge to KPT Interchange
Segment-5	KPT Interchange to Finance and Trade Center (FTC) Flyover
Segment-6	FTC Flyover to Shahrah-e-Faisal
Segment-7	Shahrah-e-Faisal (Nursery) to Shahrah-e Qaideen (Numaish Chowrangi)
Other Components	
Depot 1	Near Dawood Chowrangi
Depot 2	Landhi Road near Indus Hospital
Off-Corridor Networks	Direct Routes (06 No.s) and Feeder Routes (03 No.s)

Figure 1.2 gives location of the project.

1.5 NEED OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY FOR THE PROPOSED PROJECT

It is the requirement of Sindh Environmental Protection Agency (SEPA) under Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021, to conduct Environmental Impact Assessment (EIA) of those proposed projects which have potential of environmental impacts prior to their implementation.

As per Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021, the project falls under schedule III, Category E Sr. 4 "Transport Mass Transit Projects" thus, an EIA is required to be prepared to obtain NOC from Sindh Environmental Protection Agency.

1.6 OBJECTIVE OF EIA

The major objective of this EIA study is the identification of the possible and induced impacts of the proposed project on both short and long-term bases. The impact identification process focuses particularly on physical, ecological, socio-economic and cultural aspects of the environment. Based on the level and nature of these observations the EIA then recommends proper mitigation measures. As a planning tool, the EIA aims to ensure that environmental, socio-economic and cultural issues throughout the entire project lifecycle are anticipated and considered by the project proponent. It also serves as a framework for establishing project controls to reduce or prevent adverse environmental or socio-economic impacts.

The specific objectives of the EIA are:

- To assess the existing environmental and socioeconomic conditions of the project area;
- To identify potential impacts of the proposed project on the physical, ecological and social aspects of the project area, to predict and evaluate these impacts and determine their significance;

-
- To propose appropriate generic mitigation measures that should be incorporated in the design of the project to avoid or minimize if not eliminate the potentially adverse impacts;
 - To assess the compliance status of the proposed activities with respect to the national environmental legislation;
 - To provide institutional, monitoring, reporting and documentation measures for environmental safeguards compliance; and
 - To aid decision makers to take informed decisions.

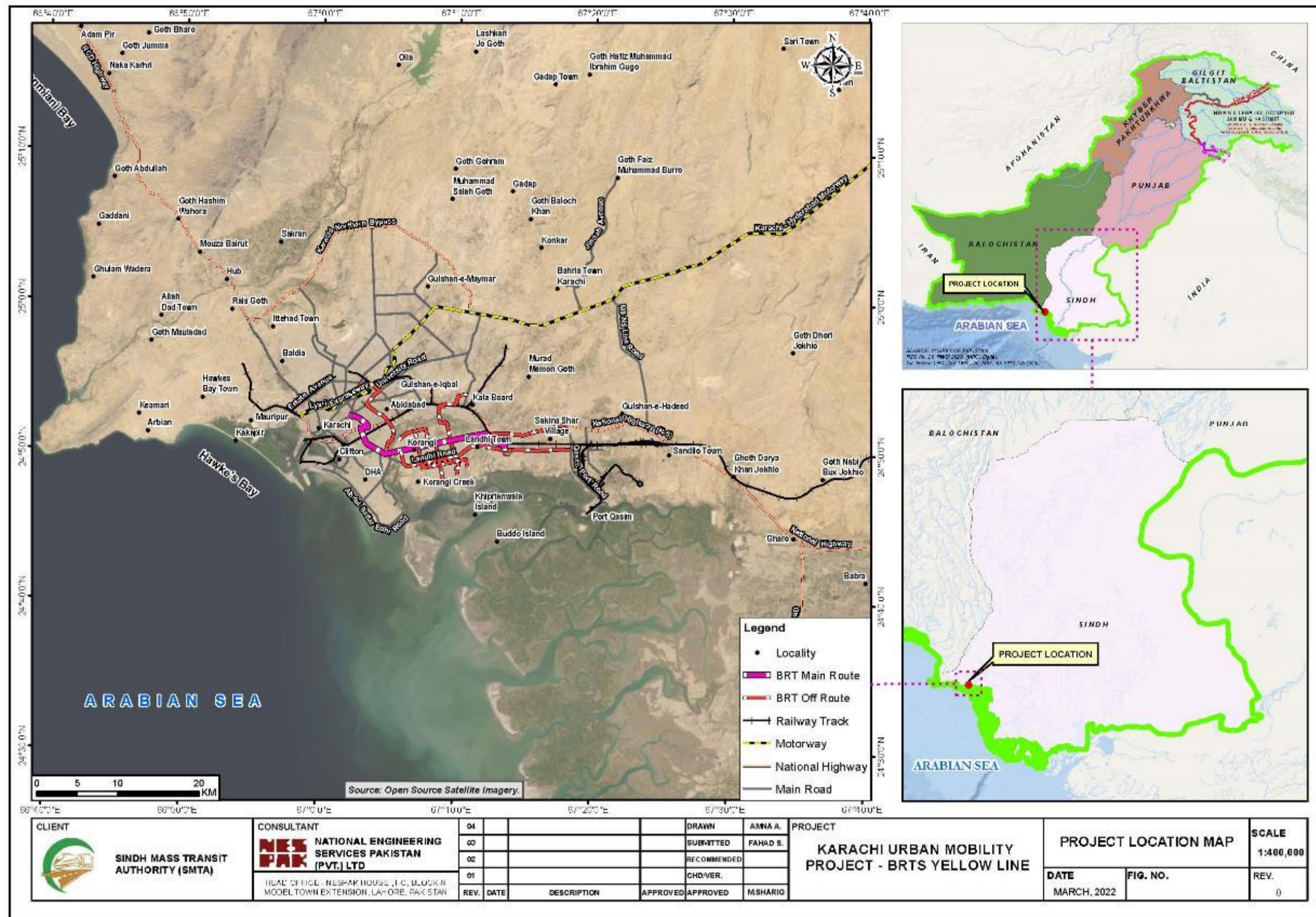


Figure 1.2: Project Location Map

1.7 THE PROPONENT

The Sindh Mass Transit Authority (SMTA) is the proponent for the Yellow Line BRT corridor project.

SINDH MASS TRANSIT AUTHORITY (SMTA)

D43/1 Shahra-e-Ghalib Clifton Block 2 Karachi
Telephone Number: 02199332207, 02199332206
E-mail Address: info@smta.sindh.gov.pk

1.8 THE CONSULTANT

The Consultant for the project is a Joint Venture (JV) between Dar Al Handasah and National Engineering Services Pakistan (Pvt.) Limited (NESPAK):

DAR AL HANDASAH

Verdun Street, Dar Al-Handasah Bldg.
P.O. Box: 11-7159, Beirut 1107 2230, Lebanon
Email: beirut@dar.com
Tel: +961 1 790 002

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LIMITED (NESPAK)

NESPAK House: 1-C, Block-N, Model Town Extension, Lahore, 54700,
(P.O. Box 1351), Pakistan
Telephone Number: 92-42-99090000
Fax Number: 92-42-99231950
Company E-mail Address: info@nespak.com.pk
Company Website: www.nespak.com.pk

Based on the requirements and objectives of the study, NESPAK formed a team of experts comprising a team leader (Environmental Specialist) with professional support from the Environmental Engineer, Environmental Scientist, Sociologist and Ecologist. The professional staff was involved in analyzing the data, impact assessment and mitigation measures and report compilation. In addition, the EIA team worked in close coordination with the design team and several inputs were provided by the design specialists to the EIA team. Detail of EIA team is given in **Table 1.1** below:

Table 1.1: Team Composition for the EIA Study

Sr. No.	Name of Expert	Designation
1.	Muhammad Shariq Ahmed	Chief Engineer/Head ERSD-QA Expert
2.	Syed Ali Sher Shah	Principal Environmental Engineer
4.	Ms. Sanobar Zubair	Senior Environmental Engineer
5.	Ms. Ramla Siddique	Senior Environmental Scientist

Sr. No.	Name of Expert	Designation
6.	Mr. Muhammad Sajjad	Senior Sociologist/Resettlement Expert
8.	Mr. Ibadullah Khan	Senior Ecologist

1.9 APPROACH & METHODOLOGY

1.9.1 Approach

The study has been conducted in accordance with Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021, Government of Pakistan (GOP) Guidelines, 1997. The study is based on both primary and secondary data and information. The primary data includes data collected from field. The secondary data includes a review of relevant information from literature. Discussions were held with stakeholders including government officials, community representatives and a wide range of road users and roadside dwellers. The main purpose of stakeholder consultation was to obtain an impartial impression of the people's perceptions about the project and its environmental and social impacts.

1.9.2 Methodology

The following methodology was adopted for carrying out the EIA study of the proposed project:

a) Orientation

Meetings and discussions were held among the members of the EIA Consulting Team. This activity is aimed at achieving a common ground of understanding of various issues of the study.

b) Data Collection Planning

Subsequent to the concept clarification and understanding obtained in the preceding step, a detailed data acquisition plan was developed for the internal use of the EIA Team of Consultant. The plan included; identification of specific data requirements and their sources; determination of schedules and responsibilities for the data collection; and indication of the logistics and other supporting needs for the execution of the data acquisition plan. Field survey was then conducted based on the data collection plan.

c) Field Survey

Several field surveys were conducted from December, 2021 to February 2022 for Yellow line BRT. The detailed site visits for collection of data were planned. The data to be collected from field included:

- Identification of environmental sensitive receptors including air sensitive receivers, noise sensitive receivers and water bodies expected to receive pollutant loads;
- Ecological survey;

- Socioeconomic survey and community consultations including gender consultations;
- Stakeholders consultation;

d) Review of Secondary Data

Previous environmental and social assessments for projects in Karachi and other published and unpublished information was collected in order to gain a complete understanding of existing environmental conditions of the area including:

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

e) Delineation of Zone of Influence (ZOI)

Yellow Line BRT Corridor passes through the districts of Korangi (Landhi Town, Korangi Town, Shah Faisal Town), District South Karachi (DHA and Clifton Cantonment Board) Karachi East (Jamshaid Town, Karachi Cantonment Board). The Yellow Line BRT Corridor services will operate from Dawood Chowrangi/Korangi 8000 Road, Abbasi Shaeed Road, Shahrah.e.Faisal, Shahrah-e-Qaideen Road to Numaish Chowrangi. The Yellow Line BRT will mostly serve the residents of Landhi / Korangi Areas and employees working in the Landhi, Korangi and Port Qasim Industrial Areas. The project comprises of following main features:

- Yellow Line BRT Corridor
- Stations
- Depots (2 No.s)
- Under Passes
- Bridges
- Elevated U-Turns
- Flyovers and
- Off-Corridor Routes

Zone of Influence means the area of a receiving environment with the potential to be altered or changed as a result of an emission or discharge. Zone of Influence (ZOI) in terms of environmental impacts along the main alignment of BRT corridor are considered for approximately 50 m from edge of existing road on both sides of the alignment whereas for off-route networks 15 m from edge of the road in linear manner. The impacts for depots are considered in 15 m around the boundary. ZOI map is attached as **Annexure-I**

f) Environmental Monitoring

Environmental Monitoring has the key role to assess the status of existing environment. An EPA certified laboratory was hired for Environmental Monitoring of air, water and noise quality. Environmental monitoring has been conducted for following parameters:

- Ambient Air Quality Monitoring (8 - 24 hours);
- Noise Measurement (24 Hours);
- Sampling & Analysis of Ground Water and Wastewater

Two (02) surface water / wastewater and five (05) drinking water/groundwater samples have been collected. Similarly, ten (10) points have been selected for the monitoring of ambient air and noise levels along the corridor.

g) Physical Environment

The information acquired for the establishment of physical environment baseline included the following main parameters:

- Land resources (including land use pattern, soil composition, contamination of soil and soil erosion etc.);
- Water resources (including available surface and groundwater resources and natural streams, hydrology, water supply, water contamination etc.);
- Climate data (including temperature, rainfall, humidity, wind speed and direction etc.);
- Ambient air quality and noise level monitoring data; and
- Existing solid waste management and effluents disposal practices and storm water drainage.
- Environmental sensitive receptors including air sensitive receivers, noise sensitive receivers and water sensitive receivers.

h) Ecological Environment

The information/data of ecological resources in the project area was collected and verified by utilization of various tools including literature review, stakeholders/departmental consultations and random ground truthing at site. The field-based data of following ecological components was also collected:

- Flora (trees, herbs, shrubs, grasses and overall vegetation including valuable or rare trees and their loss due to implementation of the project etc.);
- Fauna/ Wildlife (Mammals, reptiles, amphibians and avifauna);
- Agriculture and livestock (if any);
- Protected areas, National Parks, Game reserves, Game sanctuaries any other ecologically important areas. (if any);
- Migratory birds' corridors; and
- Endangered species (both flora and fauna).

i) Socio-Economic Environment

A sample survey was carried out within the ZOI in order to develop the socio-economic baseline information of the general settled population. Based on the sampling methodology, in total persons were interviewed located along the ZOI and consulted for the collection of baseline socio-economic data. The following major aspects were covered in the socioeconomic baseline survey of the population settled along the ZOI:

- Demographic characteristics;
- Literacy status/ education;
- Nature of business/occupation;
- Livelihood/income;
- Living standard of the population;
- Access to credit;
- Social Infrastructure available;
- Gender issues;
- Pressing needs of the people;
- Community perception about the project etc.;
- Labor Influx to Project Area;
- Waste management services;
- Religious, cultural and heritage information (mosques, shrines, graveyards);
- Archaeological monuments; and
- Other aspects.

Sensitive receptors based on access and social/cultural importance.

j) Stakeholder Consultations

The Consultants identified project stakeholders during the site reconnaissance. The EIA team met with the government functionaries, affected persons and local communities along the proposed BRT route. The objective of the consultation was to obtain apprehensions of the stakeholders and disseminate information on the project and its expected impacts, long-term as well as short-term, from primary and secondary stakeholders and to gather information on relevant issues so that the feedback received could be used to mitigate the potential environmental impacts associated with the implementation and operation of the project.

k) Environmental and Social Impact Assessment

Data collected from the field was analyzed and impacts of the proposed project on physical, ecological and socio-economic environment prevalent in the project area were identified and characterized with respect to significance and probability of occurrence at the design, construction and operation stages of the proposed project. The tools, which were used for impact assessment, are:

- Checklists;
- Matrices; and
- Overlays.

Mitigation measures and implementation mechanisms are proposed so that the impacts can be mitigated/controlled and the project implementation remains sustainable.

l) Development of Environmental Management Plan (EMP)

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

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

1.10 STRUCTURE OF REPORT

The structure of this report is given below:

Section 1: Introduction presents the project background, objectives, methodology and need of the EIA study.

Section 2: Legal and Administrative Framework Lists national as well as provincial laws, regulations and procedures.

Section 3: Project Description provides an overall description of the project including proposed alignment, design details, manpower requirement, estimation of waste generation, machinery and material requirements.

Section 4: Project Alternatives enlists possible design alternatives for the proposed project and their influence on environmental and social situation.

Section 5: Description of Environment gives a description of baseline physical, ecological and socio-economic conditions of the project area.

Section 6: Public Consultation and Information Disclosure identifies the main stakeholders and their concerns raised during scoping sessions and deals with the measures to mitigate the social impacts.

Section 7: Potential Environmental Impacts and their Mitigations Measures identifies, predicts and evaluates impacts of the project activities during the construction and operation stages and deals with the measures proposed to mitigate potential environmental impacts of the proposed project.

Section 8: Environmental Management Plan (EMP) outlines organizational framework, mitigation and monitoring plans training requirements, defines roles and responsibilities, estimates budgets requirements for satisfactory implementation.

Section 9: Conclusions and Recommendations discusses conclusion and recommendations for the environmental management of the Yellow BRT Corridor project in line with SEPA requirements.

2 LEGAL AND ADMINISTRATIVE FRAMEWORK

This chapter elucidates the current legal framework which is applicable on the proposed project in context of environment and sustainable development. The institutional arrangement that exists in Pakistan and may influence the environmental management of the proposed project is also discussed in this chapter.

2.1 POLICY FRAMEWORK

Following are the main policies applicable to the project:

Table 2.1: Policies Applicable to the BRT Yellow Line Corridor

Sr. No.	Policy/Plan	Description	Relevance to BRT yellow Line Corridor
1.	National Climate Change Policy, 2021	Pakistan developed its first National Climate Change Policy (NCCP) in 2012 which is updated in 2021 and the focus of the NCCP-2021 is on adaptation and mitigation with the major emphasis on nature-based solutions. In the policy the vulnerabilities of various sectors to climate change have been highlighted and appropriate adaptation measures spelled out. These cover policy measures to address issues in various sectors such as water, agriculture, forestry, coastal areas, bio diversity and other vulnerable ecosystems. Notwithstanding the fact that Pakistan's contribution to global greenhouse gas (GHG) emissions is small, its role as a responsible member of the global community in combating climate change has been highlighted by giving due importance to mitigation efforts in sectors such as energy, transport, forestry and agriculture. Furthermore, appropriate measures relating to disaster preparedness, capacity building, institutional strengthening; technology transfer and international cooperation have also been incorporated as important components of the policy.	The policy document pursues sustained economic growth by appropriately addressing the challenges of climate change. In addition to propose adaptation measures in other sectors. It also outlines policy measures with respect to Road Transport sector.
2.	Framework for Implementation of Climate Change Policy 2014-2030	The development of this Framework for Implementation of NCCP is a follow-up of the National Climate Change Policy (NCCP), the parent document providing broader	To minimize GHG emissions from transport sector and priority action plans in transport sector refers to develop an efficient mass

Sr. No.	Policy/Plan	Description	Relevance to BRT yellow Line Corridor
		framework concerning how to adapt to the changing impacts of climate and how to play a role in its mitigation. This Framework for Implementation of NCCP is developed keeping in view the current and future anticipated climate change threats to Pakistan's various sectors. NCCP recommends the following actions on priority basis for developing mass transit system in metropolitan cities. - Undertake detailed feasibility studies through foreign consultants to develop an efficient mass transit system in all metropolitan cities of Pakistan. - Explore the possibility to fund the development of these mass transit systems through Green Climate Fund.	transit system in all metropolitan cities of Pakistan whereas short term plan indicates to popularize mass transit system over the use of individual cars.
3.	1 st Sindh Labour Policy, 2018	1 st Sindh Labour Policy was introduced in 2018. The Major focus of the 1 st 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 labour will be employed for the project at various stages.
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-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.	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.

Sr. No.	Policy/Plan	Description	Relevance to BRT yellow Line Corridor
5.	National Action Plan for Covid-19 Pakistan	National Action Plan for Covid-19 Pakistan provides the national strategy which prescribes guidelines on how to contain and prevent the spread and ultimately eliminate the threat of the Coronavirus Disease 19 (COVID-19).	The National Action Plan for Covid-19 Pakistan is applicable to project to avoid any spread of disease during interactions at different stages of project.
6.	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.	This strategy is applicable as it addresses issues of transport including public transport as part of urban environment and the project involves the construction of proposed Yellow BRT Corridor to improve the traffic situation with least environmental burden and sustainable operation of transportation in the city.
7.	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.	This policy is applicable to the project to ensure supply of clean drinking water without jeopardizing the demand of local water users.
8.	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.	The proposed project includes construction of Jam Sadiq bridge over Malir River. Malir River is a seasonal river that flows through various areas of the city and eventually drains into the Arabian Sea.

2.2 STATUTORY FRAMEWORK

Following are the main provincial legislations applicable to the project:

Table 2.2: Acts/Legislation Applicable to the BRT Yellow Corridor

Sr. No.	Legislation/Act	Description	Relevance to BRT yellow Corridor
1	Sindh Environmental Protection Act, 2014	The law provides the basic framework for environmental management of the province. The main focus of the law is on sustainable development, protection, conservation, rehabilitation, and improvement of environment. It instructs the provincial government to establish the Sindh Environmental Protection Council. Under the law, Environmental Impact Assessment/Initial Environmental Examination (EIA/IEE) is essentially required for all the projects before commencing any construction activity. It prohibits specified discharges and emissions. Sindh Environmental Quality Standards are an essential part of the law. The SEPA empowers the provincial government to issue notices and to enforce the Act for the protection of the environment.	This Act has a direct relevance to the Project as it requires an Environmental Impact Assessment (EIA) to be approved by local regulatory authority, i.e: Sindh Environmental Protection Authority.
2	Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021.	The document defines the categories for screening of the projects. This document also sets out the requirements for conducting, filing and review of an IEE and EIA.	According to Sindh Environmental Protection Agency Regulation, 2014, the proposed Yellow BRT Corridor project is categorized in the Schedule-III under subsection E of Transport thus requiring an EIA.
3	Sindh Environmental Quality Standards (2016)	The Sindh Environmental Quality Standards SEQS were promulgated in 2016 which includes standards for ambient air, drinking water quality and noise levels. It also sets standard limits for municipal and liquid effluent, industrial gaseous emissions, motor vehicular exhaust, emission standards for diesel vehicles and petrol vehicles.	All projects to be implemented in Sindh must conform to SEQS during all the phases i.e. Construction and Operation.
4	Sindh Solid Waste Management Board (SSWMB) Act, 2014	The SSWMB Act, 2014 enacted to establish a board for collection and disposal of all solid waste, to arrange effective delivery of sanitation services, to provide	This act is applicable as project will generate the solid waste which will be managed and disposed of as per the legislative

Sr. No.	Legislation/Act	Description	Relevance to BRT yellow Corridor
		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.	requirements of this act.
5	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.	None of the sites protected under this law has been identified within the RoW/Col of the proposed Project. SMTA will get NOC from Department of Culture, Tourism and Antiquities if any protected site is identified along Yellow BRT Corridor.
6	Antiquities Act, 1975	Under the Act, the project proponents is obligated that no activity is undertaken in the proximity of a protected antiquity without getting NOC from relevant department. If an archaeological discovery is made during the course of the project, it should be reported to the Department of Archaeology, Government of Pakistan.	Although no antiquity site has been identified within the proposed Col. 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.
7	Building Code of Pakistan, 2007	Building Code of Pakistan is established after devastating earthquake of 2005 to prescribe the minimum requirements for the earthquake design and construction of buildings and building like structures and/or their components subjected to earthquake ground motions.	The provision of Building Code of Pakistan shall apply for engineering design of building like structure and related components.
8	The Canal and Drainage Act, 1873	The Canal and Drainage Act 1873 (CDA) focuses on construction and maintenance of drainage channels and defines powers to prohibit obstruction or order their removal. It also covers	This act will be applicable as the proposed alignment passes through the Malir River (one of the major flood water and drainage structure of Karachi city)

Sr. No.	Legislation/Act	Description	Relevance to BRT yellow Corridor
		issues related to canal navigation. It briefly addresses issues relating to environmental pollution. Section 70(5) of the CDA clearly states that no one is allowed to “corrupt or foul the water of any canal so as to render it less fit for the purposes for which it is ordinarily used.” In addition, Section 73 of the CDA gives power to arrest without warrant or to be taken before the magistrate a person who has willfully damaged or obstructed the canal or “rendered it less useful.	and drain at Korangi.
9	The Forest Act 2012	The Forest Act 1927 has been replaced by the provincial Forest Act 2012, after forestry became into the provincial domain under the 18th amendment to the Constitution of Pakistan. However, the main applicable clauses still hold true in essence. The Act reserve the areas having forest cover, or significant wildlife, to regulate movement and transit of forest produce, and duty leviable on timber and other forest produce. It also defines the procedure to be followed for declaring an area to be a Reserved Forest, a Protected Forest or a Village Forest.	This act will be applicable as there are many trees fall in proposed alignment.
10	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.	As the Yellow BRT corridor does not have any wildlife protected area in its vicinity nor does it fall under the flyway zone of migratory birds therefore no provision of this law would be applicable to it.
11	The Sindh Local Government (Amendment) Act, 2021	Under the Sindh Local Government Act 2013 (SLGA), Chapter VI, land use planning; implementation of building by-laws; management of environmental and health hazards; food adulteration; provision and	This act addresses environmental concerns, transportation, encroachment, roads etc. which are relevant with the Yellow

Sr. No.	Legislation/Act	Description	Relevance to BRT yellow Corridor
		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 2021 amendment served to define municipal corporations and committees, along with establishing a relationship between elected councils and provincial departments working in administrative boundaries.	BRT project.
12	Land Acquisition Act, 1894 (Sindh Amendment Act, 2009)	The Land Acquisition Act (1894), (Sindh Amendment, 2009) deals with the acquisition of private properties for public purposes. The large development projects including road projects are also being considered under this Act. There are 55 sections in this Act mainly dealing with area notifications, surveys, acquisition, compensation, apportionment awards, disputes resolution, penalties and exemptions.	The proposed project does not involve any land acquisition therefore no provision of this law would be applicable.
13	Sindh Public Property Act, 2010	The act has been passed to avoid illegal encroachments and provide measures for removal of encroachment from public property and to retrieve possession. The City Government will provide continuous oversight and reinforcement to facilitate the properties to remain free from illegal encroachments.	This act is applicable if there is any encroachment at the proposed public/ government land.
14	The Sindh Prohibition of Employment of Children Act, 2017	The Sindh Prohibition of Employment of Children Act, 2017 entails to prohibit the employment of children and to regulate employment of adolescents in certain occupations and work and to provide for matters connected therewith.	The relevance of this act to the project will be to prohibit child employment in all the stages of project.
15	Sindh Factories Act 2021	The Sindh Factories Act 2015 deals with regulations related to project area, workers and workplace Environment Health and Safety (EH&S) requirements. Conditions are specified for clean work place, toilets, waste handling, provision of drinking water quality, worker health and hygiene etc.	These laws and regulations apply in any project situation where labor rights and protections are envisaged. These laws are applicable during construction and operation of the project.
16	Hazardous Substances Rules, 2014	The rule describes the procedure of handling, transportation and disposal of hazardous substances and	The rules are relevant as handling, transportation and disposal of hazardous

Sr. No.	Legislation/Act	Description	Relevance to BRT yellow Corridor
		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.	substances and hazardous waste is expected in various project activities and stages.
17	Sindh Minimum Wages Act, 2015	This act provides for the regulation of minimum rates of wages and various allowances for different categories of workers employed in certain industrial and commercial undertakings and establishments.	The contractors and operators of the project will be bound to pay wages to the labor and employees as per the requirement of this act.
18	The Sindh Terms of Employment (Standing Orders) Act, 2015	The Sindh Terms of Employment (Standing Orders) Act, 2015 passed in 2016 expedient to provide for regulation of industrial and commercial employment in the Province of the Sindh and for matters connected therewith.	The labour law is applicable as labour is involved in all stages of the project.
19	The Sindh Occupational Safety and Health 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. 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 injury the imprisonment may extend to six months or a fine up to PKR 20,000 or both.	This law is applicable to project workers and will be complied during construction and operation phases.
20	Sindh Workers Compensation Act, 2015	The Sindh Workers Compensation Act, 2015 passed in 2016 provides a legal framework for compensating workers or their dependents in case of work-related injuries, disabilities, or deaths. The Act aims to ensure that workers are adequately compensated for injuries or fatalities that occur during the course of their employment.	The act is applicable to the Workers in case of work-related injuries, disabilities, or deaths during construction and operation stages.
21.	Fatal Accidents Act 1855	In Pakistan, the Fatal Accidents Act has been incorporated into the legal framework, and similar provisions may exist in various provincial laws. The Act enables the family members or dependents of the deceased to bring a legal action against the party responsible for the actionable wrong. The compensation awarded in such cases typically covers financial losses suffered by the dependents due to the death of the victim.	The act must be considered to enable compensation to the family of a person for loss occasioned to it by his death by actionable wrong.
22.	The Sindh Bonded Labour System	The Sindh Bonded Labour System (Abolition) Act, 2015 is a substantive law adopted in 2016 for the province	The act must be considered to avoid any bonded labour during

Sr. No.	Legislation/Act	Description	Relevance to BRT yellow Corridor
	(Abolition) Act, 2015	of Sindh, Pakistan. The purpose of this Act is to abolish the practice of bonded labor, a system in which individuals are forced to work to repay a debt, often under exploitative and degrading conditions.	construction and or operation of the project.
23.	The 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 the public sector project and shall be transparent for public
24.	Transgender Persons (Protection of Rights) Act, 2018	The act defines transgender person and intersex people, their rights and legal recognition of gender identity, protection from discrimination, offences and penalties, other areas of concern including rehabilitation, harassment, separate prison cells, etc.	The project is inclusive of all genders in all the stages of the project.
25	The Protection against Harassment of Women at the Workplace (Amendment) Act, 2022	The Protection against Harassment of Women at the Workplace (Amendment) Act, 2022 refers to sexual harassment at the workplace	This Act will be applicable to the Project as women participation in all stages of the project is will be encouraged.
26	Sexual Violence Response Framework (SVRF), Government of Sindh 2020-2024	The Home Department, Law and Parliamentary Affairs and Criminal Prosecution Department and Women Development Department, Government of Sindh have developed this framework to improve response to sexual violence in the province and reduce its occurrence to the greatest possible extent. This framework is based on primary, secondary and tertiary measures. The objective of the SVRF is two-fold. First, it provides a detailed breakdown of actions and interventions necessary for successful implementation of the recent legislation and judgments by	The project is a public facility and encourages equal participation of all genders. The safety of all genders can be ensured by implementation of Sexual Violence Response Framework.

Sr. No.	Legislation/Act	Description	Relevance to BRT yellow Corridor
		the Government. Second, it expands the scope of work of Government functionaries beyond the law to initiate primary and tertiary preventative and response measures to work towards reducing sexual violence. The SVRF was developed after a series of consultations with various key departments, institutions and individuals from civil society and legal fraternity. These include but are not limited to the Police, Medico legal department, Office of the Prosecutor General, Office of the Advocate General, Health Department, Human Rights Department, Sindh Judicial Academy, Sindh Human Rights Commission and the Sindh Commission on the Status of Women. Furthermore, two roundtable dialogues were held on 30 th July and 5 th December 2019 to discuss and receive technical feedback and expert opinion on the SVRF.	

i. Air Quality Standards

Air quality standards issued by SEPA in 2016 are given in **Table 2.3**.

Table 2.3: Air Quality Standards SEQS 2016

Sr. No.	Pollutant	Time Weighted Average	SEQS
1	SO ₂	Annual average	80 µg/m ³
		24 hours	120 µg/m ³
2	NO	Annual average	40 µg/m ³
		24 hours	40 µg/m ³
3	NO ₂	Annual average	40 µg/m ³
		24 hours	80 µg/m ³
4	O ₃	1 hour	130 µg/m ³
		-	-
5	SPM	Annual average	360 µg/m ³
		24 hours	500 µg/m ³
6	PM ₁₀	Annual average	120 µg/m ³
		24 hours	150 µg/m ³
7	PM _{2.5}	Annual average	40 µg/m ³
		24 hours	75 µg/m ³
		1 hour	15 µg/m ³
8	Lead	Annual average	1 µg/m ³
		24 hours	1.5 µg/m ³
9	CO	8 hours	5 mg/m ³
		1 hour	10 mg/m ³

ii. Noise Standards

Noise standards issued by SEPA are given in **Table 2.4**.

Table 2.4: Noise Standards SEQS 2016

Sr. No.	Category of Area	SEQS	
		Day Time	Night Time
1	Residential Area	55	45
2	Commercial Area	65	55
3	Industrial Area	75	65
4	Silence Zone	50	45

iii. Drinking Water Quality Standards

Drinking Water Quality Standards issued by SEPA are given in **Table 2.5**.

Table 2.5: Drinking Water Quality Standards SEQS, 2016

Sr. No.	Parameters	SEQS (mg/l)
Chemical Parameters		
1	Aluminium (Al)	≤ 0.2
2	Ammonium (NH ₃)	-
3	Antimony (Sb)	≤ 0.005
4	Arsenic (As)	≤ 0.05
5	Barium (Ba)	0.7
6	Boron (B)	0.3
7	Cadmium (Cd)	0.01
8	Chloride (Cl)	< 250
9	Chromium (Cr)	≤ 0.05
10	Copper (Cu)	2
11	Cyanide (CN)	≤ 0.05
12	Fluoride (F)	≤ 1.5
13	Iron (Fe)	-
14	Lead (Pb)	≤ 0.05
15	Manganese (Mn)	≤ 0.5
16	Mercury (Hg)	≤ 0.001
17	Molybdenum (Mo)	-
18	Nickel (Ni)	≤ 0.02
19	Nitrate (NO ₃)	≤ 0.50
20	Nitrite (NO ₂)	
21	Selenium (Se)	0.01

Sr. No.	Parameters	SEQS (mg/l)
22	Silver (Ag)	-
23	Sodium (Na)	-
24	Sulphate (SO ₃)	-
25	Residual Chlorine	0.2-0.5
26	Zinc (Zn)	5.0
Physical Parameters		
27	Color	≤ 15 TCU
28	Taste	Non-Objectionable/ Acceptable
29	Odor	Non-Objectionable/ Acceptable
30	Turbidity	< 5 NTU
31	Total hardness	< 500 mg/l
32	TDS	< 1000
33	pH	6.5-8.5
Biological Parameters		
34	E-Coli	Must not be detectable in any 100 ml sample
35	Total Coliforms	Must not be detectable in any 100 ml sample

2.3 INTERNATIONAL TREATIES AND CONVENTIONS

Pakistan is a signatory to a number of Multilateral Environmental Agreements (MEAs). These MEAs impose requirements and restrictions of varying degrees upon the member countries, in order to meet the objectives of these agreements. However, the implementation mechanism for most of these MEAs is weak in Pakistan. The following are the relevant international treaties and conventions that have been ratified by Pakistan. With the exception of international labor standards and climate protocols, none is likely to have a direct repercussion on the conduct of the Yellow BRT Project.

Table 2.6: Multilateral Environmental Agreements

Name	Signing	Ratification
Ramsar Convention on Wetlands (Conservation and use of Wetlands through local and national action)	1971	1976
Convention on Migratory Species (Conservation of migratory Species)	1971	1987
Convention on International Trade in Endangered Species (Protection of endangered species of wild animals and plants)	1973	1976
Convention on the Law of the Seas (Peaceful uses of the Seas and Oceans)	1982	1997
Vienna Convention for the Protection of the Ozone Layer	1989	1992
Montreal Protocol on Substances that Deplete the Ozone Layer (Reducing emissions of substances that deplete the ozone layer)	1989	1992
Convention on Biological Diversity (Conservation of biological diversity)	1992	1994

Name	Signing	Ratification
Basel Convention on the Control of Trans-Boundary Movement of Hazardous Waste (Controlling the trans-boundary movement of hazardous waste)	1992	1994
United Nations Framework Convention on Climate Change (Stabilization of greenhouse gas concentrations)	1992	1994
United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa (Combat desertification and mitigate the effects of drought)	1994	1997
Kyoto Protocol to the United Nations Framework Convention on Climate Change (Mitigation of climate change and carbon sequestration)	1997	2005
Stockholm Convention on Persistent Organic Pollutants (Protection from persistent organic pollutants)	2001	2008
Paris Agreement (Voluntary accords to mitigate climate change)	2016	2016

2.4 ADMINISTRATIVE FRAMEWORK

The proposed project falls under the following Institutional and Administrative Framework.

2.4.1 Sindh Mass Transit Authority (SMTA)

The implementing agency of the proposed project is Sindh Mass Transit Authority, Government of Sindh, therefore, it is responsible for liaising with line departments to ensure that the project complies with the laws and regulations controlling the environmental concerns of Yellow line construction and operation, and that all pre-construction requisites, such as permits and clearances are met. SMTA will be responsible for ensuring that all the measures proposed in the Environmental and Social Management Plan are effectively implemented by the contractor during construction phase and operation phase of the proposed project.

2.4.2 Sindh Environmental Protection Agency (SEPA)

Before the 18th amendment in the Constitution of Pakistan, environment related issues were governed by the federal regime through Pakistan Environmental Protection Act 1997. However, after the 18th amendment in 2010, Sindh Environmental Protection Agency (Sindh-EPA) as provincial agency and headed by Director General is responsible for environmental protection and pollution control in the province of Sindh and will be responsible for reviewing the report, issuing Environmental Approval and overall/broad based monitoring of proposed project activities.

3 PROJECT DESCRIPTION

3.1 RATIONALE OF THE PROJECT

Karachi is one of the largest and most populous metropolitan cities in the world with built-up areas comprising about 1,500 km². The study of Karachi Transportation Improvement Project by Japan International Cooperation Agency (JICA KTIP 2030) estimated that the population of Karachi is expected to be 31.6 million by 2030. With increasing population, the public transport availability has decreased and the quality has been deteriorated. Commuters face problems due to poor quality of service, sub-standard vehicles and unplanned routes resulting in unnecessary travel delays, severe traffic congestion, economic and financial losses and environmental degradation due to noise and air pollution and vehicular exhausts. Hence, Transport and Mass Transit Department (TMTD) is pursuing plans for improving and upgrading the public mass transit system in the city.

JICA carried out a detailed study for Karachi Transportation Improvement Project (KTIP) in 2009- 2012 and recommended a comprehensive Urban Transport Master Plan that integrates roads and Mass Transit projects.

KTIP study recommended two Mass Rapid Transit (MRT) lines (Blue and Brown) and six BRT lines (Green, Red, Yellow, Orange, Aqua, and Purple) besides revitalization of KCR on modern lines.

3.2 TRAFFIC STUDY

The traffic study report, January 2022 focuses on analyzing junctions and pedestrian locations for the Yellow Bus Rapid Transit (BRT) Line of the Karachi Mobility Project along Main Korangi Road & Shahrah-e-Quaideen. Traffic surveys at selected junctions and pedestrian crossings along this alignment were conducted. The survey included:

- Turning movement counts (TMCs) at 6 junctions
- Parking counts at 8 locations
- Pedestrian counts at 10 locations.

In total there are 14 main junctions located along the Yellow BRT corridor. Those junctions are classified into two groups as follows:

Group A which comprises 6 junctions that were surveyed in year 2021 are given in **Table 3.1** for the purpose of this study.

Table 3.1: Group A Junctions - Traffic Survey Locations

Location	Name	Date	
TMC 1	Tariq Road Intersection	Thursday, October 14, 2021	Weekday
		Saturday, October 16, 2021	Weekend
TMC 2	KPT Roundabout	Thursday, October 14, 2021	Weekday
		Saturday, October 16, 2021	Weekend

Location	Name	Date	
TMC 3	Bilal Chowrangi	Thursday, October 14, 2021	Weekday
		Saturday, October 16, 2021	Weekend
TMC 4	Herbion Chowrangi	Tuesday, October 12, 2021	Weekday
		Saturday, October 16, 2021	Weekend
TMC 5	Dawood Chowrangi	Tuesday, October 12, 2021	Weekday
		Saturday, October 9, 2021	Weekend
TMC 6	Vita Chowrangi	Tuesday, October 12, 2021	Weekday
		Saturday, October 9, 2021	Weekend

Table 3.2 gives following are Locations for were studied for Pedestrian Crossing Survey

Table 3.2: Pedestrian Crossing Survey Locations

Location	Name	Type	No. of Directions	Date, Weekday	Date, Weekend
Pedestrian 1	Future More	Roundabout 3-Legged	6	Thursday, October 21, 2021	Saturday, October 23, 2021
Pedestrian 2	National Medical Center	Bridge	2	Tuesday, November 2, 2021	Sunday, October 31, 2021
Pedestrian 3	Korangi Road near Tooba Masjid	Bridge	2	Tuesday, October 26, 2021	Sunday, October 24, 2021
Pedestrian 4	Korangi Road near Sunset Boulevard	Bridge	2	Tuesday, October 26, 2021	Sunday, October 24, 2021
Pedestrian 5	Near Soorty Enterprise	Bridge	2	Wednesday, October 27, 2021	Sunday, October 31, 2021
Pedestrian 6	Korangi Road near Sunset Boulevard	Bridge	2	Tuesday, October 26, 2021	Sunday, October 24, 2021
Pedestrian 7	Herbion Chowrangi	Roundabout	8	Tuesday, October 12, 2021	Saturday, October 16, 2021
Pedestrian 8	Indus Chowrangi	Roundabout	8	Thursday, October 21, 2021	Saturday, October 23, 2021
Pedestrian 9	KPT Roundabout	Roundabout	12	Thursday, October 14, 2021	Saturday, October 16, 2021
Pedestrian 10	Shahrah e Faisal near Sindhi Muslim Society	Mid-Block	2	Tuesday, October 26, 2021	Sunday, October 24, 2021

In 2021, ten (10) key junctions on the Yellow BRT route along Main Korangi Road and Shahrah-e-Quaideen were not studied as they were already studied in 2019 for the Preliminary Design. However, for this study, TMC 1 (Tariq Road Intersection) and TMC 6 (Vita Chowrangi roundabout) were resurveyed to ensure the consistency in 2019 and 2021 results. (**Table 3.3**)

Table 3.3: Group B-Junction Names and Types, Preliminary Design (PD) Study, 2019

Junction Name	Notes
Khalid Bin Waleed Intersection	Signalized Intersection
National Medical Center (NMC) Intersection	Signalized Intersection
Defense Housing Authority (DHA) Intersection	Signalized Intersection
Sunset Boulevard Intersection	Signalized Intersection
Khayaban-e-Ittehad Intersection	Signalized Intersection
Brooks Intersection	Roundabout
Shan Intersection	Roundabout
Singer Intersection	Roundabout

3.2.1 Junction Assessment for survey works for Group A, year 2021

The peak hours (morning/AM, midday/MD and evening/PM) were determined, and volumes were converted to Passenger Car Units (PCUs). The assessment of the surveyed junctions, using PTV Vistro Software, showed that in both weekdays and weekends the junctions are operating at un-acceptable Level of Service (LOS) 'F' as indicated in the **Table 3.4**. Only TMC4 and IMC5 showed acceptable LOS 'D' or better in MD peak, while this LOS was deteriorated to 'E' at TMC 5 in MD weekday and PM weekend peaks.

Table 3.4: Group A - Junction Assessment Results (Year 2021)

Site	Case	Survey Time	Peak Hour	Delay (seconds/vehicle)	LOS
TMC1	As-Is Traffic Signals	Weekday	AM	350.3	F
			MD	332.6	F
			PM	470.5	F
		Weekend	AM	311.1	F
			MD	327.5	F
			PM	415.9	F
TMC2	As-Is Unsignalized Roundabout	Weekday	AM	6,000.0	F
			MD	4,736.9	F
			PM	1,403.2	F
		Weekend	AM	5,914.5	F
			MD	3,173.2	F
			PM	4,373.5	F
TMC3	As-Is Traffic Signals	Weekday	AM	576.3	F
			MD	95.5	F
			PM	189.1	F
		Weekend	AM	183.8	F
			MD	197.7	F
			PM	203.8	F
TMC4	As-Is Traffic Signals	Weekday	AM	312.2	F
			MD	29.1	D
			PM	144.3	F
		Weekend	AM	184.6	F
			MD	31.5	D
			PM	136.5	F
TMC5	Optimized Traffic Signals	Weekday	AM	115.7	F
			MD	76.3	E
			PM	105.7	F

TMC6	As-Is Traffic Signals	Weekend	AM	112.4	F
			MD	27.5	C
			PM	72.6	E
		Weekday	AM	792.4	F
			MD	274	F
			PM	442.4	F
		Weekend	AM	486.5	F
			MD	274.3	F
			PM	228.2	F

3.2.2 Pedestrian Crossings' Assessment for survey works, year 2021

The highest peak hour assessment of the surveyed pedestrian crossings, using LOS Criteria defined by Station planning standards and guidelines 2012 edition (Transport for London), showed that the LOS is acceptable LOS 'A' and that the provided widths are acceptable since the calculated ones are less in value. Pedestrian Assessment Results, 2021 are given in **Table 3.5**.

Table 3.5: Year 2021 Pedestrian Assessment Results

Name	Volume (max/min)	Level of service	Two-way passageway width (m)	Provided width(m)
Pedestrian 1	4.53	A	0.71	3.00
Pedestrian 2	3.6	A	0.69	3.00
Pedestrian 3	1.99	A	0.65	3.01
Pedestrian 4	5	A	0.73	2.92
Pedestrian 5	6.69	A	0.77	2.90
Pedestrian 6	6.83	A	0.77	2.93
Pedestrian 7	4.13	A	0.7	3.00
Pedestrian 8	6.53	A	0.76	3.00
Pedestrian 9	9.33	A	0.83	3.00
Pedestrian 10	1.07	A	0.63	3.00

3.2.3 Junction Assessment for surveyed Group A locations, years 2026 and 2046

The peak hours' surveyed volumes for the junctions and pedestrians were projected to the years 2026 (opening year of the BRT corridor) and 2046 (the Ultimate year of the analysis, i.e. after 20 years of BRT operation) after deducting the BRT demand that this bus mode is expected to attract from the other modes of transport (cars, motorcycles, rickshaws, public transport) according to latest ODBM (Operational Design and Business Model) Report dated November 2020.

Based on the projected volumes, mitigation measures were introduced to the junctions to secure that they will operate at acceptable LOS in the future. The assessment was first carried out for year 2064 and then the same mitigations were assessed with the 2026 traffic volumes. The 2046 junction analysis, carried out also using Vistro, indicated that after introducing the mitigation measures described in the below table, all junctions shall operate at acceptable LOS 'E' or better.

In addition to the above junction assessment, **Jam Sadiq bridge** is considered a very important segment on the Yellow BRT Line corridor which connects the west and east banks of the Malir river in Karachi. This road link was assessed from traffic perspective for the years 2026, 2030, 2040, 2046 and 2050. Currently, the structure consists of only 2 traffic lanes per direction. The 2019 PD Study report is proposing to increase the bridge to 3x3 carriageway in addition to dedicated BRT lane in each direction. The LOS results, conducted for AM, MD and PM peak hours, indicated that the 3x3 carriageway shall operate at acceptable LOS up to year 2046, and shall start failing in 2050 during only the PM peak hour.

Table 3.6: Group A - Junction Assessment Results (Year 2046)

Site	Case	Time	Peak Hour	Delay (seconds/veh)	LOS
TMC1	2-Phase signals + Bridge	Weekday	AM	40.96	D
			PM	57.18	E
TMC2	4-legged 4-phase signals + Tunnel	Weekday	AM	26.04	C
			PM	51.33	D
TMC3	3-Phase signals + Tunnel	Weekday	AM	47.88	D
			PM	25.96	C
TMC4	3-Phase signals + Tunnel	Weekday	AM	56.69	E
			PM	32.64	C
TMC5	3-Phase signals + Bridge	Weekday	AM	28.11	C
			PM	37.88	D
TMC6	3-Phase signals + Tunnel	Weekday	AM	27.54	C
			PM	22.80	C

As for the 2026 results for the junctions, carried out using Vistro, the below table indicates that the junctions shall perform at acceptable LOS 'C' or better.

Table 3.7: Group A - Junctions Assessment Results (Year 2026)

Site	Case	Time	Peak Hour	Delay (seconds/veh)	LOS
TMC1	2-Phase signals + Bridge	Weekday	AM	6.29	A
			PM	6.85	A
TMC2	4-legged 4-phase signals + Tunnel	Weekday	AM	18.5	B
			PM	23.96	C
TMC3	3-Phase signals + Tunnel	Weekday	AM	20.83	C
			PM	18.91	B
TMC4	3-Phase signals + Tunnel	Weekday	AM	22.74	C
			PM	18.34	B
TMC5	3-Phase signals + Bridge	Weekday	AM	15.42	B
			PM	17.44	B
TMC6	3-Phase signals + Tunnel	Weekday	AM	16.86	B
			PM	16.59	B

3.2.4 Pedestrian Crossings' Assessment for surveyed locations, years 2026 and 2046

The pedestrian assessment in years 2046 and 2026 showed acceptable LOS results 'A' or better and that the provided widths can accommodate the demand, as can be seen from the below table. Although some of these locations will be relocated or demolished, still it was necessary to carry out the assessment to shift the volumes to the new locations for instance at the junctions serving BRT stations

3.2.5 Group B Junctions - year 2021

As mentioned in the introduction eight (8) out of the 10 junction's of 2019 PD Study were adopted for the junction assessment. The table below shows the Level of Service of the exiting junctions.

Table 3.8: Group B - Junction Names and Types - 2019 PD Study

Junction Name	Level of Service
Khalid Bin Waleed Intersection	F
NMC Intersection	F
DHA Intersection	F
Sunset Boulevard Intersection	F
Khayaban-e-Ittehad Intersection	F
Brooks Intersection	F
Shan Intersection	F
Singer Intersection	F

3.2.6 Group B Junctions' Assessment for year 2046

The mitigation measures, initially introduced under PD Study, were re-assessed and modified as deemed necessary to achieve acceptable LOS results in year 2046. The **Table 3.9** summarizes the outcomes of the LOS assessment carried out using Vistro. As can be seen from the table the 2019 PD Study mitigations showed unacceptable LOS 'F' at all junctions, while after re-modifying the mitigation measures at the junctions the LOS shall improve to 'E' and better.

Table 3.9: Group B - Junction Assessment Results (Year 2046)

Intersections	Mitigations Based on 2019 PD Study		Additional Mitigations	
	LOS	Delay (Sec/Veh)	LOS	Delay (Sec/Veh)
Khalid Bin Waleed Intersection	F	205.41	D	45.67
NMC Intersection	F	321.41	A	4.31
DHA Intersection	F	416.69	B	12.32
Sunset Boulevard Intersection	F	317.00	A	8.93
Ittehad Intersection	F	476.56	E	60.12
Brooks Intersection	F	980.06	E	75.16
Shan Chowrangi Intersection	F	461.79	E	55.46
Singer Intersection	F	1027.67	D	49.96

3.2.7 Group B Junctions' Assessment for year 2026

The 2019 PD Study mitigation measures adopted for the eight (8) junctions (Group B), as well as the modified mitigation measures proposed under year 2046 at the junctions, were assessed based on 2026 PCU traffic volumes that were input into Vistro. The below **Table 3.10** showed that after introducing the modified mitigation measures, the LOS at the junctions shall be 'B' or better.

Table 3.10: Group B - Junction Assessment Results (Year 2026)

Intersections	2019 Study PD Mitigations		Additional Mitigations	
	LOS	Delay (Sec/Veh)	LOS	Delay (Sec/Veh)
Khalid Bin Waleed Intersection	C	30.36	B	18.04
NMC Intersection	D	42.52	A	0.57
DHA Intersection	F	82.86	A	0.71
Sunset Boulevard Intersection	D	45.36	A	0.63
Ittehad Intersection	F	152.79	A	0.93
Brooks Intersection	F	424.65	B	10.25
Shan Chowrangi Intersection	F	137.55	B	17.24
Singer Intersection	F	561.26	A	8.51

3.2.8 Summary Junctions' Mitigation Measures for Groups A & B

The below table summarizes the proposed mitigation measures at the 14 junctions located along Yellow BRT Line corridor.

Table 3.11: Proposed Mitigation Measures at 14 Junctions (Groups A & B)

Junction Name	Junction Label 2021 Study	Mitigation Summary 2021 Study
Tariq Road Intersection	TMC1	Bridge on Major Street (3 lane/direction + BRT) • U-Turn Under the new bridge • NB (Sindhi) has 4 lanes • All left lanes for SB (Tariq Rd) • Channelized unsignalized left turns • 2-Phase signals
KPT Roundabout	TMC2	• Detour Local Road & Qayyumabad Road legs • Tunnel for through direction (southbound) from Main Korangi to Korangi Crossing. • Add extra 1 pocket lane for each leg • Channelized un-signalized left turns • 4-Phase signals
Bilal Chowrangi	TMC3	• Through traffic in underground tunnel on Main Corridor (3 lane/direction + BRT)

Junction Name	Junction Label 2021 Study	Mitigation Summary 2021 Study
		- Add left pocket lane for EB (Brookes) - Add right-turn to NB (Landhi RD) - Add pocket lane for left turn in NB (Landhi RD) - Channelized unsignalized left turns 3-Phase signals
Herbion Chowrangi	TMC4	- Through traffic in an underground tunnel on Main Corridor (2 lane/direction + BRT) - Add left pocket lane for EB (Brookes) - Add right-turn to NB (Landhi RD) & SB (Sharafi Goth) - Add pocket lane for a left turn in NB (Landhi RD) & SB (Sharafi Goth) - Channelized un-signalized left turns 3-Phase signals
Dawood Chowrangi	TMC5	- Through traffic on bridge on Main Corridor (2 lane/direction + BRT) - Add extra through lane in NB & SB (Remove Market) - U-turns under bridge in Main corridor - Channelized unsignalized left turns
Vita Chowrangi	TMC6	- Through traffic in an underground tunnel on Main Corridor (3 lane/direction + BRT) - Add left pocket lane for EB (Brookes) - Add left pocket lane for WB (Dawood) - Channelized un-signalized left turns 3-Phase signals
Khalid Bin Waleed Intersection	Khalid	- Close the south leg (turned into 3-legged) - Right-turn from Khalid Bin Waleed diverted to turn left then make a U-turn - Additional 2 lanes for right turn movements from Korangi to Khalid Bin Waleed (1 main lane + 1 pocket lane) - U-turn heading to the Nursery direction (southbound) is diverted to Khalid Bin Waleed road then detoured to use the local roads
NMC Intersection	NMC	- All traffic from Mehmoodabad east leg is diverted to make a left turn - Right-turn from Mehmoodabad diverted to turn left then make a U-turn 2 lanes Thru bridge from Chenasar to Mehmoodabad - The right turn from Chenasar heading southbound will use the bridge then detour through the local roads. - Additional 1 Thru lane per direction at Korangi - Additional pocket lane at Korangi for EB left-turn - All conflicts were eliminated
DHA Intersection	DHA	- All the right-turns were banned and detoured - Only through movements at the intersection 2 lanes bridge for thru movements between South Avenue and DHA

Junction Name	Junction Label 2021 Study	Mitigation Summary 2021 Study
		- The right turns from the minor road will also use the bridge then will detour through the local roads - Additional 1 left lane at South Avenue - All conflicts were eliminated
Sunset Boulevard Intersection	Sunset	- The right-turn movement from to Sunset Boulevard became grade-separated through an underpass. - Directional 2 lanes bridge for right turn from Sunset to Korangi - All conflicts were eliminated
Khayaban-e-Ittehad Intersection	Ittehad	- Banning right-turn from DHA towards KPT and divert it to the proposed elevated U-turn 2 lanes directional right turn bridge from Korangi - Korangi has 4 Lanes per direction at the grade intersection - Additional left pocket lane at Khayaban-e-Ittehad road - All conflicts were eliminated
Brooks Intersection	Brooks	- Shift the tunnel to be on the minor road (2 lanes per direction) - Add detectors to prioritized the BRT service - Each direction at Korangi has 4 main lanes + 2 right pocket lanes + 1 left pocket lane - Right turns are diverted to the proposed tunnel then detoured to the local roads - The right turn from Mehran is diverted toward new planned Korangi Link 2-phase signals at grade intersection
Shan Intersection	Shan	- Main Korangi's thru mix-traffic use a tunnel - Add 4 left Pocket lanes at grade - Add 1 right pocket lane from Korangi to Landhi - Ban thru movement from the at-grade intersection 3-phase signals at grade intersection
Singer Intersection	Singer	- Shift the tunnel to be on the minor road (2 lanes per direction) - Add detectors to prioritized the BRT service - Each direction at Korangi has 3 main lanes + 2 right pocket lanes + 1 left pocket lane - Right turns are diverted to the proposed tunnel then detoured to the local roads - The right turn from Ghosia can be detoured toward new planned Korangi Link 2-phase signals at grade intersection

3.2.9 Micro-simulation for Groups A & B Junctions

The mitigation measures summarised above were tested from micro-simulation perspective using PTV Vissim Software. The model was built for the year 2046, considering the Vistro outcomes for junctions' operations. The vehicular modes (unlike Vistro which volumes are input in PCUs) were input into the model with their specific behavior characteristics.

The vehicular volume comparison between the volumes counted from the Vissim model and the traffic volumes raw data after being forecasted to 2046 were compared. The results indicated clear differences between the two groups of numbers. This is justified by the following:

- The data collection was not surveyed on the same day for all the junctions.
- 8 out of the 14 junctions' data were adopted from the 2019 PD Study Report.
- There are many local roads between the junctions as indicated in the tables, which in reality divert much traffic from and to the main corridor. It could be assumed that each road has a capacity of nearly 700 vehicles per hour, however, they could not be modelled in the micro-simulation due to the lack of accurate data.
- The forecasted data of 2046 is much higher than the surveyed volumes in 2021, which affects the speed of the traffic flow and causes lower vehicular counts than the calculated volumes.

The results of the assessment indicated that the junctions shall operate at LOS 'E' or better. Only 3 junctions showed unacceptable LOS 'F' which is not a very high failing level for the long run assessment. The table below summarizes the LOS outcomes.

Table 3.12: Vissim Model Output for Junctions

Junction Name	LOS	Delay (seconds)
Khalid Bin Waleed Intersection	E	76.77
Tariq Road Intersection (TMC 1)	E	69.68
NMC Intersection	D	26.23
DHA Intersection	C	16.69
Sunset Boulevard Intersection	E	45.75
Khayaban-e-Ittehad Intersection	F	87.68
KPT Roundabout	F	120.05
Brooks Intersection	E	59.24
Shan Intersection	F	93.90
Vita Chowrangi (TMC 6)	C	31.25
Bilal Chowrangi (TMC 3)	B	16.44
Singer Intersection	B	17.49
Herbion Chowrangi TMC 4	E	62.39
Dawood Chowrangi (TMC 5)	E	63.78

It is to be noted that, the Vissim output differs from the Vistro LOS results. Vissim calculates the junction average delay from all the vehicles passing across the intersection, either through the intersection, un-signalized merging and diverging, or even grade separated bridges and tunnels. On the other hand, Vistro calculates only the average delay of traffic passing through the intersection. In addition, the data set entered in Vissim was vehicular data, but the Vistro had PCUs as its input.

Finally, it is proposed, to improve the LOS of the 'E' and 'F' junctions in the long run (year 2046), that the government with the private sector adopt certain measures to encourage the Motorcycles and Rickshaw/ Qingqi users to transfer to other public transport modes

including the BRT. This Motorcycles/ Rickshaw/ Qingqi represents 60% to 70% of the total vehicular demand. By applying such strategy, the corridor shall perform from traffic perspective - at acceptable operational levels.

