Environment and Social Due Diligence Report

November 2014

IND: Accelerating Infrastructure Investment Facility in India –Sai Maatarini Tollways Ltd.

Prepared by

India Infrastructure Finance Company Limited for the Asian Development Bank

INDIA INFRASTRUCTURE FINANCE COMPANY LIMITED

ENVIRONMENTAL & SOCIAL SAFEGUARDS DUE DILIGENCE REPORT

Of

SAI MAATARINI TOLLWAYS LTD.

THE SUB PROJECT: **DESIGN, ENGINEERING, FINANCE, CONSTRUCTION, OPERATION AND MAINTENANCE OF FOUR LANING OF PANIKOILI - RIMULI ROAD SECTION OF NH-215 FROM KM 0+000 – 163+000 IN THE STATE OF ORISSA UNDER NHDP PHASE-III AS BOT (TOLL) BASIS.**

NOVEMBER 2014

The Sub Project: **Design, Engineering, Finance, Construction, Operation and Maintenance of Four Laning of Panikoili - Rimuli Road Section of NH-215 from Km 0+000 – 163+000 in the State of Orissa under NHDP Phase-III as BOT (Toll) basis.**

Environmental and Social Safeguards Due Diligence Report

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ABBREVIATIONS

ADB	:	Asian Development Bank
BOT	:	Built Operate and Transfer
CA	:	Concession Agreement
CSR	:	Corporate Social Responsibility
DBFOT	:	Design, Built, Finance Operate and Transfer
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
EPC	:	Engineering Procurement and Construction
ESDDR	:	Environmental and Social Due Diligence Report
IIFCL	:	India Infrastructure Finance Company Limited
GoI	:	Government of India
LHS	:	Left Hand Sight
LIE	:	Lenders Independent Engineers'
MoEF	:	Ministry of Environment and Forestry
NH	:	National Highway
NHDP	:	National Highway Development Plan
NOC	:	No Objection Certificate
PD	:	Project Director
PPP	:	Public Private Partnership
RHS	:	Right Hand Sight
RoW	:	Right of Way
SDDR	:	Social Due Diligence Report
SMTPL		Sai Maatarini Tollways Pvt. Ltd.

Project Background

1. PURPOSE OF THE REPORT:

1. This Environmental and Social Due Diligence Report (ESDDR) has been carried out by India Infrastructure Finance Company Limited (IIFCL) in consultation with the Concessionaire, Sai Maatarini Tollways Pvt. Ltd. (SMTPL) to assess the adequacy of the project with the applicable National Safeguard compliance status. The report has been prepared as per the documents/information received from the concessionaire and the site visit observations. In order to be eligible for funding from the ADB, IIFCL has prepared the Environmental and Social Due Diligence Report (ESDDR) for the sub-project on behalf of the concessionaire SMTPL. The information given in the ESDDR is agreed and confirmed by the Concessionaires SMTPL.

2. SUBPROJECT TITLE

2. The subproject: Design, Engineering, Finance, Construction, Operation and Maintenance of four laning of Panikoili - Rimuli Road Section of NH-215 from Km 0+000 – 163+000 in the State of Orissa Under NHDP Phase-III as BOT (Toll) Basis.

3. SUBPROJECT SCOPE

3. The scope of work broadly includes widening and strengthening of the existing 2-lane road carriageway section of NH-215 by 4 laning from Km 0+000 – 163+000, (design length: 166.173 Km.) construction/ strengthening of service road, construction and /or rehabilitation of major bridges, minor bridges, culverts, pedestrian under pass, vehicular under pass, animal/cattle/reptile under pass, foot/rail over bridge, box culverts, pipe culverts, truck/bus lay bay, road intersections, interchanges, drains, etc., and operation of toll plaza, wayside amenities and maintenance thereof by the concessionaire. The project has allotted to the concessionaire for the concession period of 24 years (including the construction period of 910 days) from the date of appointment.

4. SUBPROJECT DESCRIPTION:

4. The National Highways Authority of India has awarded the Concession to Sai Maatarini Tollways Pvt. Ltd. (SMTPL) on 28th day of September 2011 to undertake four laning of Panikoili - Rimuli Road Section of NH-215 From Km 0+000 – 163+000 (design length: 166:173 Km.) in the State of Odisha Under NHDP Phase-III as BOT (Toll) Basis, through public, private partnership (PPP) under design, engineer, construct, develop, finance, operate and maintain the Project Highway on DBFOT (Toll) Basis.

5. The Project road starts at Panikoili (Design Chainage km 0.00) and ends at Rimuli (Design Chainage km 167.00), with a design length of 166.173 kms. The stretch is located in the State of Orissa and falls under the jurisdiction of two districts namely Keonjhar and Jajpur. The project reach from Km. 0.000 to Km. 25.000 is in Jajpur District and the major portion from Km. 25.000 to Km. 163.000 in Keonjhar District. The project road intersects with NH-6 and NH-23 at Keonjhar and connects NH-5 at Panikoili. The detail project stretch given in **Figure:-1**

6. The project road alignment is on a plain terrain consisting mostly of agricultural and forest activities. The Keonjhar district (Joda, Mespo areas) is one of the premier minerals districts in the state of Orissa. The project corridor acts as major connection for mining industries (Iron ore, manganese, bauxite, calcium carbonate, laterite, etc.) and also connecting Jharkhand state for transporting these minerals to Paradip port and to various parts of India.

7. The proposed project road is 2-lane (existing) highway and widening & strengthening of existing carriageway by 4 laning is in progress. The existing carriageway 313.37 ha remains untouched to facilitate the movement of present ongoing traffic.

8. The proposed road section with 4-lane divide carriageway with 1.5 m wide paved and 2.0 m wide earthen shoulder with 4.5 m wide raised median. In built up area, 4-lane divided carriageway with 7.0 m service roads shall be provided and raised median width is reduced to 2.0 m for the stretches, where the project highway passes through the major towns bypasses are to be provided. The paved carriageway shall be 17.5 meters wide (excluding the median).

Figure-1: Project Location: Sai Maatarini Tollways Pvt. Ltd.

9. The existing Right of way on average is 23.00 m and varies between 20 m to 30 m along the project road. The proposed ROW is 60 m .The existing road has both the flexible and rigid pavement. The height of embankment varies from ground level to about 10 m near approaches to structures and other places. The seven meter wide service roads has proposed in 23 number of villages along the project road with aggregate length of the service road is 42.336 Kms., on both sides, though not continuous.

10. To minimize the resettlement impact on the existing structure and minimization of additional land acquisition as far as possible. To avoid resettlement and to minimize rehabilitation; four realignment and five numbers of bypasses totalling to 32.800 Kms. have been proposed to minimize the social impact of the project. The chainage wise detail of bypasses and realignments have given in **Table:-1** and **Table:-2** below:

Table-1: Chainage wise bypasses:

Sl.No	Name	Existing Chainage (Km)		Design Chainage (Km)		Total Length (Km)	Side
		From	To	From	To		
1	Jajpur	6.700	14.112	6.700	13.150	6.45	Right
2	Anandpur	41.547	44.756	39.900	43.400	3.50	Left
3	Ghatgaon	76.381	79.978	74.800	79.000	4.20	Right
4	Keonjhar	114.161	125.667	113.300	128.950	15.65	Left
5	Jumpura	142.902	145.980	146.300	149.300	3.00	Left
Total Length of Bypasses						**32.800**	

Table-2: The Geometric Realignment

S. No.	Existing Chainage (Km)	Design Chainage	Total Length (Km)	Land for Re-alignment
1	35.331-37.559	34.40-35.966	1.566	60 m ROW proposed
2	129.10-130.277	132.4-133.750	1.350	
3	135.84-136.758	139.25-140.10	0.850	
4	161.80-162.070	163.30-165.10	1.800	
Total			**5.566**	

11. The proposed widening and strengthening work would mainly involve: Toll Plazas, roadside furniture, pedestrian facilities, landscaping, truck lay byes, bus-byes and passenger shelters, cattle crossing / underpasses (vehicular) /flyovers, highway lighting, administrative, operation and maintenance of base camp, vehicle rescue posts, telecom system and highway traffic management systems. The project salient feature is given in below **Table-3**.

Table-3: Project Salient Features

Sl.No.	Parameter	Information
1	Concessionaire	Sai Maatarini Tollways Pvt. Ltd. (SMTPL)
2	Concessioning Authority	National Highways Authority of India (NHAI)

3	Sub Projects	Design, Engineering, Finance, Construction, Operation and Maintenance of Four Laning of Panikoili - Rimuli Road Section of NH-215 from Km 0+000 – 163+000 in the state of Odisha under NHDP Phase-III as BOT (Toll) basis.
4	Location	Panikoili - Rimuli Road Section of NH-215
5	Chainage	Km 0+000 – 163+000 Km.
6	Total Term Loan	Rs.1397.35 Cr.
7	Length (in Kms.)	approx. 163.00 Km.
8	By pass	Five
9	Right of Way (RoW)	23.00 m and varies between 20 m to 30 m along the project road. The proposed RoW is 60 m.
10	Service Road	42.336
11	Toll Plaza	3 Nos.
12	Major Bridges	6 Nos.
13	Minor Bridges	30 Nos.
14	Flyover	01 Nos.
15	Rail Over Bridges	02 Nos.
16	PUP/Cattle Crossing	21Nos.
17	Vehicular Under Pass	15 Nos.
18	Animal Underpasses	6 Nos.
19	Elephant Underpasses	2 Nos.
20	Reptile Underpasses	50 Nos. Min.
21	Slab Culverts	04 Nos.
22	Box Culverts	256 Nos.
23	Pipe Culverts	38 Nos.
24	Wayside Amen	2 Nos.
25	Truck Lay Bay	4 Nos.
26	Bus Lay Bay	43 Nos.

Source: Information Received from Concessionaire and other relevant Documents.

5. PROJECT ADMINISTRATIVE DETAILS:

12. The administrative and financial details of the project as follows in the below **Table-4**:

Table-4: Administrative details of the project:

Sl. No.	Description	Project Data
1	Client	National Highways Authority of India
2	Project Cost	Rs. 2306.10 Cr
3	Project Management Consultant	Sheladia Associates INC., USA
4	EPC Contractor	M/s Gayatri Projects Ltd., Hyderabad
5	EPC Cost	Rs. 2020.00 Cr. inclusive of Taxes, duties payable
6	Independent Engineer	M/s Sai Consulting Engineers Pvt. Ltd.
7	Date of Concession Agreement	28th September 2011
8	Appointed Date	2nd May 2013
9	Scheduled Project Completion Date	2nd November 2014
10	Concession Period	24 Years including 2.5 years of construction period
11	Construction Period	910 days from the appointed date
12	Lenders Independent Engineer	M/s Consulting Engineering Services (India) Ltd. Mumbai
13	Ecologically Sensitive Area	The project is not passing through any sanctuary/national park

Source: LIE Report: September 2014 and other relevant Documents.

6. ALTERNATINVE ANALYSIS

13. The analysis of alternatives has been carried out on the basis of with project and without project scenarios in terms of socio-economic and environmental consequences.

14. The project offers some environmental alternatives in order to facilitate the decision making process. 'With' and 'without' project scenarios analysis has been carried out to justify the proposal of a widening alternative to no widening alternative. The "with" project scenarios will, however, only occur if the recommendations provided for the construction stage are followed and all construction activities are carried out according to principles of Environment Friendly Road Construction.

15. Without Project Scenario: The existing project road is 2 lanes highway. The capacity of the existing 2 lanes highway dotted with pot holes is insufficient for handling large number of vehicles which needs immediate improvements. The present highway passes through five urban settlements which hamper the smooth flow of traffic. This is further compounded by the rapid industrialization in the area. Increasing mining and commercial activities will further exacerbate the situation.

16. The existing road is not capable to cater to increasing traffic needs due to rapid industrialization. The road also passes through mining areas. Iron (Number of working mines 32), Chromite (Number of working mines 3), Lime Stone mines (Number of working mines 37) are mostly located in Keonjhar District. There has been an increase in the movement of heavy vehicles transporting minerals and goods. The existing unsafe conditions and slow traffic movement, the prevailing environmental quality along the highway will continue to deteriorate in the absence of proposed improvement/widening of the highway. It will also impede the economic development of the region. Forest land (151.94), private land (363.35 ha), government land (132.15 ha) and Tree cutting (Approx. 15000) will not be required.

17. With Project Scenario: This scenario includes the 4-laning of existing 2-lane national highway sections of NH-215 stretch between Panikoili to Rimuli, as envisaged in the project objectives. The "with project scenario", has been assessed to be economically viable and will alleviate the existing conditions. It will, therefore, contribute to the development goals envisaged by the Government of India, and enhance the growth potential of the region. This is one of the main highways for effective connectivity to Paradeep port.

18. To avoid the large scale acquisition of land and properties, the project envisages the four laning of the highway. Five by passes have been proposed at Jajpur, Anandpur, Ghatgaon, Keonjhar and Jumapura to minimize the impact on the existing settlements in the town area. With the improvement of road surface and proposed by passes and under passes (elephant and reptiles), the traffic congestion due to obstructed movement of vehicles will be minimized and will reduce emission of pollutant from the vehicles. The proposed under passes will enhance smooth and comfortable movements of elephants and reptiles.

19. Widening of the road and construction of proposed facilities will improve traffic flow, overall safety and drainage along the road. Rain water harvesting structures will also be provided which will minimize surface runoff losses of rain water.

20. On the basis of above analysis it is concluded that "with" project scenario will be more beneficial as compared to "without" project scenario. The proposed project will instigate faster and comfortable movement of people and transportation of goods. Therefore, proposed road widening project with minor reversible impacts is justified.

7. PUBLIC HEARINGS

21. In order to obtain No Objection Certificate (NoC) from State Pollution Control Board, or Environmental Clearance from the MoEF, Pubic Hearing has been made mandatory. The requirement was introduced in the MoEF notification, which came into effect on 10th April 1997. But subsequently MoEF has issued a notification on 3rd January, 2001 the following; However Public hearing is not required in respect of Small Scale Industrial Units (as defined in the Industrial Policy from time to time), **widening and strengthening of highways**, mining projects (major minerals) with lease area up to twenty-five hectares and modernization of existing irrigation projects. Hence, this project does not require public hearing.

8. ROAD FURNITURE AND ENHANCEMENT:

22. Further as part of the project road furniture and enhancement of Common property Resources, various project facilities shall be provided which will also put advantage to the environmental and social safeguards of the project. The project facilities to be provided has been mentioned below:

- Toll Plaza;
- Service Road

- Animal/Elephant/ Reptile Underpass
- Road side furniture;
- Pedestrian facilities;
- Truck/Bus lay-bays;
- Street Lighting;
- Ambulances/Cranes at toll plaza locations;
- Traffic Aid Post;
- People/Vehicular/Cattle Underpasses;
- Administration, Operation and Maintenance of Base Camp;
- Junction Improvements;
- Highway patrolling, ambulance measures during operation.

9. DEBT COMPONENT OF THE PROJECT:

23. The debt[1]allocation to various banks and IIFCL for the proposed project is being financed by a syndication of loan. Sai Maatarini Tollways Ltd. has signed a Common Rupee Loan Agreement with consortium of Lenders comprises of IDBI Bank as a Lead Bank, India Infrastructure Finance Company Limited (IIFCL), Canara Bank, Oriental Bank of Commerce, Andhra Bank, Indian Overseas Bank, Life Insurance Corporation, and Central Bank of India. The total cost of the project is Rs. 2306.10 Cr. The debt component of the project is Rs.1397.35 Cr, equity is Rs.360.32 Cr. and the grant is 548.49 Cr.

10. EPC CONTRACTOR:

24. The EPC contractor, M/s Gayatri Projects Ltd. (GPL) has signed the Engineering Procurement and Construction Contract (EPC) agreement with M/s Sai Maatarini Tollways Ltd. on 12th day of April 2013 and the EPC cost is INR Rs. 2020.00 Cr. inclusive of Taxes.

11. LENDER'S ENGINEER:

25. M/s. Consulting Engineering Services (I) Pvt. Ltd has been appointed as Lender's Engineer for the project M/s Sai Maatarini Tollways Ltd. As per the Lender's Engineer report for the month of September 2014, the physical progress is 15.75% and financial progress is about 34.37%.

12. INDEPENDENT ENGINEER

26. NHAI has appointed M/s Sai Consulting Engineers Pvt. Ltd. as Independent Engineer to monitor the subproject periodically and submitting the periodic compliance monitoring report, six-monthly to

[1] The loan sanctioned (Rupees in Crores) by various banks which include: IDBI Bank: Rs.350.00 Cr., Canara Bank: Rs. 150.00 Cr., Bank of India: Rs. 200.00 Cr., Oriental Bank of Commerce: Rs.100.00 Cr., Andhra Bank: Rs.97. 35 Cr., Indian Overseas Bank: Rs.100.00 Cr. Life Insurance Corporation: Rs. 100.00Cr. Central Bank of India: Rs.100.00 Cr. and IIFCL: Rs. 280.00 Cr. (Senior debt Rs. 200.00 Cr. + Rs.80.00 Cr. Sub Debt).

NHAI for the subproject which also includes the status of land acquisition, compensation, any disputes, utility shifting, and religious structures affected.

ENVIRONMENTAL SAFEGUARS

ENVIRONMENTAL SAFEGUARD DUE DILIGENCE

13. AVAILABILITY OF EIA/EMP REPORTS:

27. The environmental impact assessment (EIA) study was carried out in accordance with requirements of Ministry of Environment and Forests (MOEF), GOI, guidelines for highway projects in the winter season of 2005-2006 (December 2005, January and February 2006). The proposal was examined in the Ministry of Environment and Forests and environmental clearance was accorded vide letter No. 5-20/2007-IA-III dated 16 May, 2007. Environment Impact Assessment Notification, 2006. Copies of the EIA/EMP reports and environmental clearance letter are attached as **Appendix-1.**

14. ENVIRONMENTAL SENSITIVITY AND DUE DILIGENCE:

28. The project site was visited by the Environmental Safeguard Specialist of IIFCL along with the concessionaire's and EPC contractor's officials during 27-28 October, 2014 for field verification of environmental safeguards.

- Project Highway NH-215 starts km0.000 (Panikoili in District Jajpur) to km 163.000 (Remuli in District Keonjhar) in the State of Odisha. The design length of the project highway is 166.173 km;
- The project road is passing through rural/urban settlements and forest area of Jajpur and Keonjhar Districts. The area along project road represent mostly rural environment. To avoid dense habitation and ensure smooth, safe & uninterrupted traffic flow five By Passes have been proposed at Jajpur (length 6.45 km) Anandapur (length 3.50 km), Ghatgaon (length 4.2 km), Keonjhar (length 15.65 km) and Jumpura (length 3.00 km);
- The existing ROW varies between 20 m and 30 m with average 23.00 m. The proposed ROW of the project road is 60 m;
- Agriculture is the predominant land-use of the area followed by forest and homestead land.
- The project road does not pass through any protected area like Wildlife Sanctuary, National Park, Bio Reserve, etc.;
- There are no known rare, threatened or endangered flora and fauna species reported in the area close to the corridor of impact (CoI) of the project road;
- The project road is passing through forest area in Jajpur and Keonjhar Districts. 151.94 Ha. forest land is involved in this project. The forest land delineated for diversion is based on the digital global positioning system (DGPC) survey conducted by Odisha Space Application Center (ORSAC), Department of Science and Technology, Government of Odisha which is authenticated. On the basis of the recommendations of Forest Advisory Committee, the Central Government has accorded Stage I approval for the diversion of 151.94 ha of forest land vide letter F.No. 8-01/2014-FC dated 6 May, 2014 and Stage II clearance is expected shortly;
- No work in forest area shall be commenced until the requisite statutory approvals are received from MoEF/Forest Divisions at Cuttack, Anandapur & Keonjhar.
- For smooth movement of elephants and reptiles, elephant and reptiles under passes have been proposed;

- The tree cutting permission is already taken from the concerned authority;
- There are no archaeological monuments of national importance within corridor of impact for the project;
- The project management team is in constant interaction with the affected community;
- Elaborate environmental management and monitoring activities are being conducted;
- Drains will be provided to improve the drainage along the project;
- The concessionaire has undertaken implementation of environment management measures as per agreed EMP during the construction stage of the project.
- As part of EMP implementation, a provision of INR 15.31 Cr. (approx.) has been proposed.

15. CATEGORIZATION OF SUB-PROJECT:

29. The sub-project may be classified as Category B based upon the Asian Development Bank's policies on environment. This classification is based on the review of EIA/EMP and other available documents provided by the Concessionaire with respect to the environmental sensitivity due to project activities.

16. STATUS OF REGULATORY CLEARANCES:

30. The sub-project meets the requirements of appropriate State and National legislations by considering appropriate obligations and guidelines of Regulatory Authorities. The sub project needs to have necessary national and local environmental clearances as well as permits and approvals for project implementation and suitable environmental management. The statutory clearances required as part of the proposed widening and strengthening of the sub-project has been assessed and current status of such clearances are provided in **Table-5.**

Table-5: Status of Regulatory Clearances Obtained

Sl. No.	Clearances Required	Statutory Authority	Current Status of Clearance
1.	Environmental Clearance	Ministry of Environment and Forests, GoI, New Delhi	Environmental clearance has been accorded by MOEF vide No. 5 – 20/2007- IA – III dated 16 May, 2007**(Appendix-II)**.
2.	Forest Clearance	Ministry of Environment and Forests, Government of India	Stage I approval for diversion of 151.94 ha of forest land has been accorded by **(Appendix-III)** MOEF, GOI vide letter F.No. 8-01/2014-FC, dated 06 May, 2014 and Stage II clearance is expected shortly.
4.	Water Drawing Permission	Water Resource Department, Rajasthan	Permission has been obtained (**Appendix-IV**).
5.	Permission to Install & Operate	Rajasthan State Pollution Control Board	NoCs have been obtained for the installation and operation of Stone Crusher, Hot Mix Plant, DG sets, etc. **(Appendix-V).**

6.	Tree Cutting Permission	State Government	Permissions have been obtained **(Appendix-V).**
7.	Storage of Petroleum Product	Petroleum & Explosives Safety Organization, Ministry of Commerce & Explosives	Permissions have been obtained **(Appendix-V).**
8.	Quarry/Borrow Area Permission	State Government	NoCs have been obtained **(Appendix-V).**

Source: Concessionaire and Field Observation

31. Copies of all relevant clearance, approvals and permits inkling permission from the Panchayat are attached as **Appendix-II to V.**

17. ENVIRONMENT AND SAFETY CLAUSES IN CONCESSION AGREEMENT

32. The NHAI has signed concession agreements with on 28th September, 2011. Copy of the Concession Agreement (CA) is attached as **Appendix VI.**

33. Safety requirements are given under Article 18 in which it is specified that the Concessionaire shall comply with the provisions of agreement, applicable laws and applicable permits and conform to good industry practices for securing the safety of the users. In particular, the Concessionaire shall develop, implement and administer a surveillance and safety programme for providing a safe environment on or about the project roads and shall comply with the safety requirements set forth in Schedule L.

34. As per Concessionaire Agreement **(Appendix VI),** the Concessionaire shall comply with safety requirements set forth in Schedule – L (the Safety Requirements). The concessionaire shall comply with the provisions of the Agreement, Applicable Laws and Permits and conform to Good Industry Practices for securing the safety of users of the Contractor.

35. As per Concessionaire Agreement all costs and expenses arising out of or relating to safety requirements shall be borne by the Concessionaire to the extent such costs and expenses form part of the works and services included in the scope of the project, and works and services, if any, not forming part of the Scope of the Project shall be undertaken in accordance with the provisions of Article 16.

18. ENVIRONMENT AND SAFETY CLAUSES IN EPC CONTRACT

36. M/s Sai Maatarini Tollways Limited has awarded the EPC works for this project to Gayatri Projects Limited. Copy of the EPC Contract for this project has been attached as **Appendix-VII.** As per EPC Contract the Contractor shall comply with the environment plan, applicable environmental laws and shall be responsible for adopting measures required to ensure compliance under environmental laws. It shall also obtain all necessary environmental clearances, cut trees and carry out necessary afforestation as per applicable laws at EPC contractor's own cost. The Construction Contractor shall take all reasonable precautions to avoid pollution or contamination of air, land or river and ground water arising out of the performance of works.

37. The Construction Contractor shall take all reasonable precautions for the prevention of accidents on or about the project and provide all reasonable assistance and emergency medical aid to accidents victims.

38. The Construction Contractor shall at all times during the project completion schedule period, be solely responsible for the adequacy, stability and safety of its operation at the site.

39. The Construction Contractor shall comply with and shall ensure that all its employees, agents and sub-contractors of any tier engaged in work at the site comply with the provisions of safety regulations.

40. The Construction Contractor shall at its own cost take all due precautions to ensure the health and safety of its staff and labour. In the event of outbreak of any illness of an epidemic nature, it shall comply with and carry out such regulations, orders and requirements of any Governmental instrumentality for the purpose of dealing with and overcoming the same.

41. The Construction Contractor shall initiate, maintain and supervise all surveillance, safety measures and programs in connection with the works necessary to properly protect all persons in the proximity of the project facilities from injury and danger to health and all property from damage or loss.

42. The Construction Contractor shall never permit a hazardous, unsafe, unhealthy or unsound condition or activity to be conducted at the site.

43. The Construction Contractor shall at all times take all reasonably necessary precautions to protect all staffs and labours employed on the site from nuisance, vermin and other pests and reduce the danger to health and the nuisance occasioned by the same.

19. EMP IMPLEMENTATION BUDGET:

44. As part of the project, detailed EMP measures have been undertaken including a budget of INR 15.31 Cr. (Approx.) for implementing the same. The EMP budget exclusively includes the following measures:

- Maintenance of air, noise and water quality;
- Monitoring of environmental parameters and preparation of compliance report;
- Sprinkling of water during construction;
- Tree-cutting and plantation of new trees;
- Health & safety;
- Training and awareness on health, safety and environment.

20. ENVIRONMENT MANAGEMENT PLAN (EMP) IMPLEMENTATION:

45. The environmental management plan (EMP) as appeared in the EIA is provided at Appendix-I. The EMP consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operational phases of the project to eliminate adverse environmental impacts, to offset them, or to reduce them to acceptable levels. The main aim of the EMP is to ensure that the various adverse impacts are mitigated and the positive impacts are enhanced. The EMP has proposed mitigation measures which are being adopted during the pre-construction and construction phases of the project. The EMP also elaborates on environmental monitoring program. The specific project pollution control measures have also been proposed **(Appendix-VIII).** The mitigation measures adopted during construction and operations shall include the ambient air quality management; control of water pollution including

treatment and water conservation; spill prevention and control; noise quality management from plant, machineries and vehicles and solid waste management, etc.

21. CONCESSIONAIRE AND EPC CONTRACTOR'S HSE PLAN

46. To ensure a safe and healthy working environment for all employees and workers Project Safety Plan has been prepared **(Appendix IX)** which addresses good industry practices with regard to worker safety and accident/hazard prevention at work site. Major objectives of developing such a plan is to specifically assess the risk associated with worker's health, safety and to suggest precautionary measures to avoid accidents; integrate safety with work practices; create safety awareness amongst every individual associated with the project.

22. ENVIRONMENTAL MONITORING:

47. Monitoring of environmental quality during construction and operation reflects the success of implementation of the mitigation measures and it also provides a chance to review the suggested measure and improve upon the measures. The environmental monitoring is primarily the responsibility of the EPC contractor. Provision has been made to engage the service of a MoEF/NABL approved monitoring agency to oversee monitoring of air, noise, and water and soil quality. Presently, Orbital Infrastructure Consultancy & Research Pvt Ltd a NABL accredited laboratory is carrying out the monitoring work. Environmental quality monitoring should be carried out as described in the EIA/EMP report (sampling locations, parameters and frequency of motoring).

23. INSTITUTIONAL FRAMEWORK FOR EMP IMPLEMENTATION:

48. Sai Maatarini Tollways Ltd is responsible for ensuring overall compliance with the EMP and setting up of environmental policies by EPC contractor engaged for execution of the project work. The project institutional framework as given in the project EMP **(Appendix- VIII)** indicates that the overall implementation responsibility of the EMP lies with contracting company. The arrangement made for implementation of project including quality assurance and environmental aspects is provided as **Appendix-VIII.**

24. SITE VISIT:

49. A site visit was undertaken by IIFCL's Environmental and Social Safeguard Specialists along with the concessionaire's officials during 27 – 28 October, 2014. The concessionaire has appointed EPC contractor for execution of construction work. EPC contractor/subcontractor has mobilized sufficient staff for construction, survey and quality testing work together with plant, machinery and equipment. QA/QC Lab, stores, machinery, fabrication yard and work shop. During the site visit it has been observed that:

- Camp offices including toilets and mess facilities are well maintained. Base camp and labour camps construction completed. Good sanitation and proper hygiene are being maintained regularly. Monitoring is being done daily/weekly;

- First aid facilities are provided to camp offices;

- 151.94 ha forest land being diverted for the proposed project and compensatory afforestation charges of Rs. 1, 14, 01,000/- for twice the area of degraded forest5 i.e. 304 ha, has been deposited with Campa account;

- The boundary of the forest land being diverted has been demarcated on ground jointly with concerned Forest officials. Four feet high RCC pillars were fixed on ground before DGPS survey conducted along with concerned Forest Officials;

- An amount of Rs. 13, 86, 49, 455/- has been deposited towards Net Present Value with Afforestation Fund (CAF), Orissa;
- Water sprinkling facilities have been provided for suppression of dust in the premises and quarry access road;
- At construction plant sites, crushers have been provided with wind breaking walls and water sprinkler system and the Hot Mix Plants was provided with Bag House filter to control the air pollution;
- Flag men are provided at locations construction site and where tree cutting are in progress. Proper traffic diversions and appropriate signages are being provided at appropriate locations at the construction site for the convenience of road traffic;
- Workers are being provided with the required safety gears to be worn during execution of work;
- Necessary barricading and safety precautions are being ensured. Work safety signages have been provided in places where the construction work has begun;
- Retro reflective safety signs for work zone, men at work, go slow and cautionary signs are provided;
- Staff/labour accommodation facilities at camp sites have been provided with adequate drinking water, mess and sanitation facilities;
- Periodic environmental quality monitoring is being carried out by Orbital Infrastructure Consultancy & Research Pvt Ltd a NABL accredited laboratory (a NABL accredited laboratory);

25. PROJECT IMPLEMENTATION STRUCTURE:

50. The Company proposes to form a Project Management team to supervise the construction of the Project Highway. The relationships among the key parties involved in the implementation of the Project are set out in the following figure:

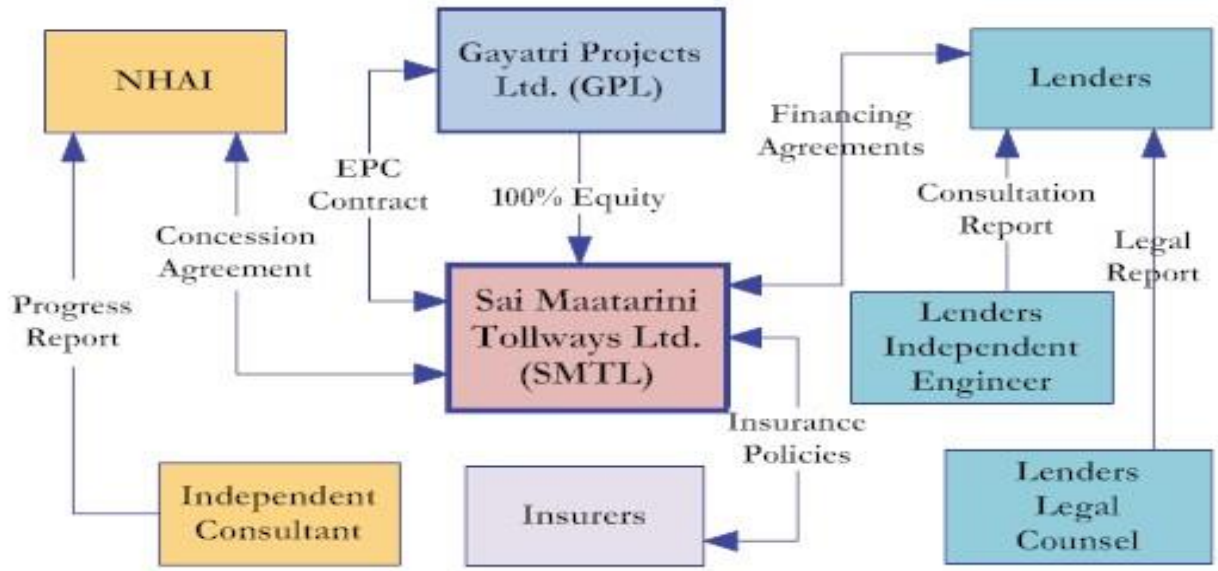


Figure-2: Project Implementation Structure

26. CONCLUSIONS AND RECOMMENDATION:

51. Based upon the available documents and site visit, it is concluded that the concessionaire through their EPC contractor has undertaken environmental safeguard measures. Safety-in-charge is posted at site, is responsible for the safety and environmental aspects of the project. He reports directly to the Project Manager. The sub-project has made sound progress. The conclusion for the sub-projects is given below:

- The project has been prepared by NHAI as per its own funding requirement and not in anticipation to Asian Development Bank's operation;
- Necessary permits/approvals, environmental clearances and forestry clearance (Stage I) for project implementation have been undertaken by the concessionaire. Stage II clearance is expected shortly;
- The proposed project does not affect any eco-sensitive zones as declared by MoEF. Also the project does not pass through any national park or wildlife sanctuary. No historical or archaeologically important monuments are also affected due to this sub-project;
- Ten times of the 15048 trees to be felled from non-forest area will be planted and maintained. Strip plantation on both sides and central verge of the road will be carried out;
- Institutional arrangement is also being done for regular environmental management. EPC Contractor has engaged NABL accredited laboratory Orbital Infrastructure Consultancy & Research Pvt Ltd for carrying out the environmental parameters monitoring work;
- The proposed project may also has a positive GHG emission reduction due to less fuel consumption for the same traffic density;
- For road safety suitable measures such as construction of under passes, installation of barricades along both sides of the road, sign boards, speed breakers, etc. will be provided;
- The solid waste generated should be used for rehabilitating the borrow area. Appropriate fencing all around the borrowed/excavated pit should be made to prevent mishap. Borrow pits and other scars created during the road construction should properly levelled & treated;
- Based on the due diligence findings, it can be deduced that the sub-projects have no significant environmental safeguard issues;
- Monitoring of environmental parameters should be carried out as described in the EIA report and six monthly compliance reports should be submitted to regional office of MOEF. Monitoring as well as compliance reports should also be submitted to IIFCL, New Delhi;
- Greenbelt should be developed as outlined in the EIA report;
- The Sub-projects, therefore, do not appear to involve any kind of reputational risk to IIFCL and the Asian Development Bank funding on environmental safeguards and is recommended for funding under the proposed head.

SOCIAL SAFEGUARS

SOCIAL SAFEGUARD DUE DILIGENCE REPORT (SSDDR)

27. METHODOLOGY FOLLOWED DURING SSDDR:

52. The social safeguard due diligence study was carried out for the sub-project with the information and documents received from the concessionaire Sai Maatarini Tollways Ltd.(SMTL), social due diligence for the subproject was initiated by IIFCL on behalf of the concessionaire SMTL. The methodology followed during the preparation of Social Due Diligence Report (SDDR) is as follows:

- Discussion with the subproject developer regarding the implementation status and progress of the project before the site visit and during the site visit;

- During the preparation of Social Safeguard Due diligence some of the relevant documents have been reviewed, like Feasibility Report, Concession Agreement (CA), Engineering Procurement & Construction (EPC) Contract, Information Memorandum of the project, Lenders Independent Engineers (LIE) June 2014 and most of the applicable clearances/permits and No Objection Certificates (NoCs) as applicable for the project.

28. SOCIAL SAFEGUARDS COMPLIANCE REVIEW:

28.1 Minimization of social impacts

53. Efforts have been taken during the project planning and design stage to minimize the resettlement impact and land acquisition. During finalizing the alignment, bypasses, realignment, symmetrical widening and side widening have been proposed to minimize the social impact. Alternatives have been adopted keeping in mind the prime objective of reducing the displacement of the people and disruption of livelihoods as much as possible. Following efforts have been undertaken to minimize negative social impact:

28.2 Bypass

54. To avoid displacement of structure and disruption of life along the cities, five number of bypasses have been proposed along the major cities like, Jajpur, Anandpur, Ghatgaon, Keonjhar and Jumpura which is more congested due to the connectivity of the other villages along the stretch as well as to avoid traffic congestion due to the movement of heavy vehicle totalling to 32.800 Km. long bypass. The chainage wise details of bypass have given in Table-1 in the project background section of this report.

28.3 23.2. REALIGNEMNT:

55. To minimize the social impact, about 5.566 Km. long realignment/geometric improvements have also been proposed in the existing project stretch. The chainage wise details of bypass have given in Table-2 in the project background section of this report.

29. LAND ACQUISITION IN THE PROJECT

56. The existing Right of Way (ROW) all along the project corridor is around 7 to 35 m on either side of the centreline. However to have a uniform RoW of 60 m on either side of the road, the land acquisition is being done NHAI with the help of the district administration. As per NHAI RoW hand over letter the total land required for the widening and strengthening of the existing 2-lane road carriageway section of NH-215 by 4 laning is 949. 18 Ha. Out of which the existing RoW is 313.37 Ha. private land is 355.32 Ha., Govt. land is 128.55 Ha. and Forest land is 151.94 Ha. The total land required for the subproject is given **Table:-6** below.

Table-6: Total land required for the project

Sl No	Ownership of Land	Required Land in Hectares (Ha.)	Land Already Acquired (Ha.)	Remaining land to be Acquired (Ha.)
1	Forest Land	151.94	Stage-II Forest Clearance is in process	151.94
2	Govt. Land	132.150	132.150	0
3	Private Land	363.35	352.451	10.899
4	Existing RoW	313.37	313.373	0
Total		**960.810**	**797.974.**	**162.839**

Source: RoW hand over letter, NHAI

57. During the discussion it was informed by the concessionaire that the land acquisition is being carried out by the Concessioning Authority i.e. NHAI after the official Gazette Notification were published (under subsection (1) of section 3A of the National Highway Act 1956) in the Gazette of India. The notifications for land acquisition have also been published in the Vernacular language in the regional daily Oriya Newspapers in "The Samay" and "The Dharitri" for Jajpur District and "The Samaya", "The Dharitri", and "The Pragatibadi" for Keonhjor District. A sample copy of the Gazette Notification for land acquisition is attached as **Appendix- X.**

58. **Gazette Notifications for Land Acquisitions:-**The Gazette of India is a public journal and an authorized legal document of the Government of India published weekly by the Department of Publication, Ministry of Urban Development. It is authentic in content, accurate and strictly in accordance with the Government policies and decisions. Through the Gazette Notifications for land acquisitions, the Central Government declared its intention to acquire the land for widening, maintenance, management and operation of National Highway No.-215 (NH-215), falling within the stretch of the land from Km 0+000 – 163+000 (Panikoili to Rumeli section), in the state of Odisha, under sub-section (3) of section 3A of the said NHAI Act 1956.

59. As per the Concession Agreement subject to provision of Section 10.2.2 and Schedule-B of Concession Agreement, the Concessioning Authority has handed over encroached free and free from all encumbrance Right of Way (RoW) has handed over to the subproject developer. The RoW hand over letter from NHAI to the Concessionaire, the Sai Maatarini Tollway Pvt. Ltd.by NHAI for the sub-project is given in **Appendix- XI.**

60. During the site visit and discussion with the concessionaire reveals that, major part of land acquisition was completed and land was already available with the concessionaire. It was also informed that there is no outstanding grievance/issue with respect to the land acquisition and compensation.

61. As information provided by the concessionaire, there are two pending litigation cases related to land acquisition and compensation which are being dealt by the competent authorities and expected to be settled on time. The reason of dispute and their current status is detailed in the below **Table-7.**

Table-7: Pending litigation cases related to land acquisition and compensation

Sl. No.	Location	Reason of Dispute	Current Status
1	Km.35.384	Belbahali Villagers wants change of	The matter reached Secretary

		alignment	(works), Odisha for his orders which are to be communicated shortly.
2	Km.161.000	Bhaluka villagers in Jumpura Bypass wants change of alignment for 1 Km.	The matter is referred to NHAI / Collector, Keonjhar for resolution.

Source: information from the Concessionaire

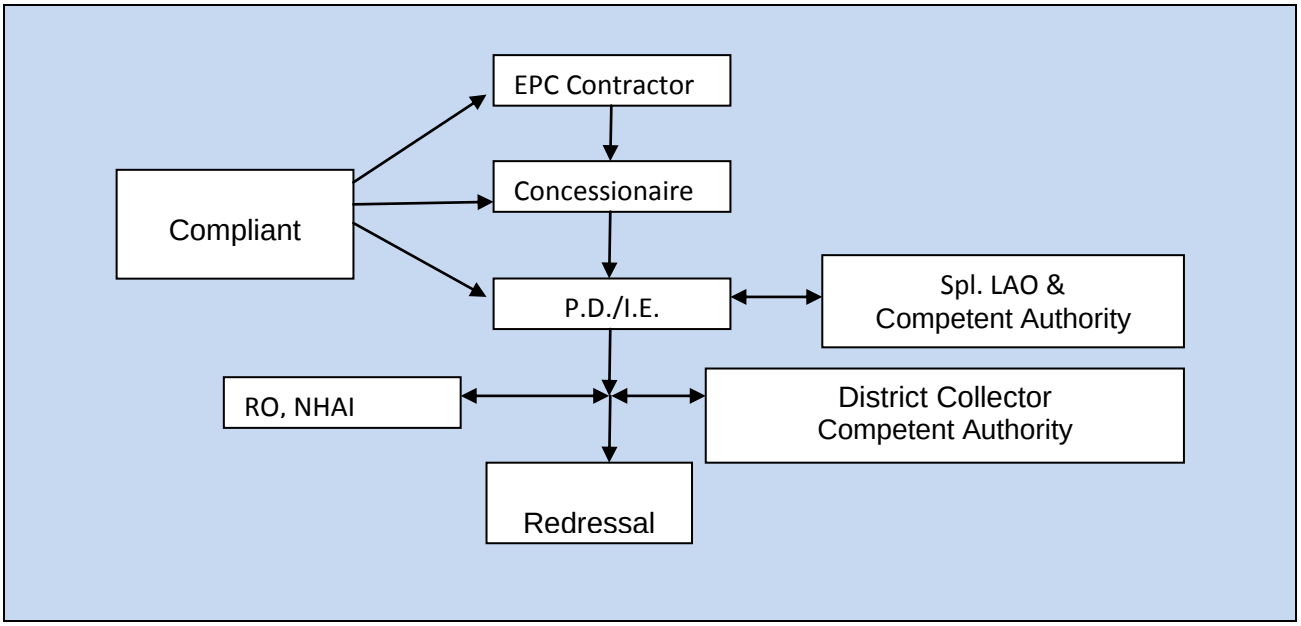
62. These two litigation cases are related with villagers of Village - Belbahali and Village – Bhaluka. The Villagers of Village – Belbahali wanted to change the alignment at Km.35.384 and the matter is pending before the Secretary Works, Odisha. The second matter is relating to Villagers of Village - Bhaluka wanted changes in Jumpura Bypass alignment for Km.161.000 and the matter has already been referred to NHAI as well as the District Collector, Keonjhar. In both the cases the subproject developer is looking forward for early resolution by the competent authority. The total length of these two stretches put together is 4 Kms and there will not be any implication on account of these pending litigations with the operation of toll revenue as confirmed by the project developer.

30. GRIEVANCE REDRESSAL MECHANISM

63. As information provided by the concessionaire, SMTL has formed their own grievance redress mechanism to deal with the land acquisition and resettlement issues in the project area. Whenever the concessionaire receives any complaints in writing from any project affected person, at first the project authority will try to resolve the issue/matter at project level by site in-charge, if the site in-charge is unable to resolve the issue then the matter will be forwarded to the Regional Officer, NHAI, Bhubaneswar as well as the concerned District Collector to resolve the issue amicably.

64. For early resolution of any issue and on time completion of project, the project authority has formed their own institutional arrangements to deal with the land acquisition and resettlement issues in the project area. The flow chart showing the Institutional Arrangement to deal with Land Acquisition, rehabilitation resettlement and other issues is as follows:

Figure-3: Grievance Redressal Mechanism



31. COMPENSATION AND ENTITLEMENT:

65. Land acquisition is being done by NHAI as per the applicable policy of NHAI Act-1956. The compensation for the loss of properties has been decided by competent authority. The payment of compensation is being paid through Cheque. A sample copy of Cheque relating to payment of compensation is attached as **Appendix-XII.**

66. NHAI has prepared this project for its own funding requirement and not in anticipation to ADB's operation, thus the land acquisition has been done by NHAI and the compensation has been paid for loss of properties as determined by the Competent Authority for Land Acquisition is the district administration. Compensation is being paid at the market value considering the local market rate obtained from the Revenue Department of the state.

32. RESETTLEMENT IMPACT IN THE SUB-PROJECT

67. During the site visit it was observed that the project corridor passes through mostly, agricultural and forest lands on either side of the road, during the project planning and preparation stage the Concessioning Authority has taken due care and consideration not to affect any major settlement areas. During the site visit, it was also observed that most of the major cities/habitation area have been avoided by providing bypasses and to minimize the impact of resettlement and rehabilitation five number of bypasses has been proposed.

68. As informed by the subproject developer, the major portion of land acquisition was completed except few stretches. It is also informed that no substantial resettlement and rehabilitation was involved in this project but some impact on private structures like; residential, commercial, residential cum commercial structures are being affected due to the 4 laning of the sub-project. However, the affected people are compensated before handing over the land to the concessionaire. The details of affected structures along the project are given in Table-8 below.

Table-8: Type of Structures Affected

Sl. No.	Type of Structures Affected	Number of Structures Affected
1	Pucca	462
2	Semi Pucca	1120
3	Kutcha	533
Total		**2115**

Source: Detail Project Report

32.1 Impact on Religious properties

69. During the site visit it was also informed that the construction work will be carried out without affecting any religious and common/community properties, however one Mazzar at Chainage 150.000 on left hand side (RHS) at Arsala village is going to be affected, for which the necessary steps is being taken by NHAI by prior consultation with local people. Also, efforts have been made during the alignment of the project that the impact may be minimal/no impact during the construction stage.

32.2 Local employment Generated by the Concessionaire

70. As informed by the concessionaire, the subproject provides employment opportunities to about 390 local people during the construction stage of the sub-project, especially with respect to skilled, semi-skilled and unskilled labour. Moreover, all the local people are employed in the six camp sites in the subproject. During the discussion with the concessionaire, it was also informed that the EPC contractor has employed few local people as security guards, driver, cook, administrative assistants, cleaning, sweeping and maintenance of the road etc. Also, few vehicles from the locality have been taken on hire basis for project works and movement. The local labour employed by the concessionaire in the project is given in below **Table-9.**

Table-9: Employment Generated During Construction Stage of the Project:

Component	Local Labour employed	Total
Skilled	**60**	**60**
Semi-Skilled	**115**	**175**
Unskilled	**215**	**390**

Source: information provided by the Concessionaire

32.3 Impact on Labour Health, Safety, Hygiene of Construction Workers

71. As informed by the subproject developer, the company has hired skilled and unskilled workers belonging to the project region. As per the labour license given by the office of the Deputy Labour Commissioner, Jajpur, Jajpur Road, Odisha and Office of the Assistant Labour Commissioner, Keonjhar, Odisha the maximum numbers of workers are to be engaged for execution of contract job engaging contract labourer not exceeding 100 (one hundred) on any day.

72. During the site visit it was noticed that, the workers have been provided with adequate safety measures such as safety helmets, safety boots, Highway jackets and gloves. Facilities like onsite accommodation with basic amenities like drinking water, toilets, transportation to work site and safety gears. Construction workers have also been provided with ready access to on- or off-site health care check-up facilities and for any minor injuries first aid tool box has been provided in base camp as well as with site offices. The detail of Labour licenses for the two districts are given under **Appendix-XIII.**

32.4 Details of Community Welfare Measures Carried out by the Developer

73. As part of goodwill and responsibility towards community, some of the welfare activities have been listed by the concessionaire under Corporate Social Responsibility (CSR). While addressing the needs of the local community, the project authorities have earmarked some of the activities for the local people's development, which are as follows:

- By providing drinking water facility to the village, Harida Ghot one tube well has been constructed;
- As per the public demand one Club Hours has been constructed at Harida Ghot;
- Levelling and repair of playground for Govt. Engineering College at Keonjhar;
- Levelling and repair of playground for Upper Primary School and for local people at Raisuan, Ranki,Banajodi village;
- Levelling of hilly area for cattle huts at Ranki village

- Development of Dams (water storage facility) for villagers at Atibhudi Pada, Ranki and Sirispal village;
- Construction of compound wall of Veda Vidyalaya at Sidha Math;
- Development and maintenance of football ground and cricket ground at Haida Ghot and Tulsichoura village respectively;
- Development of water pond and removing slush at Tulsichoura;
- Development and repair of the service road/approach road at Tulsichoura and Harid Ghot

33. DISCLOSURE:

74. The final ESDDR report will be accepted and owned by the Concessionaire and endorsed by IIFCL. After getting the No Objection Certificate (NoC) from the ADB, the report will be uploaded for public disclosure in IIFCL's website Project developer's website as well as ADB's website.

34. MONITORING BY IIFCL:

75. On behalf of NHAI the appointed Independent Engineer M/s Sai Consulting Engineers Pvt. Ltd. is being monitored periodically and submitting the periodic compliance monitoring report to NHAI for the subproject which also includes the status of land acquisition, compensation, any disputes, utility shifting, and religious structures affected.

76. On behalf of Lenders the Lenders Independent Engineer (LIE) M/s Consulting Engineering Services (India) Ltd. Mumbai, is monitoring the financial as well as physical progress of the project and submitting the Monthly Progress Report to the lenders which captures status of land acquisition, status of tree cutting, utility shifting, maintenance and applicable permits.

35. SITE VISIT OBSERVATIONS

77. Site visit was undertaken by the ESMU team of IIFCL on 27th and 28th of October 2014 to understand the project and safeguard procedures adopted by the subproject developer. During the site visit it was observed that:

- The project corridor passes through mostly, agricultural and forest lands on either side of the road;
- As informed by the subproject developer, they are organizing awareness camp for road users for following safe road use like safe driving, use helmet while driving motorcycle, safe speed, keeping vehicle in condition etc.
- With the request of the local people the subproject developer has engaged themselves for Enhancement/ construction of village road/approach road for the villagers;
- It was observed during the site visit that the rehabilitation of borrow area by converting it as pond, cultivable land, and levelling the hilly area by converting it as plane area for plantation purpose.
- As informed by the subproject developer that the local labours are being engaged in the construction activities for unskilled and semi-skilled activities;
- During the discussion with the developer , it was observed that 10-15 local vehicles are hired for support of the project;

- Within the camp site the EPC contractor has maintained proper sanitation facilities of drainage, sewerage, hygiene mess facility, for drinking water they have established RO plant for the workers;

- Construction workers are provided with ready access to on- or off-site health care check-up facilities and are being provided with first aid for minor injuries;

- Proper traffic diversions and appropriate signages are being provided at the site to prevent any disruption of life and the highway traffic.

36. CONCLUSION AND RECOMMENDATIONS

78. Based upon the available documents and site visits it appears that the subproject developer has undertaken social safeguard measures for better and on time implementation of the sub-project. The key observations on due diligence on the social impacts are summarised as follows:

- The sub-project has been prepared by NHAI as per its own funding requirement and not in anticipation to ADB's operations;

- Five bypasses have been proposed at major settlements i.e. Jajpur Road, Anandapur in Jajpur District , Ghatagaon, Keonjhar and Jhumpura in Keonjhar Destrict to avoid resettlement and rehabilitation

- The project does not pass through any ecologically sensitivity areas such as national parks, sanctuaries, tiger reserves.

- The land acquisition has been done by NHAI under the Land Acquisition Act 1894 (Act-1 of 1894), and compensation is being paid to the affected families before the start of the civil construction activity;;

- Considering the socio-economic profile of the sub-project areas, it can be noted that the sub-project will improve the quality of life of the people;

- The sub-project will improve better connectivity to the rural area by connecting through State and National Highways;

- Concessionaire has undertaken various community development activities to benefit the local people which were documented in the subsection 31.6 of this report;

- Local labourers are being hired from the locality for day to day activity and construction purposes. These labourers go back to their own houses in the evening after completing day's work;

- Based on the site visits observations, desk review and during the preparation of the due diligence report, it appears that the sub-projects have no significant social safeguard issue.

