

# Initial Environmental Examination

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March 2015

## IND: Madhya Pradesh State Roads Project

Murar – Chitora Road

Prepared by Madhya Pradesh Road Development Corporation for Asian Development Bank.

## CURRENCY EQUIVALENTS

(as of 31 March 2015)

Currency	–	Indian rupees (INR/Rs)
Rs1	=	\$ 0.016
\$1	=	Rs 62.5096

## ABBREVIATIONS

AAQ	–	Ambient Air Quality
AAQM	–	Ambient Air Quality Monitoring
ADB	–	Asian Development Bank
APHA	–	American Public Health Association
BGL	–	Below Ground Level
BOD	–	Biological Oxygen Demand
BOQ	–	Bill of Quantity
CO	–	Carbon Monoxide
COD	–	Chemical Oxygen Demand
CPCB	–	Central Pollution Control Board
CSC	–	Construction Supervision Consultant
MPRDC	–	Madhya Pradesh Road Development Corporation
DG	–	Diesel Generating set
DO	–	Dissolved Oxygen
DPR	–	Detailed Project Report
E&S	–	Environment and Social
EA	–	Executing Agency
EAC	–	Expert Appraisal Committee
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
EMOP	–	Environmental Monitoring Plan
GHG	–	Green House Gas
GIS	–	Geographical Information System
GOM	–	Government of Madhya Pradesh
GRC	–	Grievance Redress Committee
GRM	–	Grievance Redress Mechanism
HFL	–	Highest Flood Level
IEE	–	Initial Environmental Examination
IMD	–	Indian Meteorological Department
IRC	–	Indian Road Congress
LHS	–	Left Hand Side
LPG	–	Liquefied Petroleum Gas
Max	–	Maximum
Min	–	Minimum
MJB	–	Major Bridge
MNB	–	Minor Bridge
MORT&H	–	Ministry of Road Transport and Highways
MOEF	–	Ministry of Environment and Forests
MPRSD	–	Master Plan Road Sector Development
N, S, E, W,	–	Wind Directions ( North, South, East, West)
NE, SW, NW	–	Combination of two directions like South West,

NGO	–	Non-Governmental Organization
NH	–	National highway
NIC	–	National Information Centre
NOC	–	No Objection Certificate
NO <sub>x</sub>	–	Oxides of nitrogen
OBC	–	other backward classes
PCC	–	Portland Cement Concrete
PCU	–	Passenger Car Units
PD	–	Project Director
PFR	–	Project Feasibility Report
PIU	–	Project Implementation Unit
PPE	–	Personal Protective Equipment
PPT	–	Parts Per Trillion
PWD	–	Public Works Department
RCC	–	Reinforced Cement Concrete
REA	–	Rapid Environmental Assessment
RHS	–	Right Hand Side
ROW	–	Right of Way
RSPM	–	Respiratory Suspended Particulate Matter
SH	–	State Highway
SOI	–	Survey of India
SO <sub>2</sub>	–	Sulphur Dioxide
SPCB	–	State Pollution Control Board
SPL	–	Sound Pressure Level
SPM	–	Suspended Particulate Matter
SPS	–	ADB Safeguard Policy Statement, 2009
TA	–	Technical Assistance
UT	–	Union Territories
WHC	–	Water Holding Capacity

## WEIGHTS AND MEASURES

lakh	–	100 thousand = 100,000
crore	–	100 lakhs = 10,000,000
µg/m <sup>3</sup>	–	micrograms per cubic meter
km	–	kilometer
lpd	–	liters per day
m	–	meter
mg/l	–	milligrams per liter
mm	–	millimeter
ppm	–	parts per million

## NOTES

- (i) In this report, "\$" refers to US dollars.

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## **EXECUTIVE SUMMARY**

### **A. Introduction**

1. The Madhya Pradesh District Connectivity Sector Project will improve transport connectivity in the state by rehabilitating and upgrading Major District Roads (MDRs). The Project constitutes: (i) rehabilitating and upgrading about 1,600 km of MDRs, (ii) improving road maintenance and asset management, and (iii) developing an efficient accident response system. MPRDC specifically targets MDRs to form key linkage between rural, semi urban and urban areas and complete the state roads connectivity.

2. Madhya Pradesh Road Development Corporation Ltd (MPRDC), the Government of Madhya Pradesh, has started the improvements of State highway and Major District Roads network for meeting the supply-demand gap of the traffic in near future. As a part of this strategy MPRDC has taken up the up-gradation of Morar – Chitora Road. The main objectives are to improve the regional as well as inter- and intra-state transport flows to improve access to services and making the State attractive to developers and investors. To fulfill the above objectives and due considerations to environmental feasibility of above road section, this initial environmental examination (IEE) was carried out for this section.

3. Since the project is following the sector loan modality, subprojects were selected as priority roads. The present report pertains to Morar – Chitora Road sub-project, which is one of the priority roads. This subproject is categorized as Category “B” and hence, an initial environmental examination (IEE) has been undertaken. The IEE is carried out in accordance applicable laws and regulations of the Government of India and in ADB’s Safeguard Policy Statement (SPS), 2009. The report is also consistent with the requirements of the Environment Assessment and Review Framework (EARF) which was prepared for the sector loan. Since the project road will be upgraded within existing available RoW, no Environmental Clearance is required for the proposed road widening project as per EIA Notification 2006.

### **B. Description of Project**

4. Morar - Chitora road is situated in the northern part of Madhya Pradesh and traverses Gwalior and Bhind Districts with a total length of 29. 40 Km. Gwalior District is surrounded by the districts of Bhind to the northeast, Datia to the east, Shivpuri to the south, Sheopur to the east, and Morena to the northwest. The Project Road starts from Km 0+000 at + Junction (L/s Army School) Cant .Area, Morar in Gwalior District and terminates at km 29+800 at T – Junction with existing PWD Road (MDR, L/s Mehgaon & R/s Mau) in Chitora in Bhind District.

5. The existing width of carriageway along the project road is generally single and intermediate lane i.e. 5.5 meters from km 3+000 to 19+400 and 2 lane i.e. 7.0 meters from km 0+000 to 3+000. The Bituminous surface and earthen surface at some parts of the project road has been found along the Project road. The riding surface condition of existing carriage way is in partial fair condition except few locations.

### **C. Description of Environment**

6. The topography of the project area is totally plain area. Average elevation of the project influence area above mean sea level is 181m. Most of the project area is the part of the Gird Region covering Gwalior and Bhind Districts of the project road. In general, Bhind District is situated in Chambal region in the northwest of the state and Gwalior occupies a strategic

location in the Gird region of India. Both the districts are surrounded by Ganga Basin which is further divided into sub basins which are Yamuna, Tons and Sone including rivers namely Sind near Bhind and Chambal near Gwalior.

7. The climate in Madhya Pradesh is governed by a monsoon weather pattern. The distinct seasons are summer (March through May), winter (November through February), and the intervening rainy months of the southwest monsoon (June through September. In **Bhind District**, the temperature increases steadily till May, when the mean daily temperature is about 46 degree Celsius and the mean daily minimum is about 28 degree Celsius. In June, the mean daily temperature is higher by a couple of degrees. The heat in the summer season is intense and the dust laden scorching winds, which blow often, add much to the discomfort. With onset of monsoon in the district by the mid of June, there is an appreciable drop in the temperature. After October, day and night temperature decrease rapidly. January is the coldest month with the mean daily maximum temperature at about 23 degree Celsius, and the mean daily minimum at about 8 degree Celsius. In the cold season in the rear of passing western disturbances, cold waves affect Bhind District and the minimum temperature may drop down to about a degree below the freezing point of water. The **Gwalior District** temperatures averaging in the 14–16 °C (58–62 °F) range, and mostly dry and sunny conditions. January is the coldest month with average lows in the 5–7 °C range (40–45 °F) and occasional cold snaps that plummet temperatures to close to freezing.

8. Baseline data on ambient air quality including noise levels meet the national air quality standards. Water quality from hand pumps along the project road complies with the drinking water standards.

9. A section of the road does not require conversion of forest land as the proposed road does not pass through any protected area, wildlife sanctuary, national park, or bio-reserve and its buffer zones. The trees identified to be cleared within the right-of-way to accommodate needed road upgrading and do not fall under rare or endangered category. There are no archaeological and historical monuments along or near the road. No community religious properties will be affected by during road widening.

## **D. Anticipated Environmental Impacts and Mitigation Measures**

### **1. Design and Construction Phase**

#### **a. Impact on Physiography and Topography**

10. Since proposed project is only widening of existing road within available ROW without any land acquisition, impact on the physiography of the area is not significant. The design will consider the improvement of roadside drainage conditions through the improvement of cross- drainage structures. Design of the cross drainage structures will follow IRC Guidelines (IRC,1995)

#### **b. Potential Environmental Impacts on Soil**

11. **Loss of Productive Soil.** All activities will occur within the available RoW, no adverse environmental impact is anticipated on the productive soil. Lands taken on lease for access road and for construction camp will be restored its original land use.

12. **Soil Erosion.** Land clearing and grubbing will remove vegetation and soil cover which may cause some soil erosion during monsoon. Excavations in borrow pits may lead to loss of top soil and soil erosion. The risks of stream and river bank erosion near bridges and cross drainage works

are significant. To avoid or minimize erosion, land clearing and grubbing will be conducted during dry season, productive top soils from borrow pits will be stored and reused in road embankment slope protection. Erosion control measures like silt screens will be installed along rivers and nallas.

13. **Contamination of Soil.** There is the risk of contamination of soil from construction material and oil spills. Contractors are required to ensure proper handling materials and able to implement spills containment. Oil contaminated waste will be properly collected, stored disposed through third party service providers. All fuel and lubricant storage and handling areas will be located at least 500 meters from the nearest water body and provided with perimeter interceptor drains. All construction debris will be disposed by the Contractor on pre-designated area as identified by the CSC-Environmental Specialist.

#### **c. Impact on Water Resources and Drainage**

14. Deterioration of water quality may occur near the construction camp and active construction camps. This will be minimized by timing land clearing and earthmoving during the dry season; proper handling of materials including oil, and lubricants; prohibiting the disposal of untreated sewage; and proper erosion control near rivers and *nallas*.

#### **d. Impact on Ambient Air Quality**

15. Significant amount of dust will be generated during project construction. The following mitigation measures will also be undertaken:

- i. Asphalt and hot-mix plants will be located at least 1 km away from any inhabited urban and rural stretches along the road with the clearance from MP Pollution Control Board.
- ii. Sprinkling of water on the active construction fronts and construction yard.
- iii. Regular maintenance of machinery and equipment.

16. Substantial noise will be generated from the use of heavy equipment and processing of rocks and asphalt. Adequate distance separating the rock crusher and hot mix plants will be required and the sourcing of “readymade” gravel and asphalt will be promoted to avoid the establishment of these plants. Along the road particularly near sensitive sites like schools and hospitals, the use of less noisy equipment, scheduling of noisy activities, and provision of noise barriers will be implemented by the contractor to minimize disturbance.

#### **e. Impact on Flora, Fauna and Ecosystem**

17. Clearing and grubbing activities will result to the removal of shrubs, grasses, and some trees (estimated 80 trees), majority of which are indigenous and angiosperm species. All cut trees will be compensated at the rate of 1:10 with preference to fast growing local species that are more efficient in absorbing carbon emissions.

#### **f. Construction Workers' Camp**

18. As the Contractor are required to source labor from the local communities along the subproject road, the size of the construction camps will be relatively small. It is the contractual responsibility of the Contractors to maintain a hygienic camp with adequate water and electric supply; toilet facilities located away from the water bodies and wells; proper disposal of domestic refuse; temporary medical facilities; pest control; clean and adequate food; and security.

### **g. Impacts on Social Environment**

19. Construction and operation phases of project road will have some beneficial impact on social environment. Some increase in income of local people is expected as local unskilled, semiskilled and skilled persons may gain direct or indirect employment during construction phase. Since the immigration of work force during construction phase is likely to be very small, the social impacts on literacy, health care, transport facilities and cultural aspects are expected to be insignificant.

### **2. Operation Phase**

20. Increase in vehicular emissions, noise level, road crashes due to higher speed vehicular speed, and oil contaminated road surface runoff will occur during project operation phase. The impact on air quality is not expected to be significant given the low projected traffic. Community safety is enhanced through the crash barriers, speed brakes, traffic signs, and pavement markers. Oil contamination will occur but expected to be in trace amounts based on the low level vehicular traffic. To control the anticipated increase in noise level the following measures will be implemented; good road surface will reduce the road-tire noise, prohibition of horns along sensitive areas, road widening will increase capacity and decrease congestion of vehicles, and compensatory tree plantation will be located near sensitive areas.

### **E. Public Consultation and Information Disclosures**

21. Public consultations have been carried out in the project area during the feasibility as well as detailed design stage. Key issues raised during the consultations were:

- i. Provision of suitable drainage in the settlements areas.
- ii. Provisions of safety measures in school and settlement areas.
- iii. Suitable mitigation measures to address air and noise pollution.
- iv. Provision of safety signage near school.
- v. Avoid sourcing water for construction from public water sources.
- vi. Minimize the cutting of trees.
- vii. Construction labour camps should not be located near settlements area.
- viii. Avoid borrow of earth near settlement and schools.
- ix. Start tree plantation during construction phase.

### **F. Environmental Management Plan and Grievance Redress Mechanism**

#### **1. Environmental Management Plan**

22. The Morar – Chitora Road specific Environment Management Plan has been formulated which consists of mitigation and monitoring measures, and clear definition of roles and responsibilities. The project will have one grievance redress mechanism for social and environment issues comprising a village level and district level committee. The nodal officer under the PIU will be the key person to coordinate the receiving of complaints and addressing them.

#### **2. Environmental Monitoring Program (EMoP)**

23. A comprehensive monitoring plan has been prepared for all stages of the project. This includes parameters to be measured, methods to be used, sampling locations, frequency of

measurements, detection limits, cost and responsibility for implementation and supervision. Construction Stage Monitoring to be carried out by contractor under supervision of Construction Supervision Consultant (CSC).

24. Monitoring will focus on air, water, noise, soil erosion, drainage congestion and compensatory tree plantation. For tree plantation, the 75% survival rate of re-plantation shall be monitored for three years of the operation phase.

### **3. Institutional Arrangement and Capacity Building**

25. The implementation arrangements basically follow the ongoing MPSRSP-II with the following improvements: i) expansion of the Environmental and Social cell (ESC) staff from 1 to 4 with the recruitment of two social safeguard and one environmental safeguard officers; ii) MPRDC ten division offices acting as Project Implementation Units (PIUs) will appoint a social and environment safeguards focal person; and iii) Construction Supervision Consultant's Environmental specialist from the LEC will provide technical support to MPRDC and the PIU for implementation of environment safeguards.

26. To enable MPRDC officials to implement for environmental safeguard requirements effectively, a training programme will be conducted for the EA and IA of the sector loan to improve environmental awareness, construction practices, legislative compliance requirements, EMP and EMoP implementation requirements, and roles and responsibilities.

### **G. Conclusions and Recommendations**

27. The findings of the IEE show that overall the project has limited and short term environmental impacts. Effective EMP implementation will ensure elimination and minimization of identified adverse impacts. MPRDC shall ensure that EMP and EMoP is included in Bill of Quantity (BOQ) and forms part of bid document and civil works contract. If there is any change in the project design the EMP and EMOP will accordingly. MPRDC needs capacity building and practical exposure. Adequate training shall be imparted as proposed under environmental management plan to enhance the capability of concerned EA and IA officials.



## I. INTRODUCTION

### A. Project Background

1. The Madhya Pradesh District Connectivity Sector Project will improve transport connectivity in the state by rehabilitating and upgrading Major District Roads (MDRs). The Project constitutes (i) rehabilitating and upgrading about 1,600 km of MDRs (ii) improving road maintenance and asset management and (iii) developing an efficient accident response system. MPRDC specifically targets MDRs to form key linkage between rural, semi urban and urban areas and complete the state roads connectivity.

2. Government of Madhya Pradesh has been using a combination of budgetary, PPP, and ADB financing, to improve state highways. Rural roads are specifically addressed through MPRRDA and funds are made available from the Pradhan Mantri Gram Sadak Yojana (PMGSY) which is the national rural roads plan. ADB's funds are made available to the rural roads in the state through past loans to the central line ministry. However the intermediate tiers – MDRs – have not been specifically targeted for improvement. MDRs form the key linkage between rural, semi urban and urban areas and have to be essentially developed to complete state road connectivity. In this background, GoMP has now proposed to improve the MDRs through the plan indicated in Table 1.

**Table 1: Proposed Improvement Plan for MDRs**

<b>Total MDRs in Madhya Pradesh</b>	<b>-</b>	<b>(Km) 19,574</b>
Under construction by MPPWD (Under Central Road Fund Scheme)	-	5,398
(Under Major District Roads Scheme)	-	1,134
Under Construction by MPRDC (Under build operate transfer (BOT) Toll + Annuity & Annuity Scheme)	-	1,992
<b>Total Under Construction</b>	<b>-</b>	<b>8,524</b>
<b>Balance to be constructed</b>	<b>-</b>	<b>11,050</b>
<b>Proposed under the Project a</b>	<b>-</b>	<b>1,600</b>
*The actual estimates will depend on the assessment from the DPRs. Source: MPRDC		

3. Since the project is following a sector loan modality, the description of the non – priority roads under MPDCSP has been given in the table 2 below with the details of surrounding environment.

**Table 2: Selected Non - Priority Road Projects Under the MPDCSP**

<b>Roads</b>	<b>District</b>	<b>Surrounding Environment</b>	<b>Length(Km)</b>
<b>Murar-Chitora (MC)</b>	Gwalior and Bhind District	The entire length of the project road runs through plain terrain and passing across several agricultural land, villages, and towns.	29.40

**Figure 1: Location of Project Road for MPDCSP**



4. Individual IEE reports were prepared for each of the priority project. At the time of writing, the remaining non-priority roads are at various stages of planning and designing and the technical details are being finalized. An environmental assessment and review framework (EARF) has been prepared separately for the entire project to guide the final selection of non - priority subprojects, preparation of IEE or EIA reports and implementation of all environment safeguards requirements in accordance with relevant policies and regulations of the Government of India, SGoMP, and the ADB Safeguard Policy Statement 2009 (SPS). These IEE reports and the EARF are disclosed in the MPRDC and ADB websites.

5. The present IEE report is focused on Morar – Chitora Road.

## **B. Nature, Size and Location of the Project**

6. The project involves the upgrading of the existing single / intermediate lane, 29.40 km section of the Morar – Chitora. Morar – Chitora road lies between 26°13' N latitude to 78°14' E longitude and 26°19' N latitude to 78°29' E longitude and traversing Gwalior and Bhind districts of Madhya Pradesh. The road widening activities primarily will comprise of raising the embankment at certain locations and its stabilization including construction of retaining wall if required especially near water bodies overlay on the existing carriageway, junction improvement, and construction of minor bridges, culvert and RCC drain in built-up section. The location of the Morar - Chitora road is shown in Figure 2.

## **C. Purpose and Scope of the Study**

7. This IEE report documents the environmental assessment of the Morar – Chitora Road subproject and identifies the environmental issues to be considered in the project planning and design stages. In this report, the different activities that are likely to take place to



achieve the project objectives have been analyzed and the potential impacts that may accompany them have been identified, assessed for significance, and concomitant avoidance, mitigation, and compensation measures were prepared in consultation with stakeholders to be incorporated on the engineering design and project implementation. The IEE addresses the environmental management requirements of the Government of India (GOI) and Asian Development Bank. Specifically, this report:

- Provides information about the baseline environmental setting of the subproject;
- Provides information on potential environmental impacts of the proposed subproject activities with its magnitude, distribution and duration.
- Provides information on required mitigation measures with cost to minimize the impacts.
- Analyses the alternatives options considering alternative locations, designs, management approaches for selection of most feasible and environmental acceptable options.
- Provides details of stakeholder's consultations.
- Designs an environmental management and monitoring plan with institutional measures for effective implementation of mitigates measures proposed and addressing grievances.

8. The IEE was based on proposed road alignment and key construction activities such as site clearing, removal of trees, excavation, filling, grading and embankment formation, excavation for utility trenches, subgrade preparation, base course and asphalt overlay, shoulder, and construction of permanent structures like retaining walls, culverts and drains. The IEE also covered ancillary activities like camp site establishment and maintenance, sourcing of materials, and operation of equipment like rock crusher and hot mix plant. The corridor of impact is taken as 10 meters either side of the alignment. However, the study area impact zone is considered up to 5 km on both sides of road alignment to allow for coverage of indirect and induced impacts and a larger analysis of land use and other environmental features. Assessment is carried out on the following environment components: terrestrial and aquatic ecology, soil, water, air, noise, and socio economic aspects.

9. This IEE report is presented in eight chapters as follow:

- Chapter 1 - Introduction
- Chapter 2 - Policy, Legal and Administrative Framework
- Chapter 3 - Description of Project
- Chapter 4 - Description of Environment
- Chapter 5 - Anticipated Impacts and Mitigation Measures
- Chapter 6 - Information Disclosure, Consultation, and Participation
- Chapter 7 - Environment Management Plan and Grievance Redress Mechanism
- Chapter 8 - Conclusion and Recommendation

#### **D. Methodology**

10. The methodology for IEE adopted complies with the *ADB Safeguard Policy Statement (SPS) 2009* and environmental guidelines. The study was carried out using reconnaissance survey, field visits, consultation with stakeholders, review of existing data, identification of adverse impacts and preparation of environmental management and monitoring plans. The stepwise activities carried out include:

- Review of legal requirements
- Review of feasibility study
- Reconnaissance survey for identification of key issues data requirement and preliminary consultation
- Primary and secondary data collection
- Consultation with stakeholders
- Identification of impacts and mitigation measures

## 1. Data Collection

11. Primary and secondary data on the physical, ecological, and socio-economic resources were collected to provide baseline conditions to be used in impact assessment and monitoring plan design. The type and source of information compiled in this IEE are below:

**Table 3: Primary and Secondary Information Sources**

Information	Sources
Technical information on existing road features and proposed Rehabilitation work. Inventorisation of road features; viz. water bodies community structures, environmental sensitive location areas, congested locations etc.	MPRDC Design Consultant Ground physical surveys and graphics consultants
Climatic Condition	Indian Meteorological Department, ENVIS Website, NIC, primary data collection
Geology, Seismicity, Soil and Topography	Geological survey of India, SOI Topo-sheets, Primary data collection
Land Use/ Land Cover	Survey of India (Sol) Topo-sheet, Observation during survey.
Drainage Pattern	Survey of India Topo-sheet and field observation
Status of forest areas, Compensatory afforestation norms etc.	Divisional Forest Office, Gwalior and Bhind District.
Status of Fishing Activity	District Fisheries Offices at Gwalior and Bhind District
Air quality Noise, Soil and Water	Onsite monitoring and Analysis of Field priorities during field visit
Borrow Areas, Quarries and other construction material source	
River geo-morphology, hydrology, drainage, flood patterns	Feasibility report, field observations
Socio economic Environment	Primary Census Abstract of Gwalior and Bhind District 2011. Official websites maintained by state Govt., and Public Consultation during the Field survey

## 2. Public Consultation

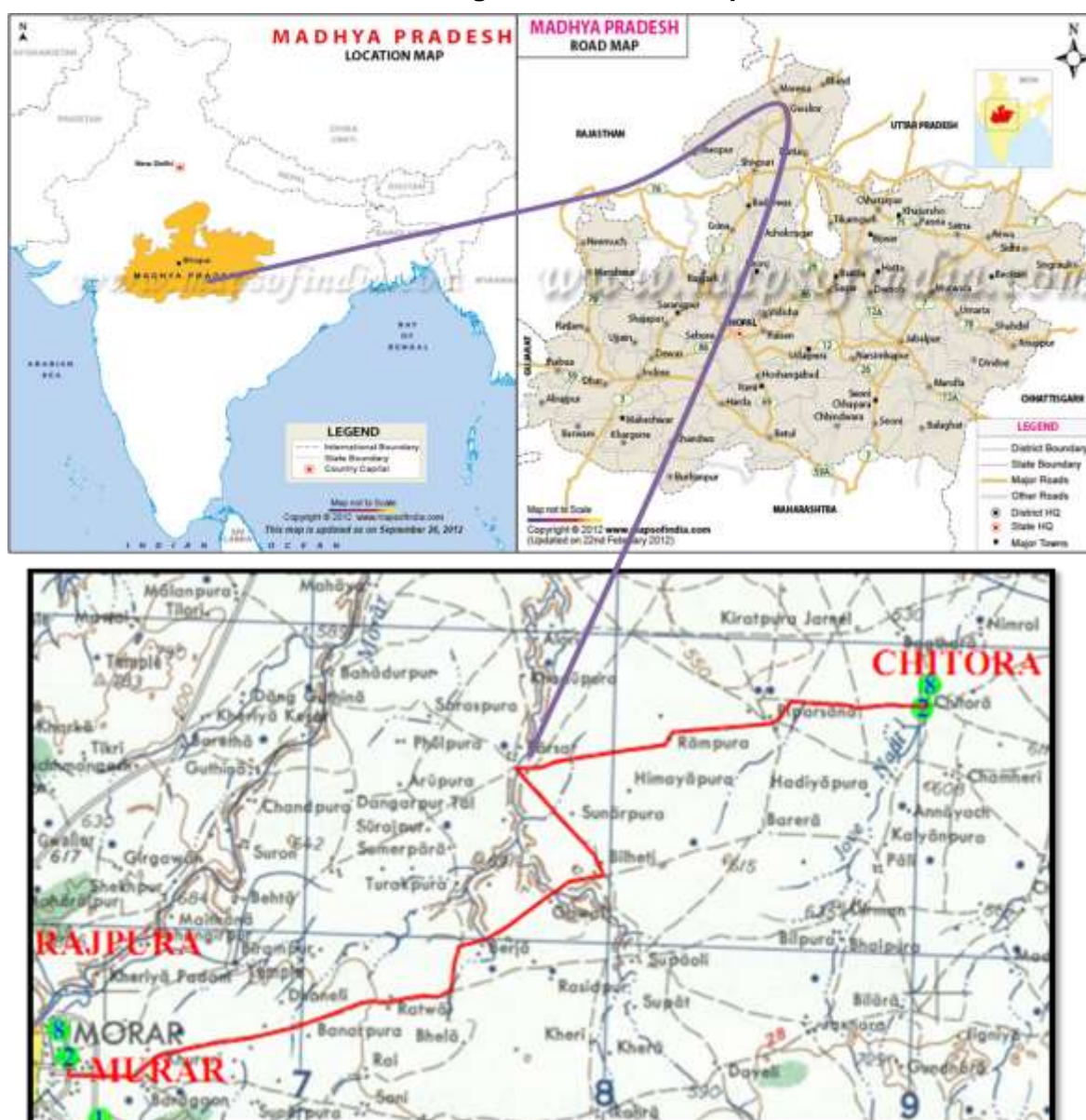
12. Extensive consultations were held during different stages (reconnaissance, detailed

design and design review) with key stakeholders that includes local and beneficiary population, government departments/agencies, road users, and project-affected persons. These consultations allowed the interaction between the stakeholders and road designers to identify road features and construction methods that will enhance road upgrading and minimize potential impacts. Information gathered was integrated in the project design and formulating mitigation measures and environmental management plan. Detailed description of public consultation is presented in Chapter 6.

## E. Organizational Setting of Implementing Agency

13. The Madhya Pradesh Road Development Corporation (MPRDC) is mandated for construction and maintenance of roads in behalf of the Government of Madhya Pradesh. MPRDC is the executing agency (EA) for this project and a PIU is created within MPRDC at headquarter which is responsible for the proper implementation of all ADB funded road projects. The EA capability for effective implementation of Environmental Management Plan (EMP) has been assessed and presented in Chapter 7.

**Figure 2: Location Map**



## II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

14. India has well defined institutional and legislative framework. The legislation covers all components of environment viz air, water, soil, terrestrial and aquatic flora and fauna, natural resources, and sensitive habitats. The environmental legislations in India are framed to protect the valued environmental components and comply with its commitment to international community under various conventions and protocols as well. Asian Development Bank has also developed interventions to guide social and environment safeguards, in their Safeguard Policy Statement, 2009. This assessment is about the applicability of above laws and regulations, and safeguards. This chapter summarizes the following:

- a. Applicability of various National and local laws and regulations at different stages of project implementations
- b. Applicability of ADB safeguards policies and categorization of the project.