3.2.10 Data Collected from Received Reports

Data received from Client were checked and the information related to the traffic assessment was extracted in relation to:

- BRT Critical load
- BRT Modal Shift
- Vehicle Occupancies
- BRT Potential Vehicle Types
- Growth and Reduction Factors in Traffic due to introduction of BRT

BRT Modal Shift is given in **Table 3.13**

Table 3.13: BRT Modal Shift

Services	Composition of the BRT demand
Public transport	90.7%
Cars	5.3%
Motorcycles	2.3%
Rickshaws	1.7%

Vehicle Occupancies is given in **Table 3.14**

Table 3.14: Vehicle Occupancies

Type	Private Cars/Taxis	Auto Rickshaws	Motorcycle
Occupancy Rate	1.6	1.7	1.2

BRT Potential Vehicle Types, is given in **Table 3.15**

Table 3.15: BRT Potential Vehicle Types

Potential Vehicle Types on BRT Corridor	
Vehicle Size BRT (meters)	Nominal Vehicle Capacity (Pass)
9	50
12	75
18	125

Growth and Reduction Factors in Traffic due to introduction of BRT, is given in **Table 3.16**

Table 3.16: Growth and Reduction Factors in Traffic due to BRT

Year	AADT Growth Factor in Traffic	BRT Reduction Factor in Traffic
2026	2.5%	12.5%
2046	2.5%	8.1%

3.3 OBJECTIVES OF THE PROJECT

The Project Development Objective is to improve mobility, safe and secure accessibility for all people with limited mobility to jobs and other economic activities. The project aims to ensure inclusion of all genders. The project will also focus on climate change adaptation and mitigation measures and other environmental co-benefits by shifting road users from polluting transport modes (e.g. old, poorly maintained buses and motorcycles) to lower carbon modes (e.g. cleaner BRT buses and non-motorized transport), and by providing resilient transport infrastructure and increasing the capacity of authorities to deal with disaster situations. The key results expected from the Project corridor, are:

- Reductions in travel time, particularly for public transport passengers;
- Improvement in public transport quality of service;
- Increase women ridership in public transport;
- Reductions in road traffic fatalities;
- Accessibility improvements for jobs and housing; and
- Reduction in Carbon dioxide (CO₂) gas emissions.

3.4 COMPONENTS OF THE PROPOSED PROJECT

The length of proposed project corridor is 21 kms and compromise of the following components:

i) Length – 21 km:

- 4 underpasses with approximately Length of 50 m each excluding the open underpasses
- 24 Stations
 - 21 at grade BRT stations
 - 3 underground BRT stations
- 2 Depots
- 2 Elevated U-turns
- Jam Sadiq Bridge
(Demolish & Reconstruct of Existing Bridge + 1 New Bridge for widening)
- Kala Pull Bridge (Reinstatement)
(South Side Bridge)
- 71.3 Km off-Corridor at-grade Park & Ride Facilities

Figure 3.1 shows accessibility of the project area whereas, **Figure 3.2** shows the proposed alignment of the BRT Yellow Corridor with its components.

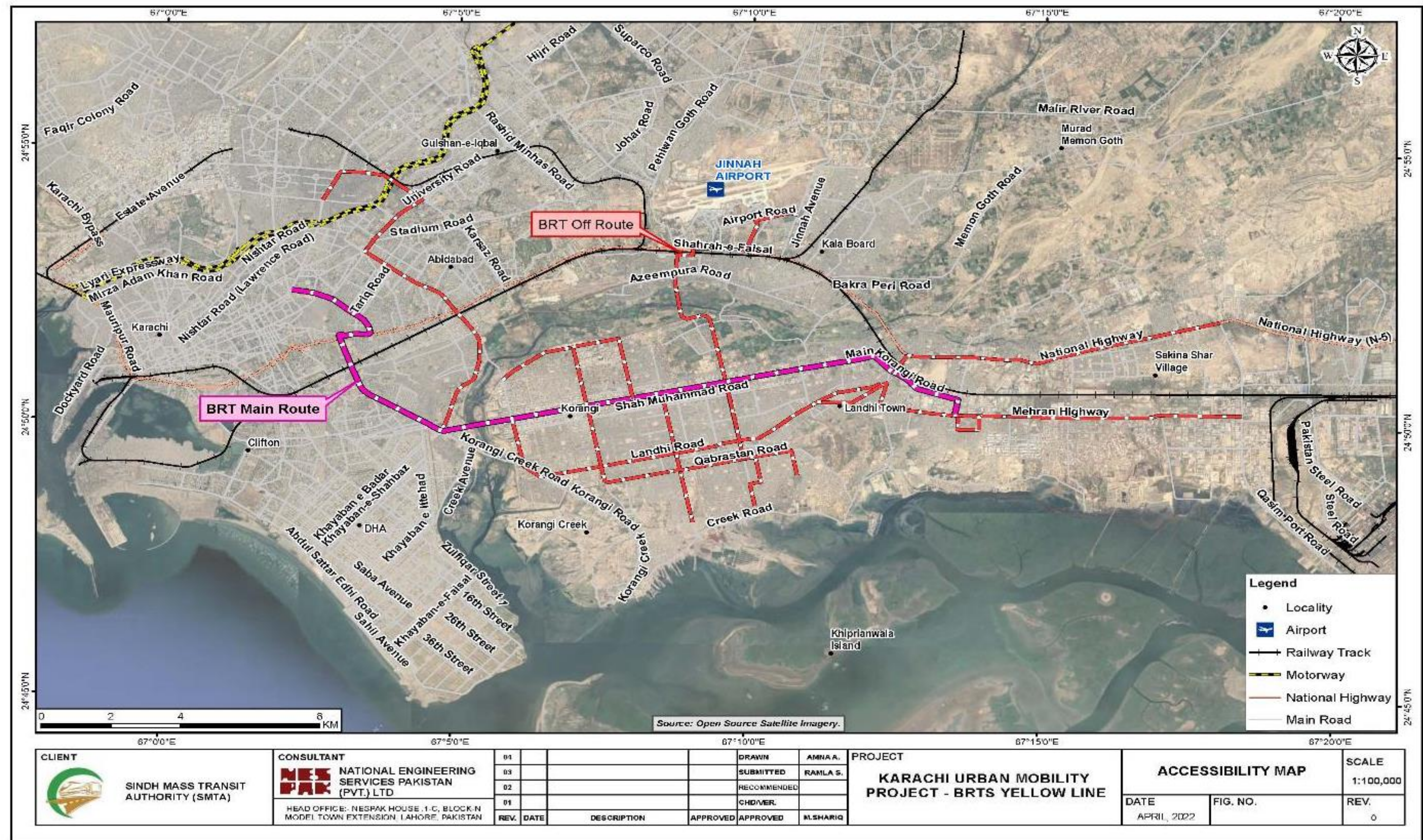


Figure 3.1: Accessibility of Proposed Project Road

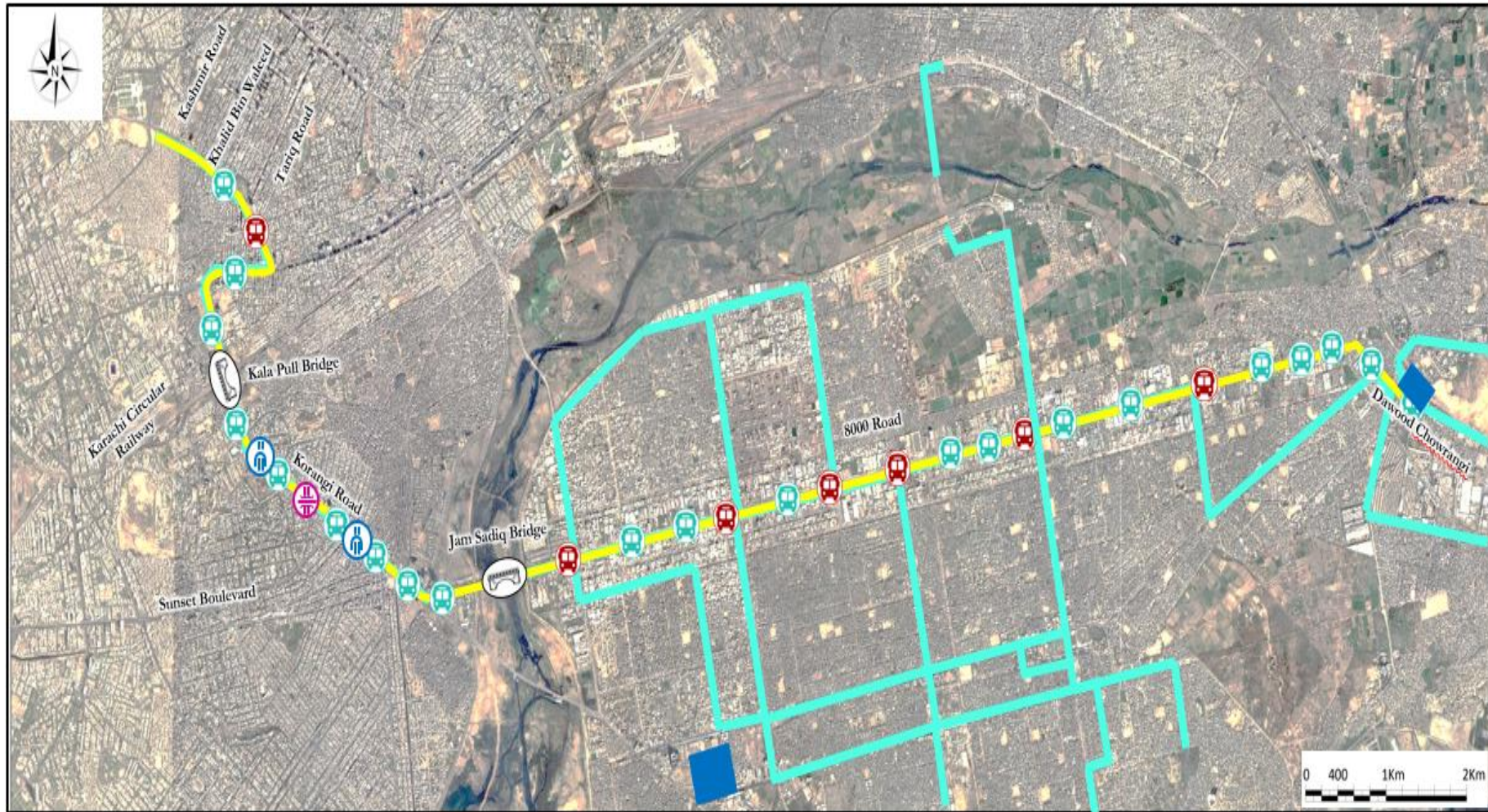


Figure 3.2: Components of Proposed Project Road

3.5 ALIGNMENT OF THE PROPOSED ROAD

The alignment of the proposed BRT will start from Dawood Chowrangi to Numaish Chowrangi. The corridor can be categorized in seven segments:

1. Dawood Chowrangi to Future Colony
2. Korangi Road (8000) along Korangi Industrial Area
3. Jam Sadiq Bridge over Malir River
4. Jam Sadiq Bridge to KPT interchange
5. KPT Interchange to FTC Flyover
6. FTC Flyover to Shahrah-e-Faisal
7. Shahrah-e-Faisal (Nursery) to Shahrah-e-Quaideen

3.5.1 Segment 1: Future Colony - from Dawood Chowrangi to Mansehra Colony

The length of segment 1 is 1.15 km. The area is predominantly residential with active formal and informal commercial activity. The cross section proposed by the project will primarily improve pedestrian facilities and rehabilitate the carriageway currently in disastrous state. Land acquisition will not be required, however, there are vendors some of these whom may need to be relocated because of the implementation of the project. In addition, due to the frequency of road encroachments from commercial and illegal parking, special attention and enforcement will be required.

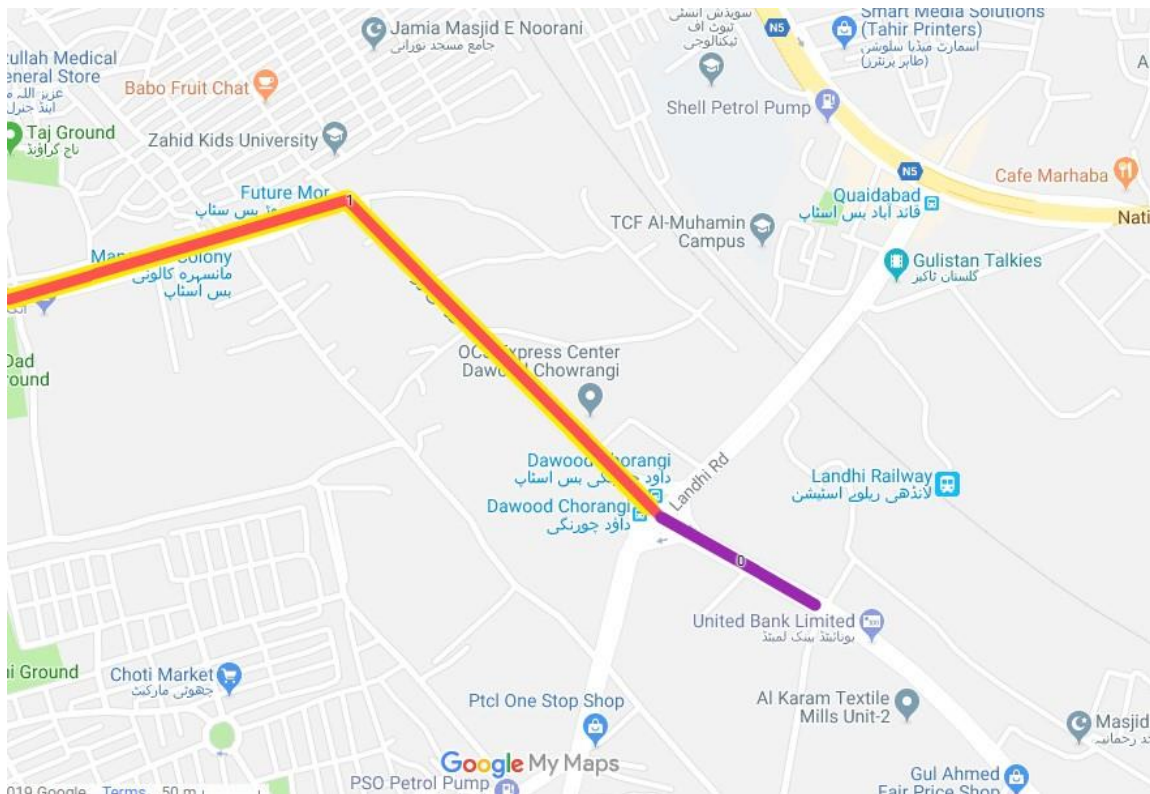


Figure 3.3: Segment-1: Dawood Chowrangi to Future Colony

3.5.2 Segment 2: 8000 Road - from Mansehra Colony to Jam Sadiq Bridge

The length of segment 2 is 10.65 km. It is characterized by a 3+3 carriageway flanked by 2-lane or more service roads used as unofficial parking space, freight cargo load and unload, and/or vehicle maintenance area. These service roads are not continuous and are often interrupted at various locations. Also, the tankers, freight cargos are parked, maintained at the median strip of the road. No land acquisition nor relocation activities are expected. Encroachments related to public space invasion and illegal parking is anticipated.

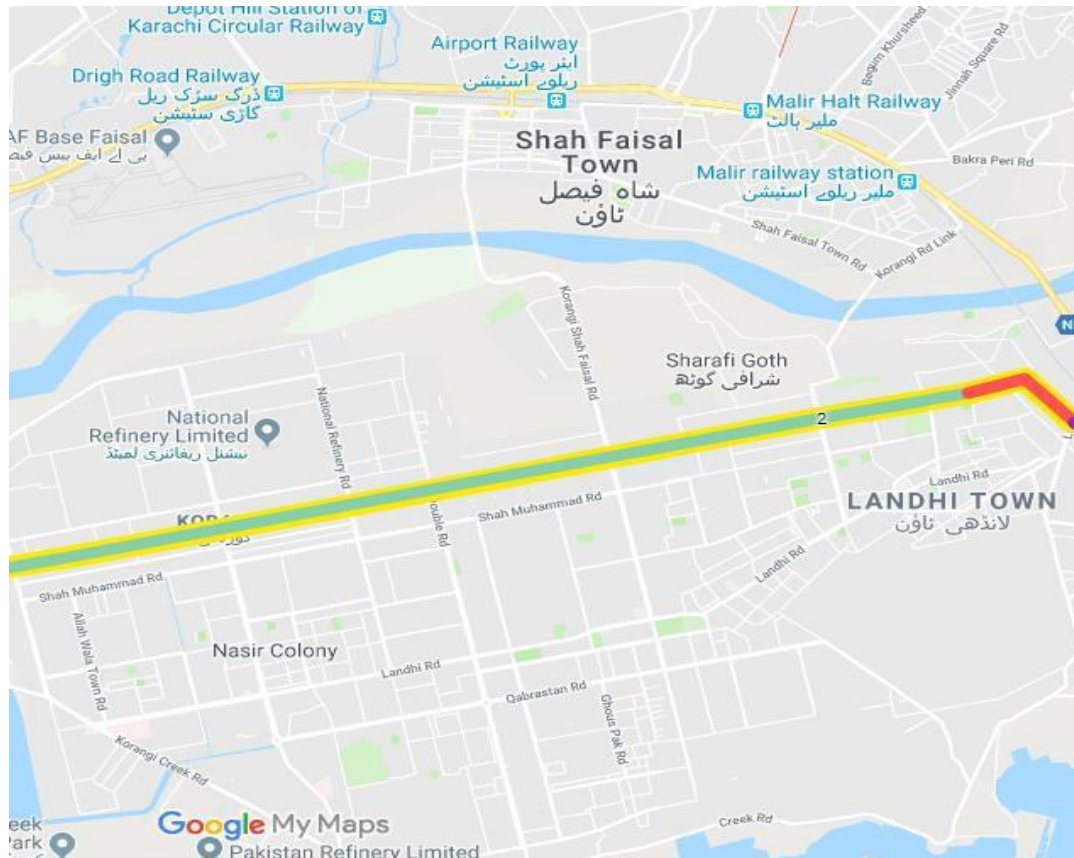


Figure 3.4: Segment-2: Korangi Road along Korangi Industrial Area

3.5.3 Segment 3: Malir River Bridge (Jam Sadiq)

The length of segment 3 is 1.1 km. A 2x2 bridge currently connects Korangi industrial area with the DHA/Karachi districts. Expansion of the existing structure is unlikely and capacity increases will only be attainable through the construction of a parallel new structure. Traffic reorganization and flow management is anticipated due to the KPT interchange flyover accesses landing on the river's west bank.

A new bridge over Malir River, parallel to the existing bridge, with a total length of around 1 km, and comprising three (3) lanes for main mixed traffic, one (1) dedicated BRT lane, a sidewalk from one side and shared sidewalk/bicycle lane on the other side.

Demolition works and site clearance of the existing Jam Sadiq bridge structure. The works for a new bridge in-lieu of the demolished bridge to accommodate three (3) lanes for main mixed traffic, one (1) dedicated BRT lane, a sidewalk from one side and a shared

sidewalk/bicycle lane on the other side.



Figure 3.5: Segment-3: Malir Bridge

3.5.4 Segment 4: KPT Interchange

The length of segment 4 is 0.85 km. The section underneath the KPT interchange features a large elliptical rotary with a minor axis of, approximately 130 m. Existing traffic flows, ply 3+3 carriageways, in a generous and undeveloped area.

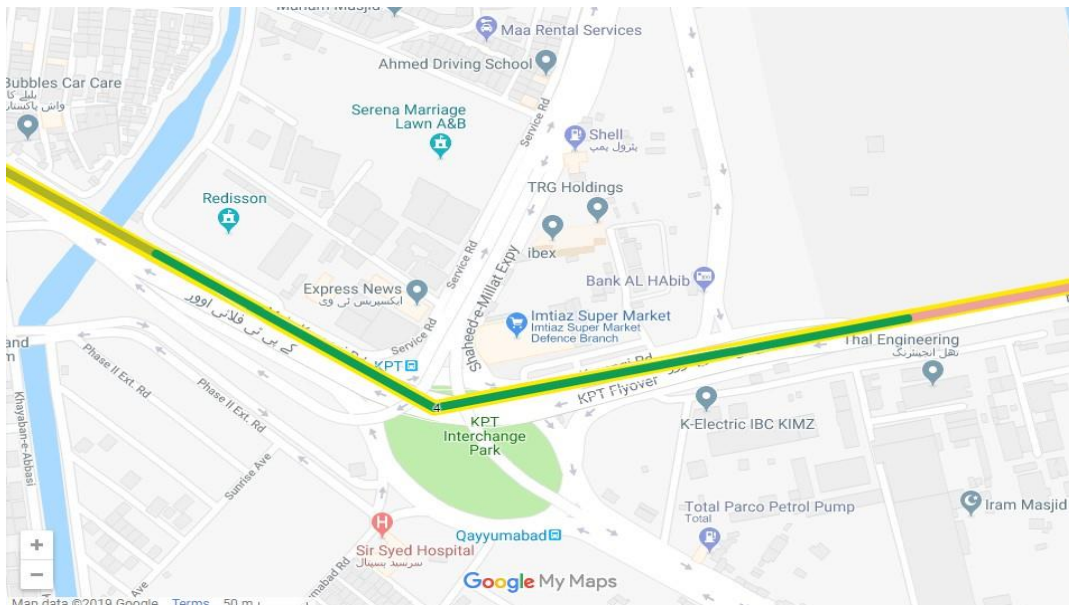


Figure 3.6: Segment-4: KPT Interchange

3.5.5 Segment 5 and 7 – Korangi Road – (KPT Interchange to Shahrah-e-Faisal Interchange) and Shahrah-e-Qaideen (Shahrah-e-Faisal to M.A. Jinnah Road)

The lengths of segment 5 and 7 are 3.9 km and 1.4 km respectively. These segments keep a more dense, established, and busy area. Mixed uses are found flanking the segment varying from residential to commercial and institutional. The presence of service roads is rare, discontinuous, and only at specific locations, where clear planning initiatives have taken place to improve traffic flow. Pedestrian and NMT facilities are not enforced despite a considerable number of users and pedestrians on the road. Median width varies from 1m at the Khayaban-e- Ittehad station area to 5 to 6 m at the DHA More Station.

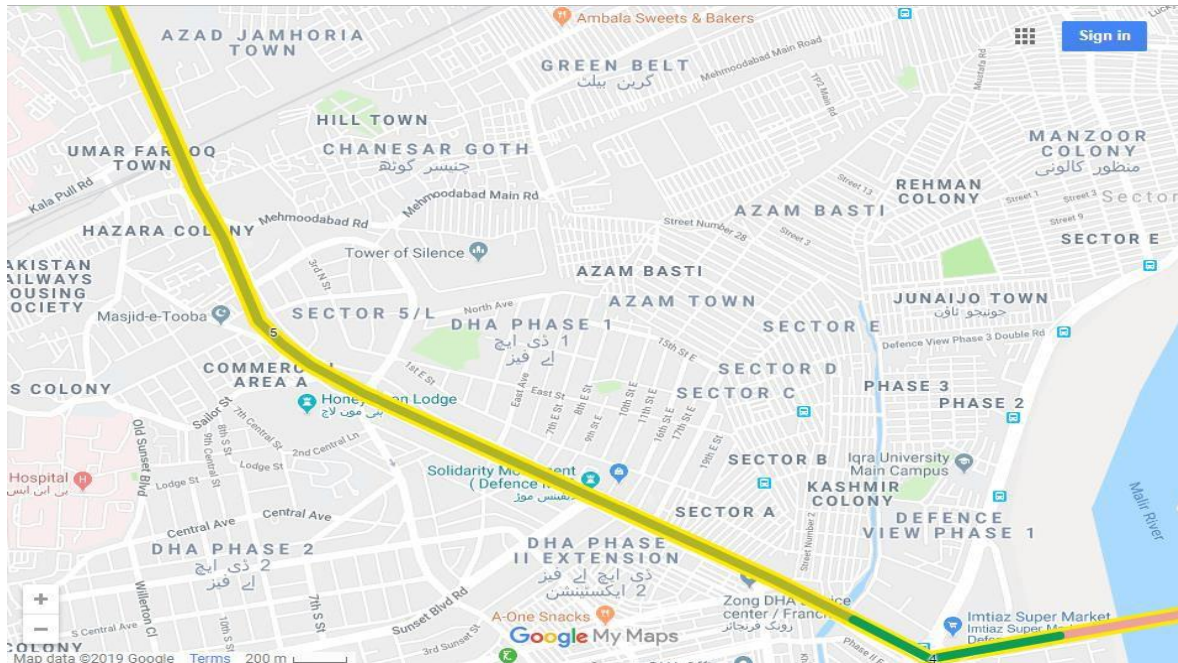


Figure 3.7: Segment-5: KPT Interchange to FTC Flyover

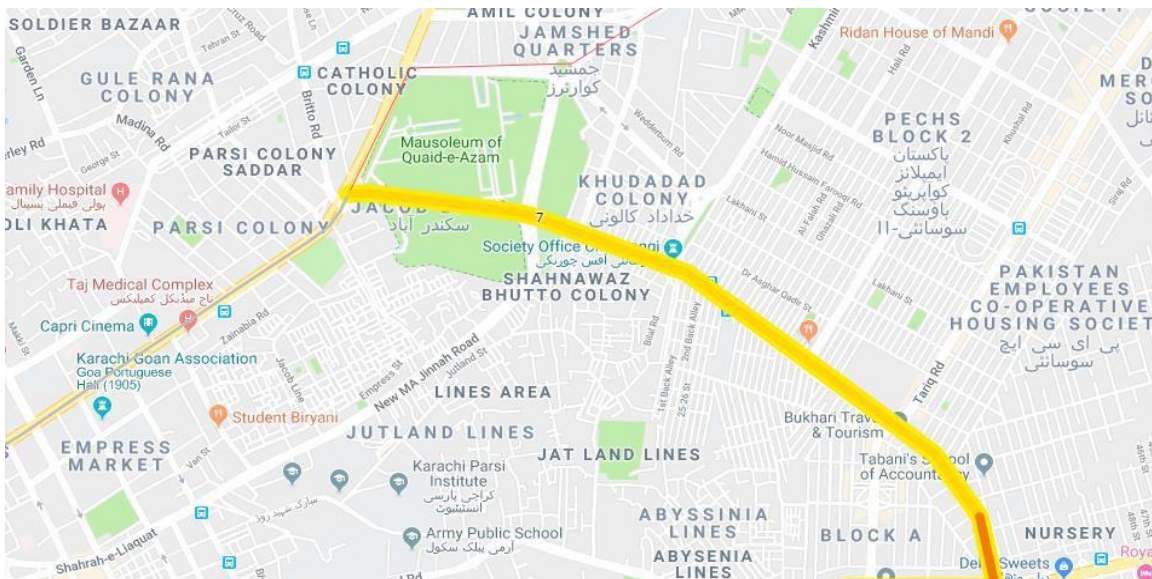


Figure 3.8: Segment-7: Shahrah-e-Qaideen

3.5.6 Segment 6: Shahrah-e-Faisal (Shahrah-e-Faisal Interchange to Shahrah-e-Qaideen)

The length of segment 6 is 1.65 km. Heavy traffic flows, on a well-established, dense, and complex urban setting, make this segment the most challenging for functional design particularly considering BRT services will share ROW with general traffic. Two flyovers provide connectivity between Korangi Road and Shahrah-e- Qaideen using the alignment of Shahrah-e-Faisal for approximately 800 m. At this segment, the ROW has a width of over 60 m allowing for a freeway type of operation with service roads, sidewalks, and on-street parking provisions.

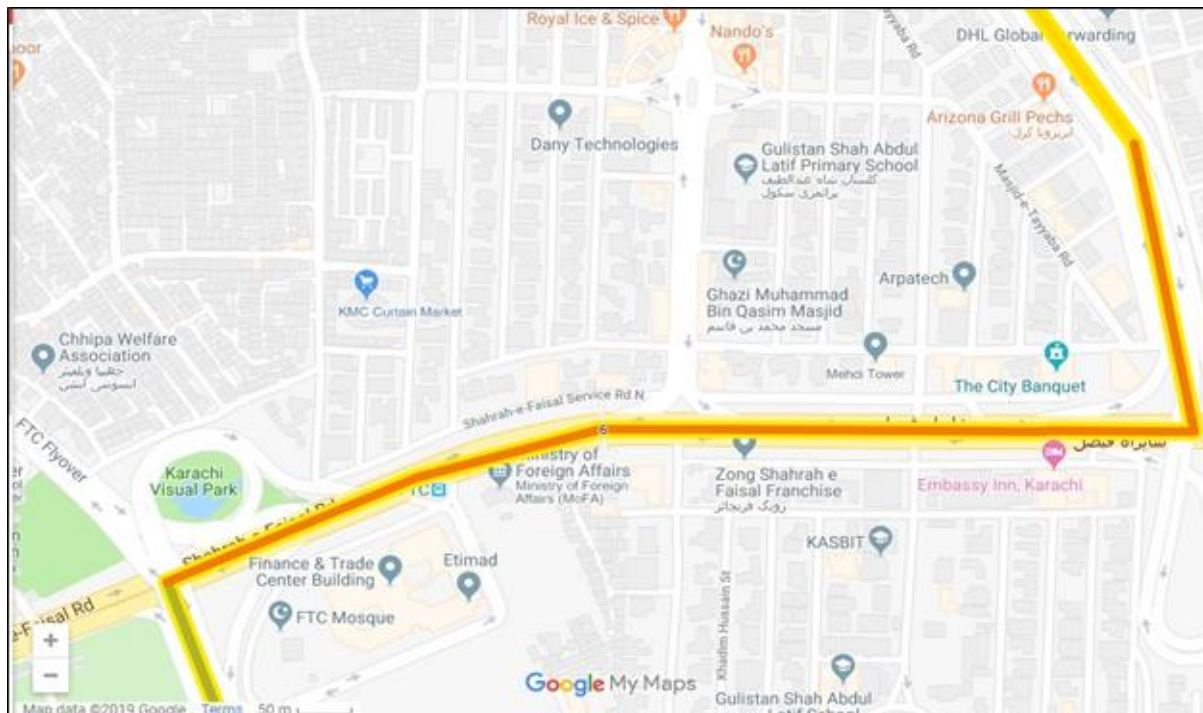


Figure 3.9: Segment-6: Shahrah-e-Faisal

The technical specifications detail of the Yellow BRT corridor is the following:

Speed of the System	50 km/hr
Yellow BRT Corridor Length	21 km
<i>Dedicated</i>	20 km
<i>Mixed Traffic</i>	1 km*
No. of Proposed Stations	24
Vertical Insertion	84% at grade and 16% underground (3.4 km)
Horizontal Insertion	Median aligned BRT lanes
Estimated BRT Ridership	300,000 Persons per day
* KPT and FTC Interchange, Shahr-e-Faisal	

3.5.7 Direct and Feeder Services

Six (6) direct and three (3) feeder routes are proposed in the service plan of Yellow BRT Corridor and infrastructure improvements.

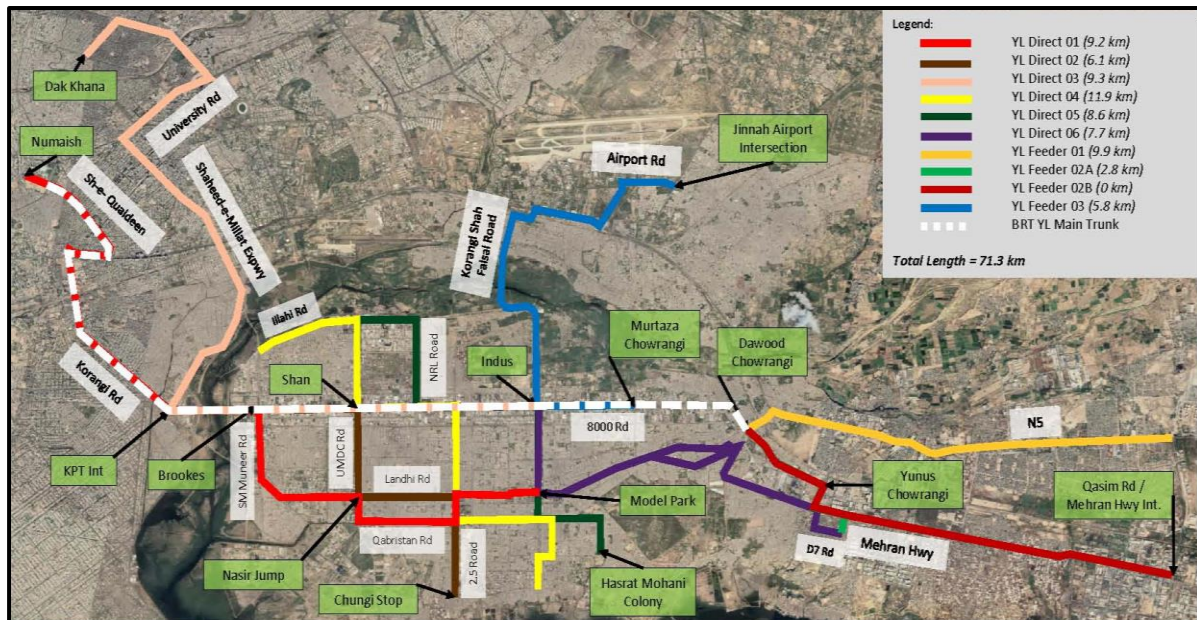


Figure 3.10: Direct and Feeder Services

The Direct Service 01 starts from the Numaish passing through Korangi Road, Jam Sadiq Bridge, Brookes Chowrangi, Landhi Road and ends near Korangi Model Park. The overall operational length of the service is 20 km, out of which 11km is on the main corridor.

The Direct Service 02 starts from the Korangi Road and ends at Chungi Stop. The overall operational length of the service is 9 km, out of which 2.4 km is on main corridor.

The Direct Service 04 starts from the Siddiq Akbar Road, passing through Syed Ammar Bukhari Road, Korangi Road, Coast Guard Chowrangi and ends near Ibrahim Hyderi area. The overall operational length of the service is 13 km, out of which 2.2 km is on main corridor.

Direct 5 Service starts from Syed Ammar Bukhari Road towards FH Enterprises from where it covers the two-way undivided road up to Primo chemicals then it follows that National Refinery Road and enters the main trunk via Vita Chowrangi and exits via Indus Chowrangi following Korangi no.5 road. The service then turns left on Qabrastan Road towards Alakram Pakwan Center, turns right and terminates at 51/C Graveyard. The total operational length of the Direct Service 5 is 11 km, out of which 2.72 km is on main Corridor.

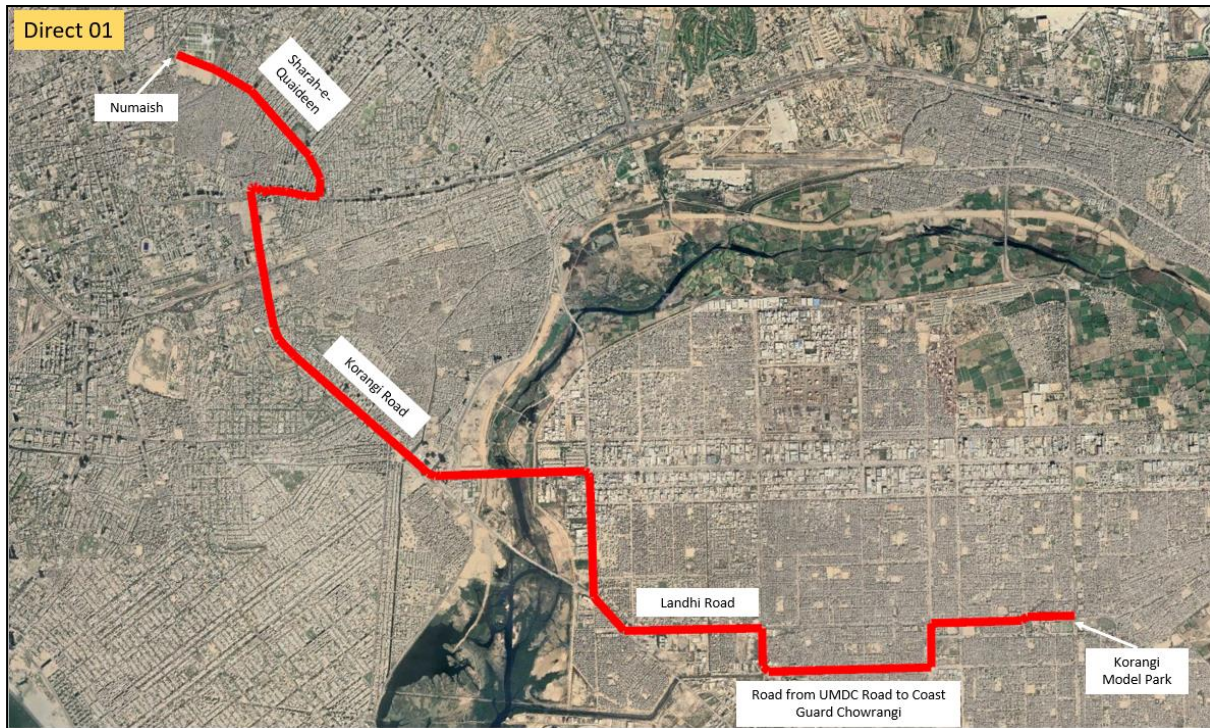


Figure 3.11: Direct Services 01

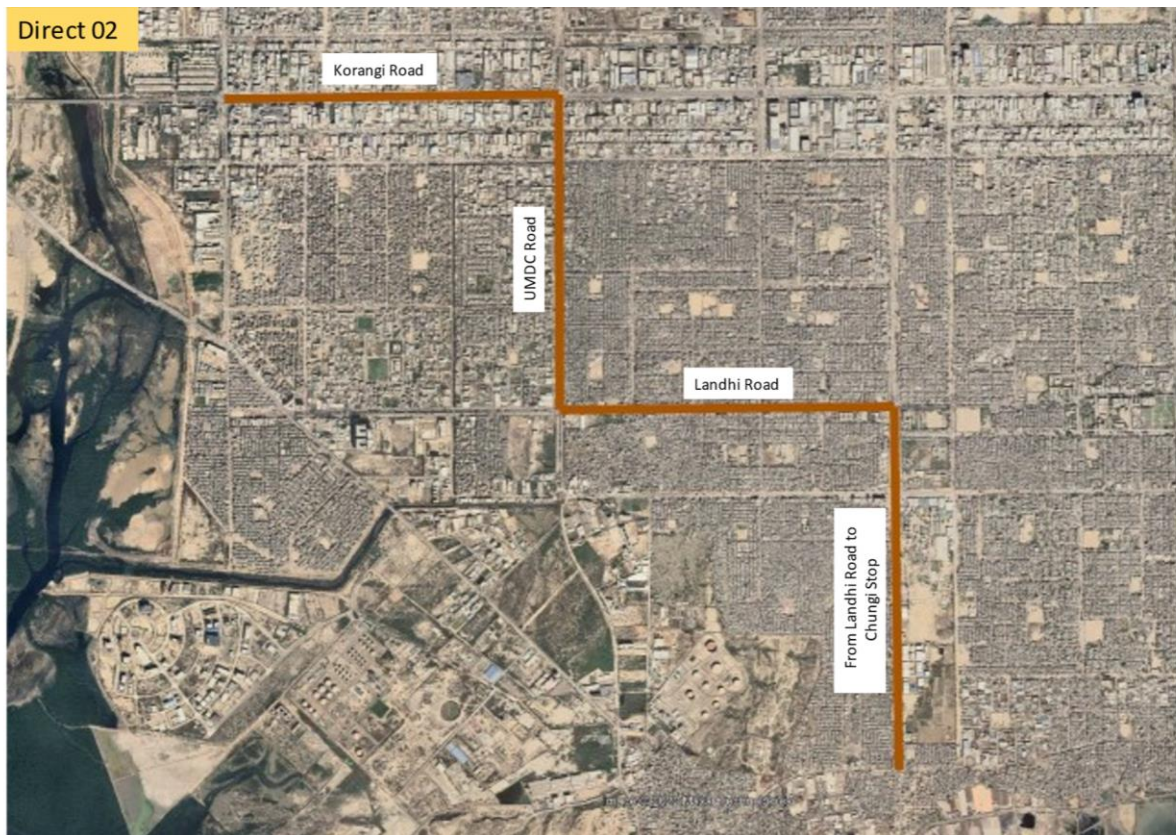


Figure 3.12: Direct Services 01

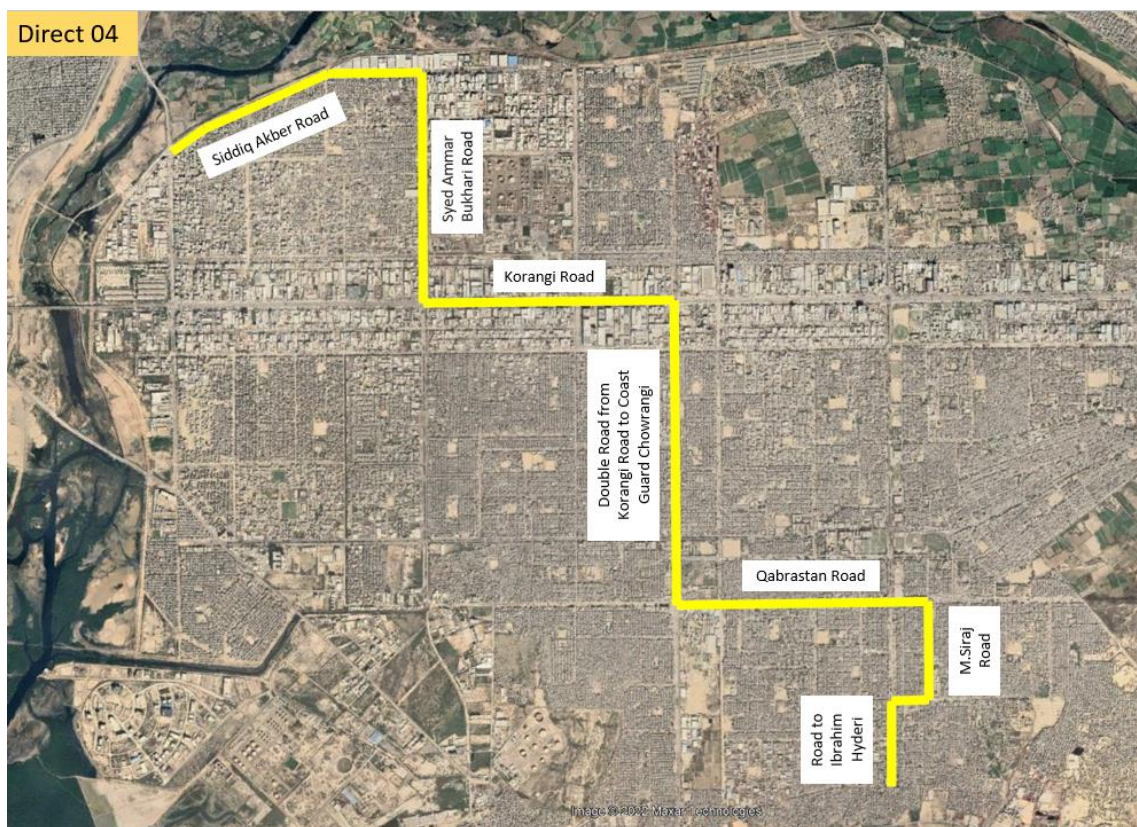


Figure 3.13: Direct Services 04

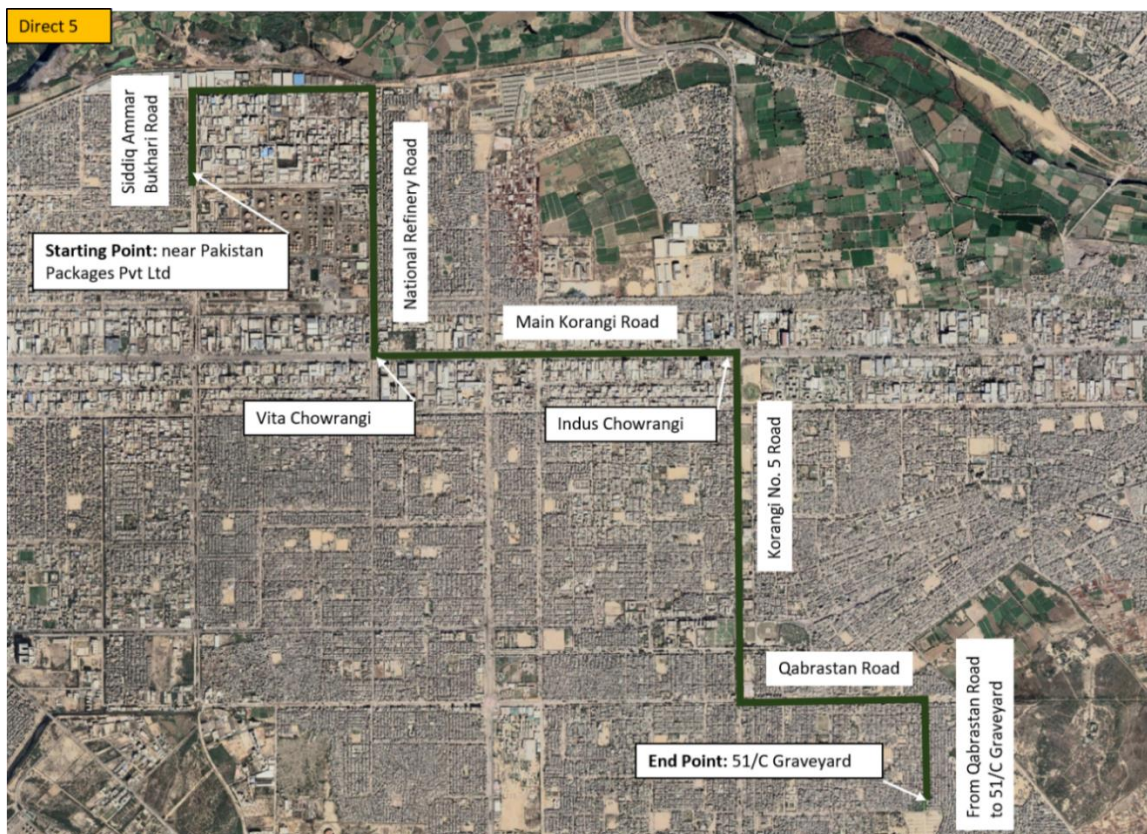


Figure 3.14: Direct Services 05

The length of YL Feeder 01 route is approximately 9.9 km and having 15 Bus Stops. The route starts from Dawood Chowrangi and ends at Port Bin Qasim Mor via Landhi road and N-5 highway.

The length of YL Feeder 02B route is approximately 11 km including an overlapping of 3.4 km with the YL Feeder 02A and having 18 Bus Stops. It starts from Dawood Chowrangi and ends at Qasim Road / Mehran Highway intersection via Landhi industrial area road and Mehran highway

The length of YL Feeder 03 route is approximately 11.8 km including an overlapping of 2.2 km with the main BRT corridor and having 11 Bus Stops. It starts from Jinnah Airport Intersection and ends at Murtaza Chowrangi via airport road, Jinnah terminal road, Shahrah-e-Faisal, Korangi shah Faisal road, Malir River Bridge and 8000 Road.



Figure 3.15: Feeder 01

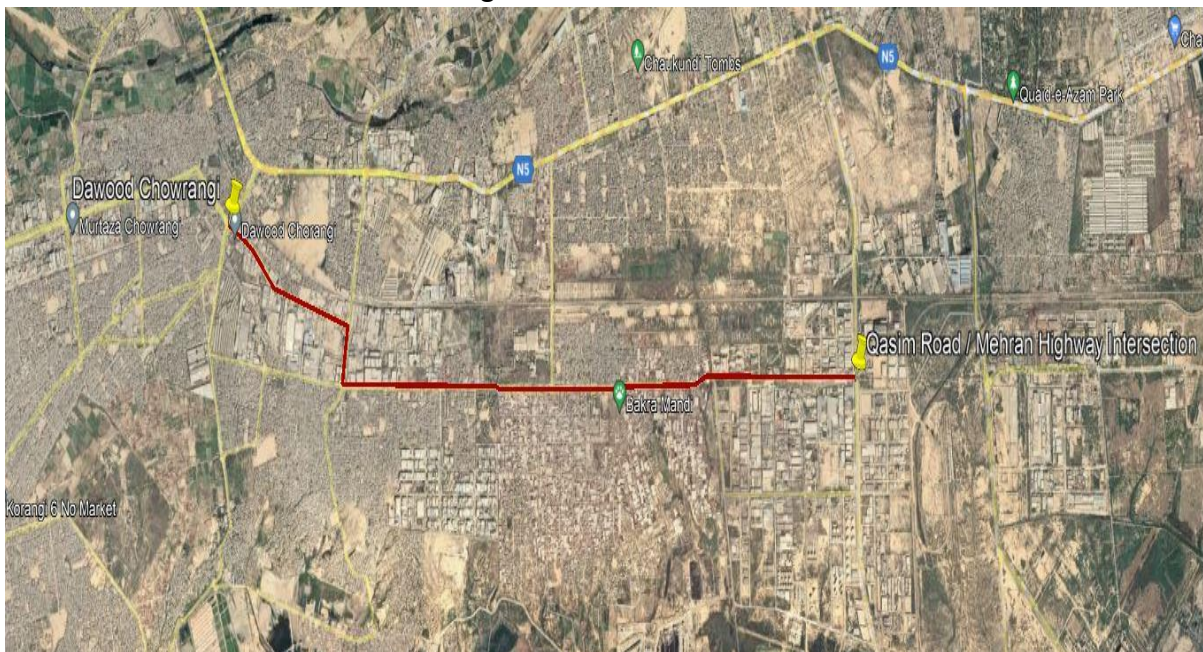


Figure 3.16: Feeder 02



Figure 3.17: Feeder 03

3.6 BRT YELLOW CORRIDOR INFRASTRUCTURE DETAIL

Following are the major infrastructure for the Yellow BRT Corridor service:

- Roads (Dedicated and mixed)
- Bridges
- Flyovers
- Elevated U-Turns
- Underpasses
- Bus Stations
- Bus stops (at off corridor routes)
- Pedestrian bridges
- Fences and barricades for the dedicated roads
- Bus depots

3.6.1 Roads (Dedicated and Mixed)

Yellow BRT corridor comprises of 21 km in which 20 kms comprise dedicated lanes and 1 km mixed traffic (KPT interchange and Shahrah-e-Faisal). The existing roads will be used for the BRT corridor following rehabilitation/reconstruction. There are about 13 intersections at the Yellow BRT corridor, out of which about six intersections have roundabouts (mainly at 8000 Road). Four (04) underpasses are being proposed to improve level of service along all intersections. A 3+3 carriageway is proposed parallel to the BRT. Walkways and cycle/motorcycle tracks will also be provided along the corridor. **Figure 3.18** shows Typical cross sections of roads

3.6.2 Flyovers and Bridges

Three existing flyovers/bridges will be used by the Yellow Line BRT Corridor project which includes North side of Kala Pull Bridge (South side will be demolished and reconstructed), Nursery Flyover, and FTC Flyover. At Jam Sadiq Bridge, a new bridge parallel to the existing bridge will be constructed and existing bridge will be demolished and reconstructed. The geometry after the widening of bridge has been designed in such a way that three (3) lanes for mix traffic are available in addition to dedicated BRT lanes. The southern-side of the Kala-Pull bridge will be reconstructed as proposed. **Figure 3.19** shows Typical cross sections of bridges.

Two elevated U-turns will also be constructed for the mix traffic. One is near the Khayaban-e-Ittehad intersection and one is near National Medical Center.

A right turning flyover at the Sunset Boulevard intersection will also be constructed for the mix traffic.

3.6.3 Underpasses

There will be four underpasses at intersections. At some intersections, wastewater drains also cross the roads. These drains alignment will not be changed. These drains will flow in the same direction at grade. The underpasses will be constructed below these drains. The depth of the underpasses will be designed according to the depth of the drains crossing over it. These underpasses are at Murtaza and Singer Chowrangi along Korangi 8000 Road. Two more underpasses are proposed one at Tariq Road Intersection and the other one at Sunset Boulevard Intersection. The under pass at Tariq Road Intersection will be used for BRT and mixed traffic and the Right Turn Underpass at Sunset Boulevard is proposed for the mixed traffic. **Figure 3.20** shows typical cross sections of underpasses.

3.6.4 Stations

There will be 24 BRT stations in the Yellow BRT corridor, with an average separation of approximately 700 m. The location of the bus stops is given as follows:

At Grade Stations:

- Dawood Chowrangi
- Mansehra Colony
- Landhi Graveyard
- Sector 21
- Jamia Darul Uloom
- SNA Motors
- National Refinery
- Toyota Southern
- KPT Interchange 1
- KPT Interchange 2
- Khayaban-e-Ittehad

- Sunset Boulevard
- Circular Avenue
- National Medical Centre
- Kala Pull
- Shahrah-e-Faisal
- Khalid Bin Walid Road
- Bilal Chowrangi
- Vita Chowrangi
- Shan Chowrangi
- Brooks Chowrangi

Underground Stations:

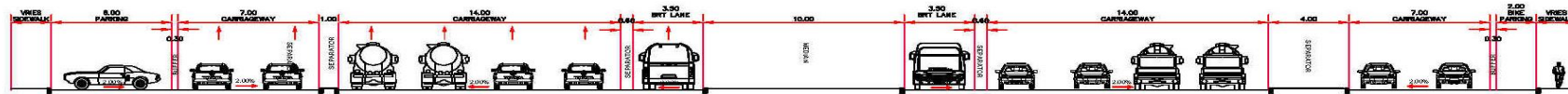
- Murtaza Chowrangi
- Singer Chowrangi
- Tariq Road intersection

The BRT station infrastructure will provide following amenities for the passengers and for the general operations of the station facility:

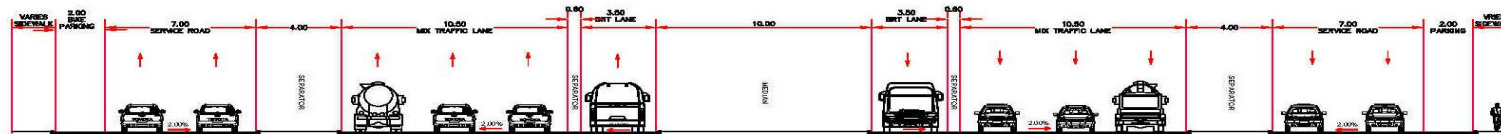
- Provision for elevators/escalators for elderly and disabled persons,
- Public address system,
- Vending machines,
- Passenger information display system,
- Turnstiles,
- Security cameras,
- Advertisement / hoardings spaces,
- Generator room,
- Ticketing room,
- Benches,
- Toilets,
- Drinking water
- Fire extinguishers / First-aid box,
- Lights, fans, etc.

Overtaking lanes: Stations of the Yellow BRT Corridor will feature overtaking lanes allowing the scheduling of Express Services which will only stop at selected stations of maximum ridership, whereas other services will stop at every station.

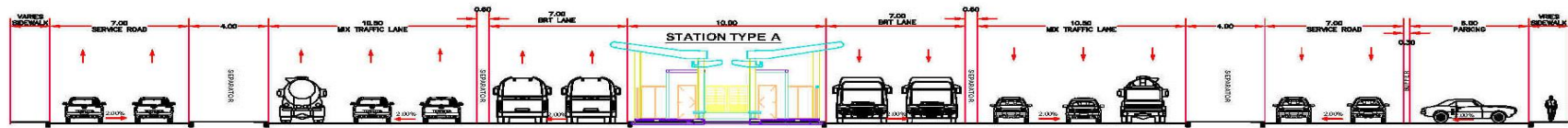
Figure 3.21, Figure 3.22 and Figure 3.23 shows Typical cross sections of stations and Typical layout of stations is attached as **Annexure-II**.



