

## Table of Contents

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	Back Ground .....	1
1.2	Project Road Description .....	1
1.3	Objectives and Scope of the Study .....	2
1.4	Approach to the Environmental Due Diligence Report .....	2
1.5	Structure of this EDDR .....	3
<b>2</b>	<b>LEGAL AND ADMINISTRATIVE FRAMEWORK.....</b>	<b>4</b>
2.1	Summary of Clearance Requirements .....	4
2.2	*Environmental Clearance Requirements.....	5
2.3	Clearance already obtained (Prior to Construction) .....	6
2.4	World Bank’s Safeguard Policies.....	6
<b>3</b>	<b>BASELINE ENVIRONMENTAL SCENARIO.....</b>	<b>10</b>
3.1	Definition of the Project Study Area .....	10
3.2	Environmental Features .....	10
3.2.1	Climate .....	11
3.2.2	Land Environment .....	11
3.2.3	Seismic Profile of the area.....	11
3.2.4	Water Environment and Water Quality.....	11
3.2.5	Drainage Pattern of the study area .....	12
3.2.6	Air Environment and Air Quality .....	12
3.2.7	Noise Environment .....	13
3.2.8	Socio-economic profile .....	13
3.2.9	Biological Resources .....	14
3.2.10	Properties Adjacent to Project Road .....	15
<b>4</b>	<b>PUBLIC CONSULTATION.....</b>	<b>16</b>
4.1	General .....	16
4.1.1	Provision of Public Consultation under EIA Notification 2006 .....	16
4.1.2	District wise Public Hearing (PH) conducted by GPCB .....	17
4.1.3	Summary of Public Hearing .....	18
<b>5</b>	<b>IMPACT IDENTIFICATION AND MITIGATION.....</b>	<b>19</b>
5.1	General .....	19
5.2	Likely to be Affected Component .....	20
5.2.1	Soil.....	20
5.2.2	Air Quality.....	21
5.2.3	Noise Quality.....	22
5.2.4	Land Acquisition .....	23
5.2.5	Loss of Cultural/ Historical Areas .....	23
5.2.6	Social Development Due to Road Widening and Increased Traffic .....	24
5.2.7	Vegetation .....	24
5.2.8	Impact on Biodiversity .....	24
5.2.9	Impacts to Wildlife Sanctuary .....	25
<b>6</b>	<b>ENVIRONMENTAL MANAGEMENT PLAN (EMP).....</b>	<b>27</b>
6.1	Introduction.....	27
6.2	EMP – Budget.....	27
<b>7</b>	<b>ENVIRONMENTAL MONITORING PROGRAMME AND IMPLEMENTATION ARRANGEMENT .....</b>	<b>29</b>
7.1	Institutional Setup .....	29
7.2	Environmental Monitoring PROGRAMME / Plan .....	31
7.3	Monitoring Indicators .....	31

7.4	Reporting System .....	34
7.5	Good Environmental Construction Guidelines .....	35
<b>8</b>	<b>ANALYSIS OF ALTERNATIVES, PROJECT BENEFITS .....</b>	<b>36</b>
8.1	Project Benefits .....	36
8.2	Benefits of road improvement.....	37
	8.2.1 Technological Benefits.....	37
8.3	Benefits under Innovative Finance.....	38
<b>9</b>	<b>SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>39</b>
9.1	Project Description .....	39
9.2	Description of Existing Environment .....	40
	9.2.1 General.....	40
	9.2.2 Land Environment .....	40
	9.2.3 Water Environment.....	41
	9.2.4 Air Environment .....	42
	9.2.5 Noise Environment .....	44
	9.2.6 Biological and Ecological Environment .....	45
	9.2.7 Solid Waste Generation.....	45
9.3	Potential Impacts and Mitigation Measures.....	45
9.4	Socio-Economic Environment .....	51
9.5	Biological and Ecological Environment.....	52
9.6	Analysis of Alternative.....	53
9.7	Environmental Management Plan .....	53
9.8	Environmental Monitoring Program .....	54
9.9	Conclusion .....	54
9.10	Recommendations .....	<b>Error! Bookmark not defined.</b>

## List of Tables

Table 2-1: Applicable Laws and Regulations (For the project corridor).....	4
Table 2-2: Clearance already obtained for the project corridor.....	6
Table 2-3: Applicability of WB Safeguard policies .....	7
Table 4-1: Schedule - District wise Public Hearing.....	17
Table 4-2: Summary of Public Hearing .....	18
Table 5-1: Potential Environmental Impacts on Valued Ecosystem Components.....	20
Table 6-1: Budgetary Provisions for Environmental Management Measures .....	27
Table 7-1: Institutional Responsibilities .....	29
Table 7-2: Environmental Monitoring Indicators.....	31
Table 7-3: Environmental Monitoring Program / Plan .....	33
Table 7-4: Summary - Details of Reporting.....	34
Table 7-5: Guideline for Good Environmental Practices .....	35
Table 9-1: Details of Project Road .....	40
Table 9-2: Air Quality Monitoring Results .....	42
Table 9-3: Results of Noise level Monitoring .....	44
Table 9-4: Air Emission Loading (CO) in (t/y) along the Project Road .....	48
Table 9-5: Air Emission Loading (HC) in (t/y) along the Project Road .....	48
Table 9-6: Air Emission Loading (NOX) in (t/y) along the Project Road .....	48
Table 9-7: Predicted Noise Level (Near Bagodara Junction, Km. 61.400) .....	49
Table 9-8: Predicted Noise Level (At Dhandhuka Village, Km. 106.050) .....	49
Table 9-9: Predicted Noise Level (At Panvi village, Km. 141.200) .....	49
Table 9-10: Land Requirement detail of Project Road .....	51

## List of Figures

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Figure 5-1: Signboard showing distance of road from Sanctuary.....	25
Figure 7-1: Organization Setup for EMP Implementation .....	30
Figure 9-1: Graphical representation of SPM .....	43
Figure 9-2: Graphical representation of RPM .....	43
Figure 9-3: Graphical representation of SO <sub>2</sub> .....	43
Figure 9-4: Graphical representation of NO <sub>x</sub> .....	43
Figure 9-5: Graphical representation of CO.....	44
Figure 9-6: (A): Graphical representation of noise monitoring results .....	44
Figure 9-7: Noise Levels (Near Bagodara Junction, Km. 61.400).....	50
Figure 9-8: Noise Levels (At Dhandhuka, Km. 106.050).....	50
Figure 9-9: Noise Levels (At Panvi Village, Km. 141.200).....	50
Figure 9-10: Noise Levels (At Chamardi Village, Km. 169.100).....	51

## List of Annexure

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Annexure 1.1	Copy of Environmental Clearance granted by SEIAA, Govt. of Gujarat
Annexure 1.2	Copy of Consent to Establish (C.T.E.), obtained from State Pollution Control Board GPCB, Gandhinagar
Annexure 1.3	Copy of In Principal Approval of Forest Clearance obtained from MoEF, GoI for Ahmedabad District

## List of Abbreviation

APHA	:	American Public Health Association
BIS	:	Bureau of Indian Standards
BOD	:	Biological Oxygen Demand
BOQ	:	Bill of Quantity
BOT	:	Build Operate Transfer
CO	:	Carbon Monoxide
COD	:	Chemical Oxygen Demand
CPCB	:	Central Pollution Control Board
CRZ	:	Coastal Regulatory Zone
dB	:	Decibel.
DO	:	Dissolved Oxygen
DoE	:	Department of Environment
DoF	:	Department of Forests
DoEF	:	Department of Environment and Forest
DPR	:	Detailed Project Report
EA	:	Environmental Assessment
EIA	:	Environmental Impact Assessment
EMC	:	Environmental Management Cell
EMP	:	Environment Management Plan
EMS	:	Environmental Management System
EMU	:	Environmental Management Unit
EPA	:	Environmental Protection Agency
GoI	:	Government of India
GSRDC	:	Gujarat State Road Development Corporation Ltd.
GPCB	:	Gujarat (State) Board Pollution Control Board.
GoG	:	Government of Gujarat.
HC	:	Hydrocarbons
IMD	:	Indian Meteorological Department
IRC	:	Indian Road Congress
MOEF	:	Ministry of Environment and Forests
MPN	:	Most Probable Number
NAAQS	:	National Ambient Air Quality Standards
NGOs	:	Non government Organizations
NH	:	National Highways
NOC	:	No Objection Certificate
NO <sub>x</sub>	:	Nitrous Oxide
PCC	:	Plain Cement Concrete
PIU	:	Project Implementation Unit
PPR	:	Preliminary Project Report
PUC	:	Pollution Under Control
PWD	:	Public Works Department
RCC	:	Reinforced Cement Concrete
ROB	:	Railway Over Bridge
ROW	:	Right of Way
R & BD	:	Roads and Building Department
RPM	:	Respirable Particulate Matter
SH	:	State Highways
SO <sub>2</sub>	:	Sulphur Dioxide
SPCB	:	State Pollution Control Board
SPM	:	Suspended Particulate Matter
SEIAA	:	State Level Environmental Impact Assessment Authority
SEAC	:	State Level Expert Appraisal Committee
TOR	:	Terms of Reference

# 1 INTRODUCTION

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## 1.1 Back Ground

Roads and Building Department (R& BD.), Govt. of Gujarat had decided to develop Bagodara Bhavnagar corridor into a 4 lane facility on PPP basis. R& BD had assigned this development to Gujarat State Road Development Corporation Limited (GSRDC). GSRDC has appointed Ahmedabad based consultancy firm namely M/s SAI Consulting Engineers Pvt. Ltd. to prepare pre feasibility study and assist GSRDC in obtaining necessary clearances including environmental clearance (EC), NOC from state pollution control board. These Clearances were obtained during December 2009 and September 2009 respectively.

BIDs were invited during 2011-12, on VGF and / or TOLL basis. GSRDC did not receive any bid. Finding this corridor as most favourable corridor to explore deploying innovative finance mechanism, GoG in consultation with the World Bank decided to include this corridor in Second Gujarat State Highway Project (GSHP II) for innovative finance candidate.

By this time, many of the social and environmental activities had been taken up by GSRDC. It is therefore necessary to examine whether World Bank safeguard provisions have been met with or not and if any GAPS are noticed, how best these can be bridged. This report aims to lay the same.

This report compiles information on environmental assessment and management plan as available from detailed EIA and measures undertaken in the project documents. The consolidated Environmental Due Diligence Report (EDDR) has been prepared with a basic objective to collate and analyze the addressal of environmental impacts and environmental management measures that are being integrated in the project documents. The report also reviews the project compliance with environmental regulations of Government of India (GoI) and the environmental safeguards requirements of the World Bank.

## 1.2 Project Road Description

The project road is located in south central part of the Gujarat state falling in two districts i.e. Ahmedabad & Bhavnagar. Bagodara – Dhandhuka – Vallabhipur – Bhavnagar Road is comprises of two state highways i.e. SH-1 & SH-36 having total length 127.700 km. State Highway-1 starts from Bagodara Junction with NH-8 at Km. 61.400 and ends near Tagadi village at Km. 113.000 having total length of 51.600 km. State Highway-36 starts near Tagadi village at Km. 113.000 (end point of SH-1) and ends at Bhavnagar at Km. 189.100 having total length of 76.100 km.

It passes through seven talukas namely Bavla, Dholka, Dhandhuka, Barwala, Vallabhipur, Shihor and Bhavnagar of Gujarat state. Out of which Bavla, Dholka, Dhandhuka and Barwala falls under Ahmedabad District and rest three talukas Vallabhipur, Shihor and Bhavnagar falls under Bhavnagar District. Out of total length of 127.7 Km., 78.4 km length falls in Ahmedabad district while 49.3 km length falls in Bhavnagar districts.

Project Road	Chainage(Km. to Km.)		Length(km)	Total Length(Km)
Bagodara to Bhavnagar	SH-1	61.400-113.000	51.600	127.700
	SH-36	113.000-189.100	76.100	

This project road stretches between Bagodara at Km. 61.400 and Bhavnagar at Km. 189.100 of SH-1 & SH-36. This road starts from junction (“T” junction) with NH-8A and ends at Bhavnagar having junction (“T” junction) with SH-25. This project road is having good connectivity with important towns and villages through other State Highways like Lothal (SH-117), Limdi (SH-20), Dholera (SH-20), Pipli (SH-40), Ranpur (SH-1), Gadhda (SH-108), Rajkot (SH-39) and Palitana (SH-36). This project road transverse through important towns and villages along this road include Dhandhuka, Bhimnath, Barvala, Vallabhipur, Chamardi, and Ghanghli.

The Bagodara – Bhavnagar is an important highway in Ahmedabad and Bhavnagar district of Gujarat state. The project road provides connectivity to the commercial hub like Alang ship breaking yard, Dholera Port, Ghogha Port and other major industrial centre like IPCL at Bhavnagar with the NH-8 running between Delhi and Mumbai.

### 1.3 Objectives and Scope of the Study

Since it is decided to develop this corridor under World Bank Funded Second Gujarat State Highway Project (GSHP II), in addition to the national and state policies, acts and rules, project also requires the World Bank policies and directives on environmental and social safeguards be adhered to in the present assignment. It is require to identify whether provisions under World Bank’s Operation Policies and Operational Directives, OP 4.01 (Environmental Assessment -EA), OP 4.04 (Natural Habitats), OP 4.36 (Forestry), OP 4.12 (Involuntary Resettlement), OP 4.10 Indigenous people, OP 4.11 Physical cultural resources (PCR) are addressed in the safeguard documents such as EIA and SIA.

### 1.4 Approach to the Environmental Due Diligence Report

The EDDR reviews the available documents and assesses the compliance of the sub project with the respect to (i) regulatory clearances (like environmental clearance, forest clearance, CRZ clearance, etc.); (ii) Environmental safeguards as per Environment and Social safeguard framework (ESSF) of PIU, R & BD-monitoring mechanism and applicable operational policies of WB (iii) analysis of alternatives; (iv) the process of identifying environmental impacts and integration of environmental management measures; (v) public consultations and information disclosure etc.

## 1.5 Structure of this EDDR

Environmental Due Diligence Report (EDDR) is made up of a number of chapters as mentioned below:

Chapter 1	Provides background of the project, describes project setting, objectives and scope of study – Environmental Due Diligence Report, Approach towards this report and structure of this report i.e. <b>Introduction</b>
Chapter 2	Describes <b>Legal and Administrative Framework (Indian Context)</b> within which permits and approvals are required.
Chapter 3	Provides Description of <b>Existing Environmental Conditions, Baseline Environmental Profile</b> of the project area
Chapter 4	Describes <b>Public Consultation</b> and Public Hearing conducted.
Chapter 5	Presents <b>Identified Environmental Impact</b> and provides <b>Mitigation Measures</b> for the same.
Chapter 6	Presents the <b>Environmental Management Plan</b>
Chapter 7	Deals with Institutional Arrangement and <b>Environmental Monitoring Programme</b> proposed for the project
Chapter 8	Briefs <b>Analysis of Alternatives</b> and enlists <b>Benefits of the Project</b>
Chapter 9	Provides <b>Summary of the Report, Conclusion and Recommendations</b>

## 2 LEGAL AND ADMINISTRATIVE FRAMEWORK

### 2.1 Summary of Clearance Requirements

Table 2-1 below summaries the clearance requirements for the project, approving agency, agency responsible for obtaining the clearances and estimated time period required for each clearances.

**Table 2-1: Applicable Laws and Regulations (For the project corridor)**

Sr. No.	Clearances	Acts	Approving Agency	Applicability to the Project	Estimated Time Required	Responsibility	
						Execution	Supervision
<b>PROJECT PREPARATION STAGE</b>							
1	Environmental Clearance	EIA Notification, 14 <sup>th</sup> September, 2006 and its subsequent amendments	MoEF, GoI / SEIAA, State Govt.	Applicable*	9-12 months		
2	No Objection Certificate (NOC)	Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981	Gujarat Pollution Control Board	Applicable*	3-6 months	PIU, R & BD., GoG	-
3	Diversion of forest land for Non-forest use	Forest Conservation Act (1980) Forest Conservation Rules (2003) and Guidelines issued to date Government of Gujarat, Gazette dt 5 <sup>th</sup> July 1973	Regional Office Western Zone, MoEF, Bhopal	Applicable	9-12 months	PIU, R & BD., GoG	-
4	Permission for removal of avenue tree within the ROW	Forest Conservation Act (1980) Forest Conservation Rules (2003) and Guidelines issued to date	Forest Department, GoG	Applicable	3-6 month for each workout area	PIU, R & BD., GoG	-
<b>PROJECT IMPLEMENTATION STAGE</b>							
5	Location, Layout of Workers Camp, Equipment, Storgae Yards etc.	EP Act, 1986 and Environmental Management Plan (EMP)	Gujarat Pollution Control Board	Applicable	3 months	Contractor	Engineer
6	Permission for Withdrawal of Surface Water from Rivers, Nala, Water harvesting structure/ Reservoirs/ Ponds/ Irrigation canals	Gujarat Water Supply and Sewerage Board Act, 1978	Gujarat Water Supply and Sewerage Board	Applicable (If the contractor is extracting surface water)	3 months	Contractor	Engineer
7	Permission for Sand Mining from river bed	Mines and Minerals (Development and Regulation) Act, 1957	Commissioner of geology and mining, GoG	Applicable	2 month	Contractor	Engineer
8	Permission for Opening of New Quarry	Mines and Minerals (Development and Regulation) Act, 1957	Commissioner of geology and mining, GoG	Applicable	2 month	Contractor	Engineer
9	Hot mix plant, Crushers, Cement Batching Plant	Air (Prevention and Control of Pollution) Act. 1981	Gujarat Pollution Control Board	Applicable	3 months	Contractor	Engineer
10	Storage of Hazardous Chemicals	Hazardous Waste (Management and Handling) Rules 1989 and Manufacturing Storage and Import of Hazardous Chemicals Rules 1989	Gujarat Pollution Control Board	Applicable	3 months	Contractor	Engineer
11	Disposal of Hazardous Waste	Hazardous Waste (Management and Handling) Rules 1989	Gujarat Pollution Control Board	Applicable	2 months	Contractor	Engineer
12	Disposal of	Water (Prevention and	Gujarat Pollution	Applicable	2 months	Contractor	Engineer

<sup>1</sup>Right of Permission and time period required for the same vests with component authority.