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NATIONAL HIGHWAYS AUTHORITY OF INDIA

(MINISTRY OF SHIPPING, ROAD TRANSPORT & HIGHWAYS)

CONSULTANCY SERVICES FOR FEASIBILITY STUDY AND DETAILED PROJECT FOR FOUR/SIX LANING FROM PANIKOILI (Km. 0.000) TO RIMULI (Km. 163.000) OF NH-215 IN THE STATE OF ORISSA

CONSULTANCY PACKAGE: NHDP - III/DL 4/23

DETAILED PROJECT REPORT

VOLUME - IV
PART - I: ENVIRONMENT IMPACT ASSESSMENT/ ENVIRONMENTAL MANAGEMENT PLAN (EIA/EMP) REPORT

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OCTOBER 2010

NATIONAL HIGHWAYS AUTHORITY OF INDIA

(MINISTRY OF SHIPPING, ROAD TRANSPORT & HIGHWAYS)

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[illegible]

PART - I: ENVIRONMENTAL IMPACT [illegible] ENVIRONMENTAL MANAGEMENT PLAN (EIA/EMP) REPORT

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OCTOBER 2010

The Team

Sl.No.	Details of the Team members	Position / Expertise
1.	**Dr. S.V. Rao** Former Member Secretary , A.P.P.C.B & Engineer-in-Chief (P.H & ME)	Project Advisor
2.	**Mr. M. Kishore Kumar**	Chief General Manager (Highways)- Expert in Highway engineering
3.	**Mr. W. Prakasa Rao**	General Manager (Highways)- Expert in Highway engineering
4.	**Dr. K.S.S.V.V. Prasad**	Senior Manager (Environment) & Team Leader (Expert in EIA /EMP)
5.	**Dr. Abhash Chandra Panda**	Expert in EIA/EMP
6.	**Mr. Abhay Kare**	Traffic expert
7.	**Mr. Harish / Suresh**	Highway Design Engineers
8.	**Mr. K.V.N.Raju/ Mr.Ch. Ramesh Naidu**	GIS experts
9.	**Mr. B. Venkat Rao**	R&R Specialist
10.	**Mr. P. Ram Mohan Rao**	R&R Specialist
11.	**Mr. Krupendra Paul / G. Sharat Chandra Rao**	Jr. R&R Specialist
12.	**Mr. K. Kareemulla Basha**	Environmental Engineer
13.	**Dr. B. Mishra**	Environment Laboratory
14.	**Mr. Binayak Dash**	Baseline Data Monitoring Expert
15.	**Mr.J. Murali Krishna**	GIS
16.	**Mr. D. Vasu**	GIS

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EXECUTIVE SUMMARY

1.0 Introduction

National Highways Authority of India (NHAI) at the direction of Ministry of Road Transport and Highways (MoRTH), Government of India has proposed to improve and strengthen the corridor of National Highway-215 in Panikoili – Keonjhar – Rimuli, between the chainage Km 0+000 to Km 163+000 of NH-215. The project road runs through the districts of Jajpur and Keonjhar in the State of Orissa. The corridor passes through several congested areas, sharp curves and has inadequate road width to cater the present traffic volumes. These deficiencies result in lesser vehicle speeds, more wear and tear on vehicles, more vehicular pollution and more vehicle operating costs. The environment impact study is a part of the feasibility studies and preparation of detailed project report and is also a statutory requirement for obtaining environmental clearance from Ministry of Environment & Forests (MoEF), New Delhi.

NHAI has assigned M/s 'aarvee associates' to carry out Environmental Impact Assessment (EIA) study for the proposed project as an integral part of Detailed Project Report. Accordingly, an aarvee associate has taken up the assignment in accordance with Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forests (MoEF) - Government of India.

2.0 Project Description

2.1 Location

The project road (NH 215) is passing through Jajpur and Keonjhar districts, having 163 km length and connecting NH-5, NH-6 and NH 23 in Orissa state. The project reach from Km. 0.00 to Km. 25.00 is in Jajpur District and the major portion from Km. 25.00 to Km. 163.00 is in Keonjhar District. The project lies between 20^0 54′ N to 21 57′ N and 86 13′ E to 85 36′ E. An average altitude of the stretch varies from 160.1 to 423.6 m. It is situated more than 65 Km away from seacoast and the climate is tropical.

2.2 Project Features

The existing National Highway –215 Project is having 2 lane road, as part of the development of the arterial National Highway- a project intended to improve the road connectivity to NH 5 & NH 6, which leads to very good communication facility to the existing Iron, Manganese, and Chromite ore mines along the corridor to Paradeep Port. NHAI at the direction of the MoRTH has proposed for upgrading from 2 lane to 4/6 laning of the existing road.

The present project is limited to widening and upgradation of existing alignment from 2 lane to 4/6 lane with bypasses.

2.2.1 Need of the project

Highways play a significant part in national and regional economies particularly in the development of trade, tourism and investment. Increasingly, Highways will become vital as freight increases in importance as a major part of the export economy and as regional markets grow. Strengthening and widening of highways and its operation are of national significance, because the highways are expected to generate a wide range of economic activities which should help national development, and also because a wide communication network is generally felt to represent its country. The proposed project is being developed as a major transit hub between different parts of the country.

2.2.2 Cost

The estimated cost of the project including direct and indirect charges is about **Rs. 1129** crores.

2.2.3 Indirect Benefits:

Road widening project can harmonize with the surrounding environment and serve multiple users with the following benefits.

- To improve the economic and social welfare of nearby people.
- Good connectivity to the highly minerals rich area, sub-urbans and link roads.
- The Increased road capacity and improved pavements can reduce travel times and lower the costs of vehicle operation,
- Increasing access to markets, jobs, education, and health services.
- Reducing transport costs for both freight and passengers.

3.0 Base Line Status of Project Site

Base line studies were undertaken to generate baseline data in and around the project site (for winter season i.e. from December 2005 to February 2006), M/s. Aarvee associates conducted Environmental studies in association with M/s. ERA Consultancy Private Limited, Bhubaneshwar. Environmental attributes namely air, noise, water, land, biological and socio-economic environment have been identified and the study conducted generally conforms to the requirements of the EIA Notification, 1994 and subsequent amendments.

4.0 Identification and Prediction of Impacts

This section summarizes the pollution potential of the proposed road widening project and its possible impact on the surrounding environment during construction and operational phases.

4.1 Air Environment

The ambient air quality status collected at 6representative location of urban, semi urban and rural areas reflect the ambient air quality status, which are well within the CPCB standards except TSPM, the TSPM values at all monitored locations with respect to Maximum, and 98 percentile are found to be exceeding its stipulated limit of 200 $\mu g/m^3$ except, at Ghatagaon. However, mean and 75 percentile values of Panikoili, Ghatagaon, Jhumpura, and Champua are well within the stipulated limit.

The total mean suspended particulate matter values observed range between 140 - 285 $\mu g/m^3$ against the CPCB standard of 200 $\mu g/m^3$. Mean Respirable particulate matter values were found to range between 43 - 72 $\mu g/m^3$ against the CPCB standard of 100 $\mu g/m^3$. Mean NOx values were observed to range between 24 - 41 $\mu g/m^3$ against the CPCB standard of 80 $\mu g/m^3$ while the Sulphur dioxide mean values were observed to range between 32 - 44 $\mu g/m^3$ against the CPCB standard of 80 $\mu g/m^3$. The carbon monoxide levels observed are in between 1.4 – 3.2 ppm (4.0 mg/ m^3) against the CPCB standard of 4 mg/ m^3.

Road construction will involve earth excavation, backfilling and concreting. Impacts on air during the construction phase could be due to earth excavation, backfilling and transportation of construction materials, D.G sets which may lead to rise in air pollution. However, the impact on ambient air quality will not be significant, since the dust generated is confined to the proposed area and as it will be taken care of by adopting suitable control measures as described in EMP. However, this impact is localized. The impacts during operation phase were predicted using California Line Source Emissions -4 (CALINE-4) model and the predicted values are observed to be within the prescribed limits of Central Pollution Control Board (CPCB), New Delhi.

4.2 Noise Environment

The noise monitoring has been done at fifteen stations. Under residential category, the day and night noise levels observed are exceeding its stipulated limit of 55 dB (A) & 45 dB (A) respectively. The maximum noise level observed under residential category is 67.8 dB (A). The day & night noise levels monitored in the Commercial areas are found to be well below the stipulated day limit of 65 dB (A) and exceeding its night limit of 55 dB (A). The maximum noise level observed under commercial category is 69.2 dB (A). Two stations fall under Industrial category exceeding its day and night stipulated limit of 75 dB (A) and 70 dB (A) respectively. The maximum level observed under this category is 81.5 dB (A). Interestingly, the noise levels observed in all categories are quite high during nighttime than daytime. This is due to the fact that trucks/lorries loaded with mineral ores are allowed to ply only during nighttime i.e. between 8PM to 8AM. Because of very poor road condition and frequent accident due to plying of about 10000 loaded trucks, Districts Administration has fixed 8 PM to 8 AM for movement of trucks.

The impact of noise levels from the project on the neighboring communities would be anticipated with the increase in vehicles and will vary with speed of vehicles. During construction, the major sources for noise pollution will be movement of vehicles transporting the construction materials to the road and the noise generating activities at the construction yard itself. However, the predicted noise levels during NH operation phase are drastically come down when compare with the existing levels. The impacts during operation phase have been predicted using Federal Highways Administration (FHWA) noise model and the predicted values are observed to be within the CPCB limits after proposing noise barriers and other mitigation measures, wherever required.

4.3 Water Environment

As road projects may cross various water bodies, the impacts during construction stage would lead to sediment load, disturbance of aquatic ecology etc. The water requirement

for the construction activities will be met from ground / surface water sources. The abstraction of water from these resources will be temporary and will have marginal impact. Due to construction activity, the run-off water and drains from construction area will contaminate the surface water bodies and the turbidity/sediment load in water bodies will increase due to run-off. There will be temporary disturbance in water flow/drainage pattern due to construction activities, which may have adverse affect on nearby water bodies. These impacts are temporary in nature and have no permanent effect on surface water.

The Wetlands under the influence of project alignment will be restored by the following managements.

1. Enhancing the capacity of Wetlands by dredging / raising its bunds or augmenting the area of lake by widening the water spread area/ deepening the lake area by de-silting.
2. Beautification of Wetlands with floral treatment and landscaping will attract the Naturalist to the maximum.
3. The natural drain system will be augmented with proper treatment facilities.

4.4 Flora and Fauna

Due to road construction some trees (Mahul, Neem, Sal, Sirish, Tamarind, Acacia, Bamboo, Banyan, Chakunda, Eucalyptus, and Gambhari etc) will be removed along ROW alignment and these can be compensated by proposed avenue plantations. Around 71.1 ha of forest land is required for the project and compensatory afforestation is proposed under the supervision & guidance of forest department.

4.5 Socio-Economic Environment

The following positive impacts are anticipated on the socio-economic environment during the project construction and operation phases:

1) A number of marginal activities and jobs would be available to the locals in the project. The project provides livelihood opportunities during construction phase at a rate of 35 jobs for the investment (Civil works) of each crore of rupees.

2) The project will provide improvements in road network leading to improved socio economic status of the region. The land prices are anticipated to rise.

3) Increasing access to markets, investments, jobs, education, and health services.

4.6 Solid Waste

During the construction considerable quantity of muck will be generated. The generated muck to some extent will be useful for embankments, filling up the low-lying areas and some part will be useful for construction of roads, etc. The top soil shall be kept separately and shall be used for plantation purpose, and also for soil conditioning by the local farmers.

4.7 Costs towards Environment and Ecology

Apart from the different developmental activities, NHAI has planned to take up mitigative measures as suggested in EMP chapter pertaining to different environmental attributes. The project proponent (NHAI) has provided a sum of Rs. **1531.9** Lakhs. The allocations for EMP costs are as follows;

Cost Estimates for Environmental Management Plan (EMP)

S.NO	Item	Unit cost/ Lump sum cost (Rs.)	Total cost (Rs.)
I Logistics cum Administrative costs			
1	Vehicle cost	@ Rs 25,000 per month for 30 vehicle	7,50,000.00

		months	
2	Office administration (including man power costs) and logistics etc for Environment Management Cell (EMC)	For 30 months @ Rs.30,000/month	9,00,000.00
II Construction costs			
3	Sanitation- sulabh – sowchalaya 16.5 sq.m area (Included in project cost)		20,00,000.00
4	Dust suppression all along the stretch & Erosion control Retaining walls, slope pitching and turfing. (Included in project cost)		1,50,00,000.00
5	Labour camps, health and other services (Included in project cost)		15,00,000.00
6	Solid waste management (Included in project cost)		15,00,000.00
III Tree plantation and compensatory afforestation			
7	Avenue trees including 3 years maintenance - around 1,30,400 trees (Included in project cost)		2,50,00,000.00
8	Shrub plantation in median and landscaping (Included in project cost)		1,50,00,000.00
9	Land for compensatory afforestation 71.1 hectares	Rs. 2,00,000/- per hectare	1,42,20,000.00
10	Compensatory afforestation for 71.1 hectares	Rs. 8,50,000	6,04,35,000.00
IV Monitoring costs : Construction Phase			
11	Air Quality Monitoring (6 Monitoring stations) once in a season during the construction period	Rs. 6,000 per station	3,24,000.00
12	Noise level Monitoring (15 Monitoring stations) once in a season during the construction period	Rs. 1000 per station	1,80,000.00

13	Water Quality Monitoring (22 Monitoring stations) once in a season during the construction period	Rs. 2000 per station	5,28,000.00
14	Soil Quality Monitoring (8 stations) once in a season during the construction period	Rs. 3000 per sample	2,88,000.00
15	Awareness programmes (Lump sum)	3,00,000	3,00,000.00
16	Borrow area monitoring (Once in a year) 43 borrow areas	Rs. 10,000 per borrow area per 3 seasons	4,30,000.00
V Monitoring costs : Operation Phase			
17	Air Quality Monitoring (6 Monitoring stations) thrice a year (once in a season)	Rs. 6000 per station	1,08,000.00
18	Noise level Monitoring (10 Monitoring stations) thrice a year (once in a season)	Rs.1000 per station	30,000.00
19	Water Quality Monitoring (6 Monitoring stations) thrice a year (once in a season)	Rs. 2000 per station	36,000.00
20	Soil Quality Monitoring (4 stations) thrice a year (once in a season)	Rs. 3000 per sample	36,000.00
21	Disaster Management Plan	L.S	5,00,000.00
22	Awareness /Training programmes and Workshops (Lump sum)	2,00,000	2,00,000.00
Total			**13,92,65,000.00**
Contingency 10%			**1,39,26,500.00**
Grand Total			**15,31,91,500.00**

Rs. 11.4 lakhs/year (from item 16 to 21) provision is made for Environmental Monitoring Programmes and other maintenance works.

5.0 Environmental Management Plan

Based on the detailed evaluation of the likely impacts on various environmental parameters, an environmental management plan is prepared. The mitigative measures for minimization of adverse impacts along with afforestation (green belt development/plantation) programme have been incorporated in the chapter on environmental management plan.

Post-project Monitoring and analysis shall be carried out as per the procedures given in chapter 6. The frequency, methodology of sampling and testing for various pollutants specified by CPCB/OPCB will be followed.

Salient Feature of Road Widening Project

1	Name of the project	:	FS/DPR for 4/6 laning from Panicoili - Keonjhar - Rimuli (Km to163) to Km 163.00) in NH-215 of Orissa State.
2	Location	:	The location lies between Panicoili in Jajpur Dist to Rim Keonjhar(Km Dist(Km. 000 to Km 163.00) and in between 20° 54' N to 21° 57' N and 86° 13' E to 85° 36' E
3	Details of the project	:	The existing National Highway –215 Project in (Panicoili-Keonjhar-Rimuli) (km 000 to km 163.00) is having 2 lane road, as part of the development of the arterial National Highway- a project intended to improve the road connectivity from Panicoili NH-5, to Rimuli NH-215. NHAI at the direction of the MoRTH has proposed for upgrading from 2 lane to 4/6 laning of the existing road. Existing road, over a length of 163 km traverses through small hillocks, where the road geometry is very poor. The available width is sufficient to form 4 lane carriageways. This project is to provide the road with better geometry by eliminating poor road geometry. Five bypasses have been proposed at major settlements i.e. Jajpur Road, Anandapur, Ghatagaon, Keonjhar, and Jhumpura town to avoid resettlement and rehabilitation problem. Care has been taken to acquire minimum forest land along the stretch. In the proposed project, forest with a width of 30m and length of 23.7 km, demand 71.1 Hectares of land is required. The alignment passes in Derakhola R.F, Poijman R.F, Atai R.F, Ghatagaon R.F, Sanamasinabila R.F, Pippilia R.F, Badaposi R.F,for a length of 23.7 km following the existing village road connecting the villages en route.

4	Project cost	:	Rs1129 Crores
5	Road configurations	:	Total formation width for the 4 lane carriageway is 25 m. Wherever land is not available median is reduced. The configuration of four lanes consists the following: ❖ 7.25 m carriage way on either side ❖ 1.5 m wide paved shoulders on either side ❖ m wide hard shoulders in either side ❖ 4.5 m wide median / central verge. ❖ Side slopes adopted are 2:1 for all embankments and excavations.
6	Length of the Road	:	Present stretch 163 kms after inclusion of bypasses 168.1 Km
7	Districts covered	:	Jajpur and Keonjhar Districts of Orissa State.
8	Land required for the project	:	(574.2 ha in Jajpur district and in Keonjhar district. Refer annex-a for village wise details.
9	Bypass details, Jajpur Road , Anandapur Ghatagaon, Keonjhar,& Jhumpura.		(i) Cost of the bypass Rs. (ii) Length in Km: 20.00 (iii) RF length passing: 23.7 km
10	Village details-passing through bypass		Refer Sl.no.3 of Annex-A (List of villages / towns passing ROW)
11.	Project Benefits	:	❖ Relieves traffic congestion. ❖ To improve the economic and social welfare of nearby people. ❖ Good connectivity to the sub-urbans and link roads.

			❖ The Increased road capacity and improved pavements can reduce travel times and lower the costs of vehicle operation, ❖ Increasing access to markets, jobs, education, and health services. ❖ Reducing transport costs for both freight and passengers.

Annex-A

The list of towns and Revenue villages and their location passing the ROW are given below:

List of Villages and Towns on NH-215 from Km 0.00 to Km 163.0

Sl No	Village/Town Name	Block	District
1	Panikoili	Korai	Jajpur
2	Mahamad Jamalpur	Korai	Jajpur
3	Aliya	Korai	Jajpur
4	Dhaneshwar	Korai	Jajpur
5	Janha	Korai	Jajpur
6	Sanpatoli	Korai	Jajpur
7	Santara	Korai	Jajpur
8	Jajpur Road	Korai	Jajpur
9	Chorda	Korai	Jajpur
10	Kanhepur	Korai	Jajpur
11	Chandma	Korai	Jajpur
12	Nuagadh	Korai	Jajpur
13	Nuagaon	Korai	Jajpur
14	Itapur	Korai	Jajpur
15	Thodagara	Korai	Jajpur
16	Kantajahri	Korai	Jajpur
17	Manjuri	Korai	Jajpur
18	Ragadi	Korai	Jajpur
19	Andhari	Korai	Jajpur
20	Jarada	Ghasipura	Keonjhar
21	Ramachandrapur	Ghasipura	Keonjhar
22	Suanpada	Ghasipura	Keonjhar
23	Nuagaon	Ghasipura	Keonjhar
24	Khalana	Ghasipura	Keonjhar
25	Badapada	Ghasipura	Keonjhar
26	Machala	Ghasipura	Keonjhar
27	Rudranarayan Pur	Ghasipura	Keonjhar
28	Bamdi	Ghasipura	Keonjhar
29	Hasanpura	Ghasipura	Keonjhar
30	Belabahali	Ghasipura	Keonjhar
31	Bharigaon	Ghasipura	Keonjhar
32	Bailo	Ghasipura	Keonjhar
33	Salpada	Ghasipura	Keonjhar

Sl No	Village/Town Name	Block	District
34	Khapana Khai	Ghasipura	Keonjhar
35	Gasipura	Ghasipura	Keonjhar
36	Sailang	Ghasipura	Keonjhar
37	Gohira	Ghasipura	Keonjhar
38	Talagaon	Ghasipura	Keonjhar
39	Biragobindapur	Ghasipura	Keonjhar
40	Bhalukumar	Ghasipura	Keonjhar
41	Dakhota	Ghasipura	Keonjhar
42	Bandha	Ghasipura	Keonjhar
43	Kanto	Ghasipura	Keonjhar
44	Kolimat	Ghasipura	Keonjhar
45	Kumuda	Ghasipura	Keonjhar
46	Darkhota	Ghasipura	Keonjhar
47	Bhojiamoda	Ghatgaon	Keonjhar
48	Melana	Ghatgaon	Keonjhar
49	Baljodi	Ghatgaon	Keonjhar
50	Ghatagoan	Ghatgaon	Keonjhar
51	Kusumpur	Ghatgaon	Keonjhar
52	Mulla Banda	Ghatgaon	Keonjhar
53	Gullabanda	Ghatgaon	Keonjhar
54	Bataharichandanpur	Ghatgaon	Keonjhar
55	Sananasilabila	Ghatgaon	Keonjhar
56	Sana Barabeda	Ghatgaon	Keonjhar
57	Langulakunti	Ghatgaon	Keonjhar
58	Tikina	Ghatgaon	Keonjhar
59	Dhenkikote	Ghatgaon	Keonjhar
60	Khajurijuani	Ghatgaon	Keonjhar
61	Katrabeda	Ghatgaon	Keonjhar
62	Chikinia	Ghatgaon	Keonjhar
63	Pipilia	Ghatgaon	Keonjhar
64	Bankapatali	Ghatgaon	Keonjhar
65	Gopalpur	Sadar	Keonjhar
66	Badaposi	Sadar	Keonjhar
67	Jamunalia	Sadar	Keonjhar
68	Naranpur	Sadar	Keonjhar
69	Haladia Tangri	Sadar	Keonjhar
70	Tangar Pulsa	Sadar	Keonjhar
71	Mandua	Sadar	Keonjhar
72	Kashipur	Sadar	Keonjhar
73	Keonjhar	Sadar	Keonjhar
74	Dhrupada	Sadar	Keonjhar
75	Baliaguda	Sadar	Keonjhar

Sl No	Village/Town Name	Block	District
76	Raisuan	Sadar	Keonjhar
77	Gobinathpur	Sadar	Keonjhar
78	Silisuan	Sadar	Keonjhar
79	Banajodi	Sadar	Keonjhar
80	Padmapur	Sadar	Keonjhar
81	Putulia	Sadar	Keonjhar
82	Jadi Chatar	Sadar	Keonjhar
83	Bankamareeni	Sadar	Keonjhar
84	Jamundhaiah	Sadar	Keonjhar
85	Palas Panga	Sadar	Keonjhar
86	Tangrani	Sadar	Keonjhar
87	Jhumpra	Jhumpura	Keonjhar
88	Arshala	Jhumpura	Keonjhar
89	Sundhi Mursuan	Jhumpura	Keonjhar
90	Badavadrapur	Jhumpura	Keonjhar
91	Katala Post	Jhumpura	Keonjhar
92	Balibanda	Jhumpura	Keonjhar
93	Rojabosa	Jhumpura	Keonjhar
94	Mursuan	Jhumpura	Keonjhar
95	Sijukala	Champuva	Keonjhar
96	Parasila	Champuva	Keonjhar
97	Remuli Chaak	Champuva	Keonjhar
98	Rimuli	Champuva	Keonjhar
99	Tuduva Pahal	Champuva	Keonjhar

Chapter - 1

INTRODUCTION

1.1 Background

India has one of the largest road networks in the world, aggregating to about 3.3 million kilometers. Out of the total road length, National and State Highways, accounting for 1,72,000 km in length, occupy an important position as nearly 60 percent of the freight and 87 percent of the passenger traffic move on them. The total length of National Highways in the country is 58,112 km, accounting for only 2% of the total road length and carryover about 40% of the total traffic. During the ninth plan and current tenth plan lot of emphasis was laid on coordinated and balanced development of road network in the country. Road development is considered an integral part of the total transport system of the country with emphasis on strengthening three functional groups, the primary system (National Highways and Expressways), Secondary System (State Highways and Major District Roads) and Rural roads.

The Central Government is responsible for the National Highways system and a massive programme for 4/6 laning of about 13000 km of National Highways has been taken up since 1999 under the National Highways Development Programme (NHDP). National Highways Authority of India (NHAI) is implementing the programme at an estimated cost of rupees 54 thousand crores. In addition to Golden Quadrilateral and North-South-East-West Corridor Project, other components which have been included under NHDP are:

- Improvement, maintenance and augmentation of the existing National Highways network.
- Providing road connectivity to major ports.
- Involving the private sector in financing the construction, maintenance and operation of National Highways and wayside amenities
- Implementation of road safety measures and environmental management.

- ❖ Introducing Information Technology in Construction, maintenance and all operation of NHAI.

National Highways Authority of India (NHAI) at the direction of Ministry of Road Transport and Highways (MoRTH), Government of India has proposed to improve and strengthen the corridor of National Highway-215 in Panikoili – Keonjhar – Rimuli, between the chain age Km 0+000 to Km 163+000 of NH-215. The project road runs through the districts of Jajpur and Keonjhar in the State of Orissa. The corridor passes through several congested areas, sharp curves and has inadequate road width to cater the present traffic volumes. These deficiencies result in lesser vehicle speeds, more wear and tear on vehicles, more vehicular pollution and more vehicle operating costs. The environment impact study is a part of the feasibility studies and preparation of detailed project report and is also a statutory requirement for obtaining environmental clearance from Ministry of Environment & Forests (MoEF), New Delhi.

1.2 Existing Facilities and Proposed Upgradation Work

The existing NH-215 comprise of 163 km having 2 lane road, connecting NH–5 at Panikoili of Jajpur district to Remuli of Keonjhar district. Keeping in view of the traffic load as well as scope of expansion of existing road , five (5) bypasses have been proposed in two districts namely Jajpur (from 0 to 24 kms) and Keonjhar (24 to 163 kms) of Orissa State. NHAI at the direction of the MoRTH has proposed for upgrading from 2 lane to 4/6 laning of the existing road.

1.3 Need for the proposal

Highways play a significant role in National and Regional economies particularly in the development of trade, tourism and investment. Increasingly, Highways will become vital as freight increases in importance as a major part of the export economy and as regional markets grow. Strengthening and widening of highways and its operation are of national significance, because the highways are expected to generate a wide range of

economic activities which should help national development, and also because a wide communication network is generally felt to represent its country. The proposed project is being developed as a major transit hub between different parts of the country.

1.4 Scope of Environmental Impact Assessment (EIA) Study

The NHAI has entrusted M/s. Aarvee Associates, Hyderabad to carry out preparation of Feasibility Study Report (FSR) and Detailed Project Report (DPR) for rehabilitation and upgradation of existing 2 lane to 4/6 lane Divided Carriageway Configuration. As part of the above studies aarvee associates, Hyderabad has undertaken Environmental Impact Assessment in view of the statutory requirement of environmental clearance for highway projects.

The report contains the findings of the study to identify, predict and evaluate the likely impacts due to the proposed activity and has suggested suitable mitigative measures to minimise the adverse impacts and ameliorate environmental quality in the surrounding region. The environmental / safety concerns which can be internalised in the project planning stage have been identified and suitable measures needed are elicited as Environmental Management Plan (EMP).

Detailed baseline data prior to project implementation had been generated for air, noise, water, land, biological and socio-economic environment within 7 km study area. The baseline data for pre-project environmental status is also presented along with identification, prediction and evaluation of impacts due to project activities.

1.5 Objectives of the Study

The objectives of the study are:

To obtain clearances from Orissa State Pollution Control Board and Ministry of Environment and Forests and to facilitate the proposed developmental works based on detailed studies of various environmental attributes viz., air, water, noise, land, biological

and socio-economic environment etc. likely to be affected and measures for redressing the impacts:

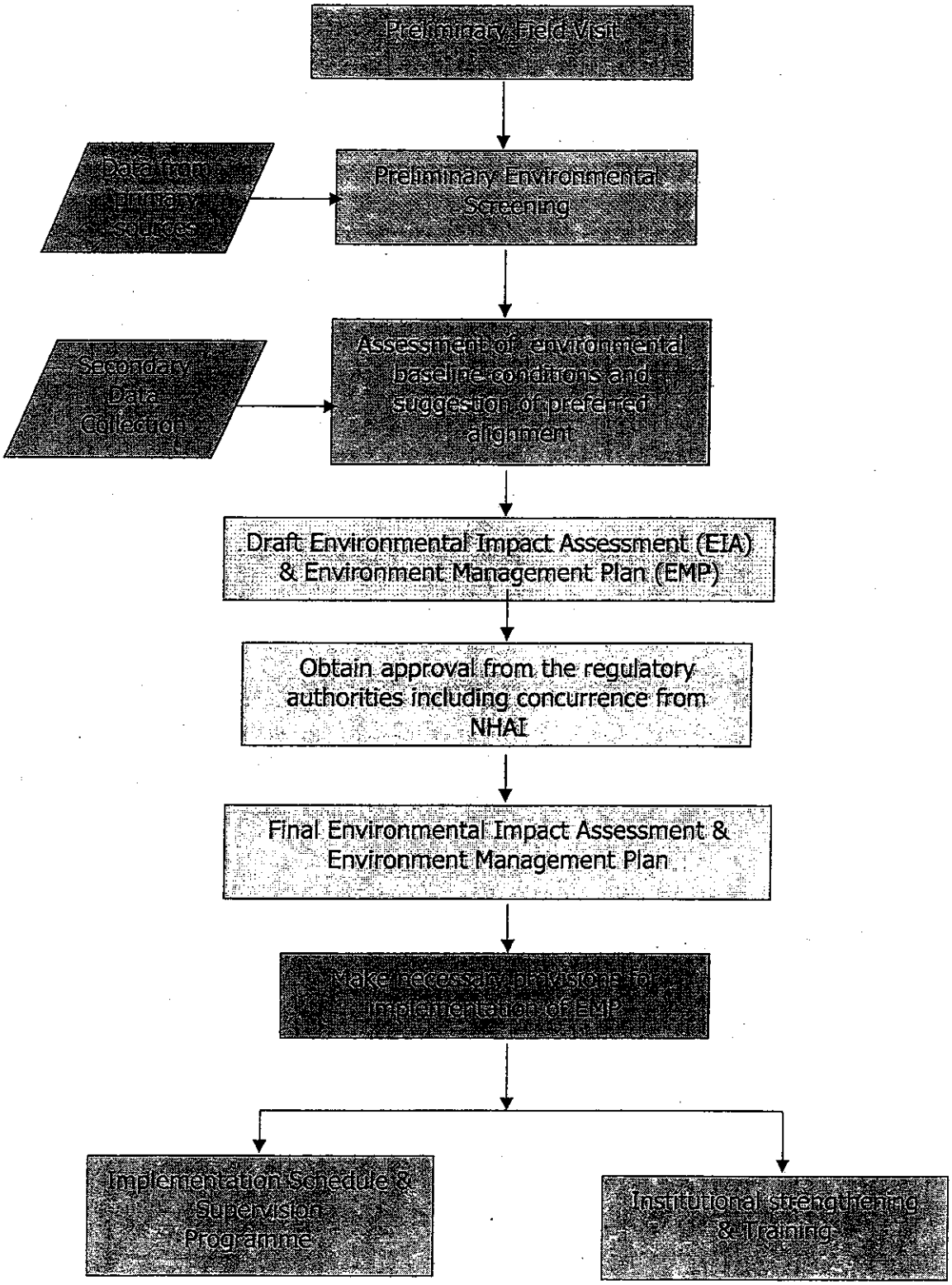
- To study the existing situation of the project in terms of its road condition, road system, road transport and the improvements with analysis of alternatives.
- To identify and quantify the significance of impacts of various activities at proposed widening of the road on environmental attributes.
- To evaluate the impacts on an environmental quality scale.
- To evaluate the proposed pollution and control measures and prepare Environmental Management Plan (EMP) outlining additional control measures to be adopted for mitigation of adverse impacts.
- To prepare a post-project monitoring programme for checking and regulating the environmental quality within the limits stipulated by State Pollution Control Board and Ministry of Environment & Forests, Government of India.

1.6 Approach and methodology

The approach for the preparation of EIA involves the following steps:
Reconnaissance survey is undertaken in order to identify the environmental attributes in and around the project site. The environmental base line data in the project impact area was generated from both primary and secondary sources. During the site visits, due importance is given to identifying the impacts of the project taking in to consideration of the project location and climatic conditions. Prediction and evaluation of the impacts are done based on mathematical models, empirical assessment and past experience. Environmental Management Plan is being prepared in order to reduce the impacts of the project to the barest minimum. Conclusively, quantification of the financial cost of mitigation measures and preparation of monitoring plan for the implementation of mitigation measures is undertaken.

The methodology adopted is presented in form of a flow chart given in figure 1.6.1.

Figure 1.6.1 Flow Chart



1.7 Structure of the EIA Report

The Environmental Impact Assessment report has been structured as follows:

Chapter-1: It contains project background, existing facilities & proposed upgradation work, need for the proposal, EIA study and major objectives of the study.

Chapter-2: This chapter presents the rules and regulations applicable for carrying out environmental assessments and laws applicable to the project in general. The institutions responsible for providing the clearances and the interfaces to be established by the project proponent and related pro-actions are also covered.

Chapter –3: The chapter depicts the existing situation of the project in terms of its road condition, road system, road transport and the improvements with analysis of alternatives.

Chapter-4: This chapter reveals the Baseline Environmental Status of the project area in terms of its physical, biological, chemical, cultural and meteorological description.

Chapter –5: This chapter presents the positive and negative impacts likely to result from the proposed project and the suggested mitigation measures.

Chapter –6: It presents Environmental Management Plan (EMP) and suggests the identification of agency for monitoring and the institutional strengthening. In addition it also suggests the cost of EMP including training.

Chapter - 2

POLICY, LEGAL AND ADMINISTRATIVEFRA ME WORK

2.1 Institutional Setting for Project

Considering the growing need of better road transportation, Government of India through Ministry of Road Transport and Highways (MoRTH) has decided to undertake widening of 2 lane road to 4/6 laning of National Highways -215 between Panikoili – Keonjhar – Rimuli, between the chainage Km 0+000 to Km 163+000,of section of NH-215. The project road runs through the districts of Jajpur and Keonjhar in the state of Orissa. Since the planning, development and management of National Highways are controlled by the National Highways Authority of India (NHAI), New Delhi, operating under the MoRTH, the present project is under the direct control of NHAI.

2.2 The Legal Framework

The Government of India has laid out various policy guidelines, acts and regulations pertaining to the sustenance of environment and some of the important have been listed below.

- The Ancient Monuments and Archaeological Sites and Remains Act, 1958
- Wildlife (Protection Act), 1972, Amendment 1991.
- The Water and Air (Prevention And Control Of Pollution) Acts (1974, 1981 And 1987)
- The Wildlife (Protection) Act, 1972, Amendment 1991.
- The Forest (Conservation) Act, 1980.
- The Environment (Protection) Act, 1986
- The Motor Vehicles Act, 1988
- The Environmental Impact Assessment Notification, 1994 and subsequent amendments till 2004.
- The guidelines of Pollution Control Board; Government of Orissa.

Some indicative list of Special Laws (other than Water Act, Air Act, EP Act and various Forest related Acts) having some provisions of Environmental Protection and relevant to this project are:

Environmental issues	Act where the issue is addressed better
Vehicular Pollution and Safety	State Motor Vehicle Acts
Transport of Flammable Toxic Chemicals on Road.	Central Motor Vehicle Act
Noise Pollution	Special Acts of States (e.g. Orissa Firecracker and Loudspeaker Regulation Act)
Conversion of Agricultural Land for Non-agricultural purposes.	Various revenue laws of the States (e.g. Orissa Land Reform Act)
Urban Land-use	Various Development Authority Acts of the States
Rural Water Sanitation	Special State Laws (e.g. Orissa Gram Panchayat Act)

2.3 Environmental Clearance Requirements from Government of India (GoI)

The primary responsibility for administration and implementation of the GoI policy with respect to conservation, ecologically sustainable development and pollution control rests with the Ministry of Environment and Forests (MoEF). MoEF is the apex administrative body in the country for regulating and ensuring environmental protection. The MoEF is responsible to enforce the regulations established pursuant to the National Conservation Strategy, National Forest Policy, the policy for abatement of pollution (1992) and the Indian Environmental Protection Act 1986, revised in 1994 and amended subsequently in 1997.

The Environmental Impact Assessment Notification, 1994 identified highways (item 21 of Schedule –1) as one of the projects requiring prior clearance in the form of EIA from the MoEF. Environmental Impact Assessment (EIA) of highways is a statutory requirement for obtaining clearance, except under conditions as given in Box 1.

The present project is limited to improvement work including only widening and strengthening of roads along the existing alignment with land acquisition (more than the requirement of marginal land condition). Road sections included in this project does not pass through any ecologically sensitive areas such as national parks, sanctuaries, tiger reserves but passes through reserve forest of about 23.7 km length.

Box 1: EIA requirement for a Highway Project

"...As per the provisions of the EIA Notification of 27th January 94 and as amended on 10th April 97, environmental clearance is required for highway projects except projects relating to improvement work including widening and strengthening of roads with marginal land acquisition along the existing alignments provided they do not pass through ecologically sensitive areas such as national parks, sanctuaries, tiger reserves, reserve forests. It is hereby clarified that marginal land acquisition means land acquisition not exceeding a total width of ***20 metre on either side of the existing alignment*** *put together. Further, it is also clarified that bypasses would be treated as stand –alone projects and would require environmental clearance only if the cost of the projects exceed* ***Rs.100 crores each".***

Source: MOEF Circular No. 21012/26-99-1A-III dated 15 October 1999 and vide amendment dated 13th June, 2002.

The Forest (conservation) Act 1980 stipulates that a project needs clearance from the Forest Department if forest land is required to be diverted for non forest purposes. The present project requires an area of **71.1 hectares of reserved forest** for highway widening.

2.4 Interface Management with Relevant Government Departments

For smooth implementation of the project the project proponent has to establish direct coordination with various government agencies like Revenue Department, Forest Department and the Pollution Control Board. A proactive role by the project proponent agency in this regard makes it convenient to get the necessary clearance from the above departments.

Department of Environment and Forests (DoEF)

DoEF perform the functions similar to the MoEF and co-ordinates the activities of the MoEF at the state level. This department is responsible to have an integrated

approach to deal with, prevention and control of air and water pollution, preservation and development of forest wealth and natural resources in the state.

State Pollution Control Board (SPCB)

The SPCBs are state level environmental management agencies with the following activities:

- Advising state Governments on air, water and industrial issues;
- Planning and executing state-level air and water initiatives;
- Establishing standards based on National Minimum Standards;
- Enforcing and monitoring of all activities within state under the Air Act, the Water Act and the Cess Act, etc,;
- Conducting and organizing public hearings for projects as defined by the various Acts and as stipulated by the Amendment (April 1997) to the EIA Act; and
- Issuing No-objection Certificates (NOC) for industrial development defined in such a way as to include road projects.

The project also requires obtaining NOC from SPCBs in pursuant to the Water (Prevention and Control of Pollution) Act of 1974, the Cess Act of 1977 and the Air (Prevention and Control of Pollution) Act of 1981 and amendment in 1987.

As per the procedure laid down by Ministry of Environment and Forests, obtaining No Objection Certificate (NOC) from the State Pollution Control Board is mandatory before seeking environmental clearance of the project. Accordingly, applications will be made to the Orissa State Pollution Control Board for obtaining 'No Objection Certificate (NOC)' and 'Consent for Establishment (CFE) ', duly paying the required fees as demanded by the Orissa State Pollution Control Board. Necessary application seeking environmental clearance of the Project from the Ministry of Environment and Forest will be made after receipt of the No Objection Certificate from the Orissa State Pollution Control Board.

Public Hearings

In order to obtain a No Objection Certificate (NOC) from the State Pollution Control Board, or environmental clearance from the MoEF, "Public Hearing" has been made mandatory. The requirement was introduced in the MoEF notification, which came into effect on 10th April 1997. But subsequently MoEF has issued a draft notification on 3rd January, 2001 stating the following: "However, public hearing is not required in respect of Small Scale Industrial Units (as defined in the Industrial Policy from time to time), **widening and strengthening of highways**, mining projects (major minerals) with lease area up to twenty-five hectares and modernization of existing irrigation projects". **Hence, this project does not require public hearing.**

State Revenue Department

An interface has to be established with Revenue Department to facilitate land acquisition for the project. This task becomes much easier if the project proponent furnishes the land acquisition plan to the department. However marginal may be the land required for its acquisition the project proponent has to proceed by the laid procedures. All costs in this regard are to be borne by the project promoter. Public grievances in matters of land acquisition complicate the schedule of project implementation. It is recommended that construction work should start only after completion of land acquisition and disbursal of compensation and / or rehabilitation.

State Forest Department

The project corridor has a lot of linear stretches of roadside plantation, which require cutting. The present status of this land is defined under the provisions of Forest (Conservation) Act, 1980 applicable to the linear (roadside) plantations. As per the modified notification (18th Feb 1998) of MoEF on roadside plantation the clearance is required from Regional Office of MoEF for cutting the roadside plantations (See Box 2).

Box 2: Applicability of the Forest (Conservation) Act, 1980

Roadside Strip Plantation

In 1986, when MoEF enacted the Environment Protection Act, the entire linear stretches of roadside plantations along the highways were declared as protected forest in certain states. Although the land is under the control of the highways department. Due to its protected status, clearance is required to cut roadside trees. Applicability of the provisions of the Forest (Conservation) Act, 1980 to the linear (road or canal side) plantations was modified by a notification from the GoI, MoEF. Dated 18th February 1998.

The new notification recognizes that the sprit behind the Forest (Conservation) Act was conservation of natural forests, and not strips plantations. In the case of the notified to be protected roadside plantations, the clearance now may be given by the concerned Regional Offices of the MoEF, irrespective of the area of plantation lost. While issuing the approval, in place of normal provision for compensatory afforestation the Regional Offices will stipulate a condition that for every tree cut at least two trees should be planted. If the concerned Regional Office does not accord the decision within 30 days of the receipt of fully completed application, the proponent agency may proceed with the widening/ expansion under intimation to the State Forest Department, and MoEF.

Forest Land

Restrictions and clearance procedure proposed in the Forest (Conservation) Act applies wholly to the natural forest areas, even in case the protected/designated forest area does not have any vegetation cover.

Department of Mines

The project promoter would obtain construction material like stone aggregates etc., from existing licensed quarries. If new quarries have to be opened up, the permission of State Department of Mines would be required.

2.5 Institution Strengthening and Arrangement

Though rich in legal and regulatory instruments, the implementing agencies are unable to regulate and monitor a sound environmental management plan due to lack of enforcement capacity. Therefore, violations or missed mitigation commitments often go unreported. The gaps and deficiencies pointed out can be removed by proper arrangements. Institutional strengthening component has accordingly been identified. As such, the over all arrangement is as follows:-

Organisational arrangements

An environmental unit will be established in each construction packages with a manager to address the environmental issues. The environmental unit will have proper staff to ensure the implementation of EMP and related measures. The manager (Environment) will be familiar with the Indian environmental legislations, will have proper training of the environment of the region, and will be able to coordinate with NGO's, community groups and Government department.

Environmental Training

Training of staff will be done at a number of levels. Some short term training is required for the Environmental Manager, other staff members of the Environmental Unit and contractor staff to raise their levels of environmental awareness. The Environmental and Natural resource division and State Pollution Control Boards conduct the training programmes, and their help will be sought in this regard. In long term training, specialized training or special environmental issues will be examined and provided to the Environment Unit.

Environmental Monitoring

In order to ensure that the prescribed environmental norms are maintained during the constructional and the operational phases, the regular monitoring is one of the most important components of the institutional arrangements. The monitoring of Air quality, Water quality, Noise quality and green belt development will be done at regular intervals. The field reports of various environmental components will be done at regular intervals. The field reports of various environmental components will be received at quarterly basis and any lapse has to be taken care of.

Some awareness training will be provided to the contractors and their personnel to ensure that the EMP is implemented effectively. The project coordinator will assess the contractor practices and if high pollution levels are suspected, will government or private sector laboratories check them.

Chapter - 3

PROJECT DESCRIPTION

This chapter depicts the existing situation of the project corridor. The present project corridor 'Panikoili – Keonjhar – Rimuli' situated between chainage from Km. 0+000 to 163+000 section of NH-215 in the State of Orissa and to be upgraded to 4/6 lane divided carriage way. The present traffic at different stretches of the road varies from 10,000 PCUs to 23,000 PCUs /day. The traffic is projected for a period of 30 years and the pavement is designed for a period of 15 years. The existing carriage way of the present stretch is around 7.0 m with two lane road. The embankment of the road varies from 1.0 to 1.5 m in general without any cut sections but its height is greater than 2m at bridge locations. The physical condition of the road is not good with a formation width of 12 m. The project corridor passes through mostly agricultural and forest lands on either side of the road.

Information pertaining to the existing quarry and other sources of potential road construction materials was collected from the local departments throughout the project area. Information from field observations and other sources was also collected. Unlike a new road development project, the present project is limited to widening and upgradation of existing alignment from 2 lane to 4/6 lane with bypasses. ***Environmental Impact Assessment Decision Support System (EIADSS)*** is done for all the bypasses with different alignments. The alternatives considered relate to modification in geometric design, horizontal alignment to minimize land acquisition and tree felling. Design changes were also suggested where encroachment and congestion related problems were encountered. Details of widening and design options are indicated in the detailed report

3.1 Project Location

The project road (NH 215) is passing through Jajpur and Keonjhar districts, having 163 km length and connecting NH-5, NH-6 and NH 23 in Orissa state. The project reach from Km. 0.00 to Km.25.00 is in Jajpur District and the major portion from Km. 25.00 to Km. 163.00 is in Keonjhar District. The project lies between 20^0 54' N to 21

57' N and 86 13' E to 85 36' E. An average altitude of the stretch varies from 160.1 to 423.6 m. It is situated more than 65 Km from seacoast and the climate is tropical. The location map showing the project area is shown in figure 3.1.

3.2 Land Use along the Project Road

3.2.1 Reserve forest

The details of project road passing through reserve forest area in Keonjhar and Jajpur district constitute 23.7 Km and it is worked out to 71.1 hectares of the total geographical area. In Keonjhar district, road passes through forest at majority of the locations. The details of forests located in road corridor are presented in table 3.2.1.

Table 3.2.1: Details about Project Road through Reserve Forest in Jajpur and Keonjhar districts

S.NO.	District	Chainage		Length (Km)
		From	To	
1	Jajpur	19.000	21.000	2.000
2	Keonjhar	39.000	40.000	1.000
3		50.000	50.500	0.500
4		58.00	66.400	8.400
5		74.000	77.00	3.00
6		84.00	85.000	1.000
7		102.500	103.00	0.500
8		107.000	109.000	2.000
9		111.000	113.000	2.000
10		129.500	130.200	0.700
11		139.00	141.200	1.800
	Total			**23.700**

3.2.2 Industries along the Project Road

The project area is surrounded with various Industries. The Kalinga Nagar Industrial Complex of Jajpur district is a distance of 9 kms from road corridor. All major Steel industries like MESCO, Nilachal Ispat Nigam Limitel, VISA Industries and Jindal Industries are located within this Industrial Complex. In Keonjhar district, Sponge Iron Industries are located close to road corridor.

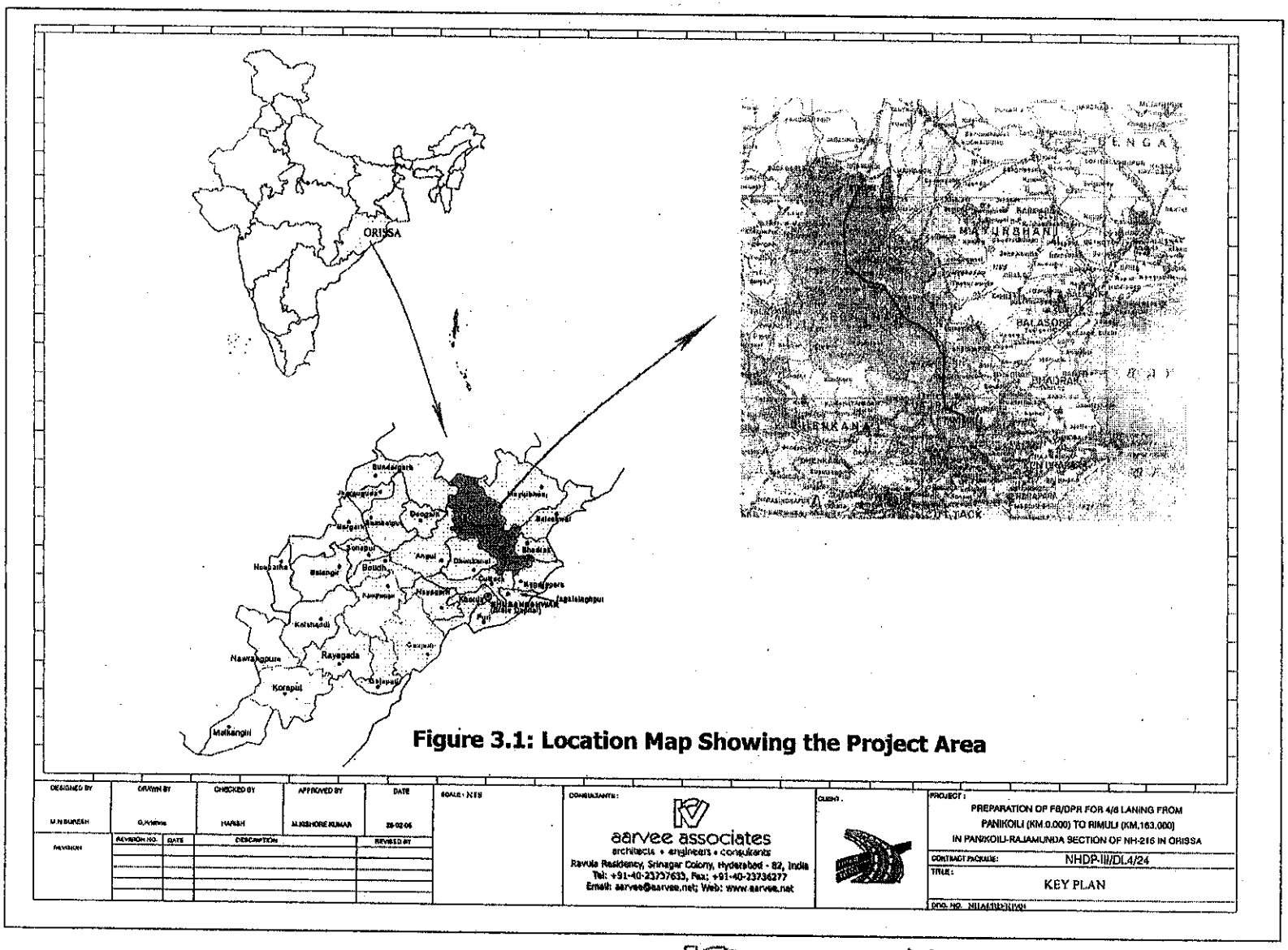


Figure 3.1: Location Map Showing the Project Area

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DATE	SCALE : NTS
M.N SURESH	G.Krishna	HARSH	M.KISHORE KUMAR	28-02-06	

REVISION NO.	DATE	DESCRIPTION	REVISED BY

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CLIENT:

PROJECT:
PREPARATION OF FR/DPR FOR 4/6 LANING FROM PANIKOILI (KM.0.000) TO RIMULI (KM.163.000) IN PANIKOILI-RAJAMUNDA SECTION OF NH-216 IN ORISSA

CONTRACT PACKAGE: NHDP-III/DL4/24

TITLE: KEY PLAN

DRG. NO.

3.2.3 Land use Pattern

Agricultural, No use (barren), rural, semi urban, Urban and Urban commercial are other land usage found along the project road. The distributions of land usage along the project road are as given in Figure 3.2 & 3.3.

Figure 3.2: Land Use Pattern of Jajpur District

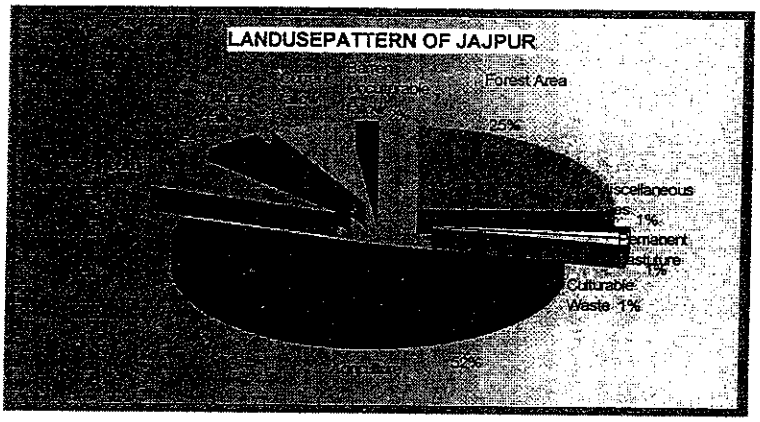
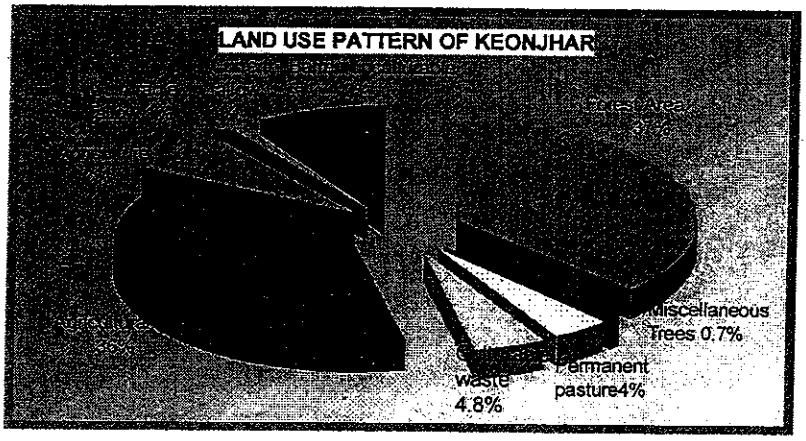


Figure 3.3: Land Use Pattern of the Keonjhar District



Agricultural, No use (barren), rural, semi urban, Urban and Urban commercial are other land usage found along the project road. The distribution of land usage along the project road are as follows: Agricultural 55%, Forest 17%, Semi Urban 12%, Urban 1.0% , Urban commercial 7% and Barren is of 8%.