### A. Country's Legal Framework and Regulatory Requirements for the Project

15. The legal framework of the country consists of several acts, notifications, rules, and regulations to protect environment and wildlife. Key policies, acts and regulations relevant for the project are provided in table 4 below

**Table 4: Summary of Relevant Environmental Legislation**

Act	Objective	Responsible Institution
Environment (Protection) Act (1986) and Rules (1986)	To protect and improve the overall environment	MoEF
Environmental Impact Assessment (EIA) Notification under Environmental Protection Rules (2006, 2009, 2011) and relevant Office Memorandums (OM)	To provide guidance on environmental clearance requirements and clarification on related specific technical issues	MoEF
Wildlife Protection Act (1972 and amended in 1993)	To protect wild animals and birds through the creation of National Parks and Sanctuaries	MoEF
The Water (Prevention and Control of Pollution) Act 1972 (Amended 1988) and Rules 1974	To provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.	CPCB
The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	To provide for the prevention, control and abatement of air pollution, and for the establishment of Boards to carry out these purposes.	CPCB and Road Authorities
Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules 2008 (Amended 2009),	To protection the general public against improper handling, storage and disposal of hazardous wastes	State Pollution Control Board
The Forest (Conservation) Act 1980 (Amended 1988) and Rules 1981 (Amended 2003)	To protect and manage forests	MoEF
Central Motor Vehicle Act (1988) and Rules (1988)	To control vehicular air and noise pollution.	State Transport Department

Act	Objective	Responsible Institution
	To regulate development of the transport sector, check and control vehicular air and noise pollution.	
Ancient Monuments and Archaeological Sites and Remains Act (1958)	Conservation of Cultural and historical remains found in India.	Archaeological Dept. GOI
Building and Other construction workers (Regulation and the Employment and conditions of service) Act, 1996	To regulate the employment and conditions of service of building and other construction workers and to provide for their safety, health and welfare measures	Ministry of Labour and Employment
Child labour (Prohibition and Regulation) Act, 1986	To regulate the employment of children including age limits, type of employment, timing of work, information disclosure and health and safety.	Ministry of Labour and Employment

### 1. Requirement of Environmental Clearance

16. As per provisions of Environmental Impact Assessment Notification 2006 amended (2009), and its amendments, vide notification S.O.3067(E), dated the 1st December 2009 all State Highway expansion projects, except those in hilly terrain (above 1000 m AMSL) and ecologically sensitive areas, have been exempted from Environmental Clearances.

17. Since, the project road is a major district road and not a state, the above EIA Notification, 2006 (amended till date) promulgated under Environment (Protection) Act 1986 is not applicable for the project road and hence no Environmental Clearance is required for the proposed road widening project.

### 2. Forests Clearance

18. As per Indian Forests Conservation Act (1980), any project requiring diversion of forests land for non-forestry purposes require forest clearance from MoEF for the same. The forestry clearance is granted through two stages process.

19. Since no diversion of forestland is involved in Morar - Chitora Road, no forest clearance is required for this road.

### 3. Permission to Withdraw Ground Water

20. As per the power Granted under Environmental Protection Act, 1986, Permission from Central Ground Water Authority is required for extracting ground water for construction purposes, from areas declared as critical or semi critical from ground water potential prospective.

### 4. Required Clearances/Permissions

21. For up-gradation of the project road, required clearances/ permissions related to

environment has been summarized in Table 5.

**Table 5: Permissions/Clearances Required for the Subproject**

S. No	Permissions/ Clearances	Acts/ Rules/ Notifications/Guidelines	Concerned Agency	Responsibility
<b>A. Pre-construction Stage</b>				
1	Permission for cutting of trees	Forest Conservation Act (1980) Procedural Guidelines developed by the Department of Environment, Government of M. P. under the orders of the Honorable High Court Tree removal will be guided as per state government rules.	District Forest Office/State Forest Department for trees felling in forest areas and District Authorities in non-forests Areas (Compensatory tree plantation to be made 1:10 as per the	MPRDC
<b>B. Implementation Stage</b>				
2	Consent to operate hot mix plant, Crushers, Batching plant	Air (Prevention and Control Pollution) Act of 1981	M.P. State Pollution Control Board (To be obtained before installation)	Contractor
3	Authorization for Disposal of hazardous waste	Hazardous Waste (Management and Handling) Rules 1989	M.P. State Pollution Control Board (To be obtained before generation)	Contractor
4	Consent for Disposal of sewage from labor camps	Water (Prevention and Control of Pollution) Act 1974	M.P. State Pollution Control Board (Before setting up the camp)	Contractor
5	Pollution Under Control Certificate	Central Motor and Vehicle Act 1988	Department of Transport, Government of M.P. authorized testing centers	Contractor
6	Employing Labour/Workers	The Building and Other Construction Workers (Regulation and Employment Conditions of Service) Act, 1996	District Labour Commissioner	Contractor

## **B. International Agreements**

22. India has been playing an active role in environmental conservation since the first United Nations (UN) conference on Human Environment in Stockholm in 1972 and recognizes that protection of environment is closely linked to combating poverty. Key international agreements that India is signatory to and relevant for the project are provided below:

- i. Convention on Wetlands of International Importance, Especially as Waterfowl

- ii. Habitat (Ramsar, 1971)
- iii. Convention concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)
- iv. Convention in International Trade in Endangered Species, CITES of Wild Fauna and Flora (Washington, 1973)
- v. Convention on Migratory Species of Wild Animals (Bonn, 1979)
- vi. Convention on the Prior Informed Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC or Rotterdam, 1990)
- vii. United Nations Framework Convention on Climate Change, UNFCCC (Rio De Janeiro, 1992)
- viii. Convention on Biological Diversity (Rio De Janeiro, 1992)
- ix. Protocol to the United Nations Convention on Climate Change (Kyoto, 1997)

23. The above list of international conventions served as requirements for the project to comply. However, due to the limited scale of the road upgrading and the predicted traffic increase during operation, the expected environmental issues that are governed by this international convention would be insignificant.

### **C. Asian Development Bank Safeguard Policies**

24. The Asian Development Bank has defined its safeguard requirements in the Safeguard Policy Statement 2009 (SPS). The prime objectives of these safeguard policies are to: (i) avoid adverse impacts of projects on the environment and affected people, where possible; and (ii) minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible.

### **D. Category of the Project as per SPS**

25. Using the prescribed ADB Rapid Environmental Assessment Checklist (see Appendix 1), project road was classified as environmental category "B." This categorization was primarily based on the following considerations:

- i. Subproject road is existing and upgrading activities are limited to the RoW,
- ii. Anticipated impacts from road upgrading on relatively flat terrain along agricultural land are mostly site specific and easily mitigated through proper design and good construction practices,
- iii. Majority of the activities have short-term duration co-terminus with the construction phase
- iv. Subproject road does not pass through or located within 10 km from any wildlife sanctuary, national park, or any other environmentally sensitive or protected areas.
- v.

### III. DESCRIPTION OF THE PROJECT

#### A. Rational and Project Setting

26. The Road i.e. **MDR-01-08 & 02-08** is **Morar - Chitora Road** and it is situated in Gwalior & Bhind Districts of Madhya Pradesh. **Gwalior** is bordered by Morena to the north, Bhind to the north-east, Datia to the east, Shivpuri to the south, and Sheopur to the west. The Project Road starts from Km 0+000 at + Junction (L/s Army School) Cantt. Area, Morar in Gwalior District and terminates at km 29+800 at T – Junction with existing PWD Road (MDR, L/s Mehgaon & R/s Mau) in Chitora in Bhind District passing through Badagaon, Dhaneli, Hasanpura, Bholakala, Ratwai, Morvansinghpura, Berja, Kakrari, Rampura, Pipersana and Badri Villages. Total length of the project road is **29.40 Km**.

27. The project road lies between 26°13' N latitude to 78°14' E longitude and 26°19' N latitude to 78°29' E longitude and traversing Gwalior and Bhind districts of Madhya Pradesh.

28. The existing carriageway is single and intermediate lane having flexible pavement, with widths varying between 3.5 m to 5.5 m along the entire length of project road. The existing road has earthen shoulder of about 1.5 m on either sides of the project road. The project involves up gradation and strengthening of existing roads within available ROW to single/intermediate lane carriageway (5.5 m wide with 2.25 m width of each lane and 2.5m earthen shoulder either side).

29. The salient Features of the MC Road is given at Table 6

**Table 6: Summary Road Components and Design Standard**

Road Length	29.40 Km length
Alignment	Follow the existing road alignment. Except some of the locations where geometric improvements is required.
Flyovers/overpasses/ROB	There is no flyovers/overpasses/ ROB in the alignment.
Major Bridges	One Major Bridge
Other Structures	Seven Minor Bridges and twenty seven culverts along the Project road. (Replacement of existing structures wherever required, provision of new structure alongside existing structures wherever required)
Embankment Design	Embankment height established for 1m free board on 20 years frequency HFL Embankment height up to 3.0 m with 2H: 1V for embankment height from 3.0 m to 6.0 m with 15H: 1V. Construction of embankment of height more than 3.0 m, using borrow soil is recommended. However high embankment have been restricted within Row providing returning walls
Design Standard	As per IRC Codes and MORSTH Guidelines Vertical Clearance 0.60 m above HFL for bridges upto 30 m length 0.90m above HFL for bridges above 30 m length. The discharges for which the bridge has been designed are maximum flood discharge on record for a period of 100 years for major bridges and 50 years for minor bridges.
Speed	Design : 80 Km/h
	Permissible : 65 Km/h
Horizontal Controls	As per IRC: 73 – 1980



	Maximum value of 7% for super elevation and 15% for side friction factor, the minimum radius for horizontal curves is 230m for design speed 80Km/hr
Vertical Controls	Grade break of 0.5%, vertical curves will be provided . Length of vertical curve will be restricted to minimum 50m
Carriageway	Carriageway:5.5m Cross fall will be 2.5% for pavement and 3% for earthen shoulder.

Source: Detailed Project Report, 2014

## B. Characteristics of the Existing Road

30. The existing road passes through Morar and Chitora. The road passes through scattered village settlements namely Badagaon, Dhaneli, Hasanpura, Bholakala, Ratwai, Morvansinghpura, Berja, Kakrari, Rampura, Pipersana and Badri Gwalior sub-urban areas. The detail of settlements along the project road has been presented in **Table 7**.

**Table 7: Existing Town/Settlements**

S. No.	Chainage		Name of Villages/ Town
	From (km)	To (km)	
1	1+600	2+200	Badagaon
2	5+600	5+800	Dhaneli
3	7+000	7+200	Hasanpura
4	8+600	8+800	Bholakala
5	9+000	9+200	Ratwai
6	10+000	10+200	Morvansinghpura
7	11+000	11+200	Berja
8	20+300	20+500	Kakrari
9	21+300	21+500	Rampura
10	23+300	23+500	Pipersana
11	24+900	25+100	Badri

31. The pavement type is flexible throughout the length of project road except few portion of CC pavement in village area. The condition of the pavement is generally fair to poor. The condition of shoulders is also poor covered with vegetation. Stretches for major improvement are listed below in **Table 8**.

**Table 8: Stretches for Improvements**

Sr. No.	Existing Chainage		Length (Km)	Carriageway Width (m)	Formation Width (m)	Type of Road	Condition
	From	To					
1	0.00	3.00	3.00	7.0	14	BT	Fair to Poor
2	3.00	8.00	5.00	5.5	10	ER	Poor to Very Poor
3	8.00	19.30	11.00	5.5	10	BT	Fair to Poor
4	19.00	29.40	10.40	3.75	7.5	BT	Poor to Very Poor
<b>Total Length (in Km)</b>			<b>29.40</b>				

32. There is no clear cut drainage system along the project corridor and hence an effective drainage system is the utmost requirement. The existing shoulder slope does not facilitate proper drainage. On an average the project road traverses through 0.50m to 1.5m embankment. Suitable measures will be carried out by site specific drainage designs. During detailed investigation it is observed that Electric power supply line, Telephone line, and Electric lines were running parallel and crossing the project road at many locations. Shifting of utilities may be required during Improvement of existing project road.

### **C. Current and Projected Daily Traffic**

33. Traffic survey stations were selected after detailed reconnaissance survey and in line with the TOR. All traffic surveys were carried out as per IRC Guidelines given in IRC: SP 19-2001, IRC: 108-1996, IRC SP: 41-1994, IRC: 102-1998, IRC 103- 1988 Pedestrian Facilities and IRC: 09-1972.

Table 9: Traffic Projection

Road Name : MDR.No.01-08 & 02-08 Morar Chitora Road										Section : Morar - Chitora					Location: Both Location								
Year	FAST MOVING VEHICLE										SLOW MOVING							SUMMARY					
	Two - Wheeler	Car	Jeep	Van/Light motor Vehicle	Tempo / LCV	Truck				Mini Bus	Bus	Animal Cart	Cycle	Auto	Auto Trolleys	Tractors	Tractors Trolleys	Total Motorized Vehicles	Total Commercial vehicles	Total Non Tollable Vehicles	Total Tollable Vehicles	Total Vehicles	PCU
						2-Axle	3-Axle	4 to 6 Axle	7- more Axle														
Growth Rate	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	2 %	2%	5%	5%	5%	5%						
PCU Factor	0.5	1	1	1	1.5	3	3	4.5	4.5	1.5	3	8	0.5	1	1.5	1.5	4.5						
2014	1945	459	0	0	174	47	24	0	0	5	25	0	428	194	0	20	209	3100	274	2586	733	3528	3360
2015	Construction of Road Will be started in the mid of year 2015																						
	2042	482	0	0	183	49	25	0	0	5	26	0	436	204	0	20	219	3255	288	2702	770	3691	3523
2016	Project Under Construction Stage																						
	2144	506	0	0	192	51	26	0	0	5	27	0	445	214	0	21	230	3416	301	2824	807	3861	3689
2017	Construction of Road will be completed in year 2017																						
	2251	531	0	0	202	54	27	0	0	5	28	0	454	225	0	22	242	3587	316	2952	847	4041	3868
Add Generated & Diverted Traffic after completion of Road																							
Percentage	10%	10%	10%	10%	10%	10%	10%	10%	10 %	10 %	10%	10 %	10%	10%	10 %	10 %	10%						
2018	2589	611	0	0	232	62	31	0	0	6	32	0	508	259	0	25	278	4125	363	3381	974	4633	4439
2019	2718	642	0	0	244	65	33	0	0	6	34	0	518	272	0	26	292	4332	382	3534	1024	4850	4656
2020	2854	674	0	0	256	68	35	0	0	6	36	0	528	286	0	27	307	4549	401	3695	1075	5077	4883
2021	2997	708	0	0	269	71	37	0	0	6	38	0	539	300	0	28	322	4776	421	3864	1129	5315	5118
2022	3147	743	0	0	282	75	39	0	0	6	40	0	550	315	0	29	338	5014	442	4041	1185	5564	5365
2023	3304	780	0	0	296	79	41	0	0	6	42	0	561	331	0	30	355	5264	464	4226	1244	5825	5625
2024	3469	819	0	0	311	83	43	0	0	6	44	0	572	348	0	32	373	5528	487	4421	1306	6100	5900
2025	3642	860	0	0	327	87	45	0	0	6	46	0	583	365	0	34	392	5804	511	4624	1371	6387	6186
2026	3824	903	0	0	343	91	47	0	0	6	48	0	595	383	0	36	412	6093	535	4838	1438	6688	6485
2027	4015	948	0	0	360	96	49	0	0	6	50	0	607	402	0	38	433	6397	561	5062	1509	7004	6801
2028	4216	995	0	0	378	101	51	0	0	6	53	0	619	422	0	40	455	6717	589	5297	1584	7336	7133
2029	4427	1045	0	0	397	106	54	0	0	6	56	0	631	443	0	42	478	7054	619	5543	1664	7685	7484
2030	4648	1097	0	0	417	111	57	0	0	6	59	0	644	465	0	44	502	7406	650	5801	1747	8050	7849
2031	4880	1152	0	0	438	117	60	0	0	6	62	0	657	488	0	46	527	7776	683	6071	1835	8433	8232
2032	5124	1210	0	0	460	123	63	0	0	6	65	0	670	512	0	48	553	8164	717	6354	1927	8834	8632
2033	5380	1271	0	0	483	129	66	0	0	6	68	0	683	538	0	50	581	8572	752	6651	2023	9255	9053
2034	5649	1335	0	0	507	135	69	0	0	6	71	0	697	565	0	53	610	9000	788	6964	2123	9697	9492

**Table 10: Summary of Projected Total Traffic Volume (As Per MCA) (Vehicles/day and PCU/day)**

Section		Year 2014	Year 2019	Year 2024	Year 2029	Year 2033
<b>Morar</b>	<b>Chitora</b>	3,528 (3,360)	4,850 (4,656)	6,100 (5,900)	7,685 (7,484)	9,255 (9,053)

#### **D. Proposed Improvement**

34. The Project Road will receive the following upgrades under the project:

- a. Curvature improvement
- b. Widening
- c. Flexible pavement
- d. Rearrangement of junctions
- e. Road side drains
- f. Bridge and cross drainage structures
- g. User facilities
- h. Traffic control and safety measures

##### **1. Curvature Improvement**

35. Based on approved geometric standards the alignment plan of the existing road requires correction of sub-standard geometry at various locations. In plain or rolling terrain, a minimum curve radius of 230 m has been attempted to achieve design speed, however an absolute minimum radius of 155m is used at location with space constraints like urban areas, structure approach, and forest area.

36. On sections with substandard geometry, improvements will require merging two or more existing curves resulting to a minor geometric realignment to achieve the desired geometric standards. Reverse curves will be modified to accommodate required rate of super elevation and provide smooth riding quality. However, at village locations with space constraints design speed has been restricted as low as 65 km/h.

##### **2. Proposed Cross Section Details**

37. **Carriageway Width.** The carriageway configuration of intermediate lane with hard shoulder is proposed for the project road having a 5.5m carriageway width.

38. **Hard Shoulder.** Hard shoulders are proposed to be 2.5m wide both sides of the proposed main carriageway for rural plain and rolling terrains.

39. **Footpath.** The minimum width of footpath in urban stretches is proposed to be 1.50m. The side drain in such stretches may be accommodated under the footpath.

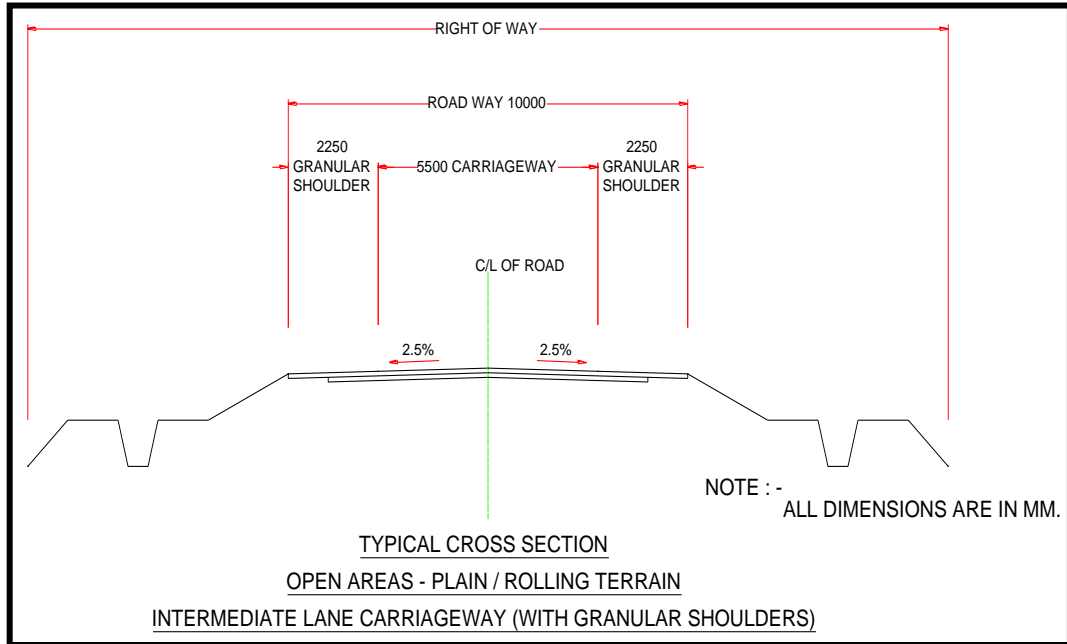
40. **Utility Corridor.** Minimum width of utility corridor for rural sections will be 2.0m and for urban/ built-up sections will be 1.00m.

41. **Embankment Slopes.** Side slopes shall not be steeper than 2H: 1V unless soil is

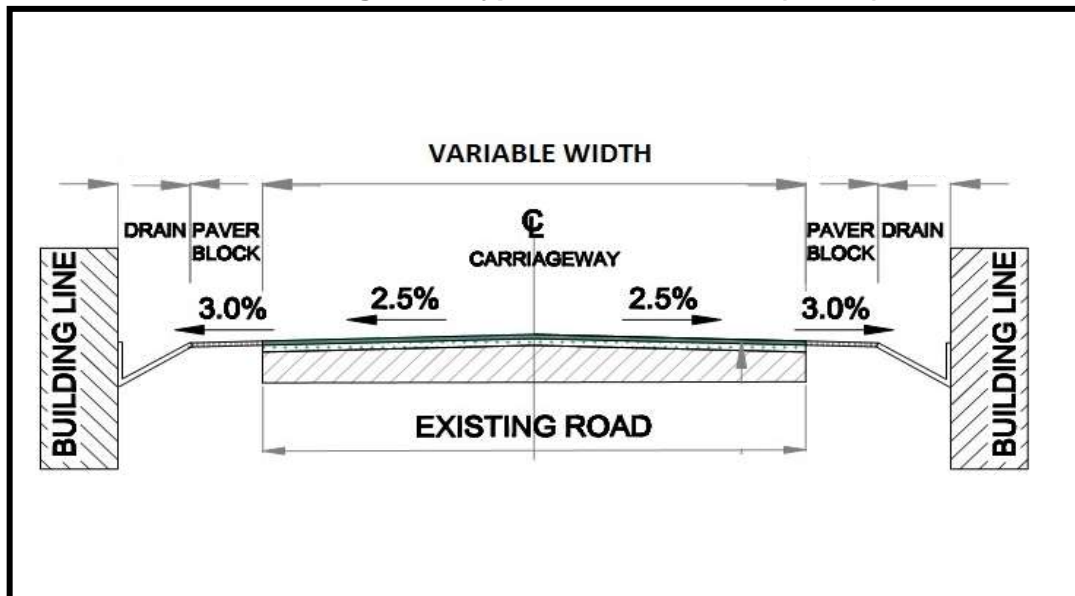
retained by suitable soil retaining structures.

42. The Typical Cross Section for the proposed project road is as given in Figures 3 and 4

**Figure 3: Typical Cross Section (TCS-1)**



**Figure 4: Typical Cross Section (TCS-2)**



### 3. Widening Proposal

43. In order to meet future traffic requirements, the existing carriageway is proposed to be upgraded to single/intermediate with hard shoulder in rural areas and with cover drain and footpath in urban areas. Concentric widening scheme is followed to minimize land acquisition issues and to ensure maximum utilization of existing configuration. The chainage - wise details of widening scheme is given at Table 11

**Table 11: Proposed Widening Scheme**

Sr. No.	Design Chainage		Length	Type Proposed carriageway	Proposed carriageway width	Road side drain type	Remarks
1	0+000	2+200	2.2	BT	5.5/7.0	LD	Badagaon
2	2+200	5+600	3.4	ER	5.5	ED	
3	5+600	5+800	0.2	ER	3.75/5.5	LD	Dhaneli
4	5+800	7+000	1.2	ER	5.5	ED	
5	7+000	7+200	0.2	ER	3.75/5.5	LD	Hasanpura
6	7+200	8+600	1.4	BT	5.5	ED	
7	8+600	8+800	0.2	BT	3.75/5.5	LD	Bholakala
8	8+800	9+000	0.2	BT	5.5	ED	
9	9+000	9+200	0.2	BT	3.75/5.5	LD	Ratwai
10	9+200	10+000	0.8	BT	5.5	ED	
11	10+000	10+200	0.2	BT	3.75/5.5	LD	Morvansinghpura
12	10+200	11+000	0.8	BT	5.5	ED	
13	11+000	11+200	0.2	BT	3.75/5.5	LD	Berja
14	11+200	20+300	9.1	BT	5.5	ED	
15	20+300	20+500	0.2	BT	3.75/5.5	LD	Kakrari
16	20+500	21+300	0.8	BT	5.5	ED	
17	21+300	21+500	0.2	BT	3.75/5.5	LD	Rampura
18	21+500	23+300	1.8	BT	5.5	ED	
19	23+300	23+500	0.2	BT	3.75/5.5	LD	Pipersana
20	23+500	24+900	1.4	BT	5.5	ED	
21	24+900	25+100	0.2	BT	3.75/5.5	LD	Badri
22	25+100	28+400	3.3	BT	5.5	ED	

### 4. Realignment

44. There is no bypass/realignment is required along the project road. The improvement of horizontal geometry has been done within existing Right of Way.

### 5. Intersections

45. All intersections falling on the project corridor have been studied for the improvement to allow a safe connection to the corridor and minimum interference to the through traffic. Based on

the above considerations, improvement scheme in respect of each junction has been finalised. Details of intersection improvement are tabulated below.

**Table 12: Major Intersections**

Sr. No.	Existing Chainage (in Km)	Major/ Minor	Link	Surface Type	Width (in mt.)	Type of Road (NH/SH/MDR/VR)
1	29+800	Major	Road Junction Gohad-Mau MPRDC, Road	BT	3.75	MDR

**Table 13: Minor Intersections**

Sr No	Existing Chainage (in Km)	Major/ Minor	Link	Surface Type	Width (in mt.)	Type of Road (NH/SH/MDR/VR)
1	1+700	Minor	R/S Badagaon	BT	3.75	Village Road
2	4+700	Minor	L/S Karagaon	ER	3.75	VR
3	5+800	Minor	L/S Dhaneli, PMGSY	ER	3.75	PMGSY
4	7+000	Minor	R/S Rahe	ER	3.75	Village Road
5	8+200	Minor	R/S Earth work	BT	3.75	Village Road
6	8+600	Minor	L/S VITM College	BT	3.75	Village Road
7	8+900	Minor	L/S Police Station	BT	3.75	Village Road
8	9+600	Minor	R/S Ritwai Village	BT	3.75	Village Road
9	10+700	Minor	L/S Morvansinghpura	BT	3.75	Village Road
10	12+200	Minor	R/S Berja	BT	3.75	Village Road
11	12+900	Minor	L/S Petrol Pump	BT	3.75	Village Road
12	17+100	Minor	R/S Supawali	BT	3.75	PMGSY
13	17+500	Minor	L/S Bilheti	BT	3.75	PMGSY
14	20+500	Minor	L/S, Kakrari Village	BT	3.75	Village Road
15	22+000	Minor	Rampura Village	BT	3.75	Village Road (PMGSY, 2+700)
16	24+300	Minor	L/S, Pipersana	BT	3.75	Village Road
17	25+000	Minor	R/S, Badri Village	BT	3.75	Village Road

## 6. Design of Road Side Drains

46. The following provisions have been considered to develop a sound drainage network:

- Road-side earthen drains of trapezoidal sections (please refer Typical Drawings) is proposed on both sides along the entire length, to capture surface run off from the main highway.
- Open chute drain in RCC on slopes of high embankment and as rapids on high cut sections. Further dissipation basins are also required to be provided at the toe of high embankments to reduce the velocity of water flow, especially where pitching is proposed.
- Road-side RCC covered drains for urban areas.
- Open lined drain in RCC on hill side in mountainous terrain.
- The requirements of additional drains and integrating with the proposed cross drainage system have been worked out for the entire length of the project road section.

**Table 14: Cement Concrete Lined Drain**

Sr. No.	Design Chainage (km)		Length	Remarks
	From	To	(km.)	
1	0+000	2+200	2.2	Badagaon
2	5+600	5+800	0.2	Dhaneli
3	7+000	7+200	0.2	Hasanpura
4	8+600	8+800	0.2	Bholakala
5	9+000	9+200	0.2	Ratwai
6	10+000	10+200	0.2	Morvansinghpura
7	11+000	11+200	0.2	Berja
8	20+300	20+500	0.2	Kakrari
9	21+300	21+500	0.2	Rampura
10	23+300	23+500	0.2	Pipersana
11	24+900	25+100	0.2	Badri
<b>Total</b>			<b>4.40</b>	



## **7. Pavement Design**

47. The project road envisages two lane carriageway with hard shoulders and upgrading of the existing pavement to carry the anticipated traffic over the design period. This would involve the construction of new pavement on the widened side and strengthening and rehabilitation of the existing pavements. Flexible asphalt pavement is proposed for the entire length of project road. The applicable IRC Guidelines would be used for this purpose, but using other internationally accepted design method(s) to ensure that the recommended design is the most appropriate one would further check the design.