Sr. No.	Clearances	Acts	Approving Agency	Applicability to the Project	Estimated Time Required	Responsibility	
						Execution	Supervision
	Construction Waste and liquid effluent from Labour camps	Control of Pollution) Act 1974	Control Board				
13	Pollution Under Control Certificate	Central Motor Vehicles Act 1988	Transport Department (GoG)	Applicable	1 Month	Contractor	Engineer
14	Employing Labour	Executing Agency of Building and other construction act, 1996	Labour & Employment Department, GoG	Applicable	1 Week	Contractor	Engineer
15	Registration of Workers	Labour welfare Acts.	Labour & Employment Department, GoG	Applicable	1 Month	Contractor	Engineer

Source: Acts, Rules and Regulation from Central and State Government

## 2.2 \*Environmental Clearance Requirements

EIA notification by MoEF, GoI dated 14<sup>th</sup> September 2006 has categorized all projects and activities into two categories<sup>2</sup> - Category A and Category B, based on the spatial extent of potential impacts and potential impacts on human health and natural and manmade resources. Environmental Impact Assessment Notification, amendment in 2009, states that “all state highways and state highways undergoing expansion in hilly terrain (above 1000m AMSL) and / or ecological sensitive area” should obtain environmental clearance from State Environmental Impact Assessment Authority (SEIAA). The amendment also states that prior environmental clearance is needed for all State Highway projects, which was eventually superseded in the subsequent amendment of April 2011- which states that - “All new state highway projects should obtain environmental clearance from SEIAA”. This new amendment excludes carrying out widening, strengthening and improvement works on the existing state highways from environmental clearances.

However, the project shall require obtaining consent from competent authorities such as the Gujarat Pollution Control Board (GPCB), for ‘*Consent to Establish*’ by submitting an online Common Application (as per Schedule-I), under Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981) and authorization under Hazardous Wastes (Management and Handling) Rules, 1989, as amended.

**As a part of preconstruction activities, by the time process of obtaining clearances initiated during 2007-08, as per prevalent legislations at that time, it was mandatory to obtain Environmental Clearances (EC) for the Bagodara – Bhavnagar since corridor falls under Category B of EIA Notification, 14<sup>th</sup> September, 2006. Subsequently EC was accorded by SEIAA, GoG.**

<sup>2</sup>All projects or activities included as *Category ‘A’* in the Schedule, including expansion and modernization of existing projects or activities and change in product mix, shall require prior environmental clearance from the Central Government in the Ministry of Environment and Forests (MoEF) on the recommendations of an Expert Appraisal Committee (EAC) to be constituted by the Central Government for the purposes of this notification; All projects or activities included as *Category ‘B’* in the Schedule, including expansion and modernization of existing projects or activities as specified in sub paragraph (ii) of paragraph 2, or change in product mix as specified in sub paragraph (iii) of paragraph 2, but excluding those which fulfil the General Conditions (GC) stipulated in the Schedule, will require prior environmental clearance from the State/Union territory Environment Impact Assessment Authority (SEIAA). The SEIAA shall base its decision on the recommendations of a State or Union territory level Expert Appraisal Committee (SEAC) as to be constituted for in this notification.

Similarly, process for obtaining Consent to Establish (i.e. NOC) from Gujarat State Pollution Control Board was also initiated during 2008-09 and same was obtained.

### *Forest Clearance Procedures*

As per the Gujarat Government Gazette dated 5<sup>th</sup> July 1973, some of the State Highways (SH) and National Highways (NH) within the state of Gujarat are declared as Notified Protected Forest (NPF), under Forest (conservation) Act 1980. Hence, any infrastructure development in the identified corridors, including strengthening and widening activity would attract Forest clearance. As per the Forest act, Form 'A' needs to be filled by the project proponent and has to be submitted along with the necessary enclosures to the District Forest Office.

**GSRDC had initiated the process of obtaining Forest Clearance during 2009.** In Principal Approval for section of the corridor passes through Ahmedabad district is obtained from MoEF, GoI, attached as **Annexure III**. Approval for the remaining section of Bagodara – Bhavnagar which passes through Bhavnagar district **is under process**.

## **2.3 Clearance already obtained (Prior to Construction)**

Following Table 2-2 lists the prior to construction, clearances (environmental& forest)already obtained for this project, under Govt. of India Legislations, EPA 1986, Ministry of Environment and Forest (MoEF), Govt. of India and State Pollution control Board (GPCB), Gujarat State.

**Table 2-2: Clearance already obtained for the project corridor**

Sr. No.	Type	Statute under which clearances required	Statutory Authority	When / Date	Validity (Duration)	Remarks
1	Environmental Clearance (EC)	MoEF Notification, 14 <sup>th</sup> Sept. 2006 and its subsequent amendments	MoEF, GoI / SEIAA, Govt. of Gujarat	18 <sup>th</sup> December 2009	Until 17 <sup>th</sup> December, 2014 (5 Years)	Annexure I
2	Consent to Establish (CTE)	No Objection Certificate (NOC) from State PCB in pursuant to the Water (Prevention and Control of Pollution) Act of 1974, and the Air (prevention and Control of Pollution) Act of 1981.	State Pollution Control Board (GPCB), Gujarat State	8 <sup>th</sup> September, 2009	7 <sup>th</sup> September, 2014 (5 Years)	Annexure II
3	Forest Diversion	FCA 1980 and its subsequent amendments, EPA 1986 and State Govt. 's gazette Notifications	MoEF, GoI / State Forest and Environment Dept., DoEF, Govt. of Gujarat	Ahmedabad District-10 <sup>th</sup> March, 2011 (In Principal Approval)		In Principal Approval obtained, prescribed Fee (NPV) is deposited for Ahmedabad district. <b>Annexure III</b>  FC application for section passes through Bhavnagar district is at MoEF, Bhopal.
4	Tree Cutting					Tree Cutting Permission for part of the section is obtained.

## 2.4 World Bank's Safeguard Policies

In addition to the national and state policies, acts and rules, the World Bank policies and directives on environmental and social safeguards need to be adhered to in the present assignment. The applicability of the relevant policies to GSHP-II is summarized in Table 2-3.

**Table 2-3: Applicability of WB Safeguard policies**

WB Safe Guard Policy	Policy objectives	Applicability	Mitigation Measures	Documentation	Present Status (Whether addressed or not ?)
OP 4.01 Environmental Assessment	Help to ensure the environmental and social soundness and sustainability of investment projects. Support integration of environmental and social aspects of projects in the decision-making process	Umbrella policy	All necessary mitigation measures incorporated.	EIA and EMP required.	Provisions of OP 4.01 are addressed through detail EIA and EMP.  Project falls under <b>Category "B"</b> as per OP 4.01.
OP 4.04 Natural Habitats	Promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions.	Eco-sensitive-Forestry and wildlife related issues	Not Applicable	Not Applicable	OP 4.04 is not applicable for this corridor. 13 km. from the project corridor is the nearest distance observed from Velavdar Black Buck National Park. Since located more than 13 kms. Away from the project corridor, natural habitats are not likely to disturbed.
OP 4.36 Forestry	Realize the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.	Forest land to be diverted	Land diversion being carried out as per provisions of the Forest Conservation Act	Forest land diversion Application has been submitted to forest department.	Out of both the districts, in principal approval for Abad district is already obtained from MoEF., GoI. For Bhavnagar district, same is under process.
OP 4.12 Involuntary Resettlement	Avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.	Acquisition of private / govt. land and assets are required along the project corridor.	To be Incorporated in RAP. Separate Consultancy Services is hired to prepare detailed RAP as per bank's guidelines.	Resettlement Action Plan (RAP).	Separate Consultancy is mobilized to address provisions of OP 4.12 through detailed RAP, and work is under progress.
OP 4.10 Indigenous people	Design and implement projects in a way that fosters full respect for indigenous peoples' dignity, human rights, and cultural uniqueness	A project corridor does not pass through notified tribal areas.	Not Applicable	Not Applicable	Project corridor falls within A'bad and Bhavnagar district. None of these districts are notified tribal areas,

WB Safe Guard Policy	Policy objectives	Applicability	Mitigation Measures	Documentation	Present Status (Whether addressed or not ?)
	and so that they (1) receive culturally compatible social and economic benefits, and (2) do not suffer adverse effects during the development process.				and does not falls under ‘*Scheduled Area’ as per the Fifth Schedule under Article 244(1) of the Constitution.
OP 4.11 Physical cultural resources (PCR)	Assist in preserving PCR and in avoiding their destruction or damage. PCR includes resources of archaeological, paleontological, historical, architectural, religious (including graveyards and burialsites), aesthetic, or other cultural significance.	A number of temples, shrines, churches etc. are located adjacent to road ROW. But NO declared cultural property exists.	Avoidance measures included in the design. Mitigation and enhancement measures for impacted structures included in designs	Incorporated in the EIA and EMP	Addressed in the EIA - EMP Report.

### EA Instruments

7. Depending on the project, a range of instruments can be used to satisfy the Bank's EA requirement: environmental impact assessment (EIA), regional or sectoral EA, strategic environmental and social assessment (SESA), environmental audit, hazard or risk assessment, environmental management plan (EMP) and environmental and social management framework (ESMF).<sup>10</sup> EA applies one or more of these instruments, or elements of them, as appropriate. When the project is likely to have sectoral or regional impacts, sectoral or regional EA is required.<sup>11</sup>

### Environmental Screening

8. The Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of EA. The Bank classifies the proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

(a) *Category A*: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive,<sup>12</sup> diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the borrower is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral EA) that includes, as necessary, elements of the other instruments referred to in para. 7.

(b) *Category B*: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A EA. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve

environmental performance. The findings and results of Category B EA are described in the project documentation (Project Appraisal Document and Project Information Document).<sup>13</sup>

(c) *Category C*: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

(d) *Category FI*: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

10. Annexes Guidance on the use of sectoral and regional EA is available in [EA Sourcebook Updates 4 and 15](#).
11. A potential impact is considered "sensitive" if it may be irreversible (e.g., lead to loss of a major natural habitat) or raise issues covered by [OP 4.04](#), *Natural Habitats*; [OP/BP 4.10](#), *Indigenous Peoples*; [OP/BP 4.11](#), *Physical Cultural Resources* or [OP 4.12](#), *Involuntary Resettlement*.
12. When the screening process determines, or national legislation requires, that any of the environmental issues identified warrant special attention, the findings and results of Category B EA may be set out in a separate report. Depending on the type of project and the nature and magnitude of the impacts, this report may include, for example, a limited environmental impact assessment, an environmental mitigation or management plan, an environmental audit, or a hazard assessment. For Category B projects that are not in environmentally sensitive areas and that present well-defined and well-understood issues of narrow scope, the Bank may accept alternative approaches for meeting EA requirements: for example, environmentally sound design criteria, siting criteria, or pollution standards for small-scale industrial plants or rural works; environmentally sound siting criteria, construction standards, or inspection procedures for housing projects; or environmentally sound operating procedures for road rehabilitation projects.

\* Includes Talukas / districts declared as 'Scheduled Area' as per the Fifth Schedule under Article 244(1) of the Constitution. In Gujarat, Scheduled Area consists of 43 tribal talukas, 15 pockets and 4 clusters located in 12 districts (Surat, Bharuch, Dangs, Valsad, Panchmahal, Vadodara, Sabarkanta, Narmada, Tapi, Navasari, Banaskantha and Dahod). These areas are among the most backward in the State, characterized by hilly terrain, rocky soil, uncertain rainfall and the presence of large tracts of forest land.

Bagodara – Bhavnagar falls within Ahmedabad and Bhavnagar district, which does not fall under Fifth Schedule Areas.

## 3 BASELINE ENVIRONMENTAL SCENARIO

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### 3.1 Definition of the Project Study Area

This chapter **briefly describes the baseline environmental profile** of the study area of the proposed four lanning of Bagodara – Bhavnagar from existing two lane section. The environmental baseline data comprise the features present within a strip of 10 km on either side of the existing road, referred to as study area in the detailed EIA. It includes environmental features such as forest areas, conservation areas, water bodies (rivers, lakes ponds and reservoirs), industries, wildlife and, places of historical importance, tourism etc.

Detailed Environmental Impact Assessment (EIA in detail) has been carried out considering likely potential impacts on physical, biological, socio-economical and cultural resources within 200 m either side of the project road, considered adequate for the assessment of most physical and social impacts arising from liner expansion projects such as highway and infrastructure development projects . However, it is also recognized that a number of potential (positive and negative) impacts could also have effects beyond this boundary, such as effects on road linkages, employment effects, and some community activities. These are also considered in the impact assessment.

The data / features documented in the detailed EIA report have been collected through field investigations, interaction with local population, interaction occurred during public hearing, concerns raised by locals during public hearing, through desk research and published data sources.

As mentioned earlier, project road sections are situated in the districts of Ahmedabad and Bhavnagar and hence can be described as influenced districts along this project road.

### 3.2 Environmental Features

Existing environmental features (with in study area) have been described in detail in the EIA. Data was collected from various sources and field visits during 2008-09. This section briefly summaries the following.

- Climate
- Land Environment
- Water Environment
- Air Environment
- Noise Environment
- Biological and Ecological Environment
- Cultural
- Socio-Economical Environment.

### 3.2.1 Climate

Major portion of the project road passes through agricultural area along with few urban stretches, which experiences hot summer and mild cold to cold winter. Both the districts of the project corridor experience nearly same weather. Detailed information on climate along with wind profile of the project impact zone is also provided under **table 4.2 of EIA report**.

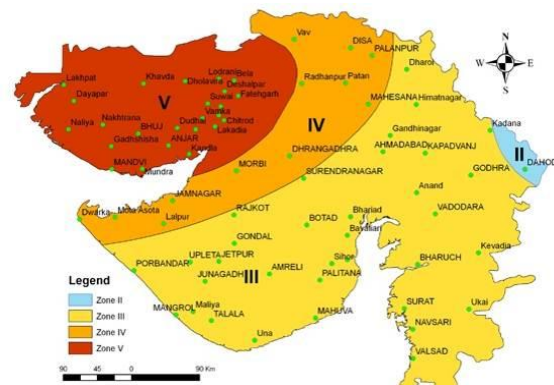
### 3.2.2 Land Environment

#### Physiographic & Land use of area

From Bagodara to Bhavnagar, project corridor traverses through plain terrain, surrounded by predominantly agricultural land with patches of semi urban, industrial and commercial areas. Dhandhuka, Barwala and Vallabhipur are the towns having major habitation along this section. Detail land use pattern of Ahmedabad & Bhavnagar districts as well as that of the state is provided in **table 4.3 of EIA**. The geological succession of the project area is also provided.

### 3.2.3 Seismic Profile of the area

Out of the four seismic zones of India, project road falls within **Zone III**. All the project components and structures (bridges, culverts) will be such constructed as to withstand the level of seismic activity as per ISI specifications for Zone-III.



### 3.2.4 Water Environment and Water Quality

#### Surface Water

On the way to Bhavnagar from Bagodara, project corridor crosses river Bhogavo and its tributaries / streams. Corridor also crosses rivers lilka, utavdi, kedia, Keri, padalio, ghelo, vid and papasiya. Part of the stretch is situated in the Bhavnagar district which is nearer to the Gulf of Khambhat. **However, any river / streams crosses the project corridor does not have any type of tidal effect. Project corridor does not cross any types of creeks either.**

#### Ground water

The average depth of ground water table around project road is between 20 to 50 m.

The ground water quality in project area is not satisfactory as nature of ground water is saline having Total Dissolved Solid (TDS) concentration between 10000 to 25000 ppm. Number of bore wells observed along the project corridor, particularly within Ahmedabad district.

The surface water quality is quite better as compared to ground water quality. Type of water resources exists along the project corridors are rivers and its tributaries / streams, ponds, bore wells, water hut, etc. Detail list of water resources exists along the corridor is provided in **Table 4.4 of EIA**.

## Water Quality

It is observed that the surface water quality of the area is quite good except few parameters. For both surface and ground water, pH ranges between 7.5 and 9.0. The nature of water is good for domestic uses. The results of surface and ground water monitoring are provided in **Table 4.5** and **Table 4.6** respectively, in the EIA report.

### 3.2.5 Drainage Pattern of the study area

Project corridor passes through almost flat-plain terrain. Surrounding land is predominant agricultural with mixture of barren and forest land. As mentioned in above para, project road crosses nos. or rivers and its tributaries. These are Lilka, Utavadi, Papasiya, Keri, Gautam, Vid and Bhogavo as well as tributaries / streams of Bhogavo river. All of these rivers and their tributaries flowing from right hand side of the project road to left hand side of the road and merges in the Gulf of Cambay. Rainfall is erratic and variable. It only rains a few days per year. Project region has a semi-arid type of climate and accounts for 60 per cent of the semi-arid tract in Gujarat. Over-exploitation of ground water combined with sea water ingress has led to salinity in the water and soils and to a sinking ground-water table.