3.2.4 Cross Drainage Structures

There are two major rivers, namely Baitarani and Ardai located in the project area. There are many other minor rivers and channels such as Kukurkatta ,Mushal ,Kusai, Sita River, Ardei & Kalinijhan River crossing the project stretch. The channels and canals flow either from East to West or from West to East depending on the terrain. Out of total six major Bridges only one is to be retained, rest five are to be reconstructed (River Bridge on Kusai, Mushal and Ardei rivers were affected during cyclone of 1999). The list of bridges in the project area is given in the table 3.2.4.1.

Table 3.2.4.1: List of bridges along the project road

Sl. No.	Chainage	Name of Crossing/Bridge	Length of Bridge	Span Arrangement	Nearest Village/Town
1	**10.046**	**Rly. Line**	**55.62**	**(2x15.120) + (1x25.380)**	**Jajpur Road**
2	18.064	Bandi Bridge	6.00	2 x 3.00 x 2.50	Jarda
3	22.980	Andhari Bridge	12.00	2 x 6.00	Jarda
4	25.776	Ghagia Nallah	25.270	(1x8.50) + (1x8.45) + (1x8.32)	Ramchandrapur
5	26.000	Kaliapal Jore	24.900	3 x 8.30	Ramchandrapur
6	32.940	Sasan Bridge			Hasanpur Village
7	34.690	Dhanaghara Nallah	9.70	1 x 9.70	Hasanpur Village
8	35.803	Kusai	211.950		Belabahai Village
9	37.790	Local Nallah	5.50	2 x 2.75	Barigaon Village
10	38.230	Khandiapata	11.350	2 x 5.675	Barigaon Village
11	41.550	Baitarani River	9.750	1 x 9.75	Ghasipura
12	45.750	Jhadeswar Bridge	22.00	4 x 5.50	Anandpur
13	50.550	Local Nallah	5.50	2 x 2.75	Birgovindapur Market Area
14	50.784	Muhan Bridge	42.920	4 x 10.73	Birgovindapur Market Area
15	58.185	Mushal Bridge	105.660	(1x19.35) + (2x22.35) + (1x22.15) +	Kanto Village

Sl. No.	Chainage	Name of Crossing/Bridge	Length of Bridge	Span Arrangement	Nearest Village/Town
				(1x19.46)	
16	58.766	Local Nallah	8.00	2 x 4.00x4.30	Kanto Village
17	68.926	Local Nallah	6.00	2x3.00 x 1.150	Melan Village
18	83.702	Sagadia Nallah	7.00	2 x 3.50	Batahari Chandanpur village
19	84.653	Kukurkata bridge	53.40	6 x 8.90	Gadadharpur Village
20	96.405	Sita River Bridge	35.40	3 x 11.80	Sitaban Village
21	98.965	Anladhar Bridge	14.40	4 x 3.60	Chikiria Village
22	104.268	Local Nallah	6.00	2 x 3.00 x 2.850	Gopalpur Village
23	107.944	Local Nallah	13.00	1x13.00	Gopalpur Village
24	108.019	Local Nallah	22.00	1x22.00	Gopalpur Village
25	109.072	Khalijore Bridge	78.00	13 x 6.00	Keonjhar
26	112.574	Khalighat Bridge	18.00	3 x 6.00	Keonjhar
27	115.095	Local Nallah	6.80	2 x 3.40	Keonjhar
28	118.300	R.O.B.	35.00	1x35.00	Keonjhar
29	119.303	Ardei River Bridge	40.68	6 x 7.78	Keonjhar
30	**123.867**		**15.20**	**4 x 3.80**	**Keonjhar**
31	129.880	Raisuan Level Crossing			Raisuan
32	136.080	Ardei River Bridge	50.40	8 x 6.30	Jhumpura Town
33	138.105	Local Nallah	5.00	2 x 2.50 x 1.10	Jhumpura Town
34	139.985	Local Nallah	13.50	3 x 4.50 x 2.35	Jhumpura Town
35	144.197	Bandha river Bridge	7.30	2 x 3.65	Jhumpura Town
36	145.150	Local Nallah	6.76	1 x 6.760 x 5.250	Jhumpura Town
37	145.700	Local Nallah	13.50	3 x 4.50 x 3.85	Jhumpura Town
38	147.646	Ardei River Bridge	346.70	(18 x 9.10) + (1x58) + (8x 9.20)	Jhumpura Town
39	148.605	Local Nallah	14.30	2 x 7.150 x 4.4.75	Jhumpura Town
40	149.436	Local Nallah	3.30	2 x 1.150 x 1.20	Jhumpura Town
41	150.433	Local Nallah	12.90	3 x 4.30 x 4.00	Jhumpura Town
42	152.130	Local Nallah	9.50	2 x 4.75x4.25	Jhumpura Town
43	153.320	Local Nallah	8.80	2 x 4.40	Rimuli

Sl. No.	Chainage	Name of Crossing/Bridge	Length of Bridge	Span Arrangement	Nearest Village/Town
44	154.848	Kasia River	42.00	3 x 14.00	Rimuli
45	159.632	Local Nallah	11.64	3 x 3.88	Rimuli

3.2.5 Road Over Bridges (ROBs) Level Crossings

Two Road Over Bridges are existing at Jajpur-Road bypass level crossing at Km 10.046 and Naranpur Skew PSC girder bridge (U/C) at chain age 118.300.

3.2.6 Terrain

The alignment is generally passing through plain, rolling, and mountainous terrain.

3.2.7 Water Tanks and Hills along the Project Length

Water tanks, canals and tube wells are the major sources for supply of water for drinking and irrigation purposes along the project area. The water tanks help in keeping the water table reasonably high. Tube wells are generally used for drinking water whereas tanks irrigation canals are used foe irrigation purposes . Due to the presence of water tanks and hills along the project length, the alignment takes many twists and turns.

3.2.8 Villages and Towns

The list of towns and villages and their location along the project road are given in the following Table:

Table 3.2.8.1 List of Villages and Towns on NH-215 from Km 0.00 to Km 163.0

Sl No	Village/Town	Block	District
1	panikoili	Korai	Jajpur
2	Mahamad Jamalpur	Korai	Jajpur
3	aliya	Korai	Jajpur
4	dhaneshwar	Korai	Jajpur
5	janha	Korai	Jajpur

Sl No	Village/Town	Block	District
6	Sanpatoli	Korai	Jajpur
7	Santara	Korai	Jajpur
8	Jajpur Road	Korai	Jajpur
9	Chorda	Korai	Jajpur
10	Kanhepur	Korai	Jajpur
11	Chandma	Korai	Jajpur
12	Nuagadh	Korai	Jajpur
13	Nuagaon	Korai	Jajpur
14	Itapur	Korai	Jajpur
15	Thodagara	Korai	Jajpur
16	Kantajahri	Korai	Jajpur
17	Manjuri	Korai	Jajpur
18	Ragadi	Korai	Jajpur
19	Andhari	Korai	Jajpur
20	Jarada	Ghasipura	Keonjhar
21	Ramachandrapur	Ghasipura	Keonjhar
22	Suanpada	Ghasipura	Keonjhar
23	Nuagaon	Ghasipura	Keonjhar
24	Khalana	Ghasipura	Keonjhar
25	Badapada	Ghasipura	Keonjhar
26	Machala	Ghasipura	Keonjhar
27	Rudranarayan Pur	Ghasipura	Keonjhar
28	Bamdi	Ghasipura	Keonjhar
29	Hasanpura	Ghasipura	Keonjhar
30	Belabahali	Ghasipura	Keonjhar
31	Bharigaon	Ghasipura	Keonjhar
32	Bailo	Ghasipura	Keonjhar
33	Salpada	Ghasipura	Keonjhar
34	Khapana Khai	Ghasipura	Keonjhar
35	Gasipura	Ghasipura	Keonjhar
36	Sailang	Ghasipura	Keonjhar
37	Gohira	Ghasipura	Keonjhar
38	Talagaon	Ghasipura	Keonjhar
39	Biragobindapur	Ghasipura	Keonjhar
40	Bhalukumar	Ghasipura	Keonjhar
41	Dakhota	Ghasipura	Keonjhar
42	Bandha	Ghasipura	Keonjhar
43	Kanto	Ghasipura	Keonjhar
44	Kolimat	Ghasipura	Keonjhar
45	Kumuda	Ghasipura	Keonjhar
46	Darkhota	Ghasipura	Keonjhar
47	Bhojiamoda	Ghatgaon	Keonjhar
48	Melana	Ghatgaon	Keonjhar
49	Baljodi	Ghatgaon	Keonjhar
50	Ghatagoan	Ghatgaon	Keonjhar
51	Kusumpur	Ghatgaon	Keonjhar
52	Mulla Banda	Ghatgaon	Keonjhar

Sl No	Village/Town	Block	District
53	Gullabanda	Ghatgaon	Keonjhar
54	Bataharichandanpur	Ghatgaon	Keonjhar
55	Sananasilabila	Ghatgaon	Keonjhar
56	Sana Barabeda	Ghatgaon	Keonjhar
57	Langulakunti	Ghatgaon	Keonjhar
58	Tikina	Ghatgaon	Keonjhar
59	Dhenkikote	Ghatgaon	Keonjhar
60	Khajurijuani	Ghatgaon	Keonjhar
61	Katrabeda	Ghatgaon	Keonjhar
62	Chikinia	Ghatgaon	Keonjhar
63	Pipilia	Ghatgaon	Keonjhar
64	Bankapatali	Ghatgaon	Keonjhar
65	Gopalpur	Sadar	Keonjhar
66	Badaposi	Sadar	Keonjhar
67	Jamunalia	Sadar	Keonjhar
68	Naranpur	Sadar	Keonjhar
69	Haladia Tangri	Sadar	Keonjhar
70	Tangar Pulsa	Sadar	Keonjhar
71	Mandua	Sadar	Keonjhar
72	Kashipur	Sadar	Keonjhar
73	Keonjhar	Sadar	Keonjhar
74	Dhrupada	Sadar	Keonjhar
75	Baliaguda	Sadar	Keonjhar
76	Raisuan	Sadar	Keonjhar
77	Gobinathpur	Sadar	Keonjhar
78	Silisuan	Sadar	Keonjhar
79	Banajodi	Sadar	Keonjhar
80	Padmapur	Sadar	Keonjhar
81	Putulia	Sadar	Keonjhar
82	Jadi Chatar	Sadar	Keonjhar
83	Bankamareeni	Sadar	Keonjhar
84	Jamundhaiah	Sadar	Keonjhar
85	Palas Panga	Sadar	Keonjhar
86	Tangrani	Sadar	Keonjhar
87	Jhumpra	Jhumpura	Keonjhar
88	Arshala	Jhumpura	Keonjhar
89	Sundhi Mursuan	Jhumpura	Keonjhar
90	Badavadrapur	Jhumpura	Keonjhar
91	Katala Post	Jhumpura	Keonjhar
92	Balibanda	Jhumpura	Keonjhar
93	Rojabosa	Jhumpura	Keonjhar
94	Mursuan	Jhumpura	Keonjhar
95	Sijukala	Champuva	Keonjhar
96	Parasila	Champuva	Keonjhar
97	Remuli Chaak	Champuva	Keonjhar
98	Rimuli	Champuva	Keonjhar
99	Tuduva Pahal	Champuva	Keonjhar

3.3 Land Requirement and Displacement

The widening of the existing road into four lane would require acquisition of about 1419 acres of land and complete and or partial displacement of about 5513 structures of which 4777 are major structures and 736 minor structures (Details given in Annexures). The land estimate is based on the assumption that the available ROW is around 30 m on the existing road and needs about another 30 m for the proposed widening of 2-lane highway to 4 lane. Of the project affected people a majority losing structures are found to be titleholders. Table-2 analyzing affected structures based on the type of usage shows that a majority of them are residential (39.61%) followed by commercial (38.87%), Government buildings (7.70%) and a few (3.71%) of them are used for both residential and commercial purposes. The summary of the project affected structures are given in Table 3.3.1.

Table-3.3.1: Summary of Project Affected Structures

Sl No	Usage	Existing Project Road (without by passes)		Proposed Project Road (with bypasses)	
		No.	%	No.	%
1	Residential	1892	39.61	1364	42.40
2	Commercial	1857	38.87	1185	36.84
3	Residential cum commercial	177	3.71	81	2.52
4	Government buildings	368	7.70	226	7.03
5	Religious	91	1.90	68	2.11
6	Industrial	16	0.33	9	0.28
7	Others	376	7.87	284	8.83
Total		**4777**	**100.00**	**3217**	**100.00**
8	Bus Shelters/Stops	32	4.35	30	6.20
9	Open well	96	13.04	75	15.50
10	Bore wells/Hand pumps	128	17.39	88	18.18
11	Water Tanks	3	0.41	1	0.21
12	Statues	4	0.54	1	0.21
13	Compound walls	473	64.27	289	59.71
Total		**736**	**100.00**	**484**	**100.00**

3.4 Traffic

The 163 km Project stretch is a part of NH-215 Section which connects two the major towns Remuli and Panikoili, which is on NH-5. This NH-215 forms an important link as it connects the mining area with the Paradip port. It passes through major towns such as Remuli, Keonjhar, Dhenkikote, Anandapur, and Jajpur. In spite of considerable deficiencies in highway geometry, poor pavement condition and absence of alternate route, a substantial percentage of Goods traffic prefer the Stretch. Based on preliminary reconnaissance studies, the Project has been divided into four traffic homogeneous sections as follows:

Section – 1 : Panikoili (Km. 0.000) to Anandpur (Km. 42.000)

Section – 2 : Anandpur (Km. 42.000) to Tarini temple (Km. 77.000)

Section – 3 : Tarini temple (Km. 77.000) to Keonjhar (Km. 124.000)

Section – 4 : Keonjhar (Km. 124.000) to Remuli (Km. 163.000)

The present traffic in different stretches of the project road varies from 10,000 PCUs to 11,500 PCUs per day. The traffic is projected for a design period of 15 years and the pavement is designed for the same. The present annual average daily traffic pertaining to the year 2005 and the projected traffic for various years is presented in Table 3.4.1 below.

Table 3.4.1Traffic along the Project Corridor (PCUs)

(Present & Projected)

Location	Average Daily Traffic in PCUs					
	Projected Traffic					
	2005	***2010***	***2015***	***2020***	***2025***	***2030***
Section 1	12960	19091	27539	38892	53769	72736
Section 2	9927	14646	21146	29874	41297	55842
Section 3	14055	20609	29560	41465	56882	76287
Section 4	23056	34105	49380	69973	97036	131659

The detail break up of the annual average traffic in number of vehicles pertaining to the year 2006 and projected traffic has been presented in Table 3.4.1(a).

Table 3.4.1 (a) Detail Break up of the Traffic along the Project Corridor (Present & Projected)

Year	Fast Moving Vehicles										Total
	Two wheelers	Three wheelers	Cars/Vans	Buses (Govt,Pvt,mini)	Mini buses	2AT	3AT	SA & S	Tractor	LCV	
Section -1											
2006	2564	43	1348	131	42	3067	193	54	34	488	7962
2010	3737	62	1894	149	47	4153	262	73	47	660	11083
2015	5855	98	2834	172	55	5934	374	104	66	943	16436
2020	8968	149	4145	195	62	8284	522	146	93	1317	23881
2025	13422	224	5923	219	70	11297	712	199	127	1796	33988
2030	19631	327	8269	242	77	15047	948	265	169	2392	47365
2035	28051	467	11275	266	85	19572	1233	344	219	3112	64624
Section -2											
2006	2126	39	543	52	22	2817	116	2	24	1	5742
2010	3098	56	763	59	26	3814	157	3	32	2	8010
2015	4855	88	1142	68	29	5451	224	4	46	2	11911
2020	7436	135	1671	77	33	7609	313	6	64	3	17347
2025	11129	202	2387	87	38	10376	427	8	88	4	24746
2030	16277	295	3333	96	41	13820	569	11	117	6	34564
2035	23259	421	4545	106	46	17977	740	14	152	7	47265

Table 3.4.1 (a) Detail Break up of the Traffic along the Project Corridor (Present & Projected)

Year	Fast Moving Vehicles										Total
	Two wheelers	Three wheelers	Cars/Vans	Buses (Govt,Pvt,mini)	Mini buses	2AT	3AT	SA & S	Tractor	LCV	
Section -3											
2006	1199	58	619	67	59	3890	187	4	11	898	6994
2010	1747	85	870	76	67	5268	253	6	16	1217	9605
2015	2738	133	1303	88	78	7528	362	8	22	1738	13998
2020	4193	204	1905	100	88	10509	505	11	31	2427	19973
2025	6276	305	2723	112	99	14331	688	15	42	3309	27901
2030	9179	446	3801	124	109	19087	917	20	56	4408	38148
2035	13117	638	5183	136	120	24828	1193	26	73	5734	51048
Section -4											
2006	4448	1029	1216	99	100	5636	645	26	172	234	13606
2010	6483	1499	1709	114	114	7633	874	35	233	317	19011
2015	10159	2350	2558	131	132	10907	1248	50	333	453	28321
2020	15559	3599	3741	148	149	15226	1743	70	465	632	41332
2025	23287	5386	5346	167	168	20763	2376	95	634	862	59086
2030	34058	7878	7463	184	185	27655	3165	127	845	1149	82709
2035	48668	11257	10177	202	204	35972	4117	165	1099	1494	113355

The summary of the traffic studies of the total project stretch are tabulated as Table 3.4.2.

Table 3.4.2: Summary of Traffic Studies

FROM CLASSIFIED TRAFFIC COUNT			
ADT(Average)	15238 (pcu); 9397 (vehicles)		
ADT(Max) at Keonjhar (TC-4)	23604 (pcu); 14977 (Vehicles)		
ADT(Min) at Anandpur (TC-2)	10377 (pcu); 6888 (Vehicles)		
CVPD - Max. in Number	5865 (Vehicles in both directions)		
Trucks – Percentage composition (average)	43%		
Cars / Jeeps / Vans	9%		
Ratio - FMV : SMV	79:21		
PHF – Average Peak Hour Factor	7.82%		
D.S. – Average Directional Split	48 : 52		
Average Peak Hour Flow (Max) at km. TC-4	2703 (PCU)		
FROM O – D SURVEY			
	OD-1	OD-2	OD-3
O – D Sample Size	Goods Veh. = 52% Passenger Veh.= 48%	Goods Veh. = 49%, Passenger Veh. = 51%	Goods Veh. = 31%, Passenger Veh. = 69%
Loaded Trucks	60%	66%	65%
Empty vehicles	40%	34%	35%
Major Commodities	Food grains (44%) House hold goods (1%)	Heavy Machinery (66%)	Heavy Machinery (61%), Building materials (1%)

Willing to Pay Toll Tax	Rs.20 or less = 90%; Above Rs.20 = 10%	Rs.20 or less = 93%; Above Rs.20 = 7%	Rs.20 or less = 89%; Above Rs.20 = 11%
Average Occupancy	Car = 3.33 3 Wheeler = 2.66	Car = 9.1 3 wheeler = 5.3	Car = 7.75 3 wheeler = 5.6
Intra – State Trips	18%	32%	30%
Inter State Trips	82%	68%	70%

FROM AXLE LOAD SURVEY AT PANIKOILI		
Description	**Axle Equivalency**	**VDF**
All Vehicles – UP direction	0.15	0.3
All vehicles – Down direction	2.868	5.72
All Vehicles Both Direction	1.97	3.94
2 Axle Trucks – Both Direction	1.6	3.3
3 Axle Trucks – Both Direction	2.0	4.0
4 Axle Trucks – Both Direction	2.0	4.0
LCV – Both Direction	0.3	0.6
BUS – Both Direction	0.3	0.6
FROM AXLE LOAD SURVEY AT DHENKIKOTE		
All Vehicles – UP direction	0.27	0.55
All vehicles – Down direction	3.0	6.0
All Vehicles Both Direction	2.4	4.8
2 Axle Trucks – Both Direction	2.0	4.1
3 Axle Trucks – Both Direction	1.8	3.7
4 Axle Trucks – Both Direction	1.8	3.7
LCV – Both Direction	0.3	0.6
BUS – Both Direction	0.3	0.6
FROM AXLE LOAD SURVEY AT KEONJHAR		
All Vehicles – UP direction	3.74	7.48
All vehicles – Down direction	0.18	0.37
All Vehicles Both Direction	1.7	3.4
2 Axle Trucks – Both Direction	1.4	2.9

3 Axle Trucks – Both Direction	1.6	3.1
4 Axle Trucks – Both Direction	1.6	3.1
LCV – Both Direction	0.3	0.6
BUS – Both Direction	0.3	0.6

PEDESTRAIN SURVEY			
	Location	**Along**	**Across**
Maximum Pedestrian Volume/hour	Dhenkikote	5175	2263
	Ghatgaon	1339	565
	Gohira Chowk	818	328
	Ramachandrapur	543	213
	Sainkul	838	396

SECONDARY INFORMATION	
GDP Growth Rate.	6.59%
GSDP Growth Rate – Orissa	10.49%
Per Capita Income Growth Rate	9.06%
Population Growth Rate	1.4%
Seasonal Factor	1.06

3.5 Design Options Considered

The Design options considered are as follows:

- Pavement Design standards are according to the current Indian Roads Congress guidelines and ASHTO method.
- For all improvement options and alternatives, a design life of 15 years has been considered.
- Upgradation options have been prepared with the aim to improve both the structural and functional performance of the existing road.

- ❖ Paved shoulders (1.5 m wide on either side) and hard shoulders (1.0 m wide on either side) are also proposed for the upgradation options as per IRC guidelines.
- ❖ The roads are designed for a speed of 100 kmph maximum and an absolute minimum of 80 kmph.
- ❖ Minimum radius of horizontal curves for a speed of 100 kmph is 360 m. However, efforts are made to provide a minimum radius of 400m.

Four Lane Configuration

Total formation width for the 4 lane carriageway is 25 m. Wherever land is not available median is reduced . The configuration of four lanes consists the following:

- ➢ 7.25 m carriage way on either side
- ➢ 1.5 m wide paved shoulders on either side
- ➢ 1.0 m wide hard shoulders in either side
- ➢ 4.5 m wide median / central verge.
- ➢ Side slopes adopted are 2:1 for all embankments and excavations

3.6 Environmental Impacts Assessment Decision Support System (EIADSS) for Alternative Locations

The Environmental Impact Assessment Decision Support System assists decision-makers to opt for alternative site locations in Highway project. The criteria used for comparing project alternatives are not limited to the impacts of the project on the physical environment such as natural resources and biological life, but also include the impacts on socio-economics, political affairs as well as financial and economics. Meanwhile, the method is flexible enough to account for the user's preferences in weighing the main categories of impacts criteria.

The EIADSS is developed in MS Excel using Environmental Audit Weightage Percentage (EAWP) techniques for the comparison between project alternatives based on all relevant aspects of the surrounding environment of a Highway project. The first step behind the conceptual basis of the EIADSS was to identify the environmental criteria that are susceptible to change due to Highway projects

construction or operation, and then categorize these criteria under main headings. The Physical factors that were known to be responsible for changing the criteria conditions were then identified. All the possible conditions of these factors were determined and compiled in a questionnaire. The Impact criteria are mainly categorized in to five (5) groups (viz. Natural Resource Impacts, Ecological impacts, Socio-Economic Impacts, Political Impacts, Financial, and Economic Impacts). The weightage percentage could be finalized using Data Capturing Instrument (DCI) and for Highway project of this nature, the weightage percentages are as follows.

Sl No.	Environmental category/ group	Weighted Percentage
1	Natural Resource Impacts	15
2.	Ecological impacts	30
3.	Socio-Economic Impacts	15
4.	Political Impacts	15
5.	Financial & Economic Impacts	25
	Total	**100**

Each group again sub-divided into different environmental aspects, which will be evaluated by using 'Environment Impact Score' instrument, which is given in Table 3.6.1.

Table 3.6.1: Environmental Impact Score instrument

Sl No.	Description	Points
1	No Occurrence	10
2	No adverse impacts	9-6
3	Negligible impact (low impact & low probability of occurrence)	5-2
4	Minor Impact (abnormal conditions which causes breach to statutory regulations, effect and probability of occurrence are low)	(+)1 to (-)2
5	Significant Impact (the activity has an effect under normal operating conditions and leading to breach of the statutory	(-)3 to (-)6

	regulations. Effects and probability of occurrence are moderate)	
6	Major Impact (the activity has an major effect under regular operating conditions and leading to major breach of the statutory regulations. Effects and probability of occurrence are extensive)	(-)7 to (-)10

The score of environmental aspects of each group will be evaluated by using the 'Environment Impact Score Instrument'. The expected positive and negative impacts to be relatively associated with the different factors and conditions were integrated in the EIADSS worksheets and the overall impact for the project alternatives will be calculated. Based on the highest marks scored, the project alternative will be finalized.

Basically this project is widening and strengthening of existing 2 lane to 4/6 lane Project. Not much required to analyze on existing alignment as it is using same alignment with minor modifications, except for bypasses. By considering the financial aspects, socio-economic conditions, traffic load and environmental considerations five bypasses have been proposed under this project namely Jajpur Bypass, Ananadpur Bypass, Ghatagaon Bypass, Keonjhar Bypass, and Jhumpura Bypass.

The various alternatives of bypasses are evaluated by using EIADSS model and are given Table no. 3.6.2 to 3.6.6 respectively. The detailed analyses of EIADSS are enclosed as **Annexure -1**.

Table 3.6.2: Alternatives Evaluation for Jajpur Bypass

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1	Weighted component	Alternative 2	Weighted component
1	Natural resources impacts	**15**	14.29	214.29	12.86	192.86
2	Ecological Impacts	**30**	50.00	1500.00	44.29	1328.57
3	Socio-Economic Impacts	**15**	60	900.00	34	510.00
4	Political Impacts	**15**	62	930.00	36	540.00
5	Financial & Economic Impacts	**25**	70	1750.00	65	1625.00
		100				
	Weighted percentages			**52.94**		**41.96**

Recommended Alternative: Alternative 1

Table 3.6.3: Alternatives Evaluation for Anandapur &Ghasipura Bypass

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1	Weighted component	Alternative 2	Weighted component
1	Natural resources impacts	15	14.29	214.29	14.29	214.29
2	Ecological Impacts	30	58.57	1757.14	52.86	1585.71
3	Socio-Economic Impacts	15	60	900.00	34	510.00
4	Political Impacts	15	62	930.00	36	540.00
5	Financial & Economic Impacts	25	70	1750.00	65	1625.00
		100				
	Weighted percentages			**55.51**		**44.75**

Recommended Alternative: Alternative 1.

Table 3.6.4: Alternatives Evaluation for Ghatagaon Bypass

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1	Weighted component	Alternative 2	Weighted component	Alternative 3	Weighted component
1	Natural resources impacts	15	14.29	214.29	17.14	257.14	8.57	128.57
2	Ecological Impacts	30	58.57	1757.14	32.86	985.71	10.00	300.00
3	Socio-Economic Impacts	15	60	900.00	34	510.00	34	510.00
4	Political Impacts	15	62	930.00	-2	-30.00	2	30.00
5	Financial & Economic Impacts	25	65	1625.00	15	375.00	70	1750.00
		100						
	Weighted percentages			**54.26**		**20.98**		**27.19**

Recommended Alternative: Alternative 1.

Table 3.6.5: Alternatives Evaluation for Keonjhar Bypass

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1	Weighted component	Alternative 2	Weighted component	Alternative 3	Weighted component
1	Natural resources impacts	15	14.29	214.29	17.14	257.14	11.43	171.43
2	Ecological Impacts	30	58.57	1757.14	52.86	1585.71	57.14	1714.29
3	Socio-Economic Impacts	15	60	900.00	34	510.00	60	900.00
4	Political Impacts	15	62	930.00	-2	-30.00	58	870.00
5	Financial & Economic Impacts	25	70	1750.00	15	375.00	65	1625.00
		100						
	Weighted percentages			**55.51**		**26.98**		**52.81**

Recommended Alternative: Alternative 1.

Table 3.6.6: Alternatives Evaluation for Jhumpura Bypass

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1	Weighted component	Alternative 2	Weighted component	Alternative 3	Weighted component
1	Natural resources impacts	15	17.14	257.14	17.14	257.14	17.14	257.14
2	Ecological Impacts	30	58.57	1757.14	44.29	1328.57	21.43	642.86
3	Socio-Economic Impacts	15	60	900.00	34	510.00	54	810.00
4	Political Impacts	15	62	930.00	-2	-30.00	40	600.00
5	Financial & Economic Impacts	25	70	1750.00	35	875.00	65	1625.00
		100						
	Weighted percentages			**55.94**		**29.41**		**39.35**

Recommended Alternative: Alternative 1.

3.7 Construction Options

Information pertaining to the existing quarry and other sources of potential road construction materials was collected from the local department and field observations throughout the project area. Map showing the quarry locations are given in **Annexure-2**.

3.7.1 Borrow Area

Large quantity of earth material is required for the widening of formation. The particulars of the Borrow areas identified are presented in Table 3.7.1.

Table 3.7.1: List of Borrow Areas along the Project Corridor

S.No.	Quarry location on nearest to project road	Position (Left/Right)	Approximate Distance from Project Road	Type of Quarry Area	Approximate Quantity Available	Village
1	15.9	L/S	0.7	Govt	6375000	Ramachandrapur
2	15.9	L/S	0.7	Govt	6375000	Ramachandrapur
3	16.3	L/S	0.35	Govt	2276562	Uppergodo
4	17.2	L/S	0.2	Govt	270000	Khantazari
5	18.8	L/S	0.15	Govt	1305000	Chandiya
6	20.05	R/S	0.1	Govt	1644500	Khammiya
7	20.45	R/S	0.1	Govt	819000	Khammiya
8	20.95	L/S	0.1	Govt	11550000	Ragadi
9	21	R/S	0.6	Private	112000	Ragadi
10	30.6	R/S	0.6	Govt	2820000	Sainkula
11	35.3	L/S	0.3	Govt	1080000	Belapahati
12	39.4	R/S	0.1	Govt	1064000	Salpada
13	43.9	L/S	2.6	Govt	2592000	Chaumunh
14	44.7	R/S	0.1	Private	950000	Podakhana
15	46.6	L/S	0.8	Govt.	4496250	Sailong
16	47	R/S	0.3	Govt.	1602250	----
17	47.4	L/S	0.4	Govt.	148200	Musabad
18	47.4	L/S	0.4	Govt	148200	Musabad
19	54.5	L/S	1.2	Govt.	89250	Amarang
20	56.95	L/S	0.15	Govt	107100	Nahakhana
21	77.8	L/S	2.2	---	90000	Kendhuwapada
22	77.9	R/S	0.9	Private	867000	Budduyia
23	78.6	R/S	0.9	Govt	285000	Ghatgaon

24	79.95	L/S	1.5	Private	1336200	Nagjouri
25	83.9	R/S	0.5	Private	775125	Gadhadhalpur
26	84.2	R/S	0.1	Govt.	479188	Gadhadharpur
27	87.4	R/S	2.6	Govt.	866250	Madhupar
28	88.5	L/S	0.3	Govt.	1098625	Boruguda
29	92.9	R/S	0.25	Private.	1179000	Kasivada
30	97.2	R/S	2.4	Private	401063	Rangavatia
31	101.9	L/S	0.2	Private.	408375	Pipidiya
32	106.5	L/S	0.9	Govt.	692312	Jarbada
33	109.1	L/S	0.6	Private	447300	Gopalpur
34	110.5	L/S	1.6	Govt.	984708	Badudigara
35	115.9	R/S	0.7	Govt.	1907612	Narayanapur
36	131.78	R/S	0.8	Govt.	1102200	Jogimoto
37	135.9	L/S	5.2	Govt.	1309000	Dumuria
38	142.05	R/S	1.45	Govt.	445500	Noga
39	150.7	L/S	25	Govt.	707072	Koalabase
40	155.7	R/S	1.4	Private	692662	Moorusuva
41	157.3	R/S	0.9	Private	5596500	Gopalnathpur
42	158.6	L/S	1.1	Govt.	97200	Makidiya
43	158.6	L/S	1.7	Private	1660500	Makidiya

3.8 Upgrdation Proposals

Bypassess

Keeping in view the traffic load as well as scope of expansion of existing road, 5 bypasses have been suggested, details of which are presented in Table 3.8.1.

Table 3.8.1: Suggested bypasses along the road corridor

Bypass	Chainage Points
Jajpur Road Bypass	6 to 14 km
Ananadpur Bypass	41 to 44 km
Ghatagaon Bypass	77 to 78 km
Keonjhar Bypass	120 to 125 km
Jhumpura Bypass	143 to 146 km

Re-alignments

Minor adjustments in alignment would be carried out wherever found feasible to improve horizontal and vertical profiles. Realignment is proposed at Km 129+100 to connect to RUB which is build by National Highway Department of Orissa Govt. Minor improvement in curve will be required which will be done at DPR stage. It will join Highway at Km130+400. Another realignment is required at Rimuli junction where road is taking is taking right angle turn. Realignment will start near Km159+500 on LHS of the road to meet geometric standards which will shorten road length and will save many structures in Rimuli village. Minor realignment in 3 to 4 places will be required between Km26 to Km71 where it is passing through hills and forest to meet geometric standards

Vehicular Underpasses

Turning movement surveys have shown that at all the existing State / National Highway crossings vehicular underpasses are required. State highway bifurcating from Bhadrak from Nh-5 joins this road at Km 40+152 at Salipada where considerable amounts of conflicting traffic are anticipated so, a vehicular underpass is proposed here. Similarly road coming from Baripada crosses this road at Dhenkikot (Km92) and goes to important tourist spot of Karanjia and vehicular underpass is proposed here. NH-75 coming from Ranchi enters state of Orissa at Champua and joins this road at Km 160 at Rimuli and a vehicular underpass is also proposed here. 13 no of underpasses are proposed on different bypasses as shown on Table 9.2.1 to 9.2.7. Thus, the total number of vehicular underpasses planned in the project reach becomes 16.

Pedestrian Underpasses

It is proposed to prevent direct access from cross roads to the project road, through a judicious combination of service roads and pedestrian underpasses with 3.0 m vertical clearance and 8.5 m horizontal clearance. The extra cost on account of such underpasses will be more than justified by way of decrease in the number of

accidents that would have otherwise occurred in the event of direct access to the Highway. The number of such underpasses is estimated tentatively as 38.

Cattle / Animal Underpasses

It is proposed to provide animal underpasses in forest areas and cattle underpasses for animals to cross to the other side of the village for fodder / water. The number of such underpasses is estimated as 15. This type of underpasses will also be utilized by humans and slow moving vehicles. In view of this, the underpass dimensions are kept as the same as that for pedestrian underpass viz 8.5 m X 3.0 m.

ROBs

One ROB is proposed in Jajpur bypass no other ROB is required as one is recently built by local NH department at Km 118. One RUB has been completed at Km 129+500.

Way Side Amenities

In accordance with NHAI guidelines and international practice, wayside amenities are proposed at Km. 55 (LHS), Km 115 (LHS) and Km 131 (LHS).

Bus Lay byes

Bus Lay-Byes and Passenger Shelters will be provided at the locations of existing Bus shelters that are dismantled in the process of road widening and also at anticipated request stops. The number of such Bus Bays / Bus shelters is tentatively estimated as 40.

Toll Gates

Toll collection gates are tentatively proposed at Km. 40 before Anandpur bypass starts and at Km. 128 after end of Keonjhar bypass.

3.9 Project Cost

The project costs (financial) of the proposed road have been converted into economic cost by using a standard conversion factor of 0.9, as suggested by the World Bank for highway projects in India. The conversion factor of 0.9 has been applied to all cost items except land acquisition cost and R&R cost. The economic cost excludes the cost of toll plazas and the proportionate design & supervision cost for the same. A salvage value of 20% of capital cost has been considered in the terminal year for flexible pavements. The project costs in financial and economic terms for different schemes are presented in Table 3.9.1.

Table 3.9.1: Summary of Section-wise Capital Cost

Sl No	Without Bypasses			With Bypasses		
	Length	Construction cost	Cost/ Km	Length	Construction cost	Cost/ Km
1	163	10,202,344,986.60	62,591,073.54	168.11	11,288,649,096.10	69,255,515.44

Costs considered in the Economic Analysis

Section	Without Bypasses		With Bypasses	
	Length	Cost/ Km	Length	Cost/ Km
1	163	59,567,269.86	168.11	63,716,374.82

Chapter -4

BASE LINE ENVIRONMENTAL STATUS

This chapter provides an overall description of the existing environmental status in the study region. Studies were undertaken to generate baseline data within a 7 km radius study region around the proposed project site on micro - meteorology, air quality, noise levels, ground and surface water quality, land environment including soil quality, geo-morphology, land-use pattern, forest cover, biological environment, socio-economic and health status of the population, etc.

4.1 Site and its Environs

4.1.1 Geographical features

This section contains a detailed description on existing environment of the proposed project area including physical and biological environment in the study districts and more particularly in the area of study. The project area is located in Orissa state covering two districts namely Jajpur (from 0 to 24 kms) and Keonjhar (24 to 163 kms).

Keonjhar is an importance district from geological and anthropological point of view. Its mineral contents are varied and rich. Its iron ore, manganese ore and chrome ore are rich as well as extensive. Two main-tribes from anthropological point of view, the Juangs and the Bhuyans inhabit the district. The district lies between 21°1'N and 22°10'N latitude and 85°11'E and 86°22'E longitude. The whole of the district of Keonjhar was a princely state before its merger with Orissa on the 1st of January 1948.

Similarly, the district of Jajpur lies within geographical coordinates of 20°34'57" to 21°8'52" North Latitude and 85°41'22" to 86°37'26" East Longitudes. As like Keonjhar district, Chrome and Iron deposits are extensive and the district is full of Industries. The district was carved out of Cuttack district and declared as a separate district on 2nd October 1992.

4.1.2 Topography

The district consists of a compact area and its extreme length from north to south is nearly 145 km and the average breadth from east to west is about 65 km. It is divided into two widely dissimilar tracts – the lower Keonjhar and the upper Keonjhar. The former is a region of valleys and low lands, while the latter includes mountainous highlands with a general slope from north to south. The mountainous tops appear from the low lands to be sharply ridged or peaked, but in reality they have extensive tablelands on their summits, fit both for pasture and for tillage. The average elevation in its central part is about 500m. At places, isolated hills rise abruptly from the plains. But most of the areas have a general elevation of over 600m, which form the watershed of some rivers. The River Baitarani takes its rise in the hilly northwestern division of the district.

The principal peaks are Gandhamardhan (1060m) about 10km from district headquarter, Mankadnacha (1117m) on the Bonai border, Gonasika (978m), Thakurani (915m), Tomka (785m), Bolat (554m), Khajara (918m), Ranga (897m), Mahaparbat (716m), Khandadhar Parbat (915m) and Sitabinji (670m).

The rivers of the district emerge out of the hilly tracts into the plain country with great velocity and are charged with large volumes of water during monsoon. In summer they became almost dry. Their beds are usually rocky which render them unfit for navigation.

Jajpur district can be broadly subdivided into five distinct geomorphologic units, namely, Structural hills, Residual and denudation hills, very deep buried pediment, shallow to moderate (at places deep) buried pediment and alluvial plains. The road section passes through the alluvial plains of the district. The alluvial deposits are formed by the river systems of the Brahmani and Baitarani. The slope of the tract is towards southeast and the altitude of the plain varies from 4 m to 25m above mean sea level.

4.1.3 Geology

The geology of the project area is a part of the northern extension of the Deccan Plateau and is mostly underlain by Precambrian rocks. A very small percentage of the total area of the Keonjhar district is constituted of the quaternary to recent formations. These latter formations are chiefly confined to the wide river valleys. The oldest rock units exposed in

this district comprise mica, sillimanite, hornblende, chlorite and quartz schist with some calc-magnesian gneisses and metavolcanic rocks grouped together in the older metamorphics. These rocks are exposed around Champua. Characterized by high metamorphism these rocks are intensely magnetized.

The study area under which road stretch is located are alluvial site, where in two types of alluvium are found, the older alluvium and the new alluvium. The older alluvium of Pleistocene age occurs in the areas fringing the Precambrian crystallines and the younger alluvium. Older alluvial formations are overlying the tertiary formations at places. The sediments are grey to brown in colour, unfossiliferous but possess plenty of calcareous concentrations. Late rites are commonly occurring as a thick capping over the obliterated ultramafics or as a capping over the impure quartziteschistose rocks.

4.1.4 Soil

The project area falls under North Central Plateau Agro Climatic Zone of the Orissa State. The soils under this zone are laterite, red and yellow or mixed red and black. The elevation is medium with high to medium rainfall.

4.1.5 Minerals

The districts of Keonjhar and Jajpur are bestowed with extensive deposits of iron, manganese, chromites and a few other minor mineral ores. Keonjhar district plays a major role in contributing sizeable production of iron ore. Similarly, more than 90% of the Orissa's manganese ore production comes from the Keonjhar-Bonai area. Important manganese ore deposits in the Keonjhar district are located in the areas of Gurda, Raida, Bhadrasahi, Sidhamatha, Nalda, Belkundi, Barbil, Kora, Joda, Kalimati, Dhubana etc. Similarly, Jajpur district, more particularly Sukinda area possess about 90% of the total chromite reserves of the country. Lot of mining activity is taking place in these two districts and NH – 215 is the only road used for transportation of ores to different industries located inside the Country as well export through Paradeep port.

4.1.6 Industries

The project area is full of Industries. The Kalinga Nagar Industrial Complex of Jajpur district is a distance of 9 kms from road corridor. All major Steel industries like MESCO, Nilachal Ispat Nigam Limitel, VISA Industries and Jindal Industries are located within this Industrial Complex. In Keonjhar district, Sponge Iron Industries are located close to road corridor. The details of Industries, Brick kilns located within a radius of 10 kms from Project road are presented in Table 4.1.6.1.

Table 4.1.6.1: Industries/Brick kilns located within the RoI of the road stretch

Chainage	LHS	Distance	RHS	Distance
0Km - 1Km			Brick kiln	0km
3Km - 4Km			Chromites Ore Washing	0km
			Nobil Oxygen Factory	0km
24KM- 25Km	MESCO, Nilachal, VISA &	9km		
26Km -27km	Poultry Feed Company	4km		
27KM - 28Km	Barar Industry	2 km		
35Km - 36Km	Brick Kiln	250mts		
38Km - 39Km			Brick Kiln at Purunia	8km
40Km - 41Km			Nilachal Industry at Tukuna	3km
			Brick Kiln	7km
44Km - 45Km	Brick Kiln	7km	Brick Kiln	2km
45Km - 46Km			Brick Kiln	5km
46Km - 47Km	Brick Kiln	1km	Brick kiln	1km
47Km - 48Km	Brick Kiln	2km		
51Km - 52Km	Brick Kiln	0km	Brick Kiln	7km
52Km - 53Km	Brick Kiln	2km	Brick Kiln 3nos	8km
63Km - 64Km			Brick Kiln	0km
108Km - 109Km			Belati Orissa Ltd	2km
110Km - 111Km			Brick Kiln	1km
114Km - 115Km	OREAN Ispat Factory	3km	Industry	5km

Chainage	LHS	Distance	RHS	Distance
	Brick Kiln	0km		
115Km - 116Km	Brick Kiln	2km	Brick Kiln	0km
116Km - 117Km	Brick Kiln	2km	Electric Pole Factory	0km
126Km - 127Km	Sponge Iron Factory	8km		
127Km - 128Km	Tile Factory at Raisuan	0km		
128Km - 129Km			Brick Kiln	2km
129Km - 130Km	Brick Kiln	0km	Brick Klin-4nos	0km
130Km - 131Km	Brick Kiln - 7nos	2km		
138Km - 139Km	Brick Kiln	2km	Jagannath Sponge Iron	1km
	Brand Alloys Industry	1km		
139Km - 140Km	Brick Kiln - 3 nos	4km	Jagannath Sponge Iron	2km
			Brick Kiln - 2 nos	3km
140Km - 141Km	Brick Kiln	0km	Bricks Kiln	1km
			Jagannath Sponge Iron	1km
141Km - 142Km	Orissa Sponge Iron	0km		
142Km - 143Km	Brick Kiln	0km	Factory	4km
146Km - 147Km	Sponge Iron Factory	3km		
147Km - 148Km	Iron factory	2km		
150Km - 151Km	Sponge Iron factory	2km	Brick Kiln	1km
151Km - 152Km	Blade factory	2km		
	Sponge Iron factory	10km		
152Km - 153Km	Brick Kiln	0km	Tile factory	0km
			Brick Kiln - 1nos	1km
153Km - 154Km	Brick Kiln	1km	Brick Kiln	1km
	Kusum & Ganesh Factory	8km		
156Km - 157Km	Brick Kiln	0km		
157Km - 158Km	Brick Kiln	.5km	Brick Kiln	1km
158Km - 159Km	Brick Kiln	0km	Brick Kiln	0km
161Km - 162Km	Brick Kiln	0km	Brick Kiln	0km

4.1.7 Regional demography

The immediate surrounding within 2 km region of the proposed project site are thickly populated in major towns (i.e., Panikoili, Jajpur, Anandpur, Ghatagaon, Keonjhar, Champua , and Rimuli) and thinly populated in villages. The total population in the core zone is about 1, 03,119 with about 104 small and large villages. The main occupation of the villagers is agriculture, other services like mining, industrial workers, construction, trade and Transport, etc.

4.1.8 Infrastructure

The study region has well-developed and extensive infrastructural facilities in place. The power supply position is good and almost all the villages in Keonjhar and Jajpur districts are electrified. The district head quarters Keonjhar and Jajpur have facilities like housing, hospital, drinking water facility, school and technical education, medical college, etc. Emergency medical care and fire fighting facilities are also available at Panikoili, Jajpur, Anandpur, Keonjhar, and Champua along the proposed project corridor.

4.1.9 Archeological Sites/Places of Tourist Interest

No archeological sites were present with in the region of influence. Some of the tourist interest places present are Laba Kusa Temple & Chikinia Park, Sitabijhini village, Maatarani Temple, Ghatagaon and Ghagra water fall near Keonjhar.

4.1.10 Seismocity of the area:

The project area falls under Zone-II (based on seismic zones - Map of India).

4.2 Meteorology of the Region

Regional Meteorological and climatological data was compiled for Angul, Orissa , which is believed to be the nearest meteorological station from the project site, for a period of 1 year (May 2005 – April 2006).

4.2.1 Climate

The climate of the region is characterised as tropical. The climate, wind and wave pattern are governed by the annually changing monsoons and transition periods between them dividing the year into four seasons as given in Table 4.2.1.

Table 4.2.1 Seasons of the Region

Season	Months	Characteristics
Summer	March-May	Hottest part of the year, occurrence of dust storms
South-West monsoon	June-Sep	Characterised by predominantly SW winds. Generally a strong and persistent wind prevails.
North-East monsoon	Oct-Nov	Characterised by predominantly NE winds. Fair weather with the variable winds.
Winter	Dec-Feb	Cool season of the year

The climate is characterized by an oppressive hot summer, high humidity and well-distributed rainfall during the monsoon season. The year may be chiefly divided into four seasons, the hot season lasts from March to May, the period from June to September is the south west monsoon season, October and November constitute the post monsoon season and the cold season is from December to February.

4.2.2 Temperature, Rainfall and Relative humidity

December and January are the coolest months of the year, while June to mid October is the rainy months. Nearly 90% of the annual rainfall is received during the SW monsoon. May and partly June are the hottest months of the year. The maximum and minimum temperatures range 36.6° - 46.6° C and 12.2° - 25.4° C respectively. The average relative humidity is in the range of 26.6 to 96.6 % during the rainy season. The average rainfall in the region is about 1254.9 mm. The climtological data obtained from the Angul, Orissa is shown in Tables 4.2.2.

4.2.3 Winds

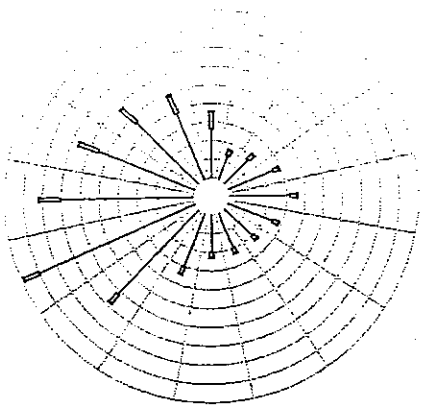
The winds in the study region are light to moderate and are strong during the monsoon season. During the summer season i.e., from March to May winds blow from Westerly & Northwesterly. In monsoon season i.e., from June to mid October winds blow from Westerly, Northwesterly & partially Easterly. During Post monsoon season (October to November) winds blow from Easterly & South Southeasterly. When it comes to winter season (December to February) winds blow from Northeasterly & Southeasterly. The average annual wind speed was found to be in the range of 0.0 to 7.3 m/s. The wind roses for a period of 1 year (May 2005 to April 2006) obtained from Anugul station is shown in figures 4.2.1 and 4.2.2.