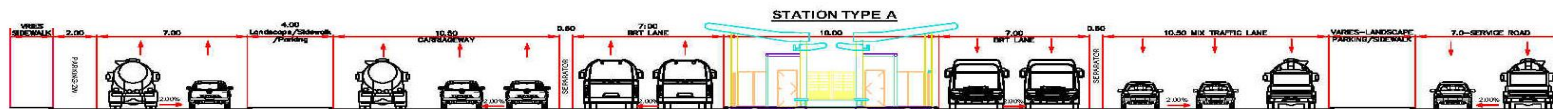
TYPICAL ROAD CROSS SECTION
SECTION D-D



TYPICAL ROAD CROSS SECTION
SECTION E - E



TYPICAL ROAD CROSS SECTION
SECTION F - F



TYPICAL ROAD CROSS SECTION
SECTION G-G

Figure 3.18: Typical cross section of Road

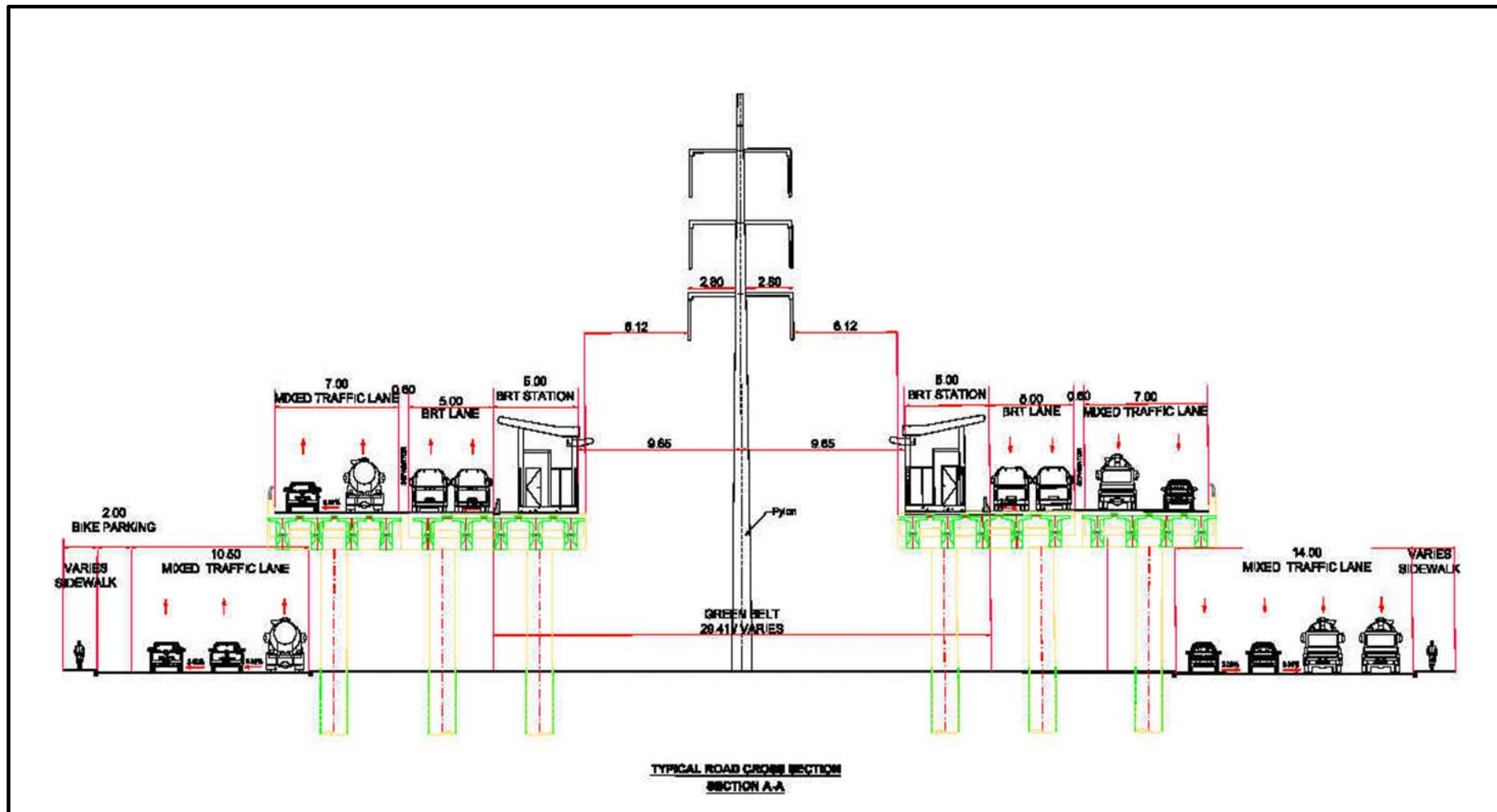


Figure 3.19: Typical cross section of Flyover

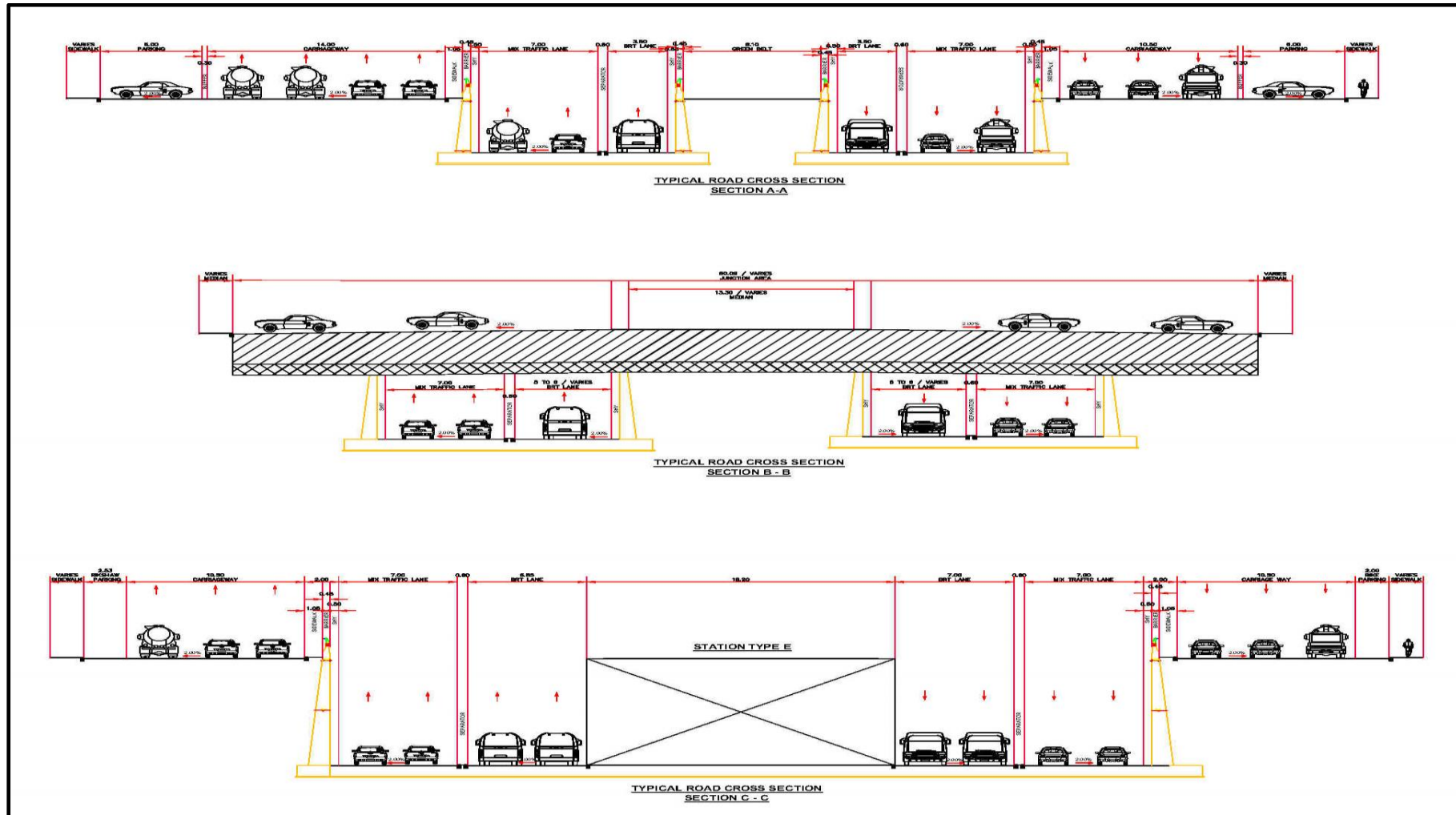
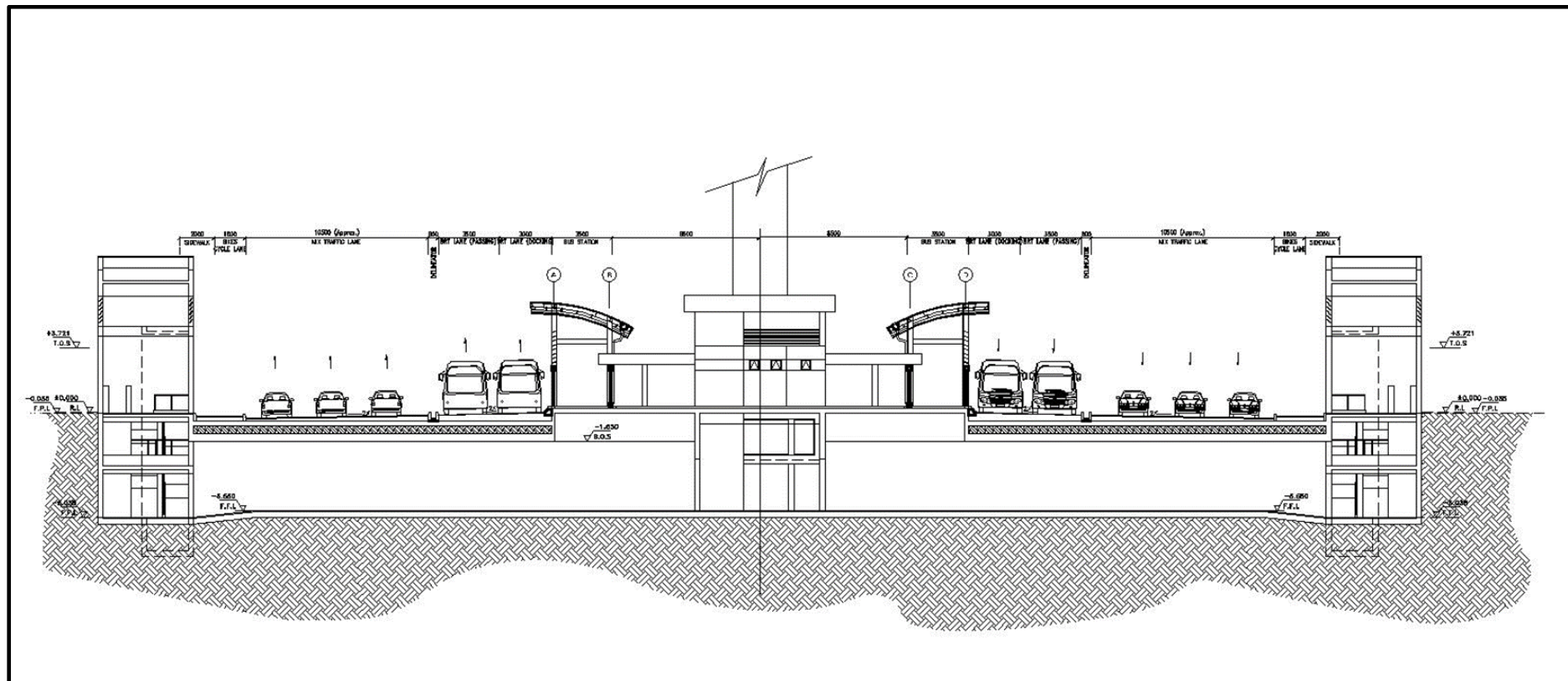


Figure 3.20: Typical cross section of Underpass



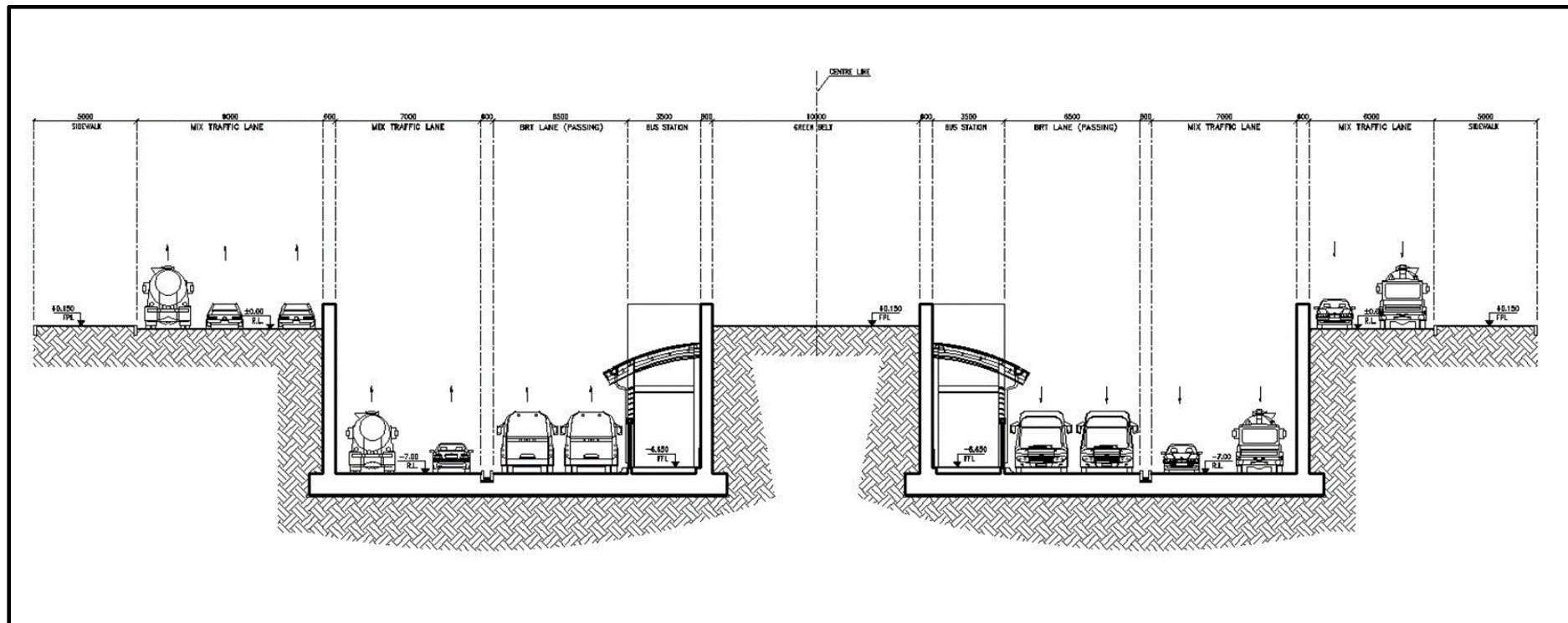


Figure 3.22: Type E Station Layout

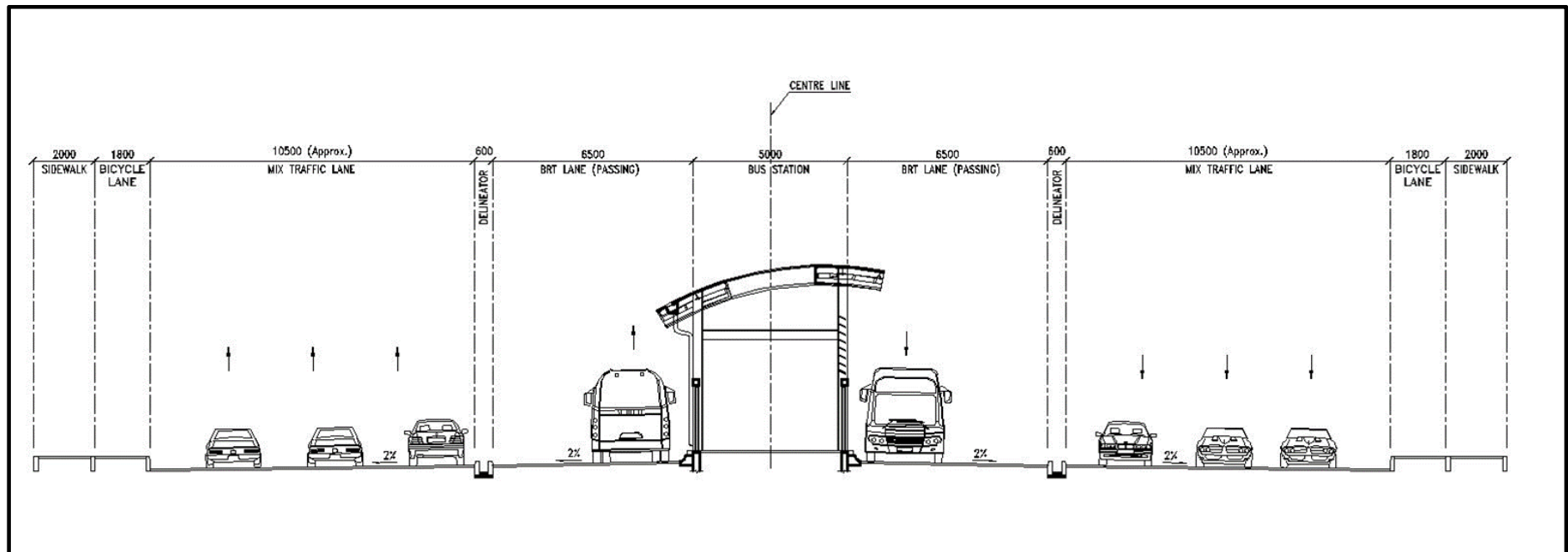


Figure 3.23: Type F Station Layout

3.6.5 Bus Depots

Depot 1

Depot 1 is located in Landhi near Dawood Chowrangi with an approximate area of 3 acres. The depot is owned by the Transport & Mass Transit Department. Location and layout plan of Depot 1 is given in **Figure 3.24** and **Figure 3.25** respectively.

The Depot 1 has been designed for 43 buses including 5 number 12 meters standard buses and 38 number 18 meters articulated busses. Following facilities have been provided in the Depot 1:

- Bus parking area
- Admin Building (Ground + 2 storey)
- Operational Building (Ground + 2 storey)
- Manual Bus Washing bays (3 numbers)
- Mechanical Repair Workshop with Pits (2 numbers)
- Fuel Dispensing Station
- Gate House
- Provision of electric charging for Electric Vehicles (EV) buses
- Landscaping



Figure 3.24: East Depot near Dawood Chowrangi



Figure 3.25: Master Plan of Depot 1 (Dawood Chowrangi)

Power Distribution

To cater the power requirement for Depot 1 a separate power supply connection at medium voltage (11kV) shall be taken from K-Electric's Grid Station located near the project premises.

The medium voltage power is supplied to the medium voltage switchgear which is stepped down via three 11kV/0.415kV transformers in the Electrical Substation located inside the Depot. The low voltage supply further feeds the following loads:

Figure 3.26: Transformer Sizes and Respective Connected Loads (Depot 1)

TRANSFORMERS & SIZES	CONNECTED LOADS
TR-1 (1000 kVA)	- Admin Building - Operational Building - Mechanical Repair Shop - Manual wash pits - Utility Building - Fuel Station - Operational Manager rest area - Entrance Gate house and reception building - Security Gate office - External Lighting
TR-2 (2500 kVA)	- EV charging
TR-3 (2500 kVA)	- EV charging

Electric Vehicle (EV) Charging:

EV charging system proposed in Depot 1 consists of the following:

- Power Cabinet with built-in power dispensers

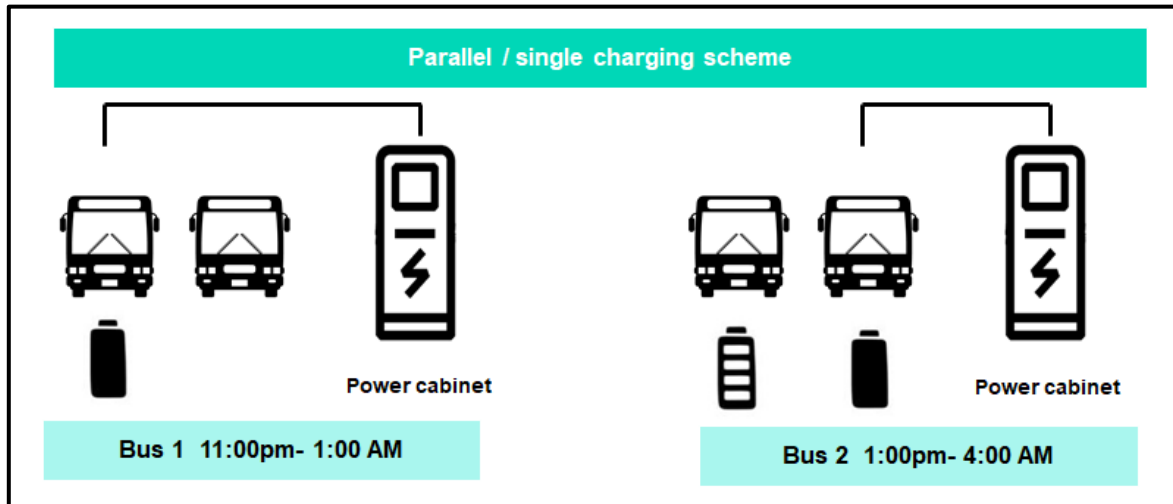
Two transformers (TR-2, TR-3) shall each supply low voltage (0.415 kV) electrical power to 10 nos. of 180kW Electric vehicle charging power cabinets through MCCBs (Moulded Caser Circuit Breaker) installed on two opposite periphery walls of the parking facility.

The proposed system works on the principle of ***Parallel/ single charging*** of Electric buses i.e. one power cabinet shall charge one electric bus at a time. The schedule of charging is as under:

Time Duration	No. of Buses Completely Charged
3 hours	20 buses
6 hours	40 buses
9 hours	60 buses

Therefore, after duration of 9 hours 60 nos. of buses shall be charged and ready for on route operations.

Figure 3.27: Parallel/ single charging of Electric buses (Depot 1)



Depot 2

The proposed Depot 2 is located on Landhi Road near Indus Hospital, and has an approximate area of 9.2 acres. The depot is owned by the Transport & Mass Transit Department. Below figure shows the location plan of Depot 2.

The Depot 2 has been designed as a multi-storey bus depot having capacity of 341 buses including 226 number 12 meters standard buses and 115 number 18 meters articulated busses. Following facilities have been provided in the Depot 2:

- Multi-storey parking structure
- Admin Building (Ground + 4 storey)
- Two Operation Buildings (Ground + 3 storeys each)
- Manual Bus Washing bays (3 numbers)
- Automatic Bus Washing bays (2 numbers)
- Mechanical Repair Shop with pits (9 numbers)
- Body Repair & Paint Shop
- Fuel Dispensing Stations
- Two Gate Houses including emergency gate house
- Provision of electric charging for EV buses
- Landscaping



Figure 3.28: South Depot near Indus Hospital



Figure 3.29: Master Plan of Depot 2 (Indus Hospital)

Power Distribution

To cater the power requirement for Depot 2 a separate power supply connection at medium voltage (11kV) shall be taken from K-Electric's Grid Station located near the project premises.

The medium voltage power from K-Electric is supplied at the Electrical Substation 1 in Depot 2. This medium voltage power supply is further distributed to the medium voltage switchgear in the following:

- i. Electrical Substation 1
- ii. Electrical Substation 2
- iii. Kiosk type Substations 1 through 5

The transformers in the above mentioned, step down 11kV power supply to 0.415kV low voltage power supply to further feed the following loads:

Table 3.17: Transformer Sizes and Respective Connected Loads (Depot 2)

SUBSTATION/ KIOSK	TRANSFORMER SIZES	CONNECTED LOADS
Electrical Substation 1	TR-1 (1500kVA)	- Admin Building - Fuel Station - Operational Manager rest area - Entrance Gate house and reception building - Security Gate office - Exit Gate with guard room - Parking Deck
Electrical Substation 2	TR-1 (1250kVA)	- Operational Building 1 with underground tank - Operational Building 2 - Clean wash Shop & space storage - Mechanical Repair Shop - Shed for Mechanical Repair shop / Manual wash pit / Paint shop - Auto washer - Parking Deck
SUBSTATION/ KIOSK	TRANSFORMER SIZES	CONNECTED LOADS
Kiosk type Substation (K-D2/1)	TR-1 (1000kVA)	- EV charging
Kiosk type Substation (K-D2/2)	TR-1 (1000kVA)	- EV charging
Kiosk type Substation (K-D2/3)	TR-1 (1000kVA)	- EV charging
Kiosk type Substation (K-D2/4)	TR-1 (1000kVA)	- EV charging
Kiosk type Substation (K-D2/5)	TR-1 (1500kVA)	- EV charging

Electric Vehicle (EV) Charging:

EV charging system proposed in Depot 2 consists of the following:

- i. Kiosk type Substations
- ii. Power Cabinet
- iii. Power dispensers

The transformers in kiosk type substation (K-D2/1, K-D2/2, K-D2/3, K-D2/4 & K-D2/5) shall each supply low voltage (0.415kV) electrical power to 04 or 06 nos. of 150kW Electric vehicle charging Power cabinets through pedestal mounted MCCBs at the footpaths inside the parking deck on the ground floor only.

The power dispensers shall be mounted on ladders supported between the beams above the Electric buses to be charged.

The proposed system works on the principle of **Sequential charging of** Electric buses, i.e. one power cabinet shall be connected to three buses via power dispensers charging one at a time. The schedule of charging is as under:

Time Duration	No. of Buses Completely Charged
3 hours	22 buses
6 hours	44 buses
9 hours	66 buses

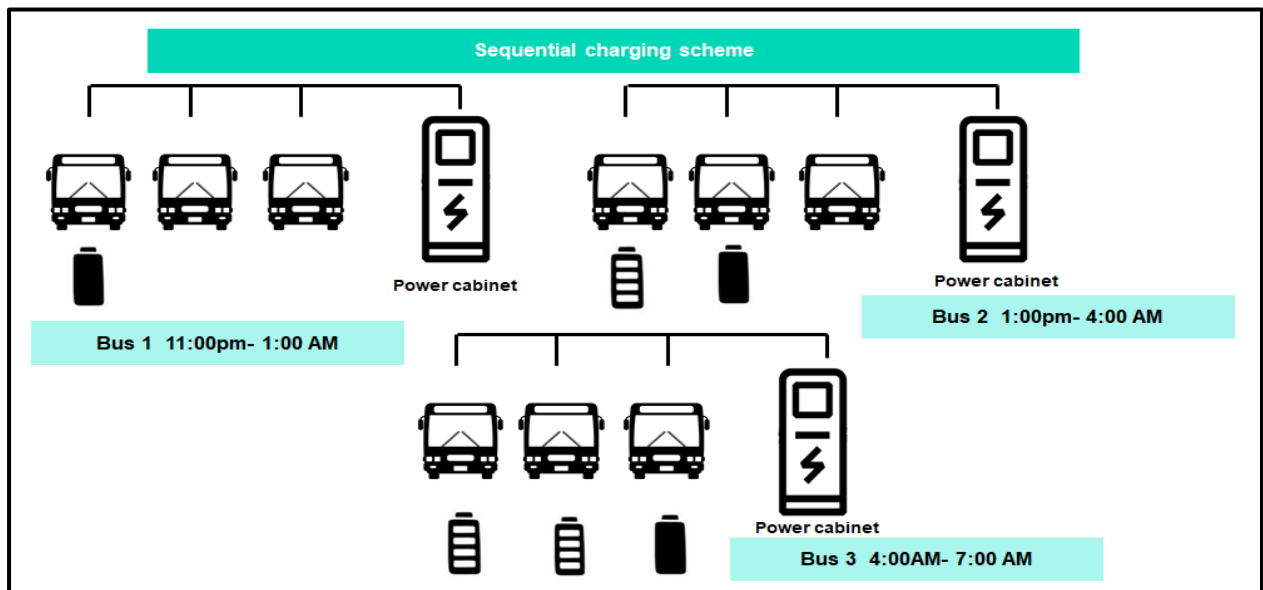


Figure 3.30: Parallel/ single charging of Electric buses (Depot 2)

Therefore, after duration of 9 hours 66 nos. of buses shall be charged and ready for on route operations.

3.6.6 Utilities

Major utilities at Yellow BRT corridor, stations and depots are as under:

- Electricity
- Water
- Generators

3.6.7 Electricity

Electricity will be required to operate above mentioned amenities at stations and at bus depots, including elevators/escalators, public address system, vending machines, passenger information display system, turnstiles, security cameras, generator room, ticketing room, lights, fans, drinking water coolers, and road lights. The power requirement for the Yellow BRT corridor is about 1,000 kW or 1 Megawatt (MW). About 13,000-kilowatt hour (kWh) electricity will be consumed to operate Yellow BRT System in the city.²

3.6.8 Water

Water will be required for drinking purpose and for toilets at bus stops and at bus depots. This water will be supplied through municipal supply system or through water tankers. It is estimated that about 250 - 350-meter cube (m³) water will be required per day. *(350,000 passengers x 25-35% consume water at bus stops x 5 l/d per person = 438 – 612 m³/d)²*

3.6.9 Generators

Generators are the standby sources of the electricity, operated at diesel fuel. These generators will be required at each bus stop to continue the bus operation uninterruptedly during power outage. There will be about 24 generators, operating at the bus stops. It is estimated that the diesel consumption will be in the range of 300 – 500 liter per day. *(456 kWh generation/hr from generators x 2.5 – 4 hr/d operation ÷ 3 kWh/liter = 380 – 608 liter/d)²*

3.7 YELLOW BRT BUSES

This section gives detail of the buses to be operated at the Yellow BRT corridor for Trunk, Direct and Feeder services.

3.7.1 Bus Type and Dimension

The following types of bus engines were analyzed for the Yellow BRT corridor:

- Diesel
- Diesel hybrid³
- Compressed Natural Gas (CNG) or Liquefied Natural Gas (LNG)
- CNG / LNG hybrid
- Electrical

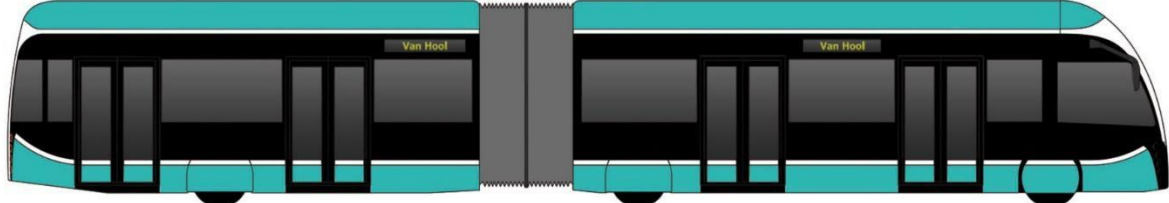
The electric and diesel hybrid-based engine buses will be considered for the Yellow BRT corridor. Consistent supply of CNG and LNG in future is doubtful, therefore, it may be not the

² Environmental Impact Assessment Report, Karachi Mobility Project- BRT Yellow Corridor, 2019.

³ The hybrid electric buses are powered by fuel and electrical propulsion systems. This system reduces emissions and conserves fuel. Hybrid buses have enhanced acceleration, as they use electric power exclusively until they reach 10 mph. Hybrid buses run smoother and are quieter than conventional buses. Hybrid buses utilize a regenerative braking system that charges large Nickel Metal Hydride batteries whenever the buses are coasting or braking. Also there is plug in system where batteries can be charged from other electrical sources.

choice. Only diesel-based power source buses will cause relatively more environmental pollution than the diesel hybrid buses. Electric and Hybrid buses are considered for fuel economy, emission reduction and safety purposes. Ordinary diesel-based bus travels 1.8 – 2.0 km per liter diesel whereas diesel hybrid covers about 3.5 km per liter of diesel (42% less fuel consumption).

It is considered that the length of the buses will be of 18 m for trunk BRT service (electric buses) whereas for direct and feeder BRT services, 12 m buses (diesel hybrid) will be used. The width of these buses will be of 2.5 m. Typical dimension of a BRT 18 m bus is as under:



Length in millimeters (mm)	18,610
Width (mm)	2,550
Height (mm)	3,300
Number of Seats	42 + 4 Folding
Boarding Height (mm)	330
Standing Height (mm)	2,280
Wheelbase (mm)	6,600/4,910
Front Overhang (mm)	3,400
Power (hp)	280

Source: Exqui. City 18m Diesel Hybrid

3.7.2 Bus Fleet

The Yellow BRT Corridor bus fleet will consist of about 268 buses (117 of 18 m buses and 131 of 12 m buses). About 8% (24) of the buses will be reserve buses in the fleet. The 18m buses will be electric while the 12m buses will be diesel hybrid. The seating capacity of the buses will be as under:

12 m	131 (capacity 75 passengers)
18 m	117 (Capacity 125 passengers)
Total	248 (268 including 8% reserve)

3.7.3 Bus Trips

Each bus of the Yellow BRT bus fleet will complete about 4 -5 round trips daily.

3.7.4 Bus Fare

Bus fare structure for the Yellow BRT system is proposed to be in the range of Rs. 15 – 55 per passenger on a distance-based scheme. The minimum fare of Rs. 15 will be for trips of up to 2 km. The value will increase proportionally every additional 2 km travelled by the passenger.

3.8 RELOCATION OF UTILITIES

Following utilities exist at the proposed Yellow BRT corridor:

- Electrical cables/poles
- Telephone cables/poles
- Wastewater drains (at median and curbside)
- Water distribution pipelines
- Sewage Lines
- Gas pipelines
- Oil pipelines

The design consultant M/s NESPAK has prepared drawings for different stretches of the corridor on which all the above-mentioned utilities have been marked. These drawings have been shared with all the concerned departments to intimate the existing utilities and to get their utility relocation plan and estimated budget for relocation. The detail of these departments is given in **Table 3.18**.

Table 3.18: Concerned Departments for Utilities Relocation

Sr. No.	Department/Authority	Concerned Utility
1	Karachi Municipal Corporation	Streetlights, roadside drains, signaling cables
2	Karachi Water and Sewerage Board (KW & SB)	Water, sewerage and drainage pipelines
3	Karachi Electric Supply Corporation	Electric lines
4	Sui Southern Gas Company	Gas pipelines
5	National Telecommunication Corporation	Telephone lines
6	Pakistan Telecommunication Company Ltd.	Mobile, telephone exchanges and fixed lines network
7	Pak Arab Refinery Ltd. (PARCO)	PARCO Line
8	National Refinery Limited	NRL line
9	Pakistan Refinery Limited	PRL Line

3.9 CONSTRUCTION SEQUENCE

Construction activities will include some or all of the following:

- Construction/relocation of utilities
- Roadway rehabilitation work (including demolition, clearing and earthwork)
- Construction of station platforms and facilities such as ticket machines and information kiosks
- Installation of pedestrian bridge
- Traffic signal and street lighting installation
- Pavement overlays
- Construction of electrical and other utility service lines to stations
- Erection of overhead pedestrian walkways and lifts for access to station areas

Additional work taking place along curb lanes may include:

- Sidewalk, curb and gutter reconstruction
- Motorbike track
- Storm drainage modifications
- Signage and street lighting
- Localized lane striping and pavement marking

A Construction Staging Plan will need to be developed in collaboration with the Government Agencies prior to the start of the work. The Construction Staging Plan will describe that i) how the overall construction will be phased, ii) how work zones will be sequenced and iii) how work locations within the zones will be managed. Proposed construction work hours and zone limits will need to be established subject to final confirmation with the relevant departments. The construction staging plan is necessary to minimize construction impact on businesses by providing reasonable access to parking and pedestrian access. Construction staging precedes development of traffic control strategies for minimizing traffic delays and queuing; and provides for development of safe pedestrian access during construction through and around work sites.

3.10 LIST OF MACHINERY

The list of machinery and vehicles that are envisaged to be required for the project construction works will include but not limited to:

Sr. No.	Name of Equipment
1	Mobile Crane 20-50 Ton
2	Excavators
	Caterpillar 330 or equivalent
3	Excavator with hammer
	Caterpillar 345 or equivalent
4	Bull Dozer D6
5	Dump Trucks
6	Wheel Loader .
7	Mobile Lubricator / Diesel Tankers
8	Air Compressor
9	Generators
	Various capacities 10-500 kVA
10	Motor Grader
11	Rollers (vibratory and static)
12	Water Tankers / Sprinkler
	(5000 gallon)
13	Pneumatic Roller
14	Compactors
15	i. Asphalt Batching Plants – 200Ton/hr
	ii. Asphalt Batching Plants – 125Ton/hr
16	Asphalt Paver
17	Asphalt Distributor
18	Concrete Batching Plants – 500 Cu.m./hr
19	Transit Mixer (6 cu.m. capacity)
20	Concrete pumps static
21	Poker Vibrator

- 22 Dewatering Pumps
- 23 Bar Bender Machine
- 24 Bar Cutter Machine
- 25 Low Bed Trailer
- 26 Flat Bed Trailer
- 27 Weigh bridge
- 28 Tractor trolley
- 29 Mobile welding plant
- 30 Jack Hammer

3.11 IMPLEMENTATION SCHEDULE

The tentative implementation schedule is given below:

Sr. No.	Details of Packages	Construction time lines	Implementation schedule
Package 1	(Depots 1 & 2)	24 months	(starting 2 nd quarter 2024)
Package 3	(Main Corridor – The 8000 Road)	36 months	(starting 4 th quarter 2023)
Package 4	(Main Corridor – Jam Sadiq Bridge)	36 months	(starting 2 nd quarter 2024)
Package 5	(Main Corridor – Korangi Road)	36 months	(starting 4 th quarter 2023)
Package 6	(Off-Corridor)	24 months	(starting 2 nd quarter 2026)

3.12 COST OF THE PROJECT

Total project cost is US\$ 438.9 million. The contribution of World Bank and the GoS is US\$ 382 million and US\$ 19.4 million respectively. The private sector's financial commitment amounts to US\$ 37.5 million.

3.13 CONSTRUCTION CAMP

Camp sites will be selected keeping in view the availability of adequate area for establishing camp sites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. Final locations will be selected by the contractor after approval from Local Government Department, Government of Sindh.

3.14 MANPOWER REQUIREMENTS

The manpower requirement of the proposed project during the construction phase will be approximately 500 in number, which may vary depending upon the construction period.

3.15 CONSTRUCTION MATERIALS

The material in construction of Yellow Line BRT corridor project will include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement, cement etc. Aggregates, soil, cement and steel are locally available in the area.

3.16 ESTIMATED QUANTITIES OF GENERATION OF WASTE DURING CONSTRUCTION

Estimated water demand for workers is 20,000 L/capita/day (500 x 40).⁴

Estimated waste water generation is 1600 L/capita/day (2000 x 0.8).

Estimated quantities of solid waste generated is 250 kg/person (500 x 0.45).⁵

3.17 POWER REQUIREMENT

During Construction Phase:

The main source of electricity/electric power during construction phase will be diesel generators.

During Operational Phase:

Major source of power would be taken from main electric power grid, supplying power to the main city

⁴ Tentative Work Force 500

= (500) x (40) = 20,000 liters/day

= 80% of water consumption = 16,000 liters/day

⁵ Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.5 kg/capita/day

4 PROJECT ALTERNATIVES

Analysis of alternatives is conducted to select the most effective alternative considering technical, economic, social, and environmental aspects. Detailed alternative analyses regarding alignment of all the corridors was done by the Study for Karachi Transport Improvement Project in the Islamic Republic of Pakistan, Final Report Volume-II Feasibility Study 2012, JICA. Based on the comprehensive technical, economic, social, and environmental criteria, the study conducted alternative analyses and finalized the alignments of all the corridors. This EIA considers that the proposed alignment of Yellow BRT corridor was comprehensively analyzed by the JICA study under alternative framework. Accordingly, proposed Environmental Management Plan provides detailed mitigations measures to ensure that this alignment of the corridor should comply the environmental criteria.

Following section describes analysis of the alternatives considered by JICA Master Plan study.

4.1 “NO PROJECT” OPTION

As per JICA Master Plan, traffic situation in Karachi would become worse in the future if no transport project is implemented because of:

- Population growth (1.67 times from 2010 to 2030);
- Economic growth, which increases the trip rate;
- Increase in car ownership rate, which increases the trip rate and decrease road space; and
- Expansion of urbanized area, which increases the trip length (1.64 times from 2010 to 2030).

Heavier traffic will cause the deterioration of bus services which results in more modal shift to motorcycle and private cars and increase the traffic on roads.

To evaluate the situation without transport investment, a “No project” option was analyzed in which the following conditions were assumed:

- No mass transit system including KCR would be implemented.
- Population growth, economic growth and urban development are the same conditions as the demand forecast in “with master plan” case.
- The number of buses would increase according to passenger demand.

The last assumption is an optimistic case for “No project” option. The “No project” option means that no mass transit system will be implemented, but improvement of bus transport services will be taken place. In case that no action about public transport is taken in the future, as has been in the last 20 years, the number of buses would not increase even if traffic demand increases.

Figure 4.1 illustrates the simulation result of “No project” option. Orange, red, and brown color indicates the road section where traffic volume exceeds the capacity (volume to

capacity ratio (V/C) exceeds 1.0). The V/Cs less than 1.5 (orange and red) would be possible but those of 1.5 and more (brown) that the transport network cannot deal with the demand.

The result shows that most roads will suffer from traffic saturation in case of “Do-Nothing” scenario.

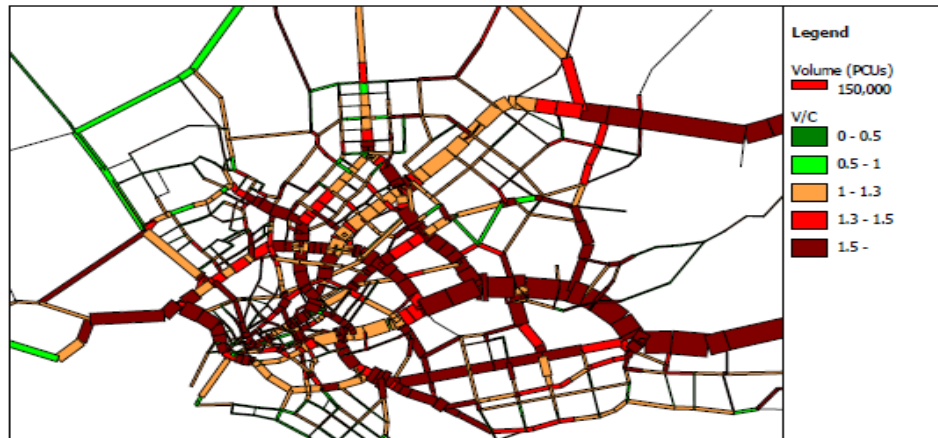


Figure 4.1: Do-Nothing Scenario (2030)

Source: KTIP (Preliminary Demand Forecast Model)

4.2 “ROAD DEVELOPMENT” SCENARIO

Karachi has developed road infrastructure such as flyovers and underpasses recently, which has improved traffic situation in Karachi. As per Master Plan, the “Road Development” Scenario was prepared to evaluate the present trend concentrating on road development. The condition of this scenario is the same as that of the “Do-Nothing” Scenario except for the road network used in the traffic assignment. The road network for the “Road Development” Scenario is the same as the road network in KUTMP 2030 in which new roads in total length of 740 km is included. Since the road network in the urbanized area in Karachi has been developed, further development of the road network would be difficult. **Figure 4.2** shows the result of the traffic assignment for “Road Development” Scenario. It is observed that traffic on some roads is significantly improved compared to “Do-Nothing” Scenario, but congestion will remain in many roads.

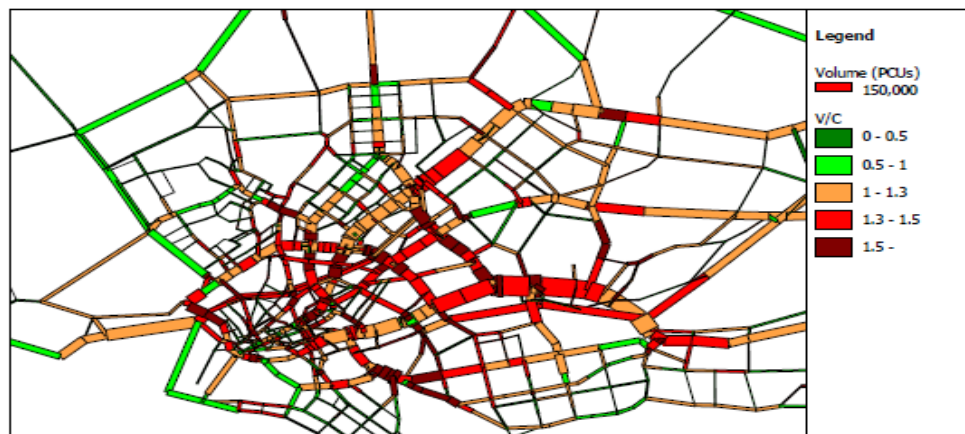


Figure 4.2: Road Development Scenario (2030)

Source: KTIP (Preliminary Demand Forecast Model)

4.3 “ROAD DEVELOPMENT + KCR” SCENARIO

KCR is a committed project by the Government of Pakistan (GOP). It was approved by the GOP on September 3, 2009. The “Road Development + KCR” Scenario is the case when only KCR is developed as a mass transit system in addition to road development. Figure 4.3 shows the result of the traffic assignment for this scenario. Traffic is improved by KCR project although its impact on road traffic is not clear from this figure. Since KCR provides the transport service for the circular direction, roads for radial directions remain congested.

4.4 “DO-EXISTING PLAN” SCENARIO

BRT as mass transit system for Karachi was proposed in “Detailed Study on a Private /Public Partnership based Environmentally-friendly Public Transport System for Karachi”. According to Karachi Mass Transit Corridors (KMTCC), this is one of the most important studies about mass transit system in Karachi.

This study proposed 16 bus routes as shown in **Figure 4.3**. Out of 16 proposed BRT routes, 3 lines were proposed to use the KCR line Karachi Central Station and NIPA. From this figure, it is clear that the KCR route plays an important role to formulate BRT corridors in the study. The study emphasized the advantage of converting KCR to BRT. In this case City District Government Karachi (CDGK) must purchase the right of way of KCR from Pakistan Railways.

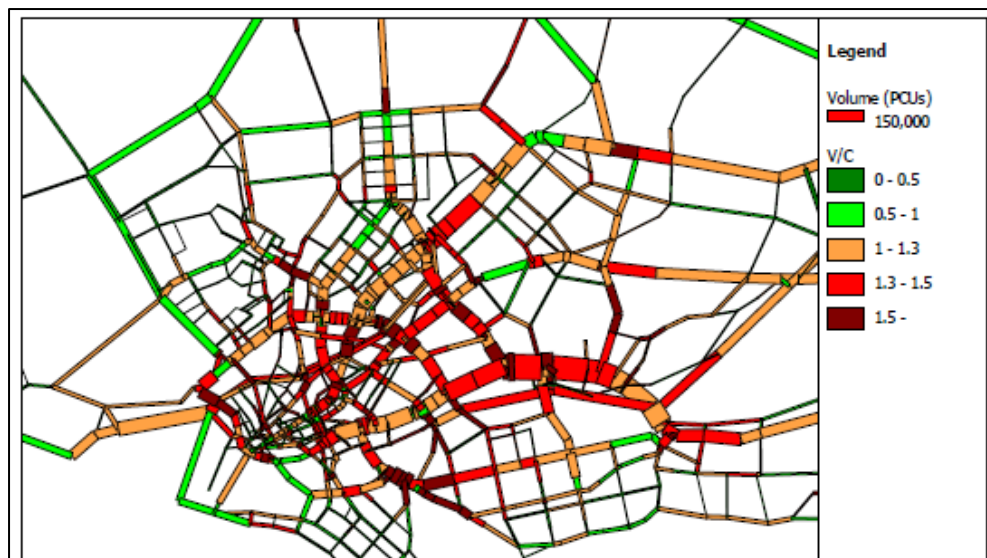


Figure 4.3: Road Development + KCR Scenario (2030)

Source: KTIP (Preliminary Demand Forecast Model)

As per Master Plan, the existing plan is difficult to be implemented because of the changes in road infrastructure. Development of Corridor-2 is almost impossible within a feasible scheme. Corridor-4 and Corridor-6 are duplicated with KCR alignment. In this study, convertible elevated structure, where the mass transit system can be changing from BRT into Railway, is not considered with following reasons.

Firstly, planning of railway-based system at ground level is unrealistic from the perspective of complete separation between road and rail. Such a plan would worsen the traffic situation in the city more and more. Secondly, if BRT system is originally built on such elevated structure, which has enough strength and width for railway system, it would be uneconomic. Even in such excessive case, it would be impossible to install underground structure after the elevated structure is once constructed. Finally, even if these engineering and resettlement problems are solved, construction of 6 corridors and KCR is not possible scenario in view of budget and schedule.

4.5 SCENARIO BY NETWORK TYPE

The public transport network depends on the type of mass transit system. For example, a low capacity system requires dense network while the dense network is costly in case of a large capacity transit system. To analyze the best mass transit system, the following three scenarios were evaluated.

1. Mass Rapid Transit (MRT) development along high priority corridors
2. Light Rail Transit (LRT) development along major corridors
3. Bus Rapid Transit (BRT) development along major roads

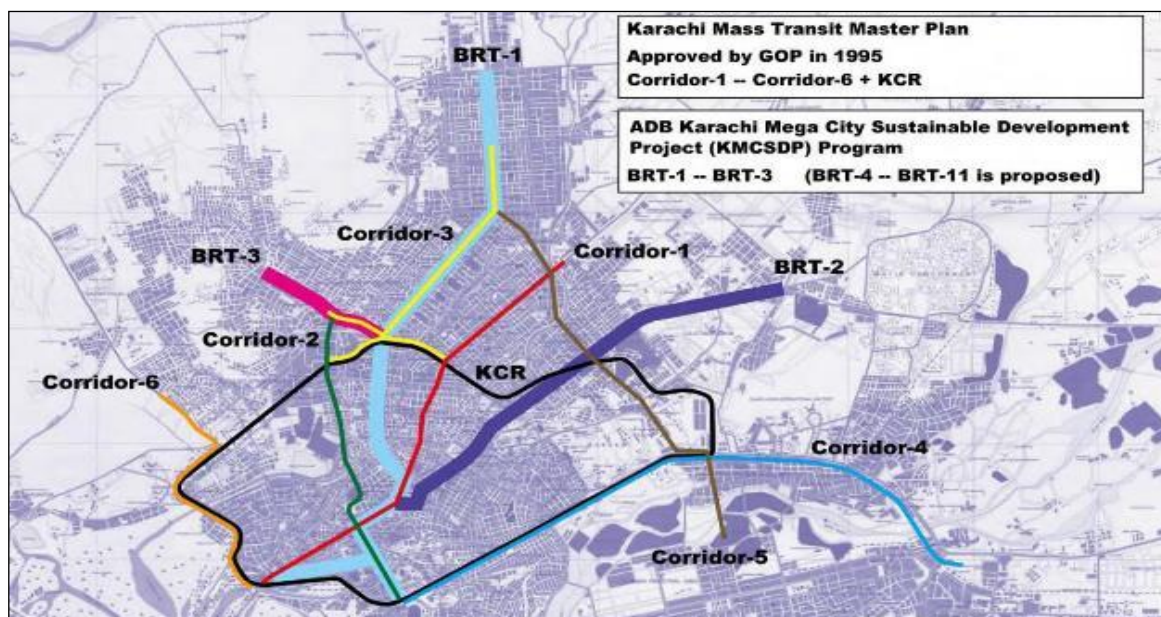


Figure 4.4: Do Existing Plan Scenario (2030)

In this analysis, MRT means a large capacity railway system (heavy rail, rail rapid transit) with a number of train cars (typically 6-12 cars). The concept of MRT scenario comes from the idea that it might be more feasible to construct a large capacity transit system along the priority corridor than constructing a lot of parallel LRT routes with short intervals. Although the cost of a MRT line is higher than a LRT line, the total cost of MRT network might be lower than that of LRT network because of the less number of lines. Feeder service is inevitable for this scenario.

The concept of LRT scenario is similar to that of the approved plan of Karachi Mass Transit Corridors. This scenario provides public transport service along major corridors. Construction period of a line in this scenario is shorter than that of MRT scenario.

The concept of BRT scenario is based on the “Study on a Public/ Private Partnership based Environmental-friendly Public Transport System for Karachi” and the BRT study by ADB. It is proposed 14 BRT routes in the study. The service area is largest among three scenarios.

	MRT Network Scenario Two MRT routes are constructed along the busiest corridors. Only MRT system of 8-car train with 40km/h is introduced. Coverage area of this scenario is very small. The advantage is that the east-west line (in blue color) can be constructed as elevated structure, and the early implementation would be possible. On the other hand, the north-south line (in red color) needs underground section.
	LRT Network Scenario Four LRT routes are constructed with a total length of 96 km. Only LRT system of 4-car train with 30km/h is introduced. The service area is very large but the construction cost is highest among the scenarios. This network requires road widening to avoid underground construction.
	BRT Network Scenario The network of this scenario is based on the network proposed in Environment Friendly PPP Study. The KCR line will be converted to BRT routes in this scenario. This scenario requires road widening in the center of the city. Since BRT system uses a part of lanes of the road, which reduces the road capacity, the positive impact on road traffic is not clear.

Figure 4.5: Concept of Network Type

Source: KTIP

4.6 SCENARIO BY MARKETING SEGMENT

Marketing is also an important factor for mass transit scenario. Unlike intercity trains, a mass transit system in urban area does not provide different services such as first class, second class and economy class in most cases. Usually, an urban transport system provides the same level of service to all passengers. If the target of the mass transit system is the same as those who cannot afford to pay the higher fare than existing minibuses, MRT and LRT will be very difficult choice. For example, KCR study by JICA shows that its financial interest rate of return (FIRR) is only 2.3% under the condition of keeping the fare structure similar to that of existing buses. If the target passengers are high income class those who use private cars, the improvement of the road congestion would be very significant. The willingness-to-pay survey implies that people who are using bikes and cars can pay a higher fare for mass transit than that of existing buses, if the mass transit is developed as a world standard level.

4.7 MASS RAPID TRANSIT SYSTEMS ALTERNATIVES

Following are the mass rapid transit system alternatives:

Monorail: It is a contemporary means of elevated rail transit.

Maglev Trains: These are also elevated rail transit system. Conventional wheels are replaced by magnetic fields with much higher speeds and acceleration.

Light Rail Transit: These trains have articulated rail vehicles powered by electricity from overhead trolley cables at surface level.

Heavy Rail: These are urban passenger transportation service operating on fully grade separated right of ways i.e. underground or elevated structures.

Commuter Rail: They are passenger train transit service that operates on the same right of ways used by intercity railway. It carries passengers from corridors of heavy concentrations of suburban and urban locations therefore also known as suburban rail.

Bus Rapid Transit: These are bus-based transit system that operates on segregated right of ways to provide higher quality of service with characteristics similar to modern rail-based transit system.

(Source: Suggesting Urban Mass Transit Technology for Pakistan "A Comparative Analysis of Rail Based Rapid Transit and Bus Rapid Transit)

The infrastructure cost for the above-mentioned systems is as under:

4.8 INFRASTRUCTURE COST PER KILOMETER (US\$ MILLION/KM)

Bus Rapid Transit	0.5 - 15
Light Rail Transit (At grade)	13 - 40
Metro (Elevated)	30 - 100
Metro (Underground)	45 - 320

Source (GTZ, 2004)

Bus rapid transit systems are the cheapest when compared to the other alternates.

Following **Table 4.1** compares various alternatives giving technical, operational, cost, environmental and social aspects (pros and cons) of each option.

Table 4.1: Comparison of Various Alternatives

	Advantages	Disadvantages
Do-Nothing	- No additional technical and operational implications - No additional cost will be incurred - No Land acquisition & Resettlement may be involved.	- The roads will remain congested with increasing traffic resulting in increased vehicular emissions and noise; - Delays and uncomfortable travelling; - Vehicle collisions/accidents due to traffic congestion.
Road Development	- Lesser technical, operational implications and cost will be incurred - Road development may result in immediate solution of traffic congestion along main corridors. - Decrease in noise and vehicular emissions but may not keep up the pace of growing traffic.	- The solution will be temporary solution and serious traffic congestion will remain resulting in increased vehicular emissions and noise gradually in long run. - Land acquisition & Resettlement may be involved.
Road Development + KCR	- KCR will improve the road traffic in Central Business District (CBD) to some extent. - Additional technical, operational and cost implications will be involved.	- Traffic congestion will still remain especially for radial directions. - The solution will be temporary solution and serious traffic congestion will still remain resulting in increased vehicular emissions and noise gradually in long run. - Land acquisition & Resettlement may be involved.
Do-Existing Plan	Traffic congestion will be reduced resulting in lesser vehicular emissions and noise.	- Road conditions will be improved however, additional technical, operational and cost implications will be involved. - Land acquisition & Resettlement may be involved.

4.9 CONCLUSION OF SCENARIO ANALYSIS

Master Plan concludes from the above scenario analysis that:

1. Road development will remarkably improve the road traffic along major corridor. However, serious traffic congestion will still remain.
2. KCR will improve the road traffic in Central Business District (CBD) to some extent. However, traffic congestion will still remain especially for radial directions.
3. Construction of a number of LRT will not be efficient in terms of cost performance. A large number of resettlements will be necessary in case of elevated structure in CBD.
4. MRT network with one or two lines is not enough for the future demand.
5. The future mass transit network should be the mixture of MRT and BRT.

The target of mass transit development should be middle income people, who are using motorcycles as transport mode.

5 DESCRIPTION OF ENVIRONMENT

This section describes the existing conditions of physical, ecological, and socio-economic environment of the project area. Information on these aspects has been obtained from the review of available studies and data collected through field observations and analysis. The baseline surveys were carried out during February, 2022.

The surveys were carried out along the alignment, however to establish baseline and assess impacts a zone of influence (ZOI) was defined. The ZOI for the project was taken as varying from 50 m from the edge of the road. Other than ZOI, impacts were also assessed in other areas like depots and feeder routes, construction camps batching plants and asphalt plants.

5.1 PHYSICAL ENVIRONMENT

5.1.1 Topography

The greatest height of the region is 76 m that gradually decreases to 1.5 m above mean sea level along the coastline. The topography of the project area ranges from 8-11 m. Topography of project area is presented in **Figure 5.1**.

5.1.2 Geology

The project area mainly consists of alluvial deposits up to the depth of 20.0 to 25.0 meters from Dawood Chowrangi to Malir River towards west. Bed rock present at the project location is of Gaj Formation of Lower Age Miocene. Gaj formation consists of shale with subordinate sandstone and limestone. Moving towards Malir River, one of the two rivers that passes through the city of Karachi drains into the Arabian Sea via Ghizri creek, deposits of Sandstone of Manchar Formation (Quaternary age) and near Malir River deposits of Korangi Conglomerate are found at the surface. On the other bank of the river siltstone, limestone, sandstone and clay of Gulistan e Johar member of Gaj Formation are deposited and exposed at different locations.

The deposition of the area mainly consists of 'loose to very dense, fine to coarse grained sand, clayey sand,' 'soft to hard, silty and sandy clay', 'very soft to hard, sandy clayey silt', 'very dense, fine to coarse grained sandy gravel', highly weathered and fractured pieces of sandstone, friable sandstone', 'extremely weak, moderately weathered and fractured claystone' and 'highly weathered and fractured mudstone'. Geology of project area is presented in **Figure 5.2**.

5.1.3 Groundwater

The investigation was carried out from December 2021 to February 2022 and groundwater table was encountered at a depth range of 1.7 to 17.40 meters below the existing ground level. Groundwater levels are susceptible to seasonal fluctuations and may be higher during wetter periods than dryer periods.