To facilitate smooth flow of all these rivers and its tributaries and drain water of surrounding areas, overall 95 major cross drainage structures exist on the Bagodara – Bhavnagar road, which comprises 16 major and 79 minor bridges. Besides, there are no. of culverts exist, for the smooth flow of drain water, which includes 51 pipe culverts and 29 slab culverts. During the rainy season, overtopping has been reported at following locations.

**Details of overtopping and improvement**

Sr. No.	Chainage (Km.)	Length (m.)	Total Proposed Width	Improvement	Height to be Increased (m.)	Remarks
1	69.2	15.30	24.00	Replacement	2.5	Bridge to be replaced due to Overtopping
2	141.9	3.10	24.00	Replacement	3.5	
3	170.2	7.10	24.00	Replacement	3.5	
4	170.8	7.00	24.00	Replacement	2.5	
5	172.2	7.00	24.00	Replacement	0.5	
6	174.4	7.10	24.00	Replacement	3.5	
7	176.7	7.30	24.00	Replacement	3.5	
8	176.7	7.30	24.00	Replacement	3.5	

At all the locations, already major / minor bridge exists. In order to overcome the problem of overtopping, and as a part of the improvement proposal, all these locations will be replaced with higher elevation and bridge will be designed in such a way that overtopping can not occur in the future.

### 3.2.6 Air Environment and Air Quality

The ambient air quality was measured at three locations which are considered sensitive to air quality. Locations are selected keeping in view the land use of area, traffic pattern / characteristics and settlement aspects. The selected locations were: a) Dhandhuka Village (Hotel Hindva), near km. 102.2, b) Panvi Village (On Gram Panchayat Office) at km. 142 and c) Karjad Villagenear km. 187. High Volume Sampler is used to check the air quality. The summary of the results of Ambient Air Monitoring carried out is provided in **Table 4.8 of EIA**. Graphical representation of levels of parameters pertaining to air quality monitoring along the project road are also provided vide **Figure 4.6, 4.7, 4.8, 4.9 and 4.10** in the EIA.



Parameters monitored were Pb, SPM, RPM, SO<sub>2</sub>, NO<sub>x</sub> and CO as per then prevalent environmental legislations. Result of samples reveals that RPM levels at all the three locations are less than prescribed standards, while SPM level are higher than the prescribed standard (i.e. 200 µg/m<sup>3</sup>) at two locations. SO<sub>2</sub> and NO<sub>x</sub> are well within the prescribed limits of 80 µg/m<sup>3</sup>. The concentration of CO is also higher than prescribed limit at Dhandhuka.

SPM levels at two locations are higher than prescribed standards, mainly due to the following factors:

- a) Existing vehicular traffic and condition of the existing pavement which is poor, damage road surface and road side dust.
- b) Shoulders along the project road are not paved and so lead to an increase in dust and other particulate matter.
- c) Allied agricultural activities

### 3.2.7 Noise Environment

The ambient noise levels were measured using an Integrated digital sound level meter, along the project corridor at the same locations as finalised for the monitoring of parameters for air quality. The selection of locations had been done keeping in view the land use of area, traffic pattern / characteristics and settlement aspects. Results of the noise level monitoring are provided in table 4.9, while graphical representation of noise levels along the project road are provided through **Figure 4.11 in the EIA** . At all the monitoring locations, the noise levels found lower than the prescribed limits i.e. 65 dB (A) of the Central Pollution Control Board (CPCB).

### 3.2.8 Socio-economic profile

\*Population data of the state and that of the districts (i.e. Ahmedabad and Bhavnagar, through which the corridor passes) is given below. Total population of the state was **50,671,017**. The density of population was only 258 persons per sq. km. compares favourable with the other states of the country. Ahmedabad district has the highest population in Gujarat State with density of 719 populations per sq. Km, while Bhavnagar district had population according to 2001 Census about 2,469,630.

**Demographic Profile of Project Region**

Indicators	India	Gujarat	Ahmedabad	Bhavnagar
Population (no.)	<b>1027015247</b>	<b>50671017</b>	<b>5816519</b>	<b>2469630</b>
Sex Ratio	933	920	892	937
% Decadal Growth	21.34	22.66	26.79	19.31
Population Density per sq. km.	324	258	719	247

\*Source: Census data 2001

Project road passes through seven talukas namely Bavla, Dholka, Dhandhuka, Barvala Vallabhipur, Shihor and Bhavnagar. Percentage of urbanisation of Ahmedabad is 80.18% and Bhavnagar is 37.86%. Over 19.82% population of Ahmedabad district and over 62.14% population of Bhavnagar district reside in rural areas. The decadal growth rate of Ahmedabad has increase to 26.79 from 24.25 but that of Bhavnagar has decrease to 19.31 from 23.13 in

last decade. Literacy rate Ahmedabad is about 62.30% and that in Bhavnagar is 58.72% according to 2001 census data.

### Industrial profile

Bhavnagar and Ahmedabad are both important economic centres of Gujarat as well as India. There are several industrial and commercial establishments situated along this road. A number of small and medium scale industries can also be observed along the project road. These include salt industries, cotton ginning industries, brick kilns, marble factories and small construction companies. The project road provides connectivity to the commercial hub like Alang ship breaking yard, Dholera Port, Ghogha Port and other major industrial centre like IPCL at Bhavnagar with the NH-8 running between Delhi and Mumbai.

### 3.2.9 Biological Resources

#### Vegetation

The area surrounding the Bagodara - Bhavnagar road has very less vegetation, the having mostly shrub type vegetation. The stretch of the project road has trees like Australian Babul, Neem, Pilu and Bore.

#### Fauna

Black Buck National Park / Sanctuary is at least 13 km. away from the project road (At Km. 150.990 on SH - 36), which is nearest point at project corridor from the sanctuary in Bhavnagar district. The Black Buck National Park is famous for Black Buck and lying in Velavadar village of Bhavnagar district. The region had unique grassland ecosystem that has attracted fame for the successful conservation of the Blackbuck, the wolf and the lesser Florican. The Velavadar national park is situated 65 km away from the Bhavnagar. The area of the national park is 35 square kilometres, which is flat grassland. The national park gives an ideal home for the Black Bucks, Wolves, Hares, Jackals, fox, jungle cat, wild pig, hare and rodents etc.



#### Forests along the project road

Protected forest exists along the project road in the form of strip plantations covered under protected forest category of the state forestry department. The vegetation at both sides of the project road is covered with shrubs, mainly Australian acacia or Babool.

### **Trees along Project Road**

There are about 3476 (1580 on LHS, 1896 on RHS) trees of various species existing all along the project road. Out of these about 1710 trees are likely to be cut due to the proposed project. Chainage wise list of trees along the project road is given in **Table 4.12 of EIA**.

### **3.2.10 Properties Adjacent to Project Road**

#### **Cultural and Community Properties**

Cultural properties such as temples, dargah, shrines etc. exist along the project corridor. Details of same are provided vide **Table 4.13 in EIA**. Also, there exist a number of community properties like schools, bus stops, commercial buildings, petrol pumps, etc. **Table 4.14 of EIA reports** provides details of such properties along the road.

## 4 PUBLIC CONSULTATION

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### 4.1 General

Consultation with the affected communities is an integral component of environmental assessment and project design. Without public consultation, a project will not reflect issues or solutions identified by local residents, in addition to missed opportunities to share experiences and identify solutions to difficult concerns / issues.

#### 4.1.1 Provision of Public Consultation under EIA Notification 2006

As per Ministry of Environment and Forest (MoEF), Govt. of India (GoI)'s Environmental Impact Assessment (EIA) Notification 14<sup>th</sup> September 2006, "Public Consultation" refers to the process by which the concerns of local affected persons and others who have plausible stake in the environmental impacts of the project or activity are ascertained with a view to taking into account all the material concerns in the project or activity design as appropriate.

All Category 'A' and Category B1 projects or activities shall undertake Public Consultation, except the following:-

- (a) Modernization of irrigation projects (item 1(c) (ii) of the Schedule)
- (b) All projects or activities located within industrial estates or parks (item 7(c) of the Schedule) approved by the concerned authorities, and which are not disallowed in such approvals.
- (c) Expansion of Roads and Highways (item 7 (f) of the Schedule) which do not involve any further acquisition of land.
- (d) All Building /Construction projects/Area Development projects and Townships (item 8).
- (e) All Category 'B2' projects and activities.
- (f) All projects or activities concerning national defence and security or involving other strategic considerations as determined by the Central Government.

The Public Consultation shall ordinarily have two components comprising of:-

- (a) A public hearing at the site or in its close proximity- district wise, to be carried out in the manner prescribed in Appendix IV, for ascertaining concerns of local affected persons;
- (b) Obtain responses in writing from other concerned persons having a plausible stake in the environmental aspects of the project or activity.

The Public Hearing shall be arranged in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site(s) or in its close proximity District -wise, by the concerned State Pollution Control Board (SPCB) or the Union Territory Pollution Control Committee (UTPCC).

After completion of the public consultation, the applicant shall address all the material environmental concerns expressed during this process, and make appropriate changes in the draft EIA and EMP. The final EIA report, so prepared, shall be submitted by the applicant to the concerned regulatory authority for appraisal. The applicant may alternatively submit a supplementary report to draft EIA and EMP addressing all the concerns expressed during the public consultation.

#### 4.1.2 District wise Public Hearing (PH) conducted by GPCB

Public hearing for Bagodara – Dhandhuka - Vallabhipur - Bhavnagar road was conducted by Gujarat Pollution Control Board in both the districts i.e. Ahmedabad and Bhavnagar. Dates and relevant information pertaining to both the PH's is mentioned hereunder as Table 4-1.

**Table 4-1: Schedule - District wise Public Hearing**

Sr. No.	District	Location	Date	Presided by	GPCB Representative
1	Ahmedabad	Government Rest House, Dhandhuka	January 21 <sup>st</sup> , 2009	Shri Hareet Shukla, District Magistrate and Collector, Ahmedabad District	Shri K. C. Mistry, Regional Officer, Ahmedabad
2	Bhavnagar	Panchayat Rest House, Vallabhipur	February 10 <sup>th</sup> , 2009	Shri Pradip Shah, District Magistrate and Collector, Bhavnagar District	Shri G. V. Patel, Regional Officer, Bhavnagar

The concerned collectors had supervised and presided over the entire public hearing process. Other concerned persons having a plausible stake in the environmental aspects of the project or activity were requested to send their responses in writing to the concerned regulatory authorities.



The public hearing proceeding of both districts containing (a) statement showing participant present during public hearing, (b) statement showing issues raised by participant during public hearing & responded by project proponent and (c) issues received in writing and responded by project proponent is attached as separate volume titled “**Public Hearing Proceedings**”, along with final detailed EIA Report.



### 4.1.3 Summary of Public Hearing

The summary of public hearing for both the districts containing key issues raised during public hearing, address to the issues by project authority and relevance & compliance of issues in EIA is provided in following Table 4-2.

**Table 4-2: Summary of Public Hearing**

Sr. No.	Key issues raised	Address to the issues by project authority	Relevance & compliance of issues in EIA
1	Overtopping of road during monsoon season	Provision in project design for raising the bridge height and widening of culvert	Incorporated in Highway Design Report.
2	No payment of compensation for land acquired during earlier project	Issue is to be addressed through collector office	--
3	Land requirement on both side of road	ROW is to be expanded from 30m to 60m requiring land from both side of road	Incorporated in Highway Design Report.
4	Problem at places where local road crosses project road	Necessary median openings are provided considering local road crossing the project road.	Incorporated in Highway Design Report.
5	Sufficient arrangement of culverts.	Provision of culvert is such a way that water is discharged properly.	Incorporated in Highway Design Report.
6	Toll plaza are manned by people other than local people	Contract for toll plaza are provided as per law.	--
7	Committee should be formed at local level to negotiate developmental advisory purpose.	Suggestion noted by project authority	--
8	Is village school is located adjacent to the proposed road affected?	No	--
9	Natural drain is passing parallel to the road and due to the widening of the road, what will be the effect to the natural flow of water during monsoon.	Due care will be taken to avoid any obstruction to the natural flow of water, especially during monsoon.	Included in EIA.
11	Measures to avoid glare of opposite coming vehicles and planning for median plantation	To plant trees in the median area to avoid glaring to the drivers in night hours.	Included in EIA.
12	Acquisition of the poor owner of the private commercial property	Compensation as per provisions of Land Acquisition Act 1894	Included in EIA.
13	Who will acquired the land, whether GSRDC or R & B Department.	Custodian will be the executive engineer of R & B Department, but the land acquisition process will be carried out as per the land acquisition act , 1894	--

## 5 IMPACT IDENTIFICATION AND MITIGATION

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### 5.1 General

This chapter summarizes nature, type and magnitude of the potential impacts on relevant physical, biological and cultural environmental components along the project corridor. Basis of the assessment of impacts is the baseline environment as summarized in chapter 3 of this EDDR and discussed in detail in chapter 4 of detailed EIA report. Methodology for Environmental Impact Assessment is designed in such a way that the environmental assessment process is conducted in full compliance with the National and State regulatory frameworks as well as world banks safeguard policies, operational policies and operational directives. **Impacts are identified according to construction phases as: Pre construction, (During) construction and operation (post construction) stage.**

A wide variety of direct and indirect negative impacts have been attributed to the infrastructure developmental projects including that of road and highway construction and improvement projects. Though sharing a common concern over most environmental attributes, depending on their past experience in various projects, different agencies tend to lay varying emphasis on different biophysical and socio-environmental components and issues.

Overall, it is found that the proposed project road will result in some adverse impacts to the biophysical and socio - economic environment of the project. It needs to be mitigated by adopting appropriate mitigation measures in the design, construction and operation phase. Net environmental impacts to the biophysical and socioeconomic environment will be insignificant and of short term in nature by observing proposed mitigation measures.

### 5.1 Likely Potential Impacts

Activities such as levelling, clearing of vegetation, felling of trees along the road, construction of cross drainage structures including culverts & bridges on rivers and other related operations are expected to cause potential environmental impacts (positive / negative), including some adverse impacts to the biophysical and socioeconomic environment. Many adverse impacts can be avoided or minimized through the implementation of mitigation measures in design and construction. Impacts, which are likely to take place due to the project and will have bearing on the environmental impacts and sensitivity, are:

- Soils erosion, productivity and bank stability,
- Surface/ Ground water quality,
- Drainage pattern,
- Air quality,
- Noise quality,
- Historical places and monuments / Cultural properties
- Forests,
- Trees
- Bio Diversity / Wildlife etc

The potential Impacts on Valued Ecosystem Components due to project activities are briefed in Table 5-1. Summary of all affected environmental components along with anticipated impacts and mitigation measures is provided in **Annexure 6.1 of detailed EIA report.**

**Table 5-1: Potential Environmental Impacts on Valued Ecosystem Components**

Project Activity	Pre-Construction	Construction Phase						Opération Phase
Component Affected	Land Acquisition	Site Clearance	Earth Moving (borrow pits)	Contractor Camps	Quarries Areas	Construction of Highway	Asphalt Crusher Plants	Operation
Soil	Loss of productive agricultural land	Loss of crops, and increase in soil erosion	Loss of top soil and erosion		Increase in erosion, siltation and slope instability	Soil pollution	Pollution due to spills	Soil contamination due to surface runoff
Ground water				Water extraction for drinking		Exploitation of water for construction		Maintenance of trees / shrubs
Surface water		Change in water quality and siltation	Water logging and mosquito breeding	Water pollution from sanitary and other wastes	Water logging problems	Change in water quality	Pollution due to spill into water bodies	Degradation due to spill- over and road runoff
Drainage		Change in natural drainage pattern	Change in drainage pattern		Modification in Natural drainage	Interference with natural drainage, Water logging		Cleaning & Maintenance
Air quality		Increase in air pollution	Particulate matter pollution	Atmospheric Pollution due to fuel burning	Dust pollution	Dust pollution	SPM, SO <sub>2</sub>	Increase in SPM, NO <sub>x</sub> , CO
Noise quality		Reduced buffering of noise	Increase in noise levels due to machinery		Vibration from blasting operations	Vibrators, concrete batching plants noise	Increase in noise	Increase in levels due to increased traffic
Forest		Habitat loss, and vegetation	Loss of forest	Encroachment into forest Areas	Loss of habitat/ cover	Loss of Forest		
Trees	Tree cutting clearance	Loss of trees	Loss of trees	Cutting of trees	Tree cutting	Loss of Trees		
Temples / Mosques	Clearance	Removal / rehabilitation						

## 5.2 Likely to be Affected Component

### 5.2.1 Soil

**Likely impacts classified as:** 1) Loss of Productive Land, 2) Erosion, 3) Road Slope and Stability, 4) Spoil, 5) Construction Cross drainage structures such as new bridges and culverts, 6) Borrow Areas, 7) Query Areas, 8) Soil Contamination – from Fuel and Lubricants

Attributes as mentioned above that leads to impacts on soil are discussed in detail in chapter on impacts identification and mitigation (measures) of EIA. Mitigation measures to these impacts are also described in detail. Many of the impacts are identified, and its mitigation suggested according to construction phases as: Pre construction stage, (During) construction stage and operation state (post construction).