Table 4.2.2 Climatological Data

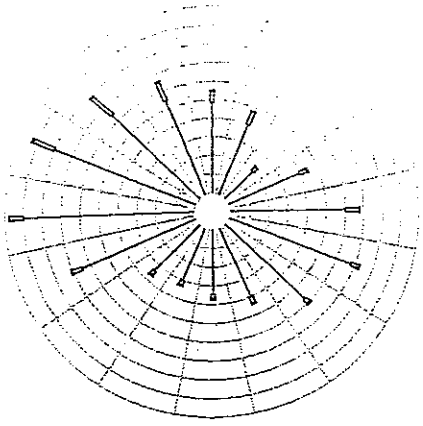
Based on Observations from **May 2005 to April 2006** **Station: Angul, Orissa**

Month	Temperature (^{0}C)		Relative Humidity (%)		Wind Speed (m/s)		Predominant Wind Directions (Deg.)	Cumulative Rainfall (mm)
	Min	Max	Min	Max	Min	Max	--	--
May 2005	21.9	46.0	13.9	98.9	0.0	8.3	Westerly & Northwesterly	33.5
June 2005	24.4	46.6	16.0	99.0	0.0	9.2	Westerly & Northwesterly	103.0
July 2005	23.7	36.8	48.5	96.3	0.0	7.8	Easterly & Westerly	471.0
August 2005	25.1	38.7	45.4	99.0	0.0	7.6	Easterly	78.5
September 2005	25.4	38.1	46.3	99.0	0.0	7.7	South Southeasterly & Westerly	316.5
October 2005	24.2	36.2	41.6	99.0	0.0	5.9	Easterly & Westerly	172.5
November 2005	16.4	33.7	20.8	99.0	0.0	5.9	South Southeasterly	0.0
December 2005	12.3	30.6	23.2	94.3	0.0	6.0	Northeasterly & Southeasterly	0.5
January 2006	12.2	33.2	19.2	96.9	0.0	6.7	Northeasterly & Southeasterly	3.5

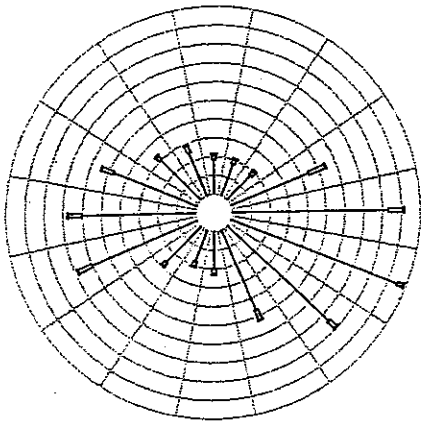
Month	Temperature (^{0}C)		Relative Humidity (%)		Wind Speed (m/s)		Predominant Wind Directions (Deg.)	Cumulative Rainfall (mm)
	Min	Max	Min	Max	Min	Max	--	--
February 2006	14.3	39.3	12.3	87.4	0.0	6.5	Southeasterly	0.0
March 2006	19.1	41.3	13.0	93.3	0.0	6.8	Southeasterly & Northwesterly	23.5
April 2006	21.5	42.5	18.6	99.0	0.0	9.4	Westerly & Southwesterly	52.4
Annual Mean	**20.0**	**38.6**	**26.6**	**96.8**	**0.0**	**7.3**	--	**1254.9**



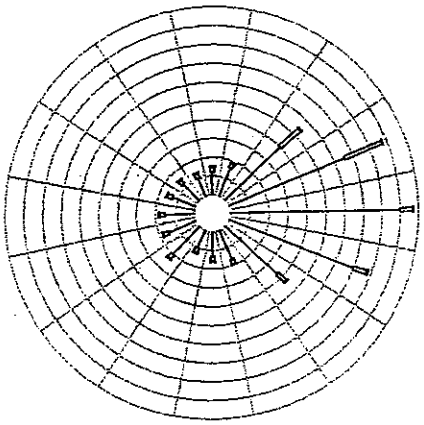
May 05 calm - 15.1%



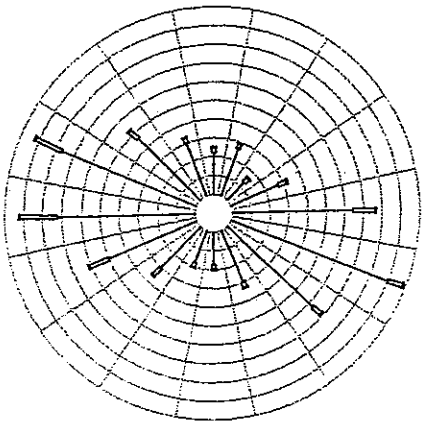
June 05 calm - 18.2%



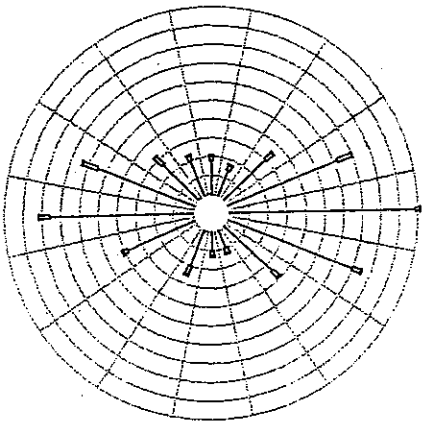
July 05 calm - 12.2%



August 05 calm - 15.1%



September 05 calm - 14.4%



October 05 calm - 3.4%

Scale: 1cm = 4%
Scale of Speeds (m/s)

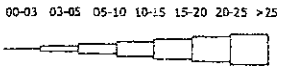
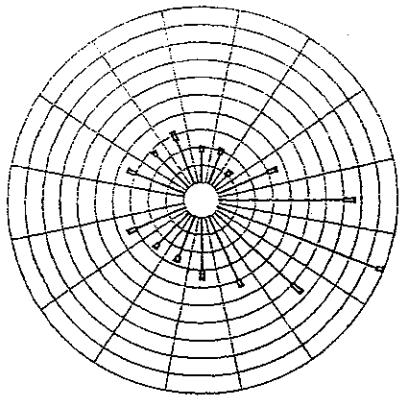
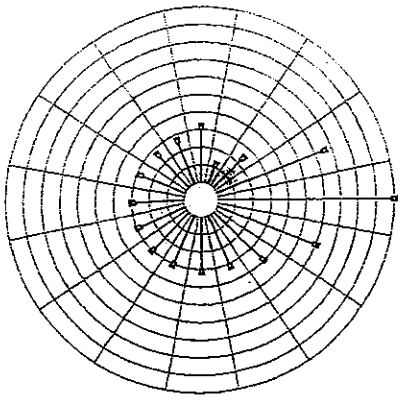


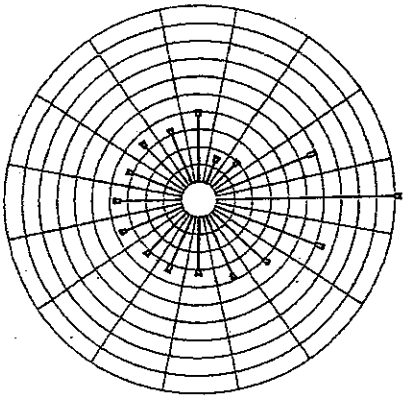
Figure 4.2.1 : Wind Roses Obtained at Angul, Orissa



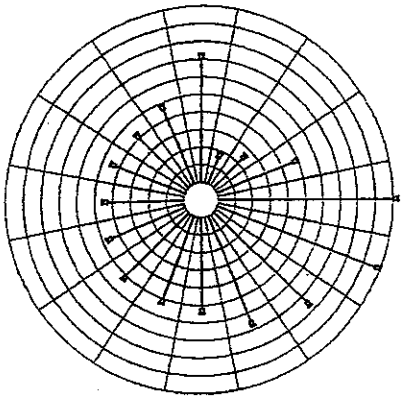
November 05 calm - 2.8 %



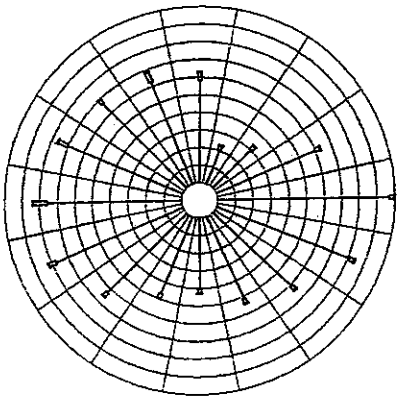
December 05 calm - 2.3 %



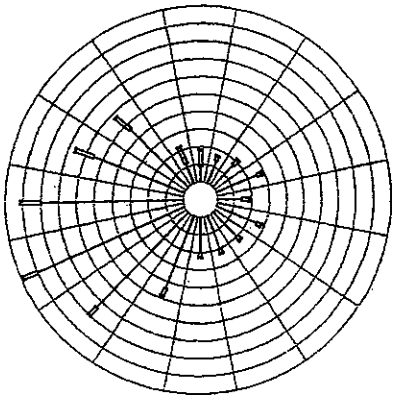
January 06 calm - 3.1 %



February 06 calm - 4.4 %



March 06 calm - 8.0 %



April 06 calm - 14.2 %

Scale: 1cm = 4%

Scale of Speeds (m/s)

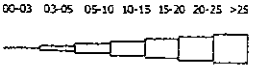


Figure 4.2.2 : Wind Roses Obtained at Angul, Orissa

4.2.4 Onsite Meteorological Conditions

At station **Jajpur** the predominant wind directions observed during winter season were mostly blowing from easterly. The wind speeds recorded during this period were in the range of 0.0 – 4.6 m/sec. The calm conditions during study period were found to be around 14.1%. Temperature and relative humidity were found to be in the range of 12.4 ^{0}C to 34.5^{0}C and 24.0 to 99% respectively. The onsite meteorological conditions are summarized as given in Table 4.2.4.

Table 4.2.4: Onsite meteorological conditions at Jajpur (M 1)

Parameter	January 06		February 06	
	Minimum	Maximum	Minimum	Maximum
Temperature (^{0}C)	12.4	32.6	13.3	34.5
Relative Humidity (%)	24.0	99.0	24.0	98.0
Wind Speed (m/sec)	0.0	4.5	0.0	4.6
Predominant wind Direction	Easterly		Easterly	
Rain fall (mm)	0.0		0.0	

At station Keonjhar the predominant wind directions observed during winter season were mostly blowing from Southeast easterly. The wind speeds recorded during this period were in the range of 0.0 – 4.8 m/sec. The calm conditions during study period were found to be around 15.2%. Temperature and relative humidity were found to be in the range of 12.3 ^{0}C to 34.6^{0}C and 26 to 99% respectively. The onsite meteorological conditions are summarized as given in Table 4.2.5.

Table 4.2.5: Onsite meteorological conditions at Keonjhar (M 2)

Parameter	January 06		February 06	
	Minimum	Maximum	Minimum	Maximum
Temperature (^{0}C)	12.3	33.4	13.3	34.6
Relative Humidity (%)	26.0	99.0	26.0	99.0
Wind Speed (m/sec)	0.0	4.7	0.0	4.8
Predominant wind Direction	Southeast easterly		Southeast easterly	
Rain fall (mm)	0.0		0.0	

The wind rose diagrams obtained at Jajpur and Keonjhar are given in Figure 4.2.3 & 4.2.4.

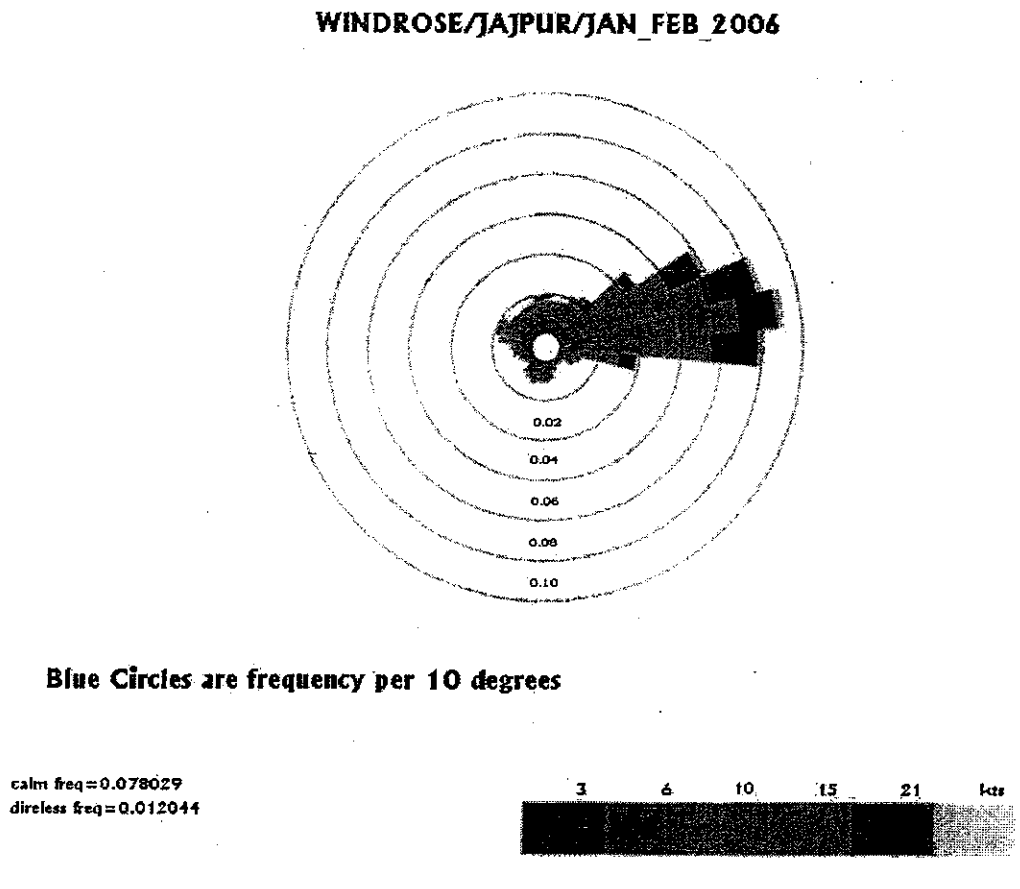


Figure 4.2.3: Wind Rose Diagram Obtained at Jajpur for the Study Period

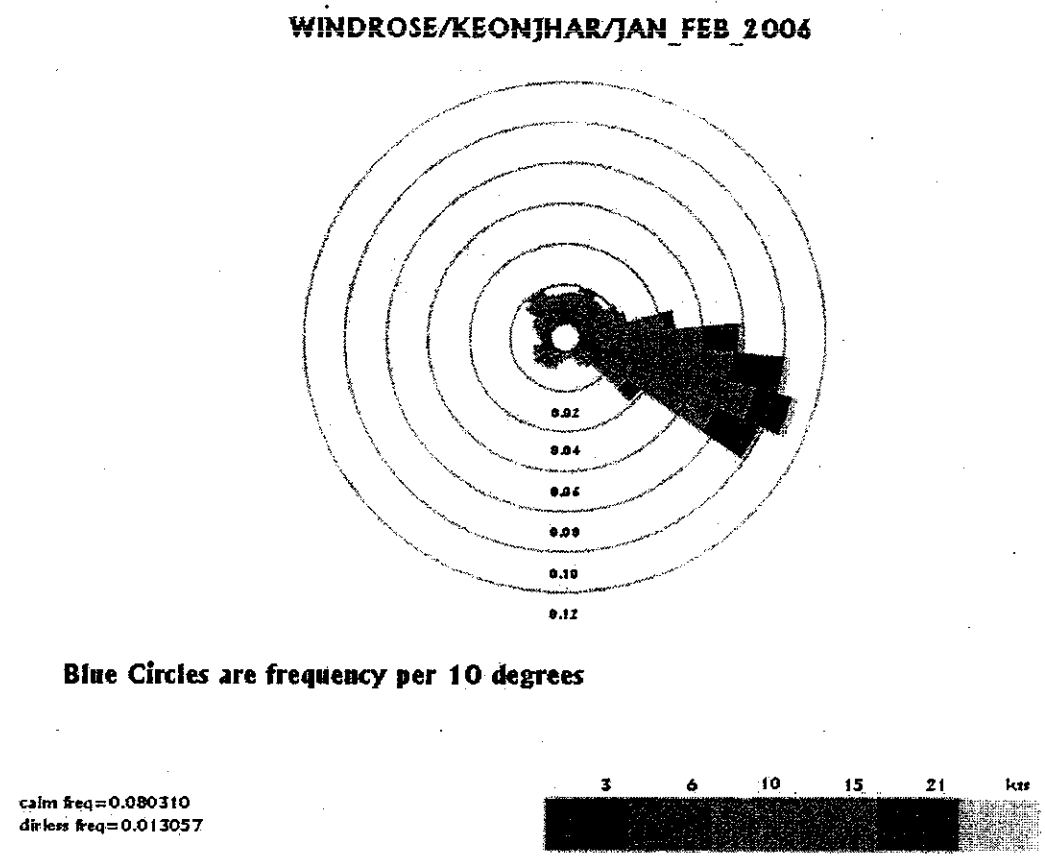


Figure 4.2.4: Wind Rose Diagram Obtained at Keonjhar for the Study Period

4.3 Air Environment

After a preliminary reconnaissance of the study region and taking into account the meteorological (predominant wind directions, wind speed), topographic conditions, major settlements & its traffic volume and details on existing industrial activities in the study region, six (6) stations were identified for carrying out Ambient Air Quality Monitoring (AAQM) in the study area spread over 163 Km, the study was carried out during winter season viz., December 2005, January and February months of 2006. The AAQ monitored locations are given in table 4.3.1 and are shown in figure 4.3.1.

Table 4.3.1 Ambient air quality monitoring locations

S.No	Station	Chain age
A1	Panikoili	0 to 1 Km
A2	Anandpur	42 to 43 Km
A3	Ghatagaon	77 to 78 Km
A4	Keonjhargarh	123 to 124
A5	Jhumpura	145 to 146 Km
A6	Champua	161 to 162 Km

Methodology

In assessing the environmental impact, collection and interpretation of baseline data is of prime importance. 'aarvee associates' in association with M/s. ERA Consultancy Private Limited, Bhubaneswar collected the primary data for the study period and the samples (24 hourly) were collected twice a week for all the weeks as per national guidelines. The criteria followed for selecting the AAQM stations is recommended by IS: 5182 and CPCB.

They are:

- Sampling station had free exposure so that it did not collect air from stagnant pockets.
- It was not obstructed by large structures including hills.
- The sampling point was not directly influenced by any local source of emission.
- It was located at a minimum height of 1.5 m from the ground level.

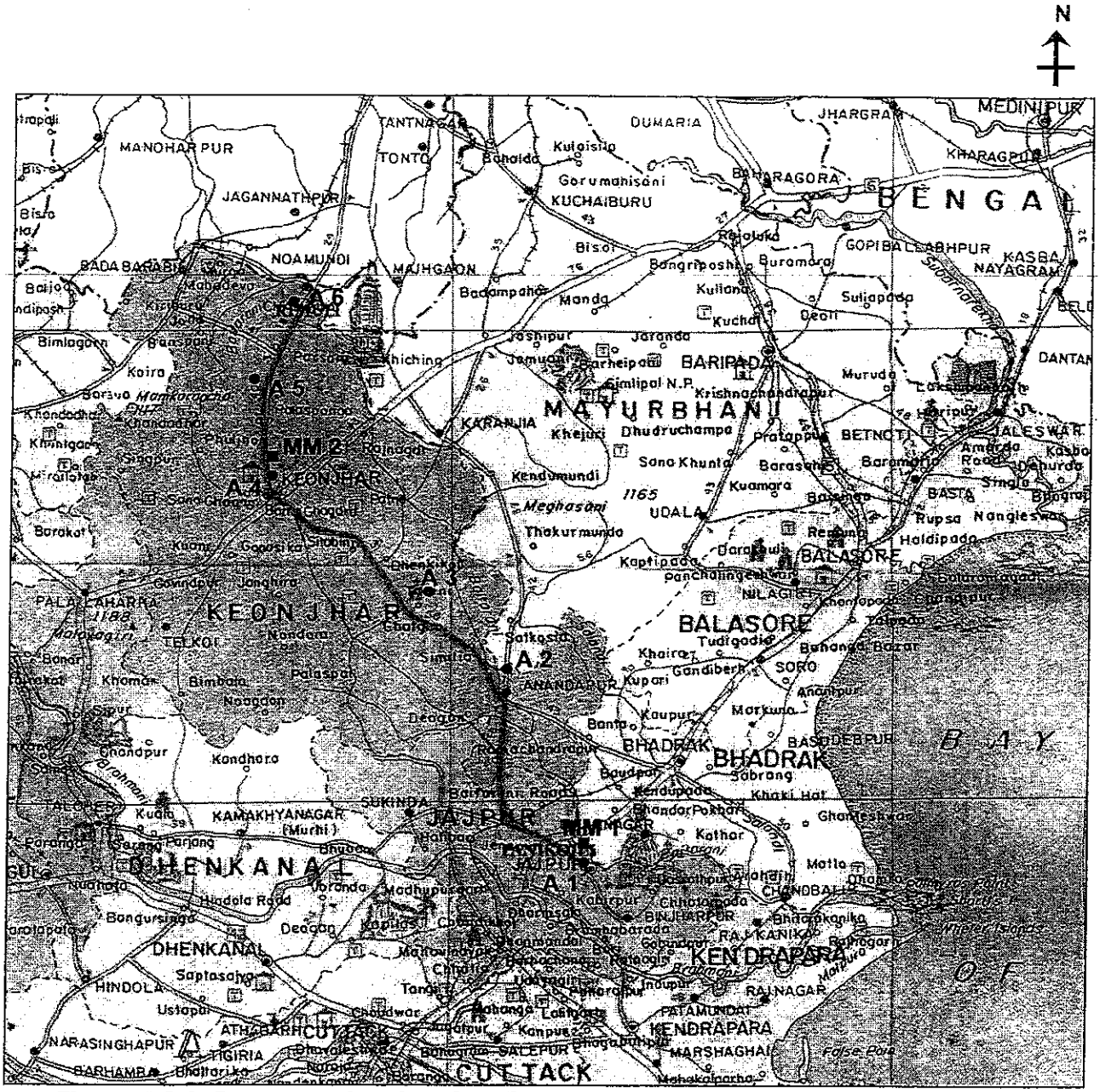


Figure 4.3.1: Base map showing the Micrometeorological & Ambient air quality monitoring stations

● - Ambient air quality stations

■ - Micrometeorological stations

Scale: Not to Scale

Selection of monitoring parameters

The parameters selected for analysing ambient air quality status were Total Suspended Particulate Matter (TSPM), Respirable particulate matter (RPM), Nitrogen Oxides (NO_x), Sulphur dioxide (SO_2), and Carbon Monoxide (CO).

Monitoring and analytical procedure

Ambient air quality was monitored for the presence of contaminants existing in the air. In order to evaluate and quantify the air pollution problem, measurements were carried out for various air pollutants mentioned above. This data was used not only to evaluate the air quality in the study region but also as the basis to develop programs aiming at preventing the spread of pollutants leading to a risk for human health and general environment. Respirable Dust Samplers (RDS) were used for ambient air sampling of selected parameters. The method for the selected parameters are based on the methods recommended by IS: 5182.

Data analysis

The observed concentrations of various pollutants at all the sampling stations were processed for different statistical parameters like arithmetic mean, minimum concentration, and maximum concentration and percentile values (75^{th} & 98^{th}). The existing baseline levels obtained during the study period at Panikoili, Anandpur, Ghatagaon, Keonjhar, Jhumpura, and Champua are presented in Table 4.3.2.

All the stations, where AAQM was carried out falls under Residential category. The recorded concentrations are compared with the National Ambient Air Quality Standards as notified on 11.04.1994 by CPCB. As can be seen from table 4.3.2 the ambient air quality levels for all the parameters monitored are well within the CPCB standards except TSPM, the TSPM values at all monitored locations with respect to Maximum, and 98 percentile are found to be exceeding its stipulated limit of 200 $\mu g/m^3$ except, at Ghatagaon. However, mean and 75 percentile values of Panikoili, Ghatagaon, Jhumpura, and Champua are well within the

stipulated limit. The values of TSPM are in the range of 121 - 322 $\mu g/m^3$, minimum has been observed at Ghatgaon and maximum has been found at Anandpur. At Ghatagaon, because of presence of matured trees, air quality is better than other locations. It was also observed that air quality in most of the areas of the project stretch is deteriorated especially during the night (8PM to 8AM). The reasons for this deterioration can be attributed to heavy traffic of loaded trucks, narrow townships, poor road condition and presence of permanent structures in townships that do not allow the emitted pollutants to get dispersed.

The ambient air quality trend obtained at monitored locations viz., Panikoili, Anandpur, Ghatagaon ,Keonjhar, Jhumpura and ,Champua, during study period for various parameters analysed are shown in Fig. 4.3.2.

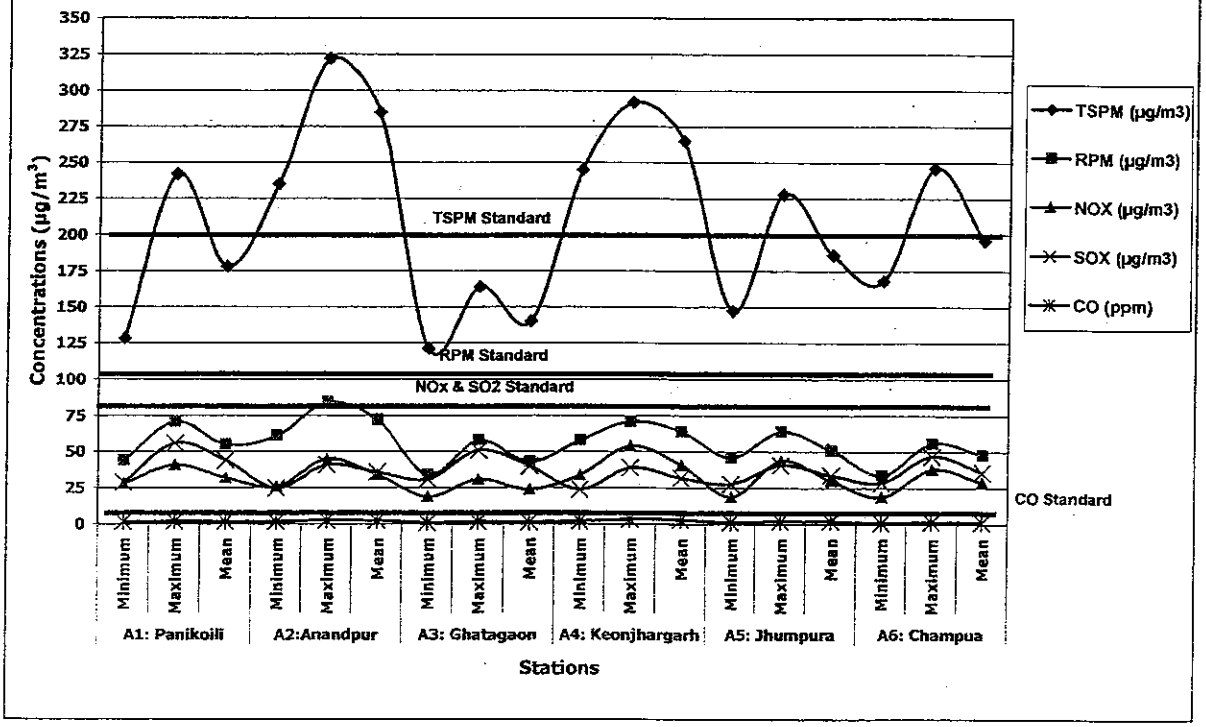
Table 4.3.2 - Ambient air quality during study period

Location	Minimum	Maximum	Mean	75 Percentile	98 Percentile	Standard
TSPM ($\mu g/m^3$)						
Panikoili	128	242	178	198	215	**200**
Anandpur	235	322	285	298	320	**200**
Ghatagaon	121	164	140	145	152	**200**
Keonjhargarh	245	292	265	268	272	**200**
Jhumpura	147	228	186	195	220	**200**
Champua	168	246	196	198	214	**200**
RPM ($\mu g/m^3$)						
Panikoili	44	71	55	42	58	**100**
Anandpur	61	84	72	45	64	**100**
Ghatagaon	34	58	43	16	37	**100**
Keonjhargarh	58	71	64	45	65	**100**
Jhumpura	46	64	51	45	57	**100**
Champua	34	56	48	34	44	**100**
NO_x ($\mu g/m^3$)						
Panikoili	28	41	32	21	30	**80**
Anandpur	26	45	34	19	28	**80**
Ghatagaon	19	31	24	12	26	**80**
Keonjhargarh	34	54	41	28	47	**80**
Jhumpura	19	44	30	19	30	**80**
Champua	19	38	29	21	31	**80**

Location	Minimum	Maximum	Mean	75 Percentile	98 Percentile	Standard
SO_2 ($\mu g/m^3$)						
Panikoili	29	56	44	29	44	**80**
Anandpur	25	41	36	14	29	**80**
Ghatagaon	31	51	40	34	44	**80**
Keonjhargarh	24	39	32	23	32	**80**
Jhumpura	28	41	34	14	28	**80**
Champua	29	47	36	23	38	**80**
CO (ppm)						
Panikoili	1.60	1.95	1.80	2.00	3.00	**4 mg/m^3**
Anandpur	1.90	2.78	2.40	2.65	2.75	**4 mg/m^3**
Ghatagaon	1.05	1.74	1.40	1.60	1.70	**4 mg/m^3**
Keonjhargarh	2.10	3.45	3.20	3.25	3.30	**4 mg/m^3**
Jhumpura	1.45	2.24	2.10	2.15	2.20	**4 mg/m^3**
Champua	1.15	1.60	1.50	1.50	1.60	**4 mg/m^3**

Note: CO 1 ppm = 1.25 mg/m^3

Figure 4.3.2: Ambient Air Quality Status During the Study Period



4.4 Water Environment

Selected physico-chemical parameters along with bacteriological indicators of pollution have been used for describing the baseline status of water environment. Generation of baseline data for water quality covers sources of ground and surface water. The major water source in the area is ground water. Assessment of water quality in the study area includes:

Surface water quality (IS 2296)
Ground water quality (IS 10500)

Surface water quality

During the study period twelve (12) samples were collected for assessing the water quality. The sampling locations designated as S1 to S15 are described in Table 4.4.1 and shown in fig. 4.4.1 respectively.

These were identified considering proximity to the project site, their activities and depending upon its utility by the people in the region. Table 4.4.2 presents surface water quality obtained at different locations.

Table 4.4.1 Surface Water Sampling Locations

Code	Code No.	Code No.
SW-1	Baitarani River, Ananadpur	42 to 43 Km
SW-2	Aradei River, Bankamareni	136 to 137 Km
SW-3	River Kusei, Belabahali	36 to 37 Km
SW-4	Sita River, Bholabeda	96 to 97 Km
SW-5	Kanjhari River, Bankapatuli	104 to 105 Km
SW-6	Musala River, Kanto	57 to 58 Km
SW-7	Machhakandana River, Ghaghra	77 to 78 Km
SW-8	Rudra MI Dam, Rudranarayan pur	33 to 34 Km
SW-9	Pond, Andhari	23 to 24 Km
SW-10	Pond, Biragobindapur	51 to 52 Km
SW-11	Pond, Raisuan	127 to 128 Km
SW-12	Pond, Padmapur	132 to 133 Km

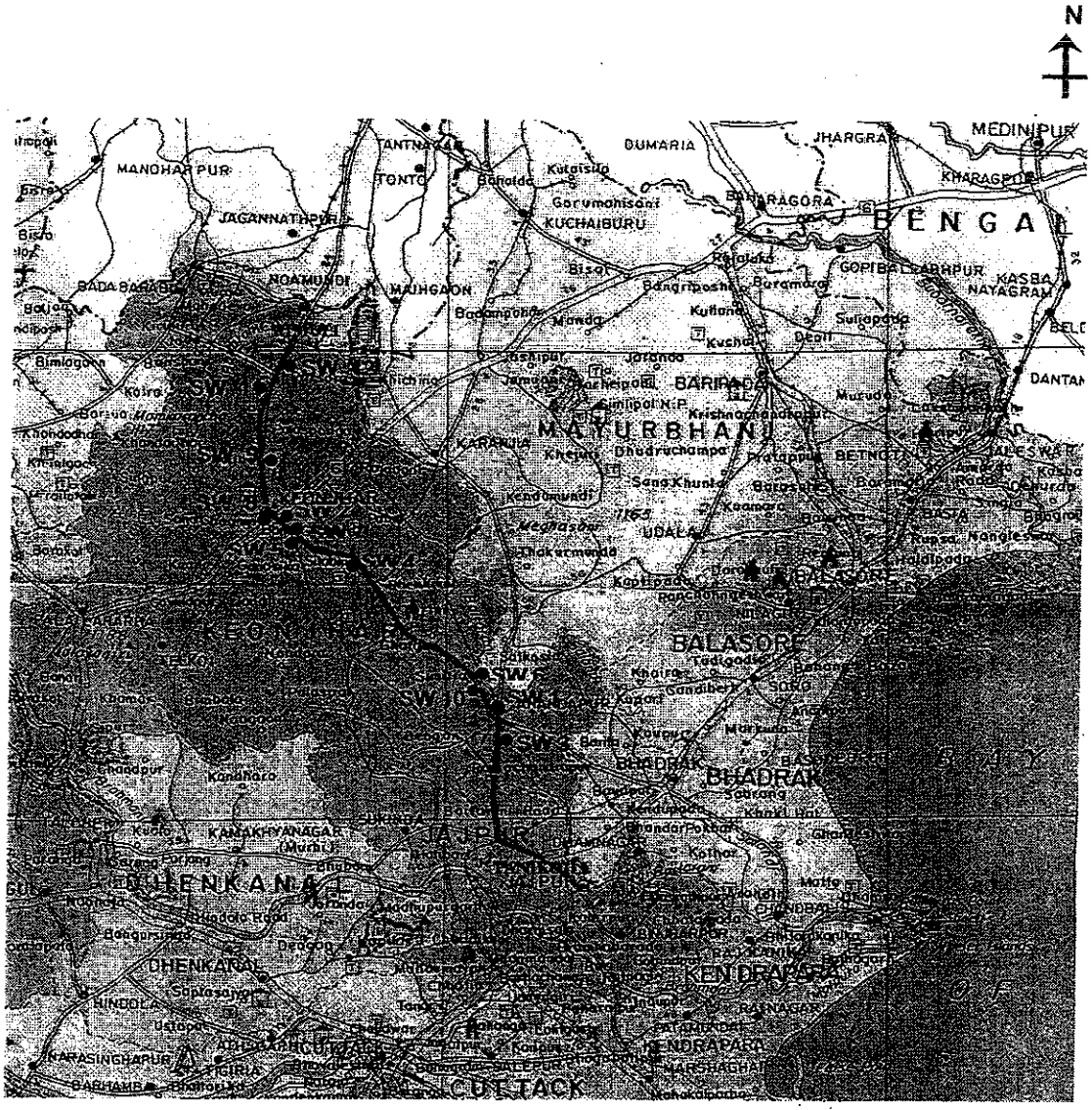


Figure 4.4.1: Base map showing the Surface water quality monitoring stations

- **Surface water quality locations**

Scale: No to Scale

Table 4.4.2: Surface Water Quality Obtained at Various Locations

Parameters	Results												Method	IS - 2296 Standards
	1	2	3	4	5	6	7	8	9	10	11	12	--	--
pH	7.85	8.10	7.65	8.40	8.36	8.21	7.01	6.90	8.02	7.65	8.25	7.00	IS 3025 Part 10 - 1984	6.5 - 8.5
Electrical Conductivity (mS/cm)	378	588	456	350	258	290	245	256	264	354	510	478	-	-
Total Dissolved Solids (mg/L)	400	300	400	200	300	200	300	200	400	300	300	300	IS 3025 Part 16 - 1984	500
Total Suspended Solids (mg/L)	28	42	36	40	25	18	39	41	15	18	22	20	-	-
Chemical Oxygen Demand (COD) (mg/L)	49	35	61	55	54	42	34	52	38	44	42	35	-	-
Dissolved Oxygen (mg/L)	6.80	6.50	5.70	7.10	6.40	7.50	6.00	5.20	3.90	8.00	6.50	7.10	-	-
Bio-chemical oxygen demand (BOD) 5 days, (mg/L)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	1.0	2.0	1.0	-	-
Hardness ($CaCO_3$) (mg/L)	228	360	215	198	155	302	212	210	208	220	254	140	IS 3025 Part 21 - 1983	300
Calcium as Ca (mg/L)	32	28	40	26	34	42	36	31	45	58	54	34	IS 3025 Part 40 - 1991	--
Magnesium as Mg (mg/L)	18	12	24	16	18	34	19	21	22	28	14	15	IS 3025 Part 40 - 1991	--
Sodium as Na (mg/L)	25	28	22	26	18	20	19	14	28	18	20	26	-	-
Potassium as K (mg/L)	1.40	1.15	1.08	1.09	1.11	1.14	1.25	1.00	1.39	1.48	0.98	1.00	-	-
Total Alkalinity (mg/L)	189	205	164	145	214	139	132	141	135	184	171	145	IS-3025 (XIII)	200
Chloride as Cl (mg/L)	86	125	71	178	84	61	70	79	45	85	68	145	IS 3025 Part 32 - 1988	250
Fluoride as F (mg/L)	0.69	1.21	0.41	0.36	0.88	0.95	1.15	0.55	0.68	1.10	1.38	0.65	IS 3025 Part 23 - 1964	1.5
Sulphate as SO_4 (mg/L)	BDL	BDL	8	6	BDL	BDL	7	BDL	BDL	BDL	BDL	BDL	IS 3025 Part 24 - 1986	400
Phosphate as PO_4 (mg/L)	6.80	BDL	5.81	BDL	3.24	BDL	BDL	6.50	BDL	BDL	BDL	BDL	-	-
Nitrate as NO_3 (mg/L)	6	5	4	3	7	6	5	5	4	6	8	4	IS 3025 Part 34 - 1988	45

Table 4.4.2: Surface Water Quality Obtained at Various Locations

Parameters	Results												Method	IS - 2296 Standards
	1	2	3	4	5	6	7	8	9	10	11	12	--	--
Iron as Fe (mg/L)	0.15	0.25	0.27	0.22	0.18	0.16	0.20	0.19	0.15	0.16	0.14	0.15	IS 3025 Part 32 - 1964	0.3
Boron as B (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	IS 3025 Part 29 - 1964	--
Copper as Cu (mg/L)	0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.01	<0.01	IS 3025 Part 36 - 1964	1.5
Lead as Pb (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	0.1
Zinc as Zn (mg/L)	0.01	<0.01	<0.01	0.01	<0.01	0.01	0.01	<0.01	0.01	0.01	<0.01	0.01	IS 3025 Part 39 - 1964	1.5
Chromium as Cr (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	IS 3025 Part 38 - 1964	--
Aluminum as Al (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	IS 3025 Part 31 - 1964	--
E - Coli	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	-	Absent
Total Coliforms/(MPN/100ml)	68	55	95	45	67	72	65	74	68	89	90	54	-	500

Data analysis

The surface water samples collected from the various sources showed pH value ranging in between 6.9 to 8.4, this has reflected in alkalinity and hardness values. Electrical conductivity values were ranged between 245 to 588 µS/cm. Water quality shows that the alkalinity and hardness values are consistent. The alkalinity values are in the range of 132 to 214 mg/l and hardness values are in the range of 155 to 360 mg/l both of them slightly exceeding its limit 200 & 300 mg/L respectively at least two locations.

The contribution of calcium is more than magnesium to the total hardness, which is reflected clearly from calcium and magnesium values. The dissolved oxygen in the sources is ranging between 3.9 to 8.0 mg/l, which implies sustainability of aquatic life. Fluoride values are in the range of 0.410 to 1.15 mg/l. However, all the values of physico-chemical parameters were found to be well within the prescribed limits. The nutrient values in the samples are found to be very low which indicates that agricultural runoff is minimal or very less. Trace metals concentrations found to be negligible.

Bacteriological analysis

Bacteriological samples were analyzed for all the surface water sampling locations, the total coli form values are observed in the range of 45 to 90 MPN/100 ml, indicates the values are far less than stipulated standard of 500 MPN/100 ml (Standards were given for Class 'B' category of water)

The surface water samples collected in the study area can be used for agriculture and other domestic purposes.

Ground water quality

Ground Water is one of the main sources of water in the project corridor for domestic, irrigation and other commercial use, and hence the rate of extraction of ground water is at a massive scale. For assessing the ground water quality around the proposed project site, ten (10) locations were collected during the study period spread over the entire stretch. Ground water samples were collected from the identified bore wells. Selection has been considered as per the utilisation pattern of the villagers for domestic and drinking purposes. The villages identified for ground water sampling during study period are listed in Table 4.4.3 and shown in Fig 4.4.3.

Table 4.4.3 Ground water sampling locations

Code no	Name of the Village	Chainage Points
GW-1	Bore Well, Panikoili	0 to 1 Km
GW-2	Open Well, Jajpur Road	10 to 11 Km
GW-3	Bore Well, Anandpur	42 to 43 Km
GW-4	Open Well, Ghatagaon	77 to 78 Km
GW-5	Bore Well, Keonjhargarh	123 to 124
GW-6	Open Well, Jhumpura	145 to 146 Km
GW-7	Bore Well, Champua	161 to 162 Km
GW-8	Open Well, Remuli	162 to 163 Km
GW-9	Bore Well, Sainkula	30 to 31 Km
GW-10	Open Well, Similia	

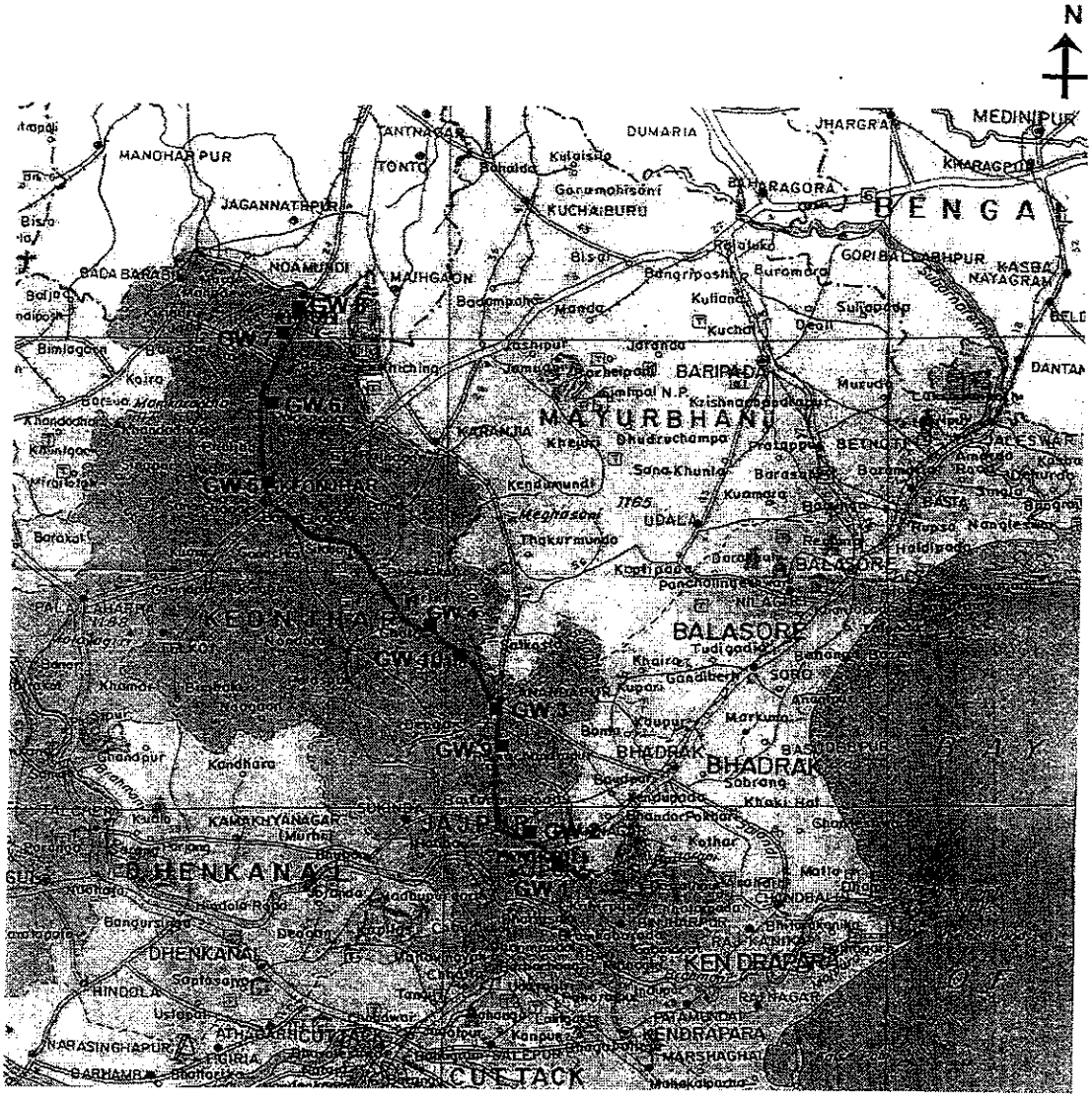


Figure 4.4.3 : Base map showing the Ground water quality monitoring stations

■ - **Ground water quality**

Scale: No to Scale

Data analysis

Ground water quality around the project site is analyzed for the requirement of IS 10500 norms and presented in **Table 4.4.4**. The pH values ranged between 6.88 to 8.25. The conductivity values of most of the village waters are in the range of 775 to 1206 µS/cm. Data on physical characteristics indicated variations in total dissolved solids in the range of 710 to 950 mg/l. The total hardness were observed to be in the range of 445 to 642 mg/l. Chloride and fluoride values of the samples are study period are in the range of 113 to 210 mg/l and 1.05 to 1.65 mg/l respectively. Chlorides found to be exceeding its limit in some of the villages, at the same time Fluoride values found to be consistent. Trace metals concentrations in ground water found to be negligible.

The ground water samples collected in the study area can be used for agriculture and other domestic purposes. It can also be used for drinking after pre-treatment.

Table 4.4.4: Ground Water Quality Obtained at Various Locations

Parameters	Results										Method	IS - 10500 Standards
	1	2	3	4	5	6	7	8	9	10		
pH	7.15	6.95	7.20	6.88	7.10	8.25	7.26	7.80	8.16	7.85	IS 3025 Part 10 - 1984	6.5 - 8.5
Electrical Conductivity (µS/cm)	1088	1110	990	1105	1180	1206	880	1085	775	1070	--	--
Total Dissolved Solids (mg/L)	800	710	795	810	925	810	823	950	824	740	IS 3025 Part 16 - 1984	500
Dissolved Oxygen (mg/L)	2.60	2.55	2.70	2.45	2.58	2.81	2.45	2.75	2.60	2.15	--	--
Chemical oxygen demand (mg/L)	48	46	54	46	52	22	47	48	32	47	--	--
Hardness ($CaCO_3$) (mg/L)	540	445	550	548	642	560	570	580	450	435	IS 3025 Part 21 - 1983	300
Calcium as Ca (mg/L)	124	138	95	132	122	120	126	185	128	130	IS 3025 Part 40 - 1991	75
Magnesium as Mg (mg/L)	78	81	80	85	62	79	45	78	85	87	IS 3025 Part 40 - 1991	30
Sodium as Na (mg/L)	45	46	34	46	51	94	52	48	47	52	--	--
Potassium as K (mg/L)	3.15	3.55	3.65	4.25	3.45	3.75	2.10	3.76	3.90	2.05	--	--
Total Alkalinity (mg/L)	310	365	410	355	420	298	344	405	356	372	IS-3025 (XIII)	200
Chloride as Cl (mg/L)	150	113	148	155	144	157	155	210	150	148	IS 3025 Part 32 - 1988	250
Fluoride as F (mg/L)	1.25	1.32	1.27	1.26	1.65	1.30	1.31	1.05	1.30	1.27	IS 3025 Part 23 - 1964	1
Sulphate as SO_4 (mg/L)	28	29	45	27	30	11	25	26	8	24	IS 3025 Part 24 - 1986	200
Phosphate as PO_4 (mg/L)	34.25	34.53	22.60	34.24	34.40	18.10	34.45	34.56	24.20	34.52	--	--
Nitrate as NO_3 (mg/L)	12	8	13	11	35	12	17	21	13	14	IS 3025 Part 34 - 1988	45
Iron as Fe (mg/L)	0.12	0.15	0.15	0.14	0.20	0.14	0.11	0.13	0.25	0.15	IS 3025 Part 32 - 1964	0.3

Table 4.4.4: Ground Water Quality Obtained at Various Locations

Parameters	Results										Method	IS - 10500 Standards
	1	2	3	4	5	6	7	8	9	10		
Boron as B (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	IS 3025 Part 29 - 1964	1
Copper as Cu (mg/L)	0.01	<0.01	<0.01	<0.01	<0.01	0.030	<0.01	<0.01	<0.01	<0.01	IS 3025 Part 36 - 1964	0.05
Lead as Pb (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	--
Zinc as Zn (mg/L)	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.040	<0.01	0.050	<0.01	IS 3025 Part 39 - 1964	5
Chromium as Cr (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	IS 3025 Part 38 - 1964	0.05
Aluminum as Al (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	0.020	<0.01	<0.01	0.030	<0.01	IS 3025 Part 31 - 1964	0.03

4.5 Noise Environment

Noise has become a major concern to all classes of people because of its growing menace, at each nook and corner of the country. Industries, transportation, many human activities contribute a lot to the sound level of a particular area. In order to assess the noise level in and around the proposed project, field monitoring was carried out at 15 locations along the existing alignment considering land use pattern, traffic intersections and diversions along the existing alignment. Precision integrating sound level meter having statistical unit with digital display was used for ambient noise level monitoring in the present study. Noise monitoring for 24 hours was carried out at each location during the study period. Noise monitoring locations and noise levels recorded i.e., Leq (day), Leq (night), Lmin and Lmax are presented in **Table 4.5.1**. Base map showing the Noise monitoring stations are shown in **Figure 4.5.1**.

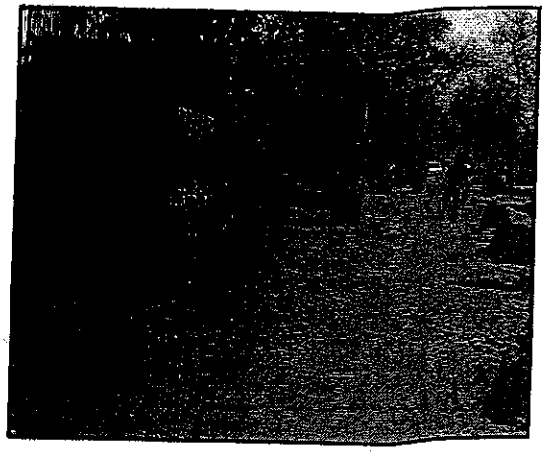


Table 4.5.1 Noise quality status along the Project Area

Code No.	Name of the Village	Category	Leq day dB(A)	Leq Night dB(A)	L min dB(A)	L max dB(A)
N1	Panikoili	Commercial	56.5	67.2	54.2	69.5
N2	Jajpur Road	Commercial	57.2	66.8	55.2	68.2
N3	Anandpur	Commercial	56.2	68.4	53.5	70.2
N4	Ghatagaon	Commercial	57.2	69.2	54.5	71.2
N5	Keonjhargarh	Commercial	57.5	66.1	55.4	68.2
N6	Jhumpura	Commercial	56.5	67.0	52.2	69.4

Code No.	Name of the Village	Category	Leq day dB(A)	Leq Night dB(A)	L min dB(A)	L max dB(A)
N7	Champua	Commercial	56.2	68.4	54.2	71.1
N8	Remuli	Residential	54.8	66.5	53.8	68.5
N9	Sainkula	Residential	55.2	67.8	56.4	68.2
N10	Similia	Residential	54.2	64.5	52.8	66.5
N11	Dhinkikote	Commercial	56.5	66.5	54.5	68.2
N12	Padmapur	Residential	55.4	63.9	53.5	66.4
N13	Palasapanga	Industrial	80.8	74.5	78.5	82.4
N14	Hatibadi	Industrial	81.5	64.9	61.8	82.4
N15	Korei	Residential	55.5	63.6	54.1	65.6

Note: Leq day starts from 06.00 AM to 09.00 PM and Leq Night starts from 09.00 PM to 06.00 AM

From the table 4.5.1, it is seen that five stations are fall under residential category, eight falls under commercial category and rest of two falls under industrial category. For residential category, the observed noise levels at Remuli, Sainkula, Similia Padmapur and Korei are slightly exceeding its day limit of 55 dB(A) and in all the locations during night time noise levels are observed to be higher side when compare with its limit of 45 dB(A). For commercial category all the day time values are well with in the stipulated limit of 65 dB(A) and all the night time values are exceeding its stipulated limit of 55 dB(A).

The observed noise levels at Palasapanga and Hatibadi are lone falls under industrial category exceeding its day and night stipulated limit of 75 dB(A) and 70 dB(A) respectively. Interestingly, the noise levels observed in all categories are quite high during nighttime than daytime. This is due to the fact that trucks/lorries loaded with mineral ores are allowed to ply only during nighttime i.e. between 8PM to 8AM. Because of very poor

road condition and frequent accident due to plying of about 10000 loaded trucks, District Administration has fixed 8 PM to 8 AM for movement of trucks. During daytime only two wheelers, LCVs are allowed to move. Because of poor road condition, the public transport is very less in the road. People prefer alternate road for commuting purpose.

The graphical representation of the same for residential, commercial, and Industrial are presented in figure 4.5.2, 4.5.3, and 4.5.4.