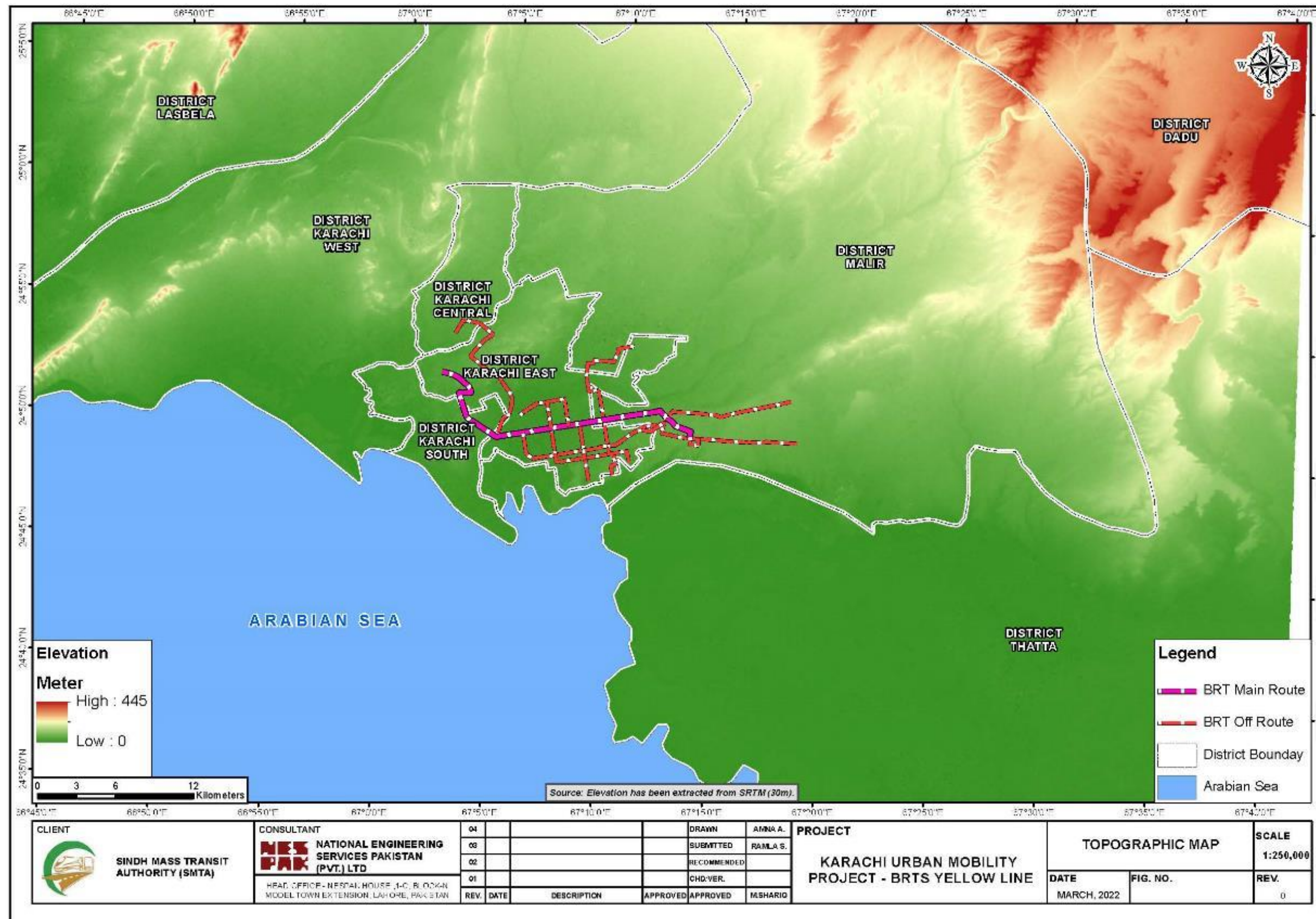


Figure 5.1: Topography of Project Area

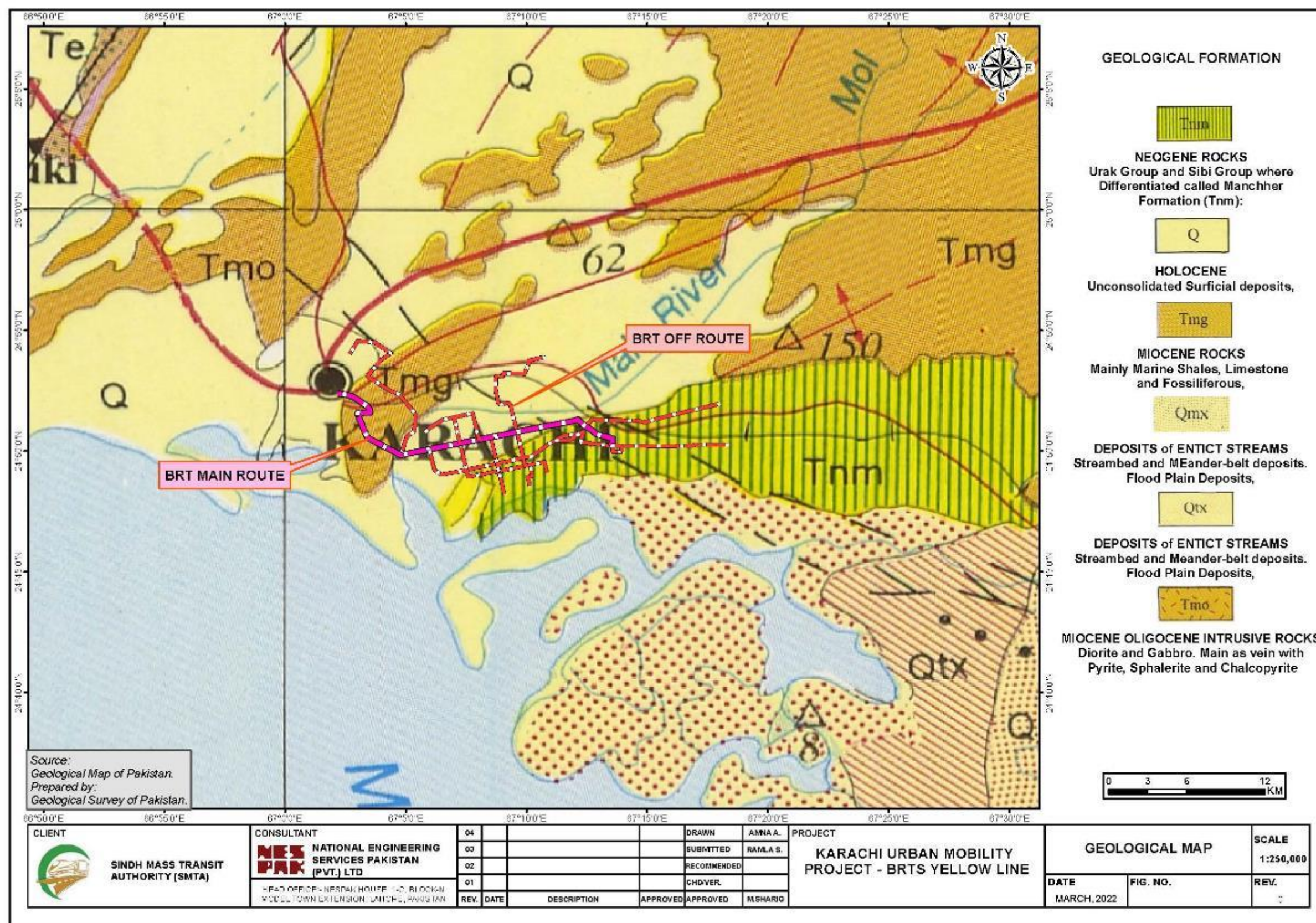


Figure 5.2: Geology of Project Area

5.1.4 Surface Water Resources

The surface water resource in project area is Malir River.

a) Malir River

Malir River is formed by the confluence of Mol and Khadeji tributaries, the catchment area of which are 611 km² (235 mile²) and 567 km² (219 mile²), respectively, whereas total catchment area up to its estuary is 2,314 km² (893 mile²). After the confluence of Mol and Khadeji, the Malir River traverses through Karachi city about 43 km (27 mile) and outfalls into the Arabian Sea. The catchments of Mol and Khadeji are generally mountainous and mostly comprise of barren hills of low to medium height consisting of pale coloured limestone contains alluvial deposits, boulders, gravel and sandy clays. Whereas the lower part of the catchment mostly comprises of fully developed & underdeveloped urban area and cultivable area along the river banks.

Currently, untreated sewerage is being drained into the Malir River bed. Solid waste, plastic bags and other trash are also dumped in the sewerage adding to pollution. Urban flooding occurs when continuous and heavy rainfall over a short duration overwhelms the city's drainage capacity. The heavy rainfall over a short duration, saturates the soil and increases run-off water, constructions and settlements over riverbeds and on flood plains, and unplanned infrastructure growth also contributes in urban flooding. In addition to this, encroachments on drains, the dumping of municipal waste and sewage in them, and the lack of open spaces and parklands also cause the city's perennial flooding problem. **Figure 5.3** gives surface water sources of the project area.

5.1.5 Seismology

According to Building code of Pakistan, 2007 prepared by NESPAK, the project area falls in Seismic Zone 2B of Pakistan (moderate damage), and peak ground acceleration (PGA) from 0.16 to 0.24 g. The Yellow BRT design must meet the criteria to withstand in seismic zone 2B. **Figure 5.4** shows the seismic zoning map of the Project area falling under Seismic Zone-2B.

5.1.6 Climate

The climate of the Karachi can be characterized by dry, hot and humid conditions and in general terms it is moderate, sunny and humid. There is a minor seasonal intervention of a mild winter from mid-December to mid- February followed by a long hot and humid summer extending from April to September, with monsoon rains from July to mid- September. The level of precipitation is low for most of the year. Karachi also receives the monsoon rains from July to September. The humidity levels usually remain high from March to November, while very low in winter as the wind direction in winter is North Easterly.

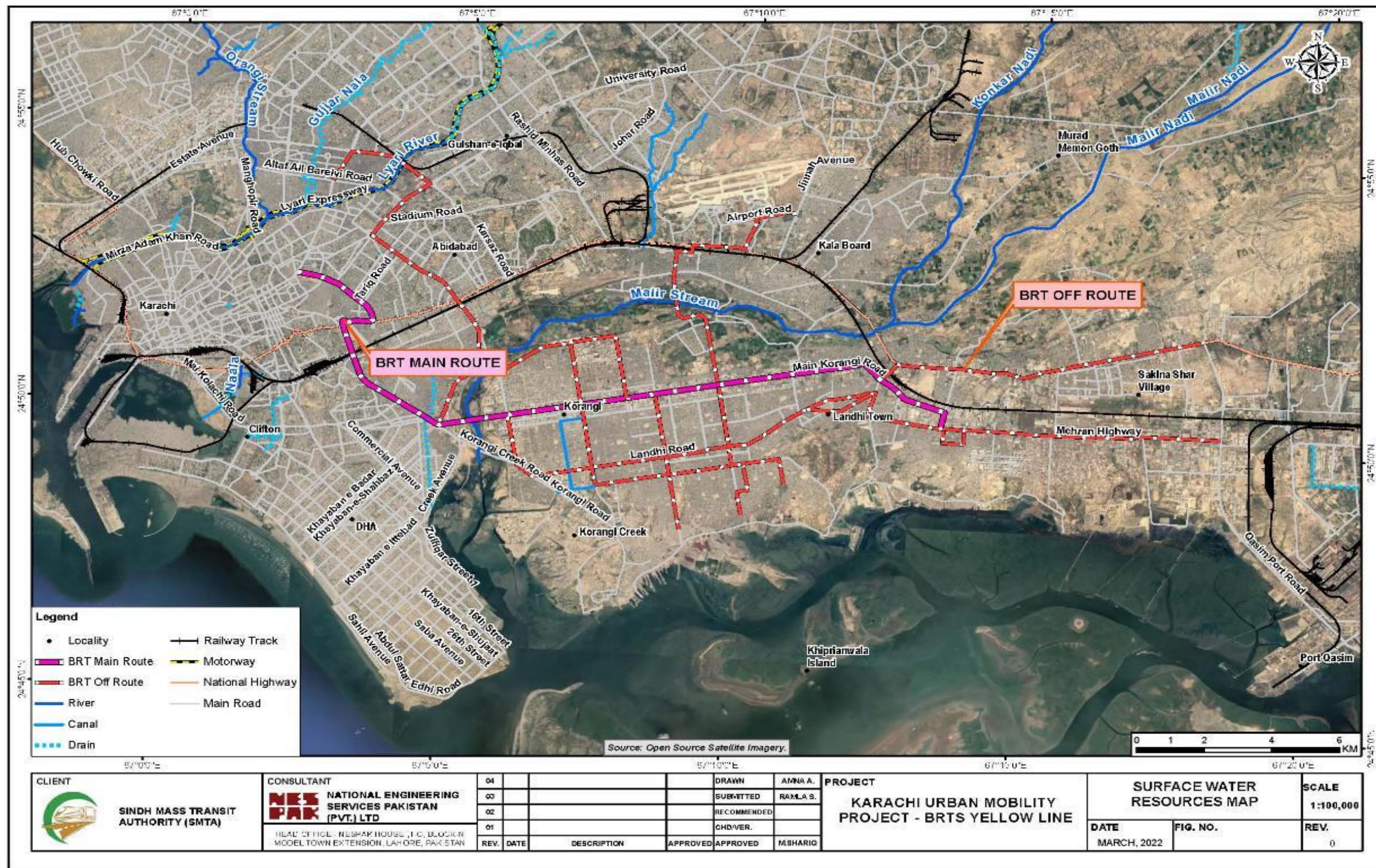


Figure 5.3: Surface Water Resources of the Project Area

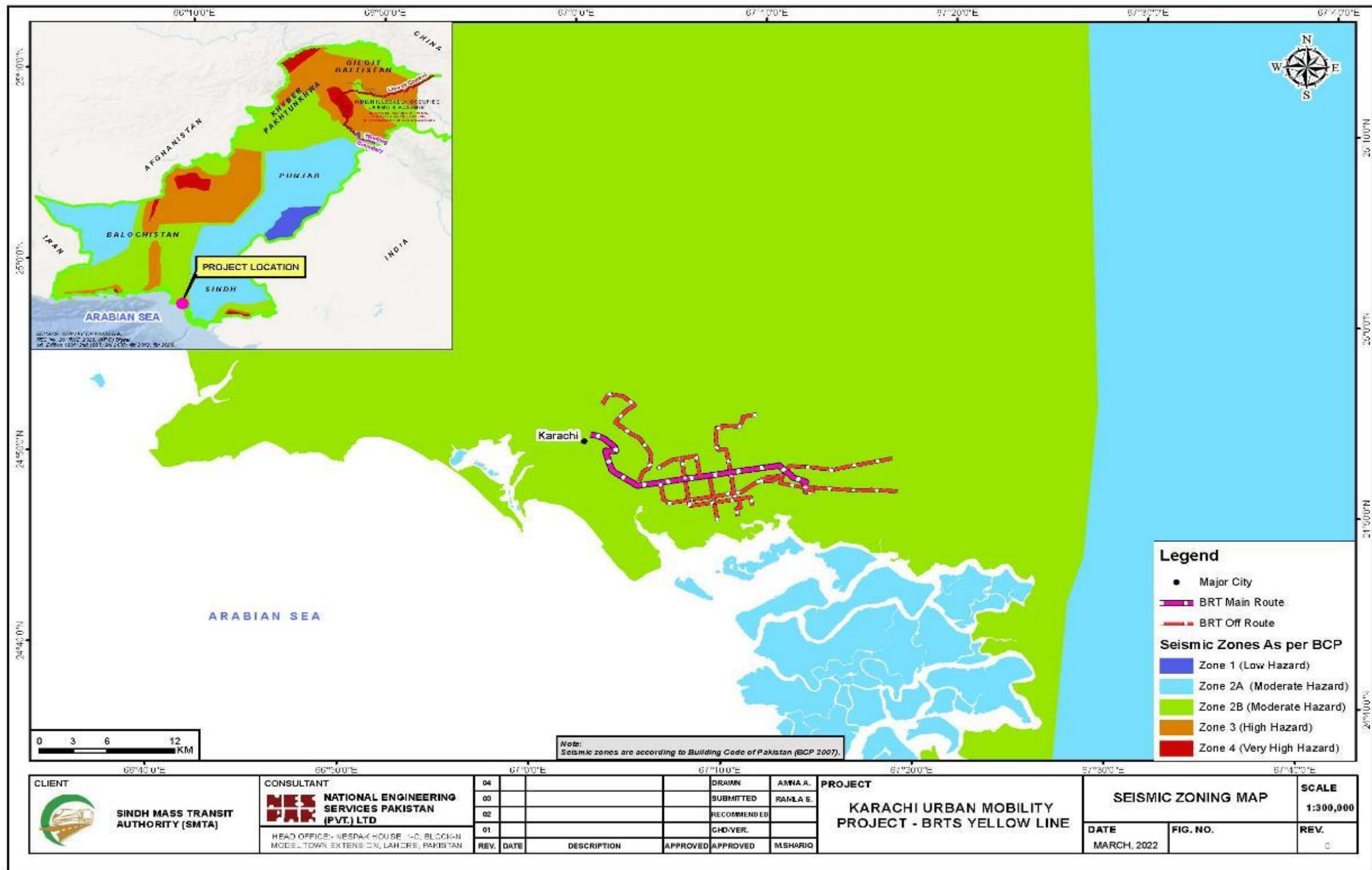
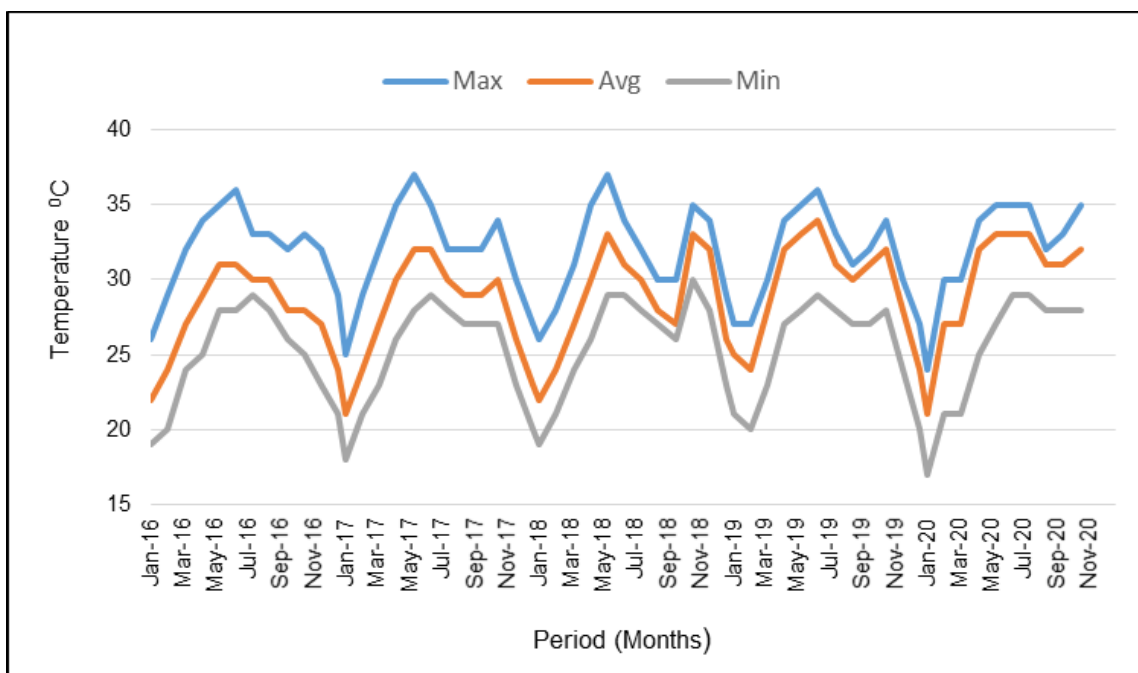


Figure 5.4: The Seismic Zoning Map of Project Area

The description of various climatic parameters in the project area is as follows:

5.1.7 Temperature

Figure 5.5 show the maximum, minimum and average monthly temperatures of the Karachi for the recent years (2016-2020). The maximum temperature range is 24 – 37 °C. The average temperature range is 21 - 34 °C. The minimum monthly temperature range is 17– 30 °C. April to November are the hot months whereas cold months are December to March. The materials and roads conditions shall be maintained to resist the temperature peaks. The worker health and safety may be affected in extreme temperature and adequate measures such as scheduling of working hours to avoid peak hours of temperature shall be considered in the project staging of construction.



Source: World Weather Online (<https://www.worldweatheronline.com/karachi-weather-history/sindh/pk.aspx>)

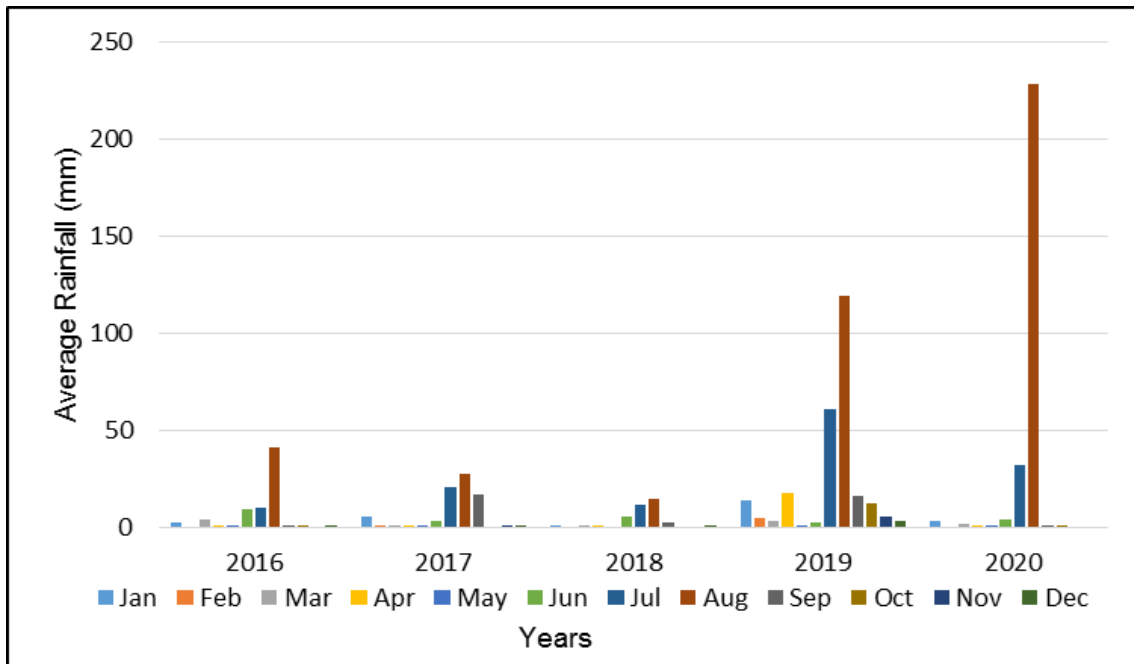
Figure 5.5: Maximum, Minimum and Average Temperature (Karachi)

5.1.8 Rainfall

Mean monthly rainfall data and the number of rainy days recorded at Airport Weather Station, Karachi met station in the vicinity of the project area is given in **Figure 5.6**. The minimum average monthly rainfall of the project area varies from 0 to 0.8 mm whereas maximum average monthly rainfall varies from 14.31 mm to 118.90 mm. As this region falls in the semi-arid climatic zone, the rainfall in Karachi is extremely low and erratic.

The maximum rainfall occurs during the months of July and August. The record-breaking rainfall in August 2020 turned Karachi roads into waterways. Winter rains generally occur during the months of December to March, whereas, May, October, November is normally the months with least precipitation. As evident from the graph rainfall trend has increased significantly during monsoon. The construction activities shall be managed accordingly

especially excavation etc.

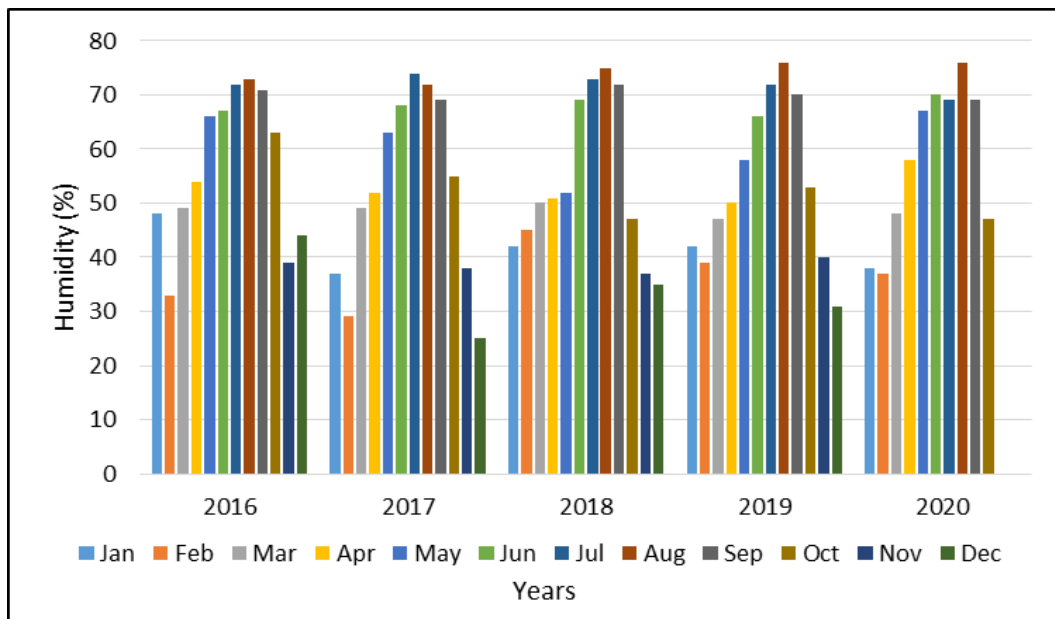


Source: World Weather Online (<https://www.worldweatheronline.com/karachi-weather-history/sindh/pk.aspx>)

Figure 5.6: Monthly Average Rainfall (mm) and Number of Rainy Days of Karachi

5.1.9 Humidity

The relative humidity data at Karachi metrological station at Airport near the proposed Project Area is given in **Figure 5.7**. Relative humidity levels are mostly high during the month of July and August, whereas, these are lower during December.



Source: World Weather Online (<https://www.worldweatheronline.com/karachi-weather-history/sindh/pk.aspx>)

Figure 5.7: Average Humidity and Clouds (%) of Karachi

5.1.10 Wind

The wind speeds are generally lower during winter (December to March) while higher wind speeds are recorded during summer (May, June, July). The wind speed shall be considered for safety of equipment, storage of material and worker health and safety.

Graphical representation of month-wise wind speed at Airport Karachi meteorological gauging station is provided below in **Figure 5.8** where **Figure 5.9** shows wind rose of Karachi.

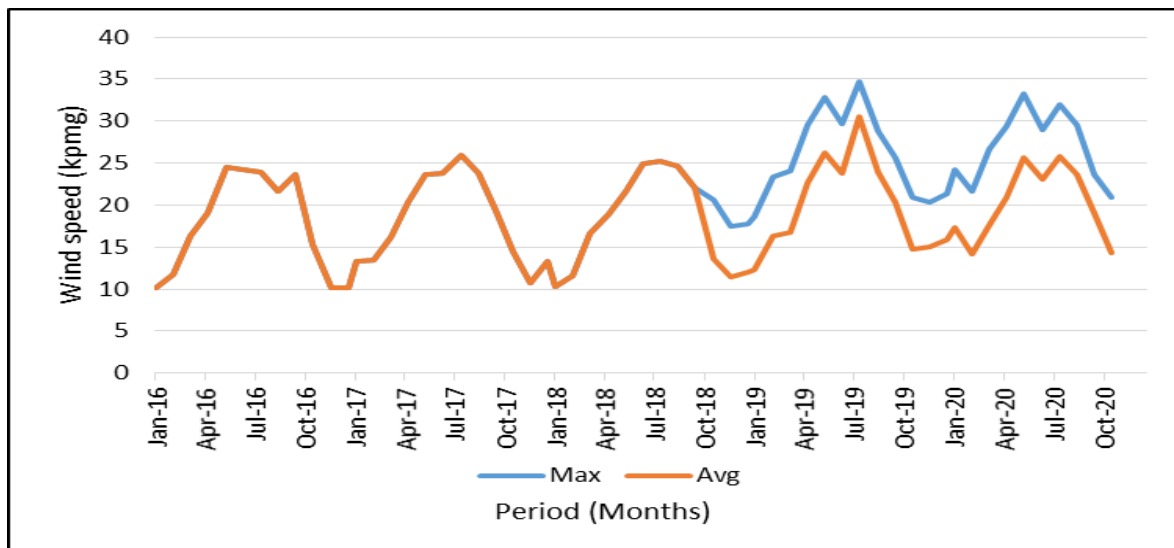


Figure 5.8: Monthly Average and Maximum Wind Speed of Karachi

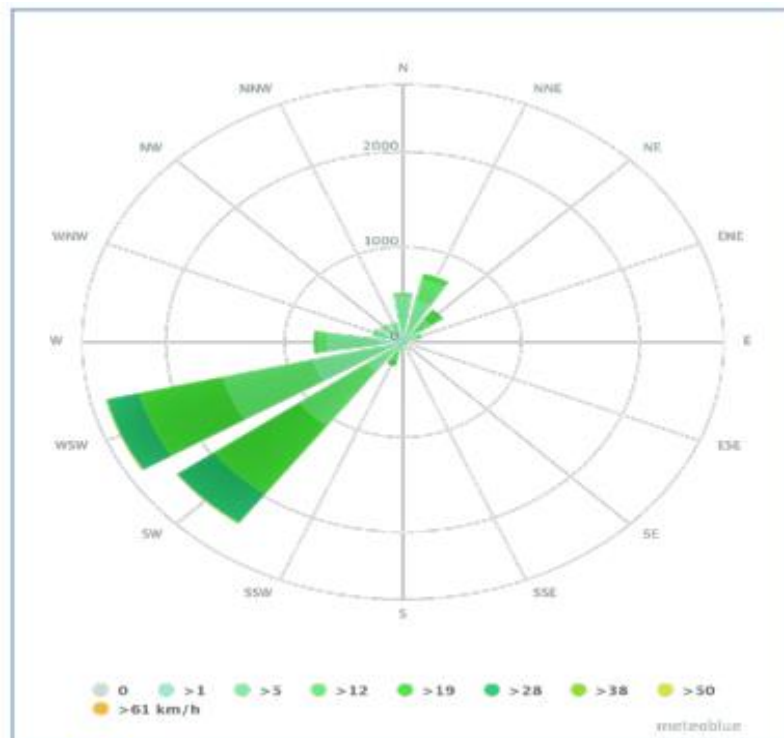


Figure 5.9: Monthly Average and Maximum Wind Rose of Karachi

5.1.11 Water Supply at Project Site

The water supply sources at project site are Karachi Water and Sewerage Corporation (KW&SC) supply, groundwater extraction, and tankers supply. Water distribution pipelines are passing at project site and consultations have been conducted with Karachi Water & Sewerage Corporation (KW&SC) in October, 2021. Most of the industries located along Korangi Road have installed their own water turbines to extract groundwater and also purchase water from tankers. Mostly the households have also installed small pumps for groundwater extraction and also purchase water from tankers.

5.1.12 Sewerage System

The natural drainage system of Karachi city includes mainly the tributaries of the Malir and Lyari Rivers. The Malir River flows from the east towards the south and center, and the Lyari River stretches from north of the city to the southwest ending in the Arabian Sea. The project alignment crosses Malir River.

Drainage channels collect surface runoff through hundreds of small/large side channels and lined nullahs (drains) that serve as important components of the drainage network. These are generally dry built channels and streambeds that flow into the main rivers described above. Whenever a heavy rain takes place, the huge amount of runoff that course through these channels may cause the rivers to overflow their banks and spread over adjacent floodplains. In any event, the drainage network of the city is severely stressed due to increased runoff from paved surfaces, and encroachment on drainage channels.

Malir River is shorter with a smaller drainage area. It is ephemeral and is constituted from two major tributaries, the Mol and Khadeji, as well as some minor tributaries. Khadeji is a perennial stream that originates at Khadeji falls and gains flow as it travels across the Malir Basin. The Malir and Khadeji River basins include dry hill torrents and flow depends upon precipitation during rains. Once the Malir enters urban space, it receives large amounts of industrial effluent from the Korangi industrial area, and discharges into the sea.

Various sewage lines are lying underneath of Yellow Line BRT Corridor. Drawings have been shared with Sewerage team and coordination with three different departments has been conducted. The lines may get damaged due to various project activities.

The existing coverage of the sewerage system is only about 30% for the Karachi, which has a number of problems. These include low sewage flows received at existing sewage treatment plants, resulting from the inadequate provisions of sewer trunk mains and the malfunctioning of pumping facilities, deterioration of water quality in rivers and canals, and clogging of waterways caused by dumping of massive rubbish.

As per KSDP 2020, more than 380 million gallons per day (MGD) wastewater is discharged daily. Only about 90 MGD is treated at existing wastewater treatment plants. According to KWSB sources, almost 441.32 MGD raw sewage gets into the sea without required level of treatment from Karachi via 11 drains. Existing sewerage facilities for sewage collection and

its treatment are far from sufficient in quantity to serve the large population of Karachi city. Additional sewage collection system including branch sewers, trunk sewers and pumping stations need to be constructed to improve living environment of the citizen. In the same manner, existing sewage treatment plants need to be extended and new plant(s) has to be implemented to treat all the generated sewage to improve water qualities of public water bodies, especially of Arabian Sea.

Untreated wastewater is one of the major sources of surface and groundwater contamination. Most of wastewater discharges from municipal and industrial sources do not meet the Sindh Environmental Quality Standards (SEQS). This indiscriminate discharge of untreated wastewater results in considerable environmental pollution and degradation. Major infectious diseases outbreaks were sourced by the contamination of fresh water resources. Most sewage flows into the nullahs and rivers which run as open sewers through the built-up area, causing highly obnoxious, insanitary conditions with serious health risks and unpleasant environment for the residents of adjoining neighborhoods.

There are numerous unauthorized settlements along most of the sewage channels where poor segments of society live. These are vulnerable to being exposed to water borne diseases, especially children. Besides causing health impacts, sewage overflow also damages already dilapidated infrastructure of Karachi, particularly roads.

The heavy metal accumulation (especially Pb) in seafood is linked to anemia, kidney failure and brain damage in humans. Mangroves and other ecological assets of the coast of Karachi are under serious threats due to exposure to the seawater contamination. Coastal ecological areas especially mangroves are habitats to invertebrate fish, shrimps, crabs, birds and reptiles.

Other major impacts of marine pollution as seen in Karachi include loss of biodiversity, dislocation of coastal communities, loss of livelihood, loss of fisheries, and degradation of beaches and recreational places.

The industrial estates of Karachi, namely Sindh Industrial Trading Estate (SITE), Landhi Industrial Trading Estate (LITE), Korangi Industrial Area (KIA), and West Wharf Industrial Area, among others, discharge effluents mainly into the Lyari and Malir rivers, which, passing through mangroves of Korangi Creek, finally drain into the Arabian Sea. SITE represents about 50% of the industrial discharges into sea.

Many of the above-mentioned industrial estates intend to or are in the process of establishing large scale effluent treatment plants. Due to paucity of land, capital and technical resources, very few industrial units have installed individual wastewater treatment plants. Therefore, almost all of the industrial effluent goes into the sea practically untreated.

a) Drainage System at Project Site

At Korangi Industrial Area, sewers are located at the center of the road and the shoulders of the roads. The industrial and residential wastewater is discharged in these sewers. Also the

storm water drains are being utilized as sewers. The major drains also intersect Korangi Road (8000 Road) from chowrangis (intersections). There will be potential threat of choking of these drains during construction of Yellow BRT Corridor at Korangi and 8000 Roads. The existing drain will be relocated (reconstructed) since the existing drain will be within the road ROW due to BRT corridor, while an additional drain will be constructed to facilitate the stormwater drainage requirements of the BRT corridor. **Plate 5.1** shows drains crossing the Chowrangi at Korangi Road.



Plate 5.1 Wastewater Drains Crossing Chowrangi at Korangi Road.

5.1.13 Environmental Monitoring

In order to determine the ambient air, noise levels, water and surface water quality of the study area, some locations were selected for environmental monitoring and samples collection. **Table 5.1** Presents selected locations for environmental monitoring.

The selection was based on the following criteria.

- Ambient air and noise monitoring points are selected based on the Source-Receptor Approach. The sources include traffic, construction activities and construction camps whereas the receptors comprise educational, health, religious, cultural, archeological, ecological resources, etc. along the project alignment.
- Major surface water bodies e.g. river and nullahs within the ZOI are considered for selection of surface as well as wastewater sampling locations.
- Drinking Water available in the vicinity of project area.

Table 5.1: Environmental monitoring Locations along the alignment

Sr. No.	Parameters	Sampling Points	Sampling Locations
1	Ambient Air	10	• Mufti Mehmood Masjid, Dawood Chowrangi, KIA Karachi • Jamia Darul uloom, Singer Chowrangi, KIA, Karachi • Near to Dewan University, Shan Chowrangi,
2	Noise Level		

Sr. No.	Parameters	Sampling Points	Sampling Locations
			KIA, Karachi • Near to EBM, Brooks Chowrangi, KIA, Karachi • Near Indus Hospital, Korangi Crossing, Karachi • NMC Hospital Mehmoodabad Rd, NMC Hospital • Gora Qaberistan, Near CSD • Surgery Hospital P.E.C.H.S Block • Rehmania Qaberistan Tariq Road • Near Hanif Rajput Office Society, Khudadad Chowrangi, Karachi
3	Surface/Wastewater	02	• Shan Chowrangi • Front of Nasla Tower
4	Drinking Water	05	• Dawood Chowrangi • Dar-ul-uloom • Near Indus Hospital • Cardiac Surgery Hospital • National Medical center

a) Air Quality

The ambient air quality monitoring for Nitrogen Dioxide (NO₂), Nitrogen Oxide (NO), Sulfur Dioxide (SO₂), Carbon Monoxide (CO), Ozone (O₃), Particulate Matter (PM_{2.5}, PM₁₀), Suspended Particulate Matter (SPM) and Lead was carried at ten locations as given in **Table 5.1**. The monitoring was conducted for 24 hours duration for NO₂, NO, SO₂, Lead, PM_{2.5}, PM₁₀ and SPM, 1 hour for O₃ and 8 hours for CO. The average concentration of ambient air pollutants is given in **Table 5.2**.

Ambient Air Monitoring results indicate that PM_{2.5}, PM₁₀, and CO exceeds the limits of SEQS. Vehicular exhaust and industries along the alignment are the major source of higher concentration of these parameters. Other parameters are complying to the standards.

b) Noise Monitoring

Noise levels were monitored with the help of digital sound meter at ten locations for twenty-four (24) hours with an interval of one hour. The average noise levels at the given locations are presented in **Table 5.3**.

The noise levels were slightly high than recommended values at Gora Qaberistan, Near CSD, Surgery Hospital P.E.C.H.S Block, Rehmania Qaberistan Tariq Road, Near Hanif Rajput Office Society, Khudadad Chowrangi, Karachi, Near Indus Hospital, Korangi Crossing, Karachi compared to normal road side areas due and traffic and busy road as the alignment crosses commercial and industrial areas.

c) Surface / Wastewater Quality

The surface/wastewater quality was measured at two (02) locations. The samples were analyzed for the parameters specified in SEQS, 2016. The detailed surface and wastewater results are given in **Table 5.4**.

Some parameters of wastewater such as TDS, chlorides, BOD, COD and Copper are higher than the SEQS due to discharge of untreated sewerage from the area.

d) Drinking/Ground Water Quality

Drinking water samples were taken from project site were analyzed for physical, chemical and microbiological parameters. **Table 5.5** shows the results of ground water analysis.

The sample of drinking water showed presence of Coliforms whereas fecal Coliform was not found in the sample. The chemical parameters were within the range of SEQS. The detailed laboratory results of environmental monitoring and testing are attached in **Annexure-III**.

Figure 5.10 shows the locations of environmental monitoring.

Table 5.2: Ambient Air Quality Monitoring

Parameters	Units	Average Obtained Concentration										SEQS, 2016 24 hrs
		Mufti Mehmood Masjid, Dawood Chowranghi, KIA Karachi	Jamia Darul uloom, Singer Chowranghi, KIA, Karachi	Near to Dewan University, Shan Chowranghi, KIA, Karachi	Near to EBM, Brooks Chowranghi, KIA, Karachi	Near Indus Hospital, Korangi Crossing, Karachi	NMC Hospital Mehmoodabad Rd, NMC Hospital	Gora Qaberistan, Near CSD	Surgery Hospital P.E.C.H.S Block	Rehmania Qaberistan Tariq Road	Near Hanif Rajput Office Society, Khudadad Chowranghi, Karachi	
NO ₂	µg/m ³	6.78	12.44	16.46	12.17	6.73	11.3	7.33	3.03	5.81	5.87	80.0
NO	µg/m ³	11.29	10.3	12.17	10.86	8.97	20.50	7.17	3.91	5.95	6.95	40.0
SO ₂	µg/m ³	9.76	7.14	9.73	6.23	3.93	5.08	9.48	5.41	5.31	6.11	120.0
CO	mg/m ³	9.02	4.86	1.43	9.32	2.7	1.5	7.5	4.81	5.8	4.0	5 mg/m ³ (8 hours)
PM ₁₀	µg/m ³	28.92	90.04	157.72	160.47	130	95.4	112.75	120.37	72.77	101.35	150
PM _{2.5}	µg/m ³	20.31	51.21	111.83	122.42	90.18	68.29	78.97	84.11	53.26	71.45	35
SPM	µg/m ³	52.02	145.31	264.90	284.77	216.4	133.5	191.73	204.48	131.83	177.92	500
Lead	µg/m ³	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5
O ₃	µg/m ³	12	0.28	6.44	12.1	11.99	11.99	11.83	11.99	12.002	12	130 µg/m ³ (1 hours)

Source: HSE Services Laboratory Test Results, 2022

Table 5.3: Noise Level Monitoring

Sr. No.	Noise dB (A)	IFC	SEQS, 2016 (Commercial)	Sampling Locations									
				Muti Memood Masjid, Dawood Chowranghi, KIA Karachi	Jamia Darul uloom, Singer Chowranghi, KIA, Karachi	Near to Dewan University, Shan Chowranghi, KIA, Karachi	Near to EBM, Brooks Chowranghi, KIA, Karachi	Near Indus Hospital, Korangi Crossing, Karachi	NMC Hospital Mehmoodabad Rd, NMC Hospital	Gora Qaberistan, Near CSD	Surgery Hospital P.E.C.H.S Block	Rehmania Qaberistan Tariq Road	Near Hanif Rajput Office Society, Khudadad Chowranghi, Karachi
1.	Day Time	70	75	60.683	73.183	74.375	74.990	77.833	63.755	73.358	70.858	71.091	73.125
2.	Night Time	70	65	49.327	64.183	64.291	70.046	75.125	60.166	66.88	67.841	68.516	68.975

Source: HSE Services Laboratory Test Results, 2022

Table 5.4: Surface / Wastewater Quality Monitoring

Parameter	Test Results		SEQS, 2016 (Wastewater)
	Shan Chowrangi	Front of Nasla Tower	
Temperature	29	30	< 30°C
pH	8.10	7.40	6-9
Biochemical Oxygen Demand (BOD ₅)	961	115	80
Chemical Oxygen Demand	2980	359	150
Total Suspended Solids	131	119	200
Total Dissolved Solids	10425	1282	3500
Phenolic Compounds (as Phenols)	0.72	<0.1	0.1
Grease and Oil	85	9	10
Chloride (Cl ⁻)	2125.95	480.82	1000
Fluoride (F ⁻)	1.98	1.27	10
Cyanide (CN ⁻)	ND	ND	1.0
An-ionic Detergents (as MBAs)	0.37	0.29	20
Sulfate (SO ₄) ²⁻	598.19	129.81	600
Sulfide (S ²⁻)	0.18	0.08	1.0
Ammonia (NH ₃)	0.84	0.39	40
Cadmium (Cd)	ND	ND	0.1
Chromium (Cr)	0.026	0.019	1.0
Copper (Cu)	1.24	1.00	1.0
Lead (Pb)	<0.1	<0.1	0.5

Parameter	Test Results		SEQS, 2016 (Wastewater)
	Shan Chowrangi	Front of Nasla Tower	
Mercury (Hg)	ND	ND	0.01
Selenium (Se)	BDL	BDL	0.5
Nickel (Ni)	0.16	0.6	1.0
Silver (Ag)	ND	ND	1.0
Total Toxic Metals	<2	<2	2.0
Zinc (Zn)	0.23	0.17	5.0
Arsenic (As)	0.012	0.008	1.0
Barium (Ba)	BDL	BDL	1.5
Iron (Fe)	0.32	0.25	8.0
Manganese (Mn)	0.37	0.30	1.5
Boron (B)	0.2	0.1	6.0
Residual Chlorine (Cl ₂)	0.98	0.10	1.0
Pesticides	ND	ND	0.15

Source: HSE Services Laboratory Test Results, 2022

Table 5.5: Drinking Water Quality Monitoring

Parameter	Unit	Results					SEQS
		Dawood Chowrangi	Dar-ul-Uloom	Near Indus Hospital	Cardiac Surgery Hospital	National Medical Center	
Temperature		-					NS
Color	-	<5	<5	<5	<5	<5	< 15 TCU
Taste	-	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Non-Objectionable/ Acceptable
Odor	-	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Non-Objectionable/ Acceptable
Turbidity	Pt-Co	BDL	BDL	BDL	BDL	BDL	< 5 NTU
Total Hardness (as CaCO ₃)	NTU	215.89	193.12	206.511	193.17	21.738	<500.00
Total Dissolved Solids	mg/l	339	355	351	353	264	< 1000
pH	mg/l	7.65	7.74	7.96	7.72	6.75	6.5-8.5
Aluminum	mg/l	ND	ND	ND	ND	ND	0.2
Antimony	mg/l	ND	ND	ND	ND	ND	0.02
Arsenic	mg/l	ND	ND	ND	ND	ND	0.01
Barium	mg/l	ND	ND	ND	ND	ND	0.7
Boron	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	0.3
Cadmium	mg/l	ND	ND	ND	ND	ND	0.003
Chloride	mg/l	130.76	123.29	122.11	115.82	176.684	250

Parameter	Unit	Results					SEQS
		Dawood Chowrangi	Dar-ul-Uloom	Near Indus Hospital	Cardiac Surgery Hospital	National Medical Center	
Chromium	mg/l	ND	ND	ND	ND	ND	0.05
Copper	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	2
Cyanide	mg/l	ND	ND	ND	ND	ND	0.07
Fluoride	mg/l	0.49	0.52	0.51	0.48	0.19	1.5
Lead	mg/l	ND	ND	ND	ND	ND	0.01
Manganese	mg/l	ND	ND	ND	ND	ND	0.5
Mercury	mg/l	ND	ND	ND	ND	ND	0.001
Nickel	mg/l	ND	ND	ND	ND	ND	0.02
Nitrate	mg/l	BDL	BDL	BDL	BDL	BDL	50
Nitrite	mg/l	BDL	BDL	BDL	BDL	BDL	3
Selenium	mg/l	BDL	BDL	BDL	BDL	BDL	0.01
Residual Chlorine	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	-
Phenolic Compounds (as Phenols)	mg/l	BDL	BDL	BDL	BDL	BDL	--
Zinc	mg/l	0.06	0.09	0.08	0.06	0.06	3.0
Total Coliforms	CFU/100ml	ND	ND	ND	ND	ND	Must not be detectable in 100 ml
E. Coli	CFU/100ml	ND	ND	ND	ND	ND	
Pesticides	mg/L	ND	ND	ND	ND	ND	

source: HSE Services Laboratory Test Results, 2022

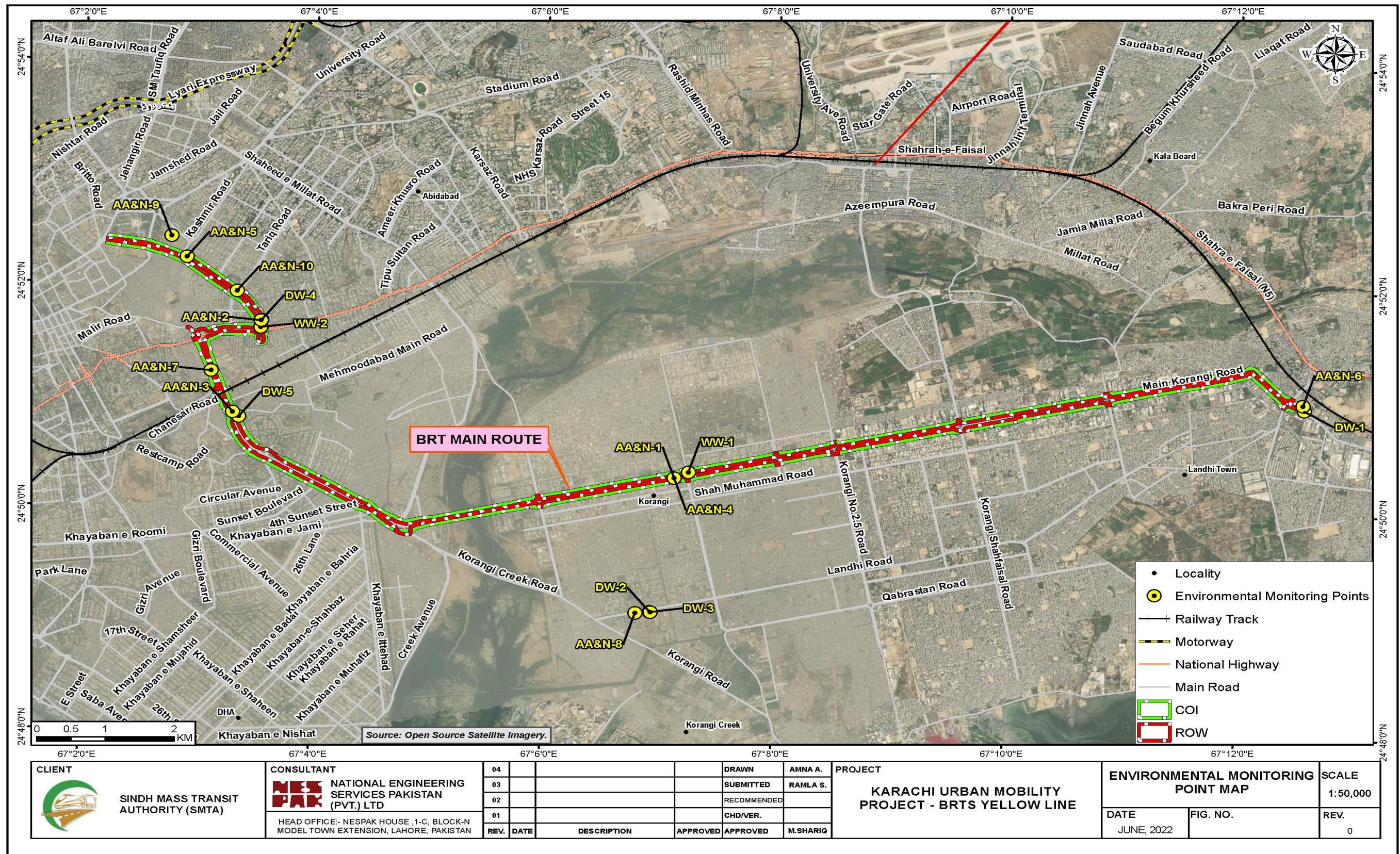


Figure 5.10: Environmental Monitoring Locations

5.1.14 Flooding

Although the climate of Karachi is arid, and rainfall is low and highly variable, whenever there is a torrential rain event, heavy rainfall occurs within a short duration, surface runoff intensifies. Heavy showers take place in the city either due to the effects of tropical storms usually in June, which rarely affect coastal areas but bring heavy showers for short periods and cause flooding. As the result of a tropical storm (6 June 2010) Karachi received 130 mm rain within a day which caused huge surface runoff. During flood in 2017, at least 23 people died in Karachi, mostly from electrocution as monsoon rains lashed the city. Various parts of the city including North Nazimabad, North Karachi, Orangi, Malir, Drigh Road, NIPA, Northern Bypass and Gujjar Nala were submerged because of the heavy rains, while some underpasses were turned into virtual swimming pools. Houses were partially submerged following heavy rainfall in Karachi.

The heavy monsoon rain mostly occurs in July and August and is the main cause of flooding in the city. However, its reoccurrence is estimated to occur at between about 3 to 5-year intervals. Flood affected areas of the city and areas susceptible to flooding include the old city areas such as Kharadar, Mithadar, Bunder Road, Ram-swami and Arambagh.

Karachi experienced heavy and sustained rainfall in August 2022, causing widespread flooding and damage in the city and surrounding areas. The flooding inundated the business district, trapped people in flooded streets, and closed the highway linking Quetta city to Karachi. The flooding resulted in at least 63 deaths, disrupted the economy, and exposed the poor infrastructure and waste management system of the city. As of November 2022, some areas were still recovering from the impact of the flooding and feared more rainfall⁶

The safety of equipment and personnel is important and will be ensured through best management practices during construction.

5.1.15 Heatwave⁷

In 2015, Karachi also experienced the deadliest heat wave which had seen in over 50 years. The city witnessed sweltering heat that continued for more than five days and in its wake left over 1,200 people dead and 40,000 suffering from heatstroke and heat exhaustion. On the heat index scale, which is a good explanatory concept utilized to gauge the impact of heatwave phenomenon to a person in a particular area by combining the overall impacts of temperature, air pressure, humidity and wind speed, in Karachi, during this event, the maximum temperature recorded was 44.8°C but the heat index was around 66°C on the peak heat wave day i.e. 20th June 2015 because of low air pressure and wind speed and very high humidity.⁸

⁶ [Pakistan's financial capital Karachi flooded by monsoon rains | CNN](#)
[Monsoon Rains Wreak Havoc Across Pakistan, Killing At Least 63 People | HuffPost Latest News](#)
[In Karachi, Flooding Lays Bare City's Governance Issues | United States Institute of Peace \(usip.org\)](#)

⁷ Technical Report on Karachi Heat wave June 2015, Ministry of Climate Change, Government of Pakistan

⁸ Commissioner of Karachi, Karachi Heatwave Management Plan: A Guide to Planning and Response

The safety of equipment and personnel is important and will be ensured through best management practices during construction.

5.1.16 Industrial Activity in Project Area

The Yellow Line BRT (YBRT) Corridor passes through the Korangi Industrial and Landhi Industrial areas. Industrial activities discharge several types of pollutant in the environment which are polluting the air, water and soil of the area. Pakistan Refinery Limited (PRL) is also close to the project alignment. Industries in project area shown in **Figure 5.11**

5.1.17 Land Use of Project Area

The land use of the project area is mainly commercial and industrial area. Landhi and Korangi Industrial Areas are located in Korangi District, in Karachi, Sindh, Pakistan. These are the largest industrial areas of Pakistan. They comprise of industries, commercial and trading units including textile, steel, pharmaceutical, automobile, chemical, engineering and flour mills. Area distribution with respect to type of Land use in project area is given in **Table 5.6**. The Index map for Land use in the project area within Corridor of Impact is given as **Figure 5.12** whereas the detailed maps of land use are attached as **Annexure-IV**.

Table 5.6: Distribution of Land use in Project Area

Land use Type	Area (acres)
Barren / Open Area	209.456
Built-up Area	268.499
Crossing Bridge	0.440
Footpath	1.554
Graveyard	9.300
Railway	0.438
River	4.549
Road / Track	269.123
Road Divider	70.239
Stream / Nullah	4.163
Water Pond	0.035

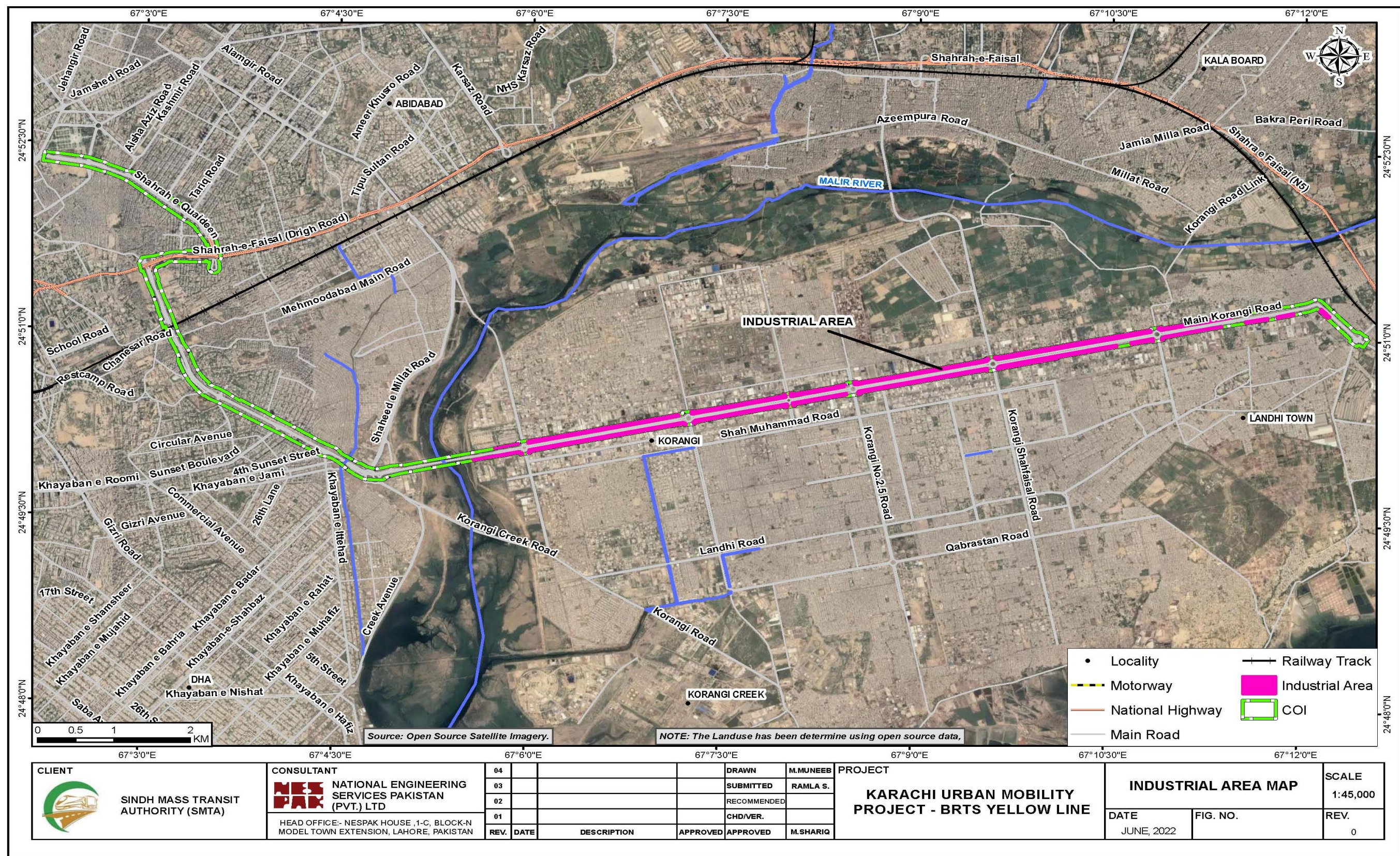


Figure 5.11: Industries in Zol of the project

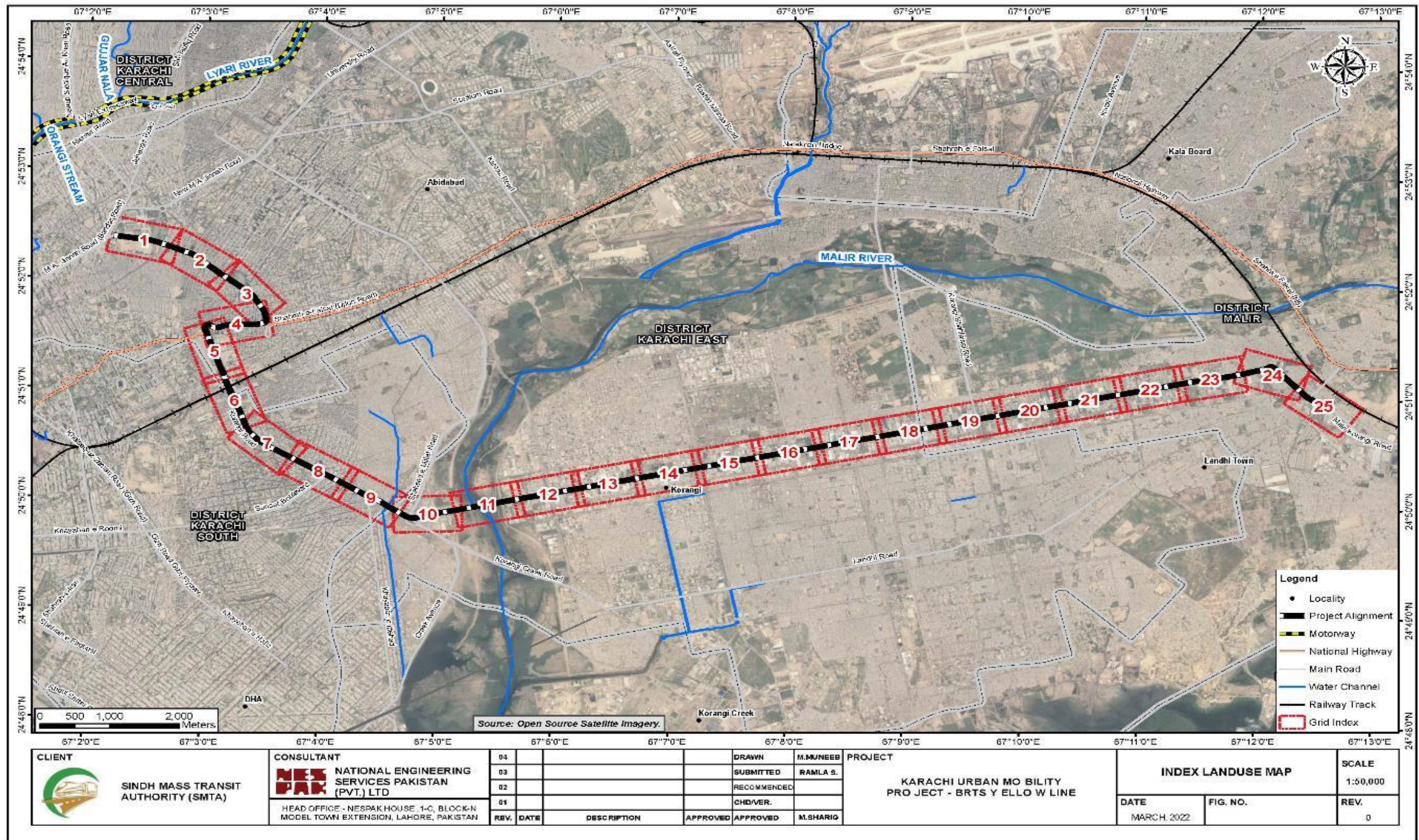


Figure 5.12: Key Map of Land use of the Project Area

5.1.18 Solid Waste in Karachi

Karachi generates more than 12,000 tons of waste per day⁹. In Karachi, municipalities allot different sites for waste dumping, but they are all out of capacity and garbage flows out on the roads. Illegal dumping is one of the largest issues faced by the society. The equipment and machinery for waste collection and disposal are insufficient in Karachi. There were heaps of solid waste dumped in the River bed as shown in the plate below.