### 5.1.1 Water Resources and Water Quality

#### Loss of Water Supply Resources / Water Bodies

Widening of the project corridor entails removal and/ or shifting of water supply lines, removal of taps, wells, hand pump and tube wells within the corridor of impact resulting in



the loss of water supply. The most significant adverse impacts to water bodies from the construction are the loss of storage capacity due to in filling by the earthmoving activities. There are total 35 different types of water resources exists with in vicinity of the road along the project corridor, which includes 13 rivers that crosses the corridor, 6 bore wells, a well, 4 ponds, 10 water hut and a overhead water tank. Out of which a well, 2 bore wells, 3 ponds and 7 water huts are likely to have negative impact due to project.

### **Increased Run-off / Groundwater Recharge and Flow Modification**

Road construction activities will lead to an increased run-off both during the construction and operation stages. During the construction stage, removal of vegetation, compaction of soil, addition of new lane and median - hardening and paving of shoulders and bitumen surface will form impervious layer leads to increased run-off .Ground water recharge areas may be also be reduced.

### **Water Quality Degradation**

Water quality may be degraded during construction due to the disposal of solid and liquid waste from the labor camp, fuel and lubricant spills or leaks from the construction equipments, fuel storage and distribution sites and from the bitumen and asphalt storage at hot-mix plants. Contamination of ground water due to the runoff carrying pollutants is of major concern because most of the domestic use is from ground water.

## **Mitigation Measures**

### **Run off Control / Drainage**

To ensure efficient drainage system and to prevent water logging along the sides, adequate size and number of cross-drainage structures have been proposed.

Nos. of mitigation measures have been proposed for the protection of surface water body / water resources, for the prevention of water quality degradation, as detailed out in EIA.

### **5.2.2 Air Quality**

Air quality along the project corridor will be adversely impacted, both during the construction and operation stages of the project. Construction stage impacts (such as generation of dust, high levels of SO<sub>2</sub>, and Hydrocarbons (HC)from hot mix plant operations, volatile toxic gases released through the heating process during bitumen production etc) will of short term and confined within RoW, however will last throughout the construction phase and have adverse impacts on the construction workers as well as the settlements adjacent to the road, especially those in the down wind direction. Operation stage impacts will not be as severe as the construction stage impacts and will be confined generally to a band of width ranging from 50 to 75m from the edge of the last lane on either side of the corridor. During operation phase, major impact on air quality will be due to plying of vehicles.

### **Prediction of Pollutant Load in Atmosphere by Vehicular Emission**

In order to predict the increase in pollution levels, there are models developed by various international agencies to predict vehicular emissions, such as HMSO Design Manual for Roads and Bridges - Environmental Assessment, Mobile 6, and Caline etc.

## **Air Quality Modelling**

In order to know the increase in pollution level, a mathematical modelling based on emission factors of various vehicles and traffic projection, increase in pollutants load in atmosphere has been calculated. Air quality monitoring reveals that the current air quality of the study area is within the permissible limits. However, Emission levels are expected to increase with the increase in vehicle numbers. Predictive modelling was conducted on the basis of emission rates and vehicle types as prescribed by HMSO Design Manual for Roads and Bridges: Environmental Assessment. Table 6.2, Table 6.3 & Table 6.4 of the EIA, provides the sections wise typical projection for Bagodara – Bhavnagar corridor of the pollutants loads in the present (starting 2008) and future years, up to 2020. Mitigation measures have been described in detail for construction phase as well as for operation phase.

### **5.2.3 Noise Quality**

#### **Potential Impacts**

##### **Construction Phase**

The potential impacts of noise pollution (Due to movement of construction machinery, concrete and asphalt plant operations and blasting/scraping in the vicinity of borrow pits and quarries etc) include deteriorated human health and reduced quality of life (e.g., reduced enjoyment of outdoor amenity areas). However, due to the short term nature of elevated noise levels during construction, hearing problems are not expected and reduced quality of life would be a short-term impact. Monitoring of current noise levels at selected locations within the study area shows that at all locations noise levels were found to be within prescribed limits of Central Pollution Control Board.

##### **Operation Phase**

During the operation stage of the project, increased traffic volumes along the highway will result in increased noise levels. Long-term noise level increases and were assessed at various sensitive receptor locations along the corridor, for the years 2008, 2010, 2015, 2020 and 2025 using the model developed by Federal Highway Administration called FHWA Transportation Noise Model. Receptor locations were set at 20 m, 50 m and 100 m from the centre of the outermost traffic lane. These have been analyzed in detailed EIA. Noise levels are expected to increase by 5.1 to 5.15 dB (A) within a 20 m, 50 m and 100 m distance from the carriageway, between 2008 and 2025 at all the locations. Noise levels along the project corridor are expected to exceed the regulatory standard of 65 dB (A) at all distances by 2025 at all locations. In general, an increase of more than 5 dB (A) is considered significant and absolute noise level above 65 dB (A) are considered unacceptable.

#### **Mitigation Measures**

Suggested mitigation measures are 1) restrict construction activities during night time, 2) provisions of noise barriers at selected locations including at sensitive receptors such as educational institutions, hospitals 3) restriction of blowing of horns and specifying silence zones in selected areas, 4) plants and equipment used for construction, blasting activity shall strictly conform to existing noise norms.

## Socio-Economic Environment

### 5.2.4 Land Acquisition

#### Construction Phase

Total required land for proposed RoW of 60m is 288.23 hectares, out of which 191.73 hectares falls within Ahmedabad districts, whereas rest 96.50 hectares falls under Bhavnagar district. The land for proposed project is to be acquired by Gujarat government through Land Acquisition Act 1894 and compensation for acquired land is to be paid as per the provision of the same act.

**Field visits during project preparatory missions by the World Bank and review of documents indicates that land is being acquired under urgency clause section 17 of LA Act (an on-going practice across India). The affected people have received compensation under protest and moved the court for enhancement of compensation. However, in the initial stages, in respect of 6 villages out of 41 villages, land acquisition was initiated under urgency clause section 17 of LA Act. Any impacts on PAH's / PAP's due to urgency clause seems minimal. It is revealed that there is GAP of 3 years between date of notification published under section – 4 (Year 2009), and date of publication under section 9 & 11 (Year 2012). Hence, although urgency clause was applied, associated impact on Land Losers / PAH's been not felt.**

**Since, Roads and Building Dept., GoG has decided to include B-B road under bank financing, World Bank's Operational Policy 4.12 on Involuntary Resettlement is applicable to it. Therefore, it is important to take corrective actions at the earliest to address two issues: (i) Revenue and monetary loss to government and people, respectively, due to litigation and (ii) retrofit the social safeguard measures to ensure compliance with Bank's OP 4.12.**

**In order to reconcile social safeguards aspects, to meet the world bank's operational policies and directives, it is require to prepare a detailed RAP and then to implement the same as per banks requirement, explore possibility for out of court settlement and reduce the time period between distribution of compensation and R&R assistance at the earliest. It is also require to ensure that As per resettlement policy, affected people should be (a) compensated for their loss at full replacement cost, (b) assisted in the move and supported during the transition period, and (c) assisted in their efforts to improve their living standards, income earning capacity and production levels, or at least to restore them.**

**Therefore separate consultancy service has been hired by Govt. of Gujarat for the preparation of detailed Resettlement Action Plan (RAP), to retrofit the social safeguard measures to ensure compliance with Bank's OP 4.12.**

### 5.2.5 Loss of Cultural/ Historical Areas

#### Construction Phase

No important archaeological resources, or sites of cultural interest within the study area that are of State or National level interest have been witnessed. However there are 32 Temples 18

Shrines and 2 Dargah located along the study area, out of which 18 temples, 11 shrines and both the Dargahs, that exists within vicinity of the road, are likely to have negative impact due to road widening. Demolition / removal of these religious structures may hurt the religious sentiments of the people, however will be relocated at identified locations with the help of concerned religious group, in consultation with the local community. Maximum effort has been made to save these structures. Where the location is not viable, the project will go for a change in the road alignment.

### **5.2.6 Social Development Due to Road Widening and Increased Traffic**

Industries and business are likely to increase and the tourism sector will flourish further. In other words this will lead to induced development. However, along with the induced development, lot of problems of social and cultural nature might arise. Such problems need to be tackled as and when they occur.

## **Impact on Ecological Resources**

### **5.2.7 Vegetation**

#### **Construction Phase**

Widening of the proposed highway will affect about **1710 trees**. The removal of these trees and the loss of vegetation cover will have some effect on local ecological balance, such as the disruption of habitat for small birds, mammals, etc., that will be forced to migrate to other areas. The removal of vegetation may also lead to minor climatic changes such as altered surface hydrology, increased temperatures due to reduced shade cover, etc.

#### **Mitigation**

Vegetation such as grasses and small shrubs will recover quickly, and for each tree that is removed, more nos. of trees will be planted in consultation with Forest Department. Although it will take time for the trees to mature, the long term impact of removing the trees is expected to be minimal.

#### **Operation Stage**

Some impacts may occur to small animals that have historically traversed the highway to access habitats on both sides of the two lane road. Given the similarities between the east and west sides and the availability of habitat on both sides of the highway, this barrier is considered to be a low to moderate impact only that is not expected to affect the fertility or survival of any species.

#### **Mitigation Measures**

Number of trees to be cut has been kept at the minimum level by modifying alignments. To balance the ecological loss compensatory afforestation (thrice in number against the trees to be cut) will be done in consultation to the Forest Department.

### **5.2.8 Impact on Biodiversity**

#### **Construction Phase**

The grazing ground for the local cattle is likely to be damaged because of the removal of green cover during site clearance activities. Pre-construction stage activities will mean mobilisation of site clearance activities, which is likely to disturb animal life. Increased vehicle movement in the area might lead to the moving away of wild animals etc. from the project area.

Due to noise created by construction machinery, birds may migrate to other place and they also might face breeding problems. Temporary displacement of the aquatic fauna may take place during the construction of the bridges over the rivers and canals across the road. The accidental spillage of chemicals coming with surface runoff may disturb the fauna of these water bodies.

### Operation Phase

During operation phase due to the increased traffic, chances of accidents of animals while crossing the road may increase. The noise created by the fast moving vehicles will disturb birds and wild animals. In order to avoid this adverse impact, the speed of the vehicles will be restricted through sensitive areas especially during night time.

#### 5.2.9 Impacts to Wildlife Sanctuary

Famous Black Buck National Park is 13 km away from the project corridor near Adhelai village in Bhavnagar district, which is nearest distance of the national park from the project corridor. The national park gives an ideal home for the Black Bucks, Wolves, Hares, Jackals, fox, jungle cat, wild pig, hare and rodents etc.

The Signboard in Figure 5-1 is at Km. 150.990 on SH – 36 which is nearest distance from the Velavadar National Park / Black Buck Sanctuary. Since the core area of National Park lies at least 13 - 15 km away from project road, cross movement of wild animals especially black buck within stretch is very less. Also National Park / Sanctuary does not open to project road.



Figure 5-1: Signboard showing distance of road from Sanctuary

Considering above facts, it is envisaged that impacts of widening of project road will not be much on National Park. Also construction /operational impacts such as noise and dust are not

expected to impact the quality of the National Park, since it is more than 10 kms. Away from the road. However, following precautionary measures are proposed to safeguard the Black Buck National Park.

- Caution boards holding the titles like NATIONAL PARK exists on left side along with SPEED LIMIT are to be placed along the road. National Park Area is to be declared as 'SILENCE ZONE' and 'NO HONKING ZONE' signboards is to be placed.
- Construction yard and labour camps is to be allowed beyond 2 Km from the boundary of National Park area.

## 6 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

### 6.1 Introduction

Environmental Management Plan sets out the environmental management procedures during design, construction and operation phase, including mitigation & enhancement measures, institutional and monitoring requirements. EMP also provides the guidelines and instructions to be followed by the PIU for effective implementation of the project.

**As part of the project preparation, an Environmental Impact Assessment (EIA) had been undertaken for the Bagodara - Bhavnagar. Environmental Management Plan for the same is developed based on the findings of EIA carried out for the project corridor, and provides the necessary details for the effective implementation of the environmental management measures required for addressing the potential environmental impacts in the project. Environmental Management Plan is described in detail in the EIA report of the corridor, with an aim to assist the project proponent and the Concessionaire / concessionaire to implement the environmental management measures in an effective manner.**

### 6.2 EMP – Budget.

Environmental Budget provided earlier require to enhance, and accordingly same is modified, enhanced. Budgetary estimates for environmental management in the project include all items envisaged as part of the EMP. The environmental budget includes provisions for various environmental management measures (other than measures considered under good engineering practices) and the environmental monitoring costs. Budgetary provisions for the project are presented in Table 6-1.

**Table 6-1: Budgetary Provisions for Environmental Management Measures**

Sr. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)
<b>A</b>	<b>CONSTRUCTION PHASE</b>				
<b>1</b>	<b>Site Clearance</b>				
1.1	Disposal of unserviceable as well serviceable material with all leads and lifts beyond the ROW	Cum	Provision shall be made by the Concessionaire		
1.2	The 30 cm top layer of disposal pit shall be provided with good earth, suitable for development of vegetation/plantation. All work shall be carried out as per specifications 301.3.2 of MoRTH and approval of the Engineer in Charge	Cum	Provision shall be made by the Concessionaire		
1.3	Regular water sprinkling (at least 4 times) per day at all construction sites for suppression of visible dust levels. <i>Note: This item is to be operated after the completion of earthwork to suppress the visible dust levels. Cost of watering during compaction of earthwork is deemed to be already covered under civil works.</i>	Km.	Provision shall be made by the Concessionaire		
<b>2</b>	<b>Construction near Water Bodies</b>				
2.1	Construction of silt traps at the discharge points of channels into to fresh water bodies across the project road as indicated in the Clause 111.4 and 111.18	m	Provision shall be made by the Concessionaire		
2.2	Providing Oil Interceptors at the fuel/oil storage camps or Construction camps.	Nos.	Provision shall be made by the Concessionaire		

Sr. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)
2.3	Providing and Construction of Rain Water Harvesting complete as per drawings and Technical Specification section 300, 1300, 1500, 1700 or as directed by the Engineer.	Nos.	Provision shall be made by the Concessionaire		
<b>3</b>	<b>Worker Safety</b>				
3.1	Providing Personal Protective Equipment to the labours during the construction phase of the project	Nos.	Provision shall be made by the Concessionaire		
<b>4</b>	<b>Monitoring of Environmental Attributes during Construction Activity</b>				
4.1	Air Quality				
4.1.1	Monitoring of Air Quality near Hot mix plants	No. of Samples	7500.00	18.00	1,35,000.00
4.1.2	Monitoring of Air Quality at Critical Locations	No. of Samples	7500.00	18.00	1,35,000.00
4.2	Noise Levels				
4.2.1	Monitoring of Noise Level at Equipment Yards	No. of Samples	3000.00	18.00	54,000.00
4.2.2	Monitoring of Noise Levels at Critical Locations	No. of Samples	3000.00	18.00	54,000.00
4.3	Water Quality	No. of Samples	6000.00	24.00	1,44,000.00
4.4	Soil Quality	No. of Samples	6000.00	8.00	48,000.00
<b>5</b>	<b>Project Level Specific Mitigation i.e. Land Scapping, Median Plantation, Afforestation, Tree Guards etc / Enhancement Measures i.e. Enhancement of Temples, Ponds, Community Places</b>				
5.1	Enhancement of a Temple	LS	2,50,000	5	12,50,000
5.2	Pond	LS	5,00,000	5	25,00,000
5.3	Tree plantation and Maintenance -1:3 trees to be cut	Nos.	1600 (Including 3 Years Maintenance)	12000	1,92,00,000
5.4	Tree Guards	Nos.	1000	1200	1,20,00,000
5.5	Median Plantation	LS	1,50,00,000		1,50,00,000
5.6	Aesthetics and Landscape	LS	1,50,00,000		1,50,00,000
5.7	Dust Suppression	LS	70,00,000		70,00,000
5.8	Sewage disposal and waste disposal during construction	LS	50,00,000		50,00,000
<b>6</b>	<b>HIV/ AIDS Prevention measures</b>				
6.1	IEC materials - Printing, Publishing		3000.00	36.00	1,08,000.00
6.2	Healthcare Clinic		30000.00	8.00	2,40,000.00
6.3	Condom Vending Machines		15000.00	6.00	90,000.00
6.4	Condom Supplies		5000.00	144.00	7,20,000.00
6.5	Testing		1500.00	1000.00	15,00,000.00
6.6	Signages and Hoardings		15000.00	30.00	4,50,000.00
	<b>Environmental Budget During Construction Phase</b>				<b>8,06,28,000.00</b>
<b>B</b>	<b>OPERATION PHASE</b>				
1	Monitoring of Air Quality at Critical Locations	No. of Samples	7500.00	18.00	1,35,000.00
2	Monitoring of Noise Levels at Critical Locations	No. of Samples	3000.00	18.00	54,000.00
	<b>Environmental Budget During Operation Phase</b>				<b>1,89,000.00</b>
	Sub Total (A+B)				
	<b>Grand Total INR. (Environmental Budget Exclusive of Cost of Measures Included Under Good Engineering Practices, A+B+ 3% contingency)</b>				<b>8,08,17,000.00</b>



# 7 ENVIRONMENTAL MONITORING PROGRAMME AND IMPLEMENTATION ARRANGEMENT

## 7.1 Institutional Setup

Environmental Monitoring Program is described in detail under Chapter 9.0 of EIA report. Effort has been made to further enhance the same under this section, since Institutional Set Up and Monitoring Mechanisms as described under EIA refers to the prevalent scenario at the time when the report was made. Now, the corridor being undertaken under World Bank Funded Second Gujarat State Highway Project (GSHP II), due care has been taken to upgrade this sections, provisions under World Bank's Operational Policies and Operational Directives especially OP 4.01, OP 4.04, OP 4.11 etc is being referred.