Figure 4.5.2: Graph Showing the Noise Quality Status in Residential Area

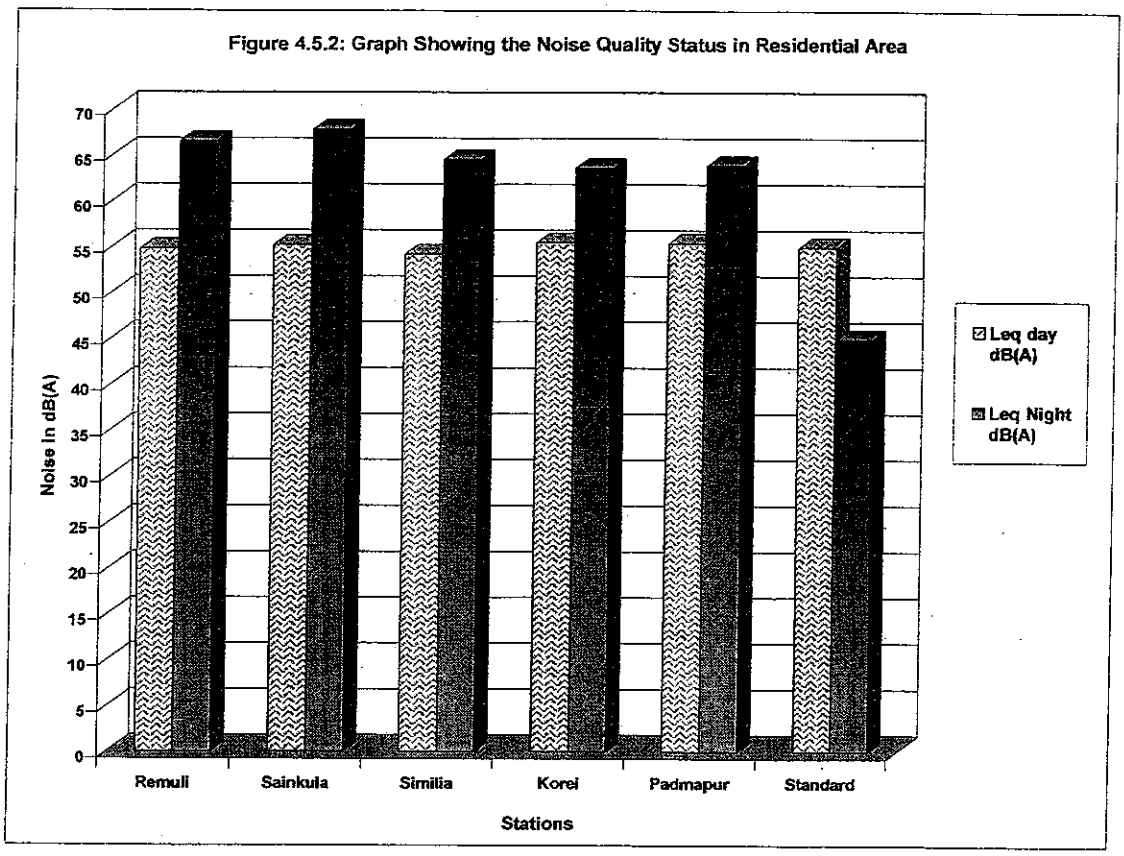


Figure 4.5.3: Graph Showing the Noise Quality Status in Commercial Areas

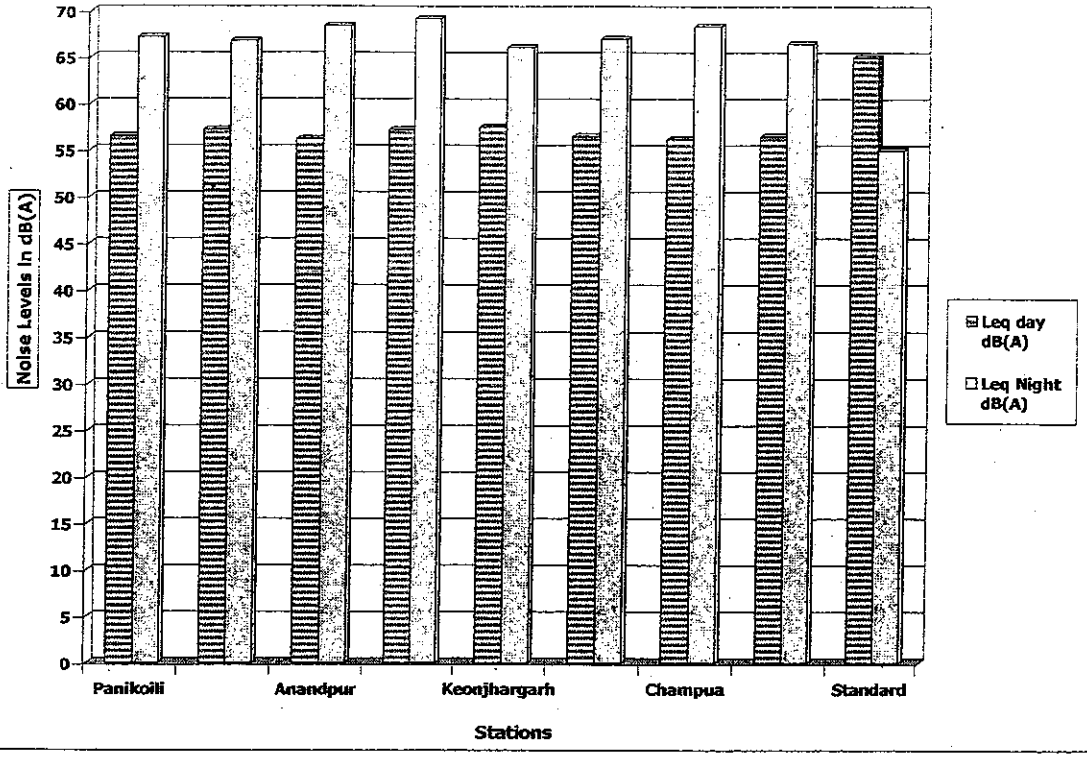
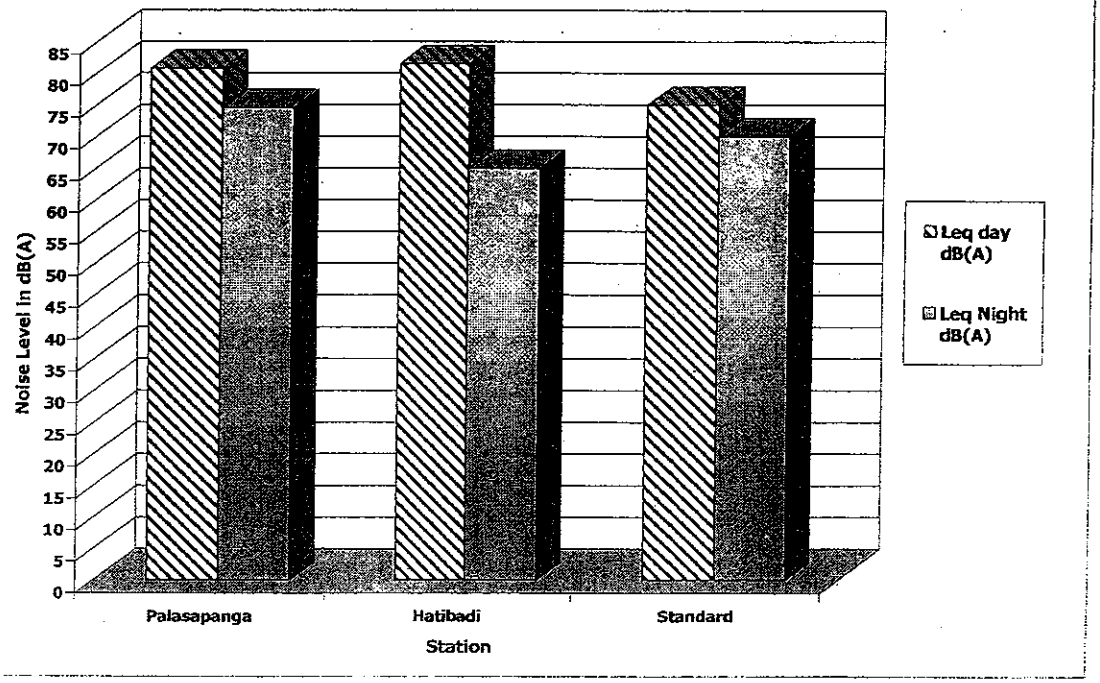


Figure 4.5.4: Graph Showing the Noise Quality Status in Industrial Area



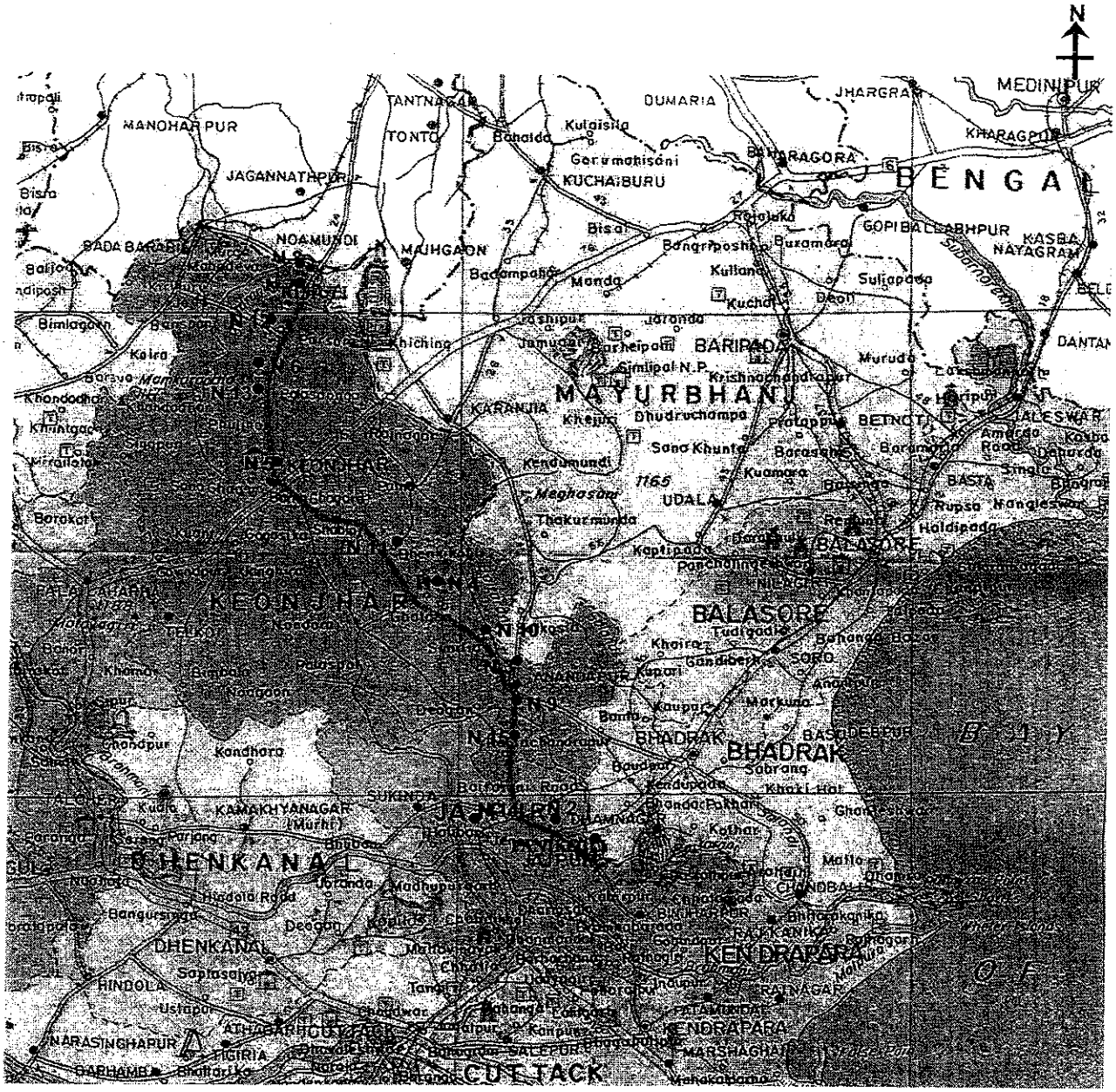


Figure 4.5.1: Base map showing the Noise quality monitoring stations

● - Ambient noise quality stations

Scale: No to Scale

4.6 Land Environment

The study area is located in Keonjhar and Jajpur districts of Orissa State. The land utilization patterns in the study districts are presented in table 9 & 10. The data reveals that in Keonjhar district, forest area accounts for 21.20% of the total geographical area. But in Jajpur district, forest area account for 2.94% of total geographical area. The land utilization pattern in the study districts indicates that 33.60% of total geographical area in Keonjhar and 55.29% in Jajpur district are cultivated. The break up for the Land utilization in Keonjhar and Jajpur Districts are given in Table 4.6.1 & 4.6.2 respectively.

Paddy is the main crop cultivated in Kharif season. Other crops are maize, pulses, oilseeds, sugarcane & vegetables. The human settlements in and around the Project areas have trees like Mango, Jackfruit, Jamun, Guava etc.

Table 4.6.1: Land utilization pattern in Keonjhar District

Category	Area (ha)	% to geographical area
Geographical area	636789	100.00
Forest area	135010	21.20
Misc tree crops & grooves (not included in net area sown)	5297	0.83
Permanent pasture & other grazing land	19070	2.99
Cultivable wasteland	27795	4.36
Land put to non agricultural uses	52427	8.23
Barren & uncultivable land	94890	14.90
Current fallows	56672	8.90
Other fallows	31659	4.97
Net area sown	213969	33.60

Table 4.6.2: Land utilization pattern in Jajpur District

Category	Area (ha)	% to geographical area
Geographical area	262574	100.00
Forest area	7711	2.94
Misc tree crops & grooves (not included in net area sown)	5105	1.94
Permanent pasture & other grazing land	11899	4.53
Cultivable wasteland	8826	3.36
Land put to non agricultural uses	44668	17.01
Barren & uncultivable land	15021	5.72
Current fallows	11118	4.23
Other fallows	13036	4.96
Net area sown	145190	55.29

4.7 Soil Environment

To assess the [illegible] soil quality characteristics in the study region, ten composite soil samples [illegible] period were collected within a depth of 1m and analysed for physico-chem[illegible]. The soil sampling locations and results of the analysis are presented [illegible] respectively. The soil sample locations are shown in Figure 4.7.1

[illegible] Soil quality monitoring stations

Locations	Chainage Points
[illegible]ren land	0 to 1 Km
[illegible] Irrigated land	10 to 11 Km
[illegible]gated land	42 to 43 Km
[illegible]orest land	77 to 78 Km
[illegible] barren land	123 to 124
[illegible]rren land	145 to 146 Km
[illegible]ren land	161 to 162 Km
[illegible] land	162 to 163 Km

Data analysis

As can be seen from the results, the soil along the study area is characterized by a pH values are in the range of 6.78 to 8.40. Percentage organic content of the soil samples are estimated in the range of 0.08 to 0.84. Chlorides and sulphates are present in the soil to an extent of 9 to 45 mg/kg and 11 to 32 mg/kg respectively. Trace metal concentrations are low and even less than <0.01 mg/kg in many of the samples. The soil in the region can be classified as red and yellow or mixed red and black. From the Table 4.7.2, the soils are conducible for the growth of different species, which are commonly found in nature.

Table 4.7.2: Soil Quality Monitoring Status along the Project Corridor

Parameters	**Reusluts**							
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**
pH	8.14	8.25	7.86	8.11	7.56	6.95	6.78	8.40
Electrical Conductivity (mS/cm)	256	189	220	275	332	240	214	210
Exchangeable Calcium (mg/kg)	1088	1122	1130	1205	1095	1105	1175	1302
Exchangeable Magnesium (mg/kg)	880	1086	1075	975	1105	895	1108	1203
Exchangeable Sodium (mg/kg)	308	105	285	305	257	95	280	245
Exchangeable Potassium (mg/kg)	38	44	65	45	33	12	43	36
Chloride as Cl (mg/kg)	35	9	34	28	45	18	31	41
Exchangenable Sodium % of soils (%)	0.2650	0.0275	0.0256	0.0425	0.0521	0.0265	0.3040	0.0255
CEC (meq/100gm)	15	8	12	19	28	12	15	21
Organic Matter (%)	0.32	0.11	0.36	0.84	0.22	0.25	0.18	0.08
Sulphate as SO_4 (mg/kg)	25	11	32	26	14	19	14	12
Phosphate as P (mg/kg)	2	1	5	4	2	3	2	4

Table 4.7.2: Soil Quality Monitoring Status along the Project Corridor

Parameters	Reusluts							
	S1	S2	S3	S4	S5	S6	S7	S8
Manganese as Mn (mg/kg)	0.12	0.10	0.09	0.15	0.13	0.14	0.08	0.12
Copper as Cu (mg/kg)	0.55	0.45	0.65	0.85	0.75	0.77	0.68	0.44
Zinc as Zn (mg/kg)	0.12	0.10	0.13	0.08	0.11	0.09	0.11	0.15
Cadmium as Cd (mg/kg)	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01
Chromium as Cr (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead as Pb (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel as Ni (mg/kg)	<0.01	0.02	<0.01	<0.01	<0.01	0.03	<0.01	<0.01

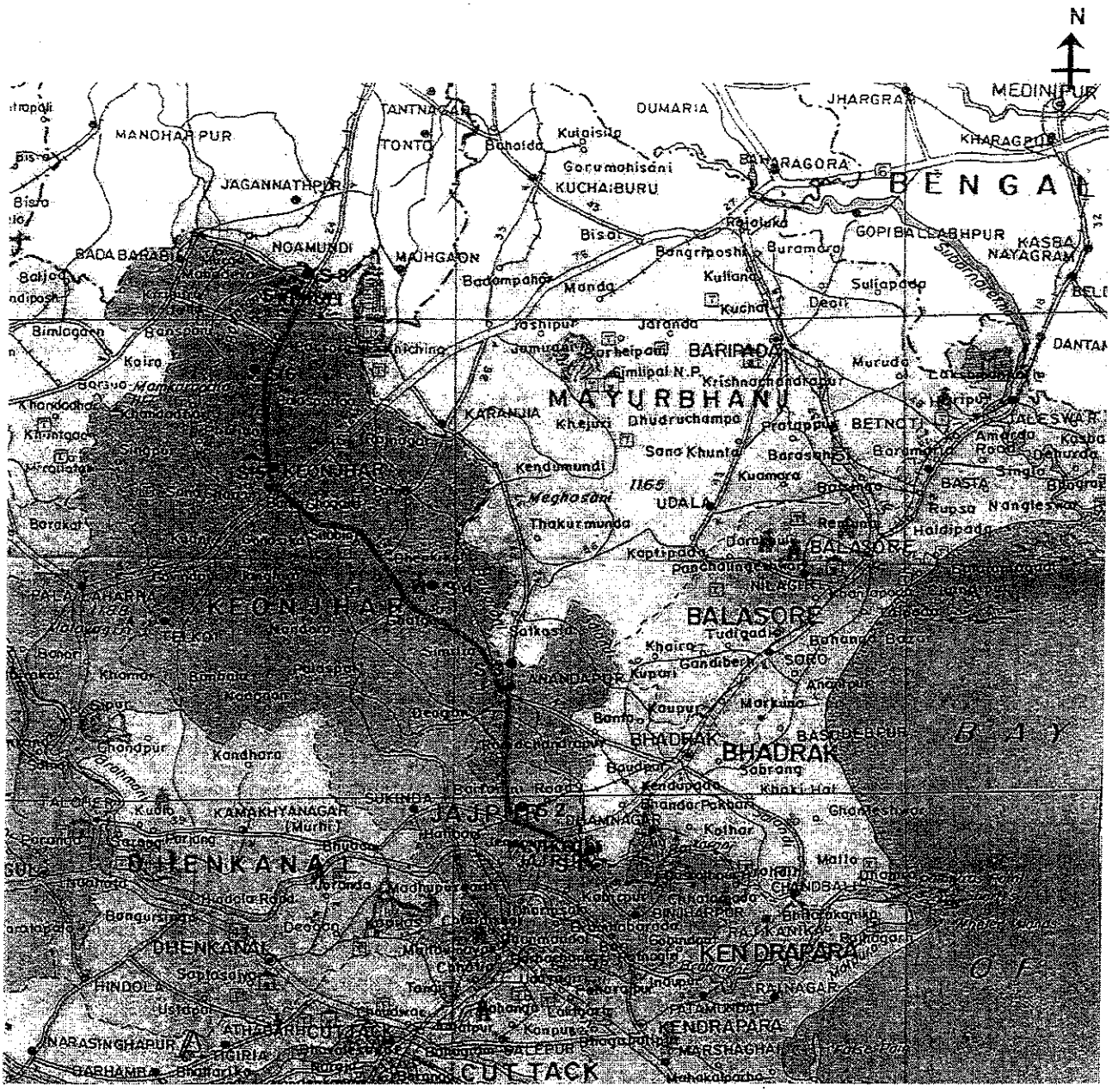


Figure 4.1: Base map showing the soil quality monitoring stations

● **- Soil quality stations**

Scale: Not to Scale

4.8 Biological Environment

4.8.1 Forests

As discussed earlier in section 4.6, forest area in Keonjhar and Jajpur district constitute 21.20 and 2.94% of the total geographical area. The Right of Way (ROW) passes through forests are i.e., Derakhola R.F, Poijman R.F, Atai R.F, Ghatagaon R.F, Sanamasinabila R.F, Pippilia R.F, Badaposi R.F, The ecological experts had visited the site to assess the flora and fauna components in the expanded zone of national highway to assess the Flora, Fauna species present in the forests and Wetland components in around the project to analyse the impact due to the proposed activity and also suggested the type of conservation measures to be adopted.

The land pattern is ecologically divided into cliffs, gorges, undulating slopes, Thick forests, patches of woodland and lowland plateau. The forest is diversified and contains semi- broad leaved trees with variable species of shrubs and climbers which are a typical feature of the habitat. Some of the dominant floral species present in the forests are Mahul, Neem, Peepal, Sal, Sirish, Tamarind, Acacia, Asan, Bamboo, Mango, Jackfruit, Banyan, Black Berry, Chakunda, Chara, Eucalyptus, and Gambhari. All along the streams green patch of vegetation exists. The fauna is also diversified by population numbers may be few due to number of valid reasons.

The chainage of ROW passes through the forest is given below.

S.NO.	District	Chainage		Length (Km)
		From	To	
1	Jajpur	19.000	21.000	2.000
2	Keonjhar	39.000	40.000	1.000
3		50.000	50.500	0.500
4		58.00	66.400	8.400
5		74.000	77.00	3.00
6		84.00	85.000	1.000
7		102.500	103.00	0.500
8		107.000	109.000	2.000
9		111.000	113.000	2.000
10		129.500	130.200	0.700
11		139.00	141.200	1.800
	Total			**23.700**

Flora found in the study area:

The list of the dominant tree species in the study forest area is given in table no.4.8.1

Table 4.8.1 : List of the dominant floral species in study area forests

Scientific Name	Scientific Name
Trees	
Ficus benghalensis	*Anthocephalus cadamba*
Mangifera indica	*Terminalia arjun*
Cassia siamea	*Cassia fistula linn*
Azadirachta indica	*Dilonix regia ral*
Tectona grandis	*Shorea robusta*
Albizzia procera	*Pithecellobium dulce benth*
Ficus religiosa	*Citrus limon burm F.*

Scientific Name	Scientific Name
Tamarindus indicus	*Phoenix sylvestris roxb*
Cedrus deodar	*Moringa oleifera lam*
Gmelina arborea	*Eucalyptus citiodra hock*
Acacia nilotica	*Saraca asoca de wild*
Pongamia pinnata	*Ziziphus mauritiana lam*
Aegle marmelos	*Sterculia foetida linn*
Ricinus communis linn	*Mimusops elengi linn*
Rosa centifolia linn	*Trewia nudiflora linn.*
Bambusa vulgaris schrad	*Ougeinik oojeinaensis H ochr*
Shrubs	
Veronia roxburghii	*Webera corymbosa*
Capparis zeylanica	*Moghania chhappar*
Eupatorium odoratum	*Rauwolfia serpentina*
Emblica robusta	*Cassia tora*
Flacourtia indica	*Fhretia buxiafolia*
Atylosia cajanifolia	*Murry koeniagii*
Pavetta indica	*Vitex negundo*
Diospyros chloroxylan	*Flacounito indica*
Mimosa pudica	*Engenia bracteata*
Lantana camara	*Randia uliginosa*
Flueggia microcarpa	*Andropogon paniculata*
Erycibe paniculata	*Euphorbia royaleana*
Ageratum conyzoides	*Phyllochlamye spino sa*
Clerodendron viscosum	*Wendnanda tinctoria*
Opilia amentacea	*Ichnocarpus frutescens*
Helicteres isora	*Glycosmis pentaphylla*
Anona squamosa	*Hollarrhena antidusenteria*
Phyllanthus reticulates	*Memecylonn edules*
Canthium parvibolium	*Antidesma diandrum*

Scientific Name	Scientific Name
Zizyphus ocnoplia	*Jasminum arborescens*
Jatropha glanduliferra	*Croton candatus*
Allophylus cobbe	*Maba buxifolia*
Flueggia microcarpa	
Climbers	
Toddalia assiatica	*Milletia auriculata*
Uvaria lurida	*Tylophora indica*
Pisonia senleota	*Combretum ovalium*
Vitis carnosa	*Milletia racemosa*
Bauhinia vahlii	*Ficus parasitica*
Combretum decandrum	*Vitis tatifolia*
Hygonia nystex	*Gloriosa superba*
Vitis tomentosa	*Heptaplenrun venulossum*
Anamirta cocculus	*Nimosa himalyana*
Grasses	
Cynodon dactylon	*Panicum indicum*
Chloris incompleta	*Imperate cylindrical*
Aristida setacea	*Heteropogon contortus*
Apluda mutica	*Themeda arundinacea*
Chrysopogon mentanus	*Eulaliopsis binata*
Dicanthium annulatum	

Fauna Found in the Study Area:

Decades before, the project area had rich diversity of mammals, birds, reptiles and fishes. Now these animals are sparsely seen due to poaching and loss of habitat. The advance of cultivation along with growth of population and communication network has driven the wild animals back to the reserve forests in and around the project area.

The detailed lists of mammals, birds, reptiles and fishes are mentioned in Table 4.8.2.

Table 4.8.2: List of Animals in the Project Area

English Name	Scientific Name
A. MAMMALS:	
Jackal	*Canis aurens*
Squirrel	*Funumbulus pennanti*
Fox	*Vulpes tengalensis*
Monkey	*Semnpitoecus entellus*
Rat	*Rattus ratus*
Mongoose	*Herpestes edwardai*
Hare	*Lepus nigricollis ruficandarus*
Wild pig	*Sis cristatus*
B. BIRDS	
Jungle crow	*Corvus macrorhynches*
House crow	*Corvus splenders*
Bul-Bul	*Pycnonotus cafen*
Myna	*Strunus tristis*
Nilkanta	*Coracias benghalensis*
Green bee-eader	*Meropsarientalis*
Blue-Tailed bee-eater	*Merops phillipinus*
Brown dove	*Streptopelia senegallensis*
Peewit	*Venellus venellus*
Papila	*Cuculus varius*
White-bellied	*Pericrocatus erthropygeus*
Black drongo	*Dicrurus macrocercus*

English Name	Scientific Name
Babbler	*Turdoides coudata*
Treepie	*Crypsirina vagabounda*
Grass owl	*Tyto capensis*
Black bittern	*Dupeper flavicollis*
Jack snipe	*Lymnocryptes minima*
Black winged stilt	*Himantous himantopus*
White-tailed lapwing	*Chettusia leucura*
Grey plover	*Souatarola squatarala*
Sooty tern	*Sterna fuscata*
Indian swallow plover	*Glareola maldivarum*
Great stone plover	*Esacus recurvirostris*
Indian water-rail	*Rallus aquaticus*
Indian grackle	*Gracula religosa*
Indian swallow plover	*Glareola maldivarum*
C. REPTILES:	
Krait	*Bungarus faciatus/caemuleus*
Garden lizard	*Calotes versicolor*
Chameleon	*Chameleon zeylanicus*
Fresh water turtle	*Geomyda trijuga*
Common wall lizard	*Hemidactylus flavirdis*
King cobra	*Ophiophagus Hannah*
Cobra	*Naja naja*

Conclusion

There are no rare or endangered species in the study area except Indian Wild Dog and Indian Wolf, Elephant, Heta Baga and Bear, which are present in interior forest. Since this

IUCN: International union for Conservation of Nature.

is road widening project the impacts anticipated on flora and fauna are minimal. By adopting the following management practices, the impacts can be minimized.

(i) Compensatory afforestation with native species for the forest land acquired.

(ii) Avenue plantation along the road.

(iii) To preserve the forest, earth borrowing, pilling, and building temporary camps are prohibited in the forest lands.

(iv) Construction workers should be informed to protect natural resources and wild animals. Hunting is prohibited. Display boards will be installed along the road side of the forest area for the protection of flora and fauna.

(v) Cross drainage structures in the form of culverts with adequate discharge capacity will be constructed for existing drains in the forest area.

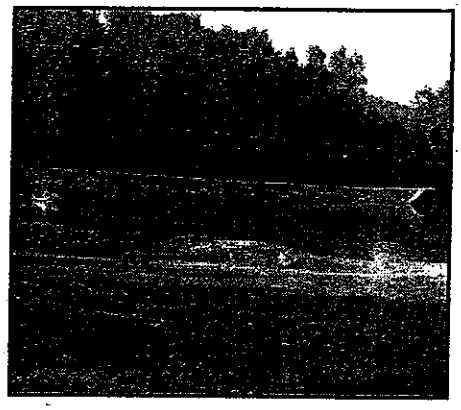
(vi) Animal under passes are envisaged for the easy movement of the animals in the forest area.

(vii) Construction vehicles should run at temporary access to avoid damaging arable lands and cattle raising lands.

END

4.8.2 Aquatic Ecosystem

Biological parameters are very important in the aquatic ecosystem, they determine the productivity. Primary productivity is an important indicator of richness of the eco-system. Fish production depends on production of zooplankton which in turn is dependent on the phytoplankton production or primary productivity. All these are related to the physico-chemical characteristics of the water.



Fish & Fisheries

The project area has a good number of ponds and rivers including minor irrigation projects, water falls etc. The principal fish found in the water bodies along the project corridor are

Rohi (Labeo rohita), Mirkali (Cirrhina mrigala), Bhakur (Catla catla), Sal (Ophicephalus marulices) and Seul (Ophicephalus striatus). Fishing is not an important economic activity along the project stretch. Though fishing is the primary occupation of fishermen community in project area.

4.9 Socio-Economic Status

The study area is limited to two districts of Orissa namely Jajpur and Keonjhar. The main socio-economic features of these two study districts as revealed from the study are presented below.

- The study districts are located in northern part of Orissa,
- Keonjhar, a princely State was created in 12th century A.D. at the time of Bhanja rulers. This time the king shifted his capital to a more centralized place and built his fort near a perennial spring (Jhara) which originated from the root of a Kendu tree. The new capital town was thus named as Kendujhar (Kendu+Jhar) and then it was corrupted into Keonjhar.
- Jajpur district was created in 1992, by carving out from Cuttack district. The name Jajpur is either a derivative of the name Jajnapur or Jajatipur as Jajati Keshari, the first Soumavamsi king of Orissa. The famous Chinese traveler Hiuen Tsang speaks of "Jajnapur" (Jajpur) as a great centre of religious.
- The Demographic details of the study districts are compiled using **Census 2001** and presented in **Table 4.9.1**. Jajpur district (560) is more densely populated than Keonjhar district (188). Sex ratio in Keonjhar district is 977 as compared to the sex ratio of Jajpur district, which is 972.
- Literacy rate of Keonjhar district is 59.75% as compared to 72.19% in Jajpur district. The male and female literacy rates are 72.53% and 46.71% in Keonjhar district. Similarly, the male and female literacy rates are 82.69% and 61.45% for Jajpur district.

- The Population of scheduled tribes is 44.50% in Keonjhar district and only 7.76% in Jajpur district. The percentage of scheduled caste is 11.62% and 22.99% in Keonjhar and Jajpur district, respectively.

Table 4.9.1: Socio-economic feature of study Districts

Parameters		Keonjhar	Jajpur
Population (2001 Census)		1561990	1624341
Male Population (2001 Census)		790036	823747
Female Population (2001 Census)		771954	800594
Rural Population (2001 Census)		1348967	1551361
Urban Population (2001 Census)		213023	72980
Sex ration (Female/1000 males)		977	972
Literacy rate (2001 Census)	Total	59.75	72.19
	Male	72.53	82.69
	Female	46.71	61.45
Density of Population (Person/sq km) (2001 Census)		188	560
% of ST Population (2001 Census)		44.50	7.76
% of SC Population (2001 Census)		11.62	22.99
Geographical Area		8303 sqkm	2899 sqkm
Total no. of Blocks		13	10
Total no. of villages		2125	1781
Major crops		Paddy	Paddy

For villagers located along the road corridor, employment is mainly on land & mining based economic activities. The summary of socio-demographical features (as per Census 2001) of the villages located along the road corridor with respect to population profile, literacy rate, workers participation, and occupational pattern are given in Table 4.9.2 to 4.9.5. The supporting data for the socio-economic parameters are presented in **Annexure -3**.

Table 4.9.2: Population Profile in villages located along the road corridor

Sl. No	District Name	No. of H.H	Population			Family Size	Sex Ratio	Children Pop (0-6)	
			Total	Male	Female			Number	% to total pop.
1	Keonjhar	18801	90638	46328	44310	4.8	956	13147	14.5
2	Jajpur	2286	12481	6428	6053	5.5	942	1681	13.5
Total		**21087**	**103119**	**52756**	**50363**	**4.9**	**955**	**14828**	**14.4**

The data presented in Table -4.9.2 indicates that there are around 21.09 thousand households in the study area with a population of 1.03 lakhs. The average family size is 4.9 and there are 955 females per thousand male populations. The percentage of children's population to the total population is only 14.4%. The proportion of population is more in villages falling in Keonjhar district (86%) as it has 4 Tahsils/84 villages with in with in core zone from the proposed Panicoili -Keonjhar -Remuli highway compared to Keonjhar district (14%) as it has only 1 Tahsil/20 villages with in core zone.

The population by sex in the study area as well as in the study districts is shown in Figure 4.9.1.

Figure 4.9.1: Population Distribution of the Villages Along the Project Areas

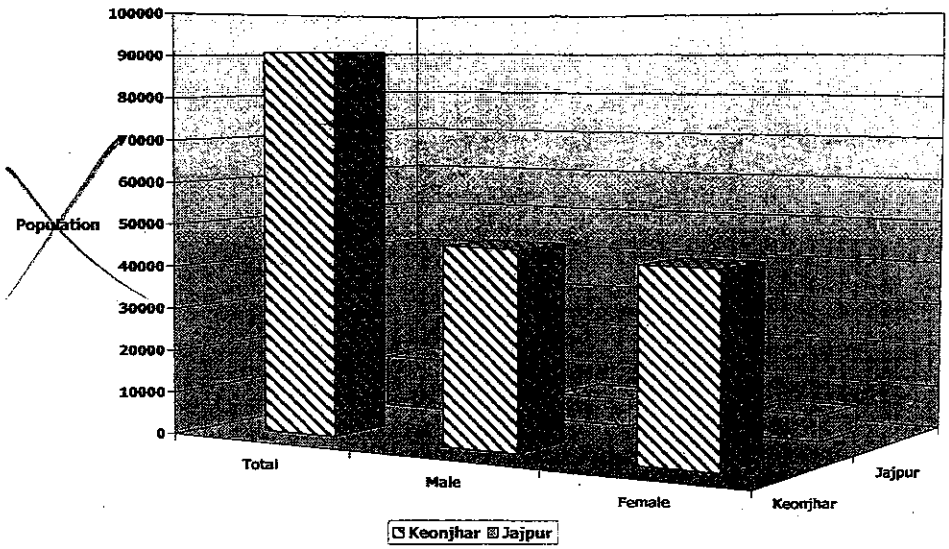


Table 4.9.3: Literacy rate Profile in villages located along the road corridor

Sl. No	District	Literate Population			Total Population	Literacy rate (%)
		Total	Male	Female		
1	Keonjhar	51156	31043	20113	90638	56.4
2	Jajpur	8146	4704	3442	12481	65.3
	Total	**59302**	**35747**	**23555**	**103119**	**57.5**

The literacy rate in the study area is only 57.5%. The trend exists in the both the study districts having 56.4% in Keonjhar and 65.3% in Jajpur districts.

The Literate population by sex in the study area as well as in the study districts is shown in Figure 4.9.2.

Figure 4.9.2: Distribution of Literates of the Villages Located in the Project Area

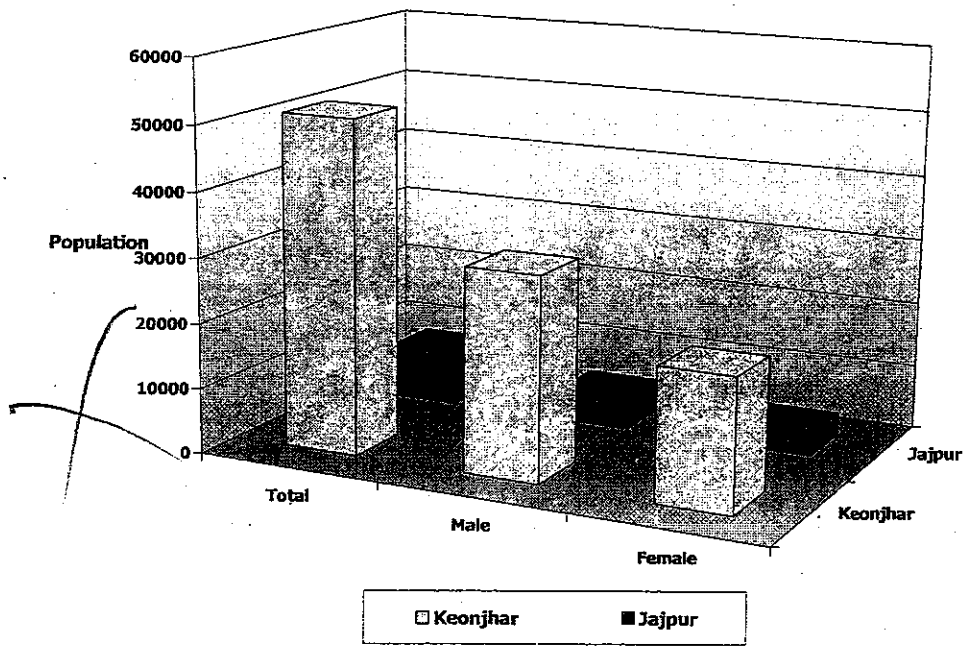


Table 4.9.4: Workers participation among total population in study area

Sl. No	District	Main Workers	% to total pop	Marginal Workers	% to total pop	Non workers	% to total pop	Total Pop.
1	Keonjhar	21076	23.2	11760	13.0	57802	63.8	90638
2	Jajpur	2799	22.4	860	6.9	8822	70.7	12481
	Total	**23875**	**23.2**	**12620**	**12.2**	**66624**	**64.6**	**103119**

The data presented in 4.9.4 denotes that there are more no. of non-workers (64.6%) consisting of old aged people, retired, house wives, children below 5 years and school going children up to 15 years followed by main workers, who are engaged in more than 180 days in a year, (23.2%) consisting of cultivators, agricultural laborers, self employed and other service holders and marginal workers who are employed in less than 180 days in a year (12.2%).

The workers & non workers and workers population by sex in the study area as well as in the study districts is shown in fig.4.9.3.

Figure 4.9.3: Distribution of Working Population of the Villages Located in the Project Area

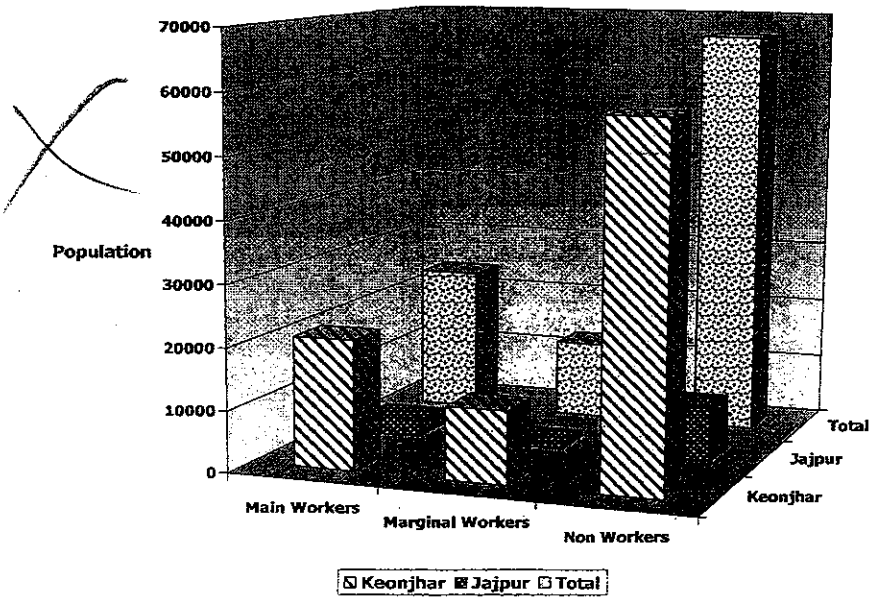
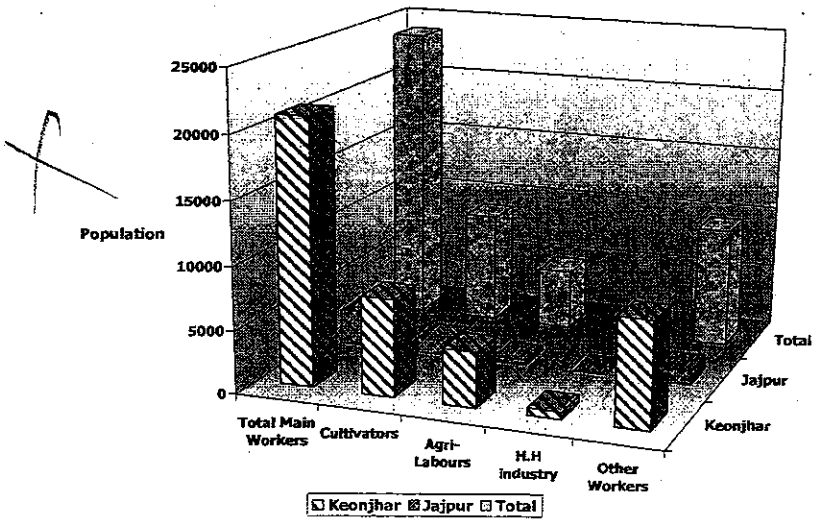


Table 4.9.5: Occupational Pattern among the total Main Workers in the Project Area

Sl.No.	District Name	Cultivators/ % to total main workers	Agri-Labours/% to total main workers	H.H industry/% to total main workers	Other Workers/% to total main workers	Total Main Workers
1	Keonjhar	7694 (36.5%)	4391 (20.8%)	597 (2.8%)	8394 (39.8%)	21076
2	Jajpur	1185 (42.3%)	403 (14.4%)	61 (2.2%)	1150 (41.1%)	2799
	Total	**8879 (37.1%)**	**4794 (20.1%)**	**658 (2.8%)**	**9544 (40.0%)**	**23875**

The occupational pattern presented in Table no 4.9.5 infers that the majority of the main workers are engaged in other than agricultural based activities or in other activities (40.0%) such as trade & commerce, transport, storage and communications, services both private & government etc. followed by cultivation (37.2%), agriculture labor (20.1%) and household industry/ self employed in pottery, black smithy, gold smithy, small size household industries (2.8%). The occupational pattern and occupation by category in the study area as well as in the study districts is shown in fig.4.9.4.

Figure 4.9.4: Distribution of the Occupational Pattern of the Villages Along the Project Area



4.9.1 Crops & Source of Irrigation

The cultivation in the study area is done mainly from bore wells and the other is rain fed. The soils in the study area are predominantly laterite, red and yellow or mixed red and black with good fertility. Paddy, Vegetable, Oil seeds, Maize, Grams, and chillies are the major crops cultivated in these areas.

4.9.2 Road Transport

The villages in the study area are well connected to the National highway/State highway or district roads. The project site is connected to National highway 5 & 6, Chennai to Kolkata and Mumbai to Kolkata Sections connecting to major towns i.e., Panikoili, Keonjhar, Chmpua, Rimuli etc. All the villages in the study area have bus facilities connecting to all important towns and cities of the district/state.

4.10 Findings of the sample socio-economic survey

The socio-economic survey was carried out in 40 sample villages and 200 families throughout the section by using a separate questionnaire. While selecting the samples attempt has been made to cover all the categories of occupational groups. The data on various socio-economic characteristics, which have been collected and will be analyzed in this chapter, include education background, workforce participation, occupational pattern and quality of life pursued by the population.

Demography

A total of 1068 persons reside in 200 sample families. The average family size is 5.34. Out of 1068 persons, 55.15% are male and 44.85% are female. Similarly, out of 200 families, 56 are joint families and 144 are nuclear ones.

Demography of Sample surveyed families

Male	Female	Total
589 (55.15%)	479 (44.85%)	1068 (100.00)

Family Size of Sample Surveyed

Joint	Nuclear	Total
56 (28%)	144 (72%)	200 (100%)

Literacy level

Education is considered as an important indicator of development as it contributes to an assessment of overall socio-economic standards and capacity of people to engage in different activities and occupation. Sex wise distribution of Literacy level is given in Table 4.10.1

Table 4.10.1: Sex-wise distribution of population by literacy level

Level of literacy	Male	Female	Total
Illiterate	25 (4.25)	49 (10.23)	74 (6.93)
Just literate	34 (5.77)	73 (15.24)	107 (10.02)
Primary	129 (21.90)	143 (29.85)	272 (25.47)
Middle	191 (32.42)	85 (17.75)	276 (25.84)
Matriculate	57 (9.68)	35 (7.31)	92 (8.60)
Intermediate	48 (8.15)	19 (3.97)	67 (6.27)
Graduate & above	54 (9.17)	31(6.47)	85 (7.95)
Technical	10 (1.70)	-	10 (0.96)

Level of literacy	Male	Female	Total
Non-school age children	41 (6.96)	44 (9.18)	85 (7.96)
Total	589 (100.00)	479 (100.00)	1068 (100.00)
Literacy Percentage excluding age (0-6 yrs)	**88.79**	**80.59**	**85.11**

As may be seen from the above table, the literacy level of the population in the project area is better. As shown in the table, 88.79 percentages of the male population and 80.59% of female population aggregating an average of 85.11% are found to be literate. But when the educational level is analyzed, it is found that 6.93% of the total population are illiterate, 10.02% are literate without formal education, 25.47% are educated up to primary level, 25.84% up to middle class level, 8.60% up to secondary level, whereas 6.27%, 7.95%, 0.96% are educated up to intermediate, graduate and having technical qualification respectively. Besides 7.96% of the total population constitute the non-school age children.

Participation in economic activities

A. Usual activity:

Adopting the procedure "Usual Activity Status" of the population in the area 30.62 percent of the total population are classified as workers and are pursuing some occupation for economic gains. Unemployment in the area is moderate with 7.59 percent people reportedly unemployed. This however is an indication of lack of economic opportunities in the area especially of the educated person. This low level of employment is also an indicator of the economic hardship and low labour productivity. The reason is that in rural areas, people always perform some kind of manual work. It is altogether different that such employment may not be adequate in terms of days of employment and wage earnings. The usual activity of the population in project area is given in Table 4.10.2.

Table 4.10.2: Usual activity of population in project area

Usual activity	Male	Female	Total
Worker	307 (52.12)	20 (4.18)	327 (30.62)
Unemployment	65 (11.04)	16 (3.34)	81 (7.59)
Household work	-	256 (53.43)	256 (23.97)
Old/Retired	31 (5.26)	30 (6.26)	61 (5.71)
Student	131 (22.24)	107 (22.34)	238 (22.28)
Non-school age children	41 (6.96)	44 (9.19)	85 (7.96)
School age children not going to school	14 (2.38)	5 (1.04)	19 (1.78)
Disabled/Handicapped	-	1 (0.22)	1 (0.09)
Total	**589 (100.00)**	**479 (100.00)**	**1068 (100.00)**

Besides the workers and the unemployed, 53.43% of women folk remain in their places to look after the daily household task. Among female non-working population, 10.23% are children who are not going to school and 22.34% are students, 6.26% are old or retired and 0.22% is physically handicapped or mentally retarded. For obvious reasons the proportion of economic participation is higher (52.12%) among men as compared to women where the rate of economic participation is only 4.18% (Table 34).

B. Occupational pattern:

The data on occupational pattern presented in table 35 reveals that agriculture is the major sector for providing employment (either as cultivator or farm wage earner) to more than 48% of main workers. Trade and business ranked second to agriculture because of the fact that PAPs are settled on the roadsides near commercial places. The variation between males and females in the economic rate of participation in different sectors is presented below. Distribution of workers by its occupation is given in Table 4.10.3.

Table 4.10.3: Distribution of workers by main occupation (% workers)

Occupation	Male		Female		Total	
	No	%	No	%	No	%
Cultivation	96	31.27	2	10.00	98	29.97
Wage labour – farm	58	18.89	1	5.00	59	18.04
Wage labour - non-farm	48	15.64	2	10.00	50	15.29
Allied activities	18	5.86	8	40.00	26	7.95
Forest produce collection	7	2.28	4	20.00	11	3.36
Service	2	0.65	0	0.00	2	0.61
Trade & Commerce	72	23.45	2	10.00	74	22.63
Artisan & Household Industry	6	1.95	1	5.00	7	2.14
Total	**307**	**100.00**	**20**	**100.00**	**327**	**100.00**

As indicated in the above table, 31.27% of the total male workers and 10% of the total female workers has got cultivation as their main occupation. Agricultural labourers constitute 18.89% and 5% among the male and female workers respectively. It is noticed from this table that 0.65% males have taken some sort of service, either in Government or Private sectors. Thus, when the occupational pattern of the population in the study area is taken into consideration, it shows that while majority of the male workers belongs to cultivation occupation, the females are mostly engaged in allied activities like dairy, poultry etc.

Besides the main workers, a sizeable percentage of marginal workers are also found to be engaged in different gainful economic activities in the area. In addition to their primary occupations, many main workers also have taken up subsidiary occupations to supplement their family income. The subsidiary occupations in which the marginal workers as well as the main workers are engaged mainly consist of allied activities and home-based income-generating work.

C. Income level:

Analysis of the level of income enjoyed by various sections of the population and the main source of income also give an idea regarding the people and the level of income derived from such activities. Such an analysis, at the same-time, brings into focus the relative importance of individual economic activity in terms of the proportional contribution to the total income.

In the present study, analysis of the level of income of the sample families has been put in a tabular form in table 36. The data presented in the table reveals that when all sources of household income are considered the average annual income of the families is Rs. 39,527/- per family.

Annual household income of sample families

Annual income range	No of families	%
<Rs 15000	39	19.50
Rs 15000 to Rs 50000	121	60.50
>Rs 50000	40	20.00
Total	**200**	**100.00**
Average annual household income	**Rs. 39,527.00**	

When the proportional contribution of various sources of income is analyzed it is revealed that highest contribution is from trade and business (45.65%) activity followed by cultivation (24.25%) activity. Wage earning as a source of income contributes 9.14% to the annual household income.

Contribution of various sources of income to the annual household income

Sources of income	Contribution (%)
Cultivation	24.25
Leased out of agricultural land	1.11
Forest produce collection	0.92
Allied activities	2.98

Wage earning	9.14
Service	11.18
Trade/business	45.65
Household industry & profession	3.19
Remittance, rent etc.	1.58
Total	**100.00**

D. Land holding status:

In terms of land holding, attempt has been made to find out the number of families falling into each of the land holding categories. This exercise was done with a view to assess the degree of dependence of the affected families on agriculture. The table 38 indicates that 59.50% families possess less than 1ha of land and 31.50% possess land holding in the range of 1 to 2 ha. Also, 8% families' falls in the land holding range of 2.01 to 5.00 ha. Only 1% families own more than 5 ha of land.

Land holding status of sample families

Land holding range	No. of families (% of families)
Land less	-
Less than 1.00 Ha.	119 (59.50)
1.01 to 2.00 Ha.	63 (31.50)
2.01 to 5.00 Ha.	16 (8.00)
More than 5.00 Ha.	2 (1.00)
Total	**200 (100.00)**

Quality of life

A. Expenditure pattern

For evaluation of the quality of life, the expenditure patterns of the sample families were studied. Having a glance at the table 39, we can have a clear idea as to what is the average standard of living of the people in the area of our concern. After analysis of the field level data it has been found that the average annual expenditure of sample families is Rs. 40,012/-. The source-wise average expenditure pattern has been presented in the table given below. Taking the average annual income into account (Table 36) it was observed that expenditure exceeds the income among the sample families. Normally when the expenditure amount exceeds the income, a family is likely to incur loan and enter into debt trap. Annual expenditure of the sample family is given in Table 4.10.4.

Table 4.10.4: Annual expenditure of sample families

(% in different sources)

Sources of expenditure	Percentage
Food	59.45
Clothing	5.26
Health	8.14
Education	6.85
Transport/Communication	6.44
Cooking fuel & electricity	4.36
Social function/Religious activities	4.88
Recreation	2.45
Miscellaneous	2.17
Total	**100.00**
Average annual expenditure	*Rs. 40,012.00*

B. Indebtedness:

Analysis of the field data (Table 40) indicate that 174 families are under debt out of a total number of 200 sample families, which shows that 87% families have borrowed money from some source or the other. The average amount of loan of the indebted has been

calculated Rs.3247/- per family. As regards the sources of debt 48.12% of the borrowers have received loan from commercial banks whereas 17.14% have borrowed money from cooperatives, 32.32% have borrowed money from private moneylenders and 2.42% have borrowed money from relatives. It is also observed that 42.91% of the total amount borrowed is obtained from commercial banks, 27.19% from cooperatives, 26.45% from private moneylenders and 3.45% from relatives. Thus it appears from the above figures that the highest number of project affected families have borrowed money from commercial banks.

Sources of debt from which sample families have taken loan

Sources	No. of borrower	% of money borrowed
Bank	48.12	42.91
Co-operatives	17.14	27.19
Pvt. Money Lenders	32.32	26.45
Relatives	2.42	3.45
Total	**100.00**	**100.00**

Chapter -5

ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATION MEASURES

The road development projects exhibit a symbiotic relationship between the environment and development with both positive and negative and reversible and irreversible impacts. The present chapter gives the analysis of the impacts in the present project corridor and suggested mitigative measures. Matrix method was adopted as methodology for assessment of impacts. Based on the scoping of the areas and the work being proposed the following key issues were assessed for this project.

- Preservation of aesthetic and landscape of the area to the possible extent
- Effective restoration of borrow area and quarries
- Noise and air quality
- Tree removal and tree plantation
- Sanitation and waste disposal
- Road safety
- Protection of flora and fauna

Road development projects can have impacts or cause impacts in four specific situations as follows:

- Impacts of Location
- Impacts of Project Design
- Impacts during Construction, and
- Impacts when the Road become Operational.

5.1 Impacts of Location

The road stretch has no specific impacts from the location. Presently the roads lack of side drains and this often leads to accumulation of water by the road side which in turn damage the road shoulders. Proper care has been taken in the designs to build in drainage system.

5.2 Impacts Due to Project Design

The engineering design of the road has been prepared incorporating all environmental safeguards. The design criteria have been covered in Chapter –3. To prevent the damages to shoulders appropriate designs are prepared which include regular dressing of the earthen shoulders to establish a gentle slope away from the carriageway.

5.3 Impacts During Construction

Since the construction is dependent on the quality and properties of the available material, the choice of material, particularly the management of borrow pits, assumes importance during construction.

5.3.1 Borrow Area

Large quantity of earth / gravel material is required for widening of formation and embankment, necessitating earth / gravel from borrow pits.

5.3.2 Borrow Pit Restoration

Arrangements for opening and using material from borrow pits shall contain enforceable provisions for the extraction and restoration of the borrow area, and their surroundings, in an environmentally sound manner to the satisfaction of the Engineer. Areas shall be graded to ensure drainage and visual uniformity, and arrangements shall be made to collect and preserve top soil for use in the excavated borrow pit sides and bottom to make it green area alternatively, these borrow areas would be sited as far as possible on high grounds or hillocks. Topsoil shall be replaced and the area re-vegetated to the satisfaction of the Engineer. The topsoil can also be used for side slope, median covering for the growth of shrubs and grass. Additional borrow pits will not be opened without restoration of those areas no longer in use.

5.3.3 Soil Quality

The problems of soil erosion exist in the stretch due to varying topography, erratic rainfall and swift velocities of water in the drains during monsoon.

Top Soil Loss: The loss of fertile topsoil / humus may occur because of the extension of carriageway, hence care and precaution need to be taken to preserve the layer and reuse the soil as it contains the humus.

Soil Erosion: It may occur due to the uneven topography and intensity of rainfall. A major problem of erosion may occur due to the removal of age-old trees along the roadside within ROW. The removal will result in the instability of soil binding and soil structure, as uprooting will make the soil loose. Erosion may occur due to the swift velocities of drains in monsoon.

Mitigation measures include periodic maintenance of drains to check scouring of soil and limiting construction activities of culverts and bridges to dry seasons. Measures should be taken to prevent contamination of soil by bituminous material and other chemicals utilized during construction. No agricultural land would be used for borrow areas. The excavated top soil will be properly stored for reuse.

In addition to the engineering design the corridor will be planted with trees to support and the strengthen the soil binding capacity.

5.3.4 Impact on Water Resources and Water Quality

To prevent accumulation of water by the road side, adequate cross drainage (CD) structures in the form of culverts with adequate discharge capacity will be constructed. During reconstruction of old cross drainage structures and construction of new ones, diversion is required to aid uninterrupted movement of traffic. Material will not be put in the drainage to avoid blockage and prevent the erosion. This will help in protecting the aquatic ecology.