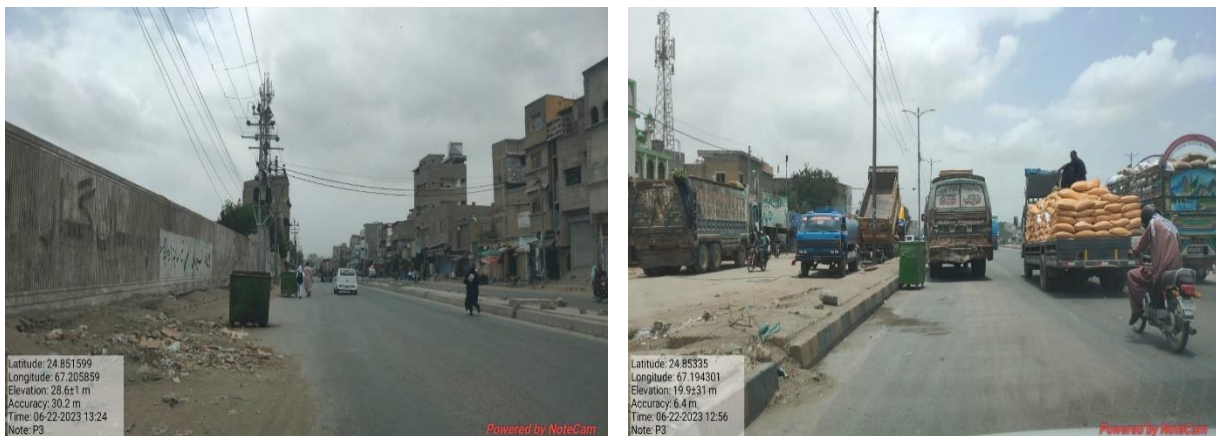


Plate 5.2 Solid Waste dumped in Karachi

5.1.19 Environmental Sensitive Receptor

The sensitive receptors identified for the proposed project within 50 meter each side of the route are commercial and residential areas, mosques and educational institutes and Malir River. They are prone to sensitivity during construction phase, due to emission of air pollutants, noise and vibration, traffic jams, temporary offices and construction camps, and mobilization issues. The water is sensitive due to increase in sediment loading.

Environmental Sensitive receivers were divided into three categories such as air sensitive receivers, noise sensitive receivers and water sensitive receivers. Air and noise sensitive receivers include Deewan University, Jamiah Dar-ul-uloom- Mufti Taqi Usmani, Jamia Masjid Muhammadi, Jamia Masjid Hazrat Umer Farooq, Aalmi Majlis Tahhafuz e Khatam e Nabuwwat, Ghaousia Masjid, Makkah Masjid, Jamia Masjid Bismilla Noor, Masjid Faran, National Medical center, East Side Hospital, Al-ShifaEye Clinic, Rehmat Clinic, Mazar e Quaid, Gora Qabristan, Rehmania Graveyard and Cardiac Surgery Hospital whereas Malir River is identified as water sensitive receiver

Locations of sensitive receptors along the proposed alignment are indicated on the map.

⁹ A Study of Solid Waste Management in Karachi City (2016), Journal of Education & Social Sciences 4(2):144-156

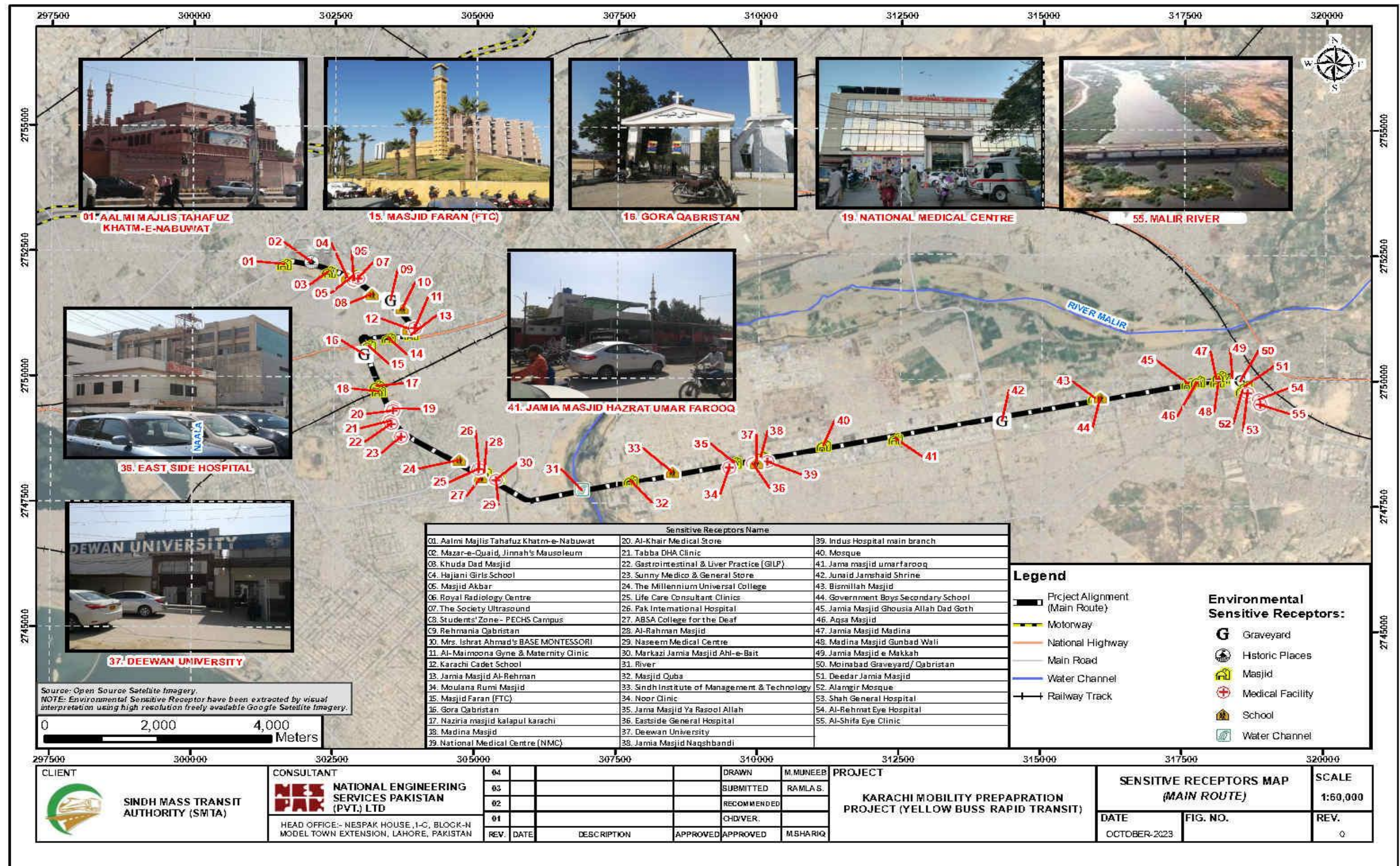


Figure 5.13: Sensitive Receptors in the Project Area

5.2 ECOLOGICAL ENVIRONMENT

All the available literature was thoroughly reviewed to better understand the project area and its surroundings including habitat, flora, and fauna. The route alignment was thoroughly examined based on the primary (field visits) and secondary (Flora of Pakistan-MI-Sheikh, Birds of Pakistan-ZB-Mirza-Mammals of Pakistan-TJ Roberts, Previous EIAs of the proposed area, Manual of silviculture for Pakistan [1965] Champion, Sir H.G.; Pakistan Forest Inst., Peshawar eng; Seth, S.K. Khattak, G.M.) data. The stakeholder Forest, Wildlife, PHA, and EPA were also consulted. This survey broadly covers ecosystem sensitivities (If any), vegetation, other flora, and fauna and numbers of trees along RoW.

Ecological context

Ecologically, the area falls in tropical thorn forests with degraded status of indigenous biodiversity. 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 indomalayan bio geographical origin. With regard to micro-ecological response, the flora and fauna of greater Karachi can be divided into the following three edaphic regions:

1. The coastal landscape and the muddy coastal swamps.
2. The costal sand dunes.
3. 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 project site is located in landscape with poor eco system. The urban ill planned growth has deprived healthy environment and reveals absence of food chain required for existence and survival of terrestrial fauna.

Habitation

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.

Reptiles and amphibians are unable to maintain their habitats (shelter and food) because of severe/extreme anthropogenic pressure which leads to destruction, the species native are mostly extinct or migrated. It was observed that these habitats are now converted into commercial buildings. Chaudhary, I.I. 1961. The vegetation of Karachi. Vegetation, 10: 229-246.

5.2.1 Flora

Deforestation in the study area has become a slow killer for the crores of residents of the city. It also destroyed the nature and climate of the city. It is the main reason behind land erosion and water erosion. Cutting down trees causes an increase in carbon dioxide in the atmosphere that harms the environment and living creatures like human beings, birds and

animals, etc. It was also observed that certain edaphic and human activity, discharge of pollutants without any pre-treatment was found responsible for variation in the nature, structure and composition of vegetation. The plant growth and their continuity was in danger in many disturb areas. Iqbal, M.Z., Shah, S.Z. and Shafiq, M. 2008. Ecological surveys of certain plant communities around urban areas of Karachi. Journal of Applied Science and Environmental Management.

The tree inventory survey was conducted in the month of august,2023 by the PHA of KMC as per the guided ROW by NESPAK Team. The PHA team under the supervision of Deputy Director Horticulture conducted the tree inventory by dividing the area in Churangi Wise for better understanding and management. The pre-designed data sheet was utilised by different teams as deployed in the project area. Initially the wall to wall data was collected by the PHA attached as **Annexure-V-A**. Further the data was updated by the NESPAK team as per the design and attached as **Annexure-V-B**. The summary of tree inventory is provided in the table given below. The trees prone to uprooting or cutting (centre median, service road left and right) are considered during the updated impacts assessment. As per wall to wall survey by the PHA the provided total number of plants is 38,270 present in the area and as per the design and project anticipated impact assessment the total number of possibly impacted trees is 10,050 approximately. The number of impacted trees has been reduced after applying multiple efforts to minimise the impact on green cover/trees.

Table 5.7: Summary of Tree Inventory Survey from Numaish Round About to Future Round About

Sr. No	Name of Place	Trees
1.	Numaish Round About to Society Office Signal	08
2.	Society Office Signal to Norani Kabab Signal	363
3.	Norani Kabab Signal to Tariq Road Signal	115
4.	Tariq Road Signal to Connecting Bridge Shahrah-E-Faisal	454
5.	Around the Bridge of Shahrah-E-Faisal	0
6.	Nursery Stop Shahrah-E-Faisal to FTC Building Corner	1,686
7.	Opp: FTC Building Tikona to Under Bridge	26
8.	FTC Building to DHA Office Signal	1,424
9.	DHA Office Signal to Defence Roundabout	1,271
10.	Defence Signal to Akhter Colony (Ittehad Road)	362
11.	Akhter Colony (Ittehad Road) to Qayumabad Roundabout	87
12.	Under Roundabout of Qayumabad	92
13.	Jam Sadiq Bridge to Brook Round About	922
14.	Brook Round About to Chamra Round About*	1344
15.	Chamra Round About to Veta Round About*	727
16.	Veta Round About to Bilal Round About*	404
17.	Bilal Round About to Singer Round About*	467
18.	Singer Round About to Murtaza Round About*	114
19.	Murtaza Round About to Future Round About	124
20.	Future Round About to Depot	46
21.	Depot to Inside Depot	15
Total		10,050

Note*A wide central island / Median is available along the 8000 road. It is proposed to maintain the width of Central Island up to 10 meters keeping in view the horizontal and vertical clearance required for the safety of Electrical transmission line, as per NEPRA / KE standards. About 1 to 3 meters from the available central island / median along the 8000 road will be utilized for the construction of dedicated BRT Corridor as per the site conditions.

The project route may support some urban plantation and horticulture activities along the road side and in centre median. The artificially grown green cover in urban areas is existing and maintained from many years, which may include Trees/plants, Shrubs and Grasses etc. The detailed floral baseline along with anticipated number of impacted trees is provided in the tree inventory report by PHA of KMC. Following are the major plants reported in the project area, details are provided in tree inventory report.

Table 5.8: Major Plants Species Reported in the Project Area

Sr. No.	Local Name	Scientific Name
1	Conocarpus	<i>Conocarpus erectus</i>
2	Neem	<i>Azadirachta indica</i>
3	Kikar	<i>Acacia nilotica</i>
4	Eucalyptus	<i>Eucalyptus camaldulensis</i>
5	Tropical Almond	<i>Terminalia arjuna</i>
6	Iple Iple	<i>Leucaena leucocephala</i>
7	Bismarckia Palm	<i>Medemia Nobilis</i>

**Details are provided in the Tree Inventory Report*



Plate 5.2 Trees in Project Area

5.2.2 Fauna

Environments for flourishing of faunal species are not encouraging, on the other hand these habitats are impoverished and degraded, resulting from commercialization, ill planned urbanization, non-availability of surface as well as groundwater and discharge of untreated in the city. This process has irreversibly reduced the indigenous biodiversity as well as introduced invasive vegetation and hence it offers very little chance for the survival/growth of fauna in the targeted environment of Project Area.

There are even otherwise, no major habitats of large and small animals, birds or reptiles within or near the Project site, except few species of birds and small mammals.

Table 5.9: List of birds of the Proposed Project Area

Sr. No.	Common Name	Scientific Name	IUCN Status
1	House Crow	<i>Corvus splendens</i>	LC
2	House Sparrow	<i>Passer domesticus</i>	LC
3	Common Mynah	<i>Acridotheros tristis</i>	LC
4	Common Bulbul	<i>Pycnonotus barbatus</i>	LC

The list of reported small mammals is presented below

Table 5.10: List of small Mammals of the Proposed Project Area

Sr. No	English Name	Scientific Name	IUCN Status
1	Roof Rat	<i>Rattus Rattus</i>	LC
2	Small Indian Mongoose	<i>Herpestes javanicus</i>	LC
4	House Mouse	<i>Mus musculus</i>	LC

5.2.3 Aquatics of Malir River

The Malir River is a seasonal river which remains dry due to scanty rainfalls in the area. Its downstream region has become perennial due to continuous flow of sewerage and industrial water. Aquatic pollution in this area has resulted in physical, chemical and biological deterioration of its water bodies causing destruction of biota. The sewerage water is heavily infested with organic load while industrial wastewater is highly polluted with inorganic load. Two fish species, *Channa punctatus* (Dola) and *Oreochromis mosambicus* (Wild tilapia) are found in few stretches of river where sewage water is added near the surface. These are very hard species and live in stagnant. Specifically, the proposed project area does not support any fish species or aquatic biota.

5.2.4 Protected/Ecologically Sensitive Areas

No Protect area was reported in proposed project ROW/COI

5.2.5 Endangered/Conservation Importance Species

No Endangered species of flora and fauna were reported

5.3 SOCIO ECONOMIC ENVIRONMENT

The socioeconomic aspect has been studied with respect to human and economic development and quality of life values of the population in the Project Area. This section deals with the social conditions of the project area. Baseline information was gathered from literature, study reports, district census reports of 1998, available data of census of 2017 and through field surveys comprising interviews and meetings by the Consultants' EIA team (Male and Female Sociologists and Environmentalists), and using survey tools attached as **Annexure-VI**. During the field survey interviews and meetings with the different categories of respondents were held and observations were also recorded after giving due consideration during survey.

5.3.1 Demographic Characteristics

In terms of population, Karachi is one of the ten largest cities in the world. The population of Karachi is about 16 million (2017) as per Pakistan Bureau of Statistics. It is a very dense city with population density of about >20,000 people/km². The increase in population is putting heavy pressures on the physical, infrastructural, financial and institutional systems of the city. A large segment of Karachi's population, roughly 40%, is afflicted with poverty. The living conditions of the deprived section and its economic wellbeing are therefore a major concern, as these impact the environment and growth potential of the city.

Karachi is Pakistan's most diverse city in terms of ethnicity, linguistic identity, and religious affiliation. While most of the population belongs to Islamic sects, the city also houses a sizeable proportion of non-Muslim communities including Christians, Hindus, and Zoroastrians. Mohajirs (migrants) form the largest ethno-linguistic and political group (almost 50%) followed by Pashtuns (25%).

Apart from in-migrants from Pakistan's provinces, a large number of migrants from Afghanistan, Bangladesh and other South Asian countries have settled in the city.

5.3.2 Socio-economic Survey

The information regarding socioeconomic baseline is based on the primary data collected from the Project Area through field visit that was carried out from in Feb, 2019 and updated in February, 2022. The socioeconomic conditions of the Project Affected Persons (PAPs) were assessed with the following objectives:

- Observe and document the existing socio-economic conditions of the people living in the proposed project area including project affected persons;
- Gain information about the demographic characteristics of the local community including PAPs;
- Identify the economic resource dependency of the respondents;
- Explore the situation of civic amenities, drinking water conditions, education and health facilities etc.
- Get feedback from the community about existing and potential social issues; and
- Evaluate the possibilities of addressing their concern through relevant authorities.

The information regarding socio-economic conditions is collected from primary and secondary sources. Methodology adopted for survey was based on collection of comprehensive information by utilization of all available resources with time effectiveness. Hence, during the socio-economic surveys, people were informed about the project objective, its location and basic design features etc.

Before conducting field survey first of all reconnaissance survey was conducted by the Consultant team comprising of Social, Gender and Environmental Experts. After familiarization of the area and requirement for the study a comprehensive survey was carried out and primary data was collected through following data collection tools:

- Socio-economic Survey
- Public Consultations
- Gender Consultations
- Consultations with transgender

Moreover, extensive public consultations were conducted at different locations along the proposed route of the road and gender consultation were also done by female staff to get their apprehensions about the project and their suggestions were recorded. A sample of 360 respondents including (males and females) was taken from the different locations of route of the proposed alignment of Yellow Line BRT (YBRT) on the basis of random sampling technique, which included passengers, riders, local residents, shop keepers, pedestrians, drivers, government & private employees, laborers, transporters etc. The purpose of this survey was to assess perception about existing situation of the public transport in the city, socio-economic conditions of the respondents and get responses about the perceived impacts and preferences towards the project implementation.

5.4 STUDY AREA

The proposed study area is main corridor and off-Corridors of the proposed Yellow Line of BRT from Dawood Chorangi to Numaish connecting Karachi's southeast suburb, characterized by dense industrial and residential land uses, with the city' Central Business District (CBD) region with thriving and dynamic commercial, Industrial, Cultural, Political and Religious activities.

5.5 SURVEY FINDINGS

Detailed findings of the survey comprising different indicators are discussed in the following sections.

5.5.1 Demographic Characteristics of the Respondents

Demography is defined as statistical analysis of data about the characteristics of a population, such as the age, sex/gender, religion, ethnic structures, mother tongue, marital status of the people within the population. According to survey, demographic characteristics of sampled population are described hereunder.

5.5.2 Gender Distribution of the Respondents

About 360 respondents, comprising 50% male and 50% female in the project area was contacted to carry out socio-economic and impact assessment survey. **Table 5.11** shows the gender ratio of the respondents.

Table 5.11: Gender ratio of the Respondents

Sr. No.	Gender Ratio	Number	Percentage %
1	Male	180	50
2	Female	180	50
Total		360	100

5.5.3 Age Composition of the Respondents

The majority of the respondents (36%) was young belonging to different walk of life. **Table 5.12** depicts the age composition of the respondents.

Table 5.12: Age Composition of the Respondents

Sr. No.	Frequency Distribution	Number	Percentage
1	18– 25	131	36
2	26– 35	75	21
3	36 – 45	83	23
4	45 and above	71	20
Total		360	100

5.5.4 Religion

The findings of the survey revealed that the majority of the respondents were Muslim (92%) while religion of remaining respondents is given in **Table 5.13**.

Table 5.13: Religion of the Respondents

Sr. No.	Religion	Number of Respondent	Percentage
1	Muslim	334	92
2	Christian	18	5
3	Hindu	07	2
4	Ahmadi	01	1
Total		360	100

5.5.5 Mother Tongue

Karachi is a multi-culture and multi-linguistics city. The survey findings explicit that Urdu was the dominant language being spoken by 31% of the respondents. However other various languages are widely spoken and understood in the studied area. The details of the different languages being spoken in the project area is shown in **Table 5.14**.

Table 5.14: Mother Tongue of the Respondents

Sr. No.	Language	Number of Respondent	Percentage
1	Urdu	110	31
2	Sindhi	81	23
3	Pushto	72	20
4	Punjabi	52	14
5	Hindko	16	4
6	Saraiki	18	5
7	Others	11	3
Total		360	100

5.5.6 Ethnic Group

The ethnic groups in Karachi include all the ethnic groups in Pakistan. Karachi's inhabitants, locally known as Karachiwala, are composed of ethno-linguistic groups from all parts of Pakistan, as well as migrants from South Asia, making the city's population a diverse melting pot. According to baseline survey, it was found that the largest part of the respondents i.e. 18% were Mohajir whereas, the castes of the other sampled respondents are given in **Table 5.15**.

Table 5.15: Caste / Ethnic Group of the Respondents

Sr. No.	Ethnic Group	Number	Percentage
1	Mohajir	65	18
2	Sindhi	51	15
3	Pathan	40	12
4	Rajpoot	34	9
5	Sheikh	28	8
6	Batt	28	7
7	Siddiqui	21	6
8	Memon	18	5
9	Arain	14	4
10	Baig	12	3
11	Ansari	8	2
12	Other	41	11
Total		360	100

5.5.7 Educational Status of the Respondents

As per the survey results it was found that majority of the respondents were literate. Out of total respondents, 16 % were illiterate. The details are depicted in the **Table 5.16**.

Table 5.16: Educational Status of the Respondents

Sr. No.	Educational Level	Number	Percentage
1	Illiterate	57	16
2	Primary	95	26
3	Middle	58	16
4	Matric	53	15
5	Intermediate	54	15
6	Graduation	34	9
7	Above Graduation	9	3
Total		360	100

5.5.8 Professional Status of the Respondents

The majority of the respondents were shopkeepers or associated with some kind of personal business. The detailed statistics based on sample survey, regarding professional status of the respondents are shown in **Table 5.17**.

Table 5.17: Professional Status of the Respondents

Sr. No.	Profession	Numbers	Percentage
1	Shopkeepers/ Businessmen	168	47
2	House wife	58	16
3	Private Service	55	15
4	Students	45	12
5	Laborers	14	4
6	Government Employees	10	3
7	Retired	4	1
8	Job Seeker	6	2
Total		360	100

5.5.9 Average Monthly Income

The data given in **Table 5.18 and 5.19** indicates that the monthly income earned from businesses/shops/kiosk varied widely among individuals with the lowest earning mentioned is less than PKR 25,000 and the highest earning being PKR 45,000 and above. Survey results show that the majority of the respondents fall in the range of upto PKR 25,000 per month.

Household expenditure depends on the earning of the families; therefore, about 41% of the respondents reported their monthly household expenditure to be less than PKR 25,000. While 07% were having their expenses more than PKR 45,000 per month.

Table 5.18: Average Monthly Income of the Respondents

Sr. No.	Average Monthly Income	Number	Percentage
1	Up to 25,000	126	35
2	25,001 to 30,000	79	22
3	30,001 to 45,000	30	9
4	Above 45,000	73	20
5	No Response	52	14
Total		360	100

Table 5.19: Monthly Expenditures of the Respondents

Sr. No.	Average Monthly Expenditures	Number	Percentage
1	Up to 25,000	147	41
2	25,001 to 30,000	92	26
3	30,001 to 45,000	63	18

4	Above 45,000	25	7
5	No Response	33	9
Total		360	100

5.5.10 Family System

During survey indicated that joint family system prevails among a majority of PAPs though nuclear family system is also quite common. The primary reason behind the prevalence of the joint family system is the economic constraints and family bonding while the reason for the nuclear family system seems to be the availability of more space for the members of the family followed by more freedom and privacy, shared responsibilities and interdependence, better bonding between husband and wife, and less conflicts. The detail is shown in **Table 5.20** below:

Table 5.20: Family Structure

Sr. No.	Family Structure	Number	Percentage
1	Joint	221	61
2	Nuclear	139	39
Total		360	100

5.5.11 Ownership Status of the Houses

Sampled respondents were asked about their housing ownership status in order to know their level of living standard as reflected in **Table 5.21**. Majority of respondents, i.e. (58%) were living in their owned houses.

Table 5.21: Ownership Status of Houses

Sr. No.	Type of Ownership of House	Respondent	Percentage
1	Self-Owned	210	58
2	Rented	137	38
3	Government Provided	13	4
Total		360	100

5.5.12 Housing Construction Pattern

A mix housing pattern has been observed in the Project Area where 64% of the respondents live in pacca houses that are constructed with superior materials and workmanship while 33% respondents have semi pacca houses that are houses made of block masonry with cement mortar. Only 03% of the respondents mentioned that they live in katcha houses **Table 5.22** shows construction pattern of houses in project area.

Table 5.22: Housing Construction Pattern

Sr. No.	Type of House	Number	Percentage
1	Pacca	232	64
2	Semi-Pacca	117	33
3	Kacha	11	3
Total		360	100

5.5.13 Basic Amenities in the Project Area

Social infrastructure and amenities are crucial to creating sustainable communities. This assessment sets spaciousness of a household's dwelling, household amenities like availability of electricity and modern appliances, nature of access to water, fuel for cooking (ease of fetching in what are primarily women's tasks), and type of sanitation facilities available as primary indicators for assessing standard of living.

The result of the survey revealed that 100% of the households had electricity facility, water supply was available for the 74% while rest of the respondents use to purchase water tankers to fulfill their requirements of water. Facility of sewerage, solid waste and gas was available to 86%, 68% and 83% respectively in the project corridor. Mobile service is available in the project area and its surroundings at satisfaction level.

The information with respect to access to social amenities and their quality of services is given in **Table 5.23**.

Table 5.23: Access to Social Amenities in the Project Area

Sr. No.	Facility	Number of Respondent	Available (%)
1	Water Supply	265	74
2	Electricity	360	100
3	Gas	298	83
4	Telephone	355	99
5	Sewerage System	311	86
6	Solid Waste Management	245	68

5.5.14 Source of Drinking Water in the Project Area

Sampled respondents are depending upon a number of sources of water for domestic use, which is shown in **Table 5.24**. Public water supply is available to 74% respondents who get water from this source.

Table 5.24: Sources of Drinking Water

Sr. No.	Water Supply Source	Number of Respondent	Percentage
1	Public Water Supply	265	74

Sr. No.	Water Supply Source	Number of Respondent	Percentage
2	Borehole (Hand Pumps/Electric Motor)	12	3
3	Water Tanker	83	23
Total		360	100

5.5.15 Satisfaction about Quality of Water

The quality of the ground water of Karachi city and its surrounding areas is poor. **Table 5.25** shows the current situation of the water quality in the project area. Majority of the respondents (69%) were not satisfied with the quality of water.

Table 5.25: Satisfaction about Quality of Water

Sr. No.	Satisfaction about Quality of Water	Number of Respondent	Percentage
1	Yes	113	31
2	No	247	69
Total		360	100

5.5.16 Mosques and Shrines

Survey finding shows the presence of religious property (mosques and shrines) in the project area. During the survey it was observed that mosques are available in almost all large and small settlements of the project area whereas, no shrine along the route of YBRT was reported by the communities in the project area.

5.5.17 Transportation Mode Options Used by Riders'

The male respondents mentioned different types of transport modes they use to go to work. The majority (90%) of the passengers currently use bus & coaster, 4% coaster/rickshaw/taxi, 3% coaster and bikes, 1% bus/taxi, coaster/bus/ bike and Rickshaw, and bike respectively. **Table 5.26** shows the detail of using different types of transport men.

Table 5.26:-Public Transportation Modes Used by Men

Sr. No.	Mode of Transport	Number	Percentage
1	Bus and coaster	163	90
2	Coaster and Rickshaw, Taxi	8	4
3	Coaster and Bikes	6	3
4	Bus, Taxi	1	1
5	Coaster, Bus and Bike	1	1
6	Rickshaw, and Bike	1	1
Total		180	100

The female respondents mentioned different types of transport modes they use to go to work and to or other daily needs. The majority 45% of the female passengers currently use

bus/coaster, 13% rickshaw and taxi, 11% rickshaw and motorcycle, 9% bus, motorcycle and rickshaw, 8% bus, rickshaw and taxi, 5% bus and van, 3% bus, rickshaw and motorcycle and 2% bus/ van/ motorcycle rickshaw, wagon/ coaster. bus and coaster/ motorcycle Rickshaw respectively. **Table 5.27** shows the detail of using different types of transport women.

Table 5.27: Public Transportation Modes Used by Women

Sr. No.	Mode of Transport	Number	Percentage
1	Bus and Coaster	81	45
3	Rickshaw and Taxi	23	13
4	Rickshaw and Motorcycle	19	11
5	Bus, Motorcycle Rickshaw	17	9
6	Bus, Rickshaw and Taxi	15	8
7	Bus and Van	9	5
8	Bus, Rickshaw and Motorcycle	6	3
9	Bus, Van, Motorcycle Rickshaw	4	2
10	Wagon, Coaster, Bus	3	2
11	Coaster, Motorcycle Rickshaw	3	2
Total		180	100

Based On 180 Respondents

5.5.18 Purpose of Using Different Modes of Transport

There were different reasons for using the existing transport. The existing transport was being used for, going to work, education, going to market and health. The majority 55% of the respondents mentioned their using the public transport to do different types of work to earn for their families followed by 15% who go for shopping. **Table 5.24** shows the detail of purpose of using of transport women.

Table 5.28: Purpose of Public Transportation Modes Used by Men

Sr. No.	Responses	Number	Percentage
1	Job and work	100	55
2	Shopping / Grocery	27	15
3	Business	14	8
4	Health Purpose	14	8
5	Study Purpose	11	6
6	Less Expensive than Personal Vehicle	6	3
7	For Safe Travelling	5	3
8	Pick and Drop kids at school	3	2
Total		180	100

Women shared different reasons for using the available transport, the categories provided in the survey ranged from recreational purposes, education, going to market, work, health and any other. In the Karachi city women working in different offices, industries and houses who are contributing in their family's income. The majority of women 38% shared that they used

the transport to go to work and reach at their work place, 33 % to get to the market, 14% women said they used transport for education purpose, 11% women said the purpose of using public transport was health related, 2% for pick and drop of their children at educational institutions and 1% mentioned their purpose of using the public transport going for entertainment with their families and & to meet relatives respectively. **Table 5.29** shows the detail of purpose of using of transport women.

Table 5.29: Purpose of Public Transportation Modes Used by Women

Sr. No.	Responses	Number	Percentage
1	Job and Wok	68	38
2	Shopping / Grocery	60	33
3	Study Purpose	26	14
4	Health Purpose	19	11
5	Pick and Drop kids at school	4	2
6	Entertainment	2	1
7	Meeting relatives	1	1
Total		180	100

5.5.19 Frequency of Transport Use Men

The majority of the respondents 90% said that they use public transport almost daily, only 2% use on1- 2 days a week, 3% use on 2-3 days a week, and 5% take rides 3-4 days a week. The frequency of using the transport is given in the **Table 5.30**.

Table 5.30: Frequency of using Public Transport Men

Sr. No.	Frequency	Number	Percentage
1	Daily	162	90
2	1-2 days a week	3	2
3	2-3 days a week	6	3
4	3-4 days a week	9	5
Total		180	100

5.5.20 Frequency of Transport Use Women

The situation for use of public transport is slightly different as compared to men. The majority of the respondents 45% said that they use public transport almost daily, 5% 1- 2 days a week, 21% 2-3 days a week, 6% 3-4 day a week, 20% 4-5 day a week and 5% said that they take rides 4-6 days a week. The frequency of using the transport is given in the **Table 5.31**.

Table 5.31: Frequency of using Public Transport Women

Sr. No.	Frequency	Number	Percentage
1	Daily	85	45
2	1-2 days a week	9	5
3	2-3 days a week	40	21
4	3-4 days a week	11	6

Sr. No.	Frequency	Number	Percentage
5	4-5 days a week	37	20
6	4-6 days a week	6	3
Total		188	100

The peak hours of using the public transport are 8 am to 10 am morning, 2pm to 3pm and evening mentioned by the respondents.

5.5.21 Expenses on Transport

The riders' have different expenditure patterns on the mode of transport. Around 22% male and 12% of female respondents said that their monthly expenses on transport was less than of PKR 2,000 while 39% of male and 22% of female riders mentioned that their monthly expense on transport was in between PKR 2,001-PKR 3,000. About 16% of male and 42% of female spent more than PKR 3,000. Nearly 25% of the mail and 24 female riders did not reply about their monthly expense on transport. **Table 5.32** shows expenses of the respondents on the transport.

Table 5.32: Expenses on Transport

Sr. No.	Expenses on Transport	Respondents			
		Male		Female	
		No.	%	No.	%
1	Less Than 2000	40	22	22	12
2	2,001-3,000	66	37	39	22
3	Above 3,000	29	16	76	42
4	No Response	45	25	43	24
Total		180	100	180	100

5.5.22 Satisfaction Level with Existing Transport System

Survey respondents were asked to evaluate their satisfaction of existing service quality. These service quality factors were included: Availability of service, fare, comfort, safety/security, Cleanliness and Time Management. Overall 89% of the respondents indicated that they are not satisfied with the existing transportation service while only 11% reported that they are satisfied.

Among all the respondents, 65% of respondents were unsatisfied with the availability of the service, 90% respondents mentioned fares are not affordable and are more than the amount fixed by the government., 97 % reported that the quality of the buses is not up to the mark and seats are not comfortable, 93% indicated issues of safety and security, 95% were unsatisfied with cleanliness of the existing transports which are on the road. Time management to reach he destination is also a big issue of the present transport service 92% of the riders showed the un-satisfaction.

Most women complained about the overcrowding and the behavior of the male passengers, conductor and drivers, which they found to be uncooperative and rude. The detail of satisfaction level is presented in the **Table 5.33** below:

Table 5.33: Satisfaction Level with Existing Transport System

Sr. No.	Satisfaction Level	Availability		Fare		Comfort		Safety/security		Cleanliness		Time Management	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	Satisfy	70	35	20	10	6	3	15	7	11	5	16	8
2	Not Satisfy	130	65	180	90	194	97	185	93	189	95	184	92
Total		200	100	200	100	200	100	200	100	200	100	200	100

The respondents mentioned poor management and implementation of laws are the main reasons of the poor existing transport system. Safety hazard, fuel cane inside ladies' compartments, accidents and over speeding, rash driving, theft crimes and harassment issues also highlighted by the female respondents.

5.5.23 Suggestion for improvement of Existing Transport System

The respondents suggested improvement of the existing transport service. overall, 35% of the respondents suggested increase in quality and quantity of buses, 24% proper seating and affordable fare, 7%-time management and control over harassment respectively, 6% improved transport system, 5% professional staff and 3% mentioned properly security armaments. Reaming 13% of the respondents keep quite. the detail of suggestion has been provided in the **Table 5.34** below:

Table 5.34: Suggestions for Improvement of Existing Transport System

Sr. No.	Suggestions	No.	%
1	Increase in Quality & Quantity of buses	70	35
2	Proper Seating / Affordable Fares	49	24
3	Time Management	15	7
4	Control over Harassment	13	7
5	Improved Transport System	12	6
6	Professional Trained Staff	9	5

5.5.24 Harassment

Out of 180 women respondents, 46% responded that they had faced the harassment during the travel on bus and on bus stops as well while 54% of women respondents said that they did not face any harassment during travel. Responses related to harassment face provided in the **Table 5.35**.

Table 5.35: Harassment Faced

Sr. No.	Responses	Number	Percentage
1	Yes	83	46
2	No.	97	54
Total		180	100

5.5.25 Types of Harassment

Out of 83 Women who faced harassment, 85% mentioned different types of the harassments that they faced during the traveling on the roads and in the public transports, i.e., abrupt touch by conductors while taking fare, cat-calling, grazing/ staring, passing comments, odd stares and included threats. Remain 15% women not responded.

5.5.26 Crimes

About 43% percent of the women faced crimes when they were out of their homes. Out of them 37% faced crime one time, 35% mentioned two times, 12% three times and 2 faced crimes four and five times respectively, and remaining 16% of women not responded the intensity of crimes they faced. They faced crimes on the roads, bus stops, in the buses and at markets. They lost mobiles phones, money, purses, Computerized National Identity Card (CNIC) & Automated teller machine (ATM) cards and even the jewelries.

5.5.27 Complains and Results Response

The victims were asked about registration of complaints against the crimes that they faced. Only 16% of the victims complained to the police, but no one criminal caught and nothing is recovered.

5.5.28 Protection Measures

The respondents suggested protection measures for the safe travelling. Overall, 58 % of the respondents suggested separate sitting place at the bus stops, 56% separate queue for getting tickets, 55% separate portion in the bus, 49% appointment of security staff, 2% install closed-circuit television (CCTV) cameras, 1% suggested appointment of female security staff at bus stations. The detail of suggestion has been provided in the **Table 5.36**.

Table 5.36: Protection Measures

Sr. No.	Protective measures	No.	%
1	Separate Sitting place at Bus Stop	116	58
2	Separate Queue	113	56
3	Separate Portion in Bus	110	55
4	Security staff	98	49
5	CCTV cameras	4	2
6	Female Security Staff	3	1

5.5.29 Awareness about the Project

A large number of respondents were those, who had no prior knowledge of the project. The knowledge of the local population about the proposed project is depicted in the **Table 5.37**. All respondents were briefed about the features of the proposed project.

Table 5.37: Awareness about the Project

Sr. No.	Awareness of the Project	Number of Respondents	Percentage
1	Yes	153	43
2	No	207	58
Total		360	100

5.5.30 Acceptability of the Proposed Project

During the survey, a vast majority of respondents was in favor of the proposed project, keeping in view its importance and need of the metropolitan city. The reason for accepting the proposed project is the availability of better transport system and improved travelling facilities are expected due to implementation of the project. Contrary to this, few responses were against the construction of the proposed project. Due to mobility problem during construction and operation of the yellow line BRT and due to loss of their commercial structures. **Table 5.38** shows acceptability of the project.

Table 5.38: Acceptability of the Proposed Project

Sr. No.	Frequency of Project Acceptability	Number of Respondent	Percentage (%)
1	Yes	345	96
2	No	15	4
Total		360	100

5.5.31 Reasons of Acceptance the Project

The respondents considered the respective project effective due to following reasons depicted in the **Table 5.39**.

Table 5.39: Reasons of Acceptance the Project

Sr. No.	Frequency of Project Acceptability	Number of Respondent	Percentage
1	Better Public Transport System	156	43
2	Better Travelling Facilities	125	35
3	Employment Opportunities	22	6
4	Value enhancement of the project area	45	13
5	No response	12	3
Total		360	100

5.5.32 Facilities Required at Yellow Line BRT

Multiple responses received regarding facilities required at YBRT route, bus stations and inside the buses. The respondents suggested “availability of service, maintain privacy, seat

comfort, ease of entering/exiting the buses and bus stations, ease of payment, cleanliness, availability of wheelchairs and safety in the vehicle” etc. Other services suggested by the respondents, appointment of female staff for public dealing, in the bus, trained drivers, separate seats for disable people, wheel chairs at bus stations, security measures, appointment of female security staff, tuck shops at bus stations, separate buses for ladies, There should be separate portions transgender in the buses. The police check post should be established along the route of the YBRT.

5.5.33 Increase of Users

Due to operation of Yellow Line BRT, it is expected that people will avail the new transport facilities. Majority of the respondents were of the view that the rider will increase because of better transport facilities in the city. The detail of responses has been given in the **Table 5.40**.

Table 5.40: Increase of User

Sr. No.	Response	Number of Respondent	Percentage
1	Yes	344	96
2	No	16	4
Total		360	100

5.5.34 Perceived Impacts of The Project During Construction

During the field survey, the anticipated project impacts were asked by the respondents at different stages of the project implementation. The responses of the respondents during construction of the project are obtained and summarized in the **Table 5.41**.

Table 5.41: Perceived Impacts (During Construction)

Sr. No.	Impacts Construction Phase	Number	Percentage
1	Loss of Income	45	13
2	Dust & Noise	75	21
3	Traffic Issues / Movement problems	45	13
4	Safety Hazards	31	9
5	Privacy Issues	82	23
6	Loss of Business	42	12
7	Loss of Structure	15	4
8	No Response	25	7
Total		360	100

The respondents also perceive positive impacts, i.e. labor opportunities during the construction period. Development of the project area, Time saving and reduce accidents after constructions.

5.5.35 Perceived Impacts of The Project During Operation Phase

The anticipated impacts of the proposed project at operational stage were also discussed with the respondents. The summary of the responses is illustrated in following **Table 5.42**.

Table 5.42: Perceived Impacts (Operation Phase)

Sr. No.	Impacts	Number	Percentage
1	Better Travelling Facilities	98	32
2	Better Public Transport System	110	25
3	Employment Opportunities	43	2
4	Reduction in traffic congestion on the road	45	15
5	Value enhancement of the project area	15	4
6	Improvement in income	13	3
7	Easy crossing the road	4	7
8	Better facilities at Bus Stations	15	2
9	No response	17	10
Total		360	100

Crossing the road will be problems for the pedestrian. Address the issue pedestrian bridges should be provided at different location.

5.5.36 Experience of Travelling in Green Line BRT

The Green Line BRT is operational in the Karachi city. The respondents were asked had they experience ever Green Line BRT. The responses of the respondents are summarized in the **Table 5.43**.

Table 5.43: Experience of Travelling in Green Line YBRT

Sr. No.	Responses	Number of Respondent	Percentage
1	Yes	175	49
2	No	154	43
3	No Response	31	9
Total		360	100

5.5.37 Findings of the Gender Survey

In addition to the above findings of the survey some additional questions were asked from the women which are given below:

5.5.38 Women's Role in Different Activities

Women play an important role in the various activities of life. The data of the gender survey indicates that the participation rate of women in household and income generation activities. On overall basis the majority 55% of participants is involved in household activities and child caring and their involvement in income generation activities is low, that is 45% who are involved in different income generation activities to support their families on average.

Table 5.44 presents Information in respect of women's participation and activities is presented in.

Table 5.44: Women's Role in Activities

Sr. No.	Activities	Number of respondents	Participation (%)
1	Household Activities	55	55
2	Income Generation activities	45	45
	Total	100	100

5.5.39 Women's Role in Decision Making

Keeping in view the important role of the female in the different activities as well as in the society, gender survey was conducted to assess their role in various activities of daily life.

The findings of survey data revealed the role of women regarding decision making in various activities mentioned in table below. Mostly the decisions of the activities are taken mutually, i.e. the education of their children, choice of availing the transport, availing health facilities, number of children to have and freedom of spending money on personal expenses. Decision regarding the marriage of their children the findings indicate 33% decision is made by male member 7% female and 31% by both male and female members of the family. Decision about sale and purchase of household women are dominated by 43%, by male members 26% and 30% decisions are taken by both male and female members. The role of decision to work women outside of home is mostly taken by male members that is 45%, while 19% of the respondents mentioned that they take decision themselves and have no restriction and 36% indicated that women to work outside of the home to support their families is decided by both male and female members of the family by mutual consensus. The detail is presented in **Table 5.45**.

Table 5.45: Women's Role in Decision Making

Categories	Decision maker									
	Men	%	Women	%	Both	%	No response	%	Total	%
Education (where to send, whom to send)	32	32	2	2	61	61	5	5	100	100
Transport Facilities (which to avail)	33	33	17	17	50	50	0	0	100	100
Health facilities (from where to avail)	43	43	12	12	45	45	0	0	100	100
Number of children to have	19	19	6	6	68	68	7	7	100	100

Children Marriages	33	33	7	7	31	31	29	29	100	100
What HH assets to buy and sell	26	26	43	43	30	30	1	1	100	100
Women to work outside home	45	45	19	19	36	36	0	0	100	100
Freedom of minor/personal expense	29	29	22	22	49	49	0	0	100	100

5.5.40 Financial Services for Women

Economic empowerment of women cannot be achieved until issues of women are considered human rights issues. A financially inclusive policy means giving women access to money, bank accounts, credit; giving them the freedom to save and to keep their money in their own hands. Women's participation in financial services has remained low due to persistent barriers such as cumbersome documentation requirements, proximity to bank branches and availability of suitable products.

Economically empowering women has huge societal gain. As many studies have shown, women tend to be more likely than men to use the resources at their disposal to promote the nutrition, health and education of their children.

The question was asked to female respondent about the availability of financial service for women in the city. Out of the total 25% mentioned the banking service, 2% Benazir Income Support Programme, 8% availability of private saving schemes 55% mentioned all (Banking services, Benazir Income Support Programme and Private Saving schemes) financial services and remaining 10% of respondents not responded to the question.

5.5.41 Challenges Faced in Access to Financial Services

Several barriers (e.g. lack of an ID to prove identity, insufficient traditionally required collateral, mobility constraints, little financial literacy, etc.) faced by women that limit their access to use more financial services. Twenty-five percent (25%) of female respondents mentioned lack of knowledge about the availability of the financial service in the area. The majority 52% of the respondents faced no barrier to access the financial services and remaining 15% of the respondents not responded.

5.5.42 Access and Control over Resources/Property

Women's equal access to and control over economic and financial resources is critical for the achievement of gender equality and empowerment of women and for equitable and sustainable economic growth and development. Gender equality in the distribution of economic and financial resources has positive multiplier effects for a range of key development goals, including poverty reduction and the welfare of children. Both micro level efficiency results through increased household productivity and macro efficiency results through positive synergies between indicators of gender equality and economic growth have been recorded.

There are significant development gains to be made in ensuring women's equitable access to and control over economic and financial resources, including in relation to economic growth, poverty eradication and the well-being of families and communities. The impact of inequality in access to resources represents a global challenge with implications at individual, family, community and national level.

Our rural society is male dominant, which is attributed to the rural social system, but in the big cities like Karachi situation is different where the level of education of women is different as compared to the rural women. The survey findings indicate that 30% respondents mentioned that the family property is mostly controlled by their male members 10% said that they control and manage their property themselves, the majority of the i.e. 52% mentioned the inheritance property transferred to the family member as per their share and reaming 8% not responded the question.

5.5.43 Issues Faced in Access and Control over Resource/ Property

The respondents were asked what kind of issues they face to get access and control over resources/ assets/Property. The male dominance was the major issue highlighted by majority of 56% percent of the respondents and 5% mentioned inheritance issue. Out of the total respondents, 22% faced no issues regarding access and control over their assets and properties.

Table 5.46: Issues Faced in Access and Control over Resources/Property

Sr. No.	Responses	Number	Percentage
1	Male Dominance	56	56
2	Inheritance Issues	5	5
3	No Issues	22	22
4	No Response	17	17
Total		100	100

5.5.44 Involvement In Income Generation Activities

Women play an important role in the various activates of life. The data of the gender survey indicates that the participation rate of women in income generation activities. On overall basis the involvement in income generation activities is low, that is 45% who are involved in different income generation activities to support their families on average and majority 55% of the respondents are not involved in these activities. Information in respect of women's participation and activities is presented in **Table 5.47**.

Table 5.47: Involvement in Income Generation Activates

Sr. No.	Responses	Number	Percentage (%)
1	Yes	45	45
2	No	55	55
Total		100	100

5.5.45 Nature of Work

Gender survey findings depict that the women are involved in the different nature of work, i.e. 38% female respondents belong to private jobs, 33% work as helpers in factories and 29% mentioned that they are associated with teaching to earn income for their household. Nature of work of female respondents is shown in **Table 5.48**.

Table 5.48: Nature of Work

Sr. No.	Responses	Number	Percentage
1	Private Job	17	38
2	Helpers	15	33
3	Teaching	13	29
Total		45	100

5.5.46 Support of Male Family Members

The majority of respondents i.e. 69% do not have the support of their male family members in respect of working and other 31% have this support. **Table 5.49** shows support of male family members for the working of their females.

Table 5.49: Support of Male Family Members

Sr. No.	Responses	Number	Percentage
1	Yes	69	69
2	No	31	31
Total		100	100

5.5.47 Permission to Work Outside of Home

Obtaining the permission of the husband or the guardian is important before going outside of the home to do the permissible work. The findings show 88% of the respondents are allowed to work outside of the homes and 12% of the respondents replied in negative as they are not allowed to work outside the home. **Table 5.50** shows the detail of responses.

Table 5.50: Permission to Work Outside of Home

Sr. No.	Responses	Number	Percentage
1	Yes	88	88
2	No	12	12
Total		100	100

5.5.48 Constraints to Work Outside of Home

Women who want to work have a hard time finding a job than men. Several interconnected factors restrict women's mobility outside the home, among them (i) social, cultural, and

religious norms; (ii) safety and crime; and (iii) the quality of available transport services.

The respondents were asked what kind of constraints they face to work outside of their homes. The transport services were the major issue highlighted by majority of 70% of the respondents, male dominance mentioned by 7%, security issues stated by 4% while 3% of the respondents highlighted cultural issues and remaining 16% not responded to the question. **Table 5.51** shows the detail of responses.

Table 5.51: Constraints to Work Outside of Home

Sr. No.	Responses	Number	Percentage
1	Cultural Constraints	3	3
2	Male Dominance	7	7
3	Transport Issues	70	70
4	Security Issues	4	4
5	No Response	16	16
Total		100	100

5.5.49 Satisfaction Level with Current Salary

The level of job satisfaction of an individual can be investigated and known by the structure of organization of the entire education system. The Level of job satisfaction of the employees working in any organization leads towards progress on the basis of their performance. The performance can either be satisfactory or unsatisfactory. **Table 5.48** depicts the satisfaction level of women about the current salary. It was noticed in gender survey that of respondents i.e. 49% are satisfied with it while 51% respondents are not satisfied.

Table 5.52: Satisfaction with Wages

Sr. No.	Responses	Number	Percentage
1	Yes	22	49
2	No	23	51
Total		45	100

5.5.50 Saving Earnings

The findings indicate that the majority of the respondents i.e. 60% save some part of their income and 40% of the respondents do not save because they have to meet their expenses. **Table 5.49** shows the detail of responses.

Table 5.53: Saving Earnings

Sr. No.	Responses	Number	Percentage
1	Yes	27	60
2	No	18	40
Total		45	100

5.5.51 Areas of Spending Earnings

Women's contributions to family income have risen over this period; women invest a large portion of their income in their families. Multiple responses received to this question, i.e. mostly working women are spending their earnings on kitchen, for the construction of houses, education & marriage of their children, purchasing household items, purchasing clothes for the members of their families and themselves, medical treatment and travelling.

5.5.52 Potential Areas for Increasing Women Participation in Economic Activities

The untapped potential of women remains a lost opportunity for economic growth and development the world can ill afford. Women's economic participation promotes agricultural productivity, enterprise development at the micro, small, and medium enterprise levels, as well as enhances business management and returns on investment. Among the biggest hurdles are discriminatory laws, regulations and business conditions, as well as women's lack of access to property rights, finance, training, technology, markets, mentors, and networks. The surveyed women highlighted potential areas where their participation can be increased, i.e. education, transport, industry and small business sector are the main areas where women's participation in economic activities could be increased.

5.5.53 Interest of Employment in SMTA

The SMTA is committed to promote the rights of all women and men at work and achieving equality between them. The survey was conducted to check the female response in getting jobs in the SMTA. The findings indicate that the majority of the respondents was not interested in getting employment in SMTA while 35% of the female respondents shown their interest to get employment in the SMTA. The findings are shown in **Table 5.54**.

Table 5.54: Interest of Employment in SMTA

Sr. No.	Responses	Number	Participation
1	Yes	35	35
2	No.	57	57
3	No Response	08	08
Total		100	100

Transport is one of several sectors that have traditionally been regarded as 'no place for women. In many respects and in many countries, this is still the case today due to many reasons. Out of 35 female respondents who were interested in employment, the majority 40% mentioned that any job relevant to their qualification, 29% were interested in administration/Marketing/public relation, 15% bus conductor 6% in cleaning section and remaining 1% were interested in ticketing section of SMTA. The detailed findings are shown in **Table 5.55**.

Table 5.55: Nature of Employment

Sr. No.	Interest	Number	Participation
1	Administration Marketing and Public Relation	10	29
2	Bus Conductor	5	15
3	Cleaning	2	6
4	Ticketing	1	1
5	Security Staff	3	9
6	Any other related to qualification	14	40
Total		100	100

The respondents also mentioned the required training after getting employment, i.e. training about the route of BRTs and training on public relations. The female respondents also shown inters to setup small business at bus stations, i.e. tuck shops, mobile accessories and charging of cell phones.

6 PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

6.1 INTRODUCTION

This chapter presents the objectives, process, and outcome of the consultations carried out with the key stakeholders of the proposed project during the present EIA study. A consultation framework, describing the consultations to be carried out during the subsequent phases of the project implementation ensuring ongoing and inclusive dialogues with key stakeholder is also provided in this chapter.

6.2 OBJECTIVE

The objectives of stakeholder consultation were to contribute to the openness, transparency and dialogue. Special efforts were made to ensure that the communication with the public should be efficient and well balanced. The concerned stakeholder groups were identified to participate in the assessment process. Specific tasks and purposes of consultations with stakeholders have been given in the **Table 6.1**.

Table 6.1: Tasks and Purpose of Consultations

Task	Purpose of Consultation with Stakeholders
Why consultation with the stakeholders?	- to inform them about the project and its potential impacts - to solicit their views and apprehensions about the project and its impacts - To build trust to ensure sustained support for the YBRT Project and build resilience for times of crisis. - To learn about public concerns that need to be addressed and taken into account in designing of the project concept and preparation mitigation measures and programs. - To learn about the strengths, skills and organizations that the stakeholders can bring to support project planning and implementation.
Modes and benefits of consultation	- Listening and dialogue with stakeholders to address the public concerns early, to pre-empt breakdowns 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.

Other objectives of public involvement include:

- Informing the stakeholders about the proposed project;
- Providing an opportunity to those who remained unable to present their views and values, therefore allowing more sensitive consideration of mitigation measures and trade-offs;
- Providing those involved with planning the proposal with an opportunity to ensure that the benefits of the proposal are maximized and that no major impacts have been overlooked;
- Providing an opportunity for the public to influence the project design in a positive manner;
- Increase in public confidence in front of proponent, reviewers and decision makers;
- Providing better transparency and accountability in decision making;
- Reducing conflict through the early identification of contentious issues, and working through these to find acceptable solutions;

- Creating a sense of ownership of the proposal in the minds of the stakeholders;
- Developing the project which is truly sustainable; and
- To ensure transparency in all activities related to rehabilitation/improvement and livelihood restoration for affected communities.

6.3 IDENTIFICATION OF STAKEHOLDER

Stakeholders are those who have a direct interest in project development, and who have been involved in the consultative process and will be involved in future consultation. Identification of stakeholders is an important step which ensures that all the concerned stakeholders are identified for the following.

- Sharing information with stakeholders about the proposed project, project activities and potential impacts of proposed project on the physical, ecological and socio-economic conditions in the COI; and
- To address the most relevant concerns of the stakeholders on project and its activities including the upfront negative impacts.

Primary stakeholders: include the communities of the Project, Project Affected Persons (PAPs), the beneficiaries of the project and the implementing agency.

Secondary stakeholders: are individuals or groups with an interest in the project, such as local or national government, policy makers, advocacy groups, elected officials, and NGOs in the project area.

Considering the importance of the project, consultations were carried out at all possible levels i.e. departmental and local level. The process of consultation is an on-going process which continues during the project life cycle and even after the submission of this report and so on. Stakeholders were identified, categorized and consulted at Departments and Communities level.

6.4 CONSULTATIONS

A series of public consultations were required to get the feedback/concerns of the different categories of stakeholders including provincial departments, district level departments, potential PAPs, local community and other general public residing in the Study Area.

Consultation process includes focus group discussion, meetings and semi-structured interviews and one to one meeting or interviewed with the government, private civil society institutions, communities. Affected person and public transport users. During the consultation process, the stakeholders were briefed about the project objectives and scope. Their concerns and suggestions were recorded. Consultations were conducted at two levels:

- Departments/Institutional Level
- Community level

Moreover, Consultations were carried out at two stages feasibility and detailed design of the Project levels.