## **8. Traffic Control and Safety Measures**

48. In addition to adequate provisions for roadway width, geometric elements and junction improvement, the following provisions are proposed to enhance the safety of road users. Due consideration has been made for the provisions contained in IRC: SP 44-1994, "Highway Safety Code". Also, various measures have been proposed to increase traffic control for the High-speed highway.

### **a. Road Signs**

49. Adequate road signs are proposed for the project road in order to provide advance information to regulate/control traffic flow and ensure safety of operations. All road signs are provided in accordance with IRC 67.

50. Appropriate road markings are provided with stop signs, give-way signs, traffic merging and diverging signs, lane closure signs, compulsory keep left/right signs or any other signs as per IRC-67. Advance cautionary signs will be installed on sharp curves along with chevron signs at the outer edge of the curves. In hilly areas, curve-ahead signs are accompanied with appropriate delineators.

51. The signs will be of retro reflective sheeting of high intensity grade with encapsulated lens and fixing details as per clause 801 of MoRT&H Specifications for Road and Bridge Works, 2001 (4th Revision, latest reprint).

## **9. Pavement Markings**

52. In project road, pavement will comply with the IRC: 35-1997, "Code of Practice for Road Marking" with centre-line, edge line, continuity line, stop line, give way lines, diagonal/chevron markings and zebra crossings. The pavement marking shall be of hot applied thermoplastic paint with glass beads as per the MORT&H specification for Road and Bridge Works, 2001(4th Revision, latest reprint).

## **10. User Facilities**

### **a. Bus Stop**

53. Bus stops are proposed at following locations in Table 15. Existing bus stops are proposed to be retained. Appropriate maintenance measures shall be made to keep it in working conditions.

**Table 15: Bus Stop Locations**

Sr. No.	Village/Town	Bus Stop Locations (in Km.)	
1	Badagaon	1+600	2+200
2	Dhaneli	5+600	5+800
3	Hasanpura	7+000	7+200
4	Bholakala	8+600	8+800
5	Ratwai	9+000	9+200
6	Morvansinghpura	10+000	10+200
7	Berja	11+000	11+200
8	Kakrari	20+300	20+500
9	Rampura	21+300	21+500
10	Pipersana	23+300	23+500
11	Badri	24+900	25+100

## **10. Improvement Proposal for Bridges and Drainage Structure**

54. There is one major bridge, seven minor bridges, and twenty seven culverts along the project Road. Existing bridges, culverts are to be widened for intermediate lane clear carriageway 7.0m and total width of 12.0 m.

### **E. Material Investigation**

55. Investigation of Borrow area for road construction has been carried out to identify the potential sources of embankment fill material and sub grade material and to assess their general availability, nature and quantum of materials available for the project.

#### **1. Borrow Soil**

56. Investigation of Borrow area for road construction has been carried out to identify the potential sources of embankment fill material and sub grade material and to assess their general availability, nature and quantum of materials available for the project.

#### **2. Aggregate Quarry**

57. Aggregate stone is basic ingredient in road construction. Investigation of quarry area has been carried out to ascertain the potential source of aggregate which can be used for the construction of different pavement layers like Bituminous Concrete (BC), Dense Bituminous Macadam (DBM), Bituminous Macadam (BM), Wet Mix Macadam (WMM), Granular Sub-base and Sand for cement concrete works, GSB etc.

#### **3. Granular Material**

58. Granular material is used for the Drainage layer (GSB) in the pavement crust. This layer is laid up to the formation width level of the pavement for effective drainage. Granular material used in the GSB layer should have liquid limit and plasticity index restricted to 25% and 6%, respectively. In case of non-availability of suitable granular material in vicinity of project area

within the reasonable lead distance, Soil, Sand and Aggregate are to be blended with suitable proportion (preferably 60:10:30) so as to achieve specified test value and gradation as per the clause 401 of MORTH specification.

#### **4. Sand**

59. Sand is generally used in the concrete work in construction. The major source of sand is the River Besli at km 15.90 which is about 15 km far from Gwalior. Property of sand varies from time to time. The other sources of sand are:

- |                             |                        |
|-----------------------------|------------------------|
| • Chambal River near Morena | 55 km from the Gwalior |
| • Kwari River near Morena   | 35 km from the Gwalior |
| • Sindh River near Morena   | 45 km towards Datia    |

#### **5. Cement**

60. There are many cement producing factories located in Madhya Pradesh State. The ACC Cement plants are located at Kaimore, Madhya Pradesh.

#### **6. Bitumen**

61. Nearest source of Bitumen is Koyali Refinery, Vadodra. Mumbai refinery in Maharashtra can also be used as a source of bitumen.

#### **7. Steel**

62. There are a number of steel rolling factories in Madhya Pradesh with availability of various grade of steel. The required type of Steel is to be procured from the open market.

#### **8. Water**

63. Ground water and surface water in the vicinity of the project road is considered as a source of water. The water for construction can be made available by constructing bore at plant site with prior consents from state and local authorities

### **F. Construction Schedule**

64. The Road Up-gradation work is planned to be completed within 24 months from the construction start date

#### IV. DESCRIPTION OF THE ENVIRONMENT

##### A. Introduction

65. The collection of baseline information on biophysical, social and economic aspects of the project area is the most important reference for conducting Initial Environmental Examination (IEE) study. The description of environmental settings includes the characteristic of area in which the activity of the project road would occur and cover area affected by all impacts. The existing baseline line conditions has been analyzed based on primary data collection with regard to air quality, water quality, noise, soil, biodiversity and socio- economic aspects and secondary data collection from published source and various government agencies.. Efforts have been made to collect the latest information both at regional as well as local level especially along the project roads alignment. The primary survey for water, air, noise and soil was carried out during May 2014. The sampling has been done along the project alignment. The existing baseline data and analysis around MOHANPUR - BEHAT - MAU Road is presented in the following sections.

##### B. Physical Resources

###### 1. Topography, Geology and Soil:

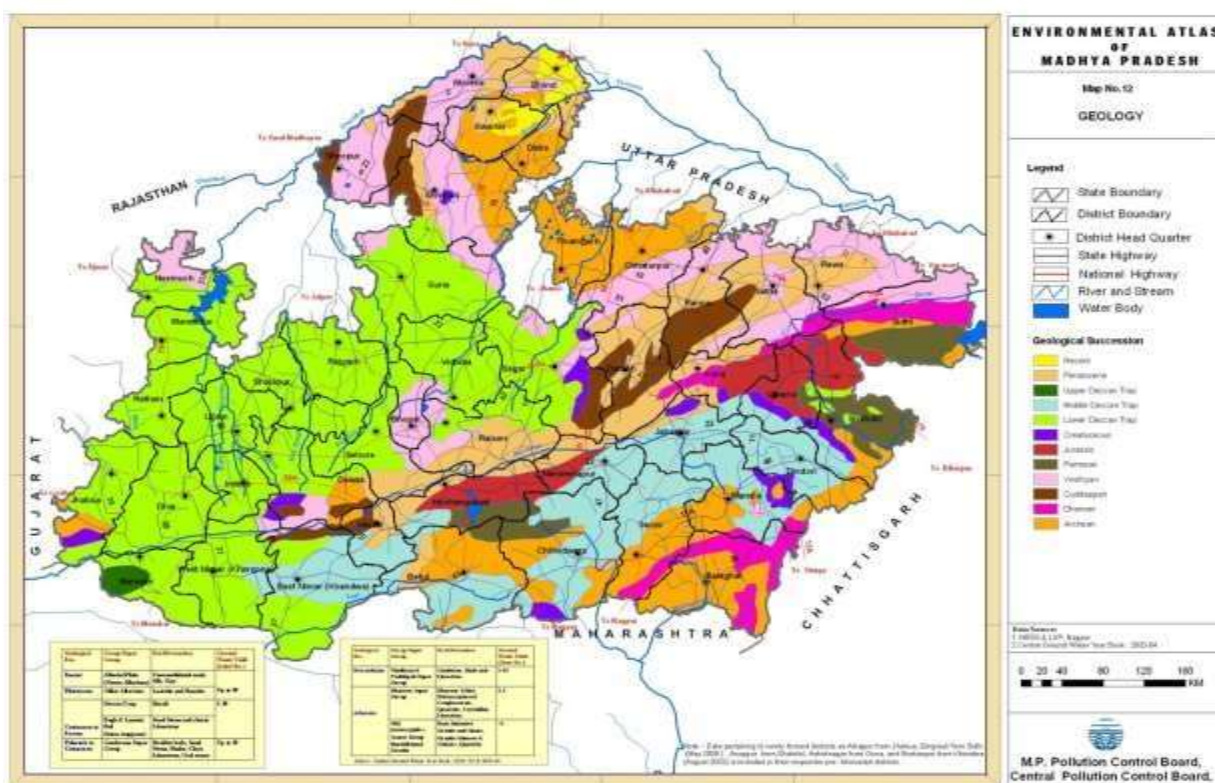
66. Madhya Pradesh nicknamed the "heart of India" due to its geographical location in India is bordered by Uttar Pradesh to the northeast, Chhattisgarh to the southeast, Maharashtra to the south, Gujarat to the west, and Rajasthan to the northwest. Madhya Pradesh the second largest state of the country has a geographic area of 30.82 million hectare, which constitutes 9.37% of the land area of the country. Geologically the State is divided in two zones; Central Plateau and Hill Region, and the Western Plateau and Hill Region. The Central Plateau and Hill Region is further divided into 7 sub-regions, namely: Bundelkhand, Madhya Pradesh Hills, Kaimore Plateau and Satpura Hills, Vindhya Plateau, Satpura Plateau, Central Narmada Valley, and Gird. The Western Plateau and Hill Region has 2 sub-regions: Jhabua Hills, and Malwa and Nimar Plateau.

**Table 16: Geological features of the State**

Zone	Sub-group (Region)	District covered	Rainfall (mm)	Climate	Type of Soil
Central Plateau and Hill Region	1. Bundelkhand	Chattarpur, Datia, Tikamgarh	700	Dry sub humid	Mixed red & Black
	2. Chhattisgarh Hills	Mandla, Dindori	1570	Moist sub humid	Red & Yellow
	3. Kaimore Plateau & Satpura Hills	Jabalpur, Panna, Satna, Rewa, Sidhi, Seoni, Katni, Balaghat, Shahdol, Anuppur, Umariya	1100	Dry sub humid	Medium Black
	4. Vindhya Plateau	Bhopal, Damoh, Raisen, Sagar, Sehore, Vidisha	1130	Dry sub humid	Shallow to Medium Black

	5. Satpura Plateau	Betul, Chhindwara, Narsinghpur	1220	Dry sub humid	Shallow to Medium Black
	6. Central Narmada Valley	Hoshangabad, Harda	1300	Dry sub humid	Deep Black
	7. Gird	Morena, Bhind, Gwalior, Guna, Shivpuri, Ashoknagar, Sheopur	670	Semi-arid	Medium Black alluvial
Western Plateau and Hill Region	8. Jhabua Hills	Jhabua	988	Semi-arid	Medium to deep black
	9. Malwa & Nimar Plateau	Indore, Narsinghgarh, Ujjain, Ratlam, Dewas, Mandasor, Rajgarh, Shajapur, Khandwa, Khargone, Neemuch, Badwani, Burhanpur	874	Semi-arid	Medium to deep black

**Figure 5 and 6 show the geological and soil map of MP.**

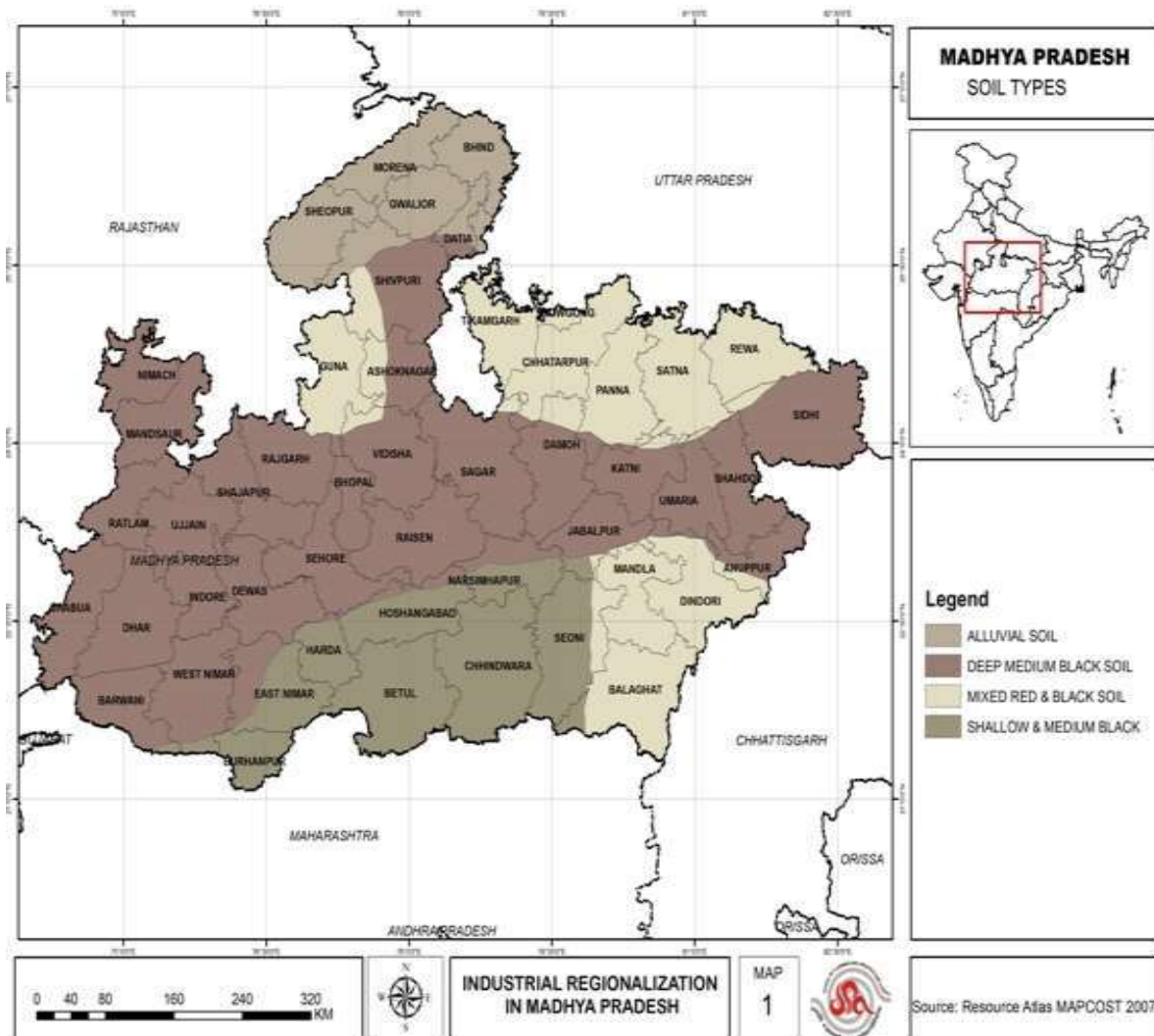


### Figure 5: Geological Map of MP

67. The proposed Morar - Chitora project road between is situated on the Central Plateau and Hill Region agro climate zone and forms Gird sub-group. The soil type in the area is medium to black alluvial. Collected soil priorities along the project corridor were analyzed and results are presented in **Table 17**. The results shows that Soil is mostly found as Sandy clay loam soil in all the three locations and it is heavily loaded with sand percentage which ranges from 55 to 48%. Nitrogen content ranges from 49 to 682 mg/1000g and is poor in organic carbon content.

**Table 17: Soil Quality along the Project road**

S. No.	PARAMETERS	TEST METHOD	UNIT	Badagaon Village, Ch. 10+500	Pipersana Village, Ch. 21+100
1.	pH(1:5 suspension)	IS:2720(Part-26)	-	7.86	7.66
2.	Electrical Conductivity at 25°C (1:5suspension.)	IS:2720(Part-21)	µmhos/cm	56.2	44.5
3.	Bulk Density	STP/SOIL	gm /cm <sup>3</sup>	1.382	1.322
4.	Moisture	STP/SOIL	%	28	22
5.	Texture	STP/SOIL	-	Sandy Clay Loam	Sandy Clay Loam
6.	Sand	STP/SOIL	% by mass	55	48
7.	Clay	STP/SOIL	% by mass	30	32
8.	Silt	STP/SOIL	% by mass	15	20
9.	Cation Exchange Capacity	STP/SOIL	mg/ kg	2.36	1.82
10.	Nitrogen	STP/SOIL	mg/1000g	62.4	48.6
11.	Potassium (as K)	STP/SOIL	mg/kg	0.6	0.5
12.	Phosphorus	STP/SOIL	mg/1000g	88	84
13.	Calcium	STP/SOIL	mg/1000g	2.8	1.6
14.	Magnesium	STP/SOIL	mg/1000g	1.62	1.75
15.	Organic Carbon	STP/SOIL	%by mass	0.25	0.24

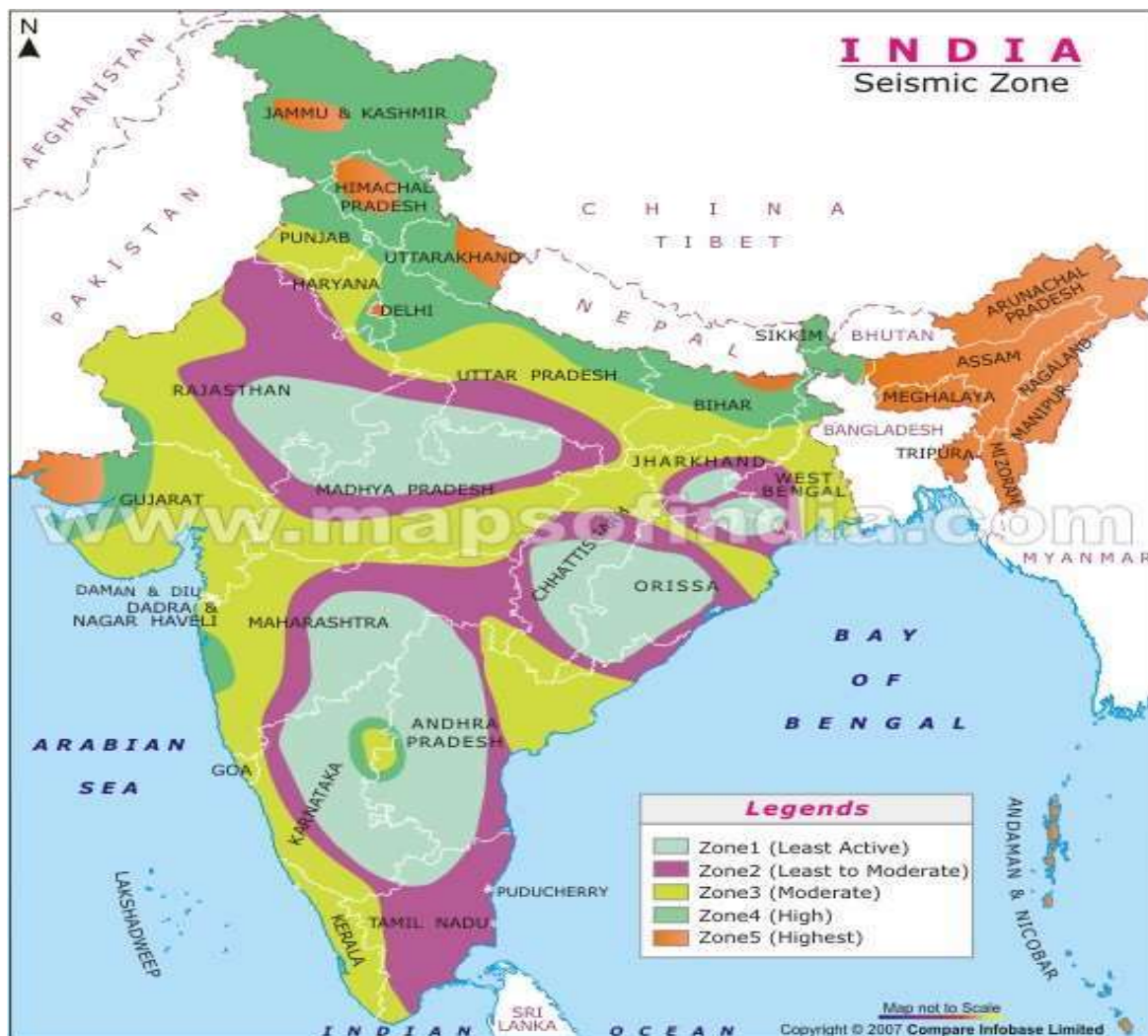


**Figure 6: Soil Map of M.P**

## 2. Seismicity

68. The entire Madhya Pradesh falls under zone least active to moderate zone as per seismic map of India. In the moderate damage risk zone structures are at risk of a Medvedev– Sponheuer–Karnik (MSK) scale VII with very strong earthquake where most people are frightened and try to run outdoors causing serious damage to older buildings, masonry chimneys collapse and small landslides. In the least active zone an MSK VI or less and is classified as the Low Damage Risk Zone where earthquake can frighten most people dishes and glassware may break and visible damage to masonry structures, cracks in plaster may occur. Figure 7 shows seismic Zone map of India.





Source: IS 1893(Part1)2002

Figure 7: Seismic Zone Map of India

### 3. Climate

69. The climate in Madhya Pradesh is governed by a monsoon weather pattern. The distinct seasons are summer (March through May), winter (November through February), and the intervening rainy months of the southwest monsoon (June through September). In **Bhind District**, the temperature increases steadily till May, when the mean daily temperature is about 46 degree Celsius and the mean daily minimum is about 28 degree Celsius. In June, the mean daily temperature is higher by a couple of degrees. The heat in the summer season is intense and the dust laden scorching winds, which blow often, add much to the discomfort. With onset of monsoon in the district by the mid of June, there is an appreciable drop in the temperature. After October, day and night temperature decrease rapidly. January is the coldest month with the mean daily maximum temperature at about 23 degree Celsius, and the mean daily minimum at about 8 degree Celsius. In the cold season in the rear of passing western disturbances, cold waves affect Bhind District and the minimum temperature may drop down to about a degree below the freezing point of water. The **Gwalior District** temperatures averaging in the 14–16 °C (58–62 °F) range, and mostly dry and sunny conditions. January is the coldest month with



average lows in the 5–7 °C range (40–45 °F) and occasional cold snaps that plummet temperatures to close to freezing.

70. The salient climatic features of the state are as follow:

Average Annual Rainfall	- 1200
Concentration of precipitation	- June to September
Humidity	- 25 to 75 %
Cloudiness	- Heavily clouded in monsoon
Wind	- Generally light
Mean Temperature	- Summer 29°C & Winter 9°C

**Table 18: Climate condition of project district**

	<b>Gwalior District</b>	<b>Bhind District</b>
Climate	warm sub-tropical	warm sub-tropical
Maximum temperature	46°C in May.	48°C in May
Minimum temperature	7°C in Jan.	6°C in Jan.
Average Rainfall	900 mm	668.3

#### **4. Surface and Ground Water Hydrology**

##### **a. Surface Water Hydrology**

71. There are ten major rivers that originate from the State. As Madhya Pradesh is located in the center of India, most of the rivers are interstate rivers. The rivers namely; Chambal, Sindh, Betwa and Ken flow northward and meet with Yamuna whereas, the river Son falls directly into the Ganga. Narmada, Tapti and Mahi rivers flow westward and meet Arabian Sea whereas Wainganga and Pench rivers meet Godavari in the south. Rivers in Madhya Pradesh are mostly seasonal and Rainfed, receiving maximum water flow during the monsoon season. The non-monsoon flow in some perennial rivers is mainly due to flow from groundwater.

##### **b. Ground Water Hydrology**

72. Ground water is the major water source in the area for drinking purpose. The source of recharging of ground water is mostly from rainfall and canals. Hand pumps are commonly used to draw the water from ground in the villages. Static water levels vary along the stretch of the priority roads. First or upper ground water aquifer lies in the range of 12 to 18 m below ground level (bgl). The ground water levels in the area show a decline of 0.8 m to 1.2 m from post monsoon to pre monsoon period. The details of hand pumps along the project road are given in Table 19.

**Table 19: Water Bodies along the Project Road**

<b>S. No.</b>	<b>Chainage (km)</b>	<b>Distance from centre of Existing Roads (meter)</b>	<b>Left / Right/ Crossing</b>	<b>Type- Ponds, River, Well, Hand Pump, Tube Well etc.</b>	<b>Remarks</b>
1	1.465	7.35m	Left	Hand Pump	
2	1.839	8.23m	Left	Hand Pump	
3	12.324	7.12m	Right	Hand Pump	
4	16.600		Crossing	River	
5	24.350	11.54	Left	Pond	
6	28.050		Crossing	Canal	

\*Note: Utilities coming under 6.0m need to be relocated

## 5. Water Quality

73. Water quality along the priority roads were priority and analyzed for a Physico- chemical characteristics based on procedures specified in 'Standard Methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA). Results were compared to the standards for drinking water as per IS: 10500 and were all found suitable for drinking water and all parameters are within desirable limit.

**Table 20: Ground/ Water Quality along the Project Road (Physical & Chemical Parameters)**

S. No	Parameter	Unit	Method No.	Requirement as per IS-10500-2012		Location	
				Desirable Limit	Permissible Limit	Badagaon Village(HP), Ch.10+500	Pipersana Village(SW), Ch. 21+100
1	pH	-	4500	6.5-8.5	No relaxation	7.45	7.58
2	Temperature	°C	-	-	-	35	35
3	Dissolved Oxygen	mg/lit	3025(P-38)	-	-	4.4	4.8
4	Conductivity	µmhos/cm	2510	-	-	888	883
5	Total Suspended Solid	mg/lit	3025(P-17)	-	-	<1.0	<1.0
6	Total Dissolved Solid	mg/lit	2540	500	2000	577	574
7	Alkalinity	mg/lit	2320	200	600	302	298
8	Total Hardness as CaCO <sub>3</sub>	mg/lit	2340	300	600	335	290
9	Ca Hardness as CaCO <sub>3</sub>	mg/lit	3500	-	-	248	228
10	Mg Hardness as CaCO <sub>3</sub>	mg/lit	2340	-	-	87	62
11	Chlorides as Cl	mg/lit	4500	250	1000	42	55
12	Phosphate as PO <sub>4</sub>	mg/lit	3500	-	-	<0.1	<0.1
13	Nitrates as NO <sub>3</sub>	mg/lit	4500	45	100	6.5	5.5
14	Sulphates as SO <sub>4</sub>	mg/lit	4500	200	400	44.5	35.6
15	Sodium as Na	mg/lit	3025(P-45)	-	-	45	58
16	Potassium (as K)	mg/lit	3025(P-45)	-	-	2	2
17	COD	mg/lit	APHA-5220B	-	-	BDL	BDL

18	BOD (at 27°C 3-Days)	mg/lit	IS-3025(P-44)	-	-	BDL	BDL
19	Total Coliform	mg/100ml	IS-1622	-	0	Absent	Absent/100ml
20	Faecal Coliform	mg/100ml	IS-1622		10 Max.	Absent/100ml	Absent/100ml

**Table 21: Ground/ Water Quality along the Project Road (Microbiological Requirement)**

S.No.	Parameter	Unit	Method No.	Requirement as per IS-10500-2012		Location	
				Desirable Limit	Permissible Limit	Badagaon Village(HP) Ch.10+500	Pipersana Village(SW), Ch. 21+100
19	Total Coliform	mg/100	IS-1622	-	0	Absent	Absent/100ml
20	Faecal Coliform	mg/100	IS-1622		10 Max.	Absent/100ml	Absent/100ml

## 6. Ambient Air Quality

74. The baseline status of the ambient air quality has been established through ambient air quality monitoring at selected points along the project roads. The ambient air quality has been monitored at 4 along the project road for particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>); and carbon monoxides (CO) using standard analysis technique (Table 22).