A dedicated unit, Environmental and Social Management Unit (ESMU) has been established within the PIU towards implementation of environment and resettlement provisions in GSHP-II. The PIU, **works under Chief Engineer (World Bank), Roads and Building Department, and headed by the Superintending Engineer** will have overall responsibility for policy guidance, coordination and planning, internal monitoring and overall reporting at the project level. During project implementation, the **Contractor / Concessionaire**, Engineer and PIU will be collectively responsible for ensuring effective implementation of the provisions of the EMP and to comply with all statutory and legal requirements and procedures applicable for the project. The institutional responsibilities for EMP implementation are presented in Table 7-1.

**Table 7-1: Institutional Responsibilities**

System	Designation	Responsibilities
Coordinating/Facilitating Agency	Chief Engineer World Bank	<ul style="list-style-type: none"> <li>• Overview of the project implementation</li> <li>• Ensure timely budget for the EMP</li> <li>• Coordination with different state level committee, to obtain Regulatory Clearances</li> <li>• Participate in state level meetings</li> <li>• Monthly review of the progress.</li> </ul>
	Superintending Engineer PIU	<ul style="list-style-type: none"> <li>• Overall responsible for EMP implementation</li> <li>• Reporting to various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation</li> <li>• Coordination with PIU Staff (Environmental officer).</li> <li>• Responsible for obtaining Regulatory Clearances</li> <li>• Review of the progress made by Concessionaires</li> <li>• Ensure that BOQ items mentioned in EMP are executed as per Contract provisions.</li> </ul>
	Environmental and R&R Specialist (PIU)	<ul style="list-style-type: none"> <li>• Assisting SE in overall implementation of EMP</li> <li>• Review of periodic reports on EMP implementation and advising SE in taking corrective measure.</li> <li>• Conducting periodic field inspection of EMP implementation</li> <li>• Assisting SE to reporting various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation</li> <li>• Preparing environmental training program and conducting the same for field officers and engineers of Concessionaire</li> </ul>
Implementing/Monitoring Agency	Engineer (Supervision consultant)	<ul style="list-style-type: none"> <li>• Responsible for supervision of effective implementation of EMP measures by the Concessionaire</li> </ul>

System	Designation	Responsibilities
	SC / IE Independent Engineer)	<ul style="list-style-type: none"> <li>Review progress reports and periodic reporting to PIU about the status of EMP implementation</li> <li>Work in close coordination with ERRS (PIU) and Concessionaire</li> </ul>
	RAP implementation NGO	<ul style="list-style-type: none"> <li>Conducting awareness campaign for all construction personnel (including labourers, supervisors, engineers and consultants) about HIV/AIDS/STDs in the construction and labour camps.</li> <li>Facilitating the medical testing/ routine check-up for labours as suggested in the HPP</li> </ul>
<b>Concessionaire</b>	Environmental Manager of Concessionaire	<ul style="list-style-type: none"> <li>Responsible for ensuring the implementation of EMP as per provision in the document.</li> <li>Directly reporting to the Project Manager of the Concessionaire</li> <li>Discussing various environmental/social issues and environmental/social mitigation, enhancement and monitoring actions with all concerned directly or indirectly</li> <li>Assisting his project manager to ensure social and environmentally sound and safe construction practices</li> <li>Conducting periodic environmental and safety training for Concessionaire's engineers, supervisors and workers along with sensitization on social issues that may be arising during the construction stage of the project</li> <li>Assisting the PIU on various environmental monitoring and control activities including pollution monitoring; and</li> <li>Preparing and submitting monthly reports to PIU on status of implementation safeguard measures</li> </ul>

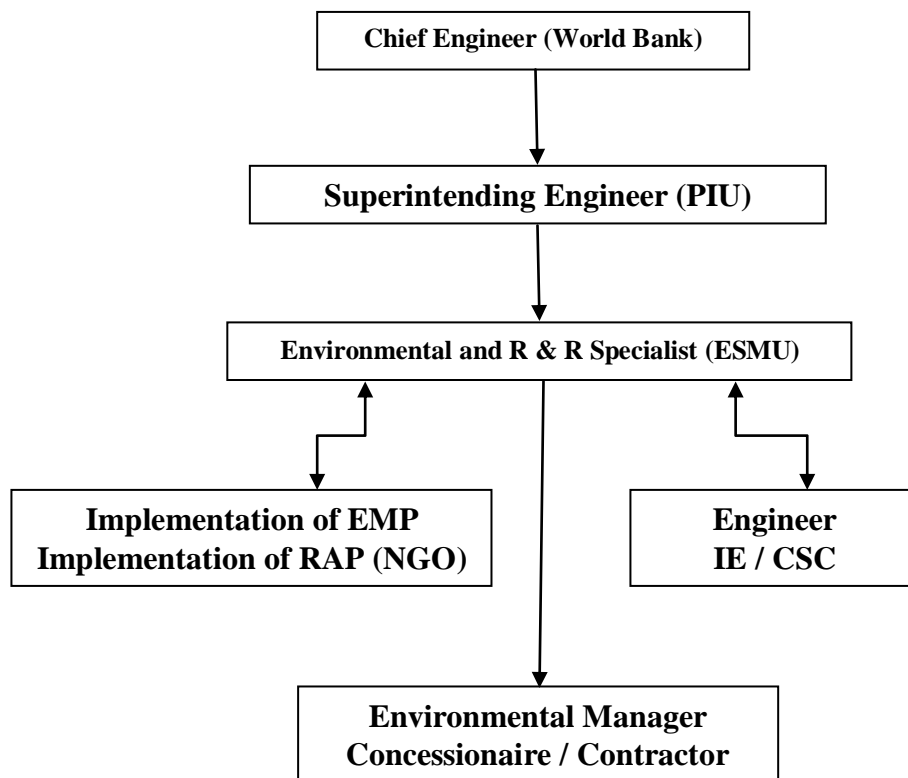


Figure 7-1: Organization Setup for EMP Implementation

## 7.2 Environmental Monitoring PROGRAMME / Plan

To ensure the effective implementation of the EMP, it is essential that an effective monitoring programme be designed and carried out. Broad objectives of the monitoring programme are:

- To evaluate the performance of mitigation measures proposed in the EMP;
- To suggest improvements in the management plans, if required;
- To satisfy the statutory and community obligations; and,
- To provide feedback on adequacy of Environmental Impact Assessment

## 7.3 Monitoring Indicators

The monitoring programme contains monitoring plan for all performance indicators, reporting formats and necessary budgetary provisions. Physical, biological and environmental management components identified as of particular significance in affecting the environment at critical locations have been suggested as Performance Indicators (PIs). The Performance Indicators shall be evaluated under three heads as:

- Environmental condition indicators to determine efficacy of environmental management measures in control of air, noise, water and soil pollution;
- Environmental management indicators to determine compliance with the suggested environmental management measures.
- Operational performance indicators have also been devised to determine efficacy and utility of the mitigation/enhancement designs proposed.

**Table 7-2: Environmental Monitoring Indicators**

Sr. No.	Indicator	Details	Stage	Responsibility
<b>A Environmental Condition Indicators and Monitoring Plan</b>				
1	Air Quality		Pre-Construction	R & BD., through Feasibility Consultants
			Construction	Concessionaire under the supervision of Engineer
			Operation (DL Period)	Concessionaire under the supervision of Engineer
2	Noise Levels	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared (Refer EIA, Also, Table 7-3)	Pre-Construction	R & BD., through Feasibility Consultants
			Construction	Concessionaire under the supervision of Engineer
			Operation (DL Period)	Concessionaire under the supervision of Engineer
3	Water Quality		Pre-Construction	R & BD., through Feasibility Consultants
			Construction	Concessionaire under the supervision of Engineer
4	Soil Quality		Pre-Construction	R & BD., through Feasibility Consultants
			Construction	Concessionaire under the supervision of Engineer
<b>B Environmental Management Indicators and Monitoring Plan</b>				
1	Tree Cutting	Progress of tree removal marked for cutting is to be reported.	Pre-construction	Forest Department/PIU
2	Construction Camps	Location of construction camps have to be identified and	Pre-construction	Concessionaire under the supervision of Engineer

Sr. No.	Indicator	Details	Stage	Responsibility
		parameters indicative of environment in the area has to be reported.		
3	Borrow Areas	Location of borrow areas have to be identified and parameters indicative of environment in the area has to be reported.	Pre-construction	Concessionaire under the supervision of Engineer
4	Rehabilitation of Borrow Areas	Engineer will undertake site visits to verify that all borrow areas have been rehabilitated in line with the landowner's request and to their full satisfaction.	Construction	Concessionaire under the supervision of Engineer

For each of the environmental condition indicator, the monitoring plan specifies the parameters to be monitored, location of the monitoring sites, frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for environmental condition indicators of the project in construction and operation stages is presented in Table 7-3.

Table 7-3: Environmental Monitoring Program / Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
<b>Air</b>	Construction	SO <sub>2</sub> , NO <sub>x</sub> , PM <sub>10</sub> , PM <sub>2.5</sub> , CO	High volume sampler to be located 50m from the plant in the Downwind direction. Use method specified by CPCB for analysis	Air (prevention and Control of Pollution) Rules, CPCB, 2009	Three seasons per year	24 hours Sampling	Along the road Hot mix / batching plant Along the road	Concessionaire under the supervision of the Engineer
	Operation (DLP)				Three seasons for one year			
<b>Water</b>	Construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the SC.	Grab sample collected from source and Analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982)	Three seasons per year	Grab Sampling	Along the road Surface water sources	Concessionaire under the supervision of the Engineer
<b>Noise</b>	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF Noise Rules, 2000	Three seasons per year	Leq in dB(A) of day time and night time	Along the road Hot mix / batching plant Along the road	Concessionaire under the supervision of the Engineer
	Operation (DLP)		Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement		Three seasons for one year			
<b>Soil</b>	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption Spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	Once in a year	Grab Sampling	Along the road Hot mix / batching plant	Concessionaire under the supervision of the Engineer
<b>Borrow area</b>	Pre-construction	Site suitability as per Guidelines	Geotechnical analysis (laboratory and/or field analysis) of all soil horizons proposed as borrow source material	-	Once (during selection of site)	-	Borrow area location	Concessionaire under the supervision of the Engineer
	Construction	As per Guidelines	Visual Observation	-	Once in a month	-		
<b>Rehabilitation of borrow area</b>	Construction	As per Guidelines	Visual Observation	-	Half Yearly	-		
<b>HIV/ AIDS Prevention Measures</b>	Construction	Awareness campaign	-	-	Annual	-	Construction and Labour Camp sites	Concessionaire under the supervision of the Engineer/ R&BD/PIU
		HIV/ AIDS Screening of construction personnel's			Within three month of mobilisation and every quarter during construction			
		IEC materials distribution			Quarterly			
		Condom Distribution			Once a month			

## 7.4 Reporting System

Reporting system for the suggested monitoring program operates at two levels as:

- Reporting for environmental condition indicators and environmental management indicators (except tree cutting indicator)
- Reporting for operational performance indicators

Concessionaire and Engineer operate the reporting system for environmental condition and environmental management indicators (except tree cutting). The Environmental and Social Management Unit of PIU will operate the reporting system for environmental management tree cutting indicator and operation performance indicators. The PIU will set the targets for each activity envisaged in the EMP beforehand and all reports will be against these targets.

Concessionaire will report to the Engineer on the progress of the implementation of environmental conditions and management measures as per the EMP. The Engineer will in turn report to the PIU on a quarterly basis. Along with these reports, ESMU shall report progress of tree cutting, compensatory plantation, landscaping and survival rate as per the monitoring plan. Reporting formats have been prepared, which will form the basis of monitoring, by the Engineer and /or the Environmental Cell as required and presented as **Annexure to the EMP of GSHP II DPR corridors.**

**Table 7-7-4: Summary - Details of Reporting**

Format No.	Item	Stage	Concessionaire	Engineer		Project Implementation Unit (PIU)
			Implementation & Reporting to Engineer	Supervision	Reporting to PIU	Oversee / Field Compliance Monitoring
EM 1	Identification of Disposal Locations	Pre-Construction	One Time	One Time	One Time	One Time
EM 2	Setting up of Construction Camp	Pre-Construction	One Time	One Time	One Time	One Time
EM 3	Borrow Area Identification	Pre-Construction	One Time	One Time	One Time	One Time
EM 4	Tree Cutting	Pre-Construction	-	-	-	Monthly
EM 5	Top Soil Monitoring	Construction	Quarterly	Continuous	Quarterly	Quarterly
EM 6	Status Regarding Rehabilitation of Borrow Areas	Construction	-	-	-	Half Yearly
EM7	Construction Safety during Construction	Construction	Monthly	Monthly	Monthly	Quarterly
EC 1	Pollution Monitoring	Construction	As Per Monitoring Plan	Quarterly	Quarterly	Quarterly
EC 2	Pollution Monitoring	Maintenance	-	-	-	As Per Monitoring Plan

In addition to these formats, to ensure that the environmental provisions are included at every activity of the implementation by the Concessionaire, it is suggested that the approval of the environmental personnel of the engineer is required in the request for application to proceed or other similar reporting formats used by the Concessionaire. These will not only ensure that the environmental provisions are addressed but also link the satisfactory compliance to environmental procedures prior to approval of the Interim Payment Certificate (IPC) by the Engineer. The activities by the Concessionaire that can impact the environment will be identified based on discussions between the Environmental Specialist of the PIU, team leader

of the Engineer and the Environmental personnel of the Engineer. The decisions will be communicated to the Concessionaire prior to the start of the construction activities.

## 7.5 Good Environmental Construction Guidelines

Comprehensive environmental construction guidelines have been prepared to guide the planning and implementing agency in preparing the project specific environmental code of conduct for Concessionaire. The list of good environmental practices is as follows. All guidelines listed are presented as **Annexure to EMP of GHSP II DPR Corridors** for reference and implementation into the Environmental Management Plans for the specific projects. **This is in addition to the Guidelines** provided in the detailed EMP of Bagodara – Bhavnagar corridor, vide **Annexure 8.1 to 8.7 of EIA**.

**Table 7-5: Guideline for Good Environmental Practices**

<b>Guidelines</b>	<b>Activities</b>
Guideline-1	Site Preparation
Guideline-2	Construction and Labour Camps
Guideline-3	Borrow Areas
Guideline-4	Topsoil Salvage, Storage and Replacement
Guideline-5	Quarry Management
Guideline-6	Water for Construction
Guideline-7	Slope Stability and Erosion Control
Guideline-8	Waste Management and Debris Disposal
Guideline-9	Water Bodies
Guideline-10	Drainage
Guideline-11	Construction Plants & Equipment Management
Guideline-12	Labour and Worker's Health and Safety
Guideline-13	Cultural Properties
Guideline-14	Tree Cutting and Afforestation
Guideline-15	Forests and Other Natural Habitats
Guideline-16	Air and Noise Pollution
Guideline-17	Environmental Monitoring

Ref: Environmental Management Plan (EMP) of World Bank Funded GSHP II Phase I DPR Corridors

## 8 ANALYSIS OF ALTERNATIVES, PROJECT BENEFITS

### 8.1 Analysis of Alternatives

The analysis of alternatives has been made on the basis of “with and without project scenarios” in terms of potential environmental impacts. It is found on the basis of analysis that “without” project scenario will do more harm than the benefits in terms of the biological and socio-economic environment of the project region as compared to “with” project scenario. Hence the “with” project scenario with minor reversible impacts is an acceptable option for the project section.

The ‘With’ project scenario includes the widening to four lanes of the existing two lane section between Bagodara to Bhavnagar i.e. from Km 61.400 to Km 127.700 as detailed out in the EIA. The "With' project scenario, has been assessed to be economically viable and will alleviate the existing conditions. It would thereby, contribute to the development goals envisaged by the Government of Gujarat, and enhance the growth potential of the area.

**Benefits of proposed four laning of the project corridor are provided in subsequent paras, below.**

### 8.1 Project Benefits

Availability of adequate and quality infrastructure is a pre-requisite for rapid development of any economy. Gujarat being one of the emerging industrial states of India has quite high traffic intensity on roads due to considerably increased growth in the industrial and commercial sectors. The existing road network is not capable to cater to increasing traffic demand due to rapid industrialization and development in project influence area. Commercial activities in the area have increased due to industrialization, Alang ship breaking yard and port activity in the Bhavnagar district. There has been an increase in movement of heavy goods vehicles transporting salts, iron road/plate, raw materials, petroleum products, agricultural product, gas cylinder, equipment and machinery, fertilizer, build material and chemicals. There is a requirement for improving the road infrastructure to prevent it from becoming a bottleneck to industrial development.

Keeping above in view, the Gujarat State Road Development Corporation had identified high density corridor Bagodara – Dhandhuka – Vallabhipur - Bhavnagar Road of SH – 1 and SH – 36 for capacity augmentation by converting this road from existing 2-lane to 4-lane divided carriageway. **Environmental Clearance (EC) and No Object Certificate (CTE) from State Pollution Control Board (GPCB) as a part of pre construction activities / clearances were obtained during 2009.** Process to obtain NOC for tree cutting and forest clearance was already initiated under GSRDC by that time. In July 2012, R & BD., GoG identified this corridor to be developed under Innovative Financing and proposed to developed under Second Gujarat State Highway Project (GSHP II).