6.4.1 Consultations with Stakeholders at Departments Level

Consultations with various departments were conducted from December 2021 to March 2022 and following concerns were recorded.

Table 6.2: List of Government/Institutions and Officials Consulted

Sr. No.	Date	Name of Person	Designation	Name of Department/ Office	Contact Number
1.	22-2-2022	Ms. Hamida Siddiqui Ms. Saeed Fatima	Deputy Director Deputy Director	Social Welfare Department (Malir and Korangi Districts)	0336-3068991
2.	23-2-2020	Jawed Nabi Ahmed	Head Administrator	Iqra University	111 264 264
3.	23-2-2020	Ms. Mehwish	Administrator	Indus Hospital	021-35112709
4.	24-2-2022	Faisal Bashir Memon	Senior superintendent of police (SSP)	Police Department (SSP Office Korangi Districts)	021-99333739
5.	24-2-2022	Zakia Malik	Assistant Sub Inspector	Police Department (Women Children Protection Cell)	021-99333739
6.	24-2-2022	Dr. Atta-ur-Rehman	Eye Specialist	Al-Shifa Eye Clinic	0318-6970085
7.	10-3-2022	Zahid Farooq	Joint Director	Urban Source Center	021-34387692
8.	17-3-2022	Ms. Syeda Fatima	Additional Director	Social Welfare Department (Central District)	0333-3196535
9.	25-2-22	Mr. Amir Hamza & Miss. Huma Ashar	Social Development Specialist & Gender Specialist	Sindh Mass Transit Authority (SMTA)	
10.	14-12-21	Mr. Muhammad Imran Sabir	Deputy Director-EIA	Sindh Environmental Protection Agency (SEPA)	
11.	16-12-22	Mr. Zain Bashir & Mr. Siraj Sadiq.	Chief Coordinator / Executive	Landhi Association of Trade & Industry	

Sr. No.	Date	Name of Person	Designation	Name of Department/ Office	Contact Number
			Member (LATI) / CEO LITE-DMC & Executive Member (LATI) / Director LITE-DMC	(LATI)	
12.	24-02-22	Dr. Aurangzeb Khan - and other faculty Members	Vice Chancellor Faculty Members	Dewan University	
13.	14-02-22	Col. Aamir Sahzad and his team.	Additional Director Development	DHA Karachi	
14.	13-01-22	Mr. Muhammad Zubair Chaya & Mr. Syed Farrukh Ali Qandhari – Other Senior Members	Chairman & CEO KATI Vice President KATI and other members of KATI	Korangi Association of trade and Industry (KATI)	
15.	29-11-21	Sarmad Saeed	Deputy Manager Public Affairs & Government Relations	K-Electric	0334-3700236
16.	17-11-21	Adil Aziz Khan & Mukhtar Ahmed	GM Pipeline & Chief Engineer Pipeline	Pak Arab Refinery Company (PARCO)	0300-8972372
17.	15-10-21	Azim Khan & Mr. Akhtar Somro	CE(P&D)-Dist.-South Azad Trade Centre & Sr. Engr. P&D-South	Sui Southern Gas Company (SSGC)	0322-8218311
18.	21-10-21	Muhammad Riaz & Khalid Farooq	Superintendent Engineer & Chief Engineer water Distribution	Karachi Water & Sewerage Board (KWSB)	0300-3589627
19.	14-12-21	Syed Imtiaz Hussain	Senior Manager (E&P)	National Refinery Limited (NRL)	021-35060844

Table 6.3: Detail of Issues/Points Raised/Discussed during Departmental Consultations

Sr. No.	Department/ Organization	Stakeholder Views/Concerns	How the Concerns will be or have been addressed
1.	Sindh Mass Transit Authority (SMTA)	• All of the information about baseline data, environmental monitoring, socio-economic, gender survey and public and departmental consultations should be part of the EIA Report; and • PAPs survey should be based on the assumed ROW (from building to building).	• The same have been included in the EIA report.
2.	Sindh Environmental Protection Agency (SEPA)	A meeting was held at the SEPA Office Karachi between SMTA, SEPA, and JV consultants (Dar Al-Handasah and NESPAK) to mark the beginning of stakeholder's consultation meetings and to bring all parties on same page concerning the requirements of SEPA and EIA. The JV Consultants' team gave a brief introduction of the project along with route alignment of Yellow BRT Corridor, its feeder lines and its construction packages. The suggestions/information from SEPA is as follows: • SEPA informed that the project will be serving Korangi and Landhi Industrial Estates, where Korangi Industrial Estate is the second largest industrial estate of Karachi, around five hundred thousand (500,000) workers/people visit this area on daily basis from different areas of Karachi; • SEPA stated during the design, implementation and operation of the project, local conditions must be kept in mind; • SEPA suggested for the early submission and consequent approval of an EIA report before the beginning of construction activities; • SEPA officials clarified about the reviewing process of EIA report. They informed that as per the court directives they have to complete the review process within sixty (60) days but usually SEPA completes this process within forty to forty-five days. This review period can be further minimized up to 30 days; and • SEPA team assured their support for the BRT Projects and clarified about keeping the project sustainable and ensuring that the design meets the local requirements and conditions.	• Construction work will begin after approval by SEPA

3.	Sindh Forest Department Government of Sindh	- The Chief Conservator Forest and the team Conservator and DFO was briefed regarding the project. - The team appreciated the project as the BRT Yellow line will be leading to reduce the pollution in the city. - The have also added that the carbon emissions will also be reduced in the region - The suggested to avoid tree cutting up to the maximum level by adopting planned measures. - In lieu of felled trees the plantation plan must be formulated and implement and SFD will be available to support the Nobel cause.	Avoidance of tree cutting recommend to design and contractor team in this report
4.	Sindh Wildlife Department, Government of Sindh	- The Deputy Director Wildlife Karachi made detailed discourse on the project as presented by the consulting Ecologist of NESPAK. - He recommended to avoid old and large tree cuttings as these trees are providing shelter and food to local birds in the city. - The official also shared some information of the wildlife of Karachi and the project area.	Points well noted to support the environment report and strong recommendations made for the safety of wildlife
5.	Horticulture and Parks Department KMC, Government of Sindh	- The DG PHA was briefed regarding the project through maps and required technical dissuasion. - The official provided splendid support regarding the information and future support. - The experts made detailed discussion to avoid trees in the project corridor to keep the area green in the best public interest - The DG recommended the compensatory plantation with 1:10 to restore anticipated losses due to proposed project activates.	The tree inventory survey was initiated to record all the available species in the corridor which will help in decision making and on the basis of same plantation/restoration plan will be formulated.
6.	Karachi Urban Transport Corporation (KUTC) Karachi Circular Railway	- KUTC suggested to check the possibility of realigning the route of the proposed demolished Kala Pul Bridge by acquiring additional land near the bridge which relates to KUTC; - KUTC informed that they have the alignment of the new KCR project which is running over the existing Kala Pul Bridge, which will be required to be considered during the design and construction of the new Kala Pul Bridge; - KUTC advised that the General Arrangement structural design drawing of the new Kala Pul Bridge should be submitted by the JV Consultants for review and approval by their technical team prior to proceed with the detailed design; - KUTC agreed to provide with the available information related to the existing Rail Network and utilities, as well as the future KCR and ML-1 project to the JV for their consideration; - KUTC agreed to provide the JV with the	- Additional land is not available. The new bridge will be constructed on the same alignment. - The Client will share the general arrangement drawings once design is ready. - Information from KUTC yet to be received.

		necessary information of the current encroachment within the Kala Pul Bridge area. They also agreed to provide compensation for existing encroachments if impacted; and • KUTC suggested that they will arrange for a technical coordination with the Consultant of the KCR project to discuss with the proposed intermodal rail station and the Yellow BRT Line project.	
7.	Korangi Association of Trade and Industry (KATI)	• KATI mentioned that Landhi Industrial Area is visited by 2 million people daily for business trips, and there are more than 3,000 registered industries in the area; • KATI requested to revisit the possibility of shifting of existing High-Tension K-Electric Line present at the Median of Road 8000 from overhead to underground. KATI also offered their services and support to consult with the K-Electric Officials. It was made very clear by KATI that reducing the size of lanes to install BRT will ruin the traffic management; • KATI; the stakeholder and end user of the project informed about the current combined drainage system of Korangi/Landhi which serves as industrial wastewater, sewage and storm water. They informed that the current ill planned system is not completely functional and so it is relatively impossible to separate drainage networks for industrial wastewater and storm water drainage. They further informed that there are two disposal points for Korangi; One at Malir River (through PS-2 Pumping station having capacity of around 16MGD) and other at Arabian Sea (through gravity flow having flow rate of 20 MGD). The expected wastewater generation in near future will be more than 40 MGD; and • KATI also suggested to avoid underpasses and proposed Flyover at all roundabouts to keep the running of BRT smoothly.	• Shifting of existing high-tension lines not possible due to high cost and time required. • As part of the project, existing drain is being relocated, while a new additional drain is being designed. • The disposal point issue will be taken up separately from this project. • Due to traffic congestion at these roundabouts, underpasses for BRT and for mix traffic are proposed to alleviate traffic congestion at the roundabouts.
8.	Landhi Association of Trade & Industry (LATI)	• LATI enquired about the fueling mechanism that will be used as part of the Yellow BRT line project. The JV clarified that the project would rely on the Diesel Hybrid buses, that can be upgraded in future depending on the renovation of the fueling technology; • LATI highlighted that the existing median of the 8000 Road carries the High Voltage Over Head Line "OHL Pylons", and asked if the project will impact them; • LATI mentioned that, the JV should check if there is illegal encroachment to the Right of Way "ROW" at Dawood Chowrangi area, as the available road corridor in this area is very narrow. LATI also added that if there is	• The project will now have two types of fuelling mechanism, electric buses for 18m fleet and diesel hybrid for 12m fleet. • The existing 132kV pylons will be protected. • The BRT project will utilize the existing available ROW near Dawood Chowrangi. • The passenger safety at stations and along the

		any illegal encroachment, there is a governmental project to restore the ROW that could allow for sufficient space for the project; • LATI mentioned that, heavy traffic coming from National Highway joins the traffic from Dawood Chowrangi and uses the Korangi 8000 road to reach at KPT. This must be taken into account while design of roads; • LATI highlighted that the 8000 Road includes a provision width for Green Belt, but it is being used currently by the business owners as parking spaces; • Mr. Zain Bashir suggested that demolition of the existing Jam Sadiq Bridge shall only be started after constructing the new bridge. The JV confirmed that this already has been considered in the scope of the related package of the project (Package 4); • Mr. Siraj Monnoo suggested that to consider some of heavy traffic be diverted to Malir Expressway to ease congestion on 8000 Road; • LATI mentioned that currently road network in Karachi is under immense pressure and such projects are very important for Karachi. The projects will not only facilitate the passengers but will also improve the aesthetics and infrastructure of Karachi they also assured the visiting project team that they will advise with the details of the focal point from their side to be contacted during the necessary coordination or support needed during the project; and • LATI suggest the following to be considered: • Ensure the safety of the BRT passengers in the stations, buses, pedestrian bridges and underpasses; • CCTV Monitoring at the stations and route of BRT; • Include sufficient toilets in the stations for the staff as well as the public, as possible; • Ensure to provide regular update to the public about the project to get their support during the construction time; • Ensure the proper coordination with the business owners during construction; • Design of stations should include emergency exits; • First Aid facilities shall be available at stations and inside the buses; • Firefighting arrangements at stations and inside the buses; • The stations and buses can be very good source of revenue generation through advertisement on buses and stations; and • Small shops at stations shall be introduced	corridor will be ensured round the clock through surveillance, liaison with local police and CCTV cameras at stations. • A Communication Plan has been developed by SMTA to keep the public aware about the project progress. • Coordination with the various stakeholders will be ensured during construction. • Design of stations includes emergency exits • First aid facilities will be provided in the stations. • Non-fare revenue stream will be explored for the project. • Small shops at stations have been planned.
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		to facilitate the BRT passengers and create some business / job opportunities.	
9.	DHA Karachi	• DHA Team was of the opinion that such projects are badly required to improve the public transport of Karachi and resolve the traffic issues. The project will also reduce the number of vehicles and motor bikes from the roads. DHA team assured for their continuous support during the implementation of project; • DHA team suggested that SMTA should be in coordination with utility companies for timely relocation of utilities (if any) to avoid disturbance to their customers and they should also be onboard during construction; • Proper traffic diversions with proper traffic controls should be considered during the construction phase; and • Stringent pollution control measures for air emissions, dust control, noise control and etc. shall be adopted during execution of the project.	• Coordination with all utility agencies has been ongoing. • Traffic diversion plans will be prepared to mitigate the impact of construction on commuters. • Environmental management plan will be strictly monitored to reduce air emissions, dust control etc. during the construction.
10.	Shaheed Benazir Bhutto Dewan University	• SBB DEWAN University informed that due to lack of proper and organized public transport in Karachi, people of Karachi especially the female students and workers are facing the number of problems. Implementation of different BRT Projects will give some relief to the Public of Karachi; • DEWAN University team was of the opinion that students and workers of this industrial area will be the beneficiaries of BRT YL Project. The team assured for their continuous support for the project; • The project should be completed in time in order to avoid any nuisance for students and public; and • Provision of bus station near SBB DEWAN University.	• Several bus shelters are proposed to be constructed along the off-corridor routes.
11.	Police Department and Women and Children Protection Cell	• The officials of the police department and women and children protection cells briefed the current situation of the crimes of various categories and different types of gender violence being reported and they suggested following measures to minimize the intensity of the crimes for the yellow line bus stations, in the buses and in the Project area: • Awareness about women and children protection laws and facilities should be created among the people using the print, electronic and social media; • To launch the complaints against women violence and crimes contact numbers services providers, helplines and websites should be displayed at yellow BRT stations and even in the buses; and • CCTV cameras should be installed at yellow	• CCTV camera will be installed at stations which will be monitored through the central control room.

		BRT stations and live monitoring cell should be established.	
12.	Iqra University	- Maximum construction work should be done after closing the educational institutions or during the late night hours; and - Awareness among the students should be created about the proposed project. Traffic should be managed properly during the civil work construction.	Proper traffic diversion plan will be implemented during the construction phase to minimize impact on traffic.
13.	Health Department/ Institutions	- Awareness among the population about the risks associated regarding project activities and mitigation measures should be created; and - The environment of most part of the Project area is friendly, but due to construction activities dust & air pollution may lead to respiratory diseases. Medical camp should be established in the area during the period of construction.	- A Communication Plan has been developed by SMTA to keep the public aware about the project progress. - Environmental management plan will be strictly monitored to reduce air emissions, dust control etc. during the construction.
14.	Social Welfare Department (Malir, Korangi and Central Districts)	- Compensation should be given to all Displaced Persons against loss of residential and commercial structures; - Impact on religious structures should be minimized and if not avoidable should be reconstructed with the consent of the local communities; - Employment should be provided to the women; - Facilities of toilet for the passengers should be provided; - At Bus Stations, waiting room for passengers should be constructed. - Maximum skilled & unskilled labour should be hired from the local community during the Project construction activities. - Occupational health and safety of workers should be taken care during construction of the project; - Physical disturbance should be avoided; - Livelihood disturbance should be minimized; and - During the construction period, safe movement of the pedestrians should be ensured and proper Traffic Management Plan should be devised.	- Compensation shall be given to affectees as per the laws. - Women will be provided employment during construction and operation phase of the project. - Skilled and unskilled labour from the local community during construction will be monitored. - Occupational Health and Safety Specialists will be monitoring the safety and health of works during the construction. - Proper traffic management plan will be prepared and implemented during the construction.

15.	Urban Source Center	- Income disturbance of the business operators should be minimized if not avoidable and should be compensated properly to restore the income activities; - For the protection of the women against violence and crimes, security plan should be developed involving relevant departments and other stakeholders to protect women during travelling; - All stakeholders should be involved in all stages of the project to get maximum benefits of the Project; - Employment opportunities should be created for women in the Project activities and during operation of the Project; and - The project will benefit to the people of the Karachi with better public transport facilities.	- All stakeholders have been involved since the inception of the project. - For proper compensation of affected assets and livelihood CLRP will be prepared. - Women will be provided employment during construction and operation phase of the project.
16.	Utilities and Services Departments (SSGC, K-Electric, PTCL, PARCO, NTC, KWSB, NRL, PRL & Pakistan State Oil (PSO))	- After several meetings with all utilities companies it is concluded that the Consultant, in collaboration with Stakeholders, will prepare drawings for utilities relocation where ever will be required based on their supplied information. Regular site visits and meetings with the SMTA, contractor and stakeholders will also be required during construction phase to resolve any potential issues, if any; - All the utilities marked on the drawings will be issued to contractor along with the bidding documents. It has also been agreed with client and all stakeholders, that a possible relocation corridor will be proposed/ considered during design stage however, if any unforeseen constraints are identified the final relocation shall be mutually agreed during construction stage. Therefore, SMTA shall instruct all stakeholders to accomplish the relocation of utilities task so that project design may be implemented and the execution of project may start as per planned schedule; - All utility companies informed that the civil works and R.O.W permission shall be the responsibility of the SMTA; - At the construction phase, close coordination between contractor, consultant and all utilities stakeholders is necessary to avoid any mishaps at project site. In particular wherever the PARCO, PRL, NRL, SSGC, KE and KWSB lines are lying, high level precautions shall be taken in liaison with utility departments to avoid any possible damage to their lines which may impact the delivery of the project; - It is also recommended that during relocation work, close supervision from the consultant shall be required to measure and record the actual quantities of relocation work which	- Coordination with all utility agencies has been continuing. - All existing utilities provided by the utility companies have been plotted on the drawings and shared with the various agencies. - Close coordination during construction will be ensured to minimize the impacts of utility relocations. - Utility crossings have been proposed for various utilities at the intersections.

		shall be paid as per actual and verified work; • Culverts and trenches shall be proposed in our design for all utilities crossing the road and extra trenches/culverts shall also be provided / considered for future requirements; • At Shan Chowrangi there are multiple lines crossing the corridor one of which critical line is PRL 6-inch line which shall be protected as per agreed terms with PRL and client SMTA; and • At intersections where underpasses are proposed protection of cross drainage structures shall be provided.	
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Meeting with SEPA



Meeting with MD KUTC



Meeting with KATI



Meeting with LATI



Meeting with DHA Officials



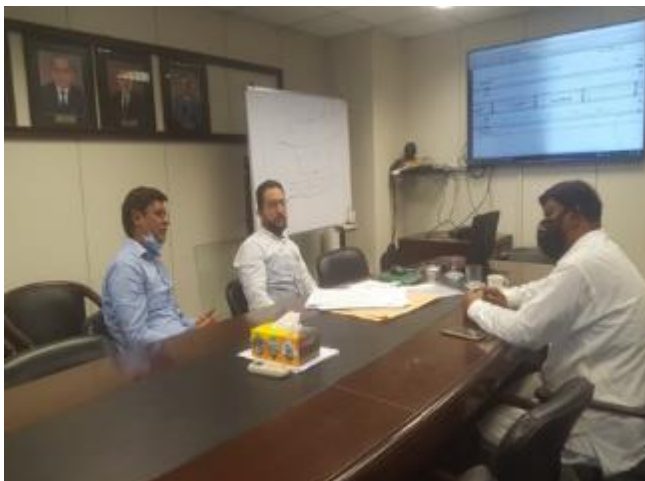
Meeting with Dewaan University Management



Meetings with Joint Director Urban Source Center



Meeting with Deputy Director Social Welfare (Malir)



Meeting with KWSB Representative



Meeting with PARCO

6.4.2 Community Consultation and Participation Process

For ascertaining the perceptions of different stakeholders about the project, meetings were held within the project area of influence. These meetings were held in an open atmosphere, in which participants expressed their views freely. 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.

6.4.2.1 Methods of Public Consultation

The following methods were used for public consultation with project stakeholders in order to ascertain their stakes regarding project implementation:

- Formal Group Meetings
- Informal Group Meetings
- Individual meetings
- Focused Group Discussions (FGDs)
- Gender Consultations
- Consultations with Transgender

The views of the beneficiaries were formally recorded. The locations selected randomly situated near the proposed route of the YBRT and off-Corridor.

6.5 CONSULTATION MEETINGS AND FORMAL & INFORMAL GROUP DISCUSSIONS

Extensive consultations have been conducted with the local communities and Affected Persons in the project area to take their views and incorporating in the project planning. In the meetings, more than 382 people participated. The major categories participated in these meetings were local population, community groups, public transport users, public transport operators, and Project Affected Persons (PAPs).

6.5.1 Locations and Summary of the Public Consultations with Male

Consultation meetings regarding project impacts, their magnitude and mitigation measures were held with different types of stakeholders, to know their concerns. Consultations were conducted with these stakeholders at various locations along the route of YBRT. The detail of the locations with number of participations is provided in the **Table 6.4**.

Table 6.4: Summary of Consultation with Males

Sr. No.	Venue	Date	No. of Participants
Detailed Design level			
1	Shahra-e-Fiasal Road	10-3-2022	20
2	National Medical Centre (NMC)	10-3-2022	17
3	Dawood Chorangi	14-2-2022	8
4	Korangi Road (Chorangies)	18-2-2022	44

5	Future Colony	18-2-2022	14
6	Mansehra Colony	18-2-2022	8
7	Defence (Phase,I&II)	19-2-2022	16
8	Kudadad Colony	19-2-2022	15
9	Kalapul	23-2-2022	15
10	Dewan University	24-2-2022	30
11	Korangi Industrial Area	24-2-2022	25
12	Jam Sadiq Bridge	25-2-2022	12
13	Shaheed-e-Millat Road	25-2-2022	20
Feasibility Level			
14	Numaish	09/2/2019	8
15	Kala Pull	09/2/2019	10
16	Nasir Colony	09/2/2019	13
17	Dawood Chowrangi	10/2/2019	7
18	Awami Colony	10/2/2019	21
19	Allah Daad Goth	10/2/2019	18
20	Zia Colony	10/2/2019	17
21	Mehran Town	10/2/2019	8
22	Azam Town	10/2/2019	14
23	Sharfi Goth	11/2/2019	22

6.6 STAKEHOLDERS CONCERNS/FEEDBACK

Feedback received during public consultation includes both project related concerns and other/general concerns. Project related concerns and suggestions are related to the willingness of people to accept project issues related to resettlement, livelihood and compensation, disturbance of utilities environment and security. Brief Introduction about the proposed project, its various components, positive and negative impacts and other technical details related to environment, social and economic considerations were briefed to the consulted stakeholders. The **Table 6.5** depicts the summary of concerns, suggestions and actions.

Table 6.5: Summary of Concerns, Suggestions and Actions

Sr. No.	Concerns/suggestions by the Participants	Mitigation Proposed by the Participants	Action to be taken by the Project Implementing Agency
1.	Religious structures should be saved from the significant impacts keeping in view the sentiments of the local people and their attachment; Impact on housing and commercial structures should be minimize and if not avoidable proper resettlement compensation should be given. Alignment should be diverted from the residential areas which are under impact,	The design alternatives will be utilized to protect the entire religious structures. In case of demolition or any impact on the structures, the compensation will be given to the community for restoration and rehabilitation of the structures.	The consultant will be responsible for design alternatives to protect the religious structures.
2.	Different types of utilities	Civic facilities should be restored	The EA will be

Sr. No.	Concerns/suggestions by the Participants	Mitigation Proposed by the Participants	Action to be taken by the Project Implementing Agency
	will be affected during the implementation of the project and local residents will face interruption of these facilities.	during the construction period and after completion of the civil work Arrangements should be made to minimize the disruption of public utilities or they may be rehabilitated on priority basis to reduce the impacts;	responsible to restore the public utilities before execution of the project so that uninterrupted services of these public utilities remain continue.
3.	Job and labor opportunities should be provided to local people.	The skilled and unskilled workforce should be hired from the local community. It will enhance the acceptability of the proposed project among local people.	The contractor will be bound to hire the skilled and unskilled workforce from the local community as a priority.
4.	The existing buses are uncomfortable and overcrowded; Existing buses are running on diesel and causes air pollution; and The staff of the existing buses does not have manners and misbehave with riders.	- Fares of YBRT should be economical, so poor people can travel easily; - The YBRT should not be overcrowded; - The YBRT stations should be closer to the colonies, so people can on board easily. - There should be a separate compartment and big in size for ladies in YBRT. - YBRT riders will reach their destination on time; - The YBRT will help in minimizing the air pollution.	EA will ensure the facilities during operational stage.
5.	Participants showed their concerns regarding the displacement of their commercial structures falling in the ROW of the proposed Project.	They were of the view that proper compensation should be given to the PAPs for the re-establishment of their structures and livelihood.	All the PAPs will be given proper compensation for their land, lost structures, assets or livelihoods including resettlement and relocation assistance.
6.	Proper compensation rates for affected structures/assets.	Market-based rates should be given to the PAPs for their affected structures/assets. Being a marginalized community, additional financial support/assistance should be given to the PAPs, so they can shift their structures to the proper location.	Market based rates will be given for the affected structures/assets. Besides, additional financial assistance will be given in the shape of allowances according to the proposed CLRP.
7.	Due to the impact on commercial structures, different types of workers working at shops on daily wages will lose their livelihood.	Proper compensation should be given to these respective workers so that they can earn their livelihood without any complications.	Allowances should be determined in the CLRP against employment loss will be given to these employees.
8.	Provision of adequate water to the households on daily basis.	Participants suggested/demanded a sufficient/adequate water supply for their households on daily basis	The respective facility is not in domain of the proposed project.

Sr. No.	Concerns/suggestions by the Participants	Mitigation Proposed by the Participants	Action to be taken by the Project Implementing Agency
		through proper management of the water distribution system.	
9.	The project should proceed on the fast track.	Transportation is a very big issue for the resident of Karachi city. The Project should proceed on the fast track so that people become able to get proper transportation facility.	Appropriate steps will be taken to complete the project at the earliest.
10.	How the PAPs or community members can register/log a complaint regarding any issue related to the Project?	The proper mechanism should be developed for the PAPs and community members to log/register their complaints.	Proper/functional Grievance Redress Mechanism (GRM) will be established for the convenience of the PAPs and community members so that they can file/register their complaints.
11.	During the construction period, the mobility of the local community especially of kids and females will be disturbed.	An alternate route should be provided to the local communities for convenience in mobility.	Alternate routes will be provided where needed before the commencement of the civil work.
12.	Disturbance of the amenities and public utilities.	Participants were of the view that due to the construction of the proposed project, several amenities and public utilities will be disturbed.	Amenities and public utilities will be restored after the completion of civil work.
13.	Due to construction activities as well as an influx of labor, movement of the citizens particularly females, residing in the local area will be restricted.	In order to tackle this situation, construction/laying work should be carried out within scheduled hours, so that after construction hours, the local community, particularly females can easily move into the area.	People will be made aware of complete construction activity plans so that they can move in the area freely and safely.
14.	Dust and noise will disturb the nearby residential and commercial structures.	All protective measures should be taken to protect the local community from noise and dust.	The contractor will be bound to take all protective and precautionary measures to protect the health and properties of the local people. Appropriate practices will be adopted in this regard. This Environmental and Social Impact Assessment (EIA) has been carried out for this purpose.
15.	The process of the consultation should continue.	The continuation of the consultation process with the PAPs and local communities may help in reducing problems arising at the local level. This is an effective strategy for the smooth implementation of the project.	Consultation is an ongoing process that will be carried out with the PAPs and other stakeholders located along the alignment of the proposed project throughout the

Sr. No.	Concerns/suggestions by the Participants	Mitigation Proposed by the Participants	Action to be taken by the Project Implementing Agency implementation period.



Consultation with Local Community at Shaheed-e-Millat Road



Consultation with APs at Jam Sadiq Bridge



Public Consultation at Industrial Area



Public Consultation at Shahrah-e-Faisal Road



Consultation with AP at Defence Turn Bridge



Public Consultation at Industrial Area

6.7 GENDER CONSULTATIONS

Keeping in view the important role of females in the household as well as in the society, gender consultations were also conducted in four settlements to record views of the females and issues related to the project implementation. Participants were briefed about the proposed project and women actively participated in the meetings and showed their support for the project. Most of the women were un-aware about the proposed project.

They considered the project valuable to the local community and highlighted some issues related to women due to project execution. The Summary of participants is provided in **Table 6.6**.

Table 6.6: Summary Consultation with Females

S. No.	Venue	Date	Participants
1	Karachi University	28-2-2022	15
2	Shaheed-e-Millat Road	28-2-2022	10
3	Shah Faisal Colony	26-2-2022	19
4	Dewan University	24-2-2022	60
5	Fabtex Apparel	24-2-2022	15
4	Singer Chowrangi	08/2/2019	8
5	Dawood Chowrangi	09/2/2019	8
6	KPT Interchange	10/2/2019	11
7	Allah Wala Town	09/2/2019	8
8	Noorani Chowrangi	10/2/2019	9
9	Shan Chowrangi	10/2/2019	12

6.8 CONCERNS AND SUGGESTIONS

Their major concerns were related to present transport system and mobility of women in the area.

- The quality of the current transport is substandard as the buses are very old;
- Availability issues and high fares of the buses;
- Women are not satisfied with the existing transportation system and are compelled to use overcrowded buses;
- There should be a separate section in the Yellow YBRT vehicles for women passengers. It is also suggested by some people that there should be separate (additional) buses running for women during the peak hours in the morning and evening;
- Existing buses are overcrowded and uncomfortable;
- People have to pay huge amount of fares by travelling in auto rickshaws and taxis. This problem is increasing in Karachi day by day;
- The YBRT will be beneficial for elderly women;
- Those who do not own any vehicle are the real sufferers. Students, office workers and other people use public transport to reach their destination and face difficulties irrespective of age and gender;
- Fares should be economical, so poor women and elderly people can easily afford;

- The drivers of the buses are usually operated by reckless drivers who do not follow the rules of the traffic;
- It is the responsibility of the government to provide citizens economical and appropriate transport facilities so that they can reach to their desired destination with comfort and safety;
- The YBRT will be beneficial for women, if fares are affordable;
- Employment opportunities should be provided to the local people;
- Ladies and elder people compartment should be separated from male compartment;
- The existing transportation system will be improved due to YBRT project.
- Women hope that their family members will get jobs in YBRT Project during construction and operational phase;
- The YBRT should have designated stops. The stops should be closer to the communities;
- To safely cross the roads, pedestrian bridges should be constructed;
- The buses could be used to educate the passengers on changing toxic masculine behaviour, stopping violence against women and transgender persons;
- In order to recruit and retain women and transgender persons in all levels of the project, it is important to set aside a certain quota as a positive discrimination measure; and
- Suggestions were also made to hire female and transgender drivers and staff at the bus stations to avoid incidents of violence.



Consultation with Students at Dewan University



Women Consultation at Shan Chowrangi



Consultation with Students at Fabtex Apparel Factory



Consultation at Karachi University

6.9 DISCUSSION WITH TRANSGENDER PEOPLE

Separate consultations were conducted with transgender people to understand their specific needs in relation to trans-mobility. The main issue faced by them was of acceptance and harassment when they travel in public buses. If they sit in the male section they are ridiculed and told to go to the female section and when they go to the female section, they are asked to leave. Not having any designated place for them cause major issues and embarrassment for them. In case of harassment, no one defends them.

Transgender people who beg or belong to the low socioeconomic stratum use public transport. Others from a slightly better economic class use Careem and Uber services for discretion and safety. Some of them use auto rickshaw to avoid harassment, which is more expensive than the public bus, however, the driver usually refused to give them a ride for fear of losing other customers who do not want to sit next to transgender people. They suggested that a separate portion in the YBRT should be provided. They should be hired in staff of the YBRT during operation phase.



Consultation with Transgender persons

6.10 CONSULTATIONS WITH BUS OPERATORS

Consultations were held with bus operators including owners, drivers, conductors, and terminal managers on potential YBRT impacts on their businesses. They were concerned that due to YBRT Project, they will lose their businesses. The suggestions came from them during consultation were option of re-routing their vehicles with the permission from the Sindh Government, providing job opportunities, purchase of discarded buses and skill training. The participants were briefed that they will continue their transport business on the same routes during construction and even in the operation phase of the YBRT project.

6.11 FOCUS GROUP DISCUSSIONS (FGDS)

Focus Group Discussions (FGDs) were conducted with the PAPs, small business operators, vendors and communities at different locations. During the FGDs, people were informed about the project objectives and extensive question and answer sessions were conducted to clarify the project related works and activities and resolve the resettlement issues.

After the meetings, respondents including local residents and other stakeholders showed support for the proposed project. This project will be beneficial in terms of improved transport for a big city, control over traffic congestion as well as good infrastructure development, not only for the local residents but also for visitors. Due to implementation of the project and better and secure transport facilities the security situation would improve and crimes would decrease.

Participants also demanded the availability of clean drinking water, wheel chairs for disable persons, electric ladders, fans, sitting place, electric switch for mobile phone charging, separate ticket counters and security at the bus stations. In FGDs, more than 20 APs participated along the alignment.

6.12 FUTURE CONSULTATIONS

The stakeholder consultation and engagement is an ongoing process and will continue throughout the project's construction as well as operation and maintenance phases. The ongoing consultation process could be scheduled on need basis with the stakeholders including but not limited to the concerned government departments, local administration, community representatives, and affected Persons of the proposed project area.

The primary goal of consultations and community engagement is to support and facilitate the project's design and implementation, to reduce conflicts and project opposition, and to increase project's acceptability.

The community members will be compensated by project proponent and they will be encouraged to participate in project activities during construction and operation phases. The consultations will be made in future to facilitate the community at the local level.

Further consultations to be undertaken as part of the Project EIA process include the Project public hearing. The Sindh EPA will require public hearing to assess public opinion on the environmental impacts of the proposed Project. The Sindh EPA will advertise the public hearing in a newspaper. The legal requirement is advertisement in at least one English or Urdu national newspaper, but in practice, advertisements are usually placed in two national newspapers and also in local newspapers. The public hearings will be held at least 30 days after the public notice. Concerns raised during the public hearing will be addressed in the EIA report before approval.

The consultations will be carried out during the construction and operation phases of project. Consultations will be undertaken in all the communities twice or more time in a year,

depending on the number of concerns raised under each consultation. Ongoing stakeholders' engagement activities include:

- Ongoing reporting on progress on the implementation of environmental and social management measures identified during the EIA process and recording of comments on the effectiveness of these measures;
- Updating communities and other stakeholders about project developments and recording comments on these; and
- Ongoing action of the grievance mechanism.

Efforts will be made to maximize the consultations during the project implementation. The consultations will be carried out with the objectives to develop and maintain communication linkages between the project promoters and stakeholders, provide key project information to the stakeholders, and to solicit their views on the project and its potential or perceived impacts, and ensure that views and concerns of the stakeholders are incorporated during the implementation with the objectives of reducing or offsetting negative impacts and enhancing benefits of the proposed project. The framework for the future consultations is elaborated in **Table 6.7** but not limited to the following:

Table 6.7: Proposed Consultations Framework

Sr. No.	Stakeholders	Project Phase	Frequency of Consultation
1	Institutions/Departments	• Pre-Implementation • During the Project Implementation • At Closure period	• One round of consultation before start of implementation of project. • Bi-annually during operation phase • Once before the closure of the project.
2	Local Communities/ Key Persons	• Pre-Implementation • During the Project Implementation • At Closure period	• Consultation at different stages, before implementation, periodic meetings during construction phase and at the time of Project completion.
3	NGOs/CBOs	• Pre-Implementation • During Project Implementation • At Closure period	• Periodic meetings will be conducted as per requirement of the Project.

During the operation phase of the project, consultation of stakeholders is important to assess the benefits of the project and impacts on the local communities. A comprehensive plan will be prepared to get feedback from the stakeholders and to resolve the issues.

6.13 INFORMATION DISCLOSURE PLAN

After suggesting the possible solutions of the stakeholders' concerns, the solutions will be disclosed once again before the stakeholders and general public in the form of workshop.

EIA report will be accessible to interested parties on request and the version of final report will be available in the project office and its summary will be available in national language.

6.14 GRIEVANCE REDRESS MECHANISM

A Grievance Redress Mechanism (GRM) for The Karachi Mobility Project (KMP) has been designed to receive, register, and address complaints from different stakeholders, including the project affected person (PAPs). The Grievance system is designed to ensure that complaints are appropriately handled and resolved timely with no cost and fear of reprisal. A functioning GRM is considered a suitable feedback mechanism from the PAPs and a practical tool for citizen engagement. Grievance's activities to be applied under the project will be handled by all types of grievances related to the project.

6.14.1.1 Objectives of Grievance Redress Mechanism

The objective of a grievance procedure is to ensure that all complaints from any project stakeholder are considered and addressed in an appropriate and timely manner. The grievance procedure will be simple, accessible, and should be administered at the local level. The specific objectives are to:

- allow stakeholders the opportunity to lodge complaints and raise concerns;
- ensure that comments, responses, and grievances are handled fairly and transparently, in line with the applicable reference framework;
- mitigate or prevent adverse impacts on communities caused by the Project operations;
- serve as an early alert system to project management of significant or recurring issues that might signal a systemic problem and facilitate a resolution. Inform the population about the project's objectives, the risks related to the project, the channels for filing complaints
- Establish safe and accessible channels for reporting complaints, including those identified by women and during specific consultations
- Make partners, beneficiaries, or other stakeholders aware of their rights to bring their claims and complaints to the GRM.

6.14.1.2 Process of GRM

The GRM includes a set of processes for receiving, recording, registering, processing, and resolving grievances. The overall strategy for the GRM will consist of six steps, as shown in Exhibit-1 and described in Exhibit-2 below.



Figure 6.1: GRM Value Chain

Table 6.8: GRM Processing STEPs

Steps	Process
Step 1: Uptake	Project stakeholders will provide feedback and report complaints through several channels.
Step 2: Sorting and processing	Complaints and feedback will be compiled by the GRM focal person and recorded in a register except for sensitive complaints related to GBV, SEA, HS, which will have to be recorded separately according to the GRM's security and confidentiality principles using encrypted codes/system and keeping the files well locked.
Step 3: Acknowledgement and follow-up.	Within three (3) days of the date a complaint is submitted, the responsible person will communicate with the complainant and provide information on the likely course of action and the anticipated timeframe for resolving the complaint (see
Step 4: Verification, investigation, and action.	This step involves gathering information about the grievance to determine the facts surrounding the issue, verifying the complaint's validity, and developing a proposed resolution
Step 5: Monitoring and evaluation	The Safeguard Specialists will be responsible for consolidating, monitoring, and reporting on complaints, inquiries, and other feedback that have been received, resolved, or pending.
Step 6: Providing Feedback.	This step involves informing those to submit complaints, feedback, and questions about how issues were resolved or providing answers to questions. Whenever possible, complainants should be informed of the proposed resolution in person.

6.14.1.3 GRM Structure

The GRM will be set up with a two-tiered structure; one at the field level enables immediate local responses to grievances and another at the Project level to address more difficult cases not resolved at the local level.

6.14.1.4 Tier-1: Field level

The process of Tier 1 will be as follows. First, a three-person committee will be formed headed by the Social Development and Gender Specialists. Second, the Committee will be composed of Environment and Social specialists from Design and Supervision Consultants led by the counterpart of PMT.

- Each complainant will receive a filled Grievance Acknowledgement Form which acknowledges that the grievance has been received. The Grievance Acknowledgement has a reference number and includes a Grievance Redress Officer (GRO) commitment to respond within three days of logging the grievance.
- The recorded complaint is verified on the ground; if it is valid and relevant to the project, then it will be discussed with the complainant for follow-up;
- IF REQUIRED, the GRO contact and, if required, meet with the complainant to discuss his/her grievance and can be solved if it is a project-related issue.
- If possible, the concerned GRO will address the complaint in a face-to-face discussion, providing information or clarification and document discussion points. The focus of resolving the complaint will be engagement and dialogue.
- In the case of a grievance, where further action or more time is required, the GRO will mention the timeline when other activities will take place. The GRO will inform the complainant about the timeline of further action.

- The issue will be resolved within the timeframe of 10 days. If the problem is not resolved at the field level or a grievance is beyond field-level staff's authority, it will be escalated to the GRC.

The Social Development Specialist and Gender Specialist will be the focal person for the overall project-related grievances and GBV cases.

Any complaints unresolved at the local level by the contractor's field staff and NGO will be forwarded to the Secretary/ focal person of GRC. The complaints received will be properly recorded and documented at PD Office by designated staff in the Complaint Register. The information recorded in the register will include the date of the complaint, particulars of the complainant, description of the grievance, actions/steps taken/to be taken to resolve the complaint at field level, the person responsible for taking action, follow up requirements, and the target date for the implementation of the resolution. The register will also record the actual measures taken to mitigate these concerns. The aggrieved PAP will be kept informed about the actions on his complaint.

The contractor or relevant project officer can address issues on-site as required. If it relates to Contractor activities, the project should ensure the Contractor remedies any damage, pays compensation for damage or loss, etc. Use of community leaders and customary methods of conflict resolution is encouraged if necessary and appropriate when an issue emerges.

6.14.1.5 Tier-2: PMT Level

GRC is notified at the Project level through an official notification issued by the Secretary, Transport & Mass Transit Department (T&MTD). The GRC will be mandated to deal with all types of grievances. The GRC members include the Secretary (T&MTD) as chair, Managing Director (SMTA) and representative from Commissioner Karachi division. The Chair will call the relevant official as per requirement of the registered complaint including the Project Director, Environment Specialist, Social Development Specialist, and Gender/GBV Specialist; a senior social safeguard specialist from the supervisory consultant and a member nominated from a civil society organization. The GRC will meet every month (if grievances are brought to the Committee), determine the merit of each grievance, and resolve grievances within three weeks (21 days) of receiving the complaint. While at the local level, grievances are first assisted and supported through staff from the contractor before referring to the GRC.

The GRC has the right to request the project technical staff and officers working at head office, field level, and facility level to attend the meetings and provide information. GRC will ensure that objective and fair decisions are taken and agreements made. The procedures include verifying documents, conducting field inspections to verify the grievance's authenticity and eligibility, listening to different parties involved, referring cases to independent agencies for technical assessment. The GRC will resolve the complaint within 21 days following the receipt of the complaint. If the grievance redress mechanism fails to satisfy the aggrieved PAPs, they can submit the case to the appropriate court of law.

6.14.1.6 Responsibilities of the GRC Focal Person

The Project Director will serve as the focal person with the following responsibilities:

- facilitate and provide information and services to the GRC members;
- document the GRC proceedings, decisions, and recommendations;
- maintain grievance-related records, reports, and attendance;
- liaise with the GRC Convener;
- facilitate arrangements for field inspections;
- handle all payments and expenses related to GRC operations;
- provide feedback to PAPs and the involve in grievances.

6.14.1.7 Implementation Guidelines for Code of Conduct

The project implementation team needs to demonstrate how they are complying with the Code of Conduct on Sexual Exploitation and Abuse. In addition, GRC members may do everything possible to reduce the power disparity between affected populations and workers and between staff within the project, ensure that there is an organizational culture that prioritizes this issue, and establish and implement responsible compliance and complaints systems.

The Code of Conduct is a comprehensive standard, which shall not be compromised. Develop and implement compliance and complaints mechanisms as part of overall managerial and staff responsibility and accountability. The Code of Conduct on GRM/GBV sets behavioral standards with zero tolerance for sexual exploitation and abuse. The project level GRC is established to ensure compliance is a crucial component of the project's success. Accountability to communities and affected populations is fundamental in project design and implementation and communication. Whatever procedures are established (e.g., information sessions, complaint registers, focal points among affected persons, referral to the focal point of the member, clear complaints channels) should be disseminated as widely as possible and should increase chances of reporting and receiving complaints.

6.14.1.8 GBV/SEA Related Complaints

Men and women may perhaps communicate their grievances differently; however, they may have different types of grievances. Therefore, gender differences should be taken into consideration when handling grievances. To address GBV-related complaints, SEA/SH. The project will make sure the availability of a GBV-sensitive GRM with multiple channels to address a complaint. The social development and gender specialist will be the focal persons for properly handling GBV allegations including assessment of the nature of the complaint, seeking support from various channels and helplines such as Citizens and Police Liaison Committee (CPLC) and *Madadgar* (Helper) to enact sanctions to be applied to the perpetrator. The PMT should have specific GBV/SEA/SH procedures, including confidential reporting with safe and ethical documenting of GBV cases based on the established information protocol.

There are at least three key actors involved in handling SEA/SH allegations: (i) the GRM operator, (ii) the GBV service provider, and (iii) the representative from SMTA. It is therefore essential that before SEA/SH complaints being received, it must be identified who specifically will be responsible for handling the complaint

- The GRM operator will keep SEA/SH allegation reports confidential
- Suppose a case is first received by the GBV service provider or through other identified reporting channels identified during the stakeholder consultations, especially those of women and girls. In that case, the report will be sent to the GM operator to ensure it is recorded in the GM system. As a result, the system will need to provide another database for sensitive complaints (SEA/SH), different from non-sensitive complaints.
- As part of the established resolution mechanism, SEA/SH allegations are considered staff trained in GBV, SEA/HS, and based on a survivor-centered approach. The agreement is reached on a plan for resolution and the appropriate disciplinary action for the perpetrator within the shortest time frame.
- For Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH), the GRM should primarily serve to (i) refer complainants to the GBV service provider (it should be noted that here it will be up to the GBV survivors, SEA, HS, to decide if they want their complaints to be referred or not). These GBV service providers have been previously identified in the project's intervention area, and (ii) record resolution of the complaint according to an information-sharing protocol signed by the GRM manager and the service providers.

6.14.1.9 Grievances Uptake Channels

The grievances will be received through the following channels:

- i. By Phone: SMTA Office Landline +92-21-99332207-8 (most preferably for an interim period)
- ii. A permanent dedicated universal access number (UAN) Toll-Free managed by the SMTA will be established to deal with all project-related complaints and issues raised by the citizens regarding social, environmental and health, and safety issues (possible compensation, noise, dust, and odor impacts on them during construction). The same UAN will be used during the operation to handle BRT service-related complaints from riders and other users.
- iii. By email: pd.kmp.ylc@gmail.com, gs.kmp.ylc@gmail.com, sds.kmp.ylc@gmail.com
- iv. By Post: D- 43 & D-43/1, Shahra-e-Ghalib, Block 2, Clifton, Karachi
- v. In-person: The Grievance Focal Person: D-43 & D-43/1, Shahra-e-Ghalib, Block 2, Clifton, Karachi
- vi. Complaints/suggestion box which will be placed along the BRT routes
- vii. A tab on the SMTA Website for those who choose to submit online: This information and a summary of the process for answering queries and managing grievances will be available on the SMTA website (in process).
- viii. Twitter handle; Twitter will be used for dissemination of project information only.

6.14.1.10 Awareness Campaign

A leaflet will be publicized translated into Urdu through the media and on notice boards along the route at the construction site offices and public administration offices and available on the SMTA's website. In addition, the GBV complaint referral protocol should be popularized to know the different channels and how to report.

6.14.1.11 Training of GRC Members and Complaint Management staff

All GRC members and complaint management staff will attend a training and orientation meeting prior to the commencement of their work. Competent technical experts should provide training in social/ resettlement and environmental management. The training will address the policy aspects, compliance requirements, expectations of the community, and need for rapport and communication with the affected communities. Finally, need for independence and transparent views in dealing with grievances.

6.14.1.12 Documentation and Reporting

All complaints or grievances will be entered into an assigned database that tracks the progress of each complaint/grievance. Complaints records (letter, email, record of conversation) are stored together, electronically or in hard copy. Records will be kept of all grievances received, including the complainant's contact details, the date the complaint was received, the nature of grievance agreed on corrective actions, the date these were affected, and the outcome. Each record has a unique number reflecting the year and sequence of received complaints (i.e., 2021- 01, 2021-02, etc.). In addition, each complaint or grievance will have a plan for addressing and closing out:

Complaints shall be reported in the regular project report and undertaken both at Field and PMT levels by the project. It should contain:

- Total number of complaints/grievances received based on gender-disaggregated data
- Number of complaints referred to care providers
- Total number resolved.
- A total number under investigation / not yet resolved.
- Total number not yet resolved and also exceeds the recommended close out time of 1month
- A brief on any significant grievances currently not yet resolved and any risks to project implementation.
- The project team may follow to see if the person is satisfied with the resolution or remedial actions.
- If more than 30 complaints/grievances are recorded, the Project Director may decide to investigate any patterns or repetition of issues that need addressing. In addition, the Project Director may decide to get an independent consultant to review and provide advice.

6.14.1.13 Monitoring of GRM Processes

A poor grievance process can disrupt the project implementation resulting in discontent within the community and disruption in the project work. Therefore, a strong emphasis will be placed on monitoring the processes and outcomes. The Social Development, Gender/GBV, and Environment Specialists of PMT will be responsible for internally monitoring the grievance procedures in their respective areas (i.e., social, gender/GBV, and EIA). This will be done through monthly review and reporting of cases, analysis of the nature and types of disputes, quality of the deliberations and GRC process, and filing and records. In sum, the Specialists (Social Development, Gender/GBV, and Environment) will be responsible for:

- (i) Providing the Project Director, a monthly report detailing the number and status of complaints received and/or resolved
- (ii) Any outstanding issues to be addressed
- (iii) An analysis of the type of complaints and actions to reduce complaints in the Monthly Progress Report (MPR) of Social, Gender/GBV, and ESIA
- (iv) Electronic database providing retrievable records of complaints redressed

6.14.1.14 Evaluation of GRM Outcomes

With field verifications of effectiveness of the GRM system, desk studies will be available annually through a standard report. There will be an annual evaluation of the GRC processes by the Project Director (PMT) Office to determine the quality of the processes and operations and the outcome of cases by tiers, including analysis of the results. The external monitor will also look into the GRC cases as part of the overall safeguard evaluation under the RAP. The evaluation will consider all cases received and resolved and analyze the outcomes using relevant key indicators.

7 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND THEIR MITIGATION MEASURES

7.1 GENERAL

This chapter identifies and analyzes the impacts arising from the project activities during all the stages of the project, i.e; design/pre-construction, construction and operation phases of the proposed project on the physical, ecological and socio-economic characteristics of the environment. Impacts significance is analyzed and appropriate mitigation measures are proposed to minimize adverse impacts.

7.2 EVALUATION OF IMPACTS

Keeping in mind benefits (positive impacts) foreseen from the project, there are some potential significant adverse environmental and social impacts on the local environment. The proposed project is divided into three (03) stages i.e. Pre-construction/Planning and Design Stage, Construction Stage and Operation and Maintenance (O&M) Stage.

Based on the reconnaissance survey, stakeholder consultations and consultant's experience, the potentially significant constraints or issues associated with the proposed project have been identified and characterize. **Table 7.1 and 7.2** presents the characterization of potential impacts of the proposed project activities for construction and O&M phases.

7.3 METHODOLOGY FOR IMPACT EVALUATION

The methodology adopted for the evaluation of the impacts included the following assessment tools;

- (i) Overlays; and
- (ii) Project impact evaluation matrix.

These tools were used to identify the significance and magnitude of the impact as well as the nature, reversibility, extent etc.

a) 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 acquisition, 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 ZOI, 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 EIA study for the quantification of the land use categories referred in Chapter 5.

b) Project Impact Evaluation Matrix

The Impact Evaluation Matrix was developed based on the various environmental settings categorized as physical, ecological and socio-economic environment likely to be affected by the proposed project actions. The impact evaluation was conducted for different phases of the project (design/pre-construction, construction and operational phases). The term “Impact” includes both adverse and beneficial impacts. The impacts are evaluated based on the nature of impact, magnitude of impact, sensitivity of the receptor and likelihood of occurrence. The significance of impact is evaluated based on variables like magnitude of Impact, probability of its occurrence and duration of Impact. 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.

The magnitude rating criteria of the impacts is described below with numerical values and relevant colour codes categorizing into negligible, low, medium

Positive Impact Score	Impact Significance	Negative Impact Score
0	Negligible	0
2 to 4	Low	2 to 4
5 to 8	Medium	5 to 8
9 to 12	High	9 to 12
>12	Very High	> 12

A project Impact Evaluation Matrix is given as **Table 7.1.** and **Table 7.2.**

Table 7.1: Impact Evaluation Matrix – Construction Stage

Environmental Component Project Component	Physical Environment					Ecological Environment					Socio Economic Environment								
	Soil (Erosion / Stability / Contamination)	Air Quality	Noise Level	Surface & Ground Water Quality	Waste Generation	Aquatic Flora and Fauna	Terrestrial Flora and Fauna	Endangered Species	Migratory Birds	Loss of Trees	Public Infrastructure	Public Access	Impact on Physical and Cultural Structures	Tourism And Recreation	Gender Facilitation	Health & Safety	Security Situation	Employment Opportunities	Disturbance of Livelihood
A. Construction Phase																			
ROW/ Site Clearance Demolition of Jam Sadiq Bridge	9	9	9	4	8	2	10	0	0	9	6	9	0	2	0	9	0	6	9
Relocation of Utilities	2	2	2	2	2	0	2	0	0	2	10	8	2	2	0	9	0	2	2
Earthwork in Filling and Excavation	10	10	10	4	9	2	8	0	0	2	4	6	0	0	0	9	4	8	0
Establishment of Construction Camps & Workshop	2	2	4	2	6	0	4	0	0	2	0	0	0	0	0	0	0	2	0
Transportation & Storage of Construction Materials	4	6	6	2	4	0	2	0	0	0	0	0	0	0	0	6	0	4	4
Use of Construction Material and Heavy Machinery	5	8	9	2	4	2	6	0	0	0	0	2	0	0	0	8	0	4	0
Installation and operation of Batching and Asphalt Plants	5	8	8	2	4	0	4	0	0	0	0	0	0	0	0	8	0	4	0
Spoil Disposal	4	4	0	4	10	0	6	0	0	0	0	0	0	0	0	4	0	2	0
Structural & Civil Work	8	8	8	6	10	2	6	0	0	0	0	2	0	0	0	9	0	8	0
Storage of Chemicals and fuels	5	2	0	2	6	0	2	0	0	0	0	0	0	0	0	6	0	0	0

Positive Impact Score	Impact Significance	Negative Impact Score
0	Negligible	0
2 to 4	Low	2 to 4
5 to 8	Medium	5 to 8
9 to 12	High	9 to 12
>12	Very High	> 12

Table 7.2: Impact Evaluation Matrix – Operation Stage

Environmental Component Project Component	Physical Environment					Ecological Environment					Socio Economic Environment								
	Soil (Erosion / Stability / Contamination)	Air Quality	Noise Level	Surface & Ground Water Quality	Waste Generation	Aquatic Flora and Fauna	Terrestrial Flora and Fauna	Endangered Species	Migratory Birds	Loss of Trees	Public Infrastructure	Public Access	Impact on Physical and Cultural Structures	Tourism And Recreation	Gender Facilitation	Health & Safety	Security Situation	Employment Opportunities	Disturbance of Livelihood
B. Operational Phase																			
Operation of Buses	0	5	2	0	6	0	0	0	0	0	0	12	0	8	12	2	2	12	0
Operation of Stations	0	0	6	2	10	0	0	0	0	0	0	0	0	0	12	2	2	12	0
Operation of Depots	2	4	6	2	8	0	0	0	0	0	0	0	0	0	0	2	2	8	0
Maintenance of Miscellaneous Work	2	5	6	0	8	0	0	0	0	0	2	2	0	0	0	4	2	8	2

Positive Impact Score	Impact Significance	Negative Impact Score
0	Negligible	0
2 to 4	Low	2 to 4
5 to 8	Medium	5 to 8
9 to 12	High	9 to 12
>12	Very High	> 12

7.4 POTENTIAL BENEFICIAL IMPACTS

The Yellow Line Bus Rapid Transit System has following positive impacts;

- BRT replaces old vehicles, reduces traffic congestion and thereby lowers greenhouse gas emissions.
- Enhancing commuters' productivity by ensuring safe and stress-free transit to their destinations.
- Shift of passengers from private to public mode of transport will help improve road safety for drivers, pedestrians, and cyclists. Dedicated bus lanes and improved driver training further contribute to safer roads.
- Provision of transportation system accessible to all genders, promoting inclusivity and equal opportunities for everyone.
- Creating economic opportunities within the community, offering jobs and fostering small businesses in the transport sector.

7.5 ADVERSE IMPACTS DURING PLANNING AND DESIGN PHASE

This section provides detail of potential environmental impacts of construction and the operational phases of the Yellow BRT project.

7.5.1 Infrastructure Design (Water Supply, Storm water & Wastewater Treatment)'

Potential Impact

The design of project infrastructure including water supply to the stations and depots, storm water & wastewater (generated from depots and stations) treatment is very important for the implementation of project. Ineffective operation of such facilities may have adverse impacts like unhygienic conditions, foul odour, pooling of water, or breeding ground for disease vector. The impact is high adverse in nature. The sensitivity is high as infrastructure failures may lead to stagnant water that server has breeding ground for disease vector and foul odours. It also will affect successful operation of BRT Service.

Mitigation Measures

- Ensure continuous supply of water and water conservation strategies shall be incorporated in design.
- Wastewater shall not be discharged without prior treatment. Wastewater treatment facilities shall be incorporated in design.
- Ensure that the existing drainage system is clean and free from debris and can withstand the storm water generated during rainfall and relocation/ new drains shall be designed considering rainfall intensity, land use pattern, topography of the project and catchment of the adjacent area, and type of structures within the project area.
- For storm water drainage at Bus Depots, the surface of depots has been graded/ sloped in such a manner that water will eventually flow on pavement surface towards the nearby existing or proposed drains. However, if there is a need to provide any drain considering the layout, sheet flow on pavements or any other factors, then it must be addressed at detail design phase.
- Based on the catchment/contributing area of underpasses, sumps along with pumping arrangement including all necessary appurtenances have been provided in design to dispose the collected water in to the nearby existing or proposed drain.

7.5.2 Seismicity

Potential Impact

The Project Area is located 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 on the basis of Peak Ground Acceleration (PGA). A low to moderate intensity earthquake impacting the project site can adversely impact the development. This impact can be categorized as direct, medium, site-specific, long term, permanent, medium probability and irreversible. The impact significance is High adverse. The sensitivity of receptors (structures and public) is high as structures stability will be affected with the hazard in case of such event.

Mitigation Measures

The proposed project 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.

7.5.3 Public Utilities

Potential Impacts

Due to the proposed project, public utilities will be affected creating disruption of public services and inconvenience to the local residents. Various utilities such as Streetlights, roadside drains, signaling cables, water, sewerage and drainage pipelines, electric lines, Gas pipelines, Telephone lines, Mobile, telephone exchanges and fixed lines network, PARCO Line, NRL line, PRL Line are situated within the ZoI of the proposed project. These utilities will be relocated before the start of construction activities. These utilities if not handled properly will cause difficulties to the people of Project Area. This impact can be categorized as high adverse. The receptor for this impact is public and sensitivity is high as disruption in utilities may affect daily activities and main supply of fuel and Gas.