**Table 22: Techniques Used for Ambient Air Quality Monitoring**

S. No.	Parameter	Technique	Minimum Detectable Limit (ug/m <sup>3</sup> )
1.	Particulate Matter (PM <sub>2.5</sub> )	Gravimetric Method	1.0
2.	Particulate Matter (PM <sub>10</sub> )	Gravimetric Method	1.0
3.	Sulphur dioxide	Modified West and Gaeke	5.0
4.	Nitrogen Oxide	Modified Jacob & Hochheiser	5.0
5.	Carbon Monoxide	Non Dispersive Infrared Spectroscopy (NDIR)	1

75. The ambient air quality was monitored at various places along the proposed road project during May / June 2014 to establish baseline conditions along the project corridor. The monitoring results for PM<sub>2.5</sub>, PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>x</sub> and CO concentrations are given in Table 24 and summarized below. The monitored values are compared with National Ambient Air Quality Standards prescribed by Central Pollution Control Board (CPCB) for residential, rural and other areas. The Ambient air quality levels meet the National air quality standards for rural, residential and industrial area all along the project road.

- **PM<sub>2.5</sub>:** The mean PM<sub>2.5</sub> concentration at ambient air quality monitoring locations varies from 24 to 39µg/m<sup>3</sup>. The values are within the permissible limit at all the stations.
- **PM<sub>10</sub>:** The mean PM<sub>10</sub> concentration at ambient air quality monitoring locations varies from 62 to 65 µg/m<sup>3</sup>. The values are within the permissible limit at all the stations.

- **SO<sub>2</sub>**: The mean concentrations of SO<sub>2</sub> at all ambient air quality monitoring locations varies from 6.2 to 9.5 µg/m<sup>3</sup>. The values are within the permissible limit at all the stations.
- **NO<sub>x</sub>**: The mean concentrations of NO<sub>x</sub> at all AAQM locations range from 12.5 to 208.5 µg/m<sup>3</sup>. The values are within the permissible limit at all the stations.
- **CO**: The mean concentrations of CO at all AAQM locations range from 0.34 to 0.88 mg/m<sup>3</sup>. The values are within the permissible limit at all the stations.

**Table 23: Ambient Air Quality in the Project Area**

S. No	Parameter	Method	Unit	Limits	Results	
					Badagaon Village, Ch. 10+500	Pipersana Village, Ch. 21+100
1.	Particulate Matter (PM <sub>10</sub> )	IS:5182 Part-XXIII	µg /m <sup>3</sup>	100.0	82	78
2.	Particulate Matter (PM <sub>2.5</sub> )	CPCB Volume – 1 / Grav	µg /m <sup>3</sup>	60.0	32	26
3.	Sulphur Dioxide	IS:5182 Part-II	µg /m <sup>3</sup>	80.0	8.6	7.5
4.	Nitrogen Dioxide	IS:5182 Part-VI	µg /m <sup>3</sup>	80	12.2	11.5
5.	Carbon Monoxide	IS:5182 Part-X	mg/m <sup>3</sup>	4.0	0.450	0.380

## 7. Noise Measurements

76. Preliminary reconnaissance survey was undertaken to identify the major noise generating sources in the area. The noise at different noise generating sources has been identified based on the industrial, commercial and residential activities, traffic and noise at sensitive areas. Sound Pressure Level (SPL) measurements were undertaken at all locations, with an interval of about 5 seconds over a period of 10 minutes per hour for 24 hr. The day noise level has been monitored during 6 AM to 10 PM and night levels during 10 P.M. to 6 AM at all locations. Day and night-time Leq have been calculated from hourly Leq values and compared with the stipulated standards. Table 24 gives the day and night-time Leq noise levels. Measured Leq noise levels exceed prescribed standards during the day time due to various commercial activities and the location of monitoring points close to the road.

**Table 24: Noise Level in the Project Area**

TEST RESULT							
S. No.	Test Parameters	Units	Badagaon Village, Ch. 10+500 (Residential Area)	Pipersana Village, Ch. 21+100 (Residential Area)	Requirement (as per CPCB Guidelines Limits in dB (A) Leq		
1.	EQUIVALENT NOISE LEVEL (6.0 AM TO 10.0 PM)	dB(A)	48	46	Category of Area/ Zone	Day Time	Night Time
					Industrial Area	75	70
2.	EQUIVALENT NOISE LEVEL (10.0 PM TO 6.0 AM)	dB(A)	37	35	Commercial Area	65	55
					Residential Area	55	45
					Silence Zone	50	40

## 10. Land use

77. The most of the geographical area of the state or 307,560 sq. km or about 98% is available for utilization. Major portion of the land use is under agriculture followed by forest cover (about 48 per cent). About 28% is under forest cover. Agriculture is the major land use in state followed by forests. The area under various land uses in the state is presented in the Table 25.

**Table 25: Land Use Pattern of the State**

S.No.	Land use pattern of the State	Area in Hectares	Percentage
1.	Total Geographical area	30,825	-
2.	Reporting area for land utilization	30,757	100.00
3.	Forests	8,696	28.27
4.	Not available for Land cultivation	3,401	11.06
5.	Permanent pastures and other grazing lands	1,337	4.25
6.	Land under Misc. tree crops and groves	19	0.06
7.	Cultivable Wasteland	1,160	3.77
8.	Fallow lands other than current fallows	621	2.02
9.	Current fallows	582	1.89
10.	Net area sown	14,941	48.58

Source: Land Use Statistics, Ministry of Agriculture, GOI, 2008-09.

**Table 26: Chainage wise Land use pattern along project road**

Chainage Km.		Land use/land cover of Morar – Chitora Road
From	To	
0.00	29.40	Agricultural Land and Built up section in small cluster

Source: Strip Plan and Ground Physical Survey

## C. Ecological Resources

### 1. Forests

78. The forest cover in the state based on interpretation of satellite data of Oct – Dec 2008, is 77,700 km<sup>2</sup> which is 25.21% of the state's geographical area. In terms of forest canopy density classes, the state has 6,640 km<sup>2</sup> areas under very dense forest, 34,986 km<sup>2</sup> areas under moderately dense forest and 36,074 km<sup>2</sup> areas under open forest. Comparison of the current forest cover assessment with the previous assessment (satellite data Oct – Dec 2006) shows that there is no change in forest cover.

79. The project districts in general have moderate to low percentage of forest cover Except Sheopur (53.3%) and Gwalior (26.16% Forest as per 2011 SFR), all other district of the region have the forest cover below state average. Some of the districts in the region like Bhind are one of the districts having lowest (2.20% forest cover) in the state. However, no forest land diversion is required for the proposed widening.



**Figure 8: Forest Cover in the District of Madhya Pradesh**

## 2. Wild Life and Protected Areas

80. The project road does not pass through any protected area such as Wildlife Sanctuary, National park or bio –reserve. There is no wildlife sanctuary Wildlife Sanctuary, National park or bio –reserve within 10 km from the project road.

## 3. Trees

81. Moderate tree density is observed all along the project road. The main tree species observed are Shisham, Neem and Babool. An estimated 80 trees (in which 49 are coming at right hand side and 31 are at left hand side) will be cleared to accommodate the require road upgrading of which 80 % is Babool (*Acacia nilotica*).

82. Summary of tree along the project corridor is as given in Table 27.

**Table 27: List of Trees within Proposed Corridor**

Side	Girth in m				Total No. of Trees	Major Species
	0.3 to 0.6m	0.6 to 0.9m	0.9 to 1.2m	>1.2m		
Left	2	7	12	10	31	Babool, Shisham and Neem
Right	18	11	10	10	49	
Total	20	18	22	20	80	

## 4. Aquatic Ecology and Fisheries

83. There is one river and nallah with season flows along the subproject road crossed by project road where water is available during rainy season only and dry the rest of the year. There is 1 major bridge, 7 minor bridges and 27 culverts along the Project road.

## 5. Rare or Endangered Species

84. No rare or endangered species found in corridor of impact along the project road.

## 6. Fauna and Wild life

85. The project road traverses mainly through agricultural fields and during field survey no wild animals were spotted. However in discussion with the Forestry Department and during the public consultations, it was found that common fauna in the study area are Neelgai /Nilgai (*Boselaphus tragocamelus*); chital or Indian Spotted Deer (*Axis axis*); monkey (*Rhesus macaque*), and hare (*Lepus nigricolis*) are listed as least concern by the IUCN based on the wide range of occurrence. Also documented to occur in the project area are threthended species of Jackal (*Canis aureus indicus*); jungle cat (*Felix chaus*), fox (*Vulpes bengalensis*), and king cobra (*Binocellate cobra*).

## D. Economic Development

86. The economy of Madhya Pradesh depends mainly on the agricultural sector as more than 80% of the people of the state depend on this sector for their livelihood. The agricultural sector contributes around 46% to the state's economy. The various kinds of crops grown in the state of Madhya Pradesh are rice, pulses, wheat, oilseeds, grams, soybeans, and maize. The state contributes 20% to the total production of pulses in the country. In Madhya Pradesh, the total production of food grain was around 14.10 million metric tonne in 2004- 2005. This sector has given a major boost to the economy in Madhya Pradesh.

87. The economy in the state of Madhya Pradesh also gets its revenue from the forest products sector as the state has a forest cover of around 1.7 million hectares. The various kinds of forest products available in the state of Madhya Pradesh are teak wood, Sal wood, and bamboos. These products are sold all over the country thus contributing to the Economy in Madhya Pradesh. The economy of Madhya Pradesh gets its revenue from the industrial sector which contributes 26% to the state's economy. The main industries in the state are of telecommunications, information technology, automobiles, and electronics. Madhya Pradesh is the 2nd biggest cement producer in the country for it contributes 13% to the total cement production in India. This sector has contributed a great deal to the growth of the economy in Madhya Pradesh.

88. Madhya Pradesh economy also depends for its revenue on the mineral resources sector for the state has a rich storehouse of minerals. The various kinds of minerals found in the state are dolomite, limestone, copper ore, bauxite, coal. Madhya Pradesh produced 52683 thousand metric ton of coal. The mineral sector has helped to boost the Economy of the state of Madhya Pradesh. The economy of Madhya Pradesh gets its revenue from the cottage industry of the state. The various kinds of cottage industry products found in Madhya Pradesh are clay toys, leather toys, wool products, hand loom cloth, and Chanderi sarees. The cottage industry sector has thus helped the economy of Madhya Pradesh to grow.

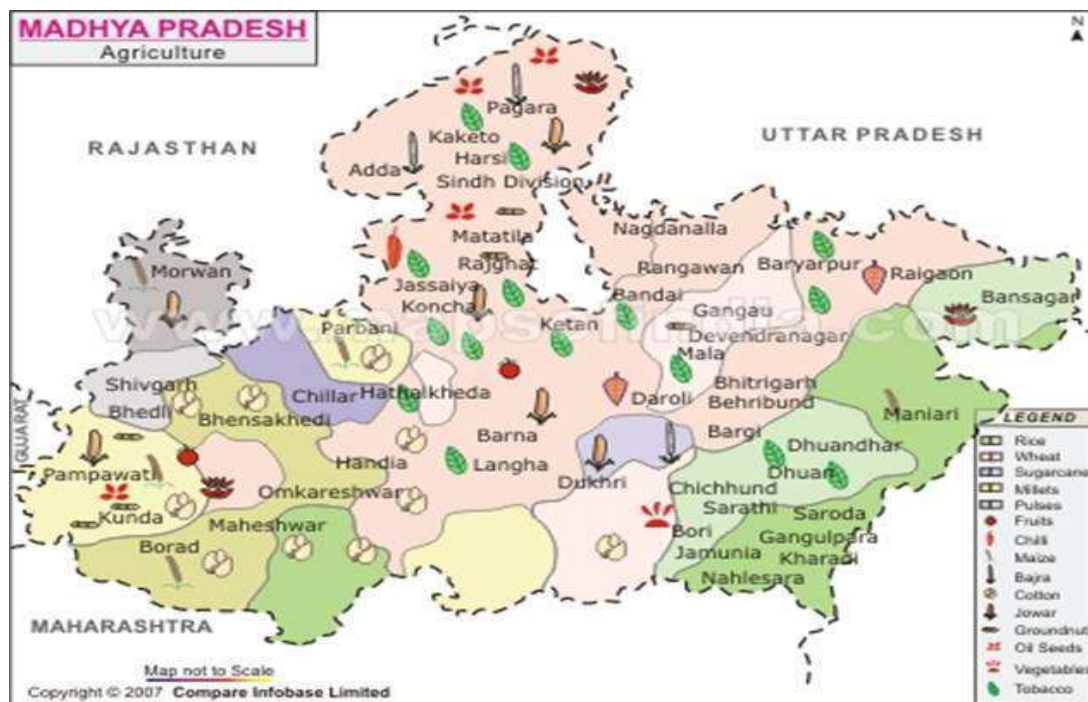
## 1. Agriculture, Forestry and Fisheries

89. Madhya Pradesh is predominantly a Kharif crop growing state. Kharif crops occupy about 54-56% whereas Rabi crops occupy 44 – 46% area out of the total cropped area in the state. About 38% of the cropped area is generally occupied by cereal crops; while pulses occupy 22%



area and oilseed occupy 31% area. Vegetables, fruits, fodder and other horticultural crops occupy the remaining 6% area.

90. Some of the important food and cash crops that are vital to agriculture in Madhya Pradesh are Rice, Wheat, Jowar, Gram, Soyabean, Pulses etc.



**Figure 9: Agriculture Map of Madhya Pradesh**

## 2. Social and Cultural Environment

91. Madhya Pradesh is a land-locked state in the central part of country with a population of about 60.3 million with more than 74 percent of the population living in the rural areas. The State has 50 districts consisting of 313 blocks and 55393 villages. The human population density is 236 persons/km<sup>2</sup> (as per 2011 census) compared to 383 persons/km<sup>2</sup> (as per 2011 census) for the entire country. Sex ratio is 931(2011 census) against the 943 (2011 census) in the country. The demographic feature of Madhya Pradesh is unique that there are many recognized tribes (about 40 percent of country), which inhabit mostly the remote areas and each with distinct culture, ethos, and traditional knowledge systems. The major minority groups in the state namely Gonds, Bhils and Oraons. The majority of the people survive on subsistence economy based mainly on the agriculture, supplemented with forest products, animal husbandry, and crafts/handloom.

92. Total population of Madhya Pradesh as per 2011 census is 72,626,809 of which male and female are 37,612,306 and 35,014,503 respectively. The state has a growth rate of about 20 percent which is above the national average of about 17 and thus the population of the state is rising considerably given the progress in the state.

93. About 73% of the state's population resides in rural areas. The state also has one of the largest tribal populations with 18 districts being predominantly tribal districts in the country. The share of schedule tribes and the schedule castes is 20.27% and 15.17% respectively. The overall literacy ratio in the state is 69.32 with male literacy being 78.73% and female literacy of 63.74%.

94. The BPL survey of 2002-03 with updated figures to October 2010 highlight that 46.48 lakh (47.4 percent) of households of rural Madhya Pradesh are living below the poverty line. The state accounts for nearly 11 percent of the total rural population in the country. The tribal households are the poorest among the most deprived social groups in India. In rural areas, 58.6 percent of the tribal population was found to be poor as compared to 42.8 percent among the SC in Madhya Pradesh.

95. The total BPL households/families comprise of 23.1 percent of SC, 33.4 percent of ST and 34.4 percent of Other Backward Class (OBC) and the remaining from the general category.

**Table 28: Demography of the Project Districts**

Indicators	Gwalior	Bhind	MP
Area Sq. Km	4,560	4,459	308,252
Actual Population	2,032,036	1,703,005	72,626,809
Male	1,090,327	926,843	37,612,306
Female	941,709	776,162	35,014,503
Population Growth	24.50%	19.21%	20.35%
Density/km2	446	382	236
Sex Ratio (Per 1000 male )	864	837	927
Child Sex Ratio (0-6 Age)	840	843	912
Average Literacy	76.65	75.26	73.395
Male Literacy	84.70%	85.40%	81.70%
Female Literacy	67.38%	63.14%	58.97%
Child Proportion (0-6 Age)	12.86%	248,230	10,809,395
Boys Proportion (0-6 Age)	13.03%	134,705	5,636,172
Girls Proportion (0-6 Age)	12.67%	113,525	5,173,223

### 3. Archaeological and Historical Monuments

96. No archaeological and historical monument is located along the project road.

### 4. Sensitive Receptors

97. During the environmental and social screening survey, it was observed that many small religious structures, school etc are located along the project road. However, no religious structures will be directly affected during widening of the project road. Details of sensitive receptors/community structure along the project road are shown in Table 29.

**Table 29: Sensitive receptors along the project road**

S. No.	Chainage	Length of Structure along the Road	Distance from Centre of existing roads	Left, Right or Crossing	Type – Temple, School, Hospital, Community Building etc.	Remarks
1	0+050	6.5	16.00	Left	Temple	
2	0+650	84.12	8.12	Right	Temple	
3	0+750	1.83	8.76	Right	Temple	
4	1+550	3.04	8.19	Right	Temple	
5	3+200	211.16	5.15	Left	School	

S. No.	Chainage	Length of Structure along the Road	Distance from Centre of existing roads	Left, Right or Crossing	Type – Temple, School, Hospital, Community Building etc.	Remarks
6	13+150	5.24	16.96	Right	Temple	
7	18+050	5.59	14.81	Right	Temple	

*\*Note: Utilities coming under 6.0m need to be relocated*

## **V. ANTICIPATED ENVIRONMENTAL IMPACTS AND ITS MITIGATION MEASURES**

98. Impact identification, screening for significance, and recommended mitigation measures for Morar – Chitora Road was guided by the use of ADB Rapid Environmental Assessment (REA) Checklist for Roads and Highways as provided in Appendix 1. The environmental screening of Morar - Chitora Road revealed the following the entire alignment is located inside or near a cultural heritage site, protected area, wetland, mangrove, estuarine, buffer zone of protected area or special area for protecting biodiversity.

99. The potential impacts of the proposed upgrading includes: removal of avenue trees, increase in ambient dust concentration, increase in noise, generation of construction debris and camp wastes, and loss of community structures.

### **A. Impact on Physical Environment Design Stage**

#### **1. Natural Hazard**

100. The entire Madhya Pradesh falls under zone least active to moderate zone as per seismic map of India and therefore the risk of damage to the project road due to earthquake is minimal. Nonetheless, relevant IS codes were adopted in the design the civil structures.

#### **2. Road Widening, Utilities shifting and Safety Planning**

101. The entire road section has enough available ROW to accommodate the proposed road improvement works and will be undertaken along the existing alignment. No Road widening has been proposed along the project road, thus no utility shifting will take place except the temporary shifting of few shops that are mobile in nature and will bear no impact to extremity. The further contraction of the useable carriageway during construction will exacerbate traffic and will hinder direct access across the road by residents along the road. Temporary detention of sewage on depressed areas during the reconstruction of drainage canals may occur.

102. Road formation widening will be made on the basis of minimizing tree cutting, utility shifting, and damage to community properties. Road design has incorporates the drainage system to avoid accumulation of sewage and surface run-off. Temporary pits will constructed side- and cross drains to collect sewage from demolished or damage drainage canals which will either be hauled for off-site treatment through septic tanks prior to disposal or land application.

103. Adequate safety provisions like crash barriers on accident prone areas, rumble strips in community areas to regulate speed, retro-reflective warning sign boards near school, hospital, and religious places are incorporated in the design. All utilities requiring shifting shall be largely made before start of construction. Prior to shifting, the Contractor will coordinate with the concerned agencies regarding the time and extent of shifting and community affected will be informed of potential service disruption at least 1 week in advance.

#### **3. Terrestrial Ecology**

104. There is no national park, wildlife sanctuaries or any other similar eco-sensitive areas within 10 km distance of the project area. However, 80 trees are likely to be affected. The impact and mitigation due to tree cutting has been discussed in following paragraphs.

105. The road has direct bearing on tree resources. Road widening option is made to minimize the cutting of tree. However efforts have been made in designing to reduce the tree cutting to only six. Compensatory plantation of 1:10 has been planned under the project to address this impact.

## B. Construction Stage

### 1. Air Quality

106. The potential sources of air emission during the construction phase of the project are: (i) dust re-suspension from earthworks including materials loading and unloading; (ii) quarrying and rock crushing; (iii) operation of construction equipment and machines; (iv) fugitive emissions from unpaved road travel; and (v) combustion of fuels from equipment, machineries, and vehicles. Particulate matter, comprising the majority from road construction, Particle size distribution from road construction is dominantly large, with 85.5% > 10µm and 55% > 20 µm<sup>2</sup> which can settle within close proximity of the source. Hot mix plant will generate carbon monoxide (CO), un-burnt hydrocarbon, sulphur dioxide, particulate matters, and nitrogen oxides (NO<sub>x</sub>) emissions. This may affect the air quality of nearby areas especially due to emission discharge from low height stack. The deterioration of the air quality within the immediate vicinity of the road construction activities will be significant but temporary.

107. **Mitigation Measures.** Following measures are proposed to minimize the dust and emission generation:

- Vehicles delivering loose and fine materials like sand and aggregates shall be covered.
- Loading and unloading of construction materials in project area or provisions of water fogging around these locations.
- Storage areas should be located downwind of the habitation area.
- Water shall be sprayed on earthworks and unpaved haulage roads regularly.
- Regular maintenance of machinery and equipment. Vehicular pollution check shall be made mandatory.
- Explore the potential for using readymade asphalt and crushed rocks to avoid or minimize the use of hot mix and rock crushing plants
- Mixing plants and asphalt (hot mix) plants shall be located at least 1 km downwind of the human settlements. The asphalt plants, crushers and the batching plants shall be sited at least 500m in the downwind direction from the nearest settlement and after securing a No-Objection Certificate (NOC) from the SPCB. Hot mix plant shall be fitted with stack of adequate height as may be prescribed by SPCB to ensure enough dispersion of exit gases.
- Only crushers licensed by PCB shall be used.
- LPG should be used as fuel source in construction camps instead of
- Tree cutting shall be restricted.
- Mask and other PPE shall be provided to the construction workers.
- Diesel Generating (DG) sets shall be fitted with adequate height as per regulations (Height of stack = height of the building + 0.2 KVA).
- Low sulphur diesel shall be used in DG sets as well as machineries.
- Air quality monitoring should be carried out during construction phase. If monitored parameters are above the prescribed limit, suitable control measures must be taken.

### 2. Noise

108. The scale of the construction necessary to upgrade the road and the corresponding slight increase in traffic are not expected to generate adverse impacts. Ambient noise level may

increase temporarily in the close vicinity of various construction activities, maintenance workshops and vehicles and earthmoving equipment. These construction activities are expected to generate noise levels in the range of 80 – 95 dB(A) at a distance of about 5 m from the source.

109. Although this level of noise is higher than the permissible limit for ambient noise level for residential/commercial levels but will occur only intermittently and temporary. This noise level will attenuate with increase in distance from noise source, decreasing by 10dB at a distance of about 55m and 20 dB at 180 meters. Impact due to noise during construction activities will be minimal to communities as construction camps are located at least 50 meters from community areas.

110. Along the project road, a number of noise sensitive places are located which includes schools and temples. Noise impacts during project construction will be significant and temporary.

111. **Mitigation Measures.** Since the baseline noise levels already exceed prescribed standards the target for the operational stage monitoring will be to ensure that the noise levels do not exceed baseline levels.

112. All equipment shall be fitted with silencers and will be properly maintained to minimize its operational noise. Noise level will be one of the considerations in equipment selection, which will favor lower sound power levels. Stationary noise making equipment shall be placed along uninhabited stretches.

113. In addition to preferring less noise generating equipment, the timing of operation can be scheduled to avoid disruption of activities like school and prayer times. Finally, provision of temporary noise barriers will be made near identified sensitive locations or near the noise source during construction.

114. To protect workers operating in noisy environment, ear plugs or ear muffs will be provided by the Contractor to the workers and occupational exposure limits will be strictly implemented.

### 3. Impact on Land and Soil

115. Borrow areas may lose its productivity if top soil is not preserved. Similarly, land area used for locating construction camp may lose its productivity, if it is not restored to its original stage after disbanding the construction camp.

116. **Mitigation Measures.** The top soil from the productive land shall be preserved and reused for plantation purposes. It shall also be used as top cover of embankment slope for growing vegetation to protect soil erosion. It shall be ensured that the land taken on lease for access road and construction camp is restored back to its original land use before handing it over back to land owner

### 4. Soil Erosion

117. Soil erosion may take place at locations of sharp bend near bridge construction locations, along steep and incompact embankment slope, and wherever vegetation is cleared. Soil erosion may have cumulative effect viz. siltation, embankment damage, and drainage problem. Loss of soil due to run off from earth stock-piles may also lead to siltation of nearby water bodies. The intensity of soil erosion at different locations will be influenced by the lithology, topography, soil type and climatic condition (mainly rainfall) and drainage pattern.

118. **Mitigation measures.** Following mitigation measures are proposed for prevention of soil erosion:

- Bank protection measures shall be taken at erosion prone areas. The protection measures may include use of geo-textiles matting, bio (vegetative) –turfing
- Provision of side drain to guide the water to natural outfalls.
- Stone pitching wherever necessary.
- When soil is spread on slopes for permanent disposal, it shall be buttressed at the toe by retaining walls.
- Side slopes of the embankment shall not be steeper than 2H:1V. Turfing of embankment slopes shall be done along the stretch.
- Shrubs shall be planted in loose soil area.
- In rural stretches, longitudinal side drains shall be intercepted by drains serving as outlet channels to reduce the erosion.
- IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control shall be taken into consideration.
- Soil erosion shall be visually checked on slopes and high embankment areas. In case soil erosion is found, suitable measures shall be taken to control the soil erosion further including bio-turfing.
- While planning or executing excavations, the Contractor will take all adequate precautions against soil erosion as per MoRTH 306.
- The earth stockpiles to be located downwind and provided with gentle slopes to prevent soil erosion

## 5. Borrow Areas and Quarries

119. The project area is flat terrain. Farmers are willing to provide earth from their field up to certain depth on adequate compensation; it is recommended that borrowing from agricultural land shall be minimized to the extent possible.

120. Borrow areas if left un-rehabilitated may pose risk to people, particularly children and animals of accidentally falling into it as well as become potential breeding ground for mosquitoes and vector born disease

121. Illegal quarrying may lead to unstable soil condition; destroy the landscape of the terrain, air and noise pollution. Opening of new quarries is not envisaged due to the proposed project. Quarry material will be sourced from existing nearby quarries.

122. **Mitigation measures.** Borrow pits shall be selected from barren land/wasteland to the extent possible. Borrow areas should not be located on cultivable lands except in the situations where land owners desires to level the land. The top soil shall be preserved and depth shall be restricted to the desired level.

123. Borrow areas should be excavated as per the intended end use by the owner. The Indian Road Congress (IRC):10-1961 guideline should be used for selection of borrow pits and amount that can be borrowed.

124. The depths in borrow pits to be regulated so that the sides shall not be steeper than 25%. To the extent possible, borrow areas shall be sited away from inhabited areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose

contamination of soil. In addition, it shall be converted into fishpond in consultation with fishery department and if desired by land owner/community.

125. Rehabilitated following the broad guidelines given at Appendix 2.

126. Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to EO, PIU. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA if new quarries are opened.

## **6. Compaction and Contamination of Soil**

127. Soil in the adjoining productive lands beyond the ROW, haulage roads, and construction camp area may be compacted due to movement of construction vehicles, machineries and equipment, and due to sitting of construction camps and workshops. Approach road either paved or unpaved is available for most the bridge approaches. However, for some bridges approach road has to be constructed.

128. Soil may be contaminated due to inappropriate disposal of liquid waste, (lubricating oil and fuel spills, waste oil and lubricant and vehicle/equipment washing effluent) and solid waste (fuel filters, oily rags) likely to be generated from repair and maintenance of transport vehicles, construction equipment and machinery. Soil may be contaminated due to inappropriate disposal of domestic solid waste and sewage from construction camps.

129. **Mitigation Measures.** Fuel and lubricants shall be stored at the predefined storage location and away from drainage channels. The storage area shall be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils. Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil.

130. All efforts shall be made to minimize the waste generation. Unavoidable waste shall be stored at the designated place prior to disposal. To avoid soil contamination at the wash-down and re-fuelling areas, oil interceptors shall be provided. Oil and grease spill and oil soaked materials are to be collected and stored in labeled containers (Labeled: WASTE OIL; and hazardous sign be displayed) and sold off to SPCB/ MoEF authorized Waste Oil Recycler.