## 8.2 Benefits of road improvement

The role of any kind of physical infrastructure in contributing to the development is an important one - its contribution is clearly vital and a must for continuing prosperity. Little infrastructure can mean the loss of opportunities to advance towards social, cultural or environmental goals. Improvement of national highways, state highways, district roads, etc is also one such development.

### 8.2.1 Technological Benefits

The improvement of this highway will provide the following technological benefits:

- Providing better level of service in terms of improved riding quality and smooth traffic flow.
- Faster transportation will ultimately lead to massive savings in the form of reduced wear and tear of vehicles, reduced vehicle operating costs (VOCs) and total reduction in transportation costs etc.
- With the improvement of road surface, the traffic congestion due to obstructed movement of vehicles will be minimized and thus wastage of fuel emissions from the vehicles will be reduced.
- Introduction of additional safety measures like crash barrier, road illumination, retro-reflective boards, delineators etc. will result in lesser accidents.
- Due to project implementation through public-private partnership, construction, operation and maintenance of new four lane highway will be by state of art technology and development of road side amenities will be of world class.

### 8.1.1 Socio-economic Benefits

The improvement of this highway will provide the following socio-economic benefits to the region:

- It will increase access of the villages and other small settlements to urban areas, thus providing connectivity of rural produce to urban markets, thereby enhancing the reach and export of perishable farm-goods, leading to better remuneration for the producer.
- By reducing the transportation costs, it will be more feasible to transfer construction materials which are important for many economic activities (house building, school building, small hydro-electric, projects etc) to hinterland. This will in turn, lead to direct as well as indirect strengthening of local economies.
- Access to social infrastructure like schools, colleges, health centers will improve, providing many benefits from increased education and health facilities, and improved social interaction and mobility.
- During the execution of the project, i.e. during the construction period, employment will be provided to workers from the local communities.
- The educated as well as uneducated people from villages will obtain access to new employment centres.
- The improvement of the road will prevent single-vehicle collision as the road will be four-lane. This would be very beneficial from the safety point and view and will thus, reduce accident rate.

- The project road provides accessibility to important tourist centres like Lothal archaeological site, Black Buck National Park etc. The proposed project will instigate faster and comfortable journeys, which will attract more and more domestic and international tourists. Thus, tourism is likely to flourish.
- Overall improved quality of life for the lesser developed areas in the neighbourhood.

### **8.3 Benefits under Innovative Finance**

Roads and Building Department (R & BD.), Govt. of Gujarat decided to develop this corridor under Innovative Financing and proposed to developed under Second Gujarat State Highway Project (GSHP II).

**Benefits of improving this corridor under innovative financing are as under:**

- The Innovative Financing Option with an IBRD Partial Credit Guarantee as credit support for the Concessionaires and the Lenders will enable the execution of the Project by the private sector under a BOT Toll structure
- The PCG support will enable the financing of the Project with preferential financing conditions including a significant reduction in financing costs and a longer repayment period
- This financing option requires a limited use of IBRD and SoG resources
- The use of an IBRD PCG to enable the commercial financing of a toll road project will set a new precedent in the market for this type of transaction and will fulfill the Finance Plus requirements of DEA

## 9 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

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### 9.1 Project Description

Gujarat State Road Development Corporation Limited had identified high density corridor namely Bagodara - Bhavnagar Road for capacity augmentation by converting this road from existing 2-lane to 4 – lane divided carriage way. GSRDC had selected Bagodara – Dhandhuka – Vallabhipur - Bhavnagar road for improvement which is of strategic importance for connecting large scale investments at key locations in the state with the network of roads (State and National highways) outside the state, as well as to connect with various industrial complexes and ports. These will improve accessibility to the commercial hub like Alang ship breaking yard, Dholera Port, Ghogha Port and other major industrial centre like IPCL at Bhavnagar with the NH-8 running between Delhi and Mumbai. The study has accorded project road, as on most priority road in the state.

**Applicable Clearances as a part of pre construction activities, such as Environmental Clearance (EC) and No Object Certificate (CTE) from State Pollution Control Board were obtained from State Level Environmental Impact Assessment Authority (SEIAA) and Gujarat Pollution Control Board (GPCB) respectively, during 2009. Process to obtain NOC for tree cutting and forest clearance was already initiated under GSRDC by that time. However, during 2011-12, bidding of this corridor got failed.**

**Since the corridor is identified as one of the most priority corridor in the state, Roads and Building Department (R & BD.), Govt. of Gujarat (GoG) has decided this high density Bagodara – Bhavnagar corridor to develop as Innovative Finance, under Second Gujarat State Highway Project (GSHP II) funded by the World Bank, as bidding under Public Private Partnership (PPP) for the same got failed during 2011 – 12.**

**Environmental Due Diligence Report is prepared based on Detailed Environmental Impact Assessment (EIA) report, and this chapter provides summary of EIA report in detail.**

The project road is located in south central part of Gujarat state falling in two districts i.e. Ahmedabad & Bhavnagar. Bagodara – Dhandhuka – Vallabhipur – Bhavnagar Road is comprises of two state highways i.e. SH-1 & SH-36 having total length 127.700 km. State Highway -1 starts from Bagodara Junction with NH-8 at Km. 61.400 and ends near Tagadi village at Km. 113.000 having total length of 51.600 km. State Highway – 36 starts near Tagadi village at Km. 113.000(end point of SH-1) and ends at Bhavnagar at Km. 189.100 having total length of 76.100 km.

It passes through seven talukas namely Bavla, Dholka, Dhandhuka, Barwala, Vallabhipur, Shihor and Bhavnagar of Gujarat state. Out of which Bavla, Dholka, Dhandhuka and Barwala falls under Ahmedabad District and rest three talukas Vallabhipur, Shihor and Bhavnagar falls under Bhavnagar District. Out of total length of 127.7 Km., 78.4 km length falls in Ahmedabad district while 49.3 km length falls in Bhavnagar districts.

Project Road	Chainage (Km. to Km.)		Length (km)	Total Length (Km)
	Bagodara to Bhavnagar	SH-1	61.400-113.000	51.600
SH-36		113.000-189.100	76.100	

This Environmental Impact Assessment (EIA) has been carried out, in accordance with the requirements of the Government of India guidelines for Rail / Road / Highway projects. For the purpose of Environmental Impact Assessment a corridor up to 10 km on either side of the road has been studied. The EIA process includes an inventory of baseline environmental conditions using data collected from secondary sources and field investigations; the identification of environmental issues / impacts and suggestions for mitigation measures to minimize adverse environmental impacts.

The project detail overview is presented below in **Table 9.1**.

**Table 9-1: Details of Project Road**

SR. NO.	PARTICULARS	EXISTING	PROPOSED
1.	Road Length	127.1 km	127.1 km
2.	Starting Chainage	km 61.400	km 61.400
3.	Ending Chainage	km 189.100	km 189.100
4.	Carriageway	Two lane	Four lane
5.	Right of Way - ROW	24 - 30 m	60 m
6.	Railway Crossing	6	ROBs proposed at all 6 locations
7.	Bypass	--	--
8.	Major Bridges	16	Widening & Strengthening
9.	Minor Bridges	79	
10.	Culverts	80	
11.	Toll Plazas	--	03
12.	Junctions	284	Improvement
13.	Safety Measures	--	Crash Barriers, Road Signs-Signals, Guard Post, Delineators, Ambulance ..etc
14.	Rain Water Harvesting Scheme / Structure	--	Provided at an interval of 500 mt. c/c on either side of road.

## 9.2 Description of Existing Environment

### 9.2.1 General

Baseline environmental data plays a key role in the assessment of environmental parameters likely to be affected due to the project. This also facilitates the decision maker to assess a particular environmental parameter which needs to be incorporated during the detailed Environmental Impact Assessment (EIA) study. The data have been collected from various sources and field visits during September 2008 and November 2008 to cover the following aspects:

### 9.2.2 Land Environment

The project corridor traverses through plain terrain. Along project corridor the predominant land use is agricultural with patches of barren land at some places.

**Soils:** Soils of Ahmedabad district is characterised by more of intrazonal soil. The geographical formation of Saurashtra is of volcanic origin; hence the soils of Bhavnagar district with the exception of a few strips are derived from trap rock.

**Minerals:** Some of the important minerals found are Lignite, Gypsum, bentonite, agate, Bauxite, Ochre etc.

**Seismic Profile:** Out of the four seismic zones of India, project corridor falls within Zone II. All the project components and structures (bridges, culverts) will be such constructed as to withstand the level of seismic activity as per ISI specifications for Zone-II.

### 9.2.3 Water Environment

#### Water Resources

Widening of the project corridor entails removal and/ or shifting of water supply lines, removal of taps, wells, hand pump and tube wells within the corridor of impact resulting in the loss of water supply.

The most significant adverse impacts to water bodies from the construction are the loss of storage capacity due to in filling by the earthmoving activities. There are total 35 different types of water resources exists with in vicinity of the road along the project corridor, which includes 13 Rivers crosses the corridor, 6 Bore wells and a wells, 4 ponds, 10 water hut, an overhead Water tank. Out of which a well, 2 bore wells, 3 ponds and 7 water huts are likely to have negative impact due to project. Most of the water bodies are non-perennial and are used by the local population, and also serve as source of water for the cattle and livestock in the post-monsoon months. Therefore, conscious efforts have been made to minimize the impacts on these surface water bodies. Reduction of the area of these surface water bodies will be a moderate long-term negative impact during the construction and operation stages of the project.

#### Water Quality

Water quality can be expressed in terms of physical, chemical and biological characterisation of water. Since the water table in the project area is at 10 m to 40 m, some likely impacts on ground water quality and flow pattern are not expected due to proposed project. TDS level of ground water is around 1000 ppm.

It is observed that the surface water quality of the area is quite good except few parameters. The nature of water is good for domestic uses as pH ranges between 6.5 and 8.5.

#### Water Requirement

The water requirement for widening of the whole Bagodara – Bhavnagar road can be estimated to 200 Cu. m/day during project duration including domestic need. During the construction phase water is used for the compaction, suppression, concrete and form work, hence causing minor and short-term impact on the local water supply, as the strain on water supply ceases after the construction is completed.

### 9.2.4 Air Environment

The study area represents mostly rural zone with a few semi-urban centres. The proposed project does not cover densely urbanized and industrialized areas, and hence the air pollution is not significant. Most of the land use along the project road is agricultural. Although there are a number of small and medium-scale industries within the project study area, the area cannot be said to be considerably polluted. The major sources of air pollution in the region are vehicular traffic and dust arising from field / road activities.

The ambient air quality was measured at three locations which are considered sensitive to air quality. The selection of locations has been done keeping in view the land use of area, traffic pattern / characteristics and settlement aspects. The selected locations are:

- (a) Dhandhuka Village (Hotel Hindva), near km 102.20
- (b) Panvi Village (On Gram Panchayat Office) at km 142
- (c) Karjad Village, at km near km 187

The summary of the results of Ambient Air Monitoring carried out is given in below **Table 9.2**.

**Table 9-2: Air Quality Monitoring Results**

Sr. No.	Location	Date	Concentration ( $\mu\text{g}/\text{m}^3$ )						Distance from road
			Pb	SPM	RPM	SO <sub>2</sub>	NO <sub>x</sub>	CO	
1	Dhandhuka, Km. 102, SH-1	18/10/08		192	66	7.87	3.33	2347	40 m
2	Panvi village Km. 142, SH-36	18/10/08	0.34	218	72	8.01	22.21	1507	10 m
3	Karjad village Km. 187, SH-6	17/10/08	0.16	271	94	7.31	14.68	2079	10 m
<b>C.P.C.B. Standards</b>			<b>1.5</b>	<b>200</b>	<b>100</b>	<b>80</b>	<b>80</b>	<b>2000</b>	-

The parameters monitored were Pb, SPM, RPM, SO<sub>2</sub>, NO<sub>x</sub> and CO. Result of samples reveals that RPM levels at all the three locations are less than prescribed standards, while SPM level are higher than the prescribed standard (i.e. 200  $\mu\text{g}/\text{m}^3$ ) at two locations. SO<sub>2</sub> and NO<sub>x</sub> are well within the prescribed limits of 80  $\mu\text{g}/\text{m}^3$ . The concentration of CO is also higher than prescribed limit at Dhandhuka.

Result of samples reveals that SPM levels at two locations are high than prescribed standards. This is mainly due to the following factors:

- d) Existing vehicular traffic and condition of the existing pavement which is poor, damage road surface and road side dust.
- e) Shoulders along the project road are not paved and so lead to an increase in dust and other particulate matter.
- f) Allied agricultural activities

Figures below shows the graphical variation of levels of various pertaining to air quality monitoring along the project road.