Mitigation Measures

Mitigation measures will include:

- The provision of relocation/rehabilitation in the design and project budget for the relocation of the existing public utilities wherever required shall be finalized in consultation with the concerned department;
- During the pre-construction phase, close coordination between contractor, consultant and stakeholders of all utilities is necessary to avoid any mishaps at project site. In particular, wherever the PARCO, PRL, NRL, SSGC, KE and KW&SC lines are lying, high level precautions shall be taken in liaison with these departments to avoid any possible damage which may impact the delivery of the project;
- Utilities shall be relocated and rehabilitated well ahead of start of construction works to avoid any inconvenience to the public;

- If utilities are accidentally damaged during construction, it shall be reported to the SMTA and utility authority, and repairs will be arranged immediately at the contractor's expense;
- The Project Team will conduct an extensive public information campaign and inform the public about any disruptions in advance, and their relocation/repair will be ensured in shortest possible time; and
- Timely public notification of unexpected disruption of services.

7.5.4 Flora

Potential Impacts

As discussed in baseline, verity of trees may be disturbed due to propped project activates. Proposed construction work will have impacts in the proposed ROW, trees coming within the ROW may be cut down.

Mitigation Measures

- Green areas/trees should be avoided during design and alternate route, best possible must be considered. The urban trees importance is very high these bird's habitats should be kept undisturbed and its development is important instead of cutting and damages.
- Only barren lands or lands with minimum vegetation shall be selected for the above-mentioned purposes.
- Incorporate technical design measures to minimize removal of trees and loss other green areas. Road alignment shall be designed or changes made as far as possible in a way to keep the tree loss to its minimum level.

7.5.5 Land Acquisition and Resettlement

Potential Impacts

The proposed BRT system will be developed within the exiting ROW. Project components along the corridor and the feeder and direct services routes in the catchment areas such as: minor road works, construction of bus shelters, rehabilitation of utilities, segregated bus-ways, interchange facilities, stations and bus shelters, terminal and depots, facilities for pedestrians, motorcyclists and non-motorized transport will not involve new land acquisition.

The required ROW has been considered wall to wall whereas, the land ownership record is not yet received from the Client. In case of additional land required, the detail of land under the impact and record of ownership status will be prepared by the Revenue Department. Furthermore, there may be issues in the clearance of existing RoW. Moreover, different types of commercial structures, (plant nurseries. shops and moveable structures) will be impacted due to clearance of RoW for the project activities.

The construction activity may disturb the business and livelihoods of the workers doing their businesses along the alignment due to the excavation activities. There are various categories of commercial activities along the proposed route of BRT Yellow Line in the ROW

and off-Corridor. The owners of the commercial structures will have a temporary impact on sources of livelihood until the re-establishment of their business in a new location. This impact will be, temporary and adverse in nature. This impact will be permanent and low adverse in nature.

Mitigation Measures

The Land Acquisition Act (LAA) of 1894 is the main law regulating land acquisition for public purpose. This impact can be mitigated by ensuring compliance of Land Acquisition Act, 1894, addressing community grievances on priority basis and timely compensation to affectees. The process of land acquisition and compensation should be followed in a transparent manner to minimize the impacts to provide judicious compensation to the displaced by providing sufficient budget in the project cost. According to Land Acquisition Act 1894, the following points are to be considered while determining compensation for the project affectees:

- The market value of land at the date of publication of notification under section 4 sub section (1);
- The damage sustained by the person interested, by reason of the taking of any standing crops, or trees which may be on the land at the time of the collector's taking possession thereof;
- The damage if any sustained by the person interested at the time of the collector's taking possession of the land by reason of acquisition injuriously affecting his other property, moveable, or immovable, in any other manner, or his earning; and
- As a consequence of the acquisition of the land by the collector, the person affected is compelled to change his residence or place of business, the reasonable expenses incidental to such change.

Therefore, compensation should be made to the affected people as per Land Acquisition Act, 1894, provincial rules and market value for the loss of assets. Adequate budget will be provided in the project cost for this compensation.

7.5.6 Temporary Acquisition of Land

Potential Impacts

The Contractors will require temporary land acquisition for:

- The development of Contractor camps and facilities i.e. storage, workshops, equipment parking and washing areas;
- Aggregate quarries; and
- Access roads/tracks for haulage, transportation etc.

The approximate area required for the establishment of one Contractor's camp facility will be about 1500m² at the different locations. This impact can be categorized as direct, site-specific, short term, temporary, medium probability and reversible.

Mitigation Measures

Land for above mentioned facilities will be directly rented from the private landowners by the

Contractors. 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. In addition, these project facilities should be finalized at available minimum distance with consultation of SMTA. It will be make sure that respective site should be on a safe distance from the existing settlements, built-up areas, and cultural monuments (if any) as the case may be. Prior to the commencement of the construction activities, the Contractor should submit a construction camp development/management plan to the Engineer-incharge and the SEPA (if required) for its scrutiny and approval. As far as possible, vacant available land i.e. areas not under commercial or residential use and natural resources should be used for setting up the contractor camps.

7.5.7 Impact on Commercial, Moveable Structures and Livelihood

The impact on Commercial, Moveable Structures and Livelihood may be disturbed during construction activities of the project as there are many commercial activities are going on along the alignment. The impacts will be of high adverse nature.

Mitigation Measures

Following measures shall be adopted to mitigate the adverse impacts:

- Livelihood restoration compensation shall be paid to mitigate the adverse impacts on livelihood and restoration of commercial activities;
- Compensation of the structures should be evaluated and provided as per market rates;
- Affected Persons (APs) should be compensated on full replacement cost of each category to construct a new structure of the same type;
- Compensation of livelihood disturbance should be provided for the period of instruction of commercial activities;
- The effort will be made through changes in design to avoid the sensitive and religious structures and to minimize the issues at possible extend. If needs demolishing, a mechanism will be developed for the restoration of these structures during the detailed design and during construction with the community consultation; and
- Proper consultations and coordination's with APs during resettlement process.

7.6 ADVERSE IMPACTS DURING CONSTRUCTION STAGE

7.6.1 Construction campsites and Contractor Facilities

Potential Impact:

The construction camp activities will result in consumption of water estimated as in 20,000 L/capita/day and Generation of waste estimated as 250 kg/person and runoff from the camp site due to washing and maintenance of machinery. The impact is high adverse in significance and sensitive due to contamination and depletion of water whereas the receptor of solid waste is public due to nuisance, odour and breeding ground for disease vector and sensitivity of the receptor is high.

Mitigation Measures:

The Contractor will provide for those living onsite food preparation and sanitation facilities, potable water supply, common dining rooms, canteens, rest rooms and health facilities, and solid/liquid waste management in accordance with Sindh Government regulations and ILO standards

The location and development of the contractor's facilities (this applies to all types of facilities, storage areas, workshops, and labor camps) will be approved by SMTA. Locations will be selected so that it does not interfere with the environment and social well-being of the surrounding communities in respect to noise, dust, vibration and other physical impacts. The construction labor camps will be located away from the nearest habitation. The size of contractor's facilities will be limited to absolute minimum to reduce unnecessary clearing of vegetation. The residual impact will be low to medium adverse.

After the completion of construction activities at each site, all construction camp facilities will be dismantled and removed from the site. The site will be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

- Oil and fuel contaminated soil will be removed and transported and buried in waste disposal areas.
- Soak pits, septic tanks will be covered and effectively sealed off.
- Debris (rejected material) will be disposed of suitably.
- In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this specification. The rehabilitation is mandatory and will be included in the agreement with the landowner by the contractor. Also, the contractor would have to obtain a certificate for satisfaction from the landowner.

7.6.2 Clogging of Wastewater Drains**Potential Impact:**

There are chances of wastewater drains clogging during construction activities, particularly at 8000 Road (Korangi Road) where wastewater drains exist at shoulders and chowrangis intersecting the roads. Clogging of drains will result in overflowing, ponding, outbreak of diseases, and nuisance at the area. This situation will also disturb the traffic of the area and the construction activities and cause chaos. The impact is high adverse in nature and the sensitivity of receptor is high.

Mitigation Measures:

It will be very important for the contractor to protect the drainage, particularly existing at the chowrangis (roundabouts) and intersecting the roads. These drains carry the industrial and domestic wastewater for disposal. Clogging of these drains will result into environmental, health and traffic problems. Prior to start construction activities close to the drainage

network, the contractors should take all precautionary measures to first protect the drains by covering it and avoiding throwing any construction debris in it. The residual impact will be medium adverse.

7.6.3 Impact on Malir River

Potential Impact:

The river water quality is already compromised; however, the construction and demolition activities will result in increase in sediment loading of the River. The impact is high adverse in nature. The sensitivity of Malir River is moderate.

Mitigation Measures:

The construction and demolition activities shall be conducted as per best management practices and protection of Malir River quality shall be ensured. Malir River Management plan is attached as **Annexure-VII**.

7.6.4 Excavation at construction sites

Potential Impact:

The project involves considerable excavation. The excavation will result in soil erosion, generation of spoil, increase in Particulate Matter deteriorating air quality and resulting in health impacts of public and hindrance in traffic flow, chances of the damage to physical cultural resources (PCRs). Soil collapse and erosion may pose risks to workers in and around excavations. Deep excavations will be done at Murtaza Chowrangi, Singer Chowrangi, Sunset Boulevard and Tariq Road. The impact is high adverse and sensitivity of air and noise receptors is high.

Mitigation Measures:

- Regularly inspecting excavation sites to identify and address any signs of soil instability or other hazards.
- Monitoring weather conditions and adjusting work practices to maintain a safe work environment.
- Providing workers with comprehensive safety training, including proper excavation techniques, hazard recognition, and safe work practices
- The excavations will be protected with necessary barriers and signs to restrict entry of unauthorized person and falls etc.
- Excavated material shall be covered while storage and transport.
- If any previously unidentified artifact or site with potential importance is discovered, chance find procedure shall be adopted. (**Annexure-VIII**)

7.6.5 Operation of batching and asphalt plant

Potential Impact:

Operation of batching and asphalt plant will result in emissions including volatile organic compounds, carbon monoxide particulate matter resulting in problems like: respiratory problems, headaches, and other health issues the workers working at road construction activities and public. Major sources of asphalt fumes are asphalt plant and spraying of asphalt on the roads. The impact is high adverse in nature. The sensitivity of receptor (workers and public) is high.

Mitigation Measures:

- The contractor may preferably select to purchase from already established facilities for which emission controls are in place. In case, the contractor sets up temporary facilities, a distance of at least 500 m from any sensitive receptor must be ensured;
- The workers will use appropriate respiratory protection devices to avoid inhalation of the asphalt fumes and particulate matter. The workers, handling the asphalt and batching plant, will also use safety gloves, apron and shoes to prevent dermal exposure to the workers;
- The application temperature of the heated asphalt will be kept as low as possible to avoid generation of fumes;
- Mobile asphalt plants shall be equipped with emission control device to capture particulate emissions;
- Emissions from the asphalt paving plant shall not cause an offensive odour;
- A log will be maintained about problems occurring at the asphalt plant, and the corrective or maintenance actions taken to resolve the problems.

7.6.6 Flooding due to Rainfall

Potential Impact:

Flooding is a serious issue of Karachi during rainy season due to improper storm water drainage system in the city. Flooding can result in stopping of the construction activities and may pose risk to workers, equipment and the completed structures. The impact is high adverse in nature. The sensitivity of receptors (workers and public) is high.

Mitigation Measures:

- The contractor will ensure drains are not blocked/clogged due to construction waste and sediments.
- The contractor will ensure protection of equipment and workers from hazards.
- The construction activities must be stopped in event of heavy rainfall

7.6.7 Stack Emission from Generators and Construction Vehicles

Potential Impact:

The stack emission from generators (used as standby source of electricity) and construction vehicles at construction and camp sites will result in emission of combustion gases of concern such as CO_x, NO_x and SO_x which can contribute in city's pollution. The improperly maintained generators and vehicles can also result in air emission of unburnt carbon particles, hydrocarbon etc. which could badly affect the ambient air quality of the city. The

impact is high adverse in nature. The sensitivity of receptors public and workers is high.

Mitigation Measures:

The stack emissions from generators, if used as standby source of power supply and vehicular/machinery movement at the site can affect the ambient air quality at project site. It will be the responsibility of the contractor to use well maintained generators and vehicles/machines to keep ambient air quality within the desired level. The contractor will be required to provide fitness certificate/maintenance records of the generators, vehicles and machines before deploying them at the construction sites. Regular monitoring of vehicular and stack emissions will be carried out at each site, to ensure the regulatory compliance with SEQS. The residual impact will be low to medium adverse in significance.

7.6.8 Dust Emission

Potential Impact:

Construction activities (excavation, demolition, surface cleaning, material dumping and mixing), vehicular and machineries movement) generate dust at construction sites. Airborne dust presents serious risks for human health. Dust particle size is a key determinant of potential hazard to human health. Particles larger than 10 µm are not breathable, thus can only damage external organs, mostly causing skin and eye irritations, conjunctivitis and enhanced susceptibility to ocular infection. Inhalable particles, those smaller than 10 µm, often get trapped in the nose, mouth and upper respiratory tract, thus can be associated with respiratory disorders such as asthma, tracheitis, pneumonia, allergic rhinitis and silicosis. However, finer particles may penetrate the lower respiratory tract and enter the bloodstream, where they can affect all internal organs and be responsible for cardiovascular disorders.¹⁰ The impact is high adverse and the sensitivity of receptors (Public and Workers) is high.

Mitigation Measures:

Regular water sprinkling will be the responsibility of the contractor at the dust generation points, during construction activities. The water will be also sprinkled at vehicular and machinery movement routes to avoid dust spreading to the nearby community. In addition, the provision of dust masks and ensuring their use by the workers will also be the responsibility of the contractor under CPEMP. The impact will be low adverse in significance.

7.6.9 Discharge of Sanitary Wastewater from Construction Camps

Potential Impact:

Sanitary wastewater will be discharged from construction camps. If this wastewater is not

¹⁰ World Meteorological Organization: Airborne Dust: A Hazard to Human Health, Environment and Society by Enric Terradellas, Slobodan Nickovic and Xiao-Ye Zhang

properly treated and disposed then it can cause different kind of environmental impacts. These impacts can be the i) soil contamination if wastewater is disposed on open land, ii) breeding of mosquitos and flies and outbreak of diseases for workers and nearby community, if ponding occurs for extended period, iii) water contamination if it is not disposed properly and mixed with the drinking water supply lines. The impact is high adverse in nature. The sensitivity of receptors is high as workers will be directly impacted and public may be affected by nuisance, odour and disease.

Mitigation Measures:

Generally proper disposal of sanitary wastewater is not practiced during construction at construction camps. It will be the responsibility of the contractor to dispose sanitary wastewater in a nearby drain after passing it through septic tanks. The contractor can also plan to include temporary septic tanks for the construction crew. Soil Contamination at Construction and Camp Sites

Potential Impact:

There are chances of soil contamination at construction and camp sites due to following reasons:

- Placement of containers of fuel, oil, solvent, paint etc. directly on unpaved floor without any containment and rain protection
- Spillage of fuel, oil, solvent, paint etc. during pouring and improper handling
- Leakages from the containers placed directly on unpaved floor without any containment
- Leakages of oil and fuel from vehicles and generators on unpaved and unprotected floors
- Maintenance of machines, vehicles and generators
- Placement of oily parts on unpaved floor
- Placement of hazardous solid waste on unpaved floors (empty containers of fuel, oil, paint, oily rags, discarded oily parts etc.)

Soil contamination is high adverse impact. Sensitivity of receptor is moderate.

Mitigation Measures:

Soil pollution will be controlled by taking following measures:

- Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 15 cm thick, done on brick edge flooring lined with polyethylene sheet
- Placement of fuel containers under containment and proper decantation arrangement to avoid its spillage and leakage on floor
- Presence of spill kit to remove spills from the floor
- Washing the contaminated floors through dry cleaning the spills from the floor with saw dust and rags

- Fuel storage and refilling areas will be located at safe distance from all cross-drainage structures and important water bodies

7.6.10 Waste at Construction Site

Potential Impact:

Following types of solid waste will be generated from construction and camp sites:

- Generation of general waste
- Generation of spoil
- Empty containers of chemicals
- leftovers chemicals
- Paints, Wood, Glass

The estimated spoil quantities are 130600 cubic meters. In case the solid waste is not properly collected, stored and disposed at appropriate place, then it can result in i) nuisance at the sites, ii) odor and breeding of mosquitos and flies and outbreak of diseases iii) inconvenience for the passersby. The impact of solid waste is high adverse impact. The sensitivity of receptors (workers and public) is high.

Mitigation Measures:

General Waste

The construction contractors will implement a Waste Management Plan. At a minimum, the plan will address the sources of waste; waste minimization, reuse, and recycling opportunities; and waste collection, storage, and disposal procedures. The Waste Management Plan will address waste including general and hazardous waste. In addition, the Waste Management Plan will address the following:

- All food waste will be contained in covered bins and disposed of on a frequent basis to avoid attracting wildlife.
- Trash bins will be accessible at all locations where waste is generated.
- The project area will be kept clean and free of litter and no litter will be allowed to disperse to the surrounding area.
- Solid waste will be removed from the site and transported to a municipal landfill or disposal site.
- Waste will not be dumped or buried in unauthorized areas or burned.
- The construction contractors will ensure all workers receive training on proper disposal of all waste prior to working on the project site.

Hazardous waste:

During construction activities different types of hazardous solid waste including empty containers of paint, lubricants, grease, fuel etc. oil filters, oily rags and construction waste are generated. The hazardous waste will be properly collected and stored at impervious surface under shade. This waste will be handed over to the authorized waste collectors so

that these could be disposed of properly. The Waste Management Plan will specify the proper management procedures for all hazardous materials and wastes that may be encountered during construction, including handling, labeling, transporting, and storing procedures.

In addition, the plan will address the following:

- Non-toxic and biodegradable produces will be used whenever possible.
- Hazardous materials will be transported and stored in appropriate containers with clearly visible labels. Hazardous materials will be stored at least 30 meters from any down gradient drainage or within secondary containment capable of containing its entire volume.
- Storm water flows will be directed away from hazardous material storage areas.
- Equipment and work areas will be regularly inspected for signs of leaks and spills. Spill containment and cleanup kits will be available wherever hazardous materials are being used or stored. Any incidental spills or leaks will be contained and cleaned up as soon as it is safe to do so. Any contaminated soil will be collected and disposed of in an appropriate land fill.
- Equipment refueling and maintenance will be limited to designated areas at least 30 meters from any down gradient drainage.
- All workers will receive training on proper handling and storage of hazardous materials, as well as spill response and cleanup procedures, prior to working on the project site.
- The debris produced during construction will preferably be dumped at nearby depressions. Leftover material will not be dumped into storm water drains or watercourses to avoid clogging man-made and natural drainage systems and cause many other problems for the residents.

Waste Management Plan is attached as **Annexure-IX**.

7.6.11 Existence of Electric Pylons

Potential Impact:

After Murtaza Chowrangi to Jam Sadiq Bridge (about 5-6 km), electricity pylons run along the alignment, covering the entire median. These pylons can be potential safety hazards for human beings. **Plate 7.1** shows the location of the electric pylons at the median of the road. The impact is high adverse in nature.



Plate 7.1: Electric Pylons at Median of the Road

Mitigation Measures:

Safety distances are required from electric pylons and high-tension lines. BRT must be kept away from high tension lines of each side at least 3 m horizontally for human safety in case of conductor fall. The standard minimum vertical ground clearance from the point of maximum sag is 9.5 meters. In case of pedestrian crossing bridges, keeping a clearance of 4.5 m, an insulation barrier for 145 kV must be provided for health and safety of humans. The residual impact will be medium adverse in nature.

7.6.12 Safety Hazards for Workers and Nearby Community

Potential Impact:

Construction sites and activities pose safety hazards to the workers and nearby community. Construction activities involve heavy machineries, sharp tools, welding, falling of material handling, working at height and in narrow spaces, handling hazardous material etc. There are safety hazards at workplaces if workers are not protected properly and appropriate safety measures are not in place.

The construction sites are also safety threat for the nearby community and passersby due to haphazard placement of machineries, sharp tools, and heavy material, and open trenches. Situation becomes very dangerous during rainy season when passage is slippery and open trenches are filled water. The impact is high adverse in nature. The sensitivity of receptors (public and workers) is high due to risk of the hazards involved.

Mitigation Measures:

Workers from Health and Safety

The contractor will be required to take all possible precautionary measures for the safety of the workmen as per the national/provincial and World Bank requirements. Contractor has to ensure that all operators of heavy or dangerous machinery are properly trained/certified, and also insured. The contractor will supply all necessary safety appliances such as safety goggles, helmets, masks, safety shoes etc., to the workers and staff. The contractor has to comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. Workers, who are engaged in welding activities, would be provided with welder's protective eye-shields. Medical facilities will be provided to the labor at the construction camp. Suitable transport will be provided to take injured or ill person(s) to the nearest approachable hospital. First Aid Box will be provided at every construction campsite and under the charge of a responsible person who will always be readily available during working hours. The contractor will be responsible for providing safe drinking water and for implementing appropriate sanitation conditions, and for supplying hygienic food and a sewerage system for the construction team at the site.

The risk of fires will be evaluated for each project site based on the activities that would occur, environmental conditions, and presence of ignitable or combustible materials in the area. If the activities pose a risk of igniting a wildfire, appropriate fire prevention and response equipment will be made available at each active site such as shovels, axes, fire extinguishers, and dedicated water tanks. All workers will be trained on proper fire prevention and response procedures prior to working on the site. Any smoking on site will be restricted to barren areas away from ignitable or combustible material. Smoking waste will be fully extinguished and disposed of appropriately.

The workers will use appropriate respiratory protection devices to avoid inhalation of the asphalt fumes. The workers, handling the asphalt, will also use safety gloves, apron and shoes to prevent dermal exposure to the workers. The application temperature of the heated asphalt will be kept as low as possible to avoid generation of fumes. The engineering controls and good work practices will be used at all work sites to minimize worker exposure to asphalt fumes.

Occupational Health Safety Plan is attached as **Annexure-X** for construction phase.

Community Health and safety:

The construction activities, particularly the excavation, will not be carried out during rainy season to avoid any accident. The excavated areas will be properly cordoned off, and warning and safety signs will be posted at accident prone areas to warn the passersby the potential danger at the construction site. The traffic will be diverted well before the construction area as per the traffic management plan. The construction contractors will install temporary signs and fences around all unsafe areas to prevent members of the public from entering the areas. If installing fences is not feasible, the area will be clearly identified as unsafe with signs and flagging.

7.6.13 Noise from Construction Activities

Construction activities generate noise from construction machineries, vehicles, material loading and unloading and construction activities. **Table 7.3** gives information about the noise from different construction equipment.

Table 7.3: Typical Noise Levels from Construction Equipment

Equipment	Typical Noise Level (50 m from Source)
Air Compressor	81
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane Derrick	88
Crane Mobile	83
Dozer	85
Generator	81
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	85
Paver	89
Pile Driver (Impact)	101
Pile Driver (Sonic)	96
Pneumatic Tool	85
Pump	76
Rail Saw	90
Rock Drill	98
Roller	74
Saw	76
Scarifier	83
Scraper	89
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Truck	88

Source: Chapter 12 of the FTA Transit Noise and Vibration Guidance Handbook

As per Sindh Environmental Quality Standards (SEQS), the noise limits are as given in Table 7.4

Table 7.4: Noise Standards as per SEQS

Sr. No.	Category of Area	SEQS	
		Day Time	Night Time
1	Residential Area	55	45
2	Commercial Area	65	55
3	Industrial Area	75	65
4	Silence Zone	50	45

Noise is considered as an interference to and imposition upon comfort, health and the quality of life. It can have both physiological as well as psychological effects on human beings. These effects include dizziness, nausea, unusual blood pressure variation, physical fatigue, hearing impairment and, in acute cases, permanent hearing loss. The psychological effects may comprise reduced efficiency and irritations. Chronic exposure of workers to higher noise levels also impairs their efficiency and skill. The impact is high adverse in nature. The sensitivity of receptors (community and worker) is high.

Mitigation Measures:

- Carry out regular inspections and maintenance of the construction vehicles and equipment.
- Replace worn and noise producing parts of construction machinery in a timely manner.
- In case of severe noise, sound barriers will be installed to avoid the dispersion of sound waves into the nearby community.
- Workers will use noise protection equipment when working in a noisy area.
- The noise level of 85 dB (A) for 8 hour working, is considered safe for the workers. The contractors will ensure keeping noise levels within safe limits. In case of higher noise levels (more than 85 dB (A)), the workers will be rotated. The workers at higher noise level areas will not be allowed to work for more than two to three hours and shifted to calm places for rest of the hours.
- Vehicles and machineries will not be allowed to operate at project site at night.
- Noisy machines and vehicles will not be allowed to be used at the project site (noise level should not be more than 85 dB (A) at 7.5 m distance).
- Frequent monitoring of vehicular, machines and ambient noise levels at the project site will be conducted to ensure compliance with the SEQS.
- It will be ensuring that workers wear noise protection gadgets at noisy areas.
- Appropriate noise barriers and enclosures will be installed to attenuate noise levels

7.6.14 Fire at Construction Camps

Potential Impacts:

There can be chances of fire hazard at construction camps. The flammable material placed at campsites such as fuel, solvent, lubricants, paints, gas cylinders etc. There can be sources of fire outbreak such as cooking, smoking and electrical short circuiting. Fire hazard can result in the loss of property and life. The impact is high adverse in nature. The sensitivity is high for Workers and nearby community.

Mitigation Measures:

The risk of fires will be evaluated for each project site based on the activities that would occur, environmental conditions, and presence of ignitable or combustible materials in the area. If the activities pose a risk of igniting a wildfire, appropriate fire prevention and response equipment will be available at each active site such as shovels, axes, fire extinguishers, and dedicated water tanks. All workers will be trained on proper fire prevention and response procedures prior to working on the site. Any smoking on site will be restricted to barren areas away from ignitable or combustible material. Smoking waste will be fully extinguished and disposed of appropriately. Workers will be protected from asphalt fumes during road construction by using appropriate measures.

Emergency Response Plan are given as **Annexure-XI** for construction phase.

7.6.15 Traffic Congestion**Potential Impacts:**

Road side construction activities affect traffic flow at or near construction sites. Traffic congestion is the serious concern for the public at construction sites as it disturbs their daily routine. Major reason for traffic congestion and inconvenience for the general public is the poor traffic management planning and enforcement by the local authorities. The impact is medium to high adverse in nature. The sensitivity is high for receptors (commuters).

Mitigation Measures:

The traffic control plans will contain details of temporary diversions at different locations. Temporary diversion for road traffic will be constructed with the approval of the SMTA. Following measure will be taken during construction for the management of traffic of the specific area:

- Traffic management plan will be prepared in consultation with the local authorities as their support will be essentially required before or during the construction period.
- Encroachment at the shoulders and service roads will first be removed. The local authority will be informed well before the construction period and require its support.
- At Korangi Road, the median and the side roads are used illegally as parking bay, rest areas and workshop area, mainly by the transport trucks and trailers. All these unauthorized activities will be discouraged and disallowed well before the start of the construction. The support of local authorities will be required for this purpose.
- At each construction site, the side roads will be constructed first, without restricting the flow of the traffic on the main roads.
- After completing the side roads and connecting the new sewer lines, the construction at the median will be started with proper fencing and cordoning off the median.
- Simultaneous construction work on the chowrangi (roundabouts) or intersections and roads will be avoided by developing a construction phasing plan. In case, if in some cases simultaneous construction work at chowrangi and road will be essentially required then it will only be done at alternate chowrangi i.e. construction work at two nearby chowrangies will not be started simultaneously. If one chowrangi is under

work, then traffic can be moved towards other chowrangi, otherwise if all the chowrangies are under work, then there will be no outlet available for the traffic.

- Road construction work will be executed in different packages. Only one site, at a time will be started and completed instead of initiating work at all the locations. Traffic management will be easy at one site as compared with as if the whole corridor is under construction work.
- Construction staging plan will be prepared after consulting other project proponents and local authorities (Green Line/Red Line, KWSB, Local Government) to avoid any haphazard conditions for traffic flow at any specific site.
- The traffic diversion plan will be effectively disclosed and communicated to the public. The public will be intimated well before time through print and electronic media for traffic routes closures and diversions.
- There will be proper arrangement for traffic management such as flagging, detouring signs, flagmen, safety signs, road barriers, road stoppers, diversion signs, lighting, fences etc. and,
- Well organized placement and parking of construction machines, vehicles and material to avoid traffic flow restriction and any kind of accident at the site.

Temporary Traffic management plan is given as **Annexure-XII**.

7.6.16 Climate Change Impacts

i. Extreme Temperatures

Impacts

Heat waves pose significant risks to equipment, materials and construction workers.

- Heat waves can cause environmental impacts such as soil instability and issues with concrete curing.
- Heat waves pose significant risks to construction workers, including heat-related illnesses like heat exhaustion and heatstroke.
- High temperatures and physical exertion can decrease worker productivity and lead to safety hazards.
- Impacts on materials and equipment performance, including malfunction, can result in project delays and increased costs.

The impact is moderate to high adverse in nature. The sensitivity is high for Workers materials and equipment.

Mitigation Measures:

Mitigation measures include following:

- Train workers and supervisors on recognizing heat-related illness signs, proper hydration, taking breaks in shaded areas, and emergency response.
- Schedule strenuous tasks during cooler times, like early mornings or evenings. adjust work hours to avoid peak heat.
- Implement regular breaks in shaded or air-conditioned areas for rest and hydration.

- Install shade structures and use umbrellas or tarps to reduce direct sun exposure.
- Ensure access to cool water throughout the site with hydration stations.
- Provide breathable, light-colored clothing and encourage hats and sunglasses for sun protection.
- Use portable fans, misters, or cooling vests for worker comfort. Consider air conditioning in rest areas or vehicles.
- Stay informed about weather forecasts and heat stress indices to plan work accordingly.
- Develop and communicate a plan for handling heat-related emergencies.
- Assign supervisors to monitor workers for signs of heat stress and ensure safety compliance.
- Implement changes to reduce heat exposure, like using reflective materials or job rotation.

ii. Urban flooding

Impacts:

Urban flooding due to rainfall at construction sites can have several significant impacts, including:

- Floodwaters can damage construction materials, equipment, and structures at the site. Excessive water can weaken foundations, erode soil, and compromise the integrity of buildings under construction.
- Flood events can halt construction activities, leading to delays in project timelines. Cleanup and repair efforts may also prolong the delay, impacting overall project completion dates and potentially incurring additional costs.
- Floodwaters pose safety risks to construction workers, including the risk of drowning, slips, trips, and falls. Debris carried by floodwaters can also cause injuries and create hazardous conditions at the site.
- Urban flooding can lead to the discharge of pollutants, sediment, and construction materials into nearby water bodies, causing water pollution and environmental degradation.
- Floodwaters may contain contaminants such as sewage, chemicals, and hazardous materials, posing risks to public health if not properly managed. Waterborne diseases and infections can spread through contact with contaminated floodwaters.
- Flooding can damage roads, bridges, and utility infrastructure surrounding the construction site, affecting access to the site and disrupting essential services such as water supply, electricity, and transportation.

The impact is moderate to high adverse in nature. The sensitivity is high for Workers structures and equipment.

Mitigation Measures:

To mitigate the impacts of urban flooding at construction sites, various measures can be implemented:

- Ensure proper drainage to direct rainwater away from construction areas and prevent pooling or flooding on-site.

- Erect temporary barriers or sandbags to protect construction materials, equipment, and structures from floodwaters during rainfall events.
- Emergency Response Plan shall include addressing flooding incidents, ensuring worker safety, and minimizing property damage.
- Monitor weather forecasts and rainfall patterns to anticipate potential flooding events and take proactive measures to mitigate risks.
- Provide training to construction workers on safety protocols and procedures to follow during flooding events, including evacuation routes and emergency response actions.

The residual impact will be low to medium adverse in significance.

7.6.17 Impact on Plants

Potential Impacts

- The Proposed Alignment/RoW passes through some green areas and approximately 10,050 trees/plants may be uprooted/cut as per the PHA inventory and further assessed by NESPAK as project design. The fairly large number of trees in urban area may be impacted. It shall cause a major negative impact on other flora and fauna.
- Establishment of contractors' camps and warehouses for storage of equipment, material etc. shall also involve, clearing of vegetation from the area, resulting in another minor negative impact;
- During the entire construction period, dust laden polluted air will form a dust film on the leaves thus blocking sunshine and stomata, thereby hindering photosynthesis process and consequently causing detrimental effect on the plant health;
- Exhaust of noxious gases from movement of heavy machinery will further pollute the air, which will adversely affect the health and vigor of plants; and
- Birds will try to find shelter and food somewhere else and will tend to move away from the project area due to the construction activities for fear of being hunted/trapped.

This impact will be of a temporary nature and moderate negative in nature. After implementation of the Tree Plantation Plan, loss of trees shall be compensated and the birds, who had earlier migrated to other destinations, shall return to their original abode. Tree Plantation Plan is attached as **Annexure-X-III**

Mitigation Measures:

- The indigenous trees most suited to the tract should be re-planted;
- Green areas will be compensated as per PHA, KMC standards.
- As recommended by PHA Trees will be compensated with **1:10 and thus 100,500** trees will be planted in the project area to recover the ecological losses and to compensate the possible impact on approximately **10,050** trees/plants.

- It is strongly recommended the trees which are possible to be uprooted and replanted must be considered by PHA. Tree cutting may be the last option which must be compensated as per plantation plan given in the report.
- The plantation of trees will be started immediately after the uprooting or cutting.
- Only native plants will be considered for afforestation and replanting, exotic species must be discouraged.
- Along the native trees flowering and ornamental shrubs should be planted along the road to beautify the landscape. Planting would however be done keeping in view the principles of landscape designing;
- Reasonable compensation should be provided to stakeholder, including departments, land holder for the loss of their standing trees and other green assets at prevailing market rates to avoid financial losses;
- An awareness campaign targeting the local communities should be run to popularize the planting of trees;
- The contractor's staff and labour should be strictly directed not to damage any vegetation such as trees or bushes. They should use the paths and tracks for movement and should not be allowed to trespass through green areas;
- Construction vehicles, equipment's and machinery should remain confined within their designated areas of movement;
- Contractor should supply gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel should not be allowed;
- Camp sites and asphalt plants should be established on waste/barren land rather than on green productive land. However, if such type of land is not available, it should be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to the trees;
- Construction of new tracks should be avoided and existing tracks should be used to access the proposed road;
- Construction vehicles, equipment and machinery will remain confined within their designated areas of movement; and

A tree plantation program shall be implemented by the Sindh Government PHA, in the proposed RoW with the help of local Forest Department, or private contractor. Trees will be planted in the available space on both sides of the road and nearby areas.

7.6.18 Fauna Impacts

Potential Impacts

- The construction activities of project will become a source of harassment to the local birds dependent on trees.
- The activities injurious to birds visiting surrounding areas in search of food or rest, causing a negative impact.
- Increased water pollution from the construction activities will add adverse impact.
- Shooting, hunting, trapping or poaching of animals and birds should totally be banned within the Study Area, so as to minimize loss of fauna and overall

ecosystem.

- Implementation of such a policy will be the sole responsibility of concerned Government Departments, supported by the contractor.
- Periodic release of fingerlings of Tilapia and other suitable fish species in the river must be ensured for aiding nature enhancing, improving and maintaining a desirable level of aquatic life.

During construction stage noise and movement of heavy machinery for project construction, shall disturb the fauna, may also get killed or move to the adjoining areas. Trees provide resting and nesting places to the birds. Their removal shall have a negative effect on the fauna.

Mitigation Measures:

- Plantation of large number of trees along the proposed project to regain the ecological habitat;
- New and good condition machinery with minimum noise should be used in construction;
- Noisy work should not be carried out in night time so that there should be no disturbance to local birds and animals;
- Contractor should ensure that the no hunting, trapping of animals should be carried out during construction;
- Borrow pits should be fenced so that no animal can fall into these;
- The camps should be properly fenced and gated to check the entry of wild animals in search of eatable goods. Similarly, waste of the camps should be properly disposed off to prevent the chances of eating by wild animals, which may prove hazardous to them; and
- Special measures should be adopted to minimize impacts on birds such as avoiding noise generating activities during the critical period of breeding.
- Nest survey should be conducted by contractor prior to initiate the work/ removal trees, if any nest found same may be relocated with help of wildlife expert.
- No activates may be executed in breeding seasons to avoid impacts on new born.

7.6.19 Potential Impacts on Parking Spaces in Narrower Sections

Potential impact

The service lanes of the existing main corridor and off-corridors particularly in the industrial area and other different locations are presently being utilized for the parking of the vehicles. In the narrower part of the road alignment from Future Colony to Dawood Chowrangi Depot there are shops on both sides of the existing route. These shops will be potentially impacted due to construction activities. Consultations with drivers and owners of parking vehicles were conducted to take their opinion about alternate parking locations during and after construction of BRT. In order to avoid or to minimize potential impacts following mitigation measures are suggested.

Mitigation Measures

- The factory owners should provide alternate vehicle parking place;
- Rerouting of heavy trucks plying on the route towards port locations;
- Build separator between walkway and motor vehicle lanes;
- SMTA needs to develop a parking policy for the BRT corridor to provide parking facility to the public for safe and an organized parking of their vehicles along the BRT corridor to avoid traffic congestion and other hazards; and
- Enforcement from the relevant authorities must be ensured to avoid ROW to be invaded/used for illegal parking.

7.6.20 Restriction of Access and mobility

Potential impact

During construction, there will be a number of activities which, if not mitigated, are likely to cause disturbance to communities in the project area; these are:

- Local residents and business operators will face difficulties getting access to their business places and residences;
- This will result in causing inconvenience to the residents/pedestrians and affect their daily activities. It may also reduce the frequent interaction between families; and
- Increased heavy traffic (construction vehicles) on public routes.

The impacts on community are moderate adverse in the short and long term.

Mitigation Measures

- Maintaining regular communication with local communities and other stakeholders to minimize tensions arising from Project activities;
- Construction activities should be carried out segment wise;
- Construction related activities will be minimal and temporary at any one location along the project corridor and would be similar throughout the corridor;
- Contractors should keep community members apprised of construction schedules in readily accessible public locations as well as on the SMTA website, and seek community input when developing construction plans;
- A traffic management plan will be prepared for this purpose as part of the EMP;
- The contractor must identify the impacts and address them during the construction phase; and
- Timely completion of the construction activities as per schedule.

7.6.21 Influx of Labor

Potential Impact

For the implementation of project activities, skilled and unskilled labor is required by the contractor. Mostly, skilled and unskilled workers have been associated with the contractor since long which they utilize, 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 behaviour 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 local residents; and
- Increase in traffic and 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.
- Project staff will receive training on the prevention of SEA/SH. Engagement of skilled trainers to raise awareness among project workers of the risks, expected behaviors, and consequences of violations, communicated through training, and publicized codes of conduct. It may also be important to raise awareness of the risks among community members and local health authorities and inform them about available grievance mechanisms; and
- Provision related to SEA/SH will be incorporated in the bidding document.

Mitigation Measures

Suggested mitigation measures for smooth execution of construction activities include:

- 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 labour force from the project area because this will reduce the labour 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;
- Plan 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 COVID-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;
- Taking all sensible precautions to avert 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 plant, 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.

7.6.22 Communicable Diseases

Potential Impact

The laborers in the Contractor Camp, truck drivers and like personnel who interact with each other have the potential for the spread of communicable diseases like COVID-19 and HIV/AIDS. Majority of the people living in the surrounding of the Project, and potential labor are not aware of the source, mode of communication or consequences of HIV/AIDS. Although their religious and cultural value system, to a large extent excludes the outbreak or rapid communication of COVID-19 and HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that awareness and preventive campaigns are run from time to time in the labor camps and the field offices of the Project to prevent the

communicable diseases.

There is a chance of spreading of an epidemic of Coronavirus disease (COVID-19) due to close interaction of the labor force during construction not only among the workers but also in the area. This impact can be categorized as direct, medium, site-specific, short term, temporary, high probability and reversible.

Mitigation Measures

The Contractor shall:

- Arrange to run an active campaign, in the labour camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS;
- SOPs related to the disinfection and environmental decontamination advised by National Action Plan for COVID-19 Pakistan to control spreading of COVID-19, shall be implemented by the contractor and should be strictly monitored;
- Strengthen the existing local health and medical services for the benefit of labour as well as the surrounding villages;
- Ensure cleanliness and hygienic conditions at the labour camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by the Health Department;
- Locating a labour camp at least away from the villages (local settlement), and
- Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.

Guidelines to combat with COVID-19 are attached as **Annexure-XIV**.

7.6.23 Gender Issues

Potential Impact

Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and act outside their normal sphere of social control. This can lead to inappropriate and criminal behavior, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the local community. A large influx of male labor may also lead to an increase in human trafficking whereby women and girls are forced into sex work.

During construction phase gender-based violence might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others. Sexual harassment against women might occur as a consequence of mixing of men and women at the construction site, and moving on the roads, bus stops and markets. Educational institutions near the project alignment are also sensitive regarding gender issues. This impact is negative in nature during construction phase.

Mitigation Measures

- The contractor will be required to provide qualified key personnel to address the specific risks identified in the project. Contractors will specify key staff with the technical skill and experience to implement the mitigation measures;
- The bidding documents will include specific requirements that minimize the use of expatriate workers and encourage hiring of local workers, thereby minimizing labor influx;
- The bidders will be required to submit Codes of Conduct (CoCs) with their bids. The CoCs will set clear boundaries for acceptable and unacceptable behaviours of all individuals and companies and will be signed by companies, managers and individuals;
- All project consulting firms will also be required to submit Codes of Conduct with their proposals;
- The contractor will be required to establish anti-sexual harassment policies that governs conduct in the workplace;
- The contractor will be required to provide mandatory and repeated training to workers on sexual exploitation and abuse and HIV/AIDS prevention and on the content and obligations derived from the code of conduct; and
- Provisions will be set in contracts for dedicated payments to contractors for Sexual Exploitation and Abuse prevention activities (e.g. training) against evidence of completion. The portion of the contract price will be guaranteed by a performance security linked to environmental and social contractor performance.
- Moreover, the Gender Action Plan (GAP) is already prepared for the proposed project.

7.6.24 Child Labor

Potential Impact

Inhabitants of the project area have mix economic background and different sources of income. Children of low-income groups mostly involve 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. Increased opportunities for the host community to sell goods and services to the incoming workers can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.

Mitigation Measures

The risk of hiring of underage worker 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 labour. 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 and 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 labour 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.

7.6.25 Economic Activity

Due to the construction of the proposed project, economic activity will be generated in the project area as the labours and semi-skilled staff will have an opportunity to work for the construction of the proposed project. This will help in generating employment in the area. This is a moderate beneficial impact.

7.7 ANTICIPATED IMPACTS DURING OPERATIONAL PHASE

The anticipated impacts related to the proposed project have been studied for the operational phase and discussed hereunder.

7.7.1 Change of Land Use

Potential Impact

As mentioned in the project description section that Yellow BRT Corridor will pass through seven major segments of Karachi. Existing land use pattern of these segments are different from each other. It is certain that Yellow BRT project will impact land use patterns in these segments differently. Major positive environmental impact linked to Yellow BRT project is the reduction in air pollution along the Yellow BRT corridor. Whereas anticipated environmental impacts related to land use change due to Yellow BRT project along the BRT corridor are: increase in air pollution due to increase in traffic flows and intensification of industrial and commercial activities along the Yellow BRT corridor, impact on natural resources, and impact on built heritage. Impacts on natural resources and built heritage are not expected due to the reason that most of the land use change will be happen in the already built up area.

Table 7.5 presents the existing land use, expected land use after the Yellow BRT project implementation, and environmental impacts by each segment. The impact will be high adverse in nature.

Table 7.5: Environmental Impacts of Change of Land Use by Yellow BRT Corridor

Segments	Major Existing Land Use	Major Future Land Use	Environmental Impacts
Future Colony – from Dawood Chowrangi terminal to Mansehra Colony (1.3 km)	Residential, formal and informal retail commercial	Residential area along BRT Corridor will be converted to retail commercial, and existing commercial areas will be further intensified in the vicinity of proposed bus stations.	Small amount of air pollution increase due to traffic jams and increase in flow of traffic
Korangi Road along Korangi Industrial Area – from Mansehra Colony to Malir River bridge (10.1 km)	Industrial	Intensification of industrial areas. Small number of industrial plots along the Yellow BRT corridor are either vacant or existing industries closed down. Increased access due to Yellow BRT project will attract either new or existing industries presently located in other areas of the city to establish/resettle medium to large industries. Land subdivision is also expected to happen. Small commercial retain activities at the bus stations.	Increase in industrial emissions, and vehicular emissions due to increase in traffic flow.
Malir River bridge (1.4 km)	Bridge	New bridge	Vehicular emission is expected to reduce due to better traffic flows due to the reduction of traffic off loaded by Yellow BRT project on existing bridge.
KPT interchange	KPT Interchange	KPT Interchange	Vehicular emission is expected to reduce due to better traffic flows due to reduction of traffic off loaded by Yellow BRT project.

Segments	Major Existing Land Use	Major Future Land Use	Environmental Impacts
Korangi Road – from KPT Interchange to Shahrah-e-Faisal Interchange (4.2 km)	Residential, commercial, and institutional	Conversion of residential areas to commercial use, intensification of existing commercial areas, and increase in retail activities at the bus stations.	Increase in vehicular emissions due to increase in traffic and expected traffic jams.
Shahrah-e-Faisal – mixed operations on split stations with left side access (1.3 km)	Commercial and Institutional	No change is expected owing to well established commercial and institutional land uses	No impact
Shahrah-e-Quaideen – from Shahrah-e-Faisal Interchange to M.A. Jinnah Road (2.7 km)	Residential, commercial, and institutional	Conversion of residential areas to commercial use, intensification of existing commercial areas, and increase in retail activities at the bus stations.	Increase in vehicular emissions due to increase in traffic and expected traffic jams.

Conversion of Residential Areas to Commercial Areas

Sindh Building Control Authority (SBCA) is the responsible agency for controlling land use in Karachi. Conversion of residential areas to any other land use needs the approval of the authority. SBCA follows zoning regulations for the conversion of land use. It is expected that after the implementation of Yellow BRT project, more applicants will approach SCBA for the conversion of land use. In addition, all the multi-story commercial buildings need the approval of SEPA by submitting an EIA for such projects. SMTA will coordinate with both the agencies to strategize the conversion of residential use to commercial use in a manner that this change of land use should not happen in a short time. The change of land use should happen under well thought land use and zoning plan for each segment of the Yellow BRT project. SMTA, SBCA, and SEPA will prepare a rational land use and zoning plan to meet the market demands, managing traffic flows, and keeping the vehicular emissions to a level that should not disturb the present level of ambient conditions along the Yellow BRT Corridor.

Managing Retail Commercial Activities at Bus Stations

Karachi Metropolitan Corporation and District Municipal Committees are responsible for the retail commercial areas along the corridor. Retail shops in the already built up area will not cause traffic flow problems. The expected traffic flow problems will occur due to the encroachment by these shops and the hawkers at the bus stations. STMA will coordinate with KMC and DMCs to ensure that encroachments should not happen and hawkers operation should remain in the designated areas.

Intensification of Industrial Areas

Intensification of industrial areas along the Yellow BRT Corridor, if happen, due to the resettlement of existing industries is better for the city. Most of the existing industries located outside the industrial estates are causing much higher level of emissions and environmental impacts. In the Korangi Industrial Area (KIA) the plot sizes are medium to large. It is expected that medium and large industries will be established in KIA. These industries are comparatively more resourceful as compared to small industries. Availability of space and resources, and effective institutional governance will enable industries to install environmental technologies for abating industrial pollution, including air emissions. In case of new industries, it is expected that these industries will be in much better position to adopt better environmental practices under resource efficiency methods. Both industries (resettled and new) need to prepare EIAs and secure NOCs from the SEPA. SMTA will coordinate with SEPA to ensure that no new and resettled industry will be established without the approval of SEPA and emissions from these industries should remain with SEQS.

7.7.2 Air Emission from Buses

Potential Impact

Yellow BRT hybrid diesel bus operation will generate air emission. The emissions will contain gases such as carbon dioxide (CO₂), carbon monoxide (CO), nitrogen oxides (NO_x), total hydrocarbons (THC¹¹), non-methane hydrocarbons (NMHC), particulate matter (PM) and sulfur dioxide (SO₂). These buses will be of EURO III standard. However, Pakistan currently produces only EURO II standard diesel (Low sulfur contents i.e. 500 ppm), therefore, the buses will comply EURO II standard or Pak II standard (both have same standard). These standards are given in **Table 7.6**. The CO₂, and the Nitrous Oxide (N₂O, a small portion of NO_x) are the Greenhouse Gases (GHGs). The impact will be high adverse in nature.

Table 7.6: Emission Standards for New Vehicles (g/kWh)

Type of Vehicle	Category/Class	Tier	CO	HC	NO _x	PM
Heavy Duty Diesel Engines	Buses	Pak-II	4.0	1.1	7.0	0.15
European Standard for Comparison						
EURO II	Diesel Trucks and Buses	EU-II	4.0	1.1	7.0	0.15
EURO III		EU-III	2.1	0.66	5.0	0.10

¹¹ THC refers to non-methane hydrocarbons plus methane

Table 7.7 shows motor vehicle exhaust and vehicular noise standard as per SEQS.

Table 7.7: Vehicular Emission and Noise Standard as per SEQS

Parameter	Standard (Maximum Permissible Limit)
Smoke	40% on the Ringelmann scale during engine acceleration mode
Carbon Monoxide	6%
Noise	85 dB (A) (7.5 m from source)

Mitigation Measures

The operator company will prepare preventive maintenance plan for the buses to inspect, maintain and protect before break down or other problems occur. Under maintenance plan, frequent vehicular emission monitoring, tuning of the engines, and changing of engine oil and filters will be carried out for each bus. It will be obligatory to get fitness certificate for each bus as per the frequency from the Government of Sindh.

All the above-mentioned measures will ensure control of air emission and in compliance with the provincial vehicular emission requirement.

Data on the Vehicle Kilometers Travelled (VKT), ridership, and modal split with and without the project were taken from the traffic model and the emissions impacts for various bus alternatives were then evaluated in terms of tons reduced per year. Fuel efficiency and carbon dioxide (CO₂) emission factors were updated for Pakistan for a typical vehicle mix in Pakistan. On average, the BRT project reduced 50,000 tons of CO₂ per year, well-to-wheel. The average annual economic value of the reduced emissions was \$3.3 million, using hybrid buses.¹²

7.7.3 Generation of Garbage from Bus Stations

Potential Impact

24 bus stops will be located at Yellow BRT corridor. The estimated daily ridership in the Yellow BRT buses will be 300,000. These 300,000 passengers will use 24 bus stops along the Yellow BRT corridor (and others depending on the level of integration proposed for each BRT service and the BRT network at large) for boarding and alighting. Also there will be staff allocated on these bus stops to provide different services to the passengers and for the maintenance of the bus stops. The garbage will be generated at each bus stop in the form of wrappers, polythene bags, paper, waste organic material etc.

In case of solid waste is not properly collected, stored and disposed at appropriate place, then it can result in i) nuisance at the dumping sites, ii) spreading of waste on streets and

¹² <https://www.adb.org/sites/default/files/linked-documents/47279-002-efa.pdf>

roads iii) clogging of drains iv) odor and breeding of mosquitos and flies and outbreak of diseases for perishable waste material. The impact will be high adverse in nature.

Mitigation Measures

It will be the responsibility of the operator company to ensure proper garbage management at each bus stop. Waste bins, in appropriate size and quantities, will be provided at each bus stop at appropriate locations to collect proper collection of waste. These bins will be emptied daily and waste will be transferred to the municipal waste collection points. Signs will be posted at bus stops to disseminate messages to the passengers regarding waste management practices and provide instructions to use waste bins for waste disposal.

7.7.4 Stack Emission from Generators

Potential Impact

There will be at least one diesel-based generator as standby source of power supply at each bus stop. Its operational frequency depends upon the extent of power outage at the specific location of the city. These generators will generate stock emissions and affect ambient air quality of the surrounding. The air emission consists of carbon dioxide, carbon monoxide, NOx, hydrocarbons and particulate matters.

It is estimated that these generators will consume about 300 – 500 liters of diesel per day. The estimated annual load of CO₂ emission from these generators will be 288 – 480 ton (*Diesel Emission Factor = 2.63 kg CO₂/Liter*). The impact will be high adverse in nature.

Mitigation Measures

The stack emissions from generators, if used as standby source of power supply at bus stops can affect the ambient air quality. It will be the responsibility of the operator company to use well maintained generators to keep ambient air quality within the desired level. The operator company will follow preventive maintenance schedule for the generators. Under the plan, frequent monitoring of stack emission, tuning of the combustion chamber, and timely changing of lubricant and filters will be carried out to keep stack emissions within SEQS.

7.7.5 Soil Contamination at Generator Site

Potential Impact

There are chances of soil contamination at generator site due to spillage/leakage and spilling over of diesel and lubricants while storage, handling and dispensing of diesel and lubricants. Also, improper placement and disposal of oil filters and discarded lubricants of generators can be a potential hazard for soil contamination. The impact will be medium adverse in nature.

Mitigation Measures

Following measures will be taken to control soil pollution at generator sites of the bus stops. The operator company will be responsible for implementing these measures.

- Placing fuel and lubricant containers at impervious floors under secondary containment
- Dispensing of fuel and lubricants through dosing pumps with secondary containment to avoid spillages on floor
- Applying spill kit to clean any spills on the floor
- Proper storage and disposal of used lubricants and oil filters to the authorized persons

7.7.6 Noise at Generator Site

Potential Impact

Generator operation generates noise in the range of 80 to 90 dB(A). As mentioned above that noise is a nuisance and cause of health implications. The impact will be high adverse in nature.

Mitigation Measures

The generator will be enclosed in sound proof canopy. The generator will be enclosed in the room with silencer installed at its emission point to avoid dispersion of noise at the bus stop and movers. The generator operator will be protected through use of sound mufflers while entering into the generator room during operation.

7.7.7 Noise from Bus Depot Operations

Potential Impact

Noise will be generated from bus depots from different activities such as arrival and departure of buses, maintenance activities, and generator operation. The bus depots are located at commercial and residential areas of the city. The noise from bus depot operation can disturb the comfort of the nearby community. The impact will be high adverse in nature.

Mitigation Measures

Special consideration will be given to the noise control aspect during bus depot design stage. The noise barriers will be installed at noise prone areas such as workshop and generator. The generator will be enclosed in the room with silencer installed at its emission point to avoid dispersion of noise at the bus depots and nearby community. The generator operator will be protected through use of sound mufflers while entering in to the generator room during operation.

7.7.8 Soil Contamination from Bus Depot Operations

Potential Impact

There are chances of soil contamination at bus depot operations due to improper disposal of contaminated mechanical solid waste from workshop, spillage and leakage of lubricants/fuel from containers and from buses on unpaved floor (parking area/workshop area), and improper collection, storage and disposal of used lubricants from workshop area. The impact will be medium adverse in nature.

Mitigation Measures

Soil pollution will be controlled at bus depots by taking following measures:

- Storage of hazardous solid waste such as fuel and oil containers, oil filters, oily parts and oily rags on impervious floor under shade
- Storage of fuel and oil containers at impervious floor with plug drains over secondary containment
- Proper decantation arrangement for fuel and oil to avoid its spillage and leakage on floor
- Presence of spill kit to remove spills from the floor
- Avoid washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags
- Proper collection, storage and disposal of used lubricants. Lubricants will be handed over to the authorized contractors.

7.7.9 Garbage from Bus Depots

The garbage will be generated from bus depot operation as these depots will remain operational for about 18 hour a day. The employees will stay there for about 24 hour and their daily activities will generate garbage. In case if this garbage is not properly collected, stored and disposed at appropriate place, then it can result in i) nuisance at the disposal sites, ii) odor and breeding of mosquitos and flies and outbreak of diseases for perishable waste material, iii) inconvenience for the passersby. The impact will be medium to high adverse in nature.

Mitigation Measures

Integrated management system shall be devised and implemented by the operator of the BRT and the collection and disposal shall be done through authorized Company.

7.7.10 Fire at Bus Depots

Potential Impacts:

There can be chances of fire hazard at bus depots. There will be many ignitable materials placed at bus depots such as fuel, solvent, lubricants, gas cylinders, etc. There can be

sources of fire outbreak such as cooking, smoking and electrical short circuiting. Fire hazard can result in the loss of property and life. The impact will be high adverse in nature.

Mitigation Measures:

It will be the responsibility of the designer of the bus depot to incorporate fire safety measures in the design. The operator company and bus depot management will be responsible to prepare fire safety procedures and implement at each bus depot. Major features of the fire safety measures at bus depots will be as under:

- Installation of fire alarms at fire prone areas
- Placement of fire extinguishers and sand buckets
- Installation fire hydrants
- Availability of trained firefighting staff
- Display of emergency telephone numbers at conspicuous places
- Restricted access for the fuel and lubricant storage areas
- Designated areas for smoking

7.7.11 Wastewater from Washing Area

Potential Impacts:

The washing area of buses will generate contaminated wastewater containing dirt, oil and detergents. If the wastewater is disposed without any treatment, then there are chances that it can contaminated soil and water resources. The impact will be high adverse in nature.

Mitigation Measures:

The wastewater from washing area will be passed through grease trap and sedimentation tank for the removal of oil and grease and dust particles prior to disposal in the sewerage system or in the wastewater drain.

7.7.12 Climate Change Impacts

Karachi city is affected by two types of climate change impacts i.e. flooding due to torrential rains and heat wave¹³. Flooding is due to the fact that the city's storm water drainage system is either not present or not working effectively. The capacity of the existing storm water drainage is not able to absorb the surface runoff during heavy rainfall events, even for a very short period of time. Heat wave is an extended period of intense heat, often caused by hot air trapped in place by high pressure systems. In Karachi the cause of heat wave is mainly due to atmospheric condition and urban heat island effect¹⁴. These climate change impact can

¹³ The World Meteorological Organization (WMO) defines heat-wave as "when the daily maximum temperature of more than five consecutive days exceeds the average maximum temperature by 5 °C, from the normal temperature of an area.

¹⁴ Government of Pakistan, Ministry of Climate Change, Technical Report on Karachi Heat Wave June 2015

also affect Yellow BRT project as under:

a) Damaging of Roads due to Extreme Weather Events (Flooding and Heat Wave)

The roads for the Yellow BRT corridor will be vulnerable to the extreme weather condition of torrential rain and heat wave in the city. The roads will be likely to be damaged due to these events. There are chances that the roads surface material will be washed away and paving material will be damaged. The impact will be high adverse in nature.