131. To prevent soil compaction in the adjoining productive lands beyond the ROW, the movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route.

- Approach roads shall be designed along the barren and hard soil area to reduce the compaction induced impact on soil.
- The productive land shall be reclaimed after construction activity.
- Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at construction camp.
- Domestic solid waste at construction camp shall be segregated into biodegradable and non-biodegradable waste. The non-biodegradable and recyclable waste shall be sold off.
- Efforts shall be made that biodegradable waste shall be composted in the mechanized and movable composter by the contractor. Non bio-degradable and non-saleable waste shall be disposed off to authorized land fill site. Non-



bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit.

- Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board

132. Construction waste constitutes debris, which are generated due to dismantling of pavement, quarry dust and unused iron bars or damaged support structures. Uncontrolled disposal of these wastes may affect soil and even receiving water bodies may cause contamination of soil, and landscape of the area.

133. **Mitigation Measures.** Construction waste shall be disposed of in environmentally acceptable manner. Some of the measures are as follows:

- The existing bitumen surface can be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, drains, cross drainage should be used for backfilling embankments, filling pits, and landscaping. Unusable debris material should be suitably disposed off at pre designated disposal locations, with approval of the concerned authority.
- The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal MoRTH guidelines should be followed.
- The locations of dumping sites should be selected with following considerations.
- Unproductive/wastelands shall be selected for dumping sites.
- Away from residential areas and located at least 1000 m downwind side of these locations,
- Dumping sites do not contaminate any water sources
- Dumping sites have adequate capacity equal to the amount of debris generated.
- Public perception and consent from the village Panchayats about the location of debris disposal site shall be obtained before finalizing the location.

## 6. Groundwater

134. Contamination of groundwater is not envisaged since construction camps will have septic tanks or mobile toilets depending on the number of workers in each camp.

135. **Mitigation Measures.** Requisite permission as applicable shall be obtained for abstraction of groundwater. The contractor shall make arrangements for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected. Water intensive activities shall not be undertaken during summer season.

## 7. Surface Water Bodies

136. Temporary pollution of water bodies may occur due to spillage of chemicals and oil at construction sites and disposal of waste from construction camps. Installation of a haul road or temporary access across the river/nala may be required while construction work is ongoing in the existing minor bridges and culverts. This may cause sedimentation and other disturbances to the water body.

137. **Mitigation Measures.** To prevent siltation of road side ponds, provision of retaining wall is made along the road for the ponds located next to the road. As enhancement

measures, efforts shall be made to increase the water holding capacity of the ponds (other than those affected) in the region by using the bed material as borrow earth. Following measures shall be followed additionally:

- Bridge construction activity including piling is recommended during non- monsoon (October to End of May) period.
- Check dams must be created during construction to catch the silt or debris generated from construction activities across the water channels
- All chemicals and oil shall be stored away from water and concreted platform with catchment pit for spills collection.
- All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up.
- Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors.
- Silt fencing and/or brush barrier shall be installed along drainage path, erosion prone areas for collecting sediments before letting them into the water body. Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated.
- All wastes arising from the construction should be disposed in an environmentally accepted manner so as not to block the flow of water in the channels. The wastes should be collected, stored and transported to the approved disposal sites.
- No vehicles or equipment should be parked or refueled near water bodies, so as to avoid contamination from fuel and lubricants
- Substructure construction should be limited to the dry season.
- Construction camps shall be located away from habitation (at least 1 Km Away) and water bodies. Sewage from labour camps will be treated through septic tanks. No untreated/treated sanitary wastewater shall be discharged into surface water bodies as these are used for bathing and washing purpose.
- The borrow areas may also be converted into ponds with the concurrence of the land owners. Fisheries activity can be encouraged in such ponds through institutional support from concerned department

## 8. Hydrology and Drainage

138. Construction material and waste may contaminate or clog the small drains if stored or disposed close to water body.

139. **Mitigation Measures.** Adequate cross drainage structures shall be provided. Additional balancing culverts shall be provided in flood prone areas. The embankment height shall be designed consistent with the existing topography of the region and shall be higher than the HFL. Elaborate drainage system shall be provided to drain the storm water from the roadway and embankment and to ensure minimum disturbance to natural drainage of surface and subsurface water of the area.

140. The design of drainage system such as surface and sub-surface drainage shall be carried out as per IRC: SP: 42 and IRC: SP: 50. Surface runoff from the main highway, embankment slopes and the service roads shall be discharged through longitudinal drains, designed for adequate cross section, bed slopes, invert levels and the outfalls. If necessary, the walls of the drains shall be designed to retain the adjoining earth.

141. IRC: 34-1970: Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments shall be referred.

142. No construction material will be stored or disposed near any water body except for reusing it for enhancement measures such as embankment raising.

## 9. Impact on Biological Environment

### a. Terrestrial Ecology

143. There is no national park, wildlife sanctuaries or any other similar eco-sensitive areas within 10 km distance of the project area. However, some trees are likely to be affected. The impact and mitigation due to tree cutting has been discussed in following paragraphs.

144. One month before the construction starts, clearing and grubbing will be performed by the contractor. All trees within the ROW with 300 mm diameter at 1m above the ground will be cut, including the removal of stumps. A total of 80 trees are likely to be affected due to the proposed project. The cutting of trees will have minor to negligible impact on local environment.

145. **Mitigation Measures.** Requisite permission from Forest Department shall be obtained for cutting of roadside trees located in forest land otherwise; permission will be taken from district commissioner.

146. One month before the construction starts, clearing and grubbing will be performed by the contractor. All trees within the ROW with 300 mm diameter at 1m above the ground will be cut, including the removal of stumps. A total of 80 trees are likely to be affected due to the proposed project. The cutting of trees will have minor to negligible impact on local environment.

147. **Mitigation Measures.** Requisite permission from Forest Department shall be obtained for cutting of roadside trees located in forest land otherwise; permission will be taken from district commissioner.

148. The project envisages plantation of approximately 800 trees along both sides of road as per IRC SP: 21 specifications. This will include the compensatory plantation as per prevailing guidelines of States forest department on 1:10 basis replacement rate or as per permission granted by district authorities for cutting of tree located on non-forest land, which vary from 1:3 to 1:10. Besides, additional plantation shall be done on banks of water bodies near bridge sites to enhance the aesthetics and check soil erosion. All tree plantations will be carried out through forest department, local community or the civil works contractor. Tree species selected for plantation must be suitable for local climatic conditions and be equal to or better in sequestering carbon than the trees removed/be good for sequestering carbon (only for roads where there is no tree cutting). Necessary advice maybe sought from the local Forestry office in the selection of tree species.

149. A range of 10-15 m Centre-to-Centre is recommended for spacing of trees (parallel to the road). Setback distance of trees in different situations shall be based on IRC: SP: 21 and IRC: 66. The distance between the kerb, if any, and the nearest edge of tree trunk shall be at least 2 m. The plantation in median shall comprise shrubs whose height would normally not exceed 1 - 1.5 m and shall be as per IRC SP: 21.

150. For safe traffic operation, vertical clearance between the crown of the carriageway and

lowest part of overhang of the tree available across the roadway shall conform to the standards laid down in IRC: SP: 21. The pit size, fencing, watering, and manuring requirements shall also conform to the above standard. The use of pesticides shall be avoided or minimized to the extent possible. Planting shall be such that it does not obstruct the visibility of traffic from any side and shall be pleasing in appearance.

#### **b. Aquatic Ecology**

151. Temporary sedimentation and water quality deterioration is expected from the project during the construction stage. Accidental spill of materials, chemicals, and fuels may also deteriorate receiving water quality and hence the aquatic ecology.

152. **Mitigation measures.** It is proposed to undertake construction activities near water bodies during summer season when most of water bodies are practically dry. Best construction practices shall be adopted to prevent increase in siltation level of the water. All precautionary efforts shall be taken as given under surface water section to prevent accidental damage of water quality.

### **7. Socio-Economic Impact**

153. Morar Chitora Road project will have both positive and negative impact on socioeconomic aspects as narrated below.

#### **a. Positive Impacts**

154. Economic activities supporting transport like fuel stations, automotive repair shops, lodging, and restaurants are expected to increase with increase of traffic and induced development of the area. The improved road will provide better connectivity which will result in (i) Reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, educational and other infrastructural facilities (iv) enhanced tourism activities in the area and state which in many terms will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

#### **b. Anticipated Negative Impacts**

155. The other impacts are expected due to sitting and operation of construction camp during construction.

### **8. Labor and Construction Camp**

156. Construction workers expected to be about 150 per day per package are likely to be employed during construction. Most of the workers will be employed locally. However, some may be from nearby areas. This will cause additional burden on local resources. However, this impact will be temporary and will not have the potential for changes in the demographic scenarios of the area. The outside workers will be housed at the construction camp, which is expected to one per package. Poor sitting and improper management of construction camp may lead to several adverse impacts on environment viz. (i) loss of vegetation due to use of wood as fuel source for cooking (ii) deterioration in nearby surface water bodies' quality (iii) compaction and contamination of soil due to uncontrolled disposal of solid waste (iv) Poor sanitation may result to transmission of communicable diseases among the workers and the host communities. This includes the possible spread of sexually transmitted disease, diseases from improper handling

and supply of foodstuffs, poor water supply, and insect-borne diseases.

157. **Mitigation Measures.** Construction camp shall be sited at such locations so as to utilize the existing infrastructure. No productive land should be utilized for construction camp. All sites must be graded, ditched and rendered free from depressions to avoid water stagnation. Accommodation and ancillary facilities including recreational facility for workers shall be erected and maintained to standards and scales approved by the resident engineer. All camps should maintain minimum distance of 1000 m from habitation and water bodies.

158. All construction camps shall be provided sanitary latrines and urinals with provision of septic tanks attached with soak pits or mobile toilets fitted with anaerobic digestion system. Storm water drains shall be provided for the flow of used water outside the camp. Drains and ditches shall be treated with bleaching powder on a regular basis. Garbage bins must be provided in the camp and regularly emptied and disposed of in a hygienic manner. LPG cylinders shall be provided as fuel source for cooking to avoid any tree cutting.

159. The Contractor will ensure the following:

- The good health and hygiene of all workers to prevent sickness and epidemics. These include the HIV/AIDS prevention program to reduce the risk and transfer of HIV virus between and among the workers and community, promote early diagnosis and assist affected individuals. Activities under the program include monthly information, education, and consultation communication campaigns to workers, drivers, delivery crew, and communities on the risk, dangers, and impacts of STD and HIV/AIDS. Contractor will also provide first aid facilities at the camp and organize regular health check-up camps as well.
- Availability of safe drinking water and sufficient supply of suitable and hygienically prepared food at reasonable price is available to the workers.
- Adoption of all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides, which should comply with local regulations.
- Prohibition on supply or availability of alcoholic liquor or prohibited drugs at the camp.
- Regular health check-up and immunization camps shall also be organized for the workers and nearby population.

## 12. Safety

160. The road construction activities may create various unsafe situations. This will require attention to the following safety aspects viz. (i) safety of construction workers, (ii) safety of road users including pedestrians and cyclists (iii) safety to cattle; (iv) safety of local community (iv) unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during design and construction stage and (v) conduct of safety audit.

161. **Mitigation measures.** During the construction phase, contractors shall be required to adopt and maintain safe working practices. Internationally accepted and widely used safety procedures should be followed during (i) road works (ii) handling of large construction equipment and machineries, (iii) handling of chemicals and hazardous materials and inflammable substances (iii) welding and (iv) electrical works. Contractor shall also arrange required PPEs for workers, first aid and firefighting equipment at construction sites. Contractor will also prepare an emergency preparedness plan, which shall be duly approved by EA to respond to any emergency and unsafe conditions. To avoid disruption of the existing traffic due to construction activities,

comprehensive traffic management plan shall be drawn up by the contractor.

162. Retro- Reflectorized traffic caution signs shall be used during construction. Regular safety audit or periodic review shall be made to assess the effectiveness of safety measures adopted during construction.

163. Adequate caution signage near school, sensitive locations, speed control, caution notes shall be fixed at appropriate locations. These shall be preferably of PCC with Retro- reflective paints. Steel base signage shall be avoided to prevent theft of the same. Crash barrier shall also be installed at appropriate locations particularly near school to provide safety to school children. Provision of speed breakers shall be made near schools and religious places.

### **C. Impacts during operation stage**

164. The subproject road is located in vast open agricultural land, which will provide adequate dispersion of gaseous emission from vehicle. Further, proposed plantation will ameliorate/enhance the micro climate. No adverse climatic changes/impacts are anticipated during operation stage other than GHG (CO<sub>2</sub>) emission due to increased traffic, which would be largely offset with better fuel efficiency and reduced vehicle idling due to improved road conditions.

#### **1. Air Quality**

165. Vehicular emissions will be the principle source of pollution during operation stage. The subproject road is mostly located in vast open agricultural land, which will provide adequate dispersion dynamics of gaseous pollutants. Moreover, majority of the traffic on the subproject will be diverted traffic from the existing highways.

166. **Mitigation Measures.** Plantation is one of the preferred solutions to check air pollution. Plants serve as a sink for pollutants, reduce the spread of dust. Tree plantation along roadsides and other places shall include pollution absorbent species. Awareness signboards shall be installed at prominent location to educate drivers for good driving and vehicle maintenance practices.

#### **2. Noise**

167. During the operational Stage, movement of traffic will be the prime source of noise. Traffic congestion and pedestrian interferences increase the use of horns. This may result in increased noise levels at nearby schools and religious places.

168. **Mitigation Measures.** Effective traffic management and good riding conditions shall be maintained to reduce the noise level throughout the stretch. Speed limitation and honking restrictions may be enforced near sensitive locations. Increased plantation along the road and boundary wall will also work as noise barrier. Since most of the schools buildings are away from the road, therefore impact of noise is expected to be insignificant. Since improved road conditions and multi-layered plantation will be helpful in attenuation of noise levels, the effectiveness of these measures shall be monitored. If noise levels are still found higher than the prescribed ambient noise standards at these sensitive receptors, adequate noise barrier shall be fixed.

#### **3. Land and Soil**

169. The better access can lead to conversion of agriculture land for residential and commercial purposes close to roads and especially in rural and urban area.

170. **Mitigation Measures.** The EA may explore the feasibility of restricting about 30 m area either side of the road as no development zone on the line restriction are imposed for National Highways authority of India.

#### **4. Soil Erosion**

171. No impact on soil is anticipated during operation phase of the project except bridge approaches where unexpected rainfall may erode the embankment formation and deterioration of borrow areas if not rehabilitated properly.

172. **Mitigation measures.** Embankment stabilization shall be check periodically during operation stage and suitable stabilization measures shall be taken wherever any erosion is identified. Borrow areas will also be rehabilitated following the guidelines given at Appendix 2.

#### **5. Groundwater**

173. No impact is anticipated on groundwater due to the project during operation phase of the project hence, no specific mitigation measure is proposed.

#### **6. Surface Water Bodies**

174. No major or long-term impact is anticipated during the operation phase on the surface water bodies due to the project implementation activities. Oil contaminated runoff from the road during monsoon will have minimal impacts considering their low concentration.

#### **7. Hydrology and Drainage**

175. Regular removal/cleaning of deposited silt shall be done from drainage channels and outlet points before the monsoon season. Rejuvenation of the drainage system by removing encroachments/ congestions will be regularly conducted.

#### **8. Impact on Biological Environment**

##### **a. Terrestrial ecology**

176. Positive impacts on terrestrial ecology are expected during the project operation stage due to the increase in vegetation and landscaping along the road. The project will coordinate with the local communities to maintain and enhance the trees planted along the state road. "No adverse impact is anticipated during operation stage except accidental damages or absence of proper tree management.

177. **Mitigation Measures.** Arrangement shall be made to ensure survivability of the tree plantation. The tree survivability audit shall also be conducted at least once in a year to assess the effectiveness of the programme.

##### **b. Aquatic Ecology**

178. No impact is envisaged during operation phase of the project and hence no mitigation proposed. However, periodic surveillance shall be conducted to check erosion and siltation in major water bodies.

## **9. Community Health and Safety**

179. During operation phase, the projected increase in the number of motorized road users traveling at higher speeds also increases the chances of injuries and fatalities from road crashes.

180. **Mitigation Measures.** Adequate caution signage near school, sensitive locations, speed control, caution notes shall be fixed at appropriate locations. These shall be preferably of PCC with Retro-reflective paints. Steel base signage shall be avoided to prevent theft of the same. Crash barrier shall also be installed at appropriate locations particularly near school to provide safety to school children. Provision of speed breakers shall be made near schools and religious places.

## **D. Climate Change Impacts and Risks**

### **1. Climate Change Mitigation**

181. The Transport Emissions Evaluation Model for Projects (TEEMP)<sup>3</sup> developed by Clean Air Asia<sup>4</sup> was utilized to assess the CO<sub>2</sub> gross emissions with and without the project improvements. The main improvement from the project that was considered for the model is better surface roughness which was translated into impacts on traffic speed and hence fuel consumption. The model also allows for the inclusion of impacts related to traffic congestion with and without project through provisions for inserting data on the traffic numbers, lane width, number of lanes and volume/capacity saturation limit.

182. Information that was fed into the model for projecting the CO<sub>2</sub> emissions was:

- i. The road will strengthen 29.40 km stretch of the project road connecting with major district roads;
- ii. The existing road having intermediate lane with a 5.5 m carriageway width will be improved and maintained to the same number of lanes and carriageway width with asphalt concrete surface;
- iii. Road roughness will decrease from the general condition of 16 m/km to 2.5 m/km;
- iv. Construction will take place over a period of 12 months in 2015 and road operations will begin in 2016.
- v. The design life of the road is 20 years. Hence the midpoint of the design life is after 10 years or 2025.
- vi. Other improvements include the repair or reconstruction of damaged
- vii. Culverts, introduction of lined longitudinal and cross drains for the road and removal of irregularities on the existing vertical profile and road safety appurtenances.

183. The traffic forecast data was taken from the traffic studies and economic analysis for the road disaggregated into vehicle types and annual average daily traffic. Key vehicle categories considered for the road and the annual average daily traffic in 2014 (baseline scenario) without project and in 2033 with the project is given in the table below.



**Table 30: Annual Average Daily Traffic for different vehicle categories**

<b>Vehicle category</b>	<b>2014 (without the project)</b>	<b>(with project)</b>
2-wheeler	1945	5380
3-wheeler/auto rickshaw	194	538
Car/jeep/taxi/van	459	1271
Light Commercial Vehicle	174	483
Minibus and standard bus	30	74
Heavy commercial vehicle	300	826
<b>TOTAL</b>	<b>3102</b>	<b>7572</b>

184. The volume/capacity saturation limit was taken at 2.0 or twice the designed road capacity and beyond which traffic congestion will result to less than optimum travel speed and increase in fuel consumption. Emission factors were taken from the CBCB/MOEF (2008) Draft Report on Emission Factor Development for Indian Vehicles, the Automotive Research Association of India, and C. Reynolds et.al (2011) Climate and Health Relevant Emissions from in-Use Indian for three-wheelers rickshaw as follows:

**Table 31: CO2 Emission Factors**

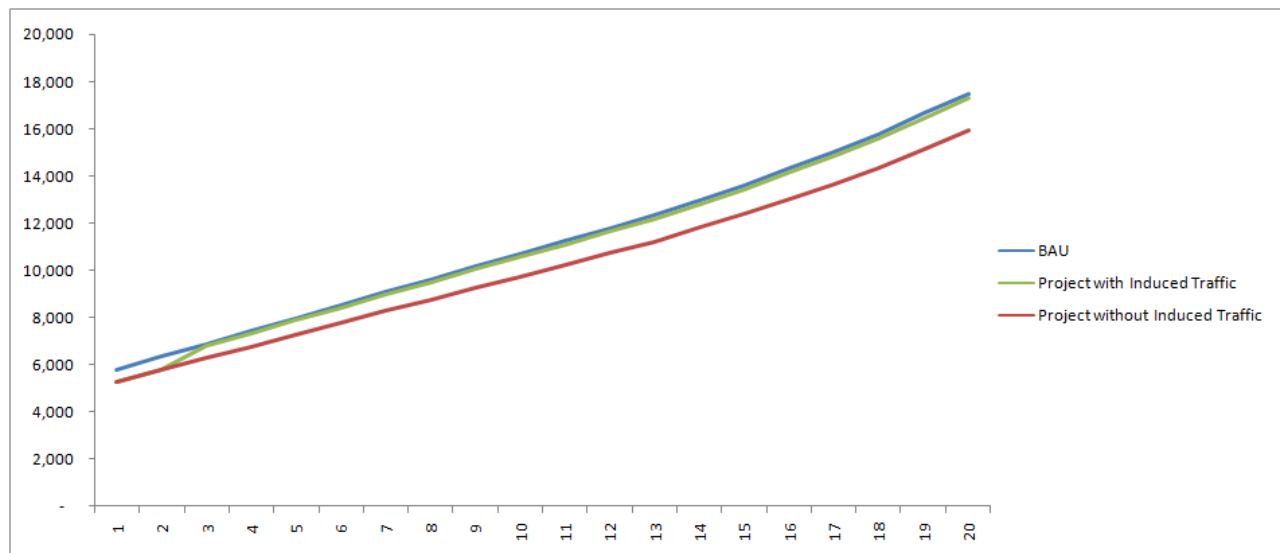
<b>Vehicle Type</b>	<b>Gas/Petrol</b>	<b>Diesel</b>
2-Wheel	2.28 kg/l	
3-Wheel		2.63 kg/l
Cars/bus/bus	2.59 kg/l	2.68 kg/l
LCV		3.21 kg/l
Bus		3.61
HCV		3.50

185. Emissions from road construction were also calculated using estimates of the total quantity of materials that will be used to rehabilitate the road which is 105 tons of steel, 880 tons of cement and 1750 tons of bitumen.

186. **Estimated carbon emissions.** The proposed road upgrading resulting to surface roughness and road capacity improvements have implications in CO2 emissions. Improved roughness results to higher speed and lesser emissions while increase road users increases emissions. These factors are further affected by traffic congestion once the volume/capacity saturation limit.

187. CO2 emissions will also result from the processing and manufacturing of raw materials needed to upgrade the road and in the case of Morar Chitora, a total of 880 tons of cement, 105 tons of steel, and 1750 tons of bitumen will be needed. These construction materials will produce an estimated 1,300 tons of CO2.

188. The Figure below presents the impacts on emissions due to road improvements. Total CO2 emission at business-as-usual scenario was estimated at 29,864 tons for the entire project life and without- and with- induced traffic are 26,700 and 32,692 tons respectively. These values are below the 100,000 tons per year threshold set in the ADB SPS 2009. Therefore it is not necessary to implement options to reduce or offset CO2 emissions under the project.



**Figure 10: Plot of CO2 Emissions Considering Improvement in Surface Roughness and Road Capacity**

189. The design life of the roads is 20 years. The project's CO2 emission intensity indicators are provided in the succeeding Table 32.

**Table 32: Project CO2 Emissions Intensity Indicators**

Details	CO2		
	Business-As-Usual	Project (without Induced Traffic)	Project (with Induced Traffic)
tons/km	1,586.79	1,284.49	1,541.90
tons/year	2,190.79	2,247.62	3,050.74
tons/km/year	79.34	81.22	86.10
g/pkm	87.58	88.51	88.47
g/tkm	45.46	45.29	45.18

## 2. Climate Risks and Adaptation needs

190. Climate risks were identified following both top down and bottom up approaches. Under the top down approach changes of key climate parameters, mainly temperature and precipitation were projected for 2050 using an ensemble of Global Climate Models (GCMs). Given the projected variations of temperature and precipitation the project roads were screened for 9 types of climate risks:

- Landslide triggered by increased precipitation
- Fire
- Flood
- Drought
- Tsunami
- Cyclone wind
- Cyclone surge
- Sea level rise
- Coastal erosion

191. Climate risk maps based on information from the GCMs were created for the project area

using Geographic Information System (GIS) maps. After overlaying the road locations on the climate risk maps low to medium risks identified for the project roads were flooding, landslides triggered by precipitation.

192. The overall climate change risk level identified from the above exercise is low. The key risk identified is flooding (increased storminess). Bridges and road embankments are the main project components that will be prone to flooding. Increase in temperature may also affect road safety.

193. Under the bottom up approach the flood prone areas in the project road were identified based on field surveys for the engineering design.

194. Key engineering measures taken to address the risk of flooding in the design are: increase in road embankment height in flood prone areas/sections, improvement and provision of lined longitudinal and cross drains and new culverts, improvement and new construction of minor and major bridges. Bridge heights have been designed to have a height of 0.6m above HFL for minor bridges and 0.9m above HFL for major bridges. Flood return period of 50 years for minor bridges and 100 years for major bridges have been considered.

## **E. Cumulative and Induced Impacts**

195. According to the ADB Environment Safeguards Sourcebook<sup>5</sup> cumulative impact is described as: "The combination of multiple impacts from existing projects, the proposed project, and anticipated future projects that may result in significant adverse and/or beneficial impacts that cannot be expected in the case of a stand-alone project." The sourcebook also describes induced impacts as: "Adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused by a project, which may occur at later or at a different location.

196. Economic activities supporting transport like fuel stations, automotive repair shops, lodging, and restaurants are expected to increase with increase of traffic and induce development in the project area. The improved road will provide better connectivity and result in (i) Reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, educational and other infrastructural facilities (iv) enhanced tourism activities in the area and state which in many terms will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

197. In terms of environment safeguard issues the improved road surface is expected to result in less dust and noise due to traffic plying on the damaged roads. However, the increased traffic due to the improved road will generate more air pollution due to vehicle exhaust and noise. The smoother road conditions will also result in increase of traffic speeds, hence creating more risks for accidents amongst traffic users as well as the local communities in the project area.

198. For addressing the impacts of air pollution and noise, regular maintenance of the road surface, maintenance and monitoring of newly planted trees and installation of noise barriers where necessary have been included in the EMP for implementation during operation stage. For addressing safety related impacts, regular maintenance of the road furniture include safety.

199. Information on future development projects along the project road was not available. Hence, it is difficult to assess cumulative impacts from other projects which may get implemented in the project area.

## VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

200. Meaningful consultations were held early and throughout the project development stage to allow the incorporation of relevant views of the stakeholders in the final project design, mitigation measures, implementation issues, and enhance the distribution of benefits. All the five principles of information dissemination, information solicitation, integration, co-ordination, and engagement into dialogue were incorporated in the consultation process. The analysis of environmental impacts likely from the project was strengthened and modified based on opinions of all those consulted, especially in the micro level by setting up dialogues with the village people from whom information on site facts and prevailing conditions were collected. The requirement of public consultation during the implementation of the project has been proposed as part of the mitigation plan.

### A. Objectives of the Public Consultation:

201. Stakeholder's consultations were held with intent to understand their concerns, apprehensions, overall opinion and solicit recommendations to improve project design and implementation. Informal meetings, interviews were organized covering the entire project design stage. Consultations provide affected people a platform to ensure incorporation of their concerns in the decision making process and foster co-operation among officers of MPRDC, the community and the stakeholders to achieve a cordial working relationship for smooth implementation of the project. It inculcates the sense of belongingness in the public about the project.

202. The discussions were designed to receive maximum inputs from the participants regarding their acceptability and environmental concerns arising out of the sub-project. They were given the brief outline of the project to which their opinions was required particularly in identifying and mitigating any potential adverse impact.

### B. Methodology for Consultations

203. Consultation with the stakeholders, beneficiaries, and community leaders were carried out using standard structured questionnaires as well as unstructured questionnaires. Questionnaire survey/ discussions were designed to obtain background information and details of general environmental issues that concern people in the project area. In addition, environmental issues were discussed with relevant organizations, government officials, beneficiaries, community leaders and experts. In addition, personal discussions with officials, on site discussion with affected stakeholders, and reconnaissance visits have also been made to the project area. Public consultation has been carried out at four locations during initial surveys as shown in table 33. The total numbers of participants in the consultations are 59.