No permanent impact is anticipated on water quality due to the project. The construction of the project needs partial filling of the tanks roadside which remain dry

during non monsoon. The some of the Ponds, wells, and other water bodies affected will be accounted as given below:

Type	Fully Affected	Partly Affected	Total
Tube well	54	-	54
Dug Well	5	-	5
Open Well	28	-	-
Pond	7	72	79
Other Water bodies	-	12	12

Construction activities may temporarily deteriorate surface water quality in terms of increased turbidity and as well as oil and grease.

The mitigation measures include proper disposal of water and other liquid wastes arising from construction. Stream courses and drains will be kept free from dumping of solid wastes and earth material.

5.3.5 Impact on Air Quality

Impacts on air during the construction phase could be due to transportation of construction equipment and road construction activities. Operation of hot mix plants and Asphalt Plants will result in the emission of fumes and obnoxious gases to the environment. Loading/ unloading of construction materials and their transportation, particularly through the unpaved or unmetalled sections of the road may lead to a rise in the ambient SPM and RPM levels. Material handling, spillage may occur during the transportation of construction materials.

Mitigation Measures:

- Hot Mix Plants shall be located away from the inhabited areas, residential settlements and water bodies.
- Trucks and Tippers carrying earth for filling, sand, gravel or stone will be duly covered with Tarpaulin sheets to avoid spilling.
- Dust level at the construction sites shall be controlled by sprinkling water.

- Construction material, machinery and equipment will be maintained in a good working condition and shall be handled with due precaution and only by trained professionals.

5.3.6 Impact on Noise

The impact of noise levels from the project on the neighboring communities would be anticipated with the increase in vehicles and vary with vehicles speed. The increased noise level is attenuated by vegetative noise barriers. (Rows of trees planted). The major sources for noise pollution during construction will be movement of vehicles transporting the construction material to the construction yard and the noise generating activities at the yard itself. The construction equipment with high noise levels, loading and transportation of material near the borrow areas will affect the construction personnel and other humans in the area.

The required mitigation materials include location of construction equipment will be at least 250 m away from inhabited areas. In addition construction workers will have to be provided with protection devices like earplugs. Other ancillary measures include maintenance of equipment in good condition, proper design of engine enclosures. Project activities shall be coincide with periods when people would be least affected. Construction activities shall be strictly prohibited between 10 P.M and 6 A.M in residential areas.

Acoustic Barriers: There are no flyovers and only pedestrian underpasses are envisaged in inhabited areas with 2.5 to 3.5 m vertical clearance and the gradients are very flat and do not require sudden acceleration. Moreover, the main carriageway is separated from the building line with the help of service roads, thereby minimising the noise pollution for the residents. In view of this, acoustic barriers are not proposed in the project.

5.3.7 Impact on Biological Environment

The widening of the existing 2-lane road might require felling of trees from the roadside plantation areas. The predominant tree species going to be felled include Palm, Siris, Gulmohur, Tamarind, and Eucalyptus. These are all ubiquitous species. The short-term impact due to felling of trees will be more than compensated in long term through the proposed avenue plantation programme.

Mitigation Measures:

An avenue plantation programme shall be promptly adopted to restore and further enrich the loss of vegetation along the following lines:

Plantation with an appropriate mix of indigenous and specially suited species shall be carried out along the corridor. The number of plants proposed to be planted are:

In the compensatory afforestation area of 71.1 hectares, trees will be raised by forest department at the rate of 3000 trees per hectare.

- Trees proposed to be planted in compensatory aforestation area= 2,13,300
- Trees proposed to be planted in Jajpur Road bypass = 6,400
- Trees proposed to be planted in Anandpur bypass = 2,400
- Trees proposed to be planted in Ghatagaon bypass = 800
- Trees proposed to be planted in Keonjhar bypass = 4000
- Trees proposed to be planted in Jhumpura bypass = 2,400
- Trees proposed to be planted from Km 0.00 to Km 163.00 = 1,30,400
- **Total number of plants proposed to be planted = 3,59,700**

Flowering plants and shrubs of the height of about 2m shall be planted at the median. The plantation in the median will serve, as a barrier against glaring headlights of the vehicular traffic plying in the opposite direction. Further, this will improve the aesthetics of the alignment.

Along the extreme edge of road boundary, tall growing trees such as Silver Oak (***Grewellia robusta***) shall be planted. At a distance of 5 m from the outer row, shade bearing and flowering trees of the following species will be taken up.

- Jacaranda (*Jacaranda mimusifolia*)
- Gulmohar (*Delonix regia*)
- Moduga (*Butea monosperma*)
- Rain tree (*Samanea saman*)
- Tabebuia (*Tabebuia avalandia /Tabebuia sp.*)
- Neem (*Azadirachta indica*)
- Sisoo (*Dalbergia sisoo*)
- Devil's tree/ Saptaparni (*Alstonia scholaris*)

Fauna

Terrestrial Fauna

During the construction, no impact on the wildlife is anticipated.

Aquatic Fauna

The proposed project would require partial filling up of some ponds. Most of these ponds remain dry during the non-monsoon months. Most of the rivers/ streams crossing the corridor remain dry during non-monsoon months.

Increasing sediment load to the recipient water bodies i.e. ponds and rivers will restrict the penetration of solar energy in the water body. This will affect photosynthesis of the aquatic flora, which in turn will have adverse impacts on the aquatic fauna. Since, most of the water bodies remain dry during the non-monsoon months, this impact will be negligible. But, the implementation of the following measures will help to avoid soil erosion and further minimize the impacts of the aquatic fauna.

Mitigation Measures:

- Filling up of ponds will be resorted only after exhausting all other options.

- Filling up of ponds wherever required shall be done during the non-monsoon months.
- Construction of bridges and culverts shall be accomplished during the non-monsoon periods.
- The requirement of filling up of ponds shall be minimised by constructing retaining structures where the height of filling is more.
- The direct discharge of oil and chemical spills to the water bodies shall be avoided.

5.3.8 Impacts on Human Use Values

Land Use

Widening of the existing 2-lane road will lead to a change in the land use pattern of areas adjacent to the road. The existing land adjacent to the road at present is mostly of agricultural use, which needs to be acquired for widening of the road. The proposed bypasses at Jajpur, Anandpur, Ghatagaon, Keonjhar and Jhumpura pass through mostly agriculture area and partly barren fields. Hence, acquisition of the fertile land and gardens will have direct bearing on the floral resources and also on the local economy.

The project corridor lies in a plain terrain and thus, no disfiguration of land is envisaged due to construction activities except for the opening up of borrow pits. The borrow pit locations have already been identified and will be restricted to those areas only. The locations of borrow pits are already given in chapter 3.

Mitigation Measures:

- Construction activities shall be limited to the corridor only.
- Care shall be taken to ensure that the construction workers camp does not disturb the surrounding land use.
- Existing access/ entrances to the highway shall be duly maintained.
- While finalising bypass alignments, options that are best from Engineering, Environmental and Social aspects are selected.

Flood Characteristics

The flood characteristics of the project area are given. In the proposed improvement scheme, embankments will be constructed for forming bypasses, construction of ROBs and vehicular underpasses. These may lead to flooding of the project area in the even of unprecedented rains.

Mitigation Measures:

- Raising of the embankment height above the submergence depth.
- Widening and strengthening of the existing cross-drainage structures particularly at the specified locations of submergence.
- Providing drain on both sides of the widened road and extending the drains to a proper outfall.
- Proper supervision during construction to avoid blocking of micro-drainage across the road.
- Maintain existing drainage outlets.
- Replace inadequate or distressed drainage structures.
- Adequate number of cross drainage structures will be provided along the bypasses.

5.3.9 Impacts on Quality of Life

Socio-economics, Land Acquisitions and Resettlements

Impacts and mitigation measures associated with social environment in the project influence area (PIA), land acquisition and resettlement of project-affected persons (PAP) have been dealt in separate Chapter.

Accident, Health and Safety

Construction activities will cause hindrance to the existing traffic flow. Thus, short-term impact in terms of accident is anticipated during construction phase of the widening project.

Mitigation Measures

- Reduce speed through construction zones.
- Construction of bridges/ culverts shall be carried out prior to construction of new corridor at the first stage.
- Strengthening or raising of the existing 2-lane shall be done only after the completion of the new pavement.
- Proper cautionary signs shall be displayed at construction sites.
- Diversion roads will be provided wherever needed.

Aesthetics and Landscape

The proposed widening of the existing 2-lane road will require partial removal of roadside plantation, which will deteriorate the corridor's aesthetic values temporarily. But the proposed plantation all along in long run will improve the aesthetics and landscaping of the corridor. Disfiguration of the landscape is also anticipated due to opening of borrow pits.

Mitigation Measures

- Mixed plantation shall be carried out at roadside and flowering shrubs in the median
- Borrow pits shall be resurfaced with conserved topsoil (borrow pit opening shall be as per IRC-10-1961).
- Plan for controlled development shall be evolved by land planning agencies.
- There shall be proper vigilance to avoid squatter development all along the corridor.

5.3.10 Impacts from Construction Workers' Camp

Local labourers shall be employed for the construction activities to the maximum possible number to minimise the production of domestic waste generation.

Mitigation Measures:

Labourers residing in the camps shall be provided with safe drinking water, adequate sanitation facilities, kerosene and all other amenities as per the prevailing Labour laws. Domestic waste generated will be treated as per IS-2470.

Sanitation and Waste Disposal

Sewage and domestic solid waste generated at the construction workers camp will be properly disposed of to prevent health and hygiene related problems. Adequate sanitary facilities will be made available at the construction camp. Periodical health check up of construction workers will be undertaken.

5.4 Impacts During Operation Phase

5.4.1 Impact on Land use

Road development may lead to establishment of petty shops and other commercial pursuits by the local populace. Local statutory bodies will strictly enforce land use. In addition the project proponent should prevent development of squatters settlements and encroachments on the vacant portions of the RoW of the road.

5.4.2 Impact on Air Quality

The impact on ambient air quality due to vehicular movement was predicted using the California Line Source Emission 4 (CALINE4) model developed by Caltrans in 1989. CALINE4 is a simple line source "Gaussian plume dispersion model", primarily predicts Carbon Monoxide (CO) impacts near roadways. Its purpose is to help planners protect public health from the adverse effects of excessive CO exposure. The user must also define CO emission factors for each roadway link. CO emission factors generated with the California Air Resources Board's EMFAC 2002, version 2.2 software in lineup to support the Caline 4 model. Minimal inputs are required for the model like source strength, meteorology and site geometry for predicting pollutant concentration for receptors within 500 meters of the roadway.

The model was used to predict 'without project scenario' and 'with project scenario' for different varying years (i.e. 2006, 2010, 2015, 2020, 2025, and 2030) have been predicted with the varying wind speeds and stability conditions. The predicted concentrations for the same are presented in **Table 5.1**. Graphical representation of the same is presented in **Figure 5.1.1**.

Without project scenario

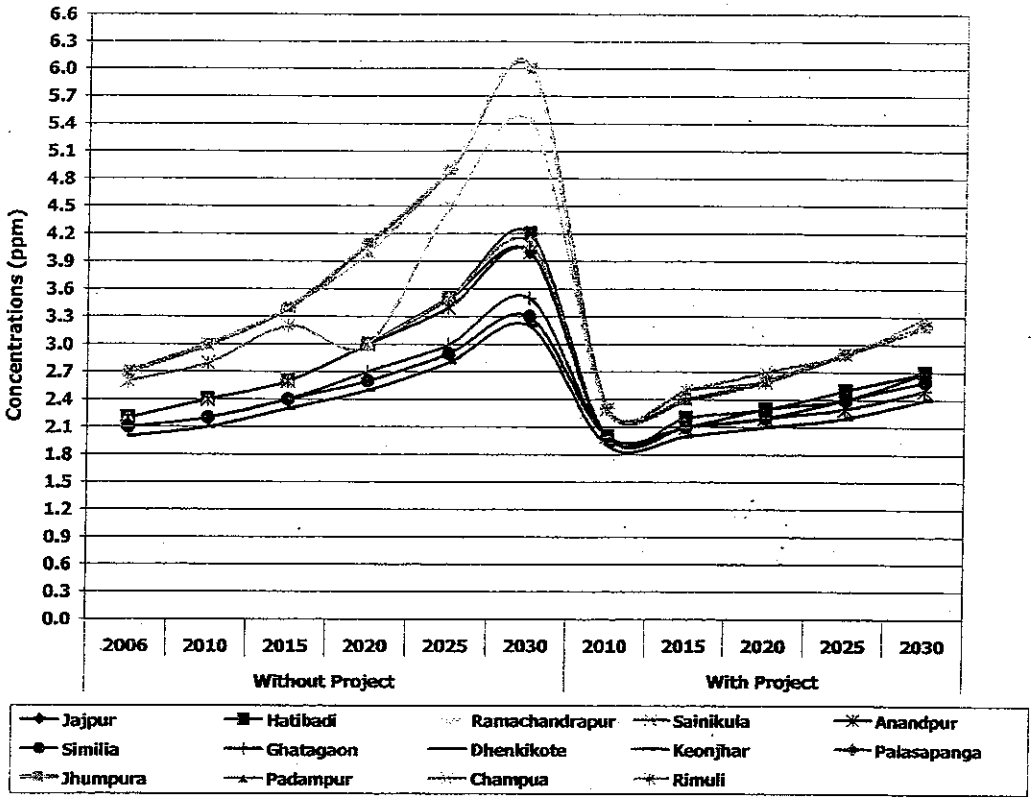
As presented in Table 5.1, the predicted CO concentrations at the receptors along the Right of Way (ROW) are in the range of 2.0 to 2.7 ppm in 2006, 2.1 to 3.0 ppm in 2010, 2.3 to 3.4 in 2015, 2.5 to 4.1 ppm in 2020, 2.8 to 4.9 in 2025, and 3.2 to 6.0 ppm in 2030. As projected up to 2030, at locations i.e. Keonjhar, Palasapanga, Jhumpura, Padampur, Champua and Rimuli are exceeding its stipulated limit of **4 mg/m^3 (3.2 ppm)** for residential categories in the years 2015, 2020, 2025, and 2030. Where as in case of the rest of locations ie. Jajpur, Hatibadi, Ramachandrapur, Sainikula, and Anandpur are exceeding it limit in year 2025. The minimum value has been identified at Dhenkikote ie. 2.0 to 3.2 ppm. (1 ppm = 1.25 mg/m^3)

Table 5.1 Projected CO values along the Project Area

Location	Without Project						With Project				
	2006	2010	2015	2020	2025	2030	2010	2015	2020	2025	2030
Jajpur	2.2	2.4	2.6	3.0	3.5	4.0	2.0	2.1	2.3	2.4	2.7
Hatibadi	2.2	2.4	2.6	3.0	3.5	4.2	2.0	2.2	2.3	2.5	2.7
Ramachandrapur	2.2	2.4	2.6	3.0	3.5	4.1	2.0	2.1	2.2	2.3	2.5
Sainikula	2.2	2.4	2.6	3.0	3.5	4.1	2.0	2.1	2.2	2.3	2.5
Anandpur	2.2	2.4	2.6	3.0	3.4	4.0	2.0	2.1	2.2	2.3	2.5
Similia	2.1	2.2	2.4	2.6	2.9	3.3	2.0	2.1	2.2	2.4	2.6
Ghatagaon	2.1	2.2	2.4	2.7	3.0	3.5	2.0	2.1	2.2	2.3	2.5
Dhenkikote	2.0	2.1	2.3	2.5	2.8	3.2	1.9	2.0	2.1	2.2	2.4
Keonjhar	2.7	3.0	3.4	4.1	4.9	6.0	2.3	2.4	2.6	2.9	3.2
Palasapanga	2.7	3.0	3.4	4.1	4.9	6.0	2.3	2.4	2.6	2.9	3.2
Jhumpura	2.7	3.0	3.4	4.1	4.9	6.0	2.3	2.4	2.6	2.9	3.2
Padampur	2.7	3.0	3.4	4.0	4.9	6.0	2.3	2.5	2.6	2.9	3.2
Champua	2.7	3.0	3.4	4.0	4.9	6.0	2.3	2.5	2.7	2.9	3.3
Rimuli	2.6	2.8	3.2	3.0	4.5	5.4	2.3	2.5	2.6	2.9	3.2

Note: CO measured in ppm (1 ppm = 1.25 mg/m^3)

Figure 5.1.1: Graph showing the predicted CO concentrations along the project area



With project scenario

As presented in Table 5.1, the predicted CO concentrations at the receptors along the ROW is in the range of 1.9 to 2.3 ppm in 2010, 2.0 to 2.5 ppm in 2015, 2.1 to 2.7 ppm in 2020, 2.2 to 2.9 ppm in 2025, and 2.4 to 3.3 ppm in 2030. As projected up to year 2030, all the predicted values are below the stipulated standard of **4 mg/m^3** for residential categories except, at Champua exceeding its limit in year 2030. (1 ppm = 1.145 mg/m^3)

On comparison of both 'without' and 'with' project scenario, concentrations are exceeding its limit in 2015 'wihtout' project scenario, where as in the case of 'with' project scenario all locations observed to be well with in the stipulated standard, except at one location that too in year 2030. When compare with each other it is clearly indicates that considerable reduction in concentrations observed 'with project scenario'.

The present Total Suspended Solids (TSPM) levels are slightly exceeding its limit, as described in 4.3 of Chapter 4. Heavy traffic of loaded trucks, narrow townships, and poor road conditions leads to increase the pollutant concentrations in the region. Five bypasses have been proposed to overcome the problem in the proposed widening and strengthening of the road.

Since the present baseline levels of other criteria pollutants RPM, NOx & SO_2 are much below the stipulated standards, 'with project scenario' the incremental emission levels for the years 2010, 2015, 2020, 2025, and 2030 will be marginal and within the standards. However, mitigation's suggested to further improve the corridors air quality are:

- Phasing out of old technology vehicles, regular emission checks, use of fuel-efficient engines, use of catalytic converter and land use control are the measures that are to be implemented by central and state governments to reduce pollution levels.
- Enforcing the existing emission norms.
- Plantation on either side of the road with selected plant species capable of absorbing pollutants
- Provision of road, improvements at intersections and separate truck parking facilities to ensure smooth and uninterrupted traffic flow. All these facilities shall result in minimizing stopping and idling of vehicles and thus improving air quality

5.4.3 Impact on Noise Quality

The major source of noise pollution in the project region is due to vehicular movements on the highway and noise in the junctions. The noise impact due to the transportation activity depends on the ultimate traffic volume and the type of the vehicles in operation. The typical base noise levels generated in the corridor is presented in the Chapter –4. To predict the cumulative noise impacts due to the traffic movement, Federal Highways Administration (FHWA) model was used. In this

model, traffic characteristics used in predicting future noise levels could make a substantial difference in the results. "Worst hourly traffic noise impact" occurs at a time when truck volumes and vehicle speeds are the greatest have been considered. FHWA model calculates day (L_d) and night (L_n) noise equivalent for each category of vehicle and also the total day night (L_{dn}) due to all kinds of transportation.

The present total L_{dn} for different locations due to the vehicular movements is more in Night time than day time. The noise levels get diluted as we move away from the centre line of the road. The predicted noise levels at various locations for different varying years (i.e., 2005, 2010, 2015, 2020, 2025, and 2030) 'without project scenario' and 'with project scenario' has been presented in **Table 5.2.**

'Without project scenario'

From Table 5.2, it is clearly indicates that the predicted noise levels based on model is almost compatible and observed to be slightly higher side when compare with base noise levels (observed at study area). All the predicted stations are fall under residential category and exceeding the stipulated day limit of 55 dB (A) in the year 2006 itself. The predicted maximum concentrations at Palasapanga, Champua, and Rimuli are in the range of 62.1 to 68.9 dB (A) till 2030. The minimum predicted concentration found to be at Anandpur are in the range of 55.2 to 62.1 dB (A) till 2030.

'With project scenario'

From Table 5.2, it is clearly indicates that the predicted noise levels for the years 2010, 2015, 2020, 2025, and 2030 are well with in the stipulated standard. Except, in 2030, at stations Keonjhar, Palasapanga, Jhumpura, Padampur, Champua, and Rimuli are slightly exceeding its day time stipulated limit of 55 dB (A). Obviously, in the year 2030 the noise levels are more as compared with rest of the years and are slightly below the stipulated standard for rest of the stations.

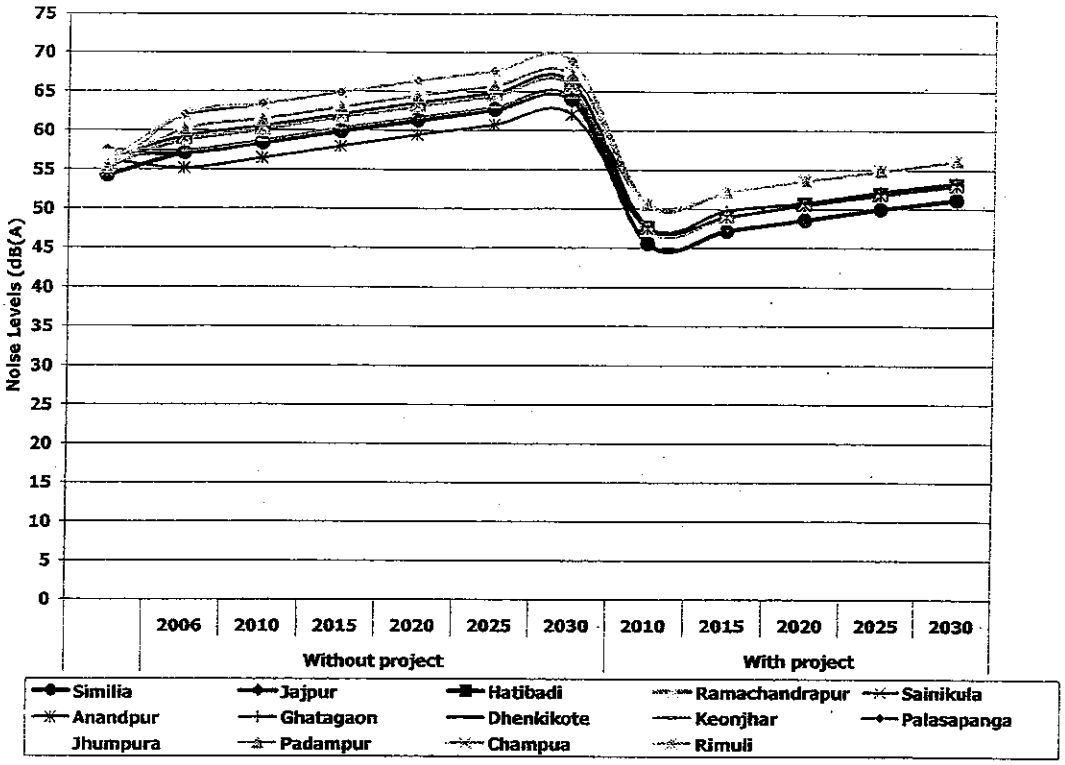
The graphical representation of noise levels pertaining to predictions without project scenario and predictions with project scenario are given in 5.2.1.

Table 5.2: Predicted Noise Concentrations along the Project Area

Location	Base Noise Levels	Noise Levels in dB(A)										
		Without project						With project				
		2006	2010	2015	2020	2025	2030	2010	2015	2020	2025	2030
Jajpur	57.2	57.1	58.4	59.9	61.3	62.7	63.9	47.5	49.0	50.5	51.8	53.0
Hatibadi	*	58.9	60.2	61.8	63.2	64.6	65.8	47.5	49.0	50.5	51.8	53.0
Ramachandrapur	55.5	58.9	60.2	61.8	63.2	64.6	65.8	47.5	49.0	50.5	51.8	53.0
Sainikula	55.2	58.9	60.2	61.8	63.2	64.6	65.8	47.5	49.0	50.5	51.8	53.0
Anandpur	56.2	55.2	56.5	58.0	59.5	60.8	62.1	47.5	49.0	50.5	51.8	53.0
Similia	54.2	57.1	58.4	59.9	61.4	62.7	64.0	45.6	47.2	48.6	50.0	51.2
Ghatagaon	57.2	57.4	58.7	60.3	61.7	63.0	64.3	47.8	49.8	50.8	52.2	53.4
Dhenkikote	56.5	59.3	60.6	62.1	63.6	64.9	66.2	47.8	49.8	50.8	52.2	53.4
Keonjhar	57.5	57.4	58.7	60.3	61.7	63.0	64.3	50.6	52.2	53.6	54.9	56.2
Palasapanga	*	62.1	63.4	64.9	66.4	67.7	68.9	50.6	52.2	53.6	54.9	56.2
Jhumpura	56.5	60.2	61.5	63.0	64.5	65.8	67.1	50.6	52.2	53.6	54.9	56.2
Padampur	55.4	60.2	61.5	63.0	64.5	65.8	67.1	50.6	52.2	53.6	54.9	56.2
Champua	56.2	62.1	63.4	64.9	66.4	67.7	68.9	50.6	52.2	53.6	54.9	56.2
Rimuli	54.8	62.1	63.4	64.9	66.4	67.7	68.9	50.6	52.2	53.6	54.9	56.2

Note: *:The base noise levels at the Industrial areas of Hatibadi & Palasapanga' were monitored (which are away from the NH) and the values are 81.5 & 80.8 dB(A) respectively. However, the predictions calculated along highway passing through Hatibadi & Palasapanga are considered under residential category.

Figure 5.2.1: Projected Noise Levels along the Project Corridor



5.4.4 Noise from construction equipment

Apart from these the utilization of construction machinery/ equipment (hot-mixer, bulldozer, loader concrete mixer, etc) and regular movement of these causes disturbance to the traffic and increases the noise levels and emits a noise ranging from 80 -95 dB. Apart from the vehicles carrying the raw materials will also create the noise than the desired levels. The magnitude of impact shall depend upon the type of machinery being used and the standards of noise emissions for the different equipment used are presented in Table 5.3.1

Table 5.3.1 Equipment Noise Levels (dB)

PLANT ITEM	Noise (dB)
Dozer D8	90
Excavator	88
Grader 14 G	86
Vibratory Roller	88
Compactor	87
Water cart	82
Truck	83
Asphalt Paving Plant	89
Air Compressor	75
Diesel Generators	79

Note: The above standards are as per the Australian Standards for Construction Equipment,

The noise emission level generated from a source shall increase in distance as per the following empirical formula:

SPL2 = spl1 - 20 Log10 (r2/r1)

Where, SPL1 an SPL2 are the sound pressure levels at distance r1 and r2 respectively

Considering the emissions of different equipment and the stationary nature of the construction equipment as a point source generating 9 dB(A) at a reference distance of 2m computed distance require to meet the permissible limits during day time for different land use categories are given in Table 5.3.2

Table 5.3.2 Required distance from Stationary source - for- meeting standards.

Category	Permissible limit (Day time)	Distance Required(M)
Silence zone	50dB(A)	200
Residential	55dB(A)	113
Commercial	65dB(A)	36
Industrial	75dB(A)	11

The mitigation measures can be taken by attenuating noise levels providing vegetation noise barrier (by absorbing technique) which can reduce 5 – 6 dB (A). Most of the villages are 50- 60 m away from the C/L of the road. But prediction has been done at 25 – 30 m from the centre line. Thus doubling of distance between sources to the receptor shall enable to reduce noise level by 5-6 dB (A). Thus the noise level at village shall be about 55 dB (A) which is the permissible limit and in the junctions the noise barriers shall be suggested.

5.5 Impact on Biological Resources

The road side plantation will enhance the aesthetics of the road and also function as a pollution arrester and also function as a soil binder. No negative impact is anticipated on forest and fauna during operation phase.

5.6 Traffic Management

Impact of better traffic management can improve the flow of traffic on the roads, reducing emissions per vehicle kilometer traveled and enhancing urban mobility. An effective & implement able traffic management policy can achieve both significant mobility and environmental benefits. Some of the important conclusions about the environmental impact of traffic management policies in developing countries are:

- Traffic management measures have been shown to improve traffic conditions and reduce emissions significantly by reducing the number and duration of stops and permitting higher travel speeds.
- Traffic management measures are relatively cheap and quick acting.
- A combination of traffic engineering measures, demand management measures, and measures giving priority to public transport vehicles has been shown to be the best approach, especially in medium to large cities with high volume travel demand corridors.
- It induces additional travel that may have to be restrained by introducing traffic demand management measures to ensure the sustainability of the traffic pollution benefits.
- The establishment of traffic management units with appropriate authority and ability to plan and implement traffic management measures is essential.

5.7 Accident Hazards and Safety

Accident hazards would be greatly reduced because of the up-gradation and will ensure smooth and fast flow of traffic. In the event of spillage of hazardous chemicals a spillage containment mechanism will be developed along with the participation of police and the fire department. In addition to this an emergency response mechanism should be evolved to tackle accidents and spillage of substances.

5.8 Aesthetics

Roadside rest areas/ bays/ public amenities and parking place for long distance travelers have been provided for in the project design. The roadside plantation will also add to the visual appearance of the area.

5.9 Evaluation of Impacts

The environmental impact of a project depends both on the project activities and on the background environmental setting. The environmental impact assessment process involves four basic steps

- Identification
- Evaluation
- Interpretation
- Communication

For the present project, the matrix method is used for assessment of impacts. In the present case the impact, a scale of –4 to +4 is taken. This method is selected because it identifies the impact of each project activity on each of the environmental attributes. Evaluation and interpretation of impacts is mostly subjective and convey a holistic view of the environmental impact of the project.

Matrix Method

The matrix used for EIA consists of project activities on the x-axis and the environmental attributes likely to be affected by these activities on the y-axis. Each cell of the matrix represents a subjective evaluation of the impacts of a particular activity on a particular attribute in terms of magnitude and importance. A blank cell indicates no impact of the activity on the component. The magnitude (M) is represented by a number from 1 to 4 where

1 = minimal 2 = appreciable
3 = significant 4 = severe

Positive sign (or no sign) indicates beneficial impact and negative sign indicates adverse impact. The importance (I) of the impact is given on a scale of 1 to 4 in each cell. This number indicates relative importance of the impact of the activity on the concerned attribute for this project. The magnitude and importance are multiplied to get a score of each cell. The score of individual cells in each row are added to determine the total impact of the project activities on each attribute. Similarly, the score in individual cells in each column are added to determine the total impact of each activity on all the environmental attributes likely to be affected. The grand total of all cells indicates the total project impact.

Since both 'M' and 'I' vary from 1 to 4, the total score in each cell can theoretically vary between –16 to +16. Therefore the total project impact can vary between (-16 x

total number of cells in the matrix) and (16 x total number of cells in the matrix). To compare score from matrices containing different number of cells, the total project scores can be normalized to a scale of 100 as follows

Total project impact scale of 100 = ((Total project impact computed by matrix)/ (16 x total number of cells in the matrix)) X100

On this scale, the overall impact can be classified as follows:

Total project impact (Scale of 100)	Magnitude of impact
-100 to –75	Severely adverse
-75 to –50	Significantly adverse
-50 to –25	Appreciably adverse
-25 to 0	Minimally adverse
0 to 25	Minimally beneficial
25 to 50	Appreciably beneficial
50 to 75	Significantly beneficial
75 to 100	Extremely beneficial

5.9.1 Evaluation for alternative scenarios

5.9.1.1 EIA without EMP

This scenario was based upon the assumption that the proposed development would go ahead without any environmental management options being implemented. The total project impact for the scenario, as can be seen in Table 5.9.1.1, was found to be –68 on a scale of (+/-) 2688. The score on a scale of (+/-) 100 for this scenario was found to be –2.53, which is on the **minimally adverse side.** This shows that if the project goes ahead without an EMP, the adverse impact on the existing environment would be several times that of the impact without the project. Thus, the EMP described in chapter 6 will have to be implemented to minimise the potential negative impact due to the proposed activity.

5.9.1.2 EIA with EMP

If the environmental management strategies discussed in Chapter 6 is fully implemented, the adverse impact of the project would be reduced, and there will be an overall improvement in physical, chemical, biological and socio-economic environment of the region. This is reflected in the total project impact score of +33 on scale of (+/-) 3072, as shown in the Table 5.9.1.2 below, for this scenario. The score on a scale of (+/-) 100 for this scenario was found to be 1.07, which is on the beneficial side. Therefore, the proposed activity **will be beneficial** for the environment of the area, provided the EMP is in place.

5.10 Conclusions

It is clear from the above, that the proposed 4/6 Laning from Panikoili - Keonjhar - Rimuli (Km 0.00 to 163.0) in NH 215 of Orissa State would have negative affect with out implementing certain environmental management strategies. If EMP, as discussed in the next chapter, is strictly adopted and implemented, the adverse impacts will be reduced and the overall environmental quality of the area would be improved.

Table 5.9.1.1 Impact Assessment for the Proposed Project (EIA without EMP)

Environmental components likely to be affected		Project activities likely to affect environmental components							
		Site preparation/ and Resettlement Rehabilitation	Construction /other activities	Building construction & materials transportation	Solid waste generation and Its handling.	Traffic escalation	Waste water generation	Post construction and operational phase	Total impact on component
Air quality	M	-1	-2	-1	-1	-2		-1	-16
	I	2	2	2	2	2		2	
Noise and Vibration	M	-1	-2	-2	-1	-2		-1	-17
	I	2	2	2	1	2		2	
Surface water quality	M		-1	-1	-1	-1	-1	-1	-7
	I		1	1	1	1	2	1	
Ground water quality	M		-1		-1		-1	-1	-4
	I		1		1		1	1	
Soil quality / erosion	M	-1	-2	-1	-1	-1	-1	-1	-11
	I	1	2	1	2	1	1	1	
Land use pattern	M	-1	-1	-1	-1			-1	-9
	I	2	2	2	1			2	
Flora and Fauna	M	-3	-1	-1	-1			-1	-13
	I	2	2	2	1			2	
Aesthetics	M	-1	-1	-1	-1	-1		-1	-8
	I	1	2	1	1	1		2	
Safety	M		-2	-2		-2		-2	-16
	I		2	2		2		2	
Human health	M	-1	-1	-2	-1	-1	-1	-1	-11
	I	1	1	2	1	1	2	1	
Socio-economic status	M	1	2	1	1	2		2	18
	I	1	2	2	1	2		3	
Economy, trade and commerce	M	2	2	2	1	2		2	26
	I	2	3	2	2	3		2	
Total action impact		-10	-15	-15	-8	-6	-6	-8	-68

I = Importance, **M** = Magnitude

Impact scale: 1 = Minimal, 2 = Appreciable, 3 = Significant, 4 = Severe.

Positive sign (or no sign) indicates beneficial impact,

Negative sign indicates adverse impact, Blank indicates no impact

Table 5.9.1.2 Impact Assessment for the Proposed Project (EIA with EMP)

Environmental components likely to be affected		Project activities likely to affect environmental components								
		Site preparation/ and Resettlement	Construction /other activities	Building materials & construction Its transportation	Solid waste generation and its handling	Traffic escalation	Waste water generation	Greenbelt development/Comp-ensatory aforestation	Post construction/ Operational phase	Total impact on component
Air quality	M	-1	-1	-1	-1	-1		2	-1	-2
	I	1	1	1	1	1		2	1	
Noise and Vibration	M	-1	-1	-1	-1	-1		2	-1	-2
	I	1	1	1	1	1		2	1	
Surface water quality	M		-1	-1	-1	-1	-1		-1	-6
	I		1	1	1	1	1		1	
Ground water quality	M				-1		-1			-2
	I				1		1			
Soil quality / erosion	M	-1	-1	-1	-1	-1	-1	2		-2
	I	1	1	1	1	1	1	2		
Land use pattern	M	-1	-1	-1	-1			2	1	1
	I	1	1	1	1			2	1	
Flora and Fauna	M	-2	-1	-1	-1			2	-1	-1
	I	1	1	1	1			2	1	
Aesthetics	M	-1	-1	-1	-1			2	1	2
	I	1	1	1	1			2	2	
Safety	M		-1	-1		-1			-1	-4
	I		1	1		1			1	
Human health	M	-1	-1	-1	-1	-1	-1	2	1	-1
	I	1	1	1	1	1	1	2	1	
Socio-economic status	M	1	2	1	1	2		1	2	21
	I	1	2	2	1	3		1	3	
Economy, trade and commerce	M	2	2	2	1	2		1	2	29
	I	2	3	2	2	3		1	3	
Total action impact		-3	1	-3	-6	6	-4	30	12	33

I = Importance, **M** = Magnitude

Impact scale: 1 = Minimal; 2 = Appreciable; 3 = Significant; 4 = Severe.

Positive sign (or no sign) indicates beneficial impact,

Negative sign indicates adverse impact, Blank indicates no impact

Chapter -6

ENVIRONMENT MANAGEMENT PLAN

The Environmental Management Plan (EMP) states the procedure in which the project proponent would carryout the implementation of the mitigation measures and ensures compliance with environmental regulations that are binding on the project. This plan also specifies the organizational requirements and institutional strengthening necessary for sound environmental management of the project. The major components of the EMP are:

1. EMP Implementing Agency
2. Monitoring of the EMP implementation
3. Training on Environmental management
4. Budget for EMP implementation.

6.1 EMP Implementing Agency

The project executor in the present case the Contracting Company will establish an Environmental Management Cell (EMC) to supervise and implement the mitigation measures as documented in the EMP. This EMC must also be adequately empowered to discharge the responsibilities as outlined in the EMP. To ensure smooth implementation of EMP the Contracting Company will have to collaborate with various government agencies like State Forest Department, Public Health Engineering Department, Revenue Department, State Pollution Control Board, Police Department and other allied departments.

The details of EMP implementation and implementation responsibilities are given in Table 6.1. This table comprehensively lists out the tasks to be performed and completed by the Contracting Company and also lists out the agencies that are involved and responsible for ensuring the timely completion of the tasks outlined under EMP. The contractors responsibilities in matters related to protection of environment shall be the part of the tender document. Table 6.3 gives the

provisions that are built in the bid document to protect and safeguard the environment by the Contractor.

Table 6.1 Implementation Schedule with Responsible/ Supervising Organization/ Authority

Construction Phase			
SNo	**Project related Issues**	**Action to be taken**	**Responsible/ Supervising Organization/ Authority**
1	Preparation of feasible land acquisition plan	➢ Initiate and complete the process for land acquisition ➢ Prepare and administer landuse control measures	DPR Consultant / NHAI, revenue department in consultation with the affected people
2	Roadside tree cutting and plantation	➢ Prepare action plan for tree felling ➢ Intimate forest dept. before starting ➢ Prepare action plan for replantation ➢ Budget allocation ➢ Implementation	Contractor / NHAI in consultation with the Forest dept.
3	Borrow pits and Quarry sites.	➢ Firm up contract with mining department for obtaining the quarry material ➢ Resurfacing and landscaping of the pits	Contractor or Concessionaire / Mining Department
4	Site for storage and construction camp	➢ Select and finalize the sites for storage and construction workers camp	Contractor or Concessionaire/ Local bodies / Labour department for ensuring compliance with labour laws for amenities.
5	Sewerage and solid waste disposal	➢ Proper sanitation facilities at the construction	Contractor or Concessionaire/ Labour department / Health

Construction Phase			
SNo	**Project related Issues**	**Action to be taken**	**Responsible/ Supervising Organization/ Authority**
		workers camp ➢ Collection of domestic refuse and its suitable disposal	department
6	Traffic management.	➢ Secure assistance from local police for traffic control during the construction ➢ Safety measures shall also be undertaken by installing road signs and markings for safe and smooth movement of traffic	Contractor or Concessionaire / NHAI
7	Noise level	➢ Stationary equipment shall be placed as far as possible from residential areas to minimise noise impacts ➢ Construction activities strictly prohibiting between 10.00 P.M to 6.00 A.M near habitation ➢ Provision of ear plugs to workers exposed to high noise levels	Contractor or Concessionaire / State Pollution Control Board
8.	Air Quality	➢ Vehicles carrying construction material shall be covered to avoid spilling	Contractor or Concessionaire / State Pollution Control Board

Construction Phase			
SNo	**Project related Issues**	**Action to be taken**	**Responsible/ Supervising Organization/ Authority**
		➢ Hot mixing plant shall be over 500m away from residential neighbourhood and 300m away from the road ➢ Mixing equipment shall be seated and equipped with dust removal device ➢ Water sprinkling in morning and evening hours at the construction yard and the unpaved sections of the road	
9	Water Quality	➢ Prior permission of the concerned engineer and regulatory authorities shall be taken regarding the discharge or disposing of any material arising from the execution of the works	Contractor or Concessionaire / concerned local authority
10	Water logging and stagnation of water in the borrow pits	➢ Uncontrolled digging of borrow pits will be avoided to prevent water accumulation which results in breeding of vectors	Contractor or Concessionaire / concerned local authority
11	Occupation Health and Safety	➢ Labourers shall be equipped with proper	Contractor or Concessionaire / Labour department

Construction Phase			
SNo	**Project related Issues**	**Action to be taken**	**Responsible/ Supervising Organization/ Authority**
		safety gears like helmets, gloves and gum boots ➢ Periodic health checkup of construction workers	
12	Basic amenities and sanitation facilities for labourers	➢ Adequate sanitary facilities shall be provided to the workers to avoid health related problems ➢ Periodic health checkup will be done	Contractor or Concessionaire / Labour department / Health Department
13	Fuel for labourers	➢ Adequate supply of fuel shall (Kerosene/ gas) be provided to the labourers to avoid felling of trees for cooking ad other domestic chores	Contractor or Concessionaire / Labour department
14	Prevention of erosion and scouring	Stabilizing the embankment with appropriate technique immediately after placing ➢ Treating high embankment slopes with rip rap, stone pitching or other technologies to prevent erosion ➢ Construction of toe drain all along the road on both sides ➢ Avoiding obstruction of existing drainage during filling	Contractor or Concessionaire / Concerned local department
15	Drainage system	➢ Providing adequate	Contractor or Concessionaire /

Construction Phase			
SNo	**Project related Issues**	**Action to be taken**	**Responsible/ Supervising Organization/ Authority**
		drainage structure ➢ Construction of toe drain along the road on both the sides ➢ Avoiding obstruction of existing drainage during filling	NHAI

Operation Phase			
SNo	**Project related Issues**	**Action to be taken**	**Responsible/ Supervising Organization/ Authority**
1	Air Quality	➢ Monitor periodically the AAQ at suggested locations ➢ Developing road side vegetation for pollutant sinking ➢ Enforcing different control measures to minimise pollution	Contractor or Concessionaire / in consultation with State Pollution Control Board and NHAI
2	Prevention of road side squatters or induced urban sprawls	➢ Plan and control development activity ➢ Removal, cleaning of squatter and temporary hutments of the labourers once the construction is completed	NHAI
3	Road safety and traffic management	➢ Prepare and administer a monitoring system on road accidents	NHAI

		➢ Adequate number of signs with clear visibility shall be installed	
4	Noise level	➢ Periodic monitoring of ambient noise levels at suggested locations ➢ Erecting sign boards at sensitive and residential locations, prohibiting the use of air horns ➢ Growing road side plantation to prevent the noise levels	Contractor or Concessionaire / in consultation with State Pollution Control Board and the Forest Department
5	Soil characteristics	➢ Periodic monitoring of soil quality at specified distance from the corridor for assessing soil contamination by vehicular emissions	Contractor or Concessionaire / in consultation with State Pollution Control Board and the State Agriculture Department
6	Maintenance of road side plantations	➢ Plantation shall be undertaken on aggressive note along the project road ➢ Employment of local people for the maintenance of plantation along the corridor	NHAI

6.2 Monitoring of EMP Implementation

6.2.1 EMP Monitoring & Implementation

The EMP will primarily be implemented by the Civil Contractor. However for an effective implementation of EMP, it is proposed to have two level monitoring. The first one is internally by the top management of Contracting Agency and the second one by the NHAI. The EMC constituted by the Contracting Company shall be the prime agency for monitoring all the activities during both the phases. NHAI shall supervise all activities and accordingly advise the Contracting Company to improve on areas where any short comings are observed. The EMC shall provide all the monitoring results to NHAI. NHAI shall keep a record of all information and shall suggest suitable measures to be adopted by Contracting Company if any aspect is found to be deviating from the anticipated Values/ Standards. Monitoring shall be carried out during construction and operation phases.

This review by NHAI and top management of Construction Company will make the EMC to implement the EMP more effectively. Table 6.2 gives the parameters to be monitored with frequency:

Table 6.2: Environmental Monitoring during Construction and Operation phase

Parameters	Location	Duration	Frequency
Air Quality: SPM, RPM, Nox, SO_2, and CO	Six locations where baseline monitoring was carried out	24 hours continuous sampling	Once in a season or thrice in year
Noise Level: L_{eq}(day) and L_{eq}(night)	Fifteen locations where baseline monitoring was carried out.	24 hours continuously	Once in a season or thrice in year
Soil Quality: Lead, oil and	Eight samples where baseline	**Grab sampling**	Once in a season or thrice in year

Parameters	Location	Duration	Frequency
grease	monitoring was carried out .		
Water Quality: For different physical, chemical and biological parameter	Twenty two samples where baseline monitoring was carried out .	**Grab sampling**	Once in a season or thrice in year
Maintenance for road side plantation	All along the project road	Throughout the year	Regularly through out the year for three years
Prevention of road side squatter development	All along the project road	Throughout the year	Regularly
Monitoring of sanitary and environmental status of borrow areas	At borrow pits	Grab Sampling for Water and Soil	Once in a season

6.2.2 Environmental Training

The Environmental Management Cell (EMC), in addition to implementing and monitoring different environmental attributes, shall also be actively involved in imparting training and raising environmental awareness level of Contractors and the construction staff so as to enable them to take the environmental aspects into consideration as and when required. In the long term, the EMC can impart additional and specialized training in the Environmental Management of the road system

6.3 Budget for EMP Implementation

The design and construction of the project involves a number of items such as erosion prevention, rehabilitation of borrow areas, safety signage, etc., which are included in the contract cost. Only those items that are not covered under the budget for construction are shown in the EMP implementation budget. The total budget for the items that are not covered in the scope of civil works contractor works out to 882.58 lakhs as given in Table 6.3. The total EMP cost works out to Rs.1531.91 lakhs.

The main components are:

- Administrative charges and logistics
- Tree plantation and compensatory afforestation
- Environmental monitoring during construction and operation phase
- Training during construction and operation phase

Table 6.3 Implementation Budget for EMP

S.NO	Item	Unit cost/ Lumpsum cost (Rs.)	Total cost (Rs.)
I Logistics cum Administrative costs			
1	Vehicle cost	@ Rs 25,000 per month for 30 vehicle months	7,50,000.00
2	Office administration (including man power costs) and logistics etc for Environment Management Cell (EMC)	For 30 months @ Rs.30,000/month	9,00,000.00
II Construction costs			
3	Sanitation- sulabh – sowchalaya 16.5 sq.m area (Included in project cost)		20,00,000.00

4	Dust suppression all along the stretch & Erosion control Retaining walls, slope pitching and turfing. (Included in project cost)		1,50,00,000.00
5	Labour camps, health and other services (Included in project cost)		15,00,000.00
6	Solid waste management (Included in project cost)		15,00,000.00
III Tree plantation and compensatory afforestation			
7	Avenue trees including 3 years maintenance - around 1,30,400 trees (Included in project cost)		2,50,00,000.00
8	Shrub plantation in median and landscaping (Included in project cost)		1,50,00,000.00
9	Land for compensatory afforestation 71.1 hectares	Rs. 2,00,000/- per hectare	1,42,20,000.00
10	Compensatory afforestation for 71.1 hectares	Rs. 8,50,000	6,04,35,000.00
IV Monitoring costs : Construction Phase			
11	Air Quality Monitoring (6 Monitoring stations) once in a season during the construction period	Rs. 6,000 per station	3,24,000.00
12	Noise level Monitoring (15 Monitoring stations) once in a season during the construction period	Rs. 1000 per station	1,80,000.00
13	Water Quality Monitoring (22 Monitoring stations) once in a season during the construction period	Rs. 2000 per station	5,28,000.00
14	Soil Quality Monitoring (8 stations) once in a season during the construction period	Rs. 3000 per sample	2,88,000.00
15	Awareness programmes (Lumpsum)	3,00,000	3,00,000.00
16	Borrow area monitoring (Once in a	Rs. 10,000 per	4,30,000.00

	year) 43 borrow areas	borrow area per 3 seasons	
V Monitoring costs :Operation Phase			
17	Air Quality Monitoring (6 Monitoring stations) thrice a year (once in a season)	Rs. 6000 per station	1,08,000.00
18	Noise level Monitoring (10 Monitoring stations) thrice a year (once in a season)	Rs.1000 per station	30,000.00
19	Water Quality Monitoring (6 Monitoring stations) thrice a year (once in a season)	Rs. 2000 per station	36,000.00
20	Soil Quality Monitoring (4 stations) thrice a year (once in a season)	Rs. 3000 per sample	36,000.00
21	Disaster Management Plan	L.S	5,00,000.00
22	Awareness /Training programmes and Workshops (Lumpsum)	2,00,000	2,00,000.00
Total			**13,92,65,000.00**
Contingency 10%			**1,39,26,500.00**
Grand Total			**15,31,91,500.00**

6.4 Risk Assessment and Disaster Management Plan

6.4.1 Risk Assessment & Mitigation measures

Risk assessment is a process that seeks to estimate the likelihood of occurrence of adverse effects as a result of major road mishaps, gas tanker explosions, fire hazards, floods , cyclones, earth quakes etc at Highway projects. Fatality rate on Indian highways is very high mainly due to road accidents. The other adverse impacts due to gas tanker explosions, fire hazards, floods , cyclones, earth quakes etc are nominal. Elimination of the risk (avoidance of accidents) is given prime importance and National Highway Authority of India (NHAI) has introduced many safety provisions in the design of highway. Some of these are listed below:

- Safety barriers/delineators hard shoulders on main roads

- Traffic signs and pavement markings
- Underpasses and other grade separators at congested junctions
- Removal of junctions and direct access points on main roads
- Improved median openings with stacking lanes
- Separate provisions and direct access point
- Service roads in towns and villages for segregating local and through traffic.

6.4.1.1 Mitigation measures considered during design stage

6.4.1.1.1 Construction of Bypasses

Along the project site five bypasses have been found technically, economically and ecologically viable. The technical viability of these bypasses was verified on ground. It is proposed to provide access control along the bypasses through the provision of barbed wire fencing. Tall growing trees at the outer edges of the right of way and shade bearing trees 5 m towards inside of the bypass are proposed. The space between the two rows will be ear marked for utilities.

6.4.1.1.2 Realignments of accident prone location

Based on the data collected from local police (traffic) on accident prone locations, realignment has been proposed.

6.4.1.1.3 Construction of Vehicular Underpasses

Turning movement surveys have shown that at all the existing State / National Highway crossings vehicular underpasses are required and few vehicle Underpasses are also required in village portions catering bus traffic. The details of vehicular underpasses are discussed in earlier chapters.

6.4.1.1.4 Construction of Pedestrian Underpasses

It is proposed to prevent direct access from cross roads to the project road, through a judicious combination of service roads and pedestrian underpasses with 3m vertical clearance and 5 m horizontal clearance. The extra cost on account of such underpasses will be more than justified by way of decrease in the number of

accidents that would have otherwise occurred in the event of direct access to the Highway. The details of pedestrian underpasses are discussed in earlier chapters.

6.4.1.1.5 Construction of Cattle/Animal Underpasses

It is proposed to provide animal underpasses in forest areas and cattle underpasses for cattle to cross to the other side of the village for fodder / water.

6.4.1.1.6 Sight Distances

To avoid unwarranted accident, it is necessary to provide adequate sight distance to permit the drivers enough time and distance to control their vehicles.
The safe stopping sight distance, intermediate sight distance and overtaking sight distance are shown below in Table no. **6.4.**1.1

Table 6.4.1.1 : Sight Distance Standards

V (Km/h)	Safe stopping distance (m)	Intermediate sight distance (m)	Overtaking sight distance (m)
20	20	40	-
25	25	50	-
30	30	60	-
40	45	90	165
50	60	120	235
60	80	160	300
65	90	180	340
80	120	240	470
100	180	360	640

The safe stopping sight distance of 180 m is followed for the present project.

6.4.1.1.7 Horizontal Alignment

IRC:38 – 1988 is being followed for design of Horizontal alignment.

6.4.1.1.8 Vertical Alignment

IRC: SP: 23 – 1983 is being followed for design of vertical alignment.

6.4.1.1.9 Gradients

The gradients is being maintained in the design are as per guidelines of the manual. Refer to Table no. **6.4.**1.2

Table6.4. 1.2 : Gradients for Roads in Different Terrains

S.no.	Terrain	Ruling Gradient	Limited gradient	Exceptional gradient
1	Plain or rolling	3.3% (1 in 30)	5% (1 in 20)	6.7% (1 in 14.3)
2	Mountainous terrain, and steep terrain having elevation more than 3,000m above the Mean Sea Level	5% (1 in 20)	6% (1 in 16.7)	7% (1 in 14.3)
3	Steep terrain up to 3,000 m height above Mean Sea Level	6% (1 in 16.7)	7% (1 in 14.3)	8% (1 in 12.5)

6.4.1.1.10 Combination of Horizontal and Vertical Curves

Where the curves cannot separate entirely, the vertical curves are contained wholly within, or kept wholly outside the horizontal curve. The length of horizontal and vertical curves is kept same and the chainages of their centres made to coincide in the design process. Sharp horizontal curvature is well avoided at or near top of crest of vertical curve nor the same is introduced at or near the low point of a sag vertical curve. Horizontal alignment and profile are made as flat as possible at intersections, where sight distance is very important.

6.4.1.1.11 Drainage Design, Slope protection & New Culverts

Trapezoidal shaped open drain will be proposed near embankment toes. On hill side of mountainous sections. "V" shaped drains lined with PCC will be provided. At high embankments (height exceeding 3m) a system of kerbing at edge of paved shoulders and chuting at 25m intervals is proposed to safely dispose off surface

water to avoid erosion. For intra-pavement drainage, it is proposed to extend the sub-base layer upto edge of embankment slopes. In the super elevation sections, a drain in the median will be constructed and the openings are provided at regular intervals to collect water. This water will be discharged by providing suitable outfall. Slope protection in the form of turfing will be proposed on all the embankment slopes. Pitching will be proposed at the toe where the height of embankment is more than 3m. Chutes will be proposed to drain off water in case of high embankments.