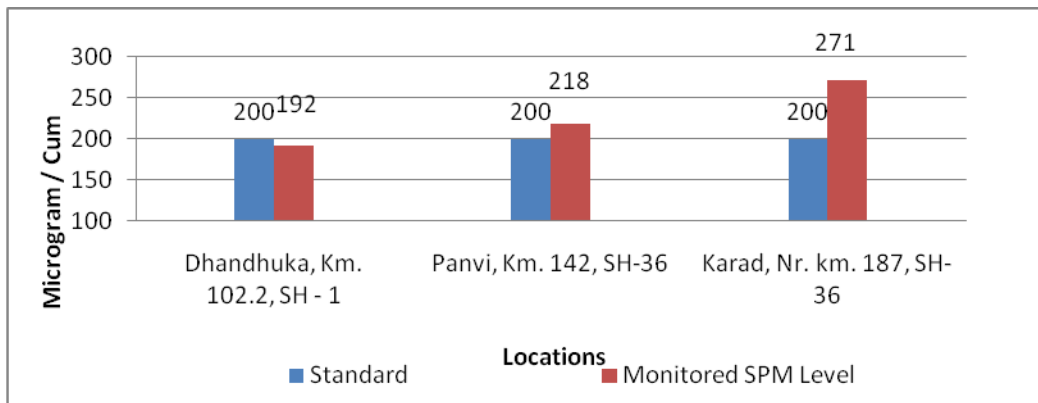


Figure 9-1: Graphical representation of SPM

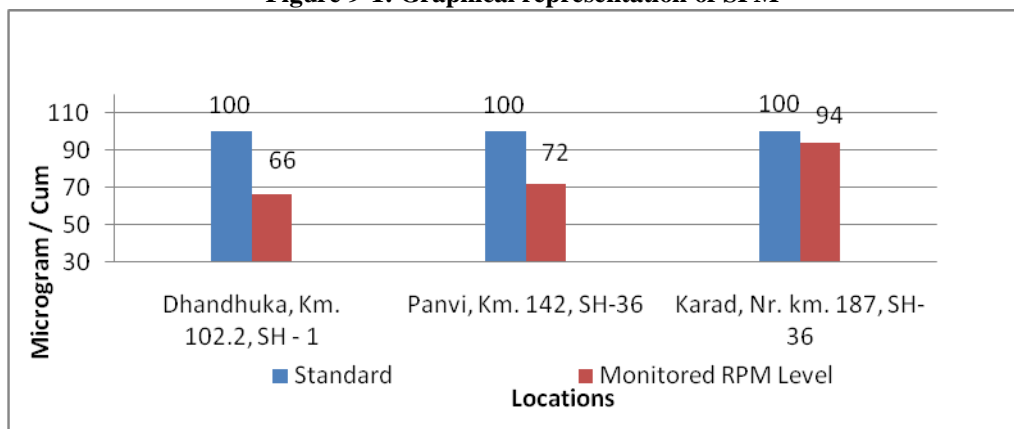


Figure 9-2: Graphical representation of RPM

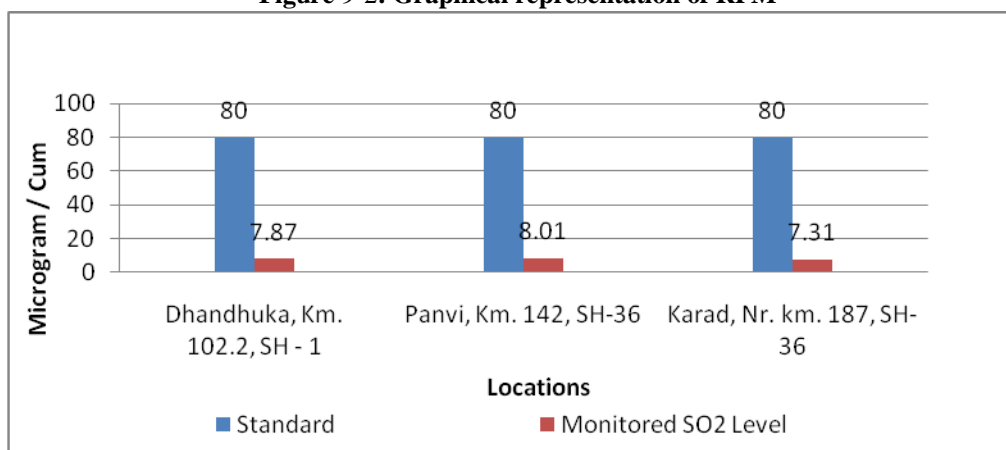


Figure 9-3: Graphical representation of SO<sub>2</sub>

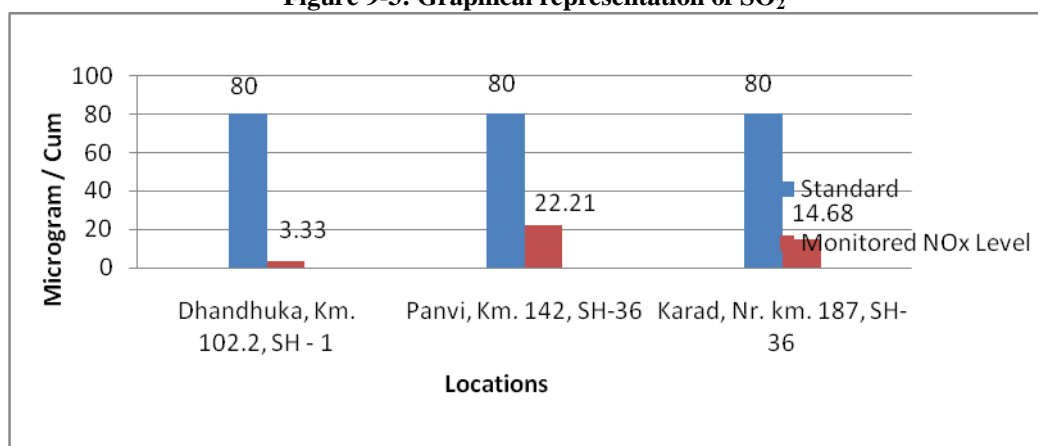


Figure 9-4: Graphical representation of NO<sub>x</sub>

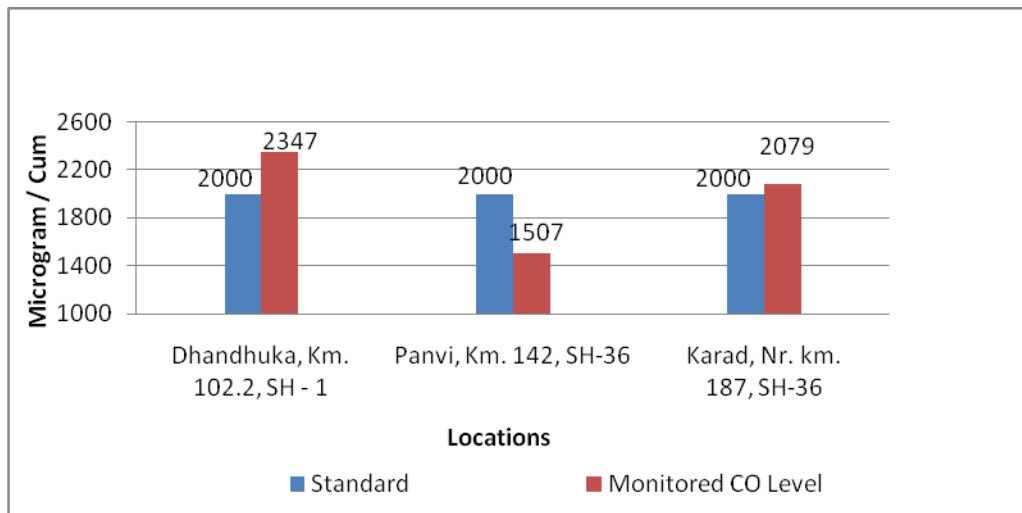


Figure 9-5: Graphical representation of CO

### 9.2.5 Noise Environment

The ambient noise levels were also measured along the project corridor at the same locations as finalised for the monitoring of parameters for air quality. The selection of locations has been done keeping in view the land use of area, traffic pattern / characteristics and settlement aspects. Integrated digital sound level meter was used for monitoring.

Table 9.3 shows the results of the noise level monitoring. Figure 9.5 (A) shows the graphical variation of noise levels along the project road.

At all the monitoring locations, the noise levels are lower than the prescribed limits i.e. 65 dB (A) of the Central Pollution Control Board.

Table 9-3: Results of Noise level Monitoring

Sr. No.	Location	Monitoring Date & Duration		Log Duration	Noise Level			
		Starting	Ending		Max dB(A)	Min dB(A)	Leq dB(A)	Standard
1	Dhandhuka, Km. 102.20,	18.10.08 08 : 00	19.10.08 07 : 00	24 hrs.	82.80	40.90	63.10	65 db(A)
2	Panvi, Km. 142	18.10.08 08 : 00	19.10.08 07 : 00		84.50	40.20	63.10	65 db(A)
3	Karhad, Km. 187.50	17.10.08 08 : 00	18.10.08 07 : 00		82.90	38.70	61.90	65 db(A)

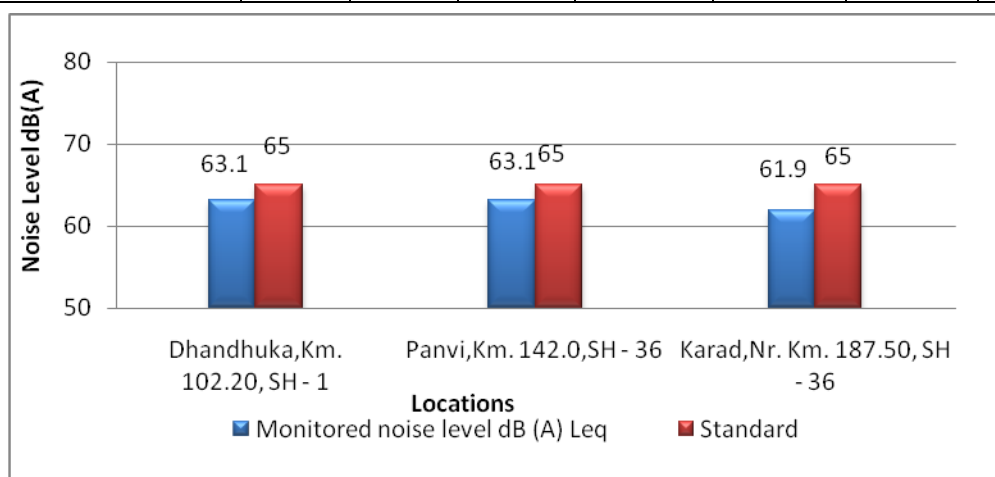


Figure 9-6: (A): Graphical representation of noise monitoring results



## 9.2.6 Biological and Ecological Environment

### Vegetation

The area surrounding the Bagodara - Bhavnagar road has very less vegetation, the having mostly shrub type vegetation. The stretch of the project road has trees such as Australian Babul, Neem, Pilu, Bore etc.

### Terrestrial Wild Life and Fauna

Black Buck National Park / Sanctuary is at least 13 km. away from the project road (At Km. 150.990 on SH - 36), which is nearest point at project corridor from the sanctuary in Bhavnagar district. The Black Buck National Park is famous for Black Buck and lying in Velavadar village of Bhavnagar district. The region has unique grassland ecosystem that has attracted fame for the successful conservation of the Blackbuck, the wolf and the lesser Florican. The Velavadar national park is situated 65 km away from the Bhavnagar. The area of the national park is 35 square kilometres, which is flat grassland. The national park gives an ideal home for the Black Bucks, Wolves, Hares, Jackals, fox, jungle cat, wild pig, hare and rodents etc.

### Trees along project road

There are about 3476 trees of various species existing all along the project road, out of these about 1710 trees are likely to be cut due to the proposed project.

### Forests along the project road

Protected forest exists along the project road in the form of strip plantations covered under protected forest category of the state forestry department. The vegetation at both sides of the project road is covered with shrubs, mainly Australian acacia or Babool.

## 9.2.7 Solid Waste Generation

The main sources of solid waste is (a) Excavation of earth and rock from sides of existing pavement for widening to four lanes (b) Demolition of existing pavement, flexible shoulders in case of concentric widening for median construction and (c) Removal of existing PCC, RCC structures & stone/brick masonry, stone pitching for road widening. The solid waste mainly consists of top soil, overburden, rock, broken PCC/RCC material and demolished bituminous material.

## 9.3 Potential Impacts and Mitigation Measures

### Physical Environment

#### Meteorology

No major change in the macro-climatic setting (precipitation, temperature and wind) is expected due to the project. The microclimate is likely to be temporarily modified by vegetation removal and of increased pavement surface. This will result in an increase in daytime temperature on the road surface and soils due to loss of shade trees and vegetation

cover. The removal of trees will increase the amount of direct sunlight resulting in increased temperatures at some locations along the highway.

This increase in the daytime temperature assumes significance especially to the slow moving traffic and to the pedestrians along the project road. Although the impact is somewhat significant and long term in nature, it is reversible in nature and shall be compensated for by additional plantation of trees. It must be noted that the impact is unavoidable. However, it may be pointed out that the project has taken care to minimize tree felling in the ROW by realigning the road.

## **Soil**

### **Impact**

There is a potential for contamination of soils from spilled fuel, engine oil, bitumen/ asphalt, etc. Some contamination of soil can be expected due to the deposition of dust, NO<sub>x</sub>, SO<sub>x</sub> and other vehicle emissions, although this is not expected to be significant. Loss of cultivated top soil is expected due to the movement removal of topsoil for construction purpose as well as acquisition of cultivated land for proposed bypass.

### **Mitigation Measures**

The primary mitigation to reduce the impacts of sand and stone material excavation is to maximize the use of materials excavated from the construction site. Any new borrow areas or quarries that are established within the vicinity of the road project, for the purposes of this road project, should be operated and closed in the context of a management plan, established prior to construction. Waste soils that are not suitable for construction will be used as much as possible to balance out fill areas, and residual volumes will be used in the rehabilitation of borrow areas for grading.

The impact of erosion will be minimized by adopting the measures such as avoiding steep slopes, minimizing cut & fill, minimizing the establishment of quarries/borrow pits, minimizing soil contamination through responsible vehicle maintenance, waste management and drainage controls, adopting stable embankment slopes (slope angles in excess of natural angle of repose) and providing retaining structures where necessary such as metal fencing, stone pitching, riprap and rock material embedded in the slope face, as well as gabions and cribs to protect stream/river embankments and replanting disturbed areas immediately after completion of construction in each segment (i.e. on an on-going basis prior to completion of all project construction).

## **Water Environment**

### **Impact**

Potential impacts on surface water hydrology include flow modification that can lead to flooding (low level) and channel modification, although significant drainage modification is unlikely. Construction activities can potentially lead to water quality degradation in the form of increased concentration of suspended solids (increase in turbidity by 5-20 NTU), resulting from surface runoff (exposed soils within the construction area) and/or erosion of the channel

(potentially resulting from increased flow velocity) and/or river or stream banks, as well as windblown dust.

The most significant adverse impacts to water bodies from the construction are the loss of storage capacity due to in filling by the earthmoving activities. 7 water huts, a well, 2 bore wells and 3 ponds are falling within the project corridor and likely to have negative impact due to project. However, there will not be any long-term negative impact during the construction and operation stages of the project.

### **Mitigation Measures**

Impacts to surface water hydrology will be controlled throughout the construction period by working primarily in the dry season when flows are very low to nil. Any watercourse diversions will be designed so as not to result in velocity impacts that could cause erosion of the stream channel, by incorporating energy dissipation into the diversion design. No work, including bridge pier or abutment construction, will be conducted directly in flowing water.

Fuel management and vehicle maintenance will be controlled to ensure that spills are minimized. Procedures provided in the EMP will ensure that contractor personnel are trained in the proper handling of fuel and other chemicals (e.g. bitumen) and emergency response and contingency planning. The Contractor will also be required to ensure that containment and clean-up equipment is readily available in the event of a spill.

Alternate water supplies, or new wells will be provided to residents where de-watering of groundwater results in water supply impacts. Concrete and asphalt plants, equipment storage and maintenance areas, and construction camps will be located at a reasonable distance away from watercourses.

## **Air Environment**

### **Impact**

Impacts to the air environment during construction will largely result from the generation of dust. Dust will be generated as a result of site clearing and grading, heavy machinery travelling over exposed soils, truck traffic, and the production of construction materials at borrow pits and off-site quarries. Dust generation impacts will be most significant along new alignments. Elevated levels of SO<sub>2</sub>, CO and hydrocarbons are likely from hot mix plant operations.

The prediction of air quality for the future years has been carried by dividing the corridor in to four different sections as discussed below.

Table 9.4, Table 9.5&Table 9.6 give the typical projection for Bagodara – Bhavnagar corridor of the pollutants loads in the present and future years for section–1, 2, 3 and 4 respectively. As shown in values given in Table 9.4 Carbon Monoxide (CO) levels are expected to increase in the Section–1 (i.e. from Bagodara Junction to Dhandhuka) by about 2.26 times over current level by year 2020 to a predicted concentration of 611.329 t/y (Year : 2020) from 270.118 t/y of year 2008. Similarly Hydrocarbon (HC) concentrations are also expected to reach about 1.96 times beyond their existing levels of 138.964 t/y for the year 2008 to 272.974 (t/y) in the year 2020. Oxides of Nitrogen (NO<sub>x</sub>) levels are also expected to

increase by 1.96 times by year 2020 over the present concentration of 619.450 t/y (Year: 2008) to 1214.605 (t/y) (Year: 2020).

Similarly in Section–2 (Km. 106.050 to 141.200), Section–3 (Km. 141.200 to 169.100) and Section–4 (Km. 169.100 to 189.100), emission loads of CO are expected to increase by about 2.235 times for the year 2010, 2015 and 2020 over the present emission load i.e. year 2008. HC concentrations are expected to increase approximately by 1.97, 1.98 and 1.94 times of their existing emission loads in above mentioned all the three the sections respectively. NO<sub>x</sub> level are also expected to increase by about 1.95 times over the current emission loads for all the three sections. The details of pollution prediction method have been supplied in Annexure 6.2.

**Table 9-4: Air Emission Loading (CO) in (t/y) along the Project Road**

Road Section	CO (Tonnes / year)			
	2008	2010	2015	2020
Section – 1, Km. 61.400 – 106.050	270.118	305.922	433.054	611.329
Section – 2, Km. 106.050 – 141.200	266.647	303.668	426.612	593.660
Section – 3, Km. 141.200 – 169.100	176.459	200.679	282.951	395.995
Section – 4, Km. 169.100-189.100	139.169	157.966	222.008	309.872

**Table 9-5: Air Emission Loading (HC) in (t/y) along the Project Road**

Road Section	HC (Tonnes / year)			
	2008	2010	2015	2020
Section – 1, Km. 61.400 – 106.050	138.964	150.819	202.242	272.974
Section – 2, Km. 106.050 – 141.200	78.53	85.44	114.407	154.139
Section – 3, Km. 141.200 – 169.100	62.739	68.221	91.530	123.575
Section – 4, Km. 169.100-189.100	108.022	117.223	156.629	210.608

**Table 9-6: Air Emission Loading (NO<sub>x</sub>) in (t/y) along the Project Road**

Road Section	NO <sub>x</sub> ( Tonnes / year )			
	2008	2010	2015	2020
Section – 1, Km. 61.400 – 106.050	619.450	671.210	895.880	1214.605
Section – 2, Km. 106.050 – 141.200	365.270	418.665	524.585	712.169
Section – 3, Km. 141.200 – 169.100	288.501	330.948	413.298	561.462
Section – 4, Km. 169.100-189.100	487.608	528.948	705.012	953.615

This increase in pollution load will lead to the increase in the atmospheric concentration over permissible limits. The likely impacts on the communities are deposition of these pollutants to the adjacent properties and some health related problems particularly related to the respiratory system. However, due to smooth traffic flow dust level will decrease.

### Mitigation Measures

During construction, water will be sprinkled regularly on exposed surfaces to reduce adverse effects caused by dust and particulate matter. Vehicles delivering construction materials will be covered to reduce spills and dust, and stringent control measures will be exercised on the maintenance of construction equipment, machinery and vehicles. Borrow pits, quarries concrete plants and asphalt mixing plants will be located more than 1000 m away from any settlement.

### Noise Environment

#### Impact

Noise impacts due to various construction activities are likely but are expected to be confined to the immediate vicinity of the project corridor. Increased noise levels are expected due to the movement of construction machinery, concrete and asphalt plant operations and

blasting/scraping in the vicinity of borrow pits and quarries. The likely noise generated during excavation, loading and transportation of material near the borrow areas will be in the range of 90 to 105 dB(A). The potential impacts of noise pollution include deteriorated human health and reduced quality of life (e.g., reduced enjoyment of outdoor amenity areas). However, due to the short term nature of elevated noise levels during construction, hearing problems are not expected, and reduced quality of life would be a short-term impact.

Monitoring of current noise levels at selected locations within the study area shows that at all locations noise levels were found to be within prescribed limits of Central Pollution Control Board.

### Operation Phase

During the operation stage of the project, increased traffic volumes along the highway will result in increased noise levels. Long-term noise level increases and were assessed at various sensitive receptor locations along the corridor, for the years 2006, 2008, 2010, 2015, 2020 and 2025 using the model developed by Federal Highway Administration called FHWA Transportation Noise Model. Receptor locations were set at 20 m, 50 m and 100 m from the centre of the outermost traffic lane. Results are shown in **Table 9.7**, **Table 9.8**, **Table 9.9** and **Table 9.10**. Also, **Figure 9.7**, **Figure 9.8**, **Figure 9.9** and **Figure 9.10** shows graphical presentation of noise levels along the project road. The details of pollution prediction method have been supplied in **Annexure 6.3**.