**Table 33: List of Public consultation and Date**

Sr. No.	Village/Town Name	Date of Consultation	Chainage	No of participants		
				M	F	T
1	Berja	10/05/2014	11+000	8	2	10
2	Khureri	10/05/2014	20+300	9	3	12

### 1. Project Stakeholders

204. All types of stakeholders were identified to ensure as wide coverage as possible.

- Residents, shopkeepers and business people who live and work along the road specially the project affected persons
- All type of road users/commuters
- Executing Agency, Construction Supervision Consultant and Implementing NGOs
- Other government institutions whose remit includes areas or issues affected by the project (state environment and forest department, Pollution Control Board (PCB), Irrigation Department, Public Health Engineering (PHED) Department
- The beneficiary community in general

## **2. Consultation with Government Departments**

205. Various officials consulted during IEE preparation included PWD Officials, State pollution control board for Air, Noise and Water quality information, IMD for the climatic data, statistical officer for Population and demographic profile, Panchyat department for village level information, Survey of India for the toposheet requirement, Revenue department for the land record information, PHQ officers for hand pump relocation and quality assessment, MPSEB offices for electric pole shifting etc.

206. These departments helped to provide various project related data and information which helped preparation of reports and data analysis.

## **3. Consultation with Local People and Beneficiaries**

207. The informal consultation generally started with explaining the project, followed by an explanation to potential impacts. Participant's views were gathered with regard to all aspects of the environment which may have direct or indirect impact on local people. Key Issues discussed are:

- Awareness and extent of the project and development components;
- Benefits of the project for the economic and social upliftment of community;
- Labour availability in the project area or requirement of outside labour involvement;
- Local disturbances due to project construction work;
- Necessity of tree felling etc. at project sites;
- Impact on water bodies, water logging and drainage problem if any;
- Environment and health
- Flora and fauna of the project area
- Socio-economic standing of the local people

208. The project has immense acceptability among the local people. They perceive that in addition to providing all weather connectivity, the subproject road will bring positive socioeconomic changes in the area. Local people mainly discussed on the issues related to flooding, rehabilitation, resettlement, and road safety issues. The list of participants views and outcome of the consultations have been summarized in Table 34.

209. The Details of Participants and Public Consultation photographs are attached in Appendix 8. In addition information on the GRM procedures and formats in local language i.e. Hindi was shared with the local people as provided in Appendix-9.

**Table 34: Outcome of the Consultations**

<b>S. No.</b>	<b>Date and Location</b>	<b>Issues Discussed</b>	<b>Measures to be Taken</b>	<b>Participant</b>
1.	10.05.2014 Berja Village	<ul style="list-style-type: none"> <li>• People are facing acute problem related to poor condition of the road.</li> <li>• Where the road passing through the settlements there should be provision of Speed breakers</li> </ul>	<ul style="list-style-type: none"> <li>• Proposed widening and strengthening of the road will provide better level of services in terms of improved riding quality and smooth traffic flow.</li> </ul>	Total-10 Participant s Local villagers
2.	10.05.2014 Khureri Village	<ul style="list-style-type: none"> <li>• Suggestion viz. (i) design shall take into hydrological aspects into consideration (ii) minimal loss of structures (iii) adequate resettlement and rehabilitation measures including provision of jobs to land losers</li> <li>• Local people informed that present road in some sections of this area submerges during normal rainfall also. Adequate measures shall be taken to avoid water logging during normal rainfall.</li> <li>• They suggested that existing alignment shall also be improved and maintained properly</li> <li>• Stress was put by the community on proper drainage system and sanitation as people face these problems to the extreme in rainy season and become more prone to diseases like malaria, diarrhea etc.</li> <li>• Road safety aspect was also recommended by some people</li> </ul>	<ul style="list-style-type: none"> <li>• There will be considerable reduction in the number of accident and level of pollution</li> <li>• Accessibility to social health and educational infrastructure will increase through all-weather road.</li> <li>• Generation of employment during construction phase of the road.</li> <li>• The discussion generate considerable awareness of the project</li> <li>• As the proposed road shall be widened one, it shall provide an efficient public transportation system besides ensuring reduction in congestion level</li> <li>• The nontitle holders shall also be compensated as per ADB guidelines.</li> <li>• Drainage system is mention in built-up area and earthen drainage for rural area.</li> <li>• Road safety features like traffic signs, Overhead Sign Boards, Road Illumination, Delineators, pavement marking, pedestrian path and rumble strips has been included in the design.</li> </ul>	Total – 12 participant s Local villagers

210. Most of the people interviewed were well aware of the environmental conditions in and around their villages. A major percentage was ignorant about any deterioration in the air and noise quality due to expansion of existing highway. However, their major concern was related to the drain blockage and stagnant water at dig holes. The villagers are quite enthusiastic about the proposed project as it will give fillip to rural economy and present them many employment opportunities during construction of project road. Overall positive approach towards the project is observed.

### C. Results of Consultation with Local People

211. Most of the people interviewed strongly support the project. The people living in the entire project area expect the different project elements to facilitate transport, employment, tourism, boost economic development and thereby provide direct, or indirect, benefits to them. In order to access the existing environment and likely impacts on surrounding population, an interview survey was carried out. A priority of the population was interviewed through a designed questionnaire. Precaution has been exercised during the survey to ensure that the priority interviewed is truly representative of the affected groups and the questions are worded so as not to generate a bias response.

212. It is observed from the interview survey that there is increased environmental awareness among the people. It can also be seen from Table 36 that about 90 percent of the persons are in the opinion that an environmental condition of the area is good. About 85 percent of the people are agreed that the quality of air, in the area is good; whereas, only about 5 to 10 percent responded feel that the environmental quality is being deteriorated. Poor road condition and vehicular emissions are the major sources they feel responsible for this. People are unaware about presence of archaeological, historical and cultural sites. There is no major history of natural disasters in the region and local people have mixed response about natural disasters. Overall, the general environmental conditions in the region are good and people have increased environmental awareness. Table 35 shows the result of public opinion survey carried out in the region.

**Table 35: Peoples' Perception about Environmental Scenario**

Sr. No.	Question asked about	No. of people interviewed	Positive response (%)	Negative response (%)	No response (%)
1	Water quality of rivers, ponds, wells, and canals	22	95	5	0
2	Noise quality of the area	22	90	8	2
3	Air quality of the area	22	70	20	10
4	Archaeological sites	22	60	0	40
5	Natural disaster	22	50	20	30
6	Rare species of animals and birds found	22	20	80	0
7	Cultural sites i.e. market, Melas	22	90	5	5

### D. Conclusion and Recommendation

213. Overall, most of the people interviewed strongly support the project. The people living in the entire project area expect the different project elements to facilitate transport, employment, tourism, boost economic development and thereby provide direct, or indirect, benefits to them. Construction camps may, however, put stress on local resources and the infrastructure in nearby communities. In addition, local people raised construction-process related grievances with the workers. This sometimes leads to aggression between residents and migrant workers. To prevent such problems, the contractor should provide the construction camps with facilities such as proper housing, health care clinics, proper drinking water and timely payment. The use of local laborers during the construction will, of course, increase benefits to local peoples and minimize these problems. Wherever possible, such people should be employed.

214. The following are the Consultants' initial findings in regard to likely positive and negative

impacts.

**Positive Impacts:**

- The improved road: will reduce travel times, fuel consumption and emissions from base traffic volumes
- Drainage conditions will be considerably improved: this because of the provision of improved side drains, culverts and causeways;
- Economic development and access will be stimulated
- Health, Agricultural and Education facility will improve.

**Negative Impacts:**

- Few tree loss which reduce the green cover but simultaneously plantation will take place to improve the green cover.
- Minor deteriorations in the present minimum levels of air, water and noise quality may be expected during construction- but this should be short-term and localized in order to minimize the impacts, the mitigation measures recommended
- During construction the traffic will slow and messy.

215. On the basis of available information, field visits over the entire length of the project road, discussions with the project authorities; other discussions amongst the project team, NGOs, local people and various governmental officials, it has been concluded that overall:

- All elements of the projects will be beneficial;
- All negative impacts, during and post construction, including those deemed “significant” can be properly mitigated; and
- No comprehensive, broad, diverse or irreversible adverse impacts have been identified.



## **VII. ENVIRONMENTAL MANAGEMENT PLAN AND GRIEVANCE REDRESS MECHANISM**

216. The environmental impacts associated with any development project are eliminated or minimized to an acceptable level through development of appropriate mitigation measures based on most suitable techno-economic options. The Environmental Management Plan (EMP) is a well-established tool to ensure effective implementation of the recommended mitigations measures throughout the subsequent project development stages. The EMP also ensures that the positive impacts are conserved and enhanced. An EMP provides location and time specific actions to be taken with defined responsibility. It also provides measures for institutional strengthening and effectiveness assessment through defined monitoring plan, reporting and corrective & preventive action planning.

### **A. Environmental Management Plan**

217. The Morar - Chitora Road specific Environment Management Plan has been formulated which consists of a set of mitigation; monitoring and institutional measures applicable to design, construction and operation stages of the project (Appendix 3). The components of this EMP includes (i) mitigation of potentially adverse impacts (ii) monitoring of impacts and mitigation measures during project implementation and operation (iii) institutional capacity building and training (iii) compliance to statutory requirements (iv) integration of EMP with project planning, design, construction and operation.

### **B. EMP Implementation Schedule**

218. The EMP provided in Appendix 3 provides measures. However, specific mention is made for location specific measures. The package specific EMP costs are separately assessed. These EMP will form part of bidding document as well. The construction period for Morar Chitora Road is considered as 24 months from the date of start of construction.

### **C. Emergency Response Plan**

219. Assessment of nature, type and extent of project activities establishes that this project may have only one environmental emergency i.e. accidents on paved roads and consequent spillage due to damage of oil tank of the vehicle. It is suggested to develop a communication and response system to minimize the response time. The project authorities shall be prepared to counteract against such emergency either by developing in-house capabilities or by associating with any competent agency.

### **D. Environmental Monitoring Plan (EMoP)**

220. The purpose of the environmental monitoring program is to ensure that the envisaged objectives of the project are achieved and result in desired benefits. To ensure the effective implementation of the mitigation measures and Environmental Management Plan (EMP), it is essential that an effective monitoring program be designed and carried out. The board objectives of environmental monitoring plan are:

- To evaluate the performance of mitigation measure proposed in the EMP,
- To evaluate the adequacy of Environmental Assessment
- To suggest improvements in management plan, if required,
- To assess change in environmental quality,

221. A comprehensive monitoring plan has been prepared for all stages of the project and provided as Appendix 4. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost and responsibility for implementation and supervision. The monitoring programme is designed for monitoring during construction and operation stages with details on budget and responsible agencies:

Construction Stage: (three years of construction period)

- Monitoring to be carried out by construction supervision consultant (CSC). The costs to form part of LEC budget.
- Six Monthly monitoring by external agency to be arranged by PIU ADB from Project cost budget. This report will be directly submitted by agency to MPRDC.
- Monitoring Programme and schedule for Key Performance Indicators (Physical, biological and environmental management components identified as of particular significance) are given in the following section:

### **1. Ambient Air Quality (AAQ) Monitoring**

222. Ambient air quality parameters recommended for road transportation developments are Fine Particular Matter (PM<sub>2.5</sub>), Respirable Particular Matter (PM<sub>10</sub>), Carbon Monoxide (CO), Oxide of Nitrogen (NO<sub>x</sub>) and Sulphur Dioxide (SO<sub>2</sub>). These are to be monitored at designated locations starting from the commencement of construction activities. Data should be generated twice in a week at all identified locations in accordance to the National Ambient Air Quantity Standards (Appendix 5). The locations and environmental parameters to be monitored are detailed out in the Environmental Monitoring Plan (Appendix 4).

### **2. Water Quality Monitoring**

223. The physical and chemical parameters recommended for analysis of water quality relevant to road development project are pH, total solids, total dissolved solids, total suspended solids, and oil & grease. The monitoring of the water quality is to be carried out at all identified locations in accordance to the Indian Standard Drinking Water Specification – IS 10500 (Appendix 6). The locations, duration and the pollution parameters to be monitored are detailed in the Environmental Monitoring Plan (Appendix 4).

### **3. Noise Levels Monitoring**

224. The measurements for monitoring noise levels would be carried out at designated locations in accordance to the ambient Noise Standards formulated by Ministry of Environment and Forests (MoEF) as given (Appendix 7). Noise level would be monitored on a twenty-four hours basis. Noise should be recorded at “A” weighted frequency using a slow time response mode of the measuring instrument. The measurement location, duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan (Appendix 4).

### **4. Tree Plantation**

225. The 75% survival rate of re-plantation shall be monitored for three years of the operation phase. If the survival rate is found below 75%, additional compensatory plantation shall be carried out by agency responsible for plantation and maintenance. The survival rate monitoring shall be again taken up after 1 year again. This cycle should continue until the 75% survival rate is achieved. Since tree plantation would be made through forest department, monitoring would be

carried out through MPRDC.

## **5. Soil Erosion and Drainage Congestion**

226. No significant soil erosion problem is anticipated due to the project either in the construction phase or in the operation phase. However, in the construction phase, some localized soil erosion may be noticed owing to construction activities. However, if soil erosion is noticed during construction and operation phase, the corrective action shall be initiated and frequency of check be increased to assess the tendency of occurrence.

### **E. Institutional Setting and Proposed Implementation Arrangement**

227. The Executing Agency for the project will be GoMP through MPRDC. MPRDC is wholly owned by GoMP and has been equipped with adequate capacity to implement the project. The implementation arrangements basically follow the ongoing MPSRSP-II. A General Manager (GM) at MPRDC headquarter has been designated as person in charge for project implementation. The Environmental and Social cell (ESC) at MPRDC headquarters, reporting to the General Manager, will be responsible for ensuring compliance with environmental and social safeguards of project roads. This cell currently has only one officer to cover both social and environment safeguards. To support this officer, two more social safeguard officers and one environmental safeguard officer will be appointed or recruited. This will allow the ESC to have a total of four officers, 2 for social safeguards and 2 for environment safeguards.

228. MPRDC has ten division offices (Bhopal, Jabalpur, Sagar, Gwalior I, Gwalior 2, Ujjain , Indore I, Indore II, Rewa I, and Rewa II) acting as Project Implementation Units (PIUs). Each PIU is headed by a Divisional Manager (Tech.) who is responsible for project implementation at the field level. Each PIU will be responsible for one to two contracts depending on the location of the sub projects, and one project manager will be assigned for each contract package. The project manager will be delegated adequate technical and administrative authority for expeditious project implementation. In each PIU one of the Assistant Engineers or Managers under the Divisional Manager will be appointed as the social and environment safeguards focal person. MPRDC will engage Construction Supervision Consultants to act as the engineer for the construction contracts. An environmental specialist from the LEC will provide technical support to MPRDC and the PIU for implementation of environment safeguards under the project. The engineer will be responsible for approving plans, engineering drawings, release of payments to contractor etc. while the LEC environmental specialist or environmental officer will be responsible for providing recommendations to “the engineer” for approving activities specific to environment safeguards. Environmental awareness and EMP implementation training will be held for MPRDC staff, contractors and LEC.

229. Six monthly monitoring reports will be prepared by the LEC environmental specialist to report on compliance with construction contracts, effectiveness of mitigation measures, and complaints (also known as project performance monitoring), and the state and health of nearby environmental resources (also known as ambient environmental monitoring).

230. Monitoring during operation shall be conducted for five years (once a year basis) as part of LEC contract and budget as this project will have a five year performance based maintenance works to be implemented by the contractor. Thereafter it will be done on an as-needed basis depending on the design or change in project activity.

231. The detailed responsibilities of MPRDC, PIUs, CSC, Contractor, and ADB are provided:

**a. MPRDC's Responsibilities**

- Ensure that Project complies with ADB's SPS and GOI's laws and regulation
- Ensure that the project complies with all environment safeguard requirements as given in this EARF
- Prepare IEE reports including EMP as may be required and hire an environmental consultant as required
- Prepare the Rapid Environmental Assessment screening checklist and forward this checklist to ADB for evaluation and confirmation of the project category;
- Based on the confirmation of the environmental categorization of the subprojects, prepare TORs to conduct IEE studies including preparation of EMP and Environmental Monitoring Plan in accordance with the environmental policy principles and safeguard requirements under the ADB SPS;
- Ensure that the preparation of environmental studies will be completed with meaningful consultations with affected people and other concerned stakeholders, including civil society throughout the project preparation stages as required by the ADB SPS
- Undertake initial review of the IEE and EMP reports to ensure its compliance with the Government's and ADB's requirement;
- Review the budgetary needs for complying with the Government's and ADB's requirements on environment safeguards
- Obtain necessary consents or permissions (e.g. environment permission, forest clearance) from relevant Government Agencies to minimize risks to the environment and mitigate environmental impacts associated. Also ensure that all necessary regulatory clearances will be obtained prior to commencing any civil work of the subproject;
- Submit to ADB the final IEE including EMP reports with consent letter for disclosure of the report on the ADB website
- Ensure that the EMP which includes required mitigation measures and monitoring requirements forms part of bidding document after seeking concurrence from ADB. EMP items may be included in the Bill of Quantities (BOQ) as necessary. For example if a subproject is required to construct noise barriers, the costs will need to be included in the BOQ;
- Ensure that contractors have access to the IEE report including EMP of the subprojects;
- Organize training and awareness programs on implementation of environment safeguards for relevant staff of MPRDC, PIU, LEC and contractors
- Ensure that contractors understand their responsibilities to mitigate environmental problems associated with their construction activities
- Ensure and Monitor that the EMP including Environmental Monitoring Plan will be properly implemented;
- In case of unanticipated environmental impacts during project implementation stage arrange to prepare and implement an updated EMP to account for such impacts after seeking concurrence from ADB. The updating shall be carried out after due consultation with the stake holders;
- In case during project implementation a subproject needs to be realigned, review the environmental classification and revise accordingly, and identify whether supplementary IEE study is required. If it is required, prepare the TOR for undertaking supplementary IEE and hire an environment consultant to carry out the study;

- Ensure that construction workers work under safe and healthy working environment in accordance with the World Bank EHS guidelines relating to occupational health and safety;
- Ensure effective implementation of Grievance Redress Mechanism to address affected people's concerns and complaints, promptly, using understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people;
- Submit semi-annual monitoring reports for all sub-projects on the implementation of EMPs to ADB for disclosure on the ADB website.
- Ensure proper implementation of corrective action plan if identified in the monitoring report; and
- Disclose information as defined in this EARF.

#### **b. PIU Responsibilities**

- Ensure that Project complies with ADB's SPS and GOI's laws and regulations
- Ensure that the project complies with all environment safeguard requirements as given in this EARF
- Obtain necessary consents or permissions (e.g. forest clearance, no objection certificate) from relevant Government Agencies. Also ensure that all necessary regulatory clearances will be obtained prior to commencing any civil work of the subproject;
- Ensure that contractors have access to the IEE report including EMP of the subprojects;
- Ensure that contractors understand their responsibilities to mitigate environmental problems associated with their construction activities
- Participate in training and awareness programs on implementation of environment safeguards and organize further on the job or subject specific training for the contractor during project implementation as necessary with the support of the LEC environmental specialist
- Conduct regular on site monitoring to ensure proper implementation of the EMP including Environmental Monitoring Plan;
- Verify and approve monitoring checklists and/or reports that will be prepared and submitted by the LEC
- In case of unanticipated environmental impacts during project implementation stage, identify the need to prepare and implement an updated EMP to account for such impacts after seeking concurrence from ADB.
- Ensure that construction workers work under safe and healthy working environment in accordance with the World Bank EHS guidelines relating to occupational health and safety;
- Ensure effective implementation of Grievance Redress Mechanism in accordance with the steps given in figure 1 to address affected people's concerns and complaints, promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people;
- Ensure timely submission of semi-annual monitoring reports for all sub-projects on the implementation of EMPs to MPRDC for further submission to ADB for disclosure on the ADB website; and
- Ensure proper implementation of corrective action plan if identified in the monitoring report

#### **c. CSC Responsibilities**

- Ensure that Project complies with ADB's SPS and GOI's laws and regulations
- Ensure that the project complies with all environment safeguard requirements as given in this EARF
- Provide necessary technical advice and support to the PIU and/or contractor to obtain consents or permissions (e.g. forest clearance, no objection certificate) from relevant Government Agencies. Also ensure that all necessary regulatory clearances will be obtained prior to commencing any civil work of the subproject;
- Ensure that contractors have access to the IEE report including EMP of the subprojects;
- Ensure that contractors understand their responsibilities to mitigate environmental problems associated with their construction activities
- Closely coordinate and communicate with the contractor to facilitate implementation of all mitigation measures identified in EMP
- Conduct training and awareness programs on implementation of environment safeguards for MPRDC, PIU and the contractors during the pre-construction stage and further organize on the job or subject specific training for the contractor during project implementation as necessary
- Conduct regular on site monitoring to ensure proper implementation of the EMP including Environmental Monitoring Plan;
- Prepare monitoring checklists and/or reports based on the site monitoring and submit them to the PIU for approval .In case of unanticipated environmental impacts during project implementation stage, upon the advice from the PIU and/or MPRDC prepare an updated EMP to account for such impacts after seeking concurrence from ADB.
- Ensure that construction workers work under safe and healthy working environment;
- Facilitate effective implementation of the Grievance Redress Mechanism in accordance with the steps given in figure 1 to address affected people's concerns and complaints, promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people;
- Prepare semi-annual monitoring reports for all sub-projects on the implementation of EMPs for submission to PIU and MPRDC and further submission to ADB for disclosure on the ADB website

#### **d. Contractor's Responsibilities**

- Ensure that adequate budget provisions are made for implementing all mitigation measures specified in the EMP
- Participate in training and awareness programs on implementation of environment safeguards
- Identify further needs for conduction of on the job or subject specific training during project implementation by the LEC or MPRDC or PIU
- Obtain necessary environmental permission etc. from relevant agencies as specified by EARF for project road works, quarries, hot-mix plant etc. prior to commencement of civil works contracts
- Implement all mitigation measures as given in the EMP in the contract documents
- Ensure that all workers, site agents, including site supervisors and management participate in training sessions organized by the PIU, MPRDC or LEC.

- Ensure compliance with environmental statutory requirements and contractual obligations
- Respond promptly to grievances raised by the local community or any stakeholder and implement environmental corrective actions or additional environmental mitigation measures as necessary.
- Based on the results of EMP monitoring, cooperate with the PIU and LEC to implement environmental corrective actions and corrective action plans, as necessary.

**e. ADB's Responsibilities**

- Review REA checklist and endorse or modify the project classification proposed by the MPRDC;
- Review IEE reports, including this environmental assessment and review framework, and disclose draft and final reports through ADB's website as required;
- Issue subproject's approval based on the respective IEE reports;
- Monitor implementation of environment safeguard requirements under the project through due diligence missions;
- Provide assistance to MPRDC, if required, in carrying out its responsibilities for implementing environment safeguards and for building capacity for safeguard compliance;
- Review and approve semi-annual environmental monitoring reports submitted by MPRDC and disclose them on the ADB website
- Monitor MPRDC's commitments under EARF

**F. Institutional Capacity Building**

232. To ensure that all parties clearly understand their role and responsibilities for implementing environment safeguards under the project, the following training and awareness programme is proposed:

- Awareness programme on environmental issues associated with construction and improvement of road projects and legislative compliance requirements.
  - **Target audience:** designated engineers from field units, contractor's
  - **Faculty:** Environmental Expert and Environment Expert of CSC.
  - **No of Programmes:** Minimum one per contract package
- EMP and EMoP implementation requirements, its benefits and roles of different level and functions.
  - **Target audience:** designated engineers from field units, contractor's officials, and key workers, other officials of MPRDC associated for the project.
  - **Faculty:** EE and Environment Expert of CSC.
  - **No of Programmes:** Minimum one per contract package

**G. Grievance Redress Mechanism**

233. Grievances related to the implementation of the project, particularly regarding the environmental management plan will be acknowledged, evaluated, and responded to the complainant with corrective action proposed. The outcome shall also form part of six monthly compliances report to ADB. Complaints maybe lodged verbally directly to the contractor or LEC or PIU at the site level.

To the extent possible efforts will be made by the contractor, LEC or PIU to address these complaints immediately on site. Only those complaints that cannot be addressed immediately at the site level will be submitted to the Grievance Redress Committee (GRC). Necessary assistance for completing the complaint form or lodging a written complaint will be made to illiterate complainants by the respective receiver of the complaint. Grievance Redress Committee (GRCs) should be established at the MPRDC state level and PIU level to assure accessibility for APs .The GRCs are expected to resolve the grievances of the eligible persons within a stipulated time. The decision of the GRCs is binding, unless vacated by the court of law. The GRC will be constituted at MPRDC level and at the PIU level.

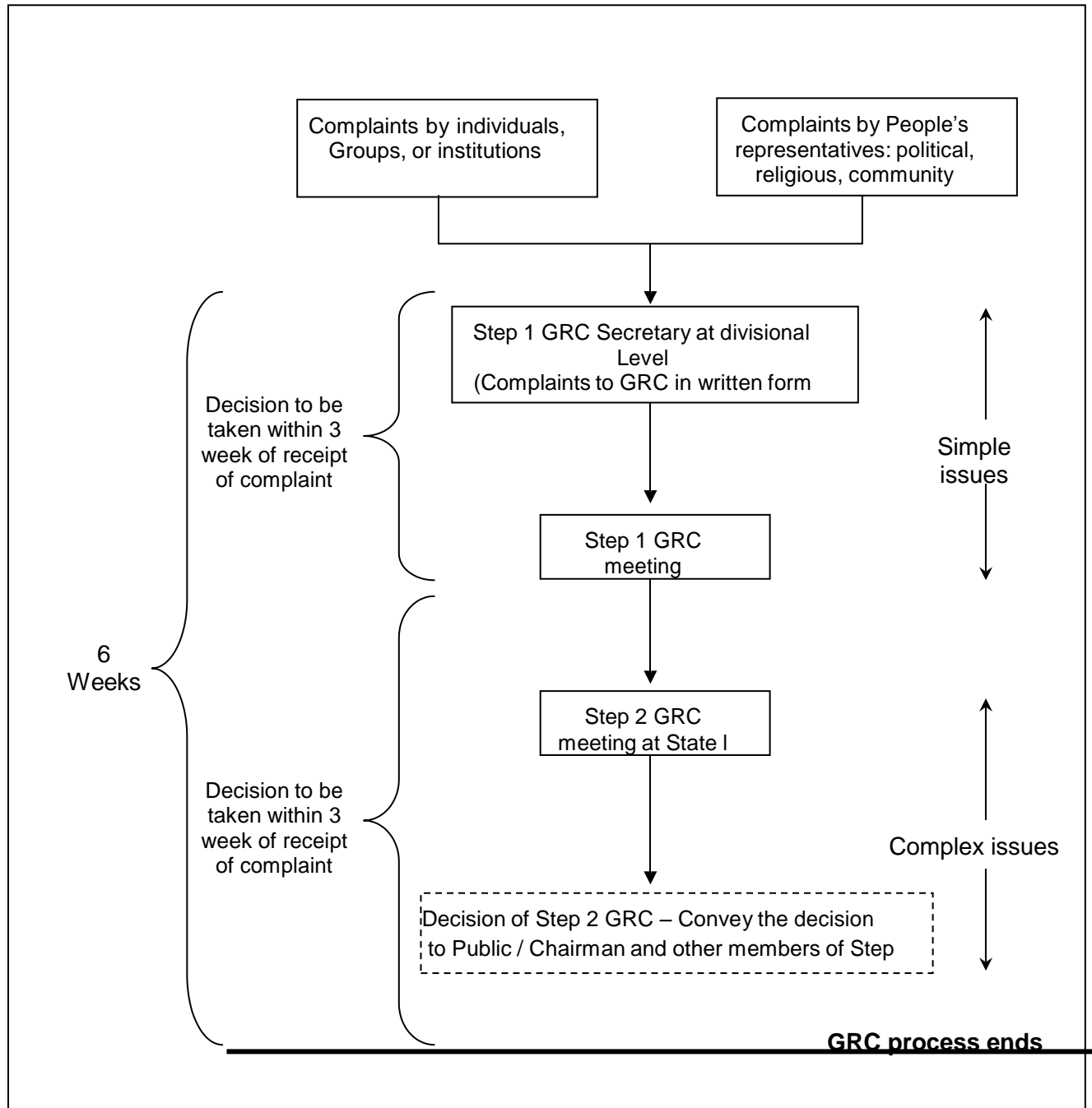
234. The State level GRC will comprise of the:-

- i. General Manager, MPRDC, Bhopal
- ii. Superintended Engineer, PWD, Bhopal
- iii. DGM, MPRDC, Bhopal
- iv. Manager (Environment & Social) , MPRDC, Bhopal

235. The PIU level GRC will comprise of the:-

- i. Divisional Manager
- ii. A representative from local NGOs or a local person of repute and standing in the society, elected representative from Zila Parisad /District Council.