The emphasis will be on using weather resistant material for the road construction. The paving material will be such that it will withstand extreme weather condition of heavy rains and high temperature predicted under international climate change models for Karachi region. The surface material will be specially selected to resist water and prevent it to be washed away.

b) Flooding in Underpasses

There will be seven underpasses, mostly at the chowrangis (intersections). There are chances that these underpasses will be flooded during rainy season. Flooding can hamper the BRT operation and damage the roads and other infrastructure. The impact will be high adverse in nature.

The storm water drainage system will be constructed along the corridor to avoid flooding at the road. The capacity of the drainage system will be designed based on extreme weather conditions predicted under international climate change models for Karachi region to cater for extreme storm water runoff.

A very sophisticated storm water drainage system will be constructed for the underpasses which will be highly vulnerable to flooding. The underpass roads will be sloped to collect water at grates that will lead to the drainage pipe and collection pits. The submersible pumps will be installed at the collection pits to discharge storm water to the nearby storm water drain network. The pumping system will be equipped with backup pumps. The capacity and the number of collection pits and submersible pumps will be computed on the basis of extreme weather conditions predicted under international climate change models for Karachi region. Generators will be installed at each underpass as a power backup for the submersible pumps because of power outage issue during rainy season.

c) Health Impacts on Passengers

Heat wave causes certain health impacts such as dizziness, headache, fainting and heat stroke. Heat stroke (dry skin, a body temperature above 103°F, confusion and sometimes unconsciousness) is more severe and requires medical attention. Passengers can be affected due to heat wave at Yellow BRT bus stations. This impact is medium to high

The bus stops will provide following facilities to attenuate heat wave impacts on passengers:

- Shades
- Ventilation
- Fans
- Drinking water
- Rest area
- Power backup (generators)

7.7.13 Flora

- No negative impacts are envisaged on the flora of the tract during the operational phase. Moreover, massive plantation shall be raised on both sides road, which will not only compensate the loss of trees from the project area, but will also improve the landscape of the area.
- However, raising of new trees, on either side will have a positive impact of permanent nature

7.7.14 Fauna

New plantations will not only compensate for the loss of trees, but will also add to the aesthetics of the area. So, resulting in healthy and positive impacts on flora and fauna during the operation stage.

7.7.15 Potential Impacts on Parking Spaces in Narrower Sections

In the narrower part of the road alignment from Future Colony to Dawood Chowrangi Depot there are various shops in both sides of the existing route. These shops will be potentially impacted due to BRT construction. The service lanes of the main korangi road, Industrial area and other parts of the proposed BRT routes being used for vehicle parking by the different factories owners and business operates.

Mitigation Measures

In order to avoid or to minimize potential impacts following mitigation measures are suggested.

- Build separator between walkway and motor vehicle lanes
- SMTA needs to develop a parking policy for the BRT corridor to provide parking facility to the public for the safe and organized parking of their vehicles along the BRT to avoid traffic congestion and other hazards.
- Enforcement from the relevant authorities must be ensured to avoid ROW to be invaded/used for illegal parking.

8 ENVIRONMENTAL MANAGEMENT PLAN

This chapter describes institutional arrangements and role of different stakeholders in environmental management, mitigation plan, monitoring framework, budget, and capacity building of stakeholders involved in environmental assessment, monitoring and management. The guidelines for environmental compliance and occupational health and safety requirements will also be described.

8.1 INSTITUTIONAL ARRANGEMENT

The institutional arrangement for the implementation and monitoring of environmental management plan for the Yellow BRT project is presented in **Figure 8.1** and **Figure 8.2** for design and construction phases and operational phase respectively.

8.1.1 Sindh Mass Transit Authority (SMTA)

The overall responsibility of the environmental management of project during design, construction and operational phases rests with KMP-YLC, SMTA. KMP YLC SMTA is an evolving organization with constrained by capacity issues, as certain positions within Karachi Mobility Project organogram are still vacant. Despite this, SMTA has completed the hiring process of key positions, including Safety, health & Environment and Quality (EHSQ), Social, Communications, and Gender specialists, Assistant Director, Resettlement and Secretary of the SMTA Board. EHSQ Social and Gender specialist Team is taken on board to look after environment and social issues relevant to the project execution. SMTA has also hired procurement Contract Management and Financial Management specialists to be inducted into the KMP YLC Project. Additional engineering and technical staff will be hired as per project's requirements before commencement of civil works.

The maintenance/rehabilitation of the existing road is the responsibility of KMC. For the implementation of Component-I and II, the Government of Sindh will issue necessary directives, handing over the responsibility of the entire corridor from Numaish to Dawood Chowrangi, to SMTA from KMC. SMTA will be responsible for contracting the civil works and managing the supervision consultants. SMTA will also be responsible for managing the implementation of the compensation and livelihood rehabilitation plan.

Component-III involves implementing traffic management and road safety activities. Multiple stakeholders are involved in this component, including KDA (installing and managing the traffic signals and undertaking road safety initiatives), and Traffic Police (for traffic management and enforcement). SMTA will coordinate closely with KDA, KMC and Traffic Police to implement the activities under this component.

The PC-1 of the project, including environmental compliance requirements, will be prepared by SMTA and submitted to Sindh Planning and Development Board (SPDB) for approval and subsequent stages of the project. The Environmental and Climate Section of SPDB will review and approve the environmental requirements of the PC-1.

Project Management Team at SMTA will be responsible for the monitoring and evaluation of the status of implementation and progress of the project. Project Management Team will be responsible to submit environmental assessment and environmental compliance documents to Sindh Environmental Protection Agency (SEPA) for acquiring NOC and complying regulatory requirements. It will also be responsible for the preparation and submission of environmental safeguard documents to World Bank as per their environmental safeguard requirements.

The Project Management Team (PMT) has been established for the project in SMTA. PMT will include Safety Health Environment & Quality Specialist and Social Development Specialist (suitably qualified and experienced in relevant field).

8.1.2 Party A (Infrastructure Development)

Party A will be the several Infrastructure Development contractors, responsible for the development of Yellow BRT Corridor infrastructure, including roads, bus stops, and bus depots. Overall responsibility of the ESMP implementation and compliance rests with Party A. Party A will be answerable to the Project Management Team for any noncompliance of the construction phase ESMP.

Figure 8.1: Institutional Arrangement for Environmental Management (Design & Construction)

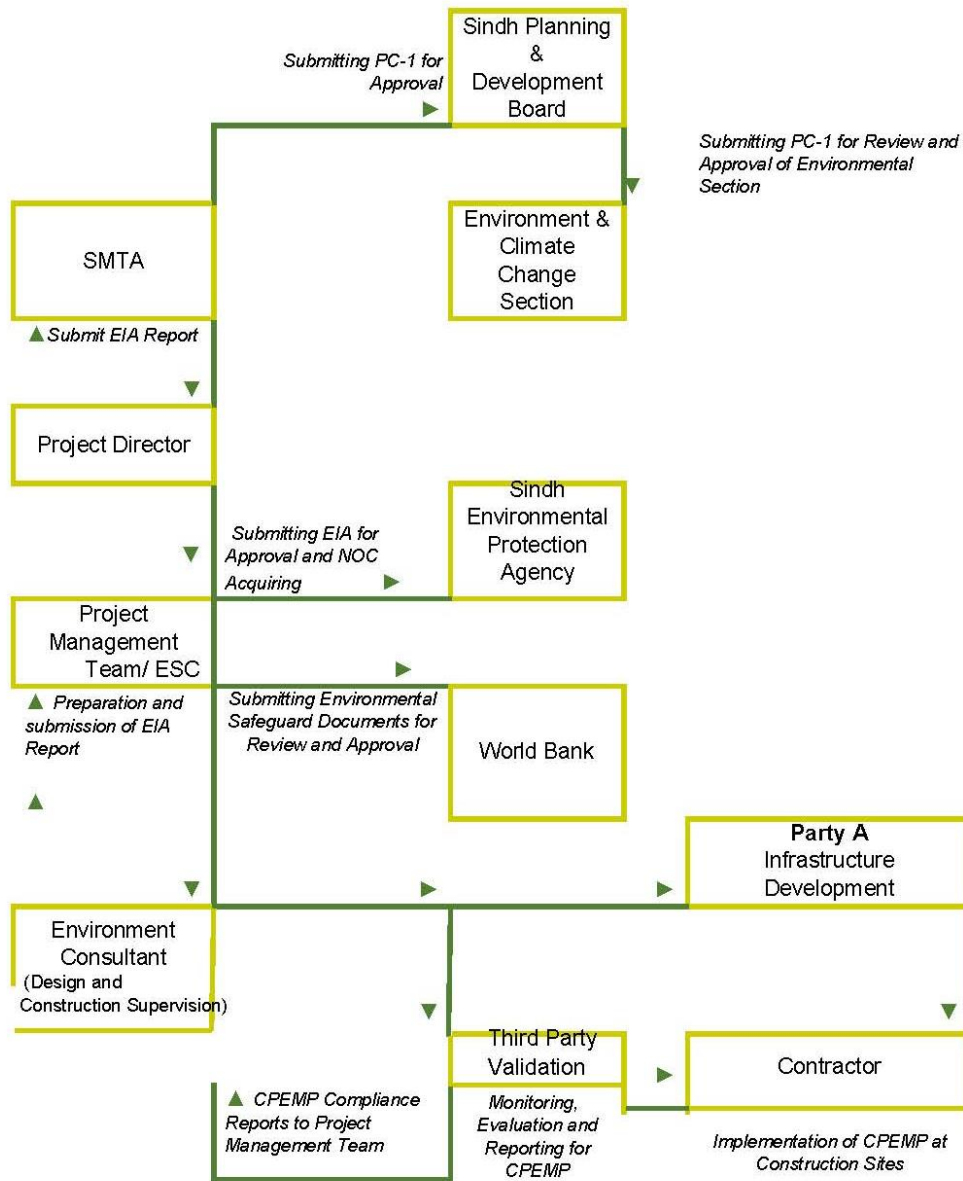
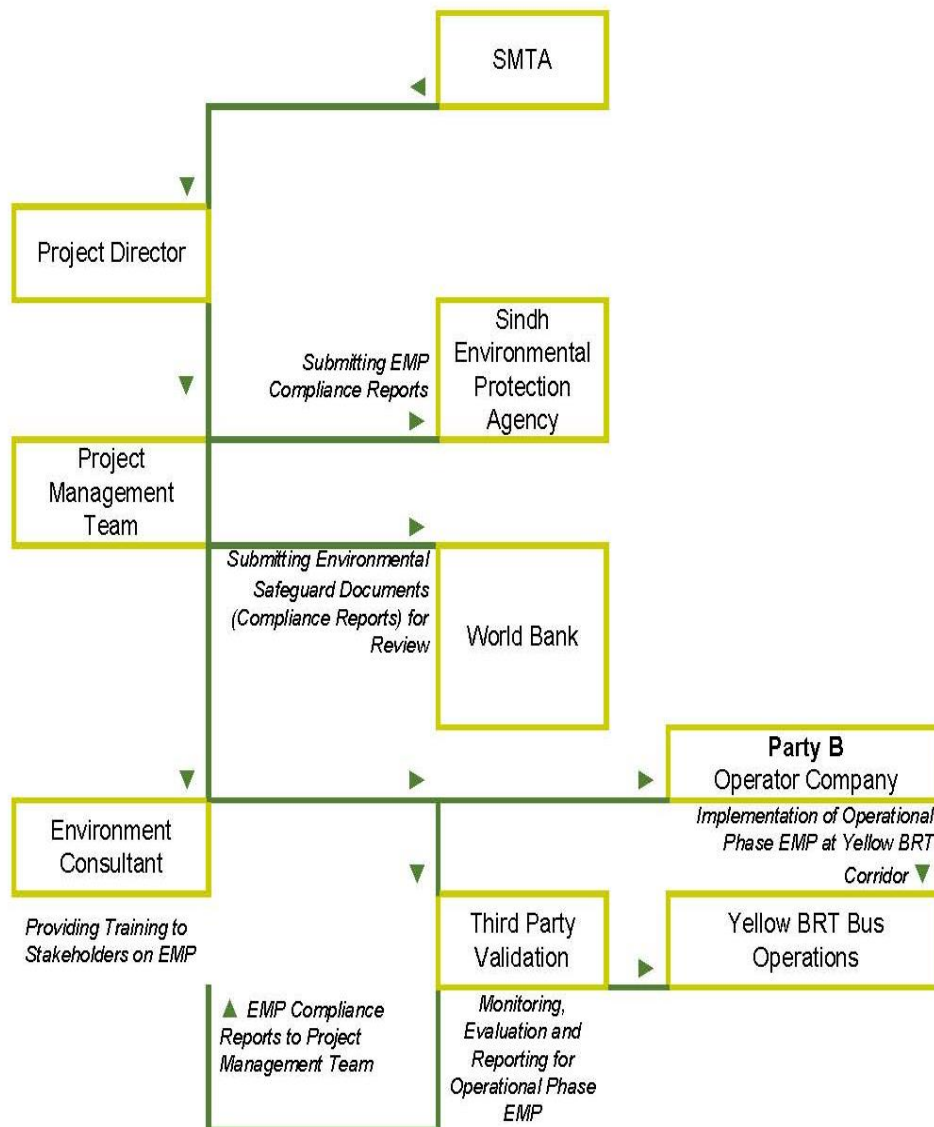


Figure 8.2: Institutional Arrangement for Environmental Management (Operational Phase)



8.1.3 Contractor

Party A will execute the infrastructure development through several contractors. Each contractor will be bound to appoint site based suitably qualified and experienced persons, to execute environmental, social and Gender Specialists, who will be working in close liaison with the PMT and SC. Following is the broad qualification criteria of the personnel hired by Each contractor:

- Health, safety and environment Specialist: (Suitably qualified and experienced in relevant field)
- Gender Specialist: (Suitably qualified and experienced in relevant field)
- Social Safeguard Specialist: (Suitably qualified and experienced in relevant field)

The Construction Phase Environmental Management Plan (CPEMP) will be prepared and appended with the tender document for the contractors. It will be a standard document. The contractors should be required to prepare their own site specific EMPs. These EMPs will contain following, but not limited to these, plans to eliminate, offset or reduce environmental, health and safety impacts during construction phase:

- Sanitation plan
- Soil pollution control plan
- Dust control plan
- Waste management plan
- Health and safety plan
- Noise abatement plan
- Traffic management plan
- Campsite restoration plan
- Tree plantation plan
- River Malir Management Plan
- Emergency preparedness and response plan

The compliance of CPEMP will be the responsibility of the contractor and compliance cost will be added in the bidding documents.

The Project Management Team will have the responsibility to ensure compliance of CPEMP during construction phase through contractors. The compliance would require measurements of environmental parameters and observations at the construction sites to evaluate compliance. Party A will be responsible for the compliance of CPEMP and answerable to the Project Management Team.

8.1.4 Supervision Consultant

During Construction Phase, Supervision Consultant will ensure efficient, safe, and compliant execution of construction activities by perform following duties:

- Review and approve the contractor's management plans;
- To oversee the performance of the Contractor to make sure that the Contractor(s) is

- complying with ESMP;
- Ensuring that the day-to-day construction activities are carried out in an environmentally and socially sound and sustainable manner;
- Strong coordination with the Contractor and Project Management Team;
- Preparing training materials and implementing programs;
- Ensure the implementation of the mitigation measures suggested in ESMP;
- To supervise and monitor environmental activities being performed at site;
- To organize periodic environmental and social training programs and workshops for the consultant's and contractor's staff;
- Periodic reporting as mentioned in ESMP; and
- Suggest any additional mitigation measures (if required).

Supervision Consultant team will comprise of following personnel:

- Health, safety and environment Specialist: (Suitably qualified and experienced in relevant field)
- Gender Specialist: (Suitably qualified and experienced in relevant field)
- Social Safeguard Specialist: (Suitably qualified and experienced in relevant field)

8.1.5 Party B (Operator Company)

Party B will be the bus operator company. This company will be responsible for the implementation of operational phase EMP at bus operations, bus stops and bus depots. This company will be responsible for any noncompliance of operational phase EMP and answerable to the Project Management Team. Project Management Team will monitor the EMP progress through Third Party Monitoring.

8.1.6 Third Party Monitoring

The Third-Party Monitoring (TPM) will be carried out biannually through independent environmental consultancy firm. The consultant firm will monitor the environmental parameters and conduct field surveys at the construction sites to evaluate compliance level by the contractors, and the Party A (Infrastructure Development). The consultant firm will prepare monitoring and evaluation report for each site and submit to Project Management Team. The Project Management Team will review the report, discuss with the consultant firm and finalize the findings. In case of noncompliance from the contractors or Party A, the Project Management Team will have the authority to halt the construction activities or impose penalties as per the contract conditions. The Project Management Team will submit the final version of monitoring and evaluation reports to the Project Director. Project Director will submit these reports to World Bank for their review and further action. Also these reports will be submitted to SEPA as per the frequency to be mentioned in the construction phase 'No Objection Certificate (NOC)' requirements (Quarterly and yearly).

TPM will also be carried out during operational phase of the project to ensure compliance of EMP by the Party B (Operator Company). In a similar way as mentioned above, the compliance reports for the operational phase will be submitted to Project Management Team.

8.1.7 Sindh Environmental Protection Agency (SEPA)

Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021 categorizes development projects into three schedules, according to their anticipated potential environmental impact. The proponents of the projects with the potential for more adverse environmental impacts (see Schedule III) are required to submit an Environmental Impact Assessment (EIA). While, for the proponents of projects with the potential for less environmental impact (see Schedule II), must submit an Initial Environmental Examination (IEE) with the respective environmental protection agency (EPA). The proponent of the projects falling under Schedule I will conduct screening and file environmental checklist.

As per Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021, the project falls under schedule III, Category E Sr. 4 “Transport Mass Transit Projects” thus, an EIA is required to be prepared to obtain NOC from Sindh Environmental Protection Authority.

8.1.8 World Bank

The World Bank is financing infrastructure and road safety component of the Yellow Line BRT Corridor project. It is World Bank’s requirement that the funded projects comply with its environmental safeguard policies. World Bank follows following project cycle for environmental review of the project.

Environmental review begins with screening at the time of project identification. Scoping and preparation of the Environmental Assessment (EA) occur in tandem with or as integral parts of the prefeasibility and feasibility studies. The final EA is sent to the Bank by the Borrower prior to appraisal. If the EA is satisfactory to both borrower and the Bank, it forms the basis for the decision of Regional Environmental Division (RED) on environmental clearance and the environmental condition to be negotiated with the borrower, some or all of which are incorporated into the loan agreement. The EA may be adequate for the purposes of appraisal, but the Bank review may reveal needs for additional analyses before clearance can be given and negotiations undertaken. Supervision includes monitoring the project's environmental performance and compliance with relevant conditions agreed on between the Bank and the borrower. After implementation is complete, the Project Completion Report (PCR) includes evaluation of both the impacts that actually occurred and the effectiveness of mitigation measures. The Operations Evaluation Department (OED) again audits selected projects possibly some years after the PCR.

8.2 NO OBJECTION CERTIFICATE (NOC)

The Sindh Environmental Protection Act (2014) pursuant to the Act state that when filing an EIA, “no objection certificates from the relevant departments will be the part of reports.” Departments from which NOCs may potentially be required include:

- Sindh Environmental Protection Agency (approval of the EIA)
- Karachi Metropolitan Corporation

- Department of Antiquities GOS -NOC was issued on May 6, 2019.

No objection certificates (NOCs) are also required from local government units and cantonment authorities where the project alignment is located in their respective jurisdictions.

8.3 ENVIRONMENTAL MITIGATION PLAN

Table 8.1 presents environmental mitigation plan for the avoiding or mitigating the potential environmental impacts identified in the previous chapter.

8.4 ENVIRONMENTAL MONITORING PLAN

Environmental monitoring framework of the EMP is already mentioned in the previous section and illustrated in **Figure 8.1** and **8.2**. The role of the stakeholders involved in the monitoring of EMP implementation is already mentioned. This section presents detail of the monitoring requirement such as monitoring and evaluation of the environmental parameters, responsibility of monitoring and frequency of monitoring during construction and operational phases of the project.

The environmental monitoring plan is presented in **Table 8.2**.

Table 8.1: Environmental Mitigation Plan

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
Design Stage			
Existence of Electric Pylons Safety hazards due to existence of electric pylons at corridor	Safety Consideration in Design Safe distance is required from electric pylons	Designer	Design Stage
Flooding at Corridor	Proper Storm Water Drainage at Corridor Proper storm water drainage system is required at corridor to avoid flooding issue	Designer	Design Stage
Construction Stage			
Clogging of Wastewater Drains Nuisance, odor, soil pollution, outbreak of diseases due to ponding and breeding of mosquitos and flies	Protection of Wastewater Drains Due consideration will be given during construction activities to protect clogging of drains. Drains will be covered prior to start of activities so that clogging could not take place due waste throwing in it.	Contractor	Construction stage
Impact on Malir River The river water quality is already compromised; however, the construction and demolition activities will result in increase in sediment loading of the River.	Protection of Malir River The construction and demolition activities shall be conducted as per best management practices and protection of Malir River quality shall be ensured. The residual impact will be moderate in significance.	Contractor	Construction stage
Vegetation Contribute in city's air pollution and disturbance to the aesthetic and landscaping of the area due to Cutting of trees, plants, bushes, green areas during relocation of utilities, construction of roads and establishing construction camps	Selection of Campsite The location and development of the contractor's facilities will be approved by SMTA. Locations will be selected so that it does not interfere with the environment and social well-being of the surrounding communities in respect to noise, dust, vibration and other physical impacts. The size of contractor's facilities are limited to absolute minimum to reduce unnecessary clearing of vegetation. It would be the responsibility of the contractor and SMTA to select those	SMTA	Start of the construction

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	areas for campsite where there are less chances of cutting of trees and vegetation and destroying the green areas Tree Plantation In case if it is not possible to avoid cutting of trees at campsite, then the project site would be restored to its original as much as possible by planting trees, vegetation and crops at the cleared land. All works will be carried out in a fashion that ensures minimum damage or disruption to the flora. SMTA will ensure the restoration of the campsite and ensure planting trees and improving landscaping of the area. After completing the project, about 100,500 plants will be planted around Yellow Line BRT Corridor (if possible) or somewhere else in Karachi. Suitable site for the plantation will be searched in the city for planting suitable plants to offset the cutting of trees at project site.	Infrastructure Company	End of construction
Physical Cultural Resources (PCRs) Chances of the loss of PCRs at the project sites during excavation	Protection of Physical Cultural Resources (PCRs) During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archaeological significance, the same will be intimated to the SMTA. Work will be suspended until further orders from the SMTA. The Archaeological Department will be intimated of the chance find and the SMTA will carry out a join inspection with the department. Actions as appropriate will be intimated to the contractor along with the probable date for resuming the work. The contractor workers will be sensitized and fully informed about the importance of PCRs before the commencement of the work as their negligence during excavation and construction activities could damage these resources. All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest	Contractor	During Construction

Title of Document	Document No.	Page No.
Environmental Impact Assessment (EIA)	4309-01	8-11

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
camps Solid Waste Nuisance, health implications on workers and community (due to breeding of mosquitos and flies), and soil contamination due to improper disposal of garbage, hazardous solid waste and construction waste from construction camps and construction sites	Solid Waste Management The construction contractors will implement a Waste Management Plan (mentioned in CPEMP). At a minimum, the plan will address the sources of waste; waste minimization, reuse, and recycling opportunities; and waste collection, storage, and disposal procedures. The Waste Management Plan will distinguish between solid and liquid waste, as applicable, and include procedures for addressing waste that may be hazardous to health and the environment. In addition, the Waste Management Plan will address the following: • All food waste will be contained in covered bins and disposed of on a frequent basis to avoid attracting wildlife. • Trash bins will be accessible at all locations where waste is generated. • The project area will be kept clean and free of litter and no litter will be allowed to disperse to the surrounding area. • Solid waste will be removed from the site and transported to a municipal landfill or disposal site. • Waste will not be dumped or buried in unauthorized areas or burned. • Human waste associated with the worker camp and latrines will be properly contained and disposed of. • The construction contractors will ensure all workers receive training on proper disposal of all waste prior to working on the project site. • The debris produced during construction should preferably be dumped at nearby depressions rather than being thrown away and left unattended. Leftover	Contractor	During Construction

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	material will not be dumped into storm water drains or watercourses, because such practices can clog these man-made and natural drainage systems and cause many other problems for the residents. Hazardous Solid Waste Management The construction contractors will implement the Hazardous Solid Waste Management Plan (mentioned in CPEMP). The Hazardous Solid Waste Management will identify proper management procedures for all hazardous materials and wastes that may be encountered during construction, including handling, labeling, transporting, and storing procedures. In addition, the plan will address the following: • Non-toxic and biodegradable produces will be used whenever possible. • Hazardous materials will be transported and stored in appropriate containers with clearly visible labels. Hazardous materials will be stored at least 100 feet from any down gradient drainage or within secondary containment capable of containing its entire volume. • Storm water flows will be directed away from hazardous material storage areas. • Equipment and work areas will be regularly inspected for signs of leaks and spills. Spill containment and cleanup kits will be available wherever hazardous materials are being used or stored. Any incidental spills or leaks will be contained and cleaned up as soon as it is safe to do so. Any contaminated soil will be collected and disposed of in an appropriate land fill. • Equipment refueling and maintenance will be limited to designated areas at least 30 meters (100 feet) from		

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	any down gradient drainage. All workers will receive training on proper handling and storage of hazardous materials, as well as spill response and cleanup procedures, prior to working on the project site		
Soil Soil contamination due to storage of oily parts and oily rags on unpaved floors, spillage and leakage of chemicals, fuel, and lubricants on soil (construction camps/sites)	Soil Pollution Control Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 15 cm thick, done on brick edge flooring lined with polyethylene sheet Placement of fuel containers under containment and proper decantation arrangement to avoid its spillage and leakage on floor Presence of spill kit to remove spills from the floor Avoid washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags Location of fuel storage and refilling areas at least 500 m from all cross-drainage structures and important water bodies	Contractor	During Construction
Noise Nuisance and health impacts on workers and nearby community due to noise from construction machineries, generators, construction activities and vehicular movement	Noise Abatement - Carry out regular inspection and maintenance of the construction vehicles and equipment - Replace worn and noise producing parts of construction machinery in a timely manner - In case of severe noise, use sound barriers to avoid the dispersion of sound waves into the nearby community - Workers will use noise protection equipment when working in a noisy area. - The noise level of 85 dB (A) for 8 hour working, is considered safe for the workers. The contractors will	Contractor	During Construction

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	ensure keeping noise levels within safe limits. In case of higher noise levels (more than 85 dB (A)), the workers will be rotated. The workers at higher noise level areas will not be allowed to work for more than two to three hours and shifted to calm places for rest of the hours • Vehicles and machineries are not allowed to operate at project site at night • Noisy machines and vehicles are not allowed to be used at the project site (noise level should not be more than 85 dB (A) at 7.5 m distance) • Frequent monitoring of vehicular, machines and ambient noise level at the project site to ensure compliance with the SEQS. • Workers will wear noise protection gadgets at noisy areas • Appropriate noise barriers and enclosures installed to attenuate noise levels		
Health and Safety Health and safety hazards for workers and community due to construction activities/sites	Occupational Health and Safety Management The contractor will be required to take all possible precautionary measures for the health and safety of the workforce and affected communities as per the national/provincial and the World Bank Group Guidelines for Occupational Health and Safety. Contractor has to ensure that all operators of heavy or dangerous machinery will be properly trained/certified, and also insured. The contractor will supply all necessary safety appliances such as safety goggles, helmets, masks, safety shoes etc., to the workers and staff. The contractor has to comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. Workers, who are	Contractor	During Construction

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	engaged in welding activities, would be provided with welder's protective eye-shields. Medical facilities will be provided to the labor at the construction camp. Suitable transport will be provided to take injured or ill person(s) to the nearest approachable hospital. First Aid Box will be provided at every construction campsite and under the charge of a responsible person who will always be readily available during working hours. The contractor will be responsible for providing safe drinking water and for implementing appropriate sanitation conditions, and for supplying hygienic food and a sewerage system for the construction team at the site. Fire Safety The risk of fires will be evaluated for each project site based on the activities that would occur, environmental conditions, and presence of ignitable or combustible materials in the area. If the activities pose a risk of igniting a wildfire, appropriate fire prevention and response equipment will be available at each active site such as shovels, axes, fire extinguishers, and dedicated water tanks. All workers will be trained on proper fire prevention and response procedures prior to working on the site. Any smoking on site will be restricted to barren areas away from ignitable or combustible material. Smoking waste will be fully extinguished and disposed of appropriately. Workers will be protected from asphalt fumes during road construction by using appropriate measures.		

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	Protection of Community from Accidents The construction activities, particularly the excavation, will not be carried out during rainy season to avoid any accident. The excavated areas will be properly cordoned off, and warning and safety signs should be posted at accident prone areas to warn the passersby the potential danger at the construction site. The traffic will be diverted well before the construction area as per the traffic management plan. The construction contractors will install temporary signs and fences around all unsafe areas to prevent members of the public from entering the areas. If installing fences is not feasible, the area will be clearly identified as unsafe with signs and flagging.		
Traffic Traffic congestion at or around construction sites due to construction activities	Traffic Management At all times, the Contractor will provide safe and convenient passage for vehicles, pedestrians and livestock. The contractor will comply the Traffic Management Plan (TMP) as provided in CPEMP. The traffic control plans will contain details of temporary diversions at different locations. Temporary diversion for road traffic will be constructed with the approval of the SMTA. Special consideration will be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night. The temporary traffic detours in settlement areas will be kept free of dust by frequent application of water. The contractor will take all necessary measures for the safety of traffic during construction work and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required for the information and protection of traffic approaching or passing through the construction site. All signs, barricades, pavement markings	Contractor	During Construction

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	will be as per road specification. Informational signs will be posted where lane and road closures could substantially disrupt traffic circulation at least 7 days prior to the closure. Proper traffic controls will be in place during closures to minimize impacts on traffic circulation and for traffic safety. Appropriate safety precautions will be taken when transporting large equipment on public roadways.		
Extreme Temperature Extreme temperature impacts worker health risks, productivity and safety concerns, equipment and material performance issues	• Train workers and supervisors on recognizing heat-related illness signs, proper hydration, taking breaks in shaded areas, and emergency response. • Schedule strenuous tasks during cooler times, like early mornings or evenings. adjust work hours to avoid peak heat. • Implement regular breaks in shaded or air-conditioned areas for rest and hydration. • Install shade structures and use umbrellas or tarps to reduce direct sun exposure. • Ensure access to cool water throughout the site with hydration stations. • Provide breathable, light-colored clothing and encourage hats and sunglasses for sun protection. • Use portable fans, misters, or cooling vests for worker comfort. Consider air conditioning in rest areas or vehicles. • Stay informed about weather forecasts and heat stress indices to plan work accordingly. • Develop and communicate a plan for handling heat-related emergencies. • Assign supervisors to monitor workers for signs of heat stress and ensure safety compliance. • Implement changes to reduce heat exposure, like using reflective materials or job rotation.	Contractor	During Construction

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
Urban Flooding Damage to materials, equipment, and structures and services, worker health and safety, project delays and increased project costs.	- Ensure proper drainage to direct rainwater away from construction areas and prevent pooling or flooding on-site. - Erect temporary barriers or sandbags to protect construction materials, equipment, and structures from floodwaters during rainfall events. - Emergency Response Plan shall include addressing flooding incidents, ensuring worker safety, and minimizing property damage. - Monitor weather forecasts and rainfall patterns to anticipate potential flooding events and take proactive measures to mitigate risks. - Provide training to construction workers on safety protocols and procedures to follow during flooding events, including evacuation routes and emergency response actions.	Contractor	During Construction
Campsite Damaging of aesthetic and landscaping of the campsites	Campsite Restoration After the completion of construction activities at each site, all construction camp facilities will be dismantled and removed from the site. The site will be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include: Oil and fuel contaminated soil will be removed and transported and buried in waste disposal areas. Soak pits, septic tanks will be covered and effectively sealed off. Debris (rejected material) will be disposed of suitably. Underground water tank in a barren/non-agricultural land will be covered. However, in an agricultural land, the tank will be removed.	Contractor	After the completion of construction activities

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	If the construction camp site is on an agricultural land, top soil will be preserved and good earth will be spread back for a minimum 30 cm for faster rejuvenation of the land. In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this specification. The rehabilitation is mandatory and will be included in the agreement with the landowner by the contractor. Also, the contractor will have to obtain a certificate for satisfaction from the landowner.		
Operational Phase			
Air Emissions Greenhouse gas emissions (Contribute in global warming)	Air Emission Control Preventive maintenance plan for the buses will be prepared and implemented. The plan will ensure that inspection, maintenance and protection is done before the break down or other problems occur. Under maintenance plan, frequent vehicular emission monitoring, tuning of the engines, and changing of engine oil and filters will be carried out for each bus. It will be obligatory to get fitness certificate for each bus as per the frequency from the Government of Sindh.	Operator Company	Operational phase
Solid Waste Nuisance and outbreak of diseases if garbage is not properly collected and disposed from bus stops	Safe Disposal of Garbage from Bus Stops Proper garbage management will be done at each bus stop. Waste bins, in appropriate size and quantities, will be provided at each bus stop at appropriate locations to collect proper collection of waste. These bins will be emptied daily and waste will be transferred to the municipal waste collection points. Signs will be posted at bus stops to disseminate messages to the passengers regarding waste management practices and providing instructions to use waste bins for waste disposal	Operator Company	Operational phase

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
Stack Emission Greenhouse gas emissions from generators (contribution to global warming)	Control of Stack Emissions of Generators Well maintained generators will be operated to keep ambient air quality within the desired level. Preventive maintenance schedule will be followed for the generators. Under the plan, frequent monitoring of stack emission, tuning of the combustion chamber, and timely changing of lubricant and filters will be carried out to keep stack emissions within SEQS.	Operator Company	Operational phase
Soil Soil contamination due to spillage/ leakage and spillover of diesel and lubricants from generators	Soil Pollution Control at Generator Site Fuel and lubricant containers at impervious floors will be placed under secondary containment. Fuel and lubricants will be dispensed through dosing pumps with secondary containment to avoid spillages on floor. Spill kit will be used to clean any spills on the floor. Storage and disposal of used lubricants and oil filters will be disposed to the authorized persons.	Operator Company	Operational phase
Noise Nuisance and health impacts due to noise from generators	Noise Abatement at Generator Sites Enclosure of generator in sound proof canopy. The generator will be enclosed in the room with silencer installed at its emission point to avoid dispersion of noise at the bus stop and to the movers. The generator operator will be protected through use of sound mufflers while entering in to the generator room during operation.	Operator Company	Operational phase
Noise Nuisance and health impacts due to noise from bus depot	Noise Abatement at Bus Depots Special consideration will be given to the noise control aspect during bus depot design stage.	Designer	Bus depot designing Stage
	Installation of noise barriers at noise prone areas such as workshop and generator. Enclosure of generator in the room with silencer installed at its emission point to avoid dispersion of noise at the bus depots and nearby	Operator Company (Bus Depot Manager)	Operational Stage

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	community. The generator operator will be protected through use of sound mufflers while entering in to the generator room during operation.		
Solid Waste Nuisance and outbreak of disease if garbage is not properly disposed from bus depots	Safe Disposal of Garbage from Bus Depots Proper garbage management will be ensured at each bus depot. Waste bins, in appropriate size and quantities, will be provided at each bus depot at appropriate locations to collect waste. These bins will be emptied daily and waste will be transferred to the municipal waste collection points. Signs will be posted at bus depots to disseminate messages to the staff regarding waste management practices and provide instructions to use waste bins for waste disposal.	Operator Company (Bus Depot Manager)	Operational Stage
Soil Soil contamination at bus depots	Soil Pollution Control at Bus Depots Storage of hazardous solid waste such as fuel and oil containers, oil filters, oily parts and oily rags on impervious floor under shade Storage of fuel and oil containers at impervious floor with plug drains over secondary containment Proper decantation arrangement for fuel and oil to avoid its spillage and leakage on floor Presence of spill kit to remove spills from the floor Washing the contaminated floors will be done through dry cleaning the spills from the floor with saw dust and rags Proper collection, storage and disposal of used lubricants. Lubricants will be handed over to the authorized contractors.	Operator Company (Bus Depot Manager)	Operational Stage
Fire Loss of property and life due to fire outbreak at bus depots	Fire Safety - Installation of fire alarms at fire prone areas - Placement of fire extinguishers and sand buckets - Installation fire hydrants - Availability of trained firefighting staff	Operator Company (Bus Depot Manager)	Operational Stage

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	• Display of emergency telephone numbers at conspicuous places • Restricted access for the fuel and lubricant storage areas • Designated areas for smoking		
Wastewater Soil and water contamination due to disposal of untreated wastewater from washing area	Wastewater Treatment Treatment of washing area wastewater by passing through grease trap and sedimentation tank for the removal of oil and grease and dust particles prior to disposal in the sewerage system or in the wastewater drain.	Operator Company (Bus Depot Manager)	
Climate Change Impacts			
Roads Damaging of roads due to extreme weather events (flooding and heatwave)	Use of weather resistant material for the road construction. The paving material will be such that it will withstand extreme weather condition of heavy rains and high temperature. The surface material will be specially selected to resist water and prevent it to be washed away. The storm water drainage system will be constructed along the corridor to avoid flooding at the road. The capacity of the drainage system will be designed based on extreme weather conditions predicted under international climate change models for Karachi region to cater for extreme storm water runoff	Designer/Contractor Designer	Design/Construction Design
Flooding Flooding in underpasses	Sophisticated storm water drainage system will be constructed for the underpasses. The underpass roads will be sloped to collect water at grates that will lead to the drainage pipe and collection pits. The submersible pumps will be installed at the collection pits to discharge storm water to the nearby storm water drain network. The pumping system will be equipped with backup pumps. The capacity and the number of collection pits and submersible pumps	Designer	Design

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	will be computed based on extreme weather conditions predicted under international climate change models for Karachi region. Generators will be installed at each underpass as a power backup for the submersible pumps because of power outage issue during rainy season.		
Health Impacts Health impacts on passengers due to heat wave	The bus stops will provide facilities to attenuate heat wave impacts on passengers such as shades, ventilation, fans, drinking water, rest area, and power backup (generators)	Operator Company	Operation

Table 8.2: Environmental Monitoring Plan

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
Safety consideration in the design for electric pylons	SMTA	Ensuring safety considerations in the design of BRT corridor for electric pylons	Design stage
Protection of drains at construction sites	Environmental Consultancy Firm	Evaluation for i) drains are properly protected and due measures are taken by the contractors to cover it and avoiding throwing construction debris in it Location: <u>Construction site:</u> Along the BRT alignment Depots Off corridor Improvement points	Fortnightly at each construction site
Proper storm water drainage system	SMTA	Ensuring for i) storm water drainage system is properly designed as per flooding hot spots at the corridor Location: <u>Construction site:</u> Along the BRT alignment Depots	Design stage

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
		Off corridor Improvement points	
Restoration of the Construction Sites Tree Plantation	Environmental Consultancy Firm	Evaluation for i) Restoration of the campsites ii) tree plantation and landscaping as close to the original features of the land at campsites, iii) tree plantation of about _____ in the city	Fortnightly at each site
Protection of Physical Cultural Resources (PCRs).	Environmental Consultancy Firm	Evaluation for i) the care taken by the contractor for the protection of PCRs (identification, protection measures taken, reporting etc.) Location: <u>Construction site:</u> Along the BRT alignment Depots Off corridor Improvement points	do
Suppression of Dust Emission	Environmental Consultancy Firm	Evaluation for i) regular water sprinkling at dust generation points at construction sites and vehicular and machineries routes ii) use of dust masks by the workers iii) fitness certificates/maintenance records of vehicles/machines Location: <u>Construction site:</u> Along the BRT alignment Depots Off corridor Improvement points	Weekly at each site

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
Control of Stack and Vehicular Emissions	Environmental Consultancy Firm	Monitoring for i) SPM, PM10, PM2.5 at construction sites, vehicular routes, nearby community, ii) stack monitoring of generators (CO, NOx, SOx iii) vehicular emissions (CO, NOx, SOx, Lead) Location: • Mufti Mehmood Masjid, Dawood Chowrangi, KIA Karachi • Jamia Darul uloom, Singer Chowrangi, KIA, Karachi • Near to Dewan University, Shan Chowrangi, KIA, Karachi • Near to EBM, Brooks Chowrangi, KIA, Karachi • Near Indus Hospital, Korangi Crossing, Karachi • NMC Hospital Mehmoodabad Rd, NMC Hospital • Gora Qaberistan, Near CSD • Surgery Hospital P.E.C.H.S Block • Rehmania Qaberistan Tariq Road • Near Hanif Rajput Office Society, Khudadad Chowrangi, Karachi	Weekly at each site
Wastewater	Environmental Consultancy Firm	Evaluation for i) proper treatment and disposal of sanitary wastewater from campsites i.e. construction of septic tanks and disposal in the nearby drain through sewers Monitoring for i) wastewater characteristics	Weekly at each site

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
		i.e. pH, BOD5, COD, TSS, TDS Location: <u>Construction site:</u> • Camp sites • Drain near Shan Chowrangi • Drain in front of Nasla Tower	
Solid Waste Management Hazardous Solid Waste Management	Environmental Consultancy Firm	Evaluation for i) compliance of waste management plan ii) compliance of hazardous solid waste management plan iii) training of the workers iv) use of Personal Protective Equipment (PPE) during handling of hazardous solid waste Location: <u>Construction site:</u> Along the BRT alignment Depots Off corridor Improvement points	Weekly at each site
Soil Pollution Control	Environmental Consultancy Firm	Evaluation for i) compliance of soil pollution control plan ii) availability of spill kit iii) spill response procedures iv) training of the workers Location: <u>Construction site:</u> Along the BRT alignment Depots Off corridor Improvement points	Weekly at each site

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
Noise Abatement	Environmental Consultancy Firm	Evaluation for i) compliance of noise abatement plan ii) use of ear plugs/ear muffs by the workers iii) enclosures for the noisy equipment iv) erection of noise barriers at appropriate places v) equipment are fitted for silencers/mufflers v) fitness certificates/maintenance records of vehicles/machines Monitoring for i) Noise levels at construction sites ii) vehicular noise at about 7.5 m distance iii) noise levels at nearby community Location: <u>Construction site:</u> Generator area • Mufti Mehmood Masjid, Dawood Chowranghi, KIA Karachi • Jamia Darul uloom, Singer Chowranghi, KIA, Karachi • Near to Dewan University, Shan Chowranghi, KIA, Karachi • Near to EBM, Brooks Chowranghi, KIA, Karachi • Near Indus Hospital, Korangi Crossing, Karachi • NMC Hospital Mehmoodabad Rd, NMC Hospital • Gora Qaberistan, Near CSD • Surgery Hospital P.E.C.H.S Block • Rehmania Qaberistan Tariq Road • Near Hanif Rajput Office Society,	Weekly at each site Noise monitoring after every two hours at each location (8:00 am to 6:00 pm)

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
		Khudadad Chowrangji, Karachi	
Occupational Health and Safety Management	Environmental Consultancy Firm	Evaluation for i) compliance of health and safety plan, ii) availability and use of PPE by the workers iii) accident records iv) availability of First Aid Boxes and trained staff for first aid v) medical facilities vi) safety measures at sites taken while working and operating machines vii) availability and use of fire control equipment viii) training of the staff ix) maintenance of hygiene conditions x) availability of safe drinking water xi) safety measures taken to avoid community accidents Location: <u>Construction site:</u> Along the BRT alignment Depots Off corridor Improvement points	Weekly at each site Weekly at each site
Traffic Management	Environmental Consultancy Firm	Evaluation for i) compliance of traffic management plan during construction Location: <u>Construction site:</u> Along the BRT alignment Depots Off corridor Improvement points	Weekly at each site
Operational Phase			
Air Emission Control of Buses	Environmental Consultancy Firm	Evaluation for i) preventive maintenance plan of the busses is	Quarterly

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
		properly followed ii) maintenance record of the buses iii) fitness certificates Monitoring for i) vehicular emission monitoring (CO, NOx, SOx, hydrocarbon, PM) Location: <u>Construction site:</u> Generator area • Mufti Mehmood Masjid, Dawood Chowranghi, KIA Karachi • Jamia Darul uloom, Singer Chowranghi, KIA, Karachi • Near to Dewan University, Shan Chowranghi, KIA, Karachi • Near to EBM, Brooks Chowranghi, KIA, Karachi • Near Indus Hospital, Korangi Crossing, Karachi • NMC Hospital Mehmoodabad Rd, NMC Hospital • Gora Qaberistan, Near CSD • Surgery Hospital P.E.C.H.S Block • Rehmania Qaberistan Tariq Road • Near Hanif Rajput Office Society, Khudadad Chowranghi, Karachi	
Safe Disposal of Garbage from Bus Stops	Environmental Consultancy Firm	Evaluation for i) proper placement of waste bins at each bus stop ii) proper implementation of garbage management plan at each bus stop iii) effectiveness of the waste collection staff iv) effectiveness of the waste management signs (Passengers follow instructions and use waste bins for waste disposal)	Monthly at each bus stop

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
		Location: Stations	
Control of Stack Emissions of Generators	Environmental Consultancy Firm	Evaluation for i) preventive maintenance plan of the generators is properly followed ii) maintenance record of the generators. Monitoring for i) stack emission monitoring (CO, NOx, SOx, hydrocarbon, PM) Location: Generator Area	Quarterly
Soil Pollution Control at Generator Sites	Environmental Consultancy Firm	Evaluation for i) soil pollution control measures are followed at generator sites, ii) the condition of the soil around generators, iii) availability and use of spill kit, iv) conditions of fuel and oil storage tanks Location: Generator Area	Quarterly at each site
Noise Abatement at Generator Sites	Environmental Consultancy Firm	Evaluation for i) sound proof enclosure of generator Monitoring for i) Noise levels dB(A) of generator Location: Generator Area	Quarterly at each site
Noise Abatement at Bus Depots	Environmental Consultancy Firm	Evaluation for i) sound proof enclosure of generator, ii) sound proof walls of the workshop, iii) installation of noise barriers at noise prone areas	Quarterly at each bus depot

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
		Monitoring for i) Noise levels dB (A) at and around bus depot Location: Bus Depots	
Safe Disposal of Garbage from Bus Depot	Environmental Consultancy Firm	Evaluation for i) proper placement of waste bins at each bus depot ii) proper implementation of garbage management plan at each bus depot iii) effectiveness of the waste collection staff Location: Bus Depots	Quarterly at each bus depot
Soil Pollution Control at Bus Depot	Environmental Consultancy Firm	Evaluation for i) soil pollution control measures are followed at each bus depot, ii) the condition of the soil around generators, workshop, fuel and oil storage areas, waste yard, iii) availability and use of spill kit, iv) status of used lube oil Location: Bus Depots	Quarterly at each bus depot
Fire Safety at Bus Depot	Environmental Consultancy Firm	Evaluation for i) availability and use of fire safety equipment at fire prone areas ii) condition of fire safety b equipment, iii) assessment of the firefighting staff, iv) fire safety incidence, root cause and preventive measures taken Location: Bus Depots	Quarterly at each bus depot

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
Wastewater Treatment at Washing Area	Environmental Consultancy Firm	Evaluation for i) availability and use of wastewater treatment facility, ii) effectiveness of the treatment Monitoring of i) BOD5, COD, TDS, TSS Location: Bus Depots	Quarterly at each bus depot
Climate Change			
Use of Weather Resistant Material at Roads Construction	Environmental Consultancy Firm	Evaluation for i) Use of weather resistant material as per design	Monthly
Storm Water Drainage System at Corridor	Environmental Consultancy Firm	Evaluation for i) construction of storm water drainage system along corridor as per design	Monthly
Storm Water Drainage System at Underpasses	Environmental Consultancy Firm	Evaluation for i) construction of storm water drainage system at underpasses as per design and availability of power backup for the pumps Location: Underpasses	Monthly
Facilities at Bus Stops to Attenuate Heatwave Impacts	Environmental Consultancy Firm	Evaluation for i) provision of facilities and their effectiveness at bus stops such as shades, ventilation, fans, drinking water, rest area, and power backup (generators) Location: Bus Stations	Monthly

8.5 CAPACITY BUILDING

Capacity building will be required for the stakeholders involved for the implementation, supervision, monitoring, evaluation, and reporting of the mitigation measures during construction and operational phases of the project components in line with the requirements and standards of the World Bank. This section describes the capacity building requirements for the stakeholders involved.

- Project Management Team SMTA (PMT-SMTA)
- Infrastructure Development Company (IDC)
- Operator Company (OC)
- Environmental Consultancy Firm (ECF)
- Contractors (CONTs)

Table 8.3 presents detail of trainings required for the capacity building of above-mentioned key stakeholders on environmental management requirements. The World Bank environmental experts will offer these trainings as part of their regular supervision mission of the project.

Table 8.3: Training Subjects for Project Implementation

	Trainings (Resource Person)	Key Stakeholders (Frequency)				
		PMT-SMTA	IDC	OC	ECF	CONTs
1.	Overview of Project and its Environmental Impacts and Mitigation Measures (Environment Consultant)	■	■	■	■	■
		Once at the start				Once for Every Contractor
2.	Construction Phase Environmental Management Plan (CPEMP) (Environment Consultant)	■	■		■	■
		Once at the start				Once for Every Contractor
3.	Environmental Monitoring and Evaluation Requirements during Construction and Operational Phases (Environment Consultant)	■	■	■	■	
		Once at the start				
4.	Environmental Monitoring, Evaluation and Compliance Reporting Requirements (Environment Consultant)	■	■	■	■	
		Once at the start				
5.	Public Consultation, Disclosure and Grievance Redress Mechanism Requirements (Environment Consultant)	■	■	■	■	
		Once at the start				

Following is the Training Plan for Contractors covers a range of training subjects, which can be general or specific to staff working with particular equipment, settings, or situations.

Table 8.4 : Training Subjects for Inclusion in Contractors Training Plan

Training Subject	Target Audience
Environmental Code of Practices	All staff
Awareness workshop regarding Covid 19 and other vector borne diseases	All staff
Handling, use & disposal of hazardous material	Construction workers involved in handling, use & disposal of hazardous material storage areas and required to use hazardous material during their works
Waste Management	All construction staff
Efficient & safe driving practices, including road & vehicle restrictions	Drivers & mobile plant operators
Pollution prevention: Best practice	All staff
Health & Safety: Safe way to work & hazard awareness	All construction staff and O&M Staff
Health & Safety: Safe use of plant & equipment	Operators of plant & equipment
Health & Safety: Working at height	Staff colony and regulator construction staff
Health & Safety: Use of PPE	All construction staff
Occupational Health and Safety	To all persons entering the construction site
Emergency procedures and evacuation	All staff
Diver training	All divers
Spill clean-up training	Contractor's spill management staff
Fire fighting	All staff
Site inductions, including requirements under the Environmental and Social Mitigation and Monitoring Plan	All staff
Culturally sensitive awareness rising on HIV/ AIDS and the spread of sexually transmitted diseases.	All staff

Table 8.5: Training Requirements

Training Activity	Participants	Type of Training	Content	Scheduling	Cost Estimates Rs.
Construction Phase (03 years)					
Environment code of practices and ESHGS of WB	Contractor Staff	Presentation	Awareness; and Applicability of environmental code of practices	Biannually	200,000/-
Awareness workshop regarding Covid 19, other communicable diseases and	Contractor Staff	Presentation	Risk, Prevention and available treatment	Biannually	200,000/-

vector borne diseases.					
Pollution prevention practices	Contractor Staff	Lecture	Awareness and importance of Practices to be adopted for pollution preventions	Biannually	200,000/-
Sensitivity to local culture	Contractor Staff	Lecture	Awareness of local culture and practices	Biannually	200,000/-
Awareness on vector borne diseases	Contractor Staff	Presentation	Risk, Prevention and available treatment	Biannually	200,000/-
Driver safety	Contractor Staff	Lecture	Risks, safe practices and responding to accidents	Biannually	200,000/-
Waste Management	Contractor Staff	Lecture	Awareness associated with waste Storage, collection and safe disposal	Biannually	200,000/-
Emergency Preparedness and Response	Contractor Staff	Workshop	Potential natural and other hazard/emergencies and dealing with emergency to minimize damage	Biannually	200,000/-
Ecological Conservation	Contractor Staff	Lecture	Awareness on regulations wild life and forest and penalties against violation of laws. Importance of protection of endangered species	Biannually	200,000/-
EPA Regulation	Managerial Staff of Contractor	Lecture	Awareness on EPA rules, guidelines, regulation and standards for satisfactory compliance	Biannually	200,000/-
World Bank Safeguard policies	Managerial Staff of Contractor	Lecture	Awareness on WB operational policies and best practices on environment and social issue	Biannually	200,000/-
Labour Management Procedures	Contractor Staff	Lecture	Awareness on World Bank ESS-2, Labour and working	Biannually	200,000/-

			conditions and HIV/STDs		
Community/ occupational health and safety	Contractor Staff	Lecture	Awareness on World Bank ESS-4, Community health and safety	Biannually	200,000/-
Gender Aspects	Contractor Staff	Lecture	Awareness on gender inequalities/GBV	Biannually	200,000/-
Total					3,000,000/-

8.6 REPORTING

The Environmental Consultant and contractor will prepare monthly reports covering various aspects of the EMP implementation during project implementation. Third party contractor will prepare reports during post-completion. List of reports to be prepared during implementation and operation stages are presented in **Table 8.6**.

Table 8.6: Reporting during Implementation and Operation Phases

Report	Contents	Prepared by	Submitted to
Monthly Progress Report for ESMP Compliance	Non-Compliances observed on sites and actions undertaken.	Contractor	Environmental Consultant
Monthly Progress Report for ESMP Compliance	Actions taken on site in response to review of Environmental Consultant Project progress and works Details of training delivered Details of accidents reported and actions taken to be undertaken in the coming three months	Environmental Consultant	PMT SMTA, EPA (as specified in NOC)
Quarterly Progress Report for ESMP Compliance	Quarterly review on implementation of ESMP including compliance and monitoring, capacity building, and grievance redressal.	SMTA/ Environmental Consultant/Contractor	World Bank, EPA (as specified in NOC)
Biannual Progress Report for ESMP Compliance	Biannual review on implementation of ESMP including compliance and monitoring, capacity building, and grievance redressal. Actions taken to issues highlighted by World bank and EPA	SMTA/ Environmental Consultant/Contractor	World Bank, EPA (as specified in NOC)

Report	Contents	Prepared by	Submitted to
Annual Report for ESMP Compliance	Results of effects of monitoring and Independent review of environmental and social performance on site and recommended actions required by all parties	SMTA/ Environmental Consultant/Contractor	World Bank, EPA (as specified in NOC)

8.7 TENTATIVE BUDGET

The tentative budget under different cost head is mentioned in **Table 8.7**. Total tentative budget for the environmental management of the project during construction is **Rs. 267.6 Million** and operational phases (per annum) is about **Rs. 2.09 Million**.

Table 8.7: Tentative Yearly Budget for Environmental Management

Sr. No.	Cost Head	Unit Cost	No. of Units	Total Amount
A- Environmental Assessment				
1	Baseline environmental monitoring	Lump Sum	-	600,000
Total-A				600,000
B- Construction Phase CPEMP Implementation				
2	Fixed cost at project site (Installation of noise barriers and safety signage etc.)	Lump Sum	-	6,000,000
3	Environmental Monitoring (Third party)	Lump Sum	-	6,540,000
4	PPE	Lump Sum	-	43,080,000
5	Solid Waste Management	Lump Sum	-	9,000,000
6	Water Sprinkling	Lump Sum	-	1,500,000
7	Traffic Management	500,000	-	750,000
8	Training cost	Lump Sum	-	3,000,000
Total-B				69,870,000
C-Tree Plantation				
9	Tree Plantation cost	Lump sum	-	194,166,000
Total-C				194,166,000
D- Third Party Monitoring Cost				
10	Third Party Monitoring Cost	500,000	Biannual	3,000,000
Total-D				3,000,000
E- Operation of Project Management Team (Per Annum)				
11	Third Party Monitoring Cost	500,000		1,000,000
12	Environmental Monitoring (Annually)	Lump sum	Biannual	1,090,000
Total-E				2,090,000
Grand Total			Construction	267,636,000
			Operation	2,090,000

Note* Basis of PPE and Monitoring Cost has been attached as **Annexure XV**.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 CONCLUSIONS

Karachi city is facing transport challenges. The public transport condition is day by day worsening and unable to cope with the fast-growing population of the city. Karachi is in dire need of a modern transport system for fast and convenient travelling. Many transportation improvement studies and master planning have identified these issues and recommended a Bus Rapid and Mass Rapid Transit system for the Karachi city.

Yellow BRT project is in line with the need of the Karachi's present and future public transit requirements. This project will result in significant positive impacts, not only on the city's urban environment but also making Karachi a livable and prospering city.

Yellow BRT project is also in compliant with the Government of Sindh and World Bank's policies and regulations, concerning environment, social impact, resettlement and compensation, and local administration.

The EIA report and EMP provide a means for environmental management at all stages of the project. A clear right of way in the public domain allows the project to be built without any land acquisition. The project provides improved access between residential and business areas. In conjunction with other transport systems, the alignment serves the core of the city.

The deployment of modern hybrid technology-based buses, equipped with EURO III standard compliant engines, besides scrapping of old bus fleet of the city, will significantly contribute in improving urban environmental quality. Yellow BRT project has no long term adverse environmental impacts. Once constructed and in operation, it will enhance its local environment and improve mobility for local communities. The project design incorporates measures for reducing the impact or footprint of the project. An extensive ITS and other interlinked systems assure enhanced bus movement and passenger safety.

The project will pose environmental impacts of minor to insignificant nature during construction and operational phases. Operational phase impacts are minor whereas construction phase impact are insignificant, temporary and reversible, which can be easily managed and controlled.

Major issues arising during construction phase may be the traffic congestion, dust emission and health and safety concerns for the workers and community. Strict vigilance of the contractors for the implementation of CPEMP for traffic management, dust suppression and health and safety of the workers and community, by the SMTA and Infrastructure Development company, will be the key for the successful completion of the project.

About 10,050 plants will be removed from the roadway in preparation for developing the carriageway and stations. These plants will be replanted at specified locations within and

outside the project boundaries to offset those removed.

A systematic approach for surveillance and monitoring for the implementation of EMP by Project Management Team will be required. Follow up public consultation is intended to provide future input to the identification of environmental impacts during the construction phase. A grievance redress mechanism (GRM) will be put into effect for project affected persons. The CPEMP will be incorporated into individual contract bidding documents.