**Table 9-7: Predicted Noise Level (Near Bagodara Junction, Km. 61.400)**

Year	Distance from Carriageway in m / Locations		
	At 20 m	At 50 m	At 100 m
2008	75.48	69.91	65.69
2010	76.07	70.50	66.29
2015	77.49	71.92	67.50
2020	78.81	73.24	69.02
2025	80.03	74.46	70.25
<b>Standards</b>	<b>65</b>	<b>65</b>	<b>65</b>

**Table 9-8: Predicted Noise Level (At Dhandhuka Village, Km. 106.050)**

Year	Distance from carriageway in m / Locations		
	At 20 m	At 50 m	At 100 m
2008	74.33	68.75	64.54
2010	74.92	69.35	65.14
2015	76.93	70.76	66.55
2020	77.65	72.08	67.87
2025	78.88	73.31	69.10
<b>Standards</b>	<b>65</b>	<b>65</b>	<b>65</b>

**Table 9-9: Predicted Noise Level (At Panvi village, Km. 141.200)**

Year	Distance from carriageway in m / Locations		
	At 20 m	At 50 m	At 100 m
2008	74.34	68.77	64.56
2010	74.94	69.37	65.16
2015	76.36	70.79	66.58
2020	77.69	72.12	67.90
2025	78.92	73.35	69.13
<b>Standards</b>	<b>65</b>	<b>65</b>	<b>65</b>

**Table 9.10: Predicted Noise Level (At Chamardi village, at Km. 169.100)**

Year	Distance from carriageway in m / Locations		
	At 20 m	At 50 m	At 100 m
2008	74.95	69.38	65.17

Year	Distance from carriageway in m / Locations		
	At 20 m	At 50 m	At 100 m
2010	75.54	69.97	65.76
2015	76.95	71.37	67.16
2020	78.25	72.68	68.47
2025	79.47	73.90	69.68
<b>Standards</b>	<b>65</b>	<b>65</b>	<b>65</b>

It can be seen that noise levels at Bagodara Junction (Nr. Km. 61.400) Village are expected to increase by 5.15 dB (A) within a 20 m , 50 m and 100 m distance from the carriageway, between 2006 and 2025. While at other locations, noise levels are expected to increase between 5.1 to 5.15 dB (A) within a 20m, 50 m and 100 m distance from the carriageway between year 2008 and 2025.

Noise Levels along the project corridor are expected to exceed the regulatory standard of 65 dB (A) at all distances by 2025 at all locations. In general, an increase of more than 5 dB (A) is considered significant and absolute noise level above 65 dB (A) are considered unacceptable.

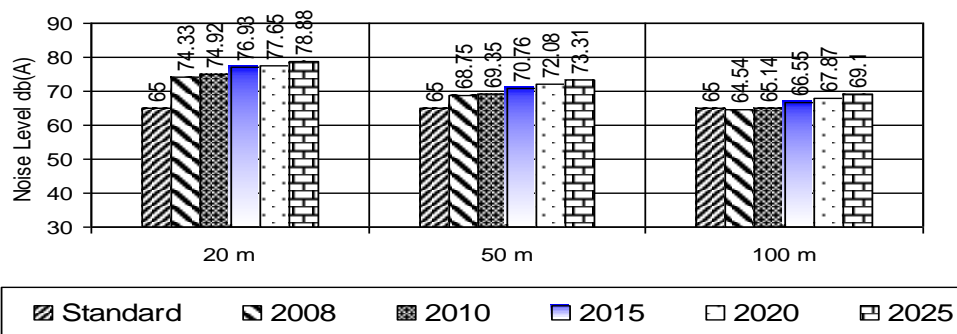


Figure 9-7: Noise Levels (Near Bagodara Junction, Km. 61.400)

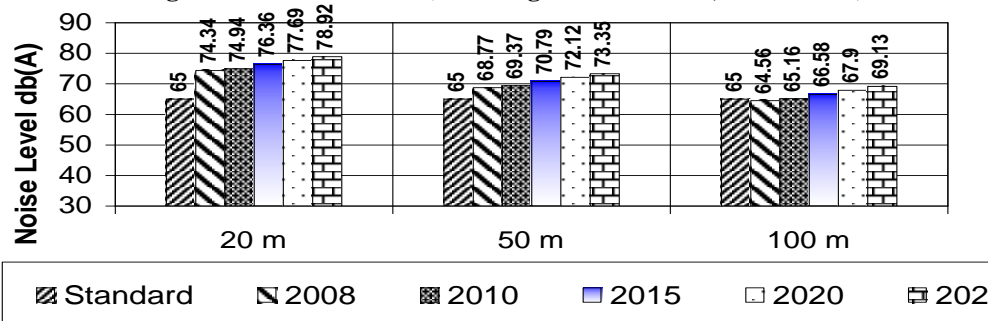


Figure 9-8: Noise Levels (At Dhandhuka, Km. 106.050)

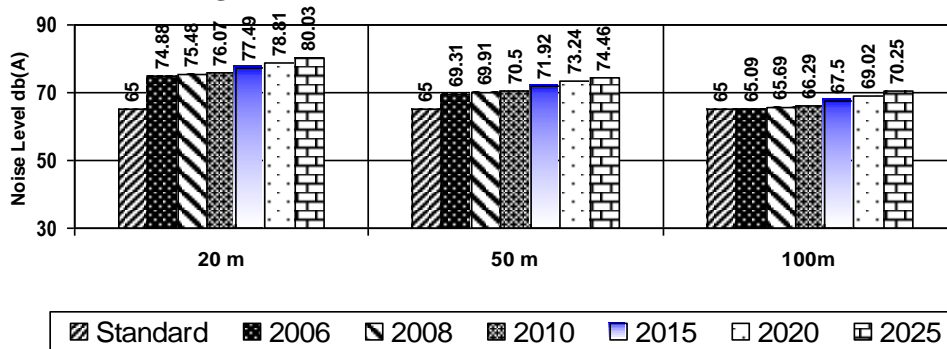


Figure 9-9: Noise Levels (At Panvi Village, Km. 141.200)

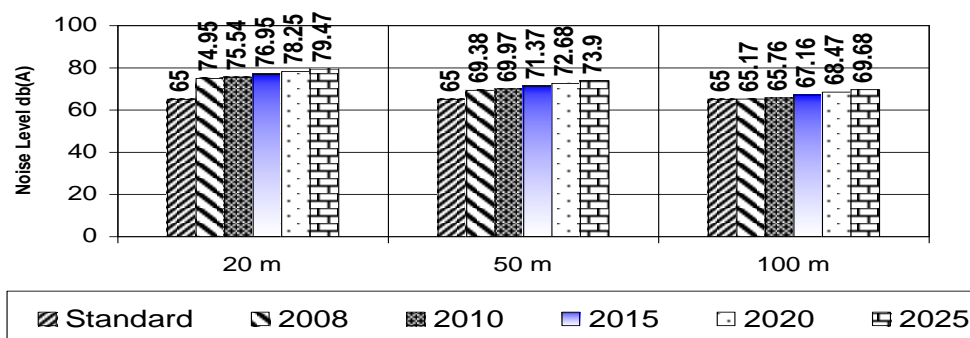


Figure 9-10: Noise Levels (At Chamardi Village, Km. 169.100)

## 9.4 Socio-Economic Environment

### Land Acquisition

Total required land for proposed ROW of 60m is 288.23 hectares in both districts. Table 9.11 gives the total land requirement for project road. In Ahmedabad districts, total land requirement is 191.73 hectares. In Bhavnagar district, total land requirement is 96.50 hectares. In Ahmedabad district, half of the land to be acquired is agricultural and half is barren with saline low area. In Bhavnagar districts, almost all land to be acquired is barren and having saline nature. The acquisition of land will cause changes in the land use pattern of the area. The displacement of these lands will result in loss of agricultural production, employment and traditional livelihood for affected farmers. The implementation of project will require the acquisition of private property. The acquisition of this land will result in the following losses:

- Productive agricultural soils and operating farms;
- Community space (common gathering places);
- Private properties, residences and businesses and amenities;

As per resettlement policy, affected people should be (a) compensated for their loss at full replacement cost, (b) assisted in the move and supported during the transition period, and (c) assisted in their efforts to improve their living standards, income earning capacity and production levels, or at least to restore them

Table 9-10: Land Requirement detail of Project Road

Sr. No.	District	Taluka	Village Name	Total Area (Ha.)
1	Ahmedabad	Bavla	Bagodra	6.25
2		Bavla	Gudanparu	13.43
3		Bavla	Dhingada	14.68
4	Ahmedabad	Dholka	Gundi	8.07
5		Dholka	Uteliya	12.80
6	Ahmedabad	Dhandhuka	Tagadi	22.95
7		Dhandhuka	Fedara	20.04
8		Dhandhuka	Rayaka	36.51
9		Dhandhuka	Parabadi	2.33
10		Dhandhuka	Dhandhuka	8.93
11		Dhandhuka	Padona	5.95
12		Dhandhuka	Jaska	5.46
13		Dhandhuka	Tagadi	7.13

Sr. No.	District	Taluka	Village Name	Total Area (Ha.)	
14	Ahmedabad	Barwala	Jarvaliya	1.35	
15		Barwala	Polarpur	3.02	
16		Barwala	Rojid	7.36	
17		Barwala	Barvada	11.12	
18		Barwala	Keriya	4.35	
<b>Total (Ahmedabad district)</b>				<b>191.73</b>	
19	Bhavnagar	Valbhipur	Lundhara	0.75	
20		Valbhipur	Panavi	1.07	
21		Valbhipur	Patana-tika-1	7.67	
22		Valbhipur	Muldharai	2.54	
23		Valbhipur	Rangpar	1.26	
24		Valbhipur	Kanpar	2.67	
25		Valbhipur	Navagam	1.73	
26		Valbhipur	Limda	0.68	
27		Valbhipur	Velavadar	1.44	
28		Valbhipur	Lakhanka	0.59	
29		Valbhipur	Vallbhipur	7.65	
30		Valbhipur	Chamardi	21.28	
31		Bhavnagar	Shihor	Magalana	14.29
32			Shihor	Ghanghali	11.15
33	Shihor		Nesada	5.12	
34	Bhavnagar	Bhavnagar	Udavi	3.21	
35		Bhavnagar	Bhojpura	2.63	
36		Bhavnagar	Kardej	7.03	
37		Bhavnagar	Vartej	3.74	
<b>Total (Bhavnagar district)</b>				<b>96.50</b>	
<b>Total</b>				<b>288.23</b>	

The land for proposed project is to be acquired by Gujarat government through Land Acquisition Act 1894 and compensation for acquired land is to be paid as per the provision of the same act.

## Cultural and community properties

### Impact

There are total 52 nos. of cultural properties existing along the project road out of which 31 are likely to be affected due to project. There are number of public structures observed all along the project road.

### Mitigation Measures

All community assets will be replaced and cultural properties will be conserved by means of special protection and relocated or replaced in consultation with the community. Places of worship that are affected will be relocated in consultation with the local community.

## 9.5 Biological and Ecological Environment

### Trees

### Construction Phase



Widening of the proposed highway will affect about 1710 trees. The removal of these trees and the loss of vegetation cover will have some effect on local ecological balance, such as the disruption of habitat for small birds, mammals, etc., that will be forced to migrate to other areas. The removal of vegetation may also lead to minor climatic changes such as altered surface hydrology, increased temperatures due to reduced shade cover, etc.

### **Mitigation**

Vegetation such as grasses and small shrubs will recover quickly, and for each tree that is removed, three trees will be planted in consultation with Forest Department. Although it will take time for the trees to mature, the long term impact of removing the trees is expected to be minimal.

### **Forest**

Protected forest exists along the project road in the form of strip plantations covered under protected forest category of the state forestry department. The vegetation at both sides of the project road is covered with shrubs, mainly Australian acacia or Babool.

### **Solid waste management**

#### **Mitigation Measures**

Top soil shall be restored on agricultural land, and will be used for the median filling and as top cover on slide slope stabilisation. Overburden and excavated material like rock are to be used in construction work for land filling and compaction in road embankment. The solid waste like broken PCC / RCC material and demolished bituminous material should be used for bottom filling of median and in embankment to the extent feasible. All the remaining waste will be used for reclamation of borrow areas.

## **9.6 Analysis of Alternative**

The analysis of alternatives has been made on the basis of “with and without project scenarios” in terms of potential environmental impacts. It is found on the basis of analysis that “with out” project scenario will do more harm than the benefits in terms of the biological and socio-economic environment of the project region as compared to “with” project scenario. Hence the “with” project scenario with minor reversible impacts is an acceptable option for the project section.

## **9.7 Environmental Management Plan**

Environmental Management Plan (EMP) has been proposed along with institutional arrangements for effective implementation, monitoring and reporting. It is envisaged that all stake holders i.e. R & BD., GoG, ESMU-PIU, GSRDC, Forest Department, Independent Engineer / Supervision Consultant (IE / CSC), Design Consultant (PMC), Contractor / Concessionaire, and public / NGO's will play their role in effective implementation of the EMP. The efforts of all the agencies will be brought together by the ‘Environmental and Social Management Unit’ proposed to be set up under the Project Implementation Unit (PIU) of the GSRDC / R & BD., GoG. This unit will also arrange training of the staff involved in

monitoring of the implementation of the EMP besides taking steps to create awareness amongst the public and stakeholders.

## 9.8 Environmental Monitoring Program

The adverse environmental impacts identified during the Environmental Impact Assessment process of the proposed project may increase further during the construction as well as during post-construction phase. Monitoring of environmental factors and constraints will enable agencies to identify the changes in the environmental impacts at particular locations, application of mitigative measures and utilisation of standard design guidelines for finalisation of alignment design. Monitoring will also ensure that actions taken are in accordance with the construction contract and specifications. It provides a basis for evaluating the efficiency of mitigation and enhancement measures, and suggests further actions needed to be taken to achieve the desired effect. To ensure the effective implementation of the EMP, an effective monitoring programme has designed.

A tentative cost, for implementing of various mitigation measures suggested on different items is expected to be about Rs. 808.2 Lacs.

## 9.9 Conclusion

Salient features of project are:

- The Bagodara-Bhavnagar project road passes through two districts i.e. Ahmedabad and Bhavnagar and seven talukas namely Bavla, Dholka, Dhandhuka, Barwala, Vallabhipur, Shihor & Bhavnagar.
- The project road passes mostly through flat, plain terrain.
- The project road lies between longitude 72° 11' 33" (E), latitude 22° 38' 15" (N) at Bagodara and longitudes 72° 02' 52" (E), latitude 21° 44' 46" (N) at Bhavnagar.
- Soils of Ahmedabad district is characterised by more of intrazonal soil. Soils of Bhavnagar district with the exception of a few strips are derived from trap rock.
- Project road along the Bagodara-Bhavnagar stretch crosses the rivers Lilka, Utavadi, Papasiya, Keri, Padalio, Vid, Ghelo, Gautam and Bhogavo as well as distributaries / streams of Bhogavo river at couple of locations.
- The average depth of ground water table around project road is between 10 to 50 m.
- There are 16 major bridges, 79 minor bridges, 80 culverts and six railway crossing in this corridor.
- Out of the 75 junctions existing on this road, 9 are Y type intersections, 1 major rotary intersection, 6 are major 4-legged junctions and 59 are type intersections.
- The average maximum temperature within the study area varies from 12 0 C to 44 0 C with the maximum temperature of 45 0 C. An intensely hot and dry summer season from the middle of February to the end of May, a warm and humid rainy season from mid June to the beginning of October and a mildly cold season from November to end of January.

- Annual average rainfall ranges from 600 mm to 900 mm.
- Result of samples shows that RPM levels at all the three locations (i.e. Dhandhuka, Panvi and Karjad) are less than prescribed standards, while SPM level are approaching the prescribed standard (i.e. 200  $\mu\text{g}/\text{m}^3$ ) at one of the location ( i.e. at Dhandhuka ) and at remaining locations, standards are higher than the prescribed limit . SO<sub>2</sub> and NO<sub>x</sub> are well within the prescribed limits of 80  $\mu\text{g}/\text{m}^3$ .
- At all the monitoring locations, the noise level is within the prescribed limits i.e. 65 dB (A) of the Central Pollution Control Board.
- The water quality in the project area was found to be within permissible limits.
- There are about 3476 trees of various species are observed along project road out of which 1710 are likely to have negative impact.
- There are some cultural properties and community properties / facilities within the ROW that are likely to be affected due to proposed project.

## 9.10 Recommendations

On the basis of data analysis, nature of impacts and observations of the various affected groups due to project, it is concluded that **Bagodara – Bhavnagar corridor can be developed without causing significant adverse environmental impacts to the natural, social, economic or cultural environment of the study area, assuming the mitigation measures identified in EDDR and EIA report are incorporated into design and implementation stage; the most important of these are:**

- Stringent Pollution Control Measures for activities responsible for pollution at construction as well as operation phase of the project,
- Incorporation of appropriate control techniques to protect elevated embankment, soil erosion and flood control,
- Providing proper sanitation and improving traffic flow conditions,
- Maintenance of roads periodically,
- Awareness about the environment and its management,
- Safety measures to the workers at construction sites.

## REFERENCES

Sr. No.	Item	Sources
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4.	EIA Notifications-Sept. 14 <sup>th</sup> , 2006 and its subsequent amendments	MOEF, GoI, New Delhi. <a href="http://www.envfor.nic.in">www.envfor.nic.in</a>
5.	EIA Guidance Mannual, for HIGHWAYS – Februay 2010	Administrative Staff College of India (ASCI), Hyderabad / <a href="http://www.envfor.nic.in">www.envfor.nic.in</a>
6.	Guidelines on Requirements for Clearances for Road Projects – 2011 IRC : SP : 93 - 2011	Indian Road Congress (IRC), New Delhi, India
7.	Technical Specifications	Ministry of Road Transport and Highways, Govt. of India
8.	World Bank's Operation Policies and Operational Directives, OP 4.01 (Environmental Assessment -EA), OP 4.04 (Natural Habitats), OP 4.36 (Forestry), OP 4.12 (Involuntary Resettlement), OP 4.10 Indigenous people, OP 4.11 Physical cultural resources (PCR)	<a href="http://www.worldbank.org">www.worldbank.org</a>