## H. Cost for Environmental Management Plan, Training and Environmental Monitoring

236. The cost of environment management, monitoring & Training programme is given in Table 36.

**Table 36: Environment Management, Monitoring and Training Programme Costs**

	<b>Parameters / Components</b>	<b>Parameter to be monitored</b>	<b>Guidelines</b>	<b>Unit Cost (Rs)</b>	<b>Total Cost (Rs)</b>
1	Ambient Air Monitoring: 2 times in a year for 3 years or construction period at 2 sites & Five years during operation/ defect liability period ,once in a year at two sites	PM10, PM2.5, SO2, NOx & CO	High Volume priority's to be used and located 50 m from the construction site	9000	279000
2	Water Monitoring: 3 times in a year for 3 years or construction period At 2 locations	pH, BOD, COD, TDS, TSS, DO, Total coliform, Conductivity, Oil & Grease	Analyze as per the standard methods for examination of water and waste water	5000	120000
3	Noise Monitoring: 3 times in a year for 3 years or construction period , 2 locations & Five years during operation/ defect liability period ,once in a year at three sites	Noise levels on dB (A) scale	Using an integrated noise level meter kept at a distance of 15 m from the construction site	3000	93000
<b>Total Monitoring Cost (A)</b>					<b>492000</b>
4.	Opening, running and restoration of stone quarry/sand extraction pits along the entire project length		IRC Code of Practice and MoSRT&H manu	LS	Engineering Cost
5.	Gabion walls (above height 4 m) along elevated embankment		IRC Code of Practice and MoSRT&H manu	LS	Engineering Cost
6.	Dust Suppression along the entire project length Three tankers in a days for 240 Days		IRC Code of Practice and MoSRT&H manu	Rs 2000/- per day per tanker	1440000/--
7.	Solid Waste management during entire project Period (36 months)		As per MoEF guidelines	3000/ month	108000/-

8.	Erosion Control Measures (Turfing / Pitching / Seeding & Mulching) Provision of Cross drainage & side drainage structures General Borrow area management and maintenance of haul roads related to borrow areas Air/noise pollution control measures in construction equipment Management and disposal of scarified waste bituminous material Provision of Informatory Signs Bus shelters Construction of Speed Humps Management of quarries Redevelopment of Borrow Areas Construction Camp Management Costs Safety measures for workers	As per IRC Guidelines	Shall be included in contractor's quoted rates	Engineering Cost
9.	Training: Three training sessions during construction period.	As per modules developed by MPRDC	50000 per session	150000
	<b>Total Training Cost (C)</b>			<b>150000/-</b>
	<b>Total Environmental Cost (A+B+C)</b>			<b>2190000/-</b>

## **VIII. CONCLUSIONS AND RECOMMENDATIONS**

237. The assessment of environment impacts for the sub-project shows that there are no significant, long term impacts. Most impacts are short term and limited to the construction stage. Key conclusions on the environmental implications of the project are given in the paras below.

### **A. Environmental Gains Due to Proposed Work Justifying Implementation**

238. The project entails various impacts on the project setting. There are many impacts bearing benefits to the area against the limited number and magnitude of negative impacts. These include the following: (i) the project will substantially improve the transport efficiency on the roads. (iii) the project once implemented will improve the overall environmental conditions with better roads, fuel efficiency and environmental protection measures (iv) will reduce traffic congestion particularly at junctions hence, air pollution due to idling of the vehicles.

### **B. Potential Impacts and Mitigation**

239. The finding of IEE indicates that project is unlikely to cause any significant adverse environmental impacts. While some of the impacts are negative, there are many bearing benefits to the area. Most of the impacts are likely to occur during construction stage and are temporary in nature. Anticipated minor impacts will be mitigated through the implementation of mitigation measures summarized in the Environmental Management Plan.

240. Factors contributing to minimal impacts include, widening of the project road confined within the available RoW, presence of no sensitive environmental issue like wildlife sanctuary, national park, bio reserve, with 10 km from the project road and most of water body crossed by the road are non-perennial in nature except one which is already bridged. However, some of the impacts are unavoidable. These impacts with mitigation measures are indicated below:

- About 80 trees will need to be cut with prior permission of district or forest authorities. Compensatory Tree plantation on the basis of 1:10 will be made to compensate this loss. Preventive measures shall be taken into consideration during construction phase especially in rainy months, to prevent soil erosion because of tree cutting and alteration of ground flora.
- Air pollution due to construction activities and operation of hot mix plant will be controlled through adoption of dust suppression measures and provision of high stack for good dispersion of gaseous emission from hot mix plant.
- Noise levels may increase during the construction phase due to operation of construction machineries. All the construction equipment and DG set will be well maintained and fitted with silencers.
- Waste materials generated during construction phase may contaminate soil, surface and ground water resources. Waste shall be segregated and reused or disposed off in environmentally acceptable manner.
- Along the project stretch, few religious structures are located. Appropriate design options are exercised to minimize the loss of such structures.
- The social issues are addressed through Social Safeguards Due Diligence reports prepared as per SPS of ADB.

### **C. Irreplaceable Resources**

241. The project does not pass through any protected areas, or eco sensitive areas. The construction material will also be sourced from identified and approved sources. As such, there are no environmental sensitive resources found in the project area, which is likely to be affected due to the project.

**D. Post IEE Surveillance and Monitoring**

242. While an IEE is meant to provide a comprehensive understanding of the environment status of the area under the study, post IEE surveillance is the means to ensure that the significant impacts identified are adequately mitigated as per the proposed mitigation plan. A detailed monitoring plan has been provided as part of the Environmental Management Plan. Air, water quality, noise, soil erosion, and tree survival rate monitoring and reporting along with the follow up actions in case of deviation from the norms have been detailed out. The frequency has been set in consideration of the likely impacts.

**E. Public Consultations**

243. The project received support and consent from most of local people. The local people did not perceive any adverse impact due to the proposed project. Environmental awareness and likewise concern were found generally low. People, however expressed the desire of minimizing the tree cutting.

**F. Recommendations**

244. Adequate mitigations shall be taken up both during construction and operation stage of the project to avoid/minimize adverse environmental impacts due to this event and any such event in future as suggested in IEE.

245. Effective EMP implementation is essential for elimination or minimization of the identified impacts. The MPRDC shall ensure that EMP and EMoP is included in Bill of Quantity (BOQ) and forms part of bid document and civil works contract. The same shall be revised if necessary during project implementation or if there is any change in the project design.

246. MPRDC needs capacity building and practical exposure. Adequate training shall be imparted as proposed under environmental management plan to enhance the capability of concerned EA officials.

## APPENDIX 1: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

### Instructions:

(i)	The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES), for endorsement by Director, RSES and for approval by the Chief Compliance Officer.
(ii)	This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
(iii)	Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country / Project Title:	India: Madhya Pradesh District Connectivity Sector Project: Subproject : <b>Morar – Chitora Road</b>
Sector Division:	South Asia Transport and Communications Division

Screening questions	Yes	No	Remarks
<b>A. Project Siting</b>			
Is the project area adjacent to or within any of the following environmentally sensitive		✓	
Cultural heritage site		✓	No archaeologically protected monument or cultural heritage site is located within the road
Protected Area		✓	No protected area is located close to roads and nearby.
Wetland		✓	No protected or classified wet land is located close to the project road
Mangrove		✓	Project road is not located in Coastal areas.
Estuarine		✓	No Estuarine is located in the Project area.
Buffer zone of protected area		✓	No such area is located in the Project vicinity.
Special area for protecting biodiversity		✓	No such area is located in the project vicinity.
<b>B. Potential Environmental Impacts</b>			

Screening questions	Yes	No	Remarks
Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		✓	No historical/cultural areas along the project road. ROW is mostly free from encroachment Since road widening will be confined to available ROW; no change in landscape is expected. Opening of new Quarries is not envisaged. Only operational and licensed quarry will be used for road construction. Earth material will be sourced from pre identified areas and with the consent of landowner. All borrow areas will be suitably rehabilitated.
Encroachment on precious ecology (e.g. Sensitive or protected areas)?		✓	No sensitive or protected area along the project road.
Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		✓	There will not be any alteration of surface water hydrology. All drainage courses will be maintained to avoid alteration in surface water hydrology so that water courses are not affected. The temporary soil stockpiles will be designed so that runoff will not induce sedimentation of waterways. Silt fencing during construction will be provided.
Deterioration of surface water quality due to silt runoff and sanitary wastes from worker- based camps and chemicals used in construction?		✓	Adequate sanitary facilities including Soak pits treatment facilities will be provided at construction camps, which will be set-up away from habitat and water bodies. No harmful ingredients are likely to be used in the construction activities. Surface water quality is not impacted due to construction. Measures like embankment slop stabilization, RCC retaining walls are proposed to prevent siltation of ponds located next to the road due to surface runoff. No possibility of deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps.
Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	✓		Localized air pollution level is likely to increase for short duration during construction period due to construction vehicle movement and asphalt processing. The asphalt mixing plant (hot mix plant) will be located away from habitat areas with adequately high stack for effective dispersion of likely emissions Dust Suppression measures like spraying of water on unpaved vehicle movement areas are proposed to minimize the dust generation.

Screening questions	Yes	No	Remarks
Risks and vulnerabilities related to occupational health and safety due to physical, chemical biological and radiological hazards during project construction and operation?	✓		Workers may get exposed to dust and noise during construction activities. However the exposure levels are likely to be short and insignificant. Workers will be provided requisite PPEs to minimize such exposure and associated harmful occupational health effects. Traffic on the road is expected to be low and as such, no occupational health hazard is anticipated during operation phase.
Noise and vibration due to blasting and other civil works?		✓	No blasting is involved. No significant noise generation is expected during construction activities except normal construction equipment operational noise. These noise levels will be impulsive in nature and its impact will be confined within few meters of either side of the road. All stationary noise making sources equipment like DG set, compressors will be installed with acoustic enclosures. There are few noises sensitive locations especially schools close to the alignment where noise level may increase due to increased traffic during operation stage. Provision of no horn zone will be made wherever noise level is likely to increase beyond the prescribed ambient noise levels.
Dislocation or involuntary resettlement of people		✓	The project road will be widened within existing RoW. The project affected persons are also expected to be very less. This aspect will be addressed as per Govt. rules and ADB's Social Safeguard Policies (SPS09) separately in a Resettlement Plan.
Dislocation and compulsory resettlement of people living in right-of- way?		✓	No displacement of people involved.
Disproportionate impacts on the poor, women and children, Indigenous peoples or other vulnerable groups?		✓	No such impact is anticipated.
Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?	✓		No such social concern is expected. Concern may arise during construction stage due to increase in ambient air pollution level, which is expected to be localized and temporary in nature. This aspect will be effectively controlled with the proposed dust suppression and other mitigation measures. As such people at large are supportive of project and are least bothered about above air pollution concern as well.



Screening questions	Yes	No	Remarks
Hazardous driving conditions where construction interferes with existing roads?	✓		Hazardous driving condition may arise around bridge construction areas and at locations of road interface with non-project roads. To minimize the impact suitable traffic management plan will be designed and implemented by the contractor to prevent any hazardous driving condition in above situations.
Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?	✓		Proper provisions for sanitation (sewage treatment), health care (drinking water supply) and periodic health check-ups) and solid waste disposal through composting facilities will be made at each construction camp. Awareness will be created amongst the workers about hygiene and health protection.
Creation of temporary breeding habitats for mosquito vectors of disease?		✓	No such condition is anticipated. Each borrow area will be rehabilitated as per pre agreed used and rehabilitation plan
Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life?	✓		Adequate safety measures will be adopted to avoid accidents during construction and operation stages. Measures, like signage, speed control; crash barriers will be taken close to sensitive locations such as schools, temples or hospitals.
Increased noise and air pollution resulting from traffic volume?	✓		Increase in noise and air pollution is expected during construction phase but is likely to be confined within few meters of either side of the road. Adequate mitigation measures will be adopted to minimize the same. During operation phase vehicular traffic will be the main, source of air and noise pollution. Improved road conditions, extensive plantation including multi-layered plantation along the road will reduce the noise and air pollution impact. Moreover, most of the road stretch passes through open agricultural land, which will provide adequate dispersion to vehicular emission.

Screening questions	Yes	No	Remarks
Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	✓		This possibility is minimal but cannot be ruled out. Controlled construction activities and proper drainage system will reduce this possibility. Provision is made for adequate signage and crash barriers near water bodies, which will minimize the possibilities of accidental water pollution.
Social conflicts if workers from other regions or countries are hired?		✓	Most of the workers will be hired locally.
Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and Sanitation systems)?		✓	Most of the workers will be hired locally. One construction camp is proposed per package with expected workers population of only 60-70. This is unlikely to cause any significant burden on social infrastructure and services.
Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		✓	The construction material aggregate from approved quarries, borrow earth, bitumen) will be sourced from nearby and approved sources. No explosive or chemicals are likely to be used. Bitumen waste if any generated during construction will either recycled or disposed off in controlled manner
Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning		✓	No such impacts are anticipated. Adequate awareness will be created amongst people and workers through information disclosure, safety signage and public consultation about safety aspects.
<b>Based on above assessment and the project is categorized as 'B'</b>			

## **APPENDIX 2: GUIDELINES FOR BORROW AREAS MANAGEMENT**

### **A. Selection of Borrow Areas**

1. Location of borrow areas shall be finalized as per IRC: 10-1961 guidelines. The finalization of locations in case of borrows areas identified in private land shall depend upon the formal agreement between landowners and contractor. If, agreement is not reached between the contractor and landowners for the identified borrow areas sites, arrangement for locating the source of supply of material for embankment and sub-grade as well as compliance to environment requirements in respect of excavation and borrow areas as stipulated from time to time by the Ministry of Environment and Forests, Government of India, and local bodies, as applicable shall be the sole responsibility of the contractor. The contractor in addition to the established practices, rules and regulation will also consider following criteria before finalizing the locations.

- The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available.
- The borrow pits preferably should not be located along the roads.
- The loss of productive and agriculture soil should be minimum.
- The loss of vegetation is almost nil or minimum.
- The Contractor will ensure that suitable earth is available.

### **B. Contractor's Responsibility**

2. The Contractor shall obtain representative prioritys from each of the identified borrow areas and have these tested at the site laboratory following a testing programme approved by the Engineer. It shall be ensured that the sub-grade material when compacted to the density requirements shall yield the design CBR value of the sub-grade. Contractor shall begin operations keeping in mind following;

- a. Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction plants is operating at the place of deposition.
- b. No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. Contractor should be permitted to remove acceptable material from the site to suit his operational procedure, then shall make consequent deficit of material arising there from.
- c. Where the excavation reveals a combination of acceptable and unacceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, carry out the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the un- acceptable materials. The acceptable material shall be stockpiled separately.
- d. The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, use of plants are siting of temporary buildings or structures.

### **C. Borrowing from Different Land-Forms**

#### **1. Borrow Areas located in Agricultural Lands**

- a. The preservation of topsoil will be carried out in stockpile.
- b. A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- c. Borrowing of earth will be carried out up to a depth of 1.5m from the existing ground level.
- d. Borrowing of earth will not be done continuously throughout the stretch.
- e. Ridges of not less than 8m widths will be left at intervals not exceeding 300m. f. Small drains will be cut through the ridges, if necessary, to facilitate drainage.
- g. The slope of the edges will be maintained not steeper than 1:4 (vertical: Horizontal).
- h. The depth of borrow pits will not be more than 30 cm after stripping the 15 cm topsoil aside.

## **2. Borrow Areas located in Elevated Lands**

- a. The preservation of topsoil will be carried out in stockpile.
- b. A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- c. At location where private owners desire their fields to be levelled, the borrowing shall be done to a depth of not more than 1.5m or up to the level of surrounding fields

## **3. Borrow Areas near River Side**

- a. The preservation of topsoil will be carried out in stockpile.
- b. A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- c. Borrow area near to any surface water body will be at least at a distance of 15m from the toe of the bank or high flood level, whichever is maximum.

## **4. Borrow Areas near Settlements**

- a. The preservation of topsoil will be carried out in stockpile.
- b. A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- c. Borrow pit location will be located at least 0.75 km from villages and settlements. If un-avoidable, the pit will not be dug for more than 30 cm and drains will be cut to facilitate drainage.
- d. Borrow pits located in such location will be re-developed immediately after borrowing is completed. If spoils are dumped, that will be covered with a layers of stockpiled topsoil in accordance with compliance requirements with respect MOEF/SPCB guidelines.

## **5. Borrow Pits along the Road**

3. Borrow pits along the road shall be discouraged and if deemed necessary and permitted by the Engineer; following precautions are recommended

- a. The preservation of topsoil will be carried out in stockpile.
- b. A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and

- side slopes not steeper than 1:2 (Vertical: Horizontal).
- c. Ridges of not less than 8m widths should be left at intervals not exceeding 300m.
  - d. Small drains shall be cut through the ridges of facilitate drainage.
  - e. The depth of the pits shall be so regulated that there bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of the final section of bank, the maximum depth of any case being limited to 1.5m.
  - f. Also, no pit shall be dug within the offset width from the toe of the embankment required as per the consideration of stability with a minimum width of 10m.

## **6. Rehabilitation of Borrow Areas**

- a. The objective of the rehabilitation programme is to return the borrow pit sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing borrow pits in a stable condition is fundamental requirement of the rehabilitation process. This could be achieved by filling the borrow pit floor to approximately the access road level.
- b. Re-development plan shall be prepared by the Contractor before the start of work in line with the owners will require and to the satisfaction of owner. The Borrow Areas shall be rehabilitated as per following;
- c. Borrow pits shall be backfilled with rejected construction wastes and will be given a vegetative cover. If this is not possible, then excavation sloped will be smoothed and depression will be filled in such a way that it looks more or less like the original round surface.
- d. Borrow areas might be used for aquaculture in case landowner wants such development. In that case, such borrow area will be photographed after their post use restoration and Environment Expert of Supervision Consultant will certify the post use redevelopment.
- e. The Contractor will keep record of photographs of various stages i.e., before using materials from the location (pre-project), for the period borrowing activities (construction Phase) and after rehabilitation (post development), to ascertain the pre and post borrowing status of the area.

**APPENDIX 3: ENVIRONMENTAL MANAGEMENT PLAN FOR MORAR – CHITORA ROAD**

Environmental Issue/ Component	Remedial Measure	Reference to laws /guidelines	Location	Monitoring indicators	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Pre-construction and Design Stage								
1. Alignment								
1.1 Pavement damage and inadequate drainage provisions in habitat areas	<ul style="list-style-type: none"><li>Construction of concrete pavement in habitat areas considering alignment level and drainage.</li><li>Raise road level above the nearby areas with provision of adequate side drains to evacuate the rain water and domestic discharges (drained by habitats occasionally to prevent damage to road and rain water entry to habitats' houses.</li><li>Provision of adequate no. of cross drainage structures based on drainage pattern around the alignment</li></ul>	Design requirement	All habitat areas throughout the alignment	Design of both cross & side drains ,no. of slab/box culverts ,no & size of Hume pipes	Review of detail design documents & drawings	Included in construction cost	Design Consultant	MPRDC (SQC)
1.2 Safety along the proposed alignment	<ul style="list-style-type: none"><li>Make provisions of crash barriers at accident prone areas as identified in the road safety studies</li><li>Provision of rumble strips in habitat areas to regulate speed.</li><li>Provision of retro-reflective warning sign boards nears school, hospital, religious places and forests areas</li><li>Provision of proper side-walks /pedestrian zone along the road near habitat areas, school, hospital, religious places and forests</li><li>Compliance with norms specified in IRC codes for state highway for curvature and grading</li><li>Provision of safety kerb at all bridges</li><li>The design should attempt to equalize cut and fill.</li><li>Minimize the cutting in hill areas. Incorporate slope stabilization measures to prevent any land slide situation.</li></ul>	Design requirement	Places where height of embankment is more than 3.0 m.	No. of accident & Vehicle collision	Field observation ,interview of locals	Included in construction cost	Design Consultant	MPRDC (SQC)
2. Natural Hazards								
2.1 Protection for damage from Earthquake	<ul style="list-style-type: none"><li>Design considering relevant IRC guidelines for earthquakes in bridges</li></ul>		Throughout the stretch	Incorporation of IRC guidelines for earthquake in bridge design	Review of bridge design	Project preparation Cost	Design Consultant	MPRDC (SQC)

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Environmental Issue/ Component	Remedial Measure	Reference to laws /guidelines	Location	Monitoring indicators	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2.1 Noise from construction vehicle, equipment and machinery.	<ul style="list-style-type: none"> <li>All equipment to be timely serviced and properly maintained.</li> <li>Bottlenecks to be removed.</li> <li>Construction equipment and machinery to be fitted with silencers and maintained properly.</li> <li>Only IS approved equipment shall be used for construction activities.</li> <li>Timing of noisy construction activities shall be done during night time and weekends near schools and selected suitable times near temples when there are no visitors, concurrent noisy operations may be separated to reduce the total noise generated, and if possible re-route traffic during construction to avoid the accumulation of noise beyond standards. Else provision of temporary noise barrier at sensitive locations or near sources.</li> <li>Time regulation near residential, built up and forest areas construction shall be restricted to daylight hours.</li> <li>Initiation of multi layered plantation, to serve as mitigation option for operation phase</li> <li>Honking restrictions near sensitive areas</li> <li>PPEs to workers</li> <li>Noise monitoring as per EMoP.</li> </ul>	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge works	Throughout project section especially at construction sites, residential and identified sensitive locations.	Noise levels Measurements  Complaints from local people	As per Noise rule, 2000  Consultation with local people	Included in Project Cost Plantation cost is separate	Contractor	MPRDC (SQC)/CSC
<b>3. Land and Soil</b>								
3.1 Land use Change and Loss of productive/top soil	<ul style="list-style-type: none"> <li>Non-agricultural areas to be used as borrow areas to the extent possible.</li> <li>If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion.</li> </ul>	Project requirement	Throughout the project section and borrow areas	Borrow pit locations  Top soil storage area	Review borrow area plan, site visits	Included in construction cost	Contractor	MPRDC (SQC)/CSC



Environmental Issue/ Component	Remedial Measure	Reference to laws /guidelines	Location	Monitoring indicators	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	<ul style="list-style-type: none"> <li>Bio-turfing of embankments to protect slopes.</li> <li>Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees.</li> <li>The side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1.</li> <li>The earth stockpiles to be provided with gentle slopes to prevent soil erosion.</li> </ul>	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road especially along hilly areas	Occurrence of slope failure or erosion issues	Review of design documents and site observation	Included in Construction cost	Design consultant and Contractor,	MPRDC (SQC)/CSC
3.3 Borrow area management	<ul style="list-style-type: none"> <li>Non-productive, barren lands, upland shall be used for borrowing earth with the necessary permissions/consents.</li> <li>Depths of borrow pits to be regulated and sides not steeper than 25%.</li> <li>Topsoil to be stockpiled and protected for use at the rehabilitation stage.</li> <li>Transportation of earth materials through covered vehicles.</li> <li>IRC recommended practice for borrow pits (IRC 10: 1961).</li> <li>Borrow areas not to be dug continuously.</li> <li>To the extent borrow areas shall be sited away from habitated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond in consultation with fishery department and land owner/community. Rehabilitation of the borrow areas as per Guidelines for redevelopment of Borrow Areas.</li> </ul>	IRC Guidelines on borrow areas and for quarries (Environmental Protection Act and Rules, 1986; Water Act, Air Act) + Clause No. 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines V for Borrow Areas management	Borrow sites location	<p>Existence of borrow areas in inappropriate unauthorized locations.</p> <p>Poor borrow area management practices.</p> <p>Incidents of accidents.</p> <p>Complaints from local people.</p>	Review of design documents and site observation	Included in Construction cost	Design consultant and Contractor,	MPRDC (SQC)/CSC
3.4 Quarry Operations	<ul style="list-style-type: none"> <li>Aggregates will be sourced from existing licensed quarries.</li> <li>Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to EO, MPRDC.</li> <li>The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA.</li> </ul>	Clause No. 111.3 MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management	Quarry area locations	<p>Existence of licenses for all quarry areas from which materials are being sourced</p> <p>Existence of a quarry redevelopment plan</p>	Review of design documents, contractor documents and site observation	Included in Construction cost	Contractor	MPRDC (SQC)/CSC

Environmental Issue/ Component	Remedial Measure	Reference to laws /guidelines	Location	Monitoring indicators	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	▪			Complaints from local people.				
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	<ul style="list-style-type: none"> <li>Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction.</li> <li>Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction.</li> <li>Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads.</li> <li>Land taken for construction camp and other temporary facility shall be restored to its original conditions.</li> </ul>	Design requirement	Parking areas, Haulage roads and construction yards.	<p>Location of approach and haulage roads</p> <p>Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition</p>	Site observation	Included in construction cost	Contractor	MPRDC (SQC)/CSC
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non bituminous debris generated from demolition and road construction	<ul style="list-style-type: none"> <li>Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil.</li> <li>Fuel storage and refueling sites to be kept away from drainage channels.</li> <li>Unusable debris shall be dumped in ditches and low lying areas.</li> <li>To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas.</li> <li>Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors</li> <li>Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit.</li> <li>Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board</li> </ul>	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	<p>Quality of soil near storage area</p> <p>Presence of spilled oil or bitumen in project area</p>	Site observation	Included in construction cost.	Contractor	MPRDC (SQC)/CSC
<b>4. Water Resources</b>								
4.1 Sourcing of water during Construction	<ul style="list-style-type: none"> <li>Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority</li> <li>Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected.</li> </ul>	-	Throughout the Project section	<p>Approval from competent authority</p> <p>Complaints from local people on water availability</p>	<p>Checking d documentation</p> <p>Talk to local people</p>	Included in construction cost	Contractor	MPRDC (SQC)/CSC

Environmental Issue/ Component	Remedial Measure	Reference to laws /guidelines	Location	Monitoring indicators	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.2 Disposal of water during construction	Provisions shall be made to connect road side drains with exiting nearby ponds otherwise make provision of water harvesting pits intermittently.	Clause No. 1010 EP Act 1986 MORT&H Specifications for Road and Bridge works	Throughout the Project section	Design of road side drains  Existence of proper drainage system for disposal of waste water	Standards methods Site observation and review of documents	Included in construction cost	Contractor	MPRDC (SQC)/CSC
4.3 Alteration in surface water hydrology due to embankment	<ul style="list-style-type: none"> <li>Existing drainage system to be maintained and further enhanced.</li> <li>Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment.</li> <li>Road level shall be raised above HFL level wherever road level is lesser than HFL.</li> </ul>	Design requirement, Clause No 501.8.6. MORT&H Specifications	Near all drainage channels, river crossings etc.	Design of road side drains	Review of design documents  Site observation	Included in construction cost	Contractor	MPRDC (SQC)/CSC
4.4 Siltation in water bodies due to construction activities/ earthwork	<ul style="list-style-type: none"> <li>Embankment slopes to be modified suitably to restrict the soil debris entering water bodies.</li> <li>Provision of Silt fencing shall be made at water bodies.</li> <li>Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated.</li> <li>Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system.</li> </ul>	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge works (CP and CP) and worldwide best practices	Near all water bodies, river embankment slopes.	Siltation of rivers, streams, ponds and other water bodies in project area	Field observation	Included in construction cost	Contractor	MPRDC (SQC)/CSC
4.5 Deterioration in Surface water quality due to leakage from vehicles and equipment's and waste from construction camps.	<ul style="list-style-type: none"> <li>No vehicles or equipment should be parked or refueled near water-bodies, so as to avoid contamination from fuel and lubricants.</li> <li>Oil and grease traps and fuelling platforms to be provided at re-fuelling locations.</li> <li>All chemicals and oil shall be stored away from water and concreted platform with catchment pit for spills collection.</li> <li>All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors</li> </ul>	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Water bodies, refuelling stations, construction camps.	Water quality of ponds, streams, rivers and other water bodies in project  Presence of oil floating in water bodies in project area	Conduction of water quality tests as per the monitoring plan  Field observation	Included in construction cost	Contractor	MPRDC (SQC)/CSC