Planning for New Culverts

- Weak and distressed culverts to be dismantled. Totally new culverts to be constructed with carriageway and median matching with highway plan and profile drawing.
- Culverts in service road locations to be extended up to the road side longitudinal drain.
- The design invert levels of the existing culvert after widening would be compared with that of the prevailing invert level on the ground. If the design invert level falls below the existing invert level then the existing culvert would be proposed to be replaced with another.

6.4.1.1.12 Road Furniture

6.4.1.1.12.1 Road Signs (Danger boards/ Speed limits/ other hazardous indicators)

All signs shall be placed on the left hand side of the road. Where extra emphasis is warranted, they may be duplicated on the right hand side as well. On non-kerbed , the extreme edge of the sign shall be 1.5m-2.0m from the edge of the carriageway. On kerbed portion, it shall not be less than 60cm from the edge of the kerb. Arrangement for proper surveillance by NHAI authority personnel after the expiry of the maintenance period by the construction agency.

6.4.1.1.12.2 Road Marking

Provisions have been made for centre and edge road marking with thermo-plastic paint as per MOST specification in preference to ordinary paint as a way of better caution to the driving motorist. This would help reduce road accidents. Border/Edge

lines shall also be marked on both sides of the carriageway along with the centre line. Road studs shall also be provided with pavement marking.

6.4.1.1.12.3 Road Delineators

Provision of road delineators has been made in the design that shall comprse roadway indicators, hazard makers and objects makers. The design shall conform to the recommendation made in IRC-79. Reflective Chevron signs at bends shall also be provided for.

6.4.1.2 Conducting of Awareness Programmes

NHAI will conduct the awareness programmes to the nearby community, transportation associations, NGOs and other interested parties about road safety, and precautionary measures to be taken in event of major disaster. The details about the warning system, precautionary measures to be taken, rehabilitation station etc shall be intimated in the public awareness programmes.

6.4.1.3 Vigilance by Highway Patrolling Unit

The highway patrolling unit under the control of local police will conduct route checks and maintain the safety surveillance.

6.4.2 Disaster Management Plan

Disaster Management Plan (DMP) should be prepared on the basis of risk analysis considering worst case disaster scenario with respect to specific cases, major road mishaps, gas tanker explosions, fire hazards, floods, cyclones, earth quakes etc. An emergency response system should be developed in co-ordination with local fire, police and Medical service. Frequent exercise should be carried out to test the preparedness of the system by mock drills.

The disaster management plan is given in fig no. **6.4.** The role and responsibility of the concerned officers are well defined and the details are as follows.

A. Emergency plan in the event of road mishaps

On receiving the information of emergency due to road mishaps, Manager (Technical), NHAI and Traffic wing will co-ordinate for rescuing the persons, arrangement of ambulance & first aid, Hospital/Dispensary, information passed on to Police/Fire brigade/Security, engagement of Rescue team with equipment (crane, mobile van and other tools).

B. Emergency plan in the event of emergency (major in nature due to major road accidents, gas tanker explosions etc.)

On receiving the information of emergency (due to major in nature like major road accidents, gas tanker explosions etc., Manager (Technical), NHAI and Traffic wing will co-ordinate for rescuing the persons, arrangement of ambulance & first aid, Hospital/Dispensary, information passed on to Police/Fire brigade/Security, engagement of Rescue team with equipment (crane and other tools).

After receiving the intimation from Manager (Technical)/Safety /Traffic wing, Director, Project Implementation Unit (PIU) will form a Committee to deal with the emergency with the following:

(i) Medical facilities
(ii) Set of Control room
(iii) Preparation of action plan
(iv) Welfare activities and
(v) Repairing and Rehabilitation works.

For the said arrangements, Manager (Technical) in co-ordination with project implementing unit will guide and monitor the work in rendering effective services to the affected people with the help of Supervisory Consultant & Contractor. The action taken and final report will be sent to top Management.

C. Emergency plan in the event of emergency (major in nature due to Natural disasters.)

On receiving the information of emergency (major in nature due to natural disasters like earth quakes, floods etc) Manager (Technical), NHAI and Traffic wing will co-ordinate the following;

(i) for rescuing the persons,
(ii) arrangement of ambulance & first aid,
(iii) Hospital/Dispensary,
(iv) information passed on to Police/Fire brigade/Security,
(v) engagement of Rescue team with equipment (crane and other tools) in co-ordination with District administration.

DMP team will be formed under District Administration control with the following officials / representatives:

(i) District Collector or District Magistrate and or his nominated officer
(ii) Manager (Technical), NHAI
(iii) Superintendent of Police (S.P) and or his nominee
(iv) District Medical and Health officer
(v) Representative from Fire department
(vi) Representative from R&B department
(vii) Divisional Engineer, Electricity department
(viii) Executive engineer, Public health engineering department
(ix) Representatives from NGOs etc.

6.4.2.1 Role and Responsibility of Important Agencies

District Administration : District administration will take active roll and they will co-ordinate with all the state government agencies for successful implementation of DMP. All the relief operations and rehabilitations will be supervised by them.

Fire Services: The Fire services department during disaster has to evacuate the people who are trapped in highway, top on the trees etc. People can be shifted to safer places (rehabilitation centers). In some cases they also take up supply of drinking water to relief camps.

Police Department: The law and order situation of the project site will be maintained by the Police Department and they will also help Fire services when ever

required. The monetary relief released for disbursement to the victims will be escorted by them. The communications (VHF sets) will be established by them.

Medical & Health department: The medical and health department has to play vital role during the disaster. During emergency, the department shall ensure that all ambulances and other vehicles are available at site along with medical teams. Mobile medical teams shall move to spot to render medical aid to the victims. Preventive measures to be taken against Gastro-enteritis, Diarrhea and fever cases . Medical and health department also distribute the medicines to the victims with proper treatment.

Role of Press & electronic media: The role of Press & Electronic media is particularly important as it helps to communicate the latest information to the public as they have close accessibility with the administration department. Flash news, news items , headlines etc helps the public to move into safer places. The T.V & news papers are also educates the people about the possible hazards, steps to mitigate the distress etc.

Role of NGOs: NGOs plays a vital role for successful implementation of relief works. Many NGO organizations are also helps to collect the donations and disburse them directly to the victims.

6.4.2.3 Implementation of DMP

In the event of disaster, Manager (Technical), NHAI and Traffic wing will co-ordinate for rescuing the persons, arrangement of ambulance & first aid, Hospital/Dispensary, information passed on to Police/Fire brigade/Security, engagement of Rescue team with equipment (crane and other tools) in co-ordination with District administration. The following rescue operations are to be made on emergency basis:

1. **Implementation of DMP in the event of emergency (major in nature due to major road accidents, gas tanker explosions, hazardous material spillage etc.)**

a. In case of disaster event, alarm the people and other persons using the Outer Ring Road and other connected roads.

b. The ambulance, fire tender and 'hazardous material removal vehicle' need to be informed to be ready.

c. Only concerned persons will be present in the affected area and all other personnel and guests need to be moved to the nearest assembly points.

d. Source of leakage to be traced and isolated from all the other areas.

e. Electrical department need to be informed to shut the power supply (in case of fuel or other fire hazard substance leakage).

f. In case of a fire the instructions listed against fire hazards needs to be followed.

g. If the fire is small engage in extinguishing the fire using nearest fire extinguisher. In case of big fire, fire tender shall be mobilized along with quick response team and take all the necessary steps to stop the fire.

2. **Emergency plan in the event of emergency (major in nature due to Natural disasters.)**

a. **Siren blowing & communication arrangements** : In case of disaster event, the siren will be blown to alarm the drivers, local people and other persons using the highway . The news about the alarming situation will be telecasted and published in news paper along with Radio advertisement.
(Agencies responsible: NHAI, District Administration, Electronic Media)

b. **Evacuation of victims and food arrangements:** The arrangements shall be made to evacuate the victims with the help of Fire brigade and local Police to rehabilitation places. Necessary arrangement shall be made for accommodation and provisions. In case of problem to evacuate through road, Air Lifting shall be done by using helicopters. Air dropping of food packets, medicines and other needful items shall be done in case of non approach through roadways.
(Agencies responsible: NHAI, District Administration, Fire brigade, police dept.)

c. **Monitoring Relief operations:** It was the practice that senior officers from State level were sent by the government to over-see and monitor the arrangements and effective implementation of the relief operations. The

necessary staff , services and goods shall be deployed for successful implementation of relief operations. Adequate arrangements are also to be made in advance for supply of drinking water. ***(Agencies responsible: State Government, District Administration, Municipalities, NHAI, police dept.)***

d. **Welfare activities**: The Social welfare/ Tribal Welfare Departments have to reserve in advance stocks of essential commodities in their hostels functioning in the vulnerable areas. During the disaster, they are responsible for preparation of food and water packets and to load them in to the Helicopters for air dropping.

(Agencies responsible: The Social welfare/ Tribal Welfare Departments, NHAI, District Administration)

e. **Medical and health services :** Medical aid to be provided to the victims by the Mobile medical teams immediately. Post disaster relief measures including surveillance of Gastro-enteritis, Diarrhea, Dysentery and other water borne diseases and spraying of disinfectant to prevent epidemics. Proper sanitation arrangement should be provided in the flood areas.

(Agencies responsible: DM&HO, District Administration, Municipalities, NHAI)

f. **Post Disaster Management**: During post disaster the district administration shall convene a meeting of all NGOs and role of NGO's is quite crucial also in terms of smooth running of relief camps.

One of the major tasks after disaster will be restoration of normal life and repair of the damaged structures. After governments approval the Restoration and Rehabilitation works will be executed by the concerned departments. The final Disaster Management report will be submitted to the NHAI's top management and State Government.

(Agencies responsible: District Administration, NHAI, Roads & Building department, Municipalities)

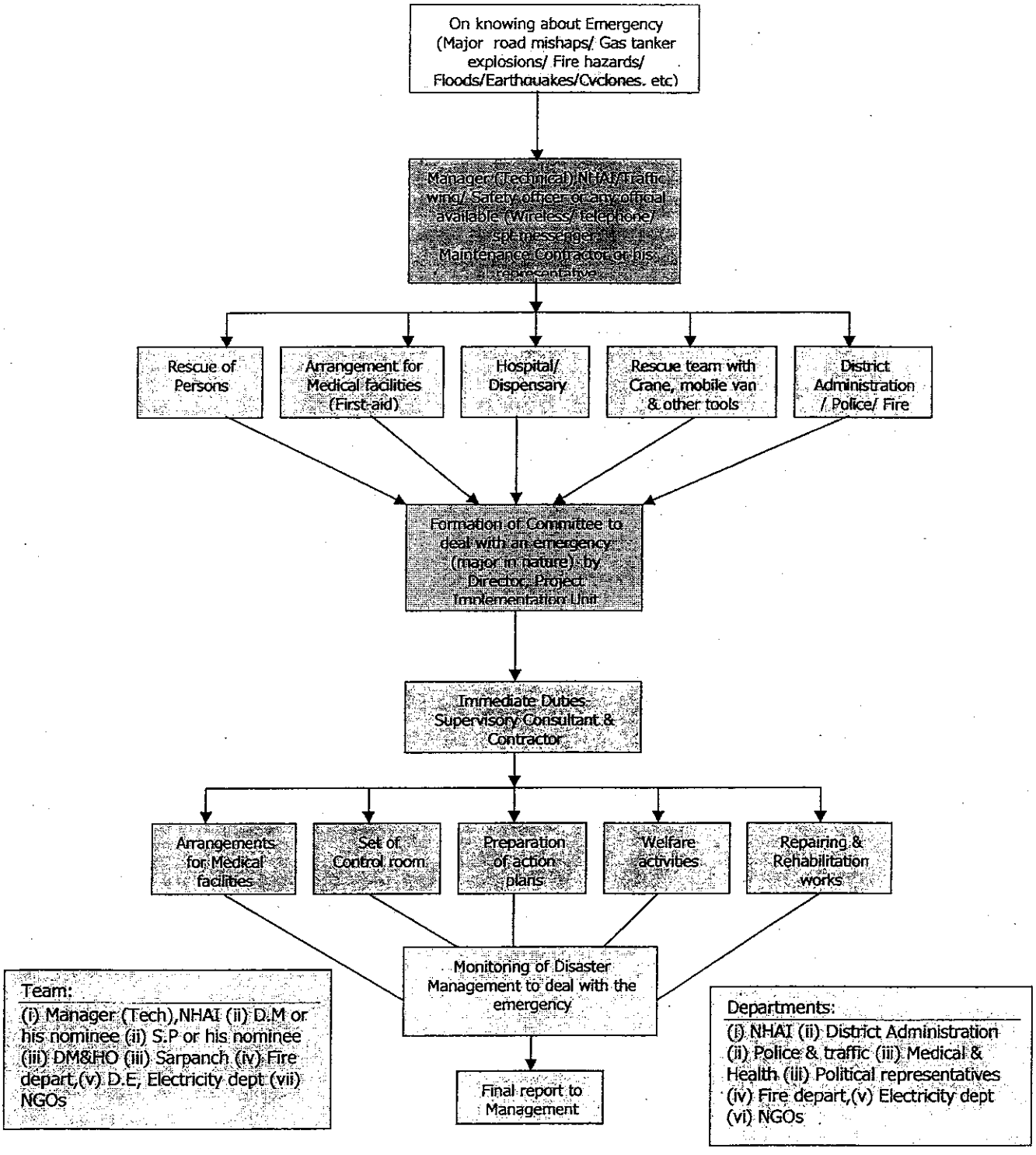


Fig 6.4. : Disaster Management Plan for proposed 4/6 Laning

ANNEXURE -1

Alternatives Evaluation of Bypasses through EIA Decision Support System

1. JAJPUR BYPASS

FEEDBACK

Area name: Jajpur bypass (Km 6.800 to Km.14.100)

S.NO.	Description	Alternative 1	Alternative 2	Alternative 3
	Length in KM	7.33	9	
	Terrain	Plain	Plain	
	Major Obstructions	The proposed alignment crosses the existing railway track, requires a new ROB (VUP-2, PUP-2, PC-6, ROB-1)	Alignment passes through the existing Jajpur by pass which is fully developed. Lot of establishments have to be demolished. We need to provide pedestrian underpass and service roads are to be provided on either side (VUP-1, PUP-2, PC-4, ROB-1)	
	Land Use	Mostly Agricultural area and barren lands	Commercial & Residential area	
	Cost in Rs. Crores	**47.22**	**58.56**	

S.NO.	Impact on Environmental Attributes	Maximum score	Alternative 1	Alternative 2	Alternative 3
1	***Natural resources impacts***				
	Natural resources utilization (optimum conservation)	10	2	1	
	Soil erosion and fertility	10	-2	-2	
	Soil pollution	10	1	1	
	Surface water quality and quantity	10	1	1	
	Ground water level, quality and quantity	10	2	2	
	Air pollution	10	1	1	
	Geo-graphical & Topographical features	10	5	5	
2	***Ecological Impacts***				
	Flora	10	2	2	
	Fauna	10	2	2	
	Aquatic life	10	5	5	
	Deforestation	10	6	6	
	Traffic congestion and Accidents mitigation	10	6	2	
	Public Health	10	6	6	
	Sites of special importance (Archeological sites & Historical protected monuments)	10	8	8	
3	***Socio-Economic Impacts***				
	Resettlement & Rehabilitation	10	5	-8	
	Land use & Land pattern	10	5	5	

S.NO.	Impact on Environmental Attributes	Maximum score	Alternative 1	Alternative 2	Alternative 3
	Job opportunities(short & long term)	10	6	6	
	Land price.	10	6	6	
	Change of life style pattern	10	8	8	
4	***Political Impacts***				
	Infrastructure development (regionwise)	10	10	10	
	Reaction from locals	10	5	-8	
	Interests of the public	10	5	5	
	Political leaders support	10	5	5	
	Political rift / legal snags	10	6	6	
5	***Financial & Economic Impacts***				
	Cost of the project	10	5	4	
	Regional roadside business activity	10	9	9	

ANALYSIS

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1		Alternative 2		Alternative 3	
			Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points
1	***Natural resources impacts***							
	Natural resources utilization (optimum conservation)		**20**		**10**		**0**	
	Soil erosion and fertility		**-20**		**-20**		**0**	
	Soil pollution		**10**		**10**		**0**	
	Surface water quality and quantity		**10**		**10**		**0**	
	Ground water level, quality and quantity		**20**		**20**		**0**	
	Air pollution		**10**		**10**		**0**	
	Geo-graphical & Topographical features		**50**		**50**		**0**	
	Average percenage	**15**	**14.29**	**214.29**	**12.86**	**192.86**	**0.00**	**0.00**
2	***Ecological Impacts***							
	Flora		**20**		**20**		**0**	
	Fauna		**20**		**20**		**0**	
	Aquatic life		**50**		**50**		**0**	
	Deforestation		**60**		**60**		**0**	
	Traffic congestion and Accidents mitigation		**60**		**20**		**0**	
	Public Health		**60**		**60**		**0**	
	Sites of special importance (Archeological sites & Historical protected monuments)		**80**		**80**		**0**	
	Average percenage	**30**	**50.00**	**1500.00**	**44.29**	**1328.5**	**0.00**	**0.00**
3	***Socio-Economic Impacts***							

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1		Alternative 2		Alternative 3	
			Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points
	Resettlement & Rehabilitation		50		-80		0	
	Land use & Land pattern		50		50		0	
	Job opportunities(short & long term)		60		60		0	
	Land price.		60		60		0	
	Change of life style pattern		80		80		0	
	Average percenage	15	60	900	34	510	0	0
4	***Political & other Impacts***							
	Infrastructure development (regionwise)		100		100		0	
	Reaction from locals		50		-80		0	
	Interests of the public		50		50		0	
	Political leaders support		50		50		0	
	Political rift / legal snags		60		60		0	
	Average percenage	15	62	930	36	540	0	0
5	***Financial & Economic Impacts***							
	Cost of the project		50		40		0	
	Regional roadside business activity		90		90		0	
		25	70	1750	65	1625	0	0
	Weighted percentages			52.94		41.96		0.00

ABSTRACT

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1	Weighted component	Alternative 2	Weighted component	Alternative 3	Weighted component
1	*Natural resources impacts*	15	14.29	214.29	12.86	192.86	0.00	0.00
2	*Ecological Impacts*	30	50.00	1500.00	44.29	1328.57	0.00	0.00
3	*Socio-Economic Impacts*	15	60	900.00	34	510.00	0	0.00
4	*Political Impacts*	15	62	930.00	36	540.00	0	0.00
5	*Financial & Economic Impacts*	25	70	1750.00	65	1625.00	0	0.00
	Weighted percentages	100		52.94		41.96		0.00

Recommended Alternative:
Alternative -1

2. ANANDPUR BYPASS

FEEDBACK

Area name: Anandpur & Ghasipura bypass (Km. 41.650to Km.44.650)

S.NO.	Description		Alternative 1	Alternative 2	Alternative 3
	Length in KM		3.98	3.65	
	Terrain		Plain	Plain	
	Major Obstructions		The proposed alignment passes through agriculture and barren lands (VUP-2, PC-5)	Alignment passes through the existing Anandpur by pass which is fully developed Lot of establishments have to be demolished. We need to provide pedestrian underpass and service roads are to be provided on either side. The geometry of the existing road is very poor and geometric improvement will be very costly. (VUP-1, PUP-2, PC-4, RUB-1)	
	Land Use		Mostly Agricultural area and barren lands	Commercial & Residential area	
	Cost in Rs.Crores		24.81	25.43	

S.NO.	Impact on Environmental Attributes	Maximum score	Alternative 1	Alternative 2	Alternative 3
1	***Natural resources impacts***				
	Natural resources utilization (optimum conservation)	**10**	**2**	**2**	
	Soil erosion and fertility	**10**	**-2**	**-2**	
	Soil pollution	**10**	**1**	**1**	
	Surface water quality and quantity	**10**	**1**	**1**	
	Ground water level, quality and quantity	**10**	**2**	**2**	
	Air pollution	**10**	**1**	**1**	
	Geo-graphical & Topographical features	**10**	**5**	**5**	
2	***Ecological Impacts***				
	Flora	**10**	**5**	**5**	
	Fauna	**10**	**5**	**5**	
	Aquatic life	**10**	**5**	**5**	
	Deforestation	**10**	**6**	**6**	
	Traffic congestion and Accidents mitigation	**10**	**6**	**2**	
	Public Health	**10**	**6**	**6**	
	Sites of special importance (Archeological sites & Historical protected monuments)	**10**	**8**	**8**	
3	***Socio-Economic Impacts***				

	Resettlement & Rehabilitation	**10**	**5**	**-8**	
	Land use & Land pattern	**10**	**5**	**5**	
	Job opportunities(short & long term)	**10**	**6**	**6**	
	Land price.	**10**	**6**	**6**	
	Change of life style pattern	**10**	**8**	**8**	
4	***Political Impacts***				
	Infrastructure development (regionwise)	**10**	**10**	**10**	
	Reaction from locals	**10**	**5**	**-8**	
	Interests of the public	**10**	**5**	**5**	
	Political leaders support	**10**	**5**	**5**	
	Political rift / legal snags	**10**	**6**	**6**	
5	***Financial & Economic Impacts***				
	Cost of the project	**10**	**5**	**4**	
	Regional roadside business activity	**10**	**9**	**9**	

ANALYSIS

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1		Alternative 2		Alternative 3	
			Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points
1	***Natural resources impacts***							
	Natural resources utilization (optimum conservation)		**20**		**20**		**0**	
	Soil erosion and fertility		**-20**		**-20**		**0**	
	Soil pollution		**10**		**10**		**0**	
	Surface water quality and quantity		**10**		**10**		**0**	
	Ground water level, quality and quantity		**20**		**20**		**0**	
	Air pollution		**10**		**10**		**0**	
	Geo-graphical & Topographical features		**50**		**50**		**0**	
	Average percenage	**15**	**14.29**	**214.29**	**14.29**	**214.29**	**0.00**	**0.00**
2	***Ecological Impacts***							
	Flora		**50**		**50**		**0**	
	Fauna		**50**		**50**		**0**	
	Aquatic life		**50**		**50**		**0**	
	Deforestation		**60**		**60**		**0**	
	Traffic congestion and Accidents mitigation		**60**		**20**		**0**	
	Public Health		**60**		**60**		**0**	
	Sites of special importance (Archeological sites & Historical protected monuments)		**80**		**80**		**0**	
	Average percenage	**30**	**58.57**	**1757.14**	**52.86**	**1585.71429**	**0.00**	**0.00**
3	***Socio-Economic Impacts***							

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1		Alternative 2		Alternative 3	
			Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points
	Resettlement & Rehabilitation		**50**		**-80**		**0**	
	Land use & Land pattern		**50**		**50**		**0**	
	Job opportunities(short & long term)		**60**		**60**		**0**	
	Land price.		**60**		**60**		**0**	
	Change of life style pattern		**80**		**80**		**0**	
	Average percenage	**15**	**60**	**900**	**34**	**510**	**0**	**0**
4	***Political & other Impacts***							
	Infrastructure development (regionwise)		**100**		**100**		**0**	
	Reaction from locals		**50**		**-80**		**0**	
	Interests of the public		**50**		**50**		**0**	
	Political leaders support		**50**		**50**		**0**	
	Political rift / legal snags		**60**		**60**		**0**	
	Average percenage	**15**	**62**	**930**	**36**	**540**	**0**	**0**
5	***Financial & Economic Impacts***							
	Cost of the project		**50**		**40**		**0**	
	Regional roadside business activity		**90**		**90**		**0**	
		25	**70**	**1750**	**65**	**1625**	**0**	**0**
	Weighted percentages			**55.51**		**44.75**		**0.00**

ABSTRACT

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1	Weighted component	Alternative 2	Weighted component	Alternative 3	Weighted component
1	*Natural resources impacts*	15	14.29	214.29	14.29	214.29	0.00	0.00
2	*Ecological Impacts*	30	58.57	1757.14	52.86	1585.71	0.00	0.00
3	*Socio-Economic Impacts*	15	60	900.00	34	510.00	0	0.00
4	*Political Impacts*	15	62	930.00	36	540.00	0	0.00
5	*Financial & Economic Impacts*	25	70	1750.00	65	1625.00	0	0.00
	Weighted percentages	100		55.51		44.75		0.00

Recommended Alternative: Alternative -1

3. GHATAGAON BYPASS

FEEDBACK

S.NO.	Description		Alternative 1	Alternative 2	Alternative 3
	Length in KM		**3.46**	**1.85**	**2.47**
	Terrain		**Plain**	**Plain**	**Plain**
	Major Obstructions		The proposed alignment passes through agriculture and barren lands (VUP-3, PUP-2, PC-3, SC-4, MIB-2)	Alignment passes through the existing Ghatgaon. There is Tarini Maa temple on the left side and business establishment on the right side. Lot of establishments have to be demolished. We need to provide pedestrian underpass and service roads are to be provided on either side (VUP-2, PUP-2, PC-3, SC-4, MIB-2)	The Proposed alignment passes through a thick forest and will be very close to the drinking water pond. The alignment also passes through number of houses which need to be demolished. (VUP-3, PUP-2, PC-3, SC-2, MIB-1)
	Land Use		Mostly Agricultural area and barren lands	Commercial & Residential area	Forest, agriculture and residential areas
	Cost in Rs. Crores		**32.58**	**62.6**	**34.1**

S.NO.	Impact on Environmental Attributes	Maximum score	Alternative 1	Alternative 2	Alternative 3
1	***Natural resources impacts***				
	Natural resources utilization (optimum conservation)	**10**	**2**	**4**	**2**
	Soil erosion and fertility	**10**	**-2**	**-2**	**-2**
	Soil pollution	**10**	**1**	**1**	**1**
	Surface water quality and quantity	**10**	**1**	**1**	**-3**
	Ground water level, quality and quantity	**10**	**2**	**2**	**2**
	Air pollution	**10**	**1**	**1**	**1**
	Geo-graphical & Topographical features	**10**	**5**	**5**	**5**
2	***Ecological Impacts***				
	Flora	**10**	**5**	**5**	**-3**
	Fauna	**10**	**5**	**5**	**-3**
	Aquatic life	**10**	**5**	**5**	**-3**
	Deforestation	**10**	**6**	**6**	**-3**
	Traffic congestion and Accidents mitigation	**10**	**6**	**2**	**5**
	Public Health	**10**	**6**	**6**	**6**
	Sites of special importance (Archeological sites & Historical protected monuments)	**10**	**8**	**-6**	**8**
3	***Socio-Economic Impacts***				
	Resettlement & Rehabilitation	**10**	**5**	**-8**	**-8**
	Land use & Land pattern	**10**	**5**	**5**	**5**

	Job opportunities(short & long term)	**10**	**6**	**6**	**6**
	Land price.	**10**	**6**	**6**	**6**
	Change of life style pattern	**10**	**8**	**8**	**8**
4	***Political Impacts***				
	Infrastructure development (regionwise)	**10**	**10**	**10**	**10**
	Reaction from locals	**10**	**5**	**-8**	**-6**
	Interests of the public	**10**	**5**	**-2**	**-2**
	Political leaders support	**10**	**5**	**1**	**1**
	Political rift / legal snags	**10**	**6**	**-2**	**-2**
5	***Financial & Economic Impacts***				
	Cost of the project	**10**	**4**	**-6**	**5**
	Regional roadside business activity	**10**	**9**	**9**	**9**

ANALYSIS

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1		Alternative 2		Alternative 3	
			Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points
1	***Natural resources impacts***							
	Natural resources utilization (optimum conservation)		**20**		**40**		**20**	
	Soil erosion and fertility		**-20**		**-20**		**-20**	
	Soil pollution		**10**		**10**		**10**	
	Surface water quality and quantity		**10**		**10**		**-30**	
	Ground water level, quality and quantity		**20**		**20**		**20**	
	Air pollution		**10**		**10**		**10**	
	Geo-graphical & Topographical features		**50**		**50**		**50**	
	Average percenage	**15**	**14.29**	**214.29**	**17.14**	**257.14**	**8.57**	**128.57**
2	***Ecological Impacts***							
	Flora		**50**		**50**		**-30**	
	Fauna		**50**		**50**		**-30**	
	Aquatic life		**50**		**50**		**-30**	
	Deforestation		**60**		**60**		**-30**	
	Traffic congestion and Accidents mitigation		**60**		**20**		**50**	
	Public Health		**60**		**60**		**60**	
	Sites of special importance (Archeological sites & Historical protected monuments)		**80**		**-60**		**80**	

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1		Alternative 2		Alternative 3	
			Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points
	Average percenage	**30**	**58.57**	**1757.14**	**32.86**	**985.7142857**	**10.00**	**300.00**
3	***Socio-Economic Impacts***							
	Resettlement & Rehabilitation		**50**		**-80**		**-80**	
	Land use & Land pattern		**50**		**50**		**50**	
	Job opportunities(short & long term)		**60**		**60**		**60**	
	Land price.		**60**		**60**		**60**	
	Change of life style pattern		**80**		**80**		**80**	
	Average percenage	**15**	**60**	**900**	**34**	**510**	**34**	**510**
4	***Political & other Impacts***							
	Infrastructure development (regionwise)		**100**		**100**		**100**	
	Reaction from locals		**50**		**-80**		**-60**	
	Interests of the public		**50**		**-20**		**-20**	
	Political leaders support		**50**		**10**		**10**	
	Political rift / legal snags		**60**		**-20**		**-20**	
	Average percenage	**15**	**62**	**930**	**-2**	**-30**	**2**	**30**
5	***Financial & Economic Impacts***							
	Cost of the project		**40**		**-60**		**50**	
	Regional roadside business activity		**90**		**90**		**90**	
		25	**65**	**1625**	**15**	**375**	**70**	**1750**
	Weighted percentages			**54.26**		**20.98**		**27.19**

ABSTRACT

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1	Weighted component	Alternative 2	Weighted component	Alternative 3	Weighted component
1	*Natural resources impacts*	15	14.29	214.29	17.14	257.14	8.57	128.57
2	*Ecological Impacts*	30	58.57	1757.14	32.86	985.71	10.00	300.00
3	*Socio-Economic Impacts*	15	60	900.00	34	510.00	34	510.00
4	*Political Impacts*	15	62	930.00	-2	-30.00	2	30.00
5	*Financial & Economic Impacts*	25	65	1625.00	15	375.00	70	1750.00
		100						
	Weighted percentages			54.26		20.98		27.19

Recommended Alternative: Alternative -1

4. JHUMPURA BYPASS

FEEDBACK

S.NO.	Description		Alternative 1	Alternative 2	Alternative 3
	Length in KM		3.51	2.6	
	Terrain		**Plain**	**Plain**	**Plain**
	Major Obstructions		The proposed alignment passes through agriculture and barren lands. (VUP-1, PUP-1, SC-5, MIB-3)	Alignment passes through the existing town or Jhumpura. Road side development is observed and a place of religious importance is situated. By the side of the road. Pedestrian underpass has to be provided apart from the service roads. (VUP-1, PUP-1, SC-1, MIB-3)	The proposed alignment passes agriculture and barren lands. (VUP-1, PUP-1, SC-3, MIB-3)
	Land Use		Mostly Agricultural area and barren lands.	Commercial & Residential area	Mostly forest, agriculture and residential areas
	Cost in Rs.Crores		**40.53**	**53.55**	**41.5**

S.NO.	Impact on Environmental Attributes	Maximum score	Alternative 1	Alternative 2	Alternative 3
1	***Natural resources impacts***				
	Natural resources utilization (optimum conservation)	**10**	**4**	**4**	**4**
	Soil erosion and fertility	**10**	**-2**	**-2**	**-2**
	Soil pollution	**10**	**1**	**1**	**1**
	Surface water quality and quantity	**10**	**1**	**1**	**1**
	Ground water level, quality and quantity	**10**	**2**	**2**	**2**
	Air pollution	**10**	**1**	**1**	**1**
	Geo-graphical & Topographical features	**10**	**5**	**5**	**5**
2	***Ecological Impacts***				
	Flora	**10**	**5**	**5**	**-2**
	Fauna	**10**	**5**	**5**	**-2**
	Aquatic life	**10**	**5**	**5**	**5**
	Deforestation	**10**	**6**	**6**	**-2**
	Traffic congestion and Accidents mitigation	**10**	**6**	**2**	**2**
	Public Health	**10**	**6**	**6**	**6**
	Sites of special importance (Archeological sites & Historical protected monuments)	**10**	**8**	**2**	**8**

3	***Socio-Economic Impacts***				
	Resettlement & Rehabilitation	**10**	**5**	**-8**	**2**
	Land use & Land pattern	**10**	**5**	**5**	**5**
	Job opportunities(short & long term)	**10**	**6**	**6**	**6**
	Land price.	**10**	**6**	**6**	**6**
	Change of life style pattern	**10**	**8**	**8**	**8**
4	***Political Impacts***				
	Infrastructure development (regionwise)	**10**	**10**	**10**	**10**
	Reaction from locals	**10**	**5**	**-8**	**2**
	Interests of the public	**10**	**5**	**-2**	**2**
	Political leaders support	**10**	**5**	**1**	**4**
	Political rift / legal snags	**10**	**6**	**-2**	**2**
5	***Financial & Economic Impacts***				
	Cost of the project	**10**	**5**	**-2**	**4**
	Regional roadside business activity	**10**	**9**	**9**	**9**

ANALYSIS

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1		Alternative 2		Alternative 3	
			Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points
1	***Natural resources impacts***							
	Natural resources utilization (optimum conservation)		**40**		**40**		**40**	
	Soil erosion and fertility		**-20**		**-20**		**-20**	
	Soil pollution		**10**		**10**		**10**	
	Surface water quality and quantity		**10**		**10**		**10**	
	Ground water level, quality and quantity		**20**		**20**		**20**	
	Air pollution		**10**		**10**		**10**	
	Geo-graphical & Topographical features		**50**		**50**		**50**	
	Average percenage	**15**	**17.14**	**257.14**	**17.14**	**257.14**	**17.14**	**257.14**
2	***Ecological Impacts***							
	Flora		**50**		**50**		**-20**	
	Fauna		**50**		**50**		**-20**	
	Aquatic life		**50**		**50**		**50**	
	Deforestation		**60**		**60**		**-20**	
	Traffic congestion and Accidents mitigation		**60**		**20**		**20**	
	Public Health		**60**		**60**		**60**	
	Sites of special importance (Archeological sites & Historical protected monuments)		**80**		**20**		**80**	

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1		Alternative 2		Alternative 3	
			Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points
	Average percenage	**30**	**58.57**	**1757.14**	**44.29**	**1328.571429**	**21.43**	**642.86**
3	Socio-Economic Impacts							
	Resettlement & Rehabilitation		**50**		**-80**		**20**	
	Land use & Land pattern		**50**		**50**		**50**	
	Job opportunities(short & long term)		**60**		**60**		**60**	
	Land price.		**60**		**60**		**60**	
	Change of life style pattern		**80**		**80**		**80**	
	Average percenage	**15**	**60**	**900**	**34**	**510**	**54**	**810**
4	Political & other Impacts							
	Infrastructure development (regionwise)		**100**		**100**		**100**	
	Reaction from locals		**50**		**-80**		**20**	
	Interests of the public		**50**		**-20**		**20**	
	Political leaders support		**50**		**10**		**40**	
	Political rift / legal snags		**60**		**-20**		**20**	
	Average percenage	**15**	**62**	**930**	**-2**	**-30**	**40**	**600**
5	Financial & Economic Impacts							
	Cost of the project		**50**		**-20**		**40**	
	Regional roadside business activity		**90**		**90**		**90**	
		25	**70**	**1750**	**35**	**875**	**65**	**1625**
	Weighted percentages			**55.94**		**29.41**		**39.35**

ABSTRACT

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1	Weighted component	Alternative 2	Weighted component	Alternative 3	Weighted component
1	*Natural resources impacts*	15	17.14	257.14	17.14	257.14	17.14	257.14
2	*Ecological Impacts*	30	58.57	1757.14	44.29	1328.57	21.43	642.86
3	*Socio-Economic Impacts*	15	60	900.00	34	510.00	54	810.00
4	*Political Impacts*	15	62	930.00	-2	-30.00	40	600.00
5	*Financial & Economic Impacts*	25	70	1750.00	35	875.00	65	1625.00
		100						
	Weighted percentages			55.94		29.41		39.35

Recommended Alternative:
Alternative -1

5. KEONJHAR BYPASS

FEEDBACK

S.NO.	Description		Alternative 1	Alternative 2	Alternative 3
	Length in KM		8.63	6.4	
	Terrain		**Plain**	**Plain**	**Plain**
	Major Obstructions		The proposed alignment passes through agriculture and barren lands. (VUP-5, PUP-3, SC-8, MIB-2)	Alignment passes through the existing town of Keonjhar, One of the big town in Orissa. There are lot of business establishments on the either side of the road, which need to be demolished. We need to provide pedestrian underpass and service roads are to be provided on either side (VUP-2, PUP-2, PC-3, SC-9,MIB-1)	The proposed alignment passes agriculture and barren lands. The Keonjhar town is spread on the western side, hence the lenth of the proposed bypass is longer. (VUP-3, PUP-2, SC-18, MIB-2)
	Land Use		Mostly Agricultural area and barren	Commercial & Residential area	Mostly forest, agriculture and residential areas
	Cost in Rs.Crores		**85.46**	**187.74**	**93.9**

S.NO.	Impact on Environmental Attributes	Maximum score	Alternative 1	Alternative 2	Alternative 3
1	***Natural resources impacts***				
	Natural resources utilization (optimum conservation)	**10**	**2**	**4**	**4**
	Soil erosion and fertility	**10**	**-2**	**-2**	**-2**
	Soil pollution	**10**	**1**	**1**	**1**
	Surface water quality and quantity	**10**	**1**	**1**	**-3**
	Ground water level, quality and quantity	**10**	**2**	**2**	**2**
	Air pollution	**10**	**1**	**1**	**1**
	Geo-graphical & Topographical features	**10**	**5**	**5**	**5**
2	***Ecological Impacts***				
	Flora	**10**	**5**	**5**	**5**
	Fauna	**10**	**5**	**5**	**5**
	Aquatic life	**10**	**5**	**5**	**5**
	Deforestation	**10**	**6**	**6**	**6**
	Traffic congestion and Accidents mitigation	**10**	**6**	**2**	**5**
	Public Health	**10**	**6**	**6**	**6**
	Sites of special importance (Archeological sites & Historical protected monuments)	**10**	**8**	**8**	**8**

3	***Socio-Economic Impacts***				
	Resettlement & Rehabilitation	**10**	**5**	**-8**	**5**
	Land use & Land pattern	**10**	**5**	**5**	**5**
	Job opportunities(short & long term)	**10**	**6**	**6**	**6**
	Land price.	**10**	**6**	**6**	**6**
	Change of life style pattern	**10**	**8**	**8**	**8**
4	***Political Impacts***				
	Infrastructure development (regionwise)	**10**	**10**	**10**	**10**
	Reaction from locals	**10**	**5**	**-8**	**5**
	Interests of the public	**10**	**5**	**-2**	**5**
	Political leaders support	**10**	**5**	**1**	**4**
	Political rift / legal snags	**10**	**6**	**-2**	**5**
5	***Financial & Economic Impacts***				
	Cost of the project	**10**	**5**	**-6**	**4**
	Regional roadside business activity	**10**	**9**	**9**	**9**

ANALYSIS

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1		Alternative 2		Alternative 3	
			Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points
1	***Natural resources impacts***							
	Natural resources utilization (optimum conservation)		**20**		**40**		**40**	
	Soil erosion and fertility		**-20**		**-20**		**-20**	
	Soil pollution		**10**		**10**		**10**	
	Surface water quality and quantity		**10**		**10**		**-30**	
	Ground water level, quality and quantity		**20**		**20**		**20**	
	Air pollution		**10**		**10**		**10**	
	Geo-graphical & Topographical features		**50**		**50**		**50**	
	Average percenage	**15**	**14.29**	**214.29**	**17.14**	**257.14**	**11.43**	**171.43**
2	***Ecological Impacts***							
	Flora		**50**		**50**		**50**	
	Fauna		**50**		**50**		**50**	
	Aquatic life		**50**		**50**		**50**	
	Deforestation		**60**		**60**		**60**	
	Traffic congestion and Accidents mitigation		**60**		**20**		**50**	
	Public Health		**60**		**60**		**60**	
	Sites of special importance (Archeological sites & Historical protected monuments)		**80**		**80**		**80**	

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1		Alternative 2		Alternative 3	
			Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points	Percentage scored	Weighted percentage points
	Average percenage	**30**	**58.57**	**1757.14**	**52.86**	**1585.714286**	**57.14**	**1714.29**
3	Socio-Economic Impacts							
	Resettlement & Rehabilitation		**50**		**-80**		**50**	
	Land use & Land pattern		**50**		**50**		**50**	
	Job opportunities(short & long term)		**60**		**60**		**60**	
	Land price.		**60**		**60**		**60**	
	Change of life style pattern		**80**		**80**		**80**	
	Average percenage	**15**	**60**	**900**	**34**	**510**	**60**	**900**
4	Political & other Impacts							
	Infrastructure development (regionwise)		**100**		**100**		**100**	
	Reaction from locals		**50**		**-80**		**50**	
	Interests of the public		**50**		**-20**		**50**	
	Political leaders support		**50**		**10**		**40**	
	Political rift / legal snags		**60**		**-20**		**50**	
	Average percenage	**15**	**62**	**930**	**-2**	**-30**	**58**	**870**
5	Financial & Economic Impacts							
	Cost of the project		**50**		**-60**		**40**	
	Regional roadside business activity		**90**		**90**		**90**	
		25	**70**	**1750**	**15**	**375**	**65**	**1625**
	Weighted percentages			**55.51**		**26.98**		**52.81**

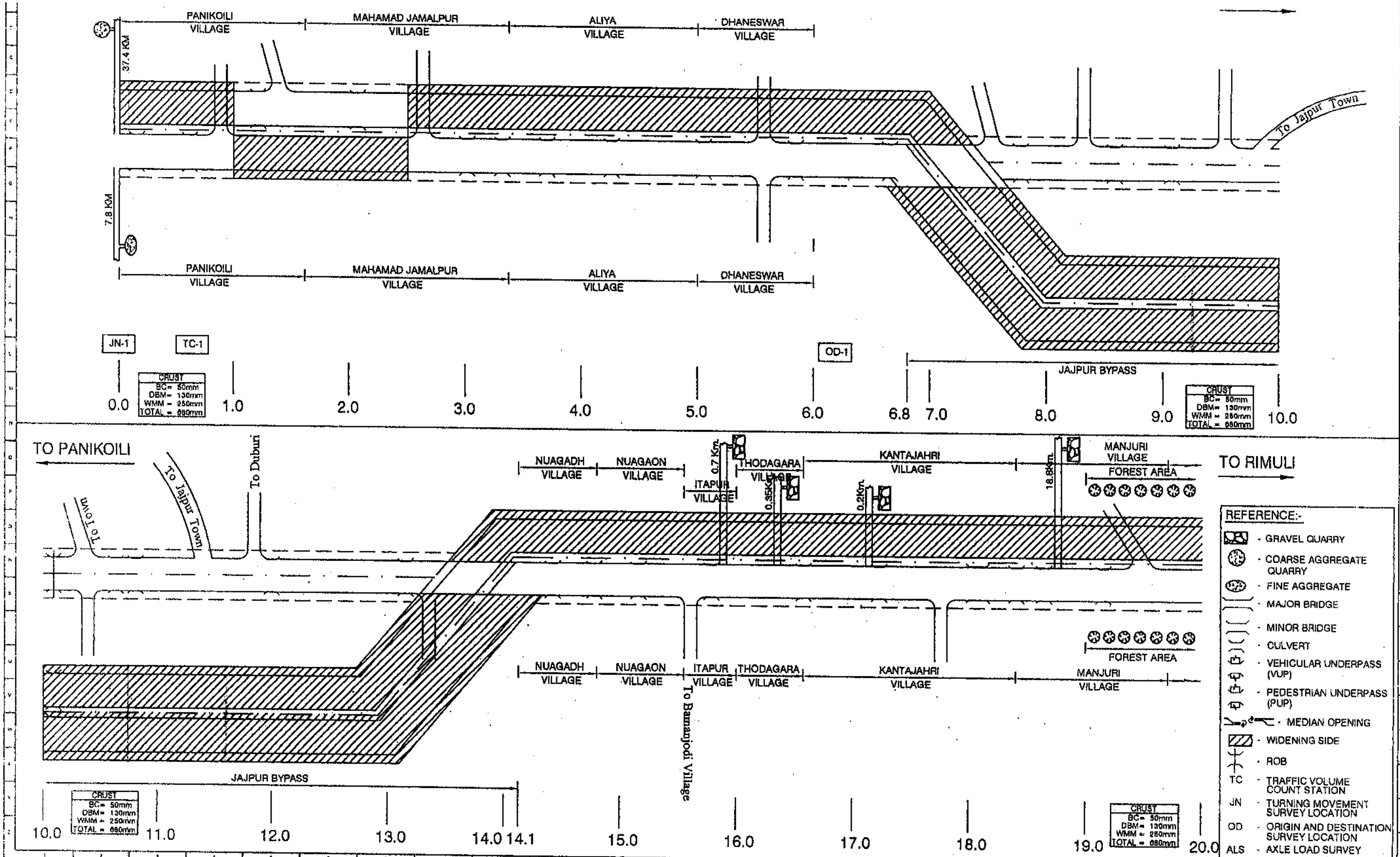
ABSTRACT

S.NO.	Impact on Environmental Attributes	Importance weighs (Set by the user)	Alternative 1	Weighted component	Alternative 2	Weighted component	Alternative 3	Weighted component
1	*Natural resources impacts*	15	14.29	214.29	17.14	257.14	11.43	171.43
2	*Ecological Impacts*	30	58.57	1757.14	52.86	1585.71	57.14	1714.29
3	*Socio-Economic Impacts*	15	60	900.00	34	510.00	60	900.00
4	*Political Impacts*	15	62	930.00	-2	-30.00	58	870.00
5	*Financial & Economic Impacts*	25	70	1750.00	15	375.00	65	1625.00
		100						
	Weighted percentages			55.51		26.98		52.81

Recommended Alternative: Alternative -1

ANNEXURE -2

Maps Showing the Quarry Locations along the Project Area



DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DATE
SURESH SAHOO				

REVISION

REVISION NO.	DATE	DESCRIPTION	REVISED BY

SCALE : NOT TO SCALE

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CLIENT :

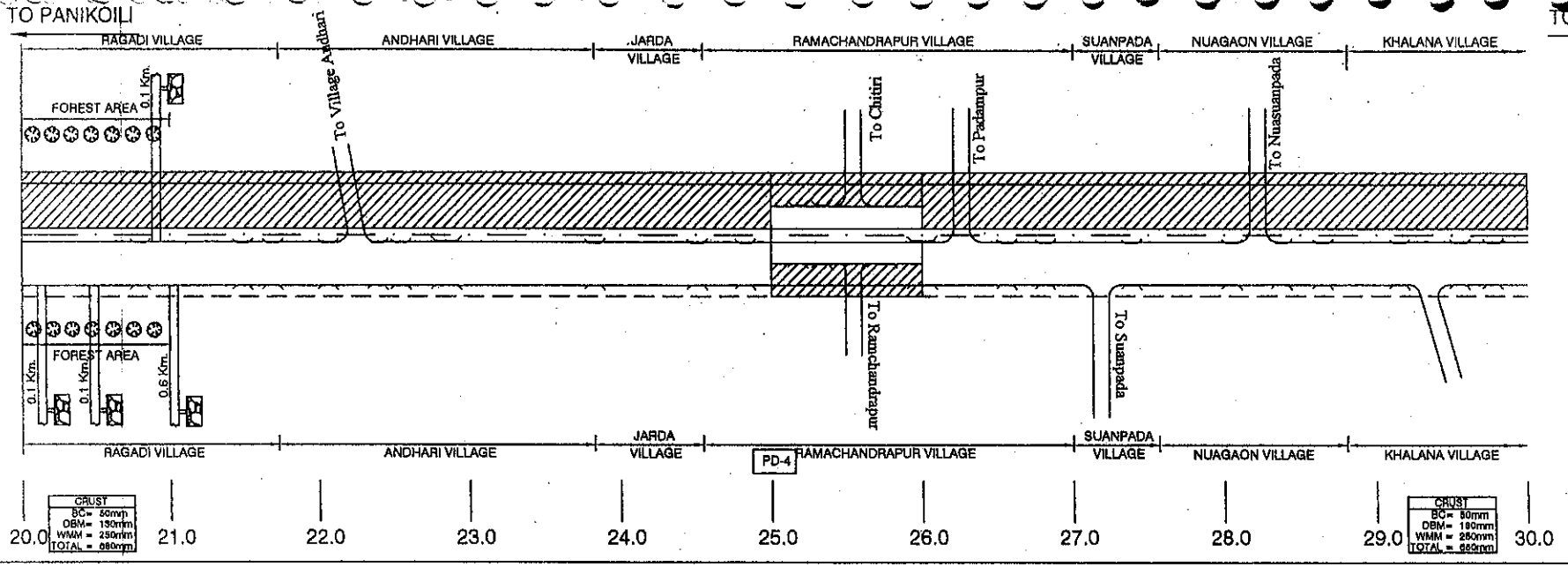
NATIONAL HIGHWAYS AUTHORITY OF INDIA

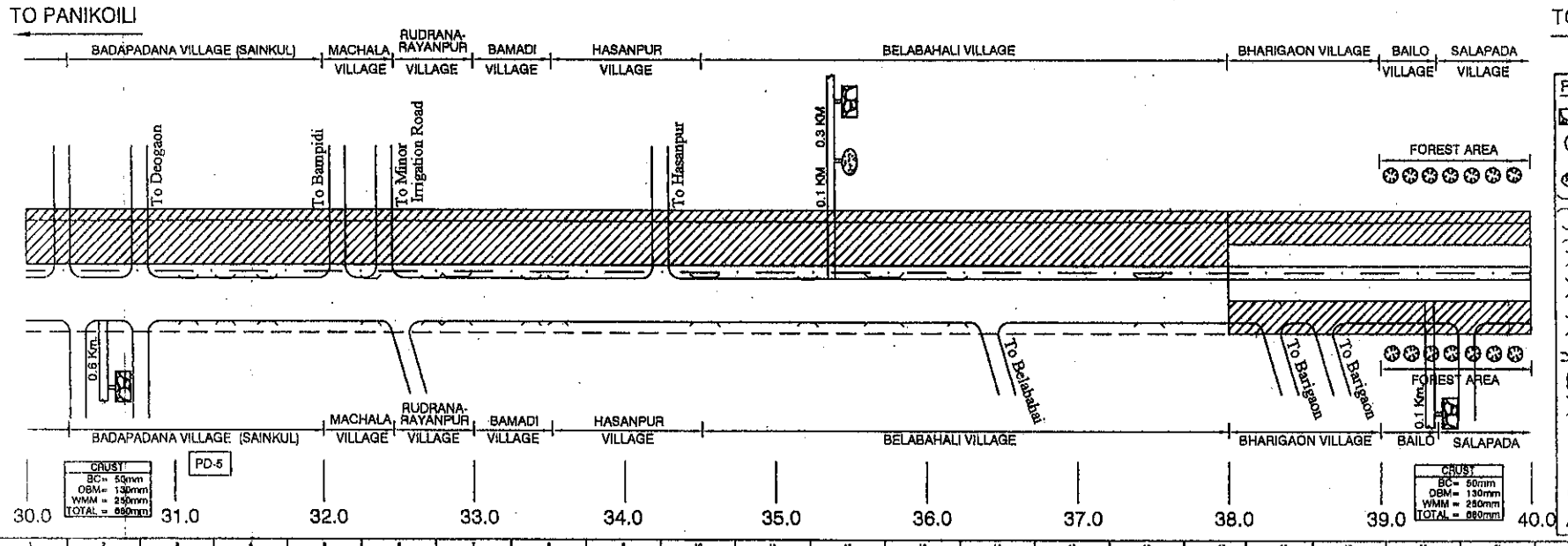
PROJECT :
PREPARATION OF FS/DPR FOR 4/6 LANING FROM PANIKOILI (KM.0.000) TO RIMULI (KM.163.000) IN PANIKOILI-RIMULI SECTION OF NH-215 IN ORISSA

CONTRACT PACKAGE: NHDP-III/DL4/23

TITLE : LINEAR STRIP PLAN FROM KM 0.000 TO 20.000

DRG. NO. [illegible]





REFERENCE:-

- GRAVEL QUARRY
- COARSE AGGREGATE QUARRY
- FINE AGGREGATE
- MAJOR BRIDGE
- MINOR BRIDGE
- CULVERT
- VEHICULAR UNDERPASS (VUP)
- PEDESTRIAN UNDERPASS (PUP)
- MEDIAN OPENING
- WIDENING SIDE
- ROB
- TC - TRAFFIC VOLUME COUNT STATION
- JN - TURNING MOVEMENT SURVEY LOCATION
- OD - ORIGIN AND DESTINATION SURVEY LOCATION
- ALS - AXLE LOAD SURVEY

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DATE
SURESH SAHOO				

REVISION

REVISION NO.	DATE	DESCRIPTION	REVISED BY

SCALE : NOT TO SCALE

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NATIONAL HIGHWAYS AUTHORITY OF INDIA

PROJECT :