Environmental Issue/ Component	Remedial Measure	Reference to laws /guidelines	Location	Monitoring indicators	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> <li>Construction camp to be sited away from water bodies.</li> <li>Wastes must be collected, stored and taken to approved disposal site only.</li> <li>Water quality shall be monitored periodically</li> </ul>							
<b>5. Flora and Fauna</b>								
5.1 Vegetation loss due to site preparation and construction activities and	<ul style="list-style-type: none"> <li>Minimize tree cutting to the extent possible.</li> <li>Roadside trees to be removed with prior approval of competent authority.</li> <li>Compensatory plantation at 1:10 basis and additional plantation as per the IRC guidelines in consultation with Forest Department.</li> <li>Regular maintenance of all trees planted.</li> <li>Provision of LPG in construction camp as fuel source to avoid tree cutting, wherever possible.</li> <li>Plantation of trees on both sides of the road. Integrate vegetation management (IVM) with the carriage way completely clear of vegetation. From the edge of the road to the boundary of ROW, vegetation structured with smaller plants near the line and larger trees further away to avoid costly and provide habitats for a wide variety of plants and animals. Additional plantation near river banks to check erosion as part of compensatory plantation.</li> <li>In the event of design changes during the construction stages additional assessments including the possibility to save trees shall be made by the EA.</li> <li>Road side Plantation Strategy as per IRC specifications including manuring.</li> <li>Controlled use of pesticides/ Fertilizers</li> </ul>	Forest Conservation Act 1980 + IRC SP: 21 and IRC SP:66	Throughout project corridor	ROW width  Number of trees for felling  Compensatory plantation plan  Number of trees replanted	Review of relevant documents – tree cutting permit, compensatory plantation plan  Field observations	Road side Plantation cost is included in project costs.	Relevant agency specialized in afforestation	MPRDC (SQC)/CSC
<b>6. Construction Camps</b>								
6.1 Impact associated with location	<ul style="list-style-type: none"> <li>All camps should maintain minimum distance from following:               <ul style="list-style-type: none"> <li># 500 m from habitation</li> <li># 500 m from forest areas where possible</li> <li># 500 m from water bodies where possible</li> <li># 500 m from through traffic route where possible</li> </ul> </li> <li>The average distance between two camps should be 50 km</li> </ul>	Design Requirement	All construction camps	Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and other construction camps	On site observation  Interaction with workers and local community	Included in construction cost	Contractor and EO	MPRDC (SQC)/CSC

Environmental Issue/ Component	Remedial Measure	Reference to laws /guidelines	Location	Monitoring indicators	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6.2 Worker's Health in construction camp	<ul style="list-style-type: none"> <li>The location, layout and basic facility provision of each labor camp will be submitted to SQC prior to their construction. The construction shall commence only after approval of SQC.</li> <li>The contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner as approved by the EA.</li> <li>Adequate water and sanitary latrines with septic tanks attached to soak pits shall be provided.</li> <li>Preventive medical care to be provided to workers including a First-Aid kit that must be available in the camp.</li> <li>Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste must be carried out .</li> <li>The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations.</li> <li>No alcoholic liquor or prohibited drugs will be imported to, sell, give, barter to the workers of host community.</li> <li>Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases.</li> </ul>	The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof	All construction camps	Camp health records  Existence of proper first aid kit in camp site  Complaints from local people	Camp records  Site observation  Consultation with local people living nearby	Part of the Contractors costs	Contractor	MPRDC (SQC)/CSC
<b>7. Management of Construction Waste/Debris</b>								
7.1 Selection of Dumping Sites	<ul style="list-style-type: none"> <li>Unproductive/wastelands shall be selected for dumping sites.</li> <li>Away from residential areas and water bodies</li> <li>Dumping sites have adequate capacity equal to the amount of debris generated.</li> <li>Public perception and consent from the village Panchayats has to be obtained before finalizing the location.</li> </ul>	Design Requirement and MORT&H guidelines	At all Dumping Sites	Location of dumping sites  Public complaints	Field survey and interaction with local people	Included in construction cost.	Contractor.	MPRDC (SQC)/CSC

Environmental Issue/ Component	Remedial Measure	Reference to laws /guidelines	Location	Monitoring indicators	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
7.2 Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> <li>The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes.</li> <li>All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping.</li> <li>Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal MOSRTH guidelines should be followed.</li> <li>Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.</li> </ul>	MORT&H guidelines	Throughout the project corridor	Percentage of reuse of existing surface material  Method and location of disposal site of construction debris	Contractor records  Field observation  Interaction with local people	Included in construction cost.	Contractor.	MPRDC (SQC)/CSC
<b>8. Traffic Management and Safety</b>								
8.1 Management of existing traffic and safety	<ul style="list-style-type: none"> <li>Temporary traffic diversion shall be planned by the contractor and approved by the 'Engineer'.</li> <li>The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. control plans shall be prepared in line requirements of IRC's SP 55 document'.</li> <li>The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.</li> <li>On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed.</li> <li>Restriction of construction activity to only one side of the existing road.</li> <li>The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer".</li> </ul>	Design requirement and IRC SP:55	Throughout the project corridor especially at intersections.	Traffic management plan  Safety signs on site  Number of traffic accidents	Review traffic management plan Field observation of traffic management and safety system  Interaction with people in vehicles using the road	Included in construction cost.	Contractor	MPRDC (SQC)/CSC

Environmental Issue/ Component	Remedial Measure	Reference to laws /guidelines	Location	Monitoring indicators	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> <li>Use of adequate signages to ensure traffic management and safety. Conduct of regular safety audit on safety measures.</li> </ul>							
8.2 Pedestrians, animal movement	<ul style="list-style-type: none"> <li>Temporary access and diversion, with proper drainage facilities.</li> <li>Access to the schools, temples and other public places must be maintained when construction takes place near them.</li> <li>Fencing wherever cattle movement is expected.</li> <li>To avoid the need for cattle underpasses, some of the proposed culverts near habitations may be widened to facilitate cattle movement.</li> </ul>	Design requirement and IRC: SP: 27 -1984 IRC:SP: 32 -1988 Road Safety for Children (5-12 Years Old) IRC:SP: 44 -1994 Highway Safety Code IRC: SP: 55 -2001 Guidelines for The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	Road signage & drainage as per IRC guideline  Complaints from local people	Field observation Interaction with local people	Included in construction cost.	Contractor	MPRDC (SQC)/CSC
8.3 Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> <li>Contractors to adopt and maintain safe working practices.</li> <li>Usage of fluorescent and retroreflectory signage, in local language at the construction sites</li> <li>Training to workers on safety procedures and precautions.</li> <li>Mandatory appointment of safety officer.</li> <li>All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with.</li> <li>Provision of PPEs to workers.</li> <li>Provision of a readily available first aid unit including an adequate supply of dressing materials.</li> <li>The contractor will not employ any person below the age of 18 years for any work</li> <li>Use of hazardous material should be minimized and/or restricted.</li> <li>Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies.</li> </ul>		Construction sites	Availability of Safety gears to workers  Safety signage Training records on safety  Number of safety related accidents	Site observation  Review records on safety training and accidents  Interact with construction workers	Included in construction cost	Obligation of Contractor	MPRDC (SQC)/CSC

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Environmental Issue/ Component	Remedial Measure	Reference to laws /guidelines	Location	Monitoring indicators	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
5.1 Vegetation	<ul style="list-style-type: none"><li>Planted trees, shrubs, and grasses to be properly maintained.</li><li>The tree survivalist audit to be conducted at least once in a year to assess the effectiveness</li></ul>	Forest Conservation Act 1980	Project tree plantation sites	Minimum of 70% of tree survival	Records and fields observations	Operation and Maintenance Cost	MPRDC (SQC)	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none"><li>Efforts shall be made to make shoulder completely clear of vegetation.</li><li>Regular maintenance of plantation along the roadside</li><li>Invasive plant not to be planted near the road.</li></ul>	Project requirement	Throughout the Project route	Presence of and extent of vegetation growth on either side of road  Accident data	Visual inspection  Accident records	Included in operation/ Maintenance cost	MPRDC (SQC)	
6.2 Accident risks associated with traffic movement.	<ul style="list-style-type: none"><li>Traffic control measures, including speed limits, will be enforced strictly.</li><li>Further encroachment of squatters within the ROW will be prevented.</li><li>No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local law</li><li>Monitor/ensure that all safety provisions included in design and construction phase are properly maintained</li><li>Highway patrol unit(s) for round the clock patrolling. Phone booths for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.</li><li>Tow-away facility for the break down vehicles if possible.</li></ul>	IRC:SP:55	Throughout the Project route	Police records on accident  Condition and existence of safety signs, rumble strips etc. on the road  Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law	Review accident records  Site observations	Included in operation/ Maintenance cost	MPRDC (SQC)	
6.3 Transport of Dangerous hazardous Material	<ul style="list-style-type: none"><li>Existence of spill prevention and control and emergency responsive system</li><li>Emergency plan for vehicles carrying hazardous material</li></ul>		Throughout the project stretch	Status of emergency system – whether operational or not	Review of spill prevention and emergency response system	Included in operation/ Maintenance cost.	MPRDC (SQC)	

Notes: **EA:** Executing Agency, **MPRDC:** Madhya Pradesh Road Development Corporation, **SQC:** Supervision Quality Controller, **EO:** Environmental Officer, **IRC:** Indian Road Congress

- The “Project engineer” or “the engineer” is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (MPRDC). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team.
- The “environmental officer” is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of “the engineer”.

### APPENDIX 4: ENVIRONMENTAL MONITORING PROGRAMME

Environmental Components	Monitoring			Location	Frequency	Institutional Responsibility	
	Parameters	Special Guidance	Standards			Implementation	Supervision
Air	PM <sub>2.5</sub> , PM <sub>10</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO	As per CPCB guidelines	The Air (Prevention and Control of Pollution) Rules, CPCB, 1982	At sites where hot mix plant / batching plant is located	3 times in a year for 3 years or construction period at 3 sites & once in year for five years at 3 sites during operation/defect liability period	Contractor through approved monitoring agency	PIU, MPRDC, SC
Water	pH, BOD, COD, TDS, TSS, DO, Total coliform, Conductivity, Oil & Grease	Grab priority collected from source and analyze as per standard methods for examination of water and wastewater	Water quality standards by CPCB	river tributaries, roadside ponds and ground water at construction camp sites	Once during pre-construction stage 3 times in a year for 3 years or construction period At 3 locations	Contractor through approved monitoring agency	PIU, MPRDC, SC
Noise Levels	Noise level for day and night on dB(A) scale	In free field at 1m distance from the equipment to be monitored	Noise standard by CPCB	At equipment yards, camp and villages along the alignment.	3 times in a year for 3 years or construction period , 3 locations & once in a year for 5 years at 3 sites during Operation/defect liability period.	Contractor through approved monitoring agency	PIU, MPRDC, SC
Soil quality	Monitoring of NPK & heavy metals and grease		As per IRC code of practice	Ad-hoc if accident / spill locations involving bulk transport of carrying	-	PIU through an approved agency	PIU, MPRDC

**APPENDIX 5: NATIONAL AMBIENT AIR QUALITY STANDARDS**

<b>S.N</b>	<b>Pollutant</b>	<b>Time Weighted Average</b>	<b>Industrial, Residential Rural &amp; Other Area</b>	<b>Ecologically Sensitive Area (Notified by Central Government )</b>
1	Sulphur dioxide (SO <sub>2</sub> in µg/m <sup>3</sup> )	Annual Average* 24 Hours**	50 80	20 80
2	Oxides of Nitrogen (No <sub>x</sub> in µg/m <sup>3</sup> )	Annual Average* 24 Hours**	40 80	30 80
3	Particulate Matter (Size less than 10 mm) or PM <sub>10</sub> in µg/m <sup>3</sup> )	Annual Average* 24 Hours**	60 100	60 100
4	Particulate Matter (Size less than 2.5 mm) or PM <sub>2.5</sub> in µg/m <sup>3</sup> )	Annual Average* 24 Hours**	40 60	40 60
5	Ozone O <sub>3</sub> in µg/m <sup>3</sup>	8 Hours* 1 Hours**	100 180	100 180
6	Lead (Pb) in µg/m <sup>3</sup> )	Annual Average* 24 Hours**	0.5 1.0	0.5 1.0
7	Carbon Monoxide (CO) in mg/m <sup>3</sup> )	8 Hours* 1 Hours**	2 4	2 4
8	Ammonia (NH <sub>3</sub> ) in µg/m <sup>3</sup> )	Annual Average* 24 Hours**	100 400	100 400
9	Benzene (C <sub>6</sub> H <sub>6</sub> ) in µg/m <sup>3</sup> )	Annual Average*	5	5
10	Benzo (a) Pyrene (BaP) particulate phase only (in µg/m <sup>3</sup> )	Annual Average*	1	1
11	Arsenic (As) in µg/m <sup>3</sup>	Annual Average*	6	6
12	Nickel (Ni) in µg/m <sup>3</sup>	Annual Average*	20	20

Note:

- \* Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.
- \*\* 24 hourly or 8 hourly or 1 hourly monitored values, as applicable shall comply 98% of the time in a year. However 2% of the time, it may exceed but not on two consecutive days.

**APPENDIX 6A: INDIAN STANDARD DRINKING WATER SPECIFICATION-IS  
10500:1991**

S.No	Parameters	Essential Standards	Relaxed Standards
<b>1.0</b>	<b>Physical Standards</b>		
1.1	Colour (Hazen units)	10	50
1.2	Taste	Agreeable	Agreeable
1.3	Odour	Unobjectionable	Unobjectionable
1.4	PH	6.5-8.5	6.5-8.5
1.5	Turbidity (NTU)	10	25
1.6	TDS (mg/l)	500(without treatment)	1500(with treatment)
1.7	Total Hardness (mg/l)	300	600
<b>2.0</b>	<b>Inorganic Parameters</b>		
2.1	Ca (mg/l)	75	200
2.2	Mg (mg/l)	30	100
2.3	Fe (mg/l)	0.3	1
2.4	Mn (mg/l)	0.1	0.5
2.5	Cl (mg/l)	250	1000
2.6	SO <sub>4</sub> (mg/l)	150	400 if Mg<30mg/l
2.7	NO <sub>3</sub> (mg/l)	45	45
2.8	F (mg/l)	0.6-1.2	1.5
2.9	Free Cl (mg/l)	0.2	0.5
<b>3.0</b>	<b>Heavy Metals</b>		
3.1	Hg (mg/l)	0.001	0.001
3.2	Cd (mg/l)	0.01	0.01
3.3	Se (mg/l)	0.01	0.01
3.4	As (mg/l)	0.05	0.05
3.5	Pb (mg/l)	0.1	0.1
3.6	Zn (mg/l)	5	10
3.7	Cr <sup>+6</sup> (mg/l)	0.05	0.05
3.8	Cu (mg/l)	0.05	1.5
<b>4.0</b>	<b>Other Parameters</b>		
4.1	Phenol Compounds (mg/l) (as C <sub>6</sub> H <sub>5</sub> HO)	0.001	0.002
4.2	CN (mg/l)	0.05	0.05
4.3	Anionic Detergents (mg/l) (as MBAS)	0.2	1.0
4.4	Mineral Oil (mg/l)	0.01	0.03
4.5	Pesticides	Absent	Absent
<b>5.0</b>	<b>Microbiological Parameters</b>		
5.1	Mean Probable Number	50 without treatment	
	Of Total Coliforms	500 outdoor bathing	
	(Number/100 ml)	5000 with treatment	
<b>6.0</b>	<b>Radiological Parameters</b>		
6.1	Gross alpha (μc/ml)	10 <sup>-6</sup>	
6.2	Gross beta (μc/ml)	10 <sup>-7</sup>	

Note: A-Desirable or essential

B-Relaxable under certain circumstances such as no alternate source being available.

Drinking Water Quality Standard					
Appendix -6B					
S.No	Parameter	Unit	Method No.	Requirement as per IS-10500-2012	
				Desirable Limit	Permissible Limit in Absence of Alternate Source
1	pH	-	4500	6.5-8.5	No relaxation
2	Temperature	$^{\circ}\text{C}$	-	-	-
3	Dissolved Oxygen	mg/lit	3025(P-38)	-	-
4	Conductivity	$\mu\text{mhos/cm}$	2510	-	-
5	Total Suspended Solid	mg/lit	3025(P-17)	-	-
6	Total Dissolved Solid	mg/lit	2540	500	2000
7	Alkalinity	mg/lit	2320	200	600
8	Total Hardness as $\text{CaCO}_3$	mg/lit	2340	300	600
9	Ca Hardness as $\text{CaCO}_3$	mg/lit	3500	-	-
10	Mg Hardness as $\text{CaCO}_3$	mg/lit	2340	-	-
11	Chlorides as Cl	mg/lit	4500	250	1000
12	Phosphate as $\text{PO}_4$	mg/lit	3500	-	-
13	Nitrates as $\text{NO}_3$	mg/lit	4500	45	100
14	Sulphates as $\text{SO}_4$	mg/lit	4500	200	400
15	Sodium as Na	mg/lit	3025(P-45)	-	-
16	Potassium (as K)	mg/lit	3025(P-45)	-	-
17	COD	mg/lit	APHA-5220	-	-
18	BOD (at $27^{\circ}\text{C}$ 3-Days)	mg/lit	IS-3025(P-4)	-	-
19	Total Coliform	mg/lit	IS-1622	-	0
20	Faecal Coliform	mg/lit	IS-1622		10 Max.
Drinking Water Quality Standard					
S.No	Parameter	Unit	Method No.	Requirement as per IS-10500-2012	
				Desirable Limit	Permissible Limit in Absence of Alternate Source
1	pH	-	4500	6.5-8.5	No relaxation
2	Temperature	$^{\circ}\text{C}$	-	-	-
3	Dissolved Oxygen	mg/lit	3025(P-38)	-	-
4	Conductivity	$\mu\text{mhos/cm}$	2510	-	-
5	Total Suspended Solid	mg/lit	3025(P-17)	-	-
6	Total Dissolved Solid	mg/lit	2540	500	2000
7	Alkalinity	mg/lit	2320	200	600
8	Total Hardness as $\text{CaCO}_3$	mg/lit	2340	300	600
9	Ca Hardness as $\text{CaCO}_3$	mg/lit	3500	-	-
10	Mg Hardness as $\text{CaCO}_3$	mg/lit	2340	-	-
11	Chlorides as Cl	mg/lit	4500	250	1000
12	Phosphate as $\text{PO}_4$	mg/lit	3500	-	-
13	Nitrates as $\text{NO}_3$	mg/lit	4500	45	100
14	Sulphates as $\text{SO}_4$	mg/lit	4500	200	400
15	Sodium as Na	mg/lit	3025(P-45)	-	-
16	Potassium (as K)	mg/lit	3025(P-45)	-	-
17	COD	mg/lit	APHA-5220	-	-
18	BOD (at $27^{\circ}\text{C}$ 3-Days)	mg/lit	IS-3025(P-4)	-	-
19	Total Coliform	mg/lit	IS-1622	-	0
20	Faecal Coliform	mg/lit	IS-1622		10 Max.

**APPENDIX 7: AMBIENT AIR QUALITY STANDARDS IN RESPECT OF NOISE**

Area Code	Category of Zones	Limits of Leq in dB(A)	
		Day time*	Night time*
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zone **	50	40
	* Day time is from 6 am to 9 pm whereas night time is from 9 pm to 6 am ** Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicles horns, loud speakers and bursting of cracking are banned in these zones		
Gazette Notification dated 26th December 1989. It is based on the weighted equivalent noise level (Leq). These noise standards have been given the status of statutory norms vide Noise Pollution (Regulation Control) Rules, 2000. However, these rules have changed the periods for 'Day Time' and 'Night Time' a.m. to 10 p.m. and 10 p.m. to 6 am respectively.			

## APPENDIX 8: DETAILS OF PARTICIPANTS AND PHOTOGRAPHS OF PUBLIC CONSULTATION



Berja Village



Berja Village



Khureri Villag



Khureri Villag





**APPENDIX 9: GRM PROCEDURES IN HINDI****सहमति पत्र**

(व्यक्तिगत रूप से हस्ताक्षर करने हेतु )

यह सहमति पत्र दिनांक .....2014 को श्री/श्रीमति .....  
 निवासी .....(जिन्हे बाद में प्रथम पक्ष कहा जायेगा) एवं मध्य प्रदेश  
 रोड डेवलपमेंट कारपोरेशन की तरफ से श्री.....(पद) .  
 .....(जिन्हे बाद में द्वितीय पक्ष कहा जायेगा) के मध्य हस्ताक्षरित किया गया।

गवाहों/साक्षी की उपस्थिति में यह दस्तावेज निष्पादित किया गया है।

- 1- यह कि प्रथम पक्ष दुकान का स्वामी/किरायेदार/अतिक्रमणधारी /फेरी वाला है। तथा वह अपना .....व्यवसाय पिछले .....वर्षों से इस स्थान पर चला रहा है। दुकानदार इस दुकान का पट्टेदार है/नहीं है। प्रस्तावित सड़क के निर्माण के दौरान व्यवसाय का स्वामी/पट्टेदार का व्यवसाय तथा आमदनी सड़क निर्माण के दौरान बाधित होने की आशंका है। यह कालावधी 30 दिन से अधिक नहीं होगी।
- 2- यह कि प्रथम पक्ष ने मध्य प्रदेश जिला कनेक्टिविटी क्षेत्र परियोजना (MPDCSP) की आवश्यकताओं के तहत आयोजित सार्वजनिक लोक सहमति में भाग लिया है, रोड निर्माण से प्राप्त होने वाले लाभ को समझ लिया है एवं रोड निर्माण हेतु सहमति दे दी है।
- 3- यह कि प्रथम पक्ष द्वारा अपनी मर्जी से ग्राम.....तहसील .....में MPDCSP अंतर्गत रोड निर्माण विकास हेतु आपनी आजीविका में संभावित अस्थायी व्यवधान को देखते हुये भी सहमति प्रदान की है।
- 4- यह कि प्रथम पक्ष रोड निर्माण से होने वाले अस्थायी आजीविका व्यवधान के खिलाफ किसी भी प्रकार के मुआवजे का दावा नहीं करेगा।
- 5- यह कि द्वितीय पक्ष को अस्थायी आजीविका व्यवधान संबंधित सहमति स्वीकार है।

6- यह कि द्वितीय पक्ष निर्माण कार्य के दौरान रोड के समीप स्थित सभी व्यवसायिक इकाईयों को नुकसान से बचाने के लिये सभी संभव सावधनियां पूर्वक कार्य करेगा।

7- यह कि प्रथम पक्ष द्वारा द्वितीय पक्ष को यह आश्वासन दिया जाता है कि वह MPDCSP अंतर्गत रोड निर्माण को किसी प्रकार का नुकसान नहीं पहुँचायेगा, ना ही सार्वजनिक वाहनों के आवागमन में व्यवधान पैदा करेगा एवं ना ही ऐसे कार्यों में शामिल होगा।

8- यह कि दोनों पक्ष MPDCSP अंतर्गत प्रस्तावित इस रोड निर्माण हेतु सहमत है।

9- यह कि हस्ताक्षरित किये जाने की तारीख से यह सहमति पत्र प्रभावी होगा।

साक्षी/गवाहों की उपस्थिति में दोनों पक्षों ने उपर लिखित तारीख को इस पत्रक को हस्ताक्षरित किया है।

हस्ताक्षर प्रथम पक्ष

द्वितीय पक्ष की ओर से अधिकृत  
(मोहर सहित)

गवाह

गवाह

1- हस्ताक्षर.....

1- हस्ताक्षर.....

नाम —.....

नाम —.....

पूरा पता —.....

पूरा पता —.....

2-हस्ताक्षर.....

2. हस्ताक्षर.....

नाम —.....

नाम —.....

पूरा पता —.....

पूरा पता —.....

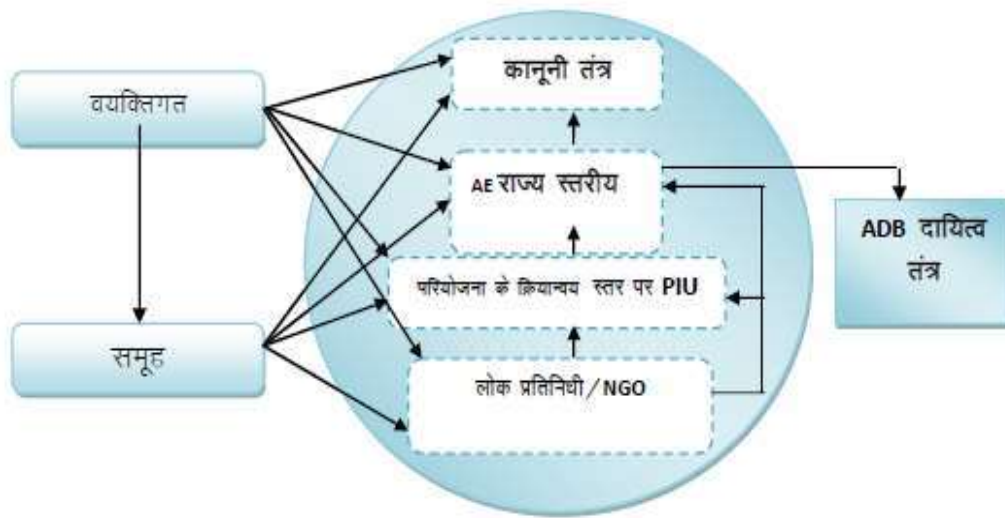
(गवाह/साक्षी में गांव के सरपंच, ग्राम पंचायत के सदस्य, डी.पी.आर. कंसलटेंट के प्रतिनिधि, गैर शासकीय संगठनों के प्रतिनिधि तथा ग्राम के बुजुर्ग/वरिष्ठ नागरिकों को शामिल किया जा सकता है)

### शिकायत निवारण तंत्र

- 5.1 सड़क निर्माण परियोजना से संबंधित विशेष शिकायत निवारण तंत्र (GRM) स्थापित किया जायेगा जिसके तहत विस्थापित व्यवसायिक इकाईयों, संबंधित शिकायतों, सामाजिक तथा पर्यावरण संबंधित शिकायतों का निराकरण करने की सुविधापरियोजना स्तर पर प्रदान की जायेगी, यह तंत्र सामाजिक तथा पर्यावरण संबंधी समस्या, शिकायत या शंकाओं के निवारण में सहायक सिद्ध होगा। यह परियोजना प्रभावित व्यक्तियों की शंकाओं तथा समस्या निराकरण करने के उद्देश्य से निर्मित किया गया है। GRM का उद्देश्य शासन की निवारण प्रक्रिया को नज़र अंदाज करना नहीं है बल्कि जन साधारण को निर्माण से होने वाले लाभ को बताना तथा पारदर्शिता के साथ समस्या तथा शंकाओं का निवारण करना है।
- 5.2 निवारण प्रक्रिया (RP) यह तंत्र प्रभावी तरीके से जन साधारण/लोक सामान्य को इस कार्य के लाभ बतलाते हुए सार्वजनिक सहमति प्राप्त करेगा शिकायत निवारण सहमति (GRC) एक समय सीमा में समस्या निवारण कार्य करेगी। कमेटी का निर्णय मा. न्यायालय के आदेश पूर्व बाध्यकारी होगा इस समिति को MPRDC के प्रबंध संचालक की अध्यक्षता में गठित किया जायेगा। PIU स्तर पर प्रबंधक (PM) पुर्नवास अधिकारी, NGO के प्रतिनिधि, समाज के प्रतिष्ठित व्यक्ति, जन प्रतिनिधि, जिला परिषद प्रतिनिधि, कमजोर तबके के व्यक्ति तथा 2 महिला प्रतिनिधि शामिल होंगे जो परियोजना कार्य पूर्ण होने तक पदस्थ रहेंगे।
- 5.3 शिकायत निवारण समिति द्वारा शिकायत के 3 सप्ताह के दौरान प्रतिक्रिया करेगी। निर्माण कार्य के पूर्व समस्त शिकायतों व शंकाओं का समाधान कर लिया जायेगा।

शिकायत निवारण समिति की बैठक 3 सप्ताह में कम से कम एक बार अवश्य होगी, माननीय न्यायालय के तहत स्वामित्व अधिकारी से संबंधित विवादों के अलावा यह समितित समस्त पुर्नवास स्थानांतरण, मुआवजे के भुगतान तथा अन्य सहायता हेतु चरण बद्ध कार्य करेगी।

### शिकायत निवारण प्रक्रिया तंत्र



अनुलग्न 1

(A) लोक शिकायत प्रपत्र / प्रलेखन (शिकायत निवारण)

[illegible]