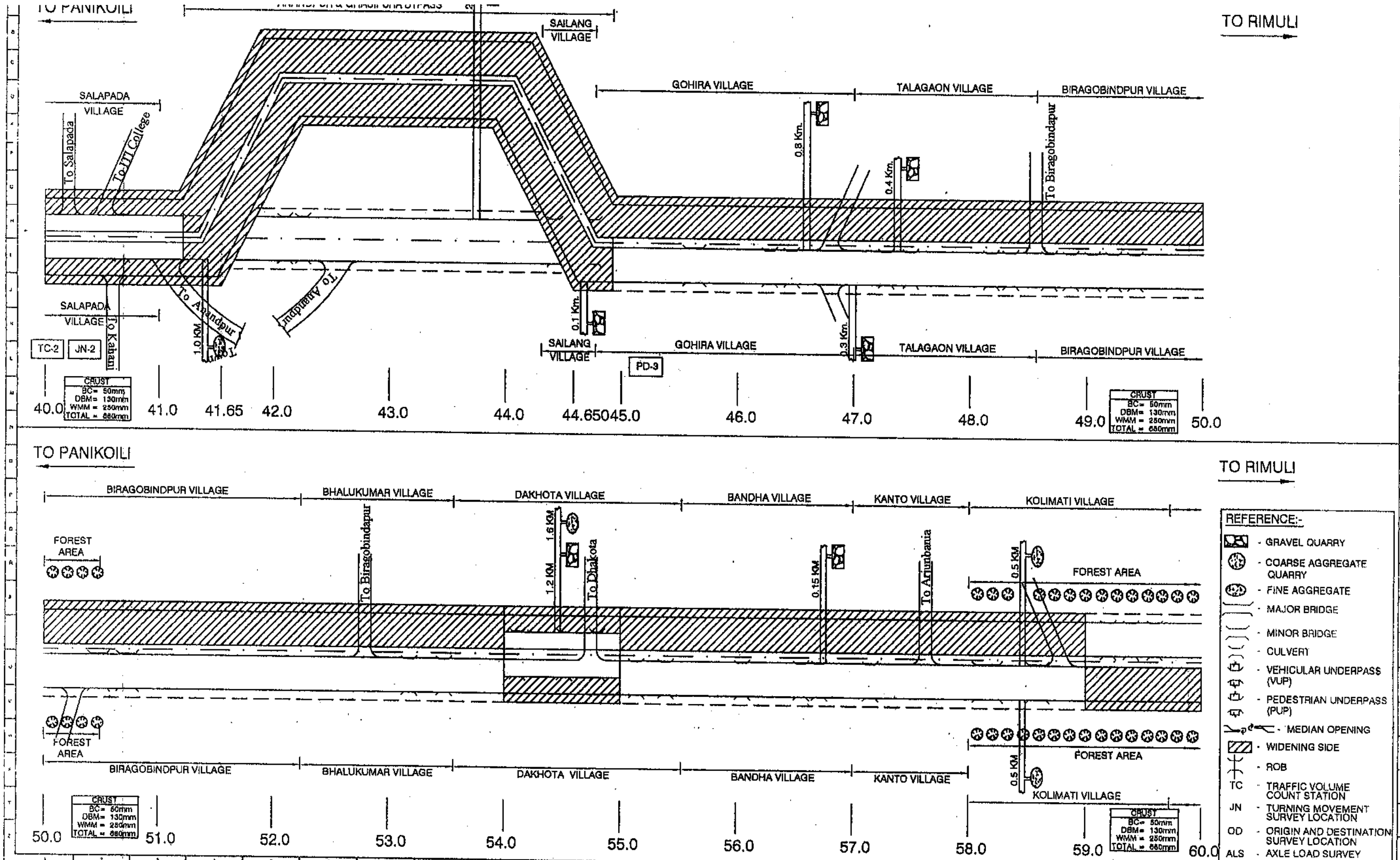
PREPARATION OF FS/DPR FOR 4/6 LANING FROM PANIKOILI (KM.0.000) TO RIMULI (KM.163.000) IN PANIKOILI-RIMULI SECTION OF NH-215 IN ORISSA

CONTRACT PACKAGE: NHDP-III/DL4/23

TITLE :

LINEAR STRIP PLAN FROM KM 20.000 TO 40.000

DRG. NO. NHAI/RD/MISC/001



DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DATE	SCALE : NOT TO SCALE
SURESH SAHOO					
REVISION	REVISION NO.	DATE	DESCRIPTION	REVISED BY	

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CLIENT :

NATIONAL HIGHWAYS AUTHORITY OF INDIA

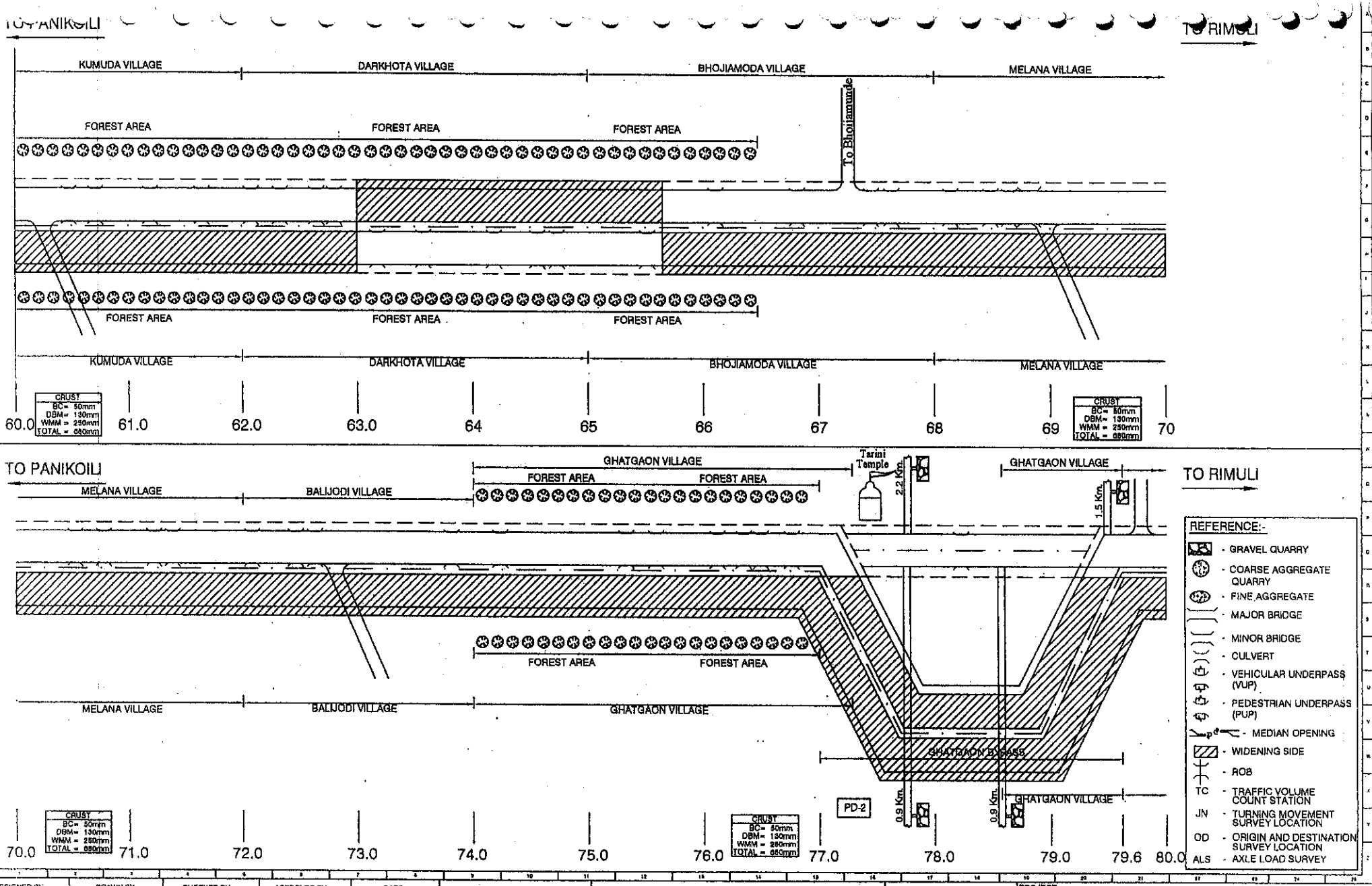
PROJECT :

PREPARATION OF FS/DPR FOR 4/6 LANING FROM PANIKOILI (KM.0.000) TO RIMULI (KM.163.000) IN PANIKOILI-RIMULI SECTION OF NH-215 IN ORISSA

CONTRACT PACKAGE: NHDP-III/DL4/23

TITLE : LINEAR STRIP PLAN FROM KM 40.0 TO 60.0

DRG. NO. [illegible]



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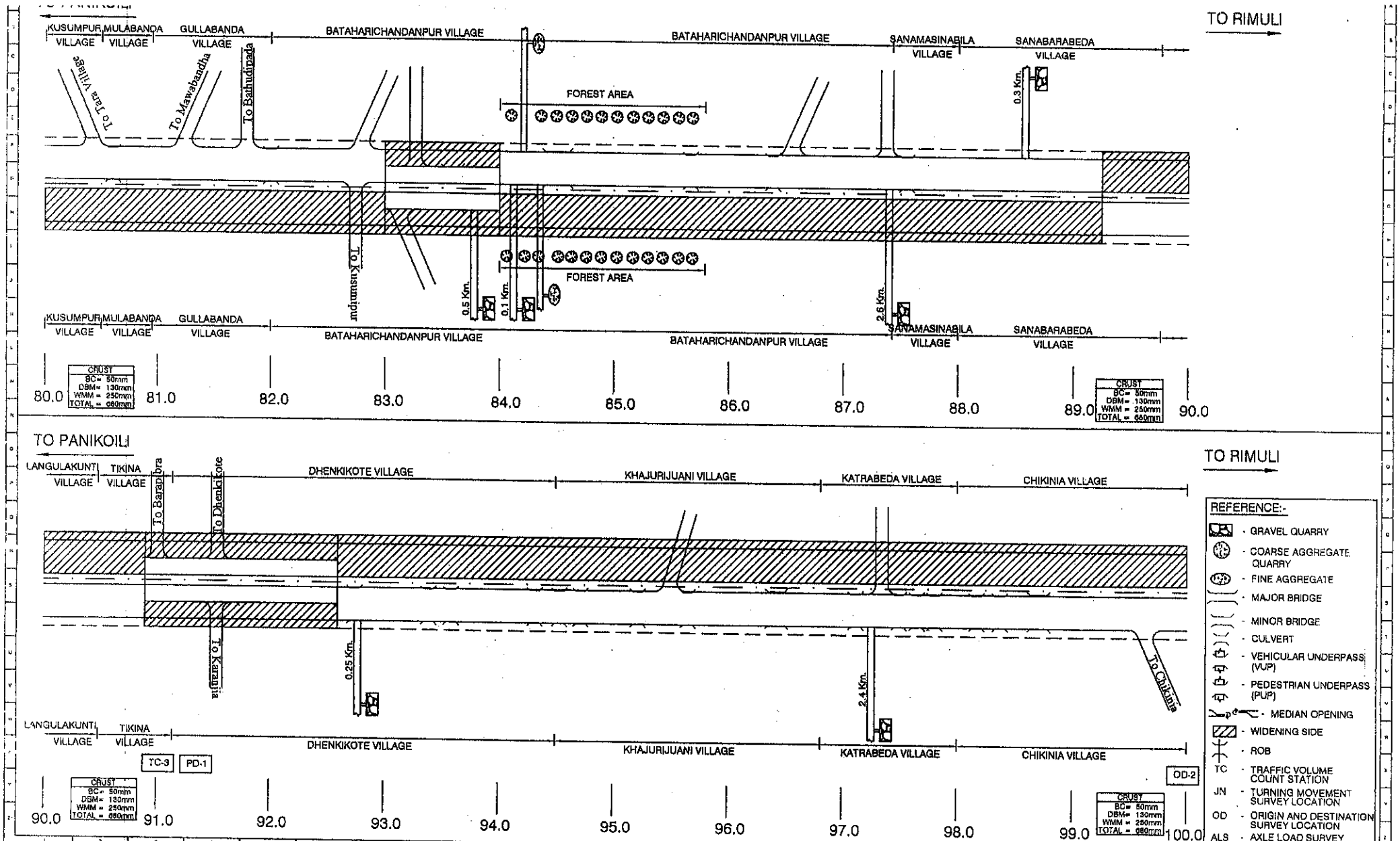
CONTRACT PACKAGE: NHDP-III/DL4/23

TITLE :

LINEAR STRIP PLAN FROM KM 60.0 TO 80.0

DRG. NO. : NHAI/RD/MISC/001



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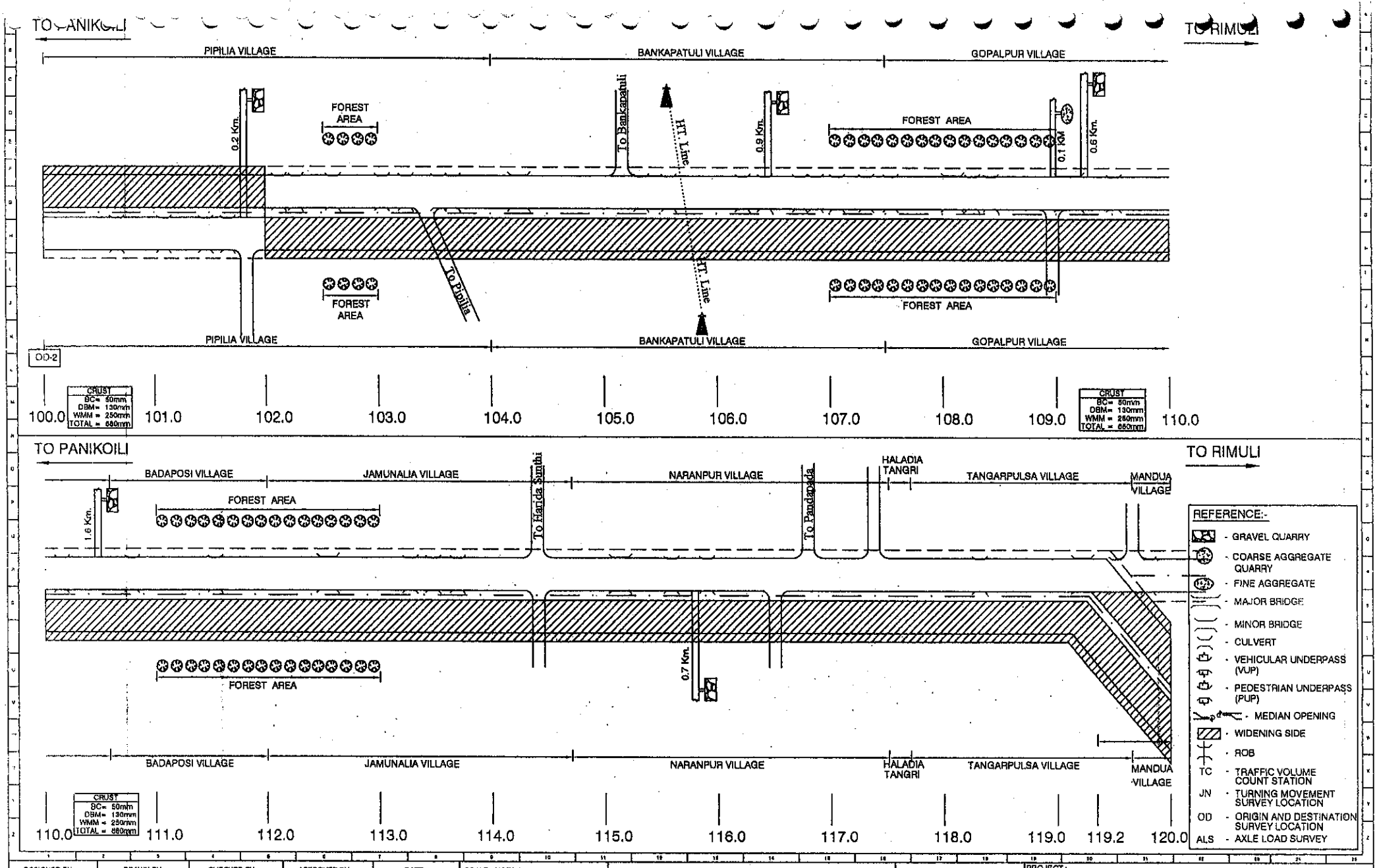
PREPARATION OF FS/DPR FOR 4/6 LANING FROM PANIKOILI (KM.0.000) TO RIMULI (KM.163.000) IN PANIKOILI-RIMULI SECTION OF NH-215 IN ORISSA

CONTRACT PACKAGE: NHDP-III/DL4/23

TITLE :

LINEAR STRIP PLAN FROM KM 80.0 TO 100.0

ORG. NO. NHAI/RDA/ISC/001



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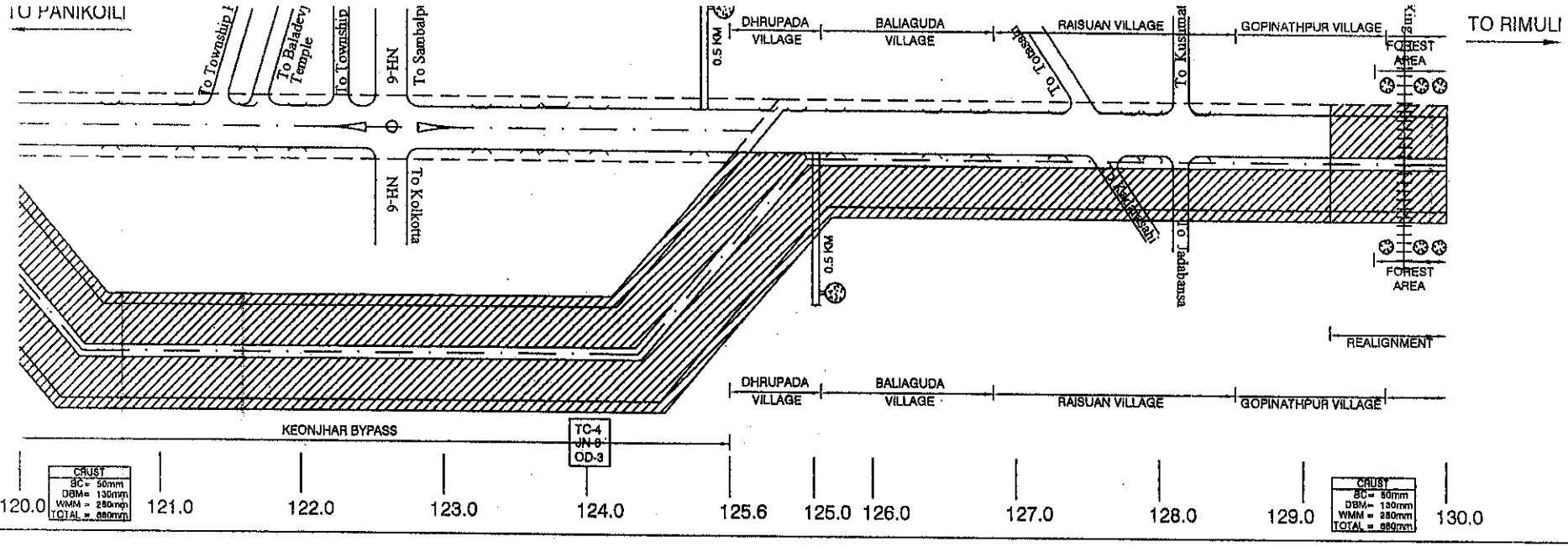
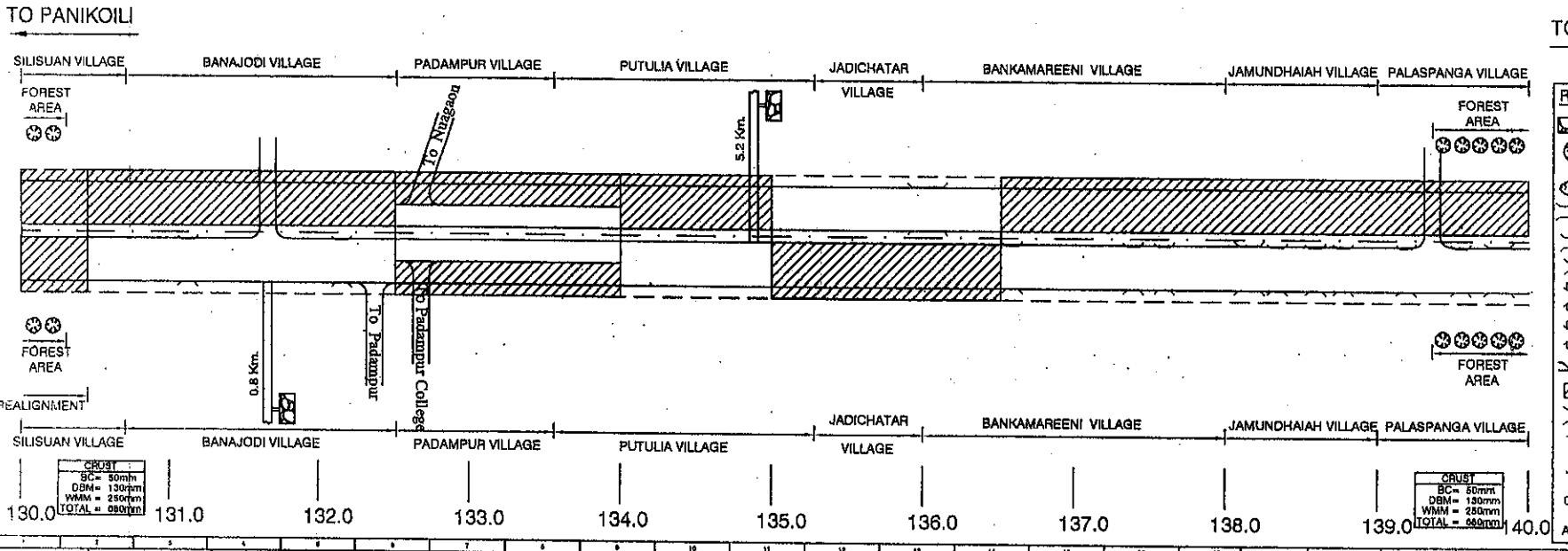
CONTRACT PACKAGE: NHDP-III/DL4/23

TITLE : LINEAR STRIP PLAN FROM KM 100.0 TO 120.0

DRG. NO. NHAI/RD/MISC/001





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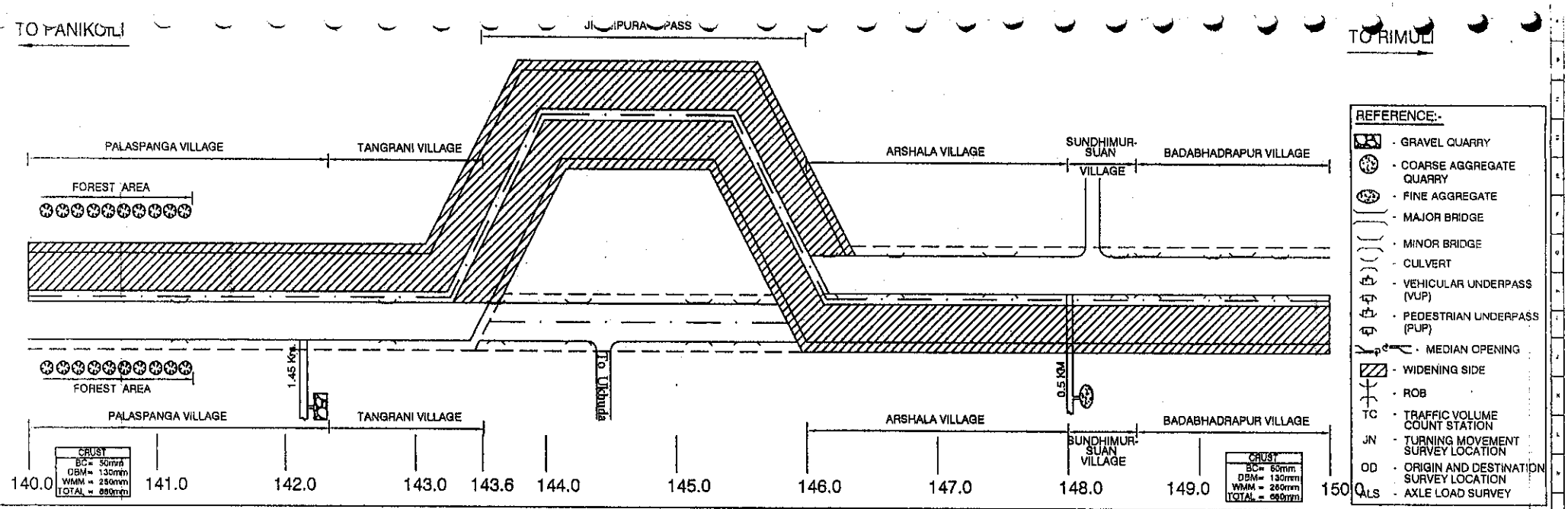
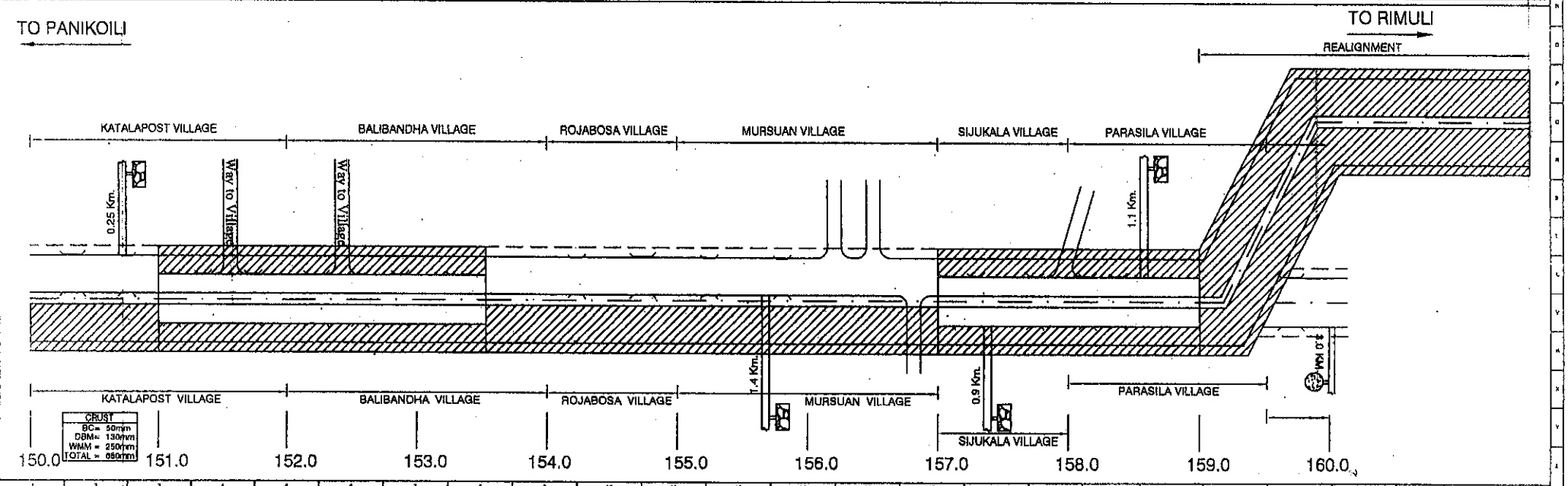
PREPARATION OF FS/DPR FOR 4/6 LANING FROM PANIKOILI (KM.0.000) TO RIMULI (KM.163.000) IN PANIKOILI-RIMULI SECTION OF NH-215 IN ORISSA

CONTRACT PACKAGE: NHDP-III/DL4/23

TITLE : LINEAR STRIP PLAN FROM KM 120 TO 140

DRG NO. NHAI/RD/[illegible]/001





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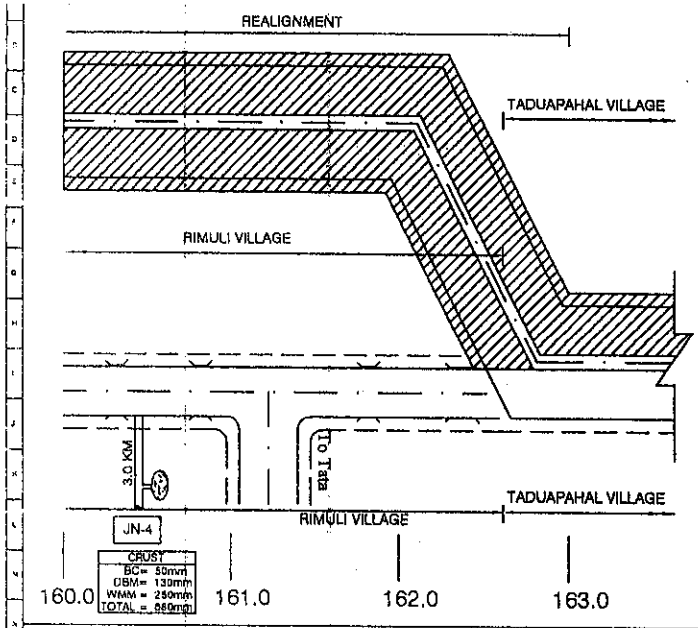
PREPARATION OF FS/DPR FOR 4/6 LANING FROM PANIKOILI (KM.0.000) TO RIMULI (KM.163.000) IN PANIKOILI-RIMULI SECTION OF NH-215 IN ORISSA

CONTRACT PACKAGE: NHDP-III/DL4/23

TITLE :

LINEAR STRIP PLAN FROM KM 140 TO 160

DRG. NO. NHAI/RD/MISC/001



REFERENCE:-

- GRAVEL QUARRY
- COARSE AGGREGATE QUARRY
- FINE AGGREGATE
- MAJOR BRIDGE
- MINOR BRIDGE
- CULVERT
- VEHICULAR UNDERPASS (VUP)
- PEDESTRIAN UNDERPASS (PUP)
- MEDIAN OPENING
- WIDENING SIDE
- ROB
- TC - TRAFFIC VOLUME COUNT STATION
- JN - TURNING MOVEMENT SURVEY LOCATION
- OD - ORIGIN AND DESTINATION SURVEY LOCATION
- ALS - AXLE LOAD SURVEY

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CLIENT :
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PROJECT :
PREPARATION OF FS/DPR FOR 4/6 LANING FROM PANIKOILI (KM.0.000) TO RIMULI (KM.163.000) IN PANIKOILI-RIMULI SECTION OF NH-215 IN ORISSA

CONTRACT PACKAGE: NHDP-III/DL4/23

TITLE :
LINEAR STRIP PLAN FROM KM 160 TO 160

DRG NO. [illegible]

ANNEXURE -3

Detail Socio-economic Analysis of the Project Area

Annexure 3.1: Distribution of Families by Population of Male, Female, and Children

Sl No	NAME OF VILLAGE	No of HH	POPULATION			POPULATION (0 to 6 YEARS)		
			TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE
Keonjhar District								
1	Pratapposi	108	526	272	254	67	29	38
2	Taduabahal	195	953	485	468	171	92	79
3	Rimuli	897	4263	2145	2118	667	337	330
4	Parsala	285	1351	690	661	187	103	84
5	Sijukala	145	653	328	325	95	44	51
6	Murusuan	184	1036	571	465	195	106	89
7	Dudhakundi	123	578	284	294	123	62	61
8	Rajabasa	128	642	325	317	110	52	58
9	Balibandha	467	2015	1021	994	239	123	116
10	Katalposi	63	266	138	128	31	14	17
11	Balabhadrapur	88	410	192	218	62	26	36
12	Sundhimurusuan	33	168	81	87	36	19	17
13	Arsala	586	2847	1458	1389	413	208	205
14	Bankapatuli	192	977	471	506	226	106	120
15	Pipilia	329	1638	814	824	232	123	109
16	Chandaposi	4	25	23	2	1	1	0
17	Bholabeda	395	1967	979	988	208	110	98
18	Gobindapur	86	336	168	168	32	17	15
19	Badaposi	108	494	248	246	78	39	39
20	Gopalpur	108	504	251	253	109	54	55
21	Khantaghara	121	659	335	324	108	55	53
22	Khajurijuani	90	442	231	211	68	37	31
23	Khatrabeda	148	706	355	351	104	49	55
24	Chikinia/Chikina - Gobinpur	208	1000	486	514	164	81	83
25	Dhenkikote	411	2097	1156	941	247	124	123
26	Sanmasinabilla	191	883	452	431	125	69	56
27	Sanabarabeda	89	460	234	226	71	31	40
28	Kusunapur	151	848	417	431	158	76	82
29	Bata Harichandanpur /Harichanduapur	205	958	475	483	159	76	83
30	Golabandha	115	534	269	265	93	44	49
31	Dhuligarh	2	9	4	5	0	0	0
32	Uparadiha	473	2443	1255	1188	365	178	187
33	Balijodi	170	971	502	469	183	109	74
34	Melana	330	1628	827	801	358	183	175
35	Palasapanga	237	1269	654	615	179	100	79
36	Jamudiha	138	679	338	341	102	55	47
37	Sarasakela	193	953	489	464	120	67	53

38	Murusuan	193	862	432	430	116	61	55
39	Jadichatar	75	365	188	177	56	31	25
40	Kesapanka	14	61	27	34	5	0	5
Sl No	**NAME OF VILLAGE**	**No of HH**	**POPULATION**			**POPULATION (0 to 6 YEARS)**		
			TOTAL	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**
41	Putulia	163	803	454	349	105	63	42
42	Bankamaruni	47	216	108	108	39	20	19
43	Padmapur	392	1903	1026	877	254	139	115
44	Banajodi	232	1018	535	483	159	82	77
45	Silisuan	224	1140	575	565	202	96	106
46	Poipani	19	117	65	52	26	15	11
47	Tangarani	121	521	262	259	73	37	36
48	Raisuan	791	3852	1962	1890	489	251	238
49	Khuntapada(KHA)	35	141	71	70	22	10	12
50	Gopinathapur	245	1100	542	558	153	69	84
51	Jamunalia	53	278	133	145	50	29	21
52	Baliaguda	166	833	443	390	120	64	56
53	Mandua	115	553	285	268	92	43	49
54	Tangarpalasa	113	538	291	247	76	43	33
55	Naranapur	305	1518	836	682	183	97	86
56	Haladiatangiri	94	473	252	221	67	36	31
57	Kanto	224	1027	518	509	181	97	84
58	Kolimati	342	1713	915	798	257	133	124
59	Amarnga	226	990	487	503	107	54	53
60	Bandha	95	459	232	227	85	48	37
61	Dhakotha	187	935	486	449	113	54	59
62	Bhalukhuma	180	924	494	430	122	70	52
63	Biragobindapur	406	2079	1057	1022	334	172	162
64	Talagaon	343	1757	996	761	250	128	122
65	Indupura	90	404	212	192	63	31	32
66	Gohira	317	1665	835	830	304	162	142
67	Belabhali	828	4004	2100	1904	546	287	259
68	Barigaon	261	1331	681	650	187	94	93
69	Bailo	242	1240	647	593	147	80	67
70	Hasanpur	85	434	235	199	49	26	23
71	Siapada	107	419	217	202	42	18	24
72	Naukana	47	203	99	104	18	11	7
73	Machhalo	412	1870	898	972	227	109	118
74	Rudranarayanpur	114	445	217	228	61	27	34
75	Bamphidi	245	1003	500	503	147	61	86
76	Sainkul	847	3985	1956	2029	444	226	218
77	Khalana	632	3029	1518	1511	412	209	203
78	Gainthagodi	4	25	11	14	6	3	3
79	Nuagaon	427	2041	1003	1038	298	143	155
80	Suanpada	116	548	289	259	79	43	36
81	Ramachandrapur	126	598	314	284	77	43	34
82	Jarda	129	509	261	248	68	41	27
83	Badapadana	508	2239	1114	1125	305	151	154

84	Sanapadana	68	282	126	156	45	21	24
	Total	**18801**	**90638**	**46328**	**44310**	**13147**	**6727**	**6420**

Sl No	**NAME OF VILLAGE**	**No of HH**	**POPULATION**			**POPULATION (0 to 6 YEARS)**		
			TOTAL	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**
	Janpur District							
1	Andhari	185	888	449	439	121	68	53
2	Godarapal	74	364	186	178	49	27	22
3	Ragadi	183	976	495	481	122	68	54
4	Mangarajpur	71	339	165	174	39	18	21
5	Manjuri	27	149	65	84	13	5	8
6	Talagarh	373	1980	1029	951	278	148	130
7	Uparagarh	56	262	134	128	37	21	16
8	Itapur	9	39	20	19	5	2	3
9	Nayagarh	74	381	203	178	36	21	15
10	Naguan	83	438	237	201	42	20	22
11	Kuanrada	81	506	248	258	68	33	35
12	Talugan	80	475	246	229	49	25	24
13	Benapur	40	191	102	89	41	23	18
14	Nuapada	67	369	192	177	43	21	22
15	Alia	73	394	213	181	54	32	22
16	Dhanapur	126	790	410	380	133	75	58
17	Oupada	33	167	86	81	23	12	11
18	Mohammed Jamalpur	91	431	214	217	59	31	28
19	Pathara Pada	202	1224	639	585	186	93	93
20	Alatiri	358	2118	1095	1023	283	153	130
	Total	**2286**	**12481**	**6428**	**6053**	**1681**	**896**	**785**
	Grand Total	**21087**	**103119**	**52756**	**50363**	**14828**	**7623**	**7205**

Annexure 3.2: Distribution of Literate Population by Male, Female, and total Population

Sl No	NAME OF VILLAGE	LITERATE			TOTAL POPULATION
		TOTAL	MALE	FEMALE	
Keonjhar District					
1	Pratapposi	384	235	149	526
2	Taduabahal	423	277	146	953
3	Rimuli	2231	1300	931	4263
4	Parsala	952	564	388	1351
5	Sijukala	324	194	130	653
6	Murusuan	532	370	162	1036
7	Dudhakundi	191	138	53	578
8	Rajabasa	364	228	136	642
9	Balibandha	980	584	396	2015
10	Katalposi	149	85	64	266
11	Balabhadrapur	196	118	78	410
12	Sundhimurusuan	43	30	13	168
13	Arsala	1698	1047	651	2847
14	Bankapatuli	330	212	118	977
15	Pipilia	947	560	387	1638
16	Chandaposi	19	18	1	25
17	Bholabeda	862	527	335	1967
18	Gobindapur	184	122	62	336
19	Badaposi	248	175	73	494
20	Gopalpur	215	136	79	504
21	Khantaghara	380	232	148	659
22	Khajurijuani	268	171	97	442
23	Khatrabeda	434	271	163	706
24	Chikinia/Chikina - Gobinpur	409	266	143	1000
25	Dhenkikote	1506	916	590	2097
26	Sanmasinabilla	433	273	160	883
27	Sanabarabeda	238	157	81	460
28	Kusunapur	381	230	151	848
29	Bata Harichandanpur /Harichanduapur	486	287	199	958
30	Golabandha	258	168	90	534
31	Dhuligarh	6	3	3	9
32	Uparadiha	1483	854	629	2443
33	Balijodi	503	316	187	971
34	Melana	503	360	143	1628
35	Palasapanga	799	455	344	1269
36	Jamudiha	407	234	173	679
37	Sarasakela	554	356	198	953

38	Murusuan	511	296	215	862
39	Jadichatar	153	113	40	365
40	Kesapanka	23	18	5	61

SI No	NAME OF VILLAGE	LITERATE			TOTAL POPULATION
		TOTAL	MALE	FEMALE	
41	Putulia	486	313	173	803
42	Bankamaruni	85	50	35	216
43	Padmapur	1209	745	464	1903
44	Banajodi	591	379	212	1018
45	Silisuan	372	238	134	1140
46	Poipani	51	39	12	117
47	Tangarani	276	175	101	521
48	Raisuan	2316	1384	932	3852
49	Khuntapada(KHA)	35	29	6	141
50	Gopinathapur	476	270	206	1100
51	Jamunalia	93	56	37	278
52	Baliaguda	434	282	152	833
53	Mandua	304	200	104	553
54	Tangarpalasa	357	226	131	538
55	Naranapur	1116	683	433	1518
56	Haladiatangiri	303	196	107	473
57	Kanto	478	308	170	1027
58	Kolimati	771	535	236	1713
59	Amarnga	501	313	188	990
60	Bandha	223	137	86	459
61	Dhakotha	566	341	225	935
62	Bhalukhuma	498	316	182	924
63	Biragobindapur	1004	653	351	2079
64	Talagaon	947	679	268	1757
65	Indupura	180	108	72	404
66	Gohira	632	429	203	1665
67	Belabhali	2757	1636	1121	4004
68	Barigaon	786	475	311	1331
69	Bailo	884	508	376	1240
70	Hasanpur	339	197	142	434
71	Siapada	328	186	142	419
72	Naukana	157	80	77	203
73	Machhalo	1348	715	633	1870
74	Rudranarayanpur	234	119	115	445
75	Bamphidi	504	282	222	1003
76	Sainkul	2767	1470	1297	3985
77	Khalana	1554	980	574	3029
78	Gainthagodi	17	8	9	25
79	Nuagaon	1238	756	482	2041
80	Suanpada	372	222	150	548
81	Ramachandrapur	408	237	171	598
82	Jarda	408	215	193	509
83	Badapadana	1525	875	650	2239

84	Sanapadana	219	102	117	282
	Total	**51156**	**31043**	**20113**	**90638**

Sl No	NAME OF VILLAGE	LITERATE			TOTAL POPULATION
		TOTAL	MALE	FEMALE	
Janpur District					
1	Andhari	533	320	213	888
2	Godarapal	140	105	35	364
3	Ragadi	739	399	340	976
4	Mangarajpur	268	145	123	339
5	Manjuri	108	55	53	149
6	Talagarh	1286	743	543	1980
7	Uparagarh	94	64	30	262
8	Itapur	24	14	10	39
9	Nayagarh	246	139	107	381
10	Naguan	353	211	142	438
11	Kuanrada	295	175	120	506
12	Talugan	323	190	133	475
13	Benapur	86	61	25	191
14	Nuapada	290	162	128	369
15	Alia	211	136	75	394
16	Dhanapur	515	295	220	790
17	Oupada	116	71	45	167
18	Mohammed Jamalpur	264	150	114	431
19	Pathara Pada	762	431	331	1224
20	Alatiri	1493	838	655	2118
	Total	**8146**	**4704**	**3442**	**12481**
	Grand Total	**59302**	**35747**	**23555**	**103119**

Annexure 3.3: Distribution of Population by Main, Marginal and Nonworkers

Sl No	NAME OF VILLAGE	MAIN WORKER			MARGINAL WORKER			NON WORKER			TOTAL POPULATION
		TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	
Keonjhar District											
1	Pratapposi	147	118	29	83	15	68	296	139	157	526
2	Taduabahal	501	254	247	11	3	8	441	228	213	953
3	Rimuli	819	671	148	796	386	410	2648	1088	1560	4263
4	Parsala	396	266	130	178	81	97	777	343	434	1351
5	Sijukala	317	171	146	54	19	35	282	138	144	653
6	Murusuan	126	118	8	114	105	9	796	348	448	1036
7	Dudhakundi	181	133	48	92	18	74	305	133	172	578
8	Rajabasa	170	149	21	3	1	2	469	175	294	642
9	Balibandha	506	422	84	157	101	56	1352	498	854	2015
10	Katalposi	20	19	1	45	43	2	201	76	125	266
11	Balabhadrapur	101	95	6	130	21	109	179	76	103	410
12	Sundhimurusuan	24	24	0	69	25	44	75	32	43	168
13	Arsala	527	502	25	314	154	160	2006	802	1204	2847
14	Bankapatuli	187	139	48	304	124	180	486	208	278	977
15	Pipilia	399	329	70	467	113	354	772	372	400	1638
16	Chandaposi	17	17	0	7	5	2	1	1	0	25
17	Bholabeda	522	428	94	298	86	212	1147	465	682	1967
18	Gobindapur	104	100	4	92	4	88	140	64	76	336
19	Badaposi	135	122	13	97	27	70	262	99	163	494
20	Gopalpur	57	54	3	172	75	97	275	122	153	504
21	Khantaghara	190	182	8	66	8	58	403	145	258	659
22	Khajurijuani	135	90	45	128	48	80	179	93	86	442
23	Khatrabeda	195	157	38	209	59	150	302	139	163	706
24	Chikinia/Chikina - Gobinpur	202	186	16	349	113	236	449	187	262	1000
25	Dhenkikote	587	531	56	28	12	16	1482	613	869	2097
26	Sanmasinabilla	129	81	48	340	172	168	414	199	215	883
27	Sanabarabeda	93	83	10	185	58	127	182	93	89	460
28	Kusunapur	276	207	69	8	4	4	564	206	358	848
29	Bata Harichandanpur /Harichanduapur	104	97	7	240	140	100	614	238	376	958
30	Golabandha	131	116	15	103	36	67	300	117	183	534
31	Dhuligarh	2	2	0	1	1	0	6	1	5	9
32	Uparadiha	566	525	41	73	36	37	1804	694	1110	2443
33	Balijodi	284	218	66	120	23	97	567	261	306	971
34	Melana	374	341	33	260	57	203	994	429	565	1628
35	Palasapanga	456	303	153	102	28	74	711	323	388	1269
36	Jamudiha	60	53	7	225	113	112	394	172	222	679
37	Sarasakela	216	176	40	232	84	148	505	229	276	953
38	Murusuan	242	187	55	103	21	82	517	224	293	862
39	Jadichatar	13	11	2	81	66	15	271	111	160	365
40	Kesapanka	2	2	0	13	6	7	46	19	27	61
41	Putulia	141	131	10	141	66	75	521	257	264	803
42	Bankamaruni	68	44	24	42	11	31	106	53	53	216

43	Padmapur	451	386	65	223	81	142	1229	559	670	1903
44	Banajodi	94	88	6	404	191	213	520	256	264	1018
45	Silisuan	268	254	14	117	32	85	755	289	466	1140
46	Poipani	4	4	0	35	19	16	78	42	36	117
47	Tangarani	155	137	18	134	17	117	232	108	124	521
48	Raisuan	623	480	143	661	394	267	2568	1088	1480	3852
49	Khuntapada(KHA)	84	45	39	6	2	4	51	24	27	141
50	Gopinathapur	309	201	108	103	74	29	688	267	421	1100
51	Jamunalia	5	5	0	86	54	32	187	74	113	278
52	Baliaguda	282	235	47	68	24	44	483	184	299	833
53	Mandua	142	120	22	59	7	52	352	158	194	553
54	Tangarpalasa	74	70	4	56	52	4	408	169	239	538
55	Naranapur	374	334	40	171	54	117	973	448	525	1518
56	Haladiatangiri	100	88	12	87	25	62	286	139	147	473
57	Kanto	212	185	27	300	100	200	515	233	282	1027
58	Kolimati	283	269	14	485	179	306	945	467	478	1713
59	Amarnga	204	197	7	151	51	100	635	239	396	990
60	Bandha	97	93	4	42	20	22	320	119	201	459
61	Dhakotha	241	228	13	54	19	35	640	239	401	935
62	Bhalukhuma	207	205	2	39	31	8	678	258	420	924
63	Biragobindapur	436	408	28	255	108	147	1388	541	847	2079
64	Talagaon	287	274	13	260	94	166	1210	628	582	1757
65	Indupura	106	101	5	2	1	1	296	110	186	404
66	Gohira	290	271	19	277	123	154	1098	441	657	1665
67	Belabhali	1029	991	38	66	60	6	2909	1049	1860	4004
68	Barigaon	338	331	7	78	51	27	915	299	616	1331
69	Bailo	315	288	27	12	10	2	913	349	564	1240
70	Hasanpur	124	114	10	9	9	0	301	112	189	434
71	Siapada	96	96	0	3	3	0	320	118	202	419
72	Naukana	46	45	1	3	3	0	154	51	103	203
73	Machhalo	465	449	16	59	20	39	1346	429	917	1870
74	Rudranarayanpur	117	113	4	16	8	8	312	96	216	445
75	Bamphidi	222	170	52	217	118	99	564	212	352	1003
76	Sainkul	1139	954	185	64	35	29	2782	967	1815	3985
77	Khalana	729	717	12	85	74	11	2215	727	1488	3029
78	Gainthagodi	7	7	0	0	0	0	18	4	14	25
79	Nuagaon	413	409	4	269	161	108	1359	433	926	2041
80	Suanpada	88	86	2	55	49	6	405	154	251	548
81	Ramachandrapur	167	146	21	111	41	70	320	127	193	598
82	Jarda	131	128	3	6	5	1	372	128	244	509
83	Badapadana	547	533	14	72	49	23	1620	532	1088	2239
84	Sanapadana	53	49	4	28	24	4	201	53	148	282
	Total	**21076**	**18158**	**2918**	**11760**	**5040**	**6720**	**57802**	**23130**	**34672**	**90638**
	Janpur District										
1	Andhari	149	144	5	309	95	214	430	210	220	888
2	Godarapal	33	32	1	126	46	80	205	108	97	364
3	Ragadi	219	209	10	48	45	3	709	241	468	976
4	Mangarajpur	100	98	2	2	0	2	237	67	170	339
5	Manjuri	39	35	4	8	2	6	102	28	74	149
6	Talagarh	440	429	11	41	36	5	1499	564	935	1980
7	Uparagarh	75	73	2	0	0	0	187	61	126	262
8	Itapur	9	8	1	0	0	0	30	12	18	39
9	Nayagarh	85	78	7	46	11	35	250	114	136	381
10	Naguan	102	95	7	15	13	2	321	129	192	438

11	Kuanrada	131	125	6	1	1	0	374	122	252	506
12	Talugan	123	117	6	4	3	1	348	126	222	475
13	Benapur	30	28	2	37	25	12	124	49	75	191
14	Nuapada	71	69	2	12	12	0	286	111	175	369
15	Alia	88	78	10	32	15	17	274	120	154	394
16	Dhanapur	162	153	9	41	31	10	587	226	361	790
17	Oupada	30	30	0	15	13	2	122	43	79	167
18	Mohammed Jamalpur	45	45	0	79	69	10	307	100	207	431
19	Pathara Pada	323	297	26	12	11	1	889	331	558	1224
20	Alatiri	545	504	41	32	17	15	1541	574	967	2118
	Total	**2799**	**2647**	**152**	**860**	**445**	**415**	**8822**	**3336**	**5486**	**12481**
	Grand Total	**23875**	**20805**	**3070**	**12620**	**5485**	**7135**	**66624**	**26466**	**40158**	**103119**

Annexure 3.4: Occupational Pattern among the Main Workers

Sl No	NAME OF VILLAGE	MAIN WORKER - CULTIVATION			MAIN WORKER - AL			MAIN WORKER - HH INDUSTRY			MAIN WORKER - OTHER			TOTAL MAIN WORKERS
		TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	
Keonjhar District														
1	Pratapposi	59	58	1	26	5	21	3	3	0	59	52	7	147
2	Taduabahal	186	149	37	283	75	208	2	2	0	30	28	2	501
3	Rimuli	288	216	72	94	59	35	35	29	6	402	367	35	819
4	Parsala	186	94	92	35	19	16	8	4	4	167	149	18	396
5	Sijukala	216	101	115	60	33	27	4	2	2	37	35	2	317
6	Murusuan	52	50	2	13	12	1	5	5	0	56	51	5	126
7	Dudhakundi	43	34	9	109	71	38	2	1	1	27	27	0	181
8	Rajabasa	66	62	4	2	2	0	18	6	12	84	79	5	170
9	Balibandha	136	125	11	114	82	32	7	5	2	249	210	39	506
10	Kataiposi	7	7	0	0	0	0	0	0	0	13	12	1	20
11	Balabhadrapur	66	63	3	0	0	0	0	0	0	35	32	3	101
12	Sundhimurusuan	9	9	0	0	0	0	0	0	0	15	15	0	24
13	Arsala	218	211	7	48	44	4	35	34	1	226	213	13	527
14	Bankapatuli	45	36	9	86	52	34	14	11	3	42	40	2	187
15	Pipilia	121	118	3	174	118	56	3	3	0	101	90	11	399
16	Chandaposi	0	0	0	0	0	0	2	2	0	15	15	0	17
17	Bholabeda	430	360	70	28	20	8	27	18	9	37	30	7	522
18	Gobindapur	43	43	0	0	0	0	2	2	0	59	55	4	104
19	Badaposi	104	104	0	12	6	6	4	4	0	15	8	7	135
20	Gopalpur	14	14	0	10	9	1	2	2	0	31	29	2	57
21	Khantaghara	166	160	6	1	1	0	1	1	0	22	20	2	190
22	Khajurijuani	100	69	31	19	10	9	6	3	3	10	8	2	135
23	Khatrabeda	125	103	22	34	20	14	5	3	2	31	31	0	195
24	Chikinia/Chikina - Gobinpur	135	130	5	43	35	8	4	4	0	20	17	3	202
25	Dhenkikote	43	41	2	2	2	0	8	2	6	534	486	48	587
26	Sanmasinabilla	1	1	0	0	0	0	75	31	44	53	49	4	129

27	Sanabarabeda	23	21	2	48	41	7	0	0	0	22	21	1	93
28	Kusunapur	36	36	0	19	9	10	10	10	0	211	152	59	276
29	Bata Harichandanpur /Harichanduapur	26	26	0	13	13	0	2	1	1	63	57	6	104
30	Golabandha	26	24	2	10	9	1	4	3	1	91	80	11	131
31	Dhuligarh	1	1	0	1	1	0	0	0	0	0	0	0	2
32	Uparadiha	40	36	4	26	21	5	2	2	0	498	466	32	566
33	Balijodi	85	75	10	108	66	42	15	11	4	76	66	10	284
34	Melana	210	194	16	130	121	9	17	10	7	17	16	1	374
35	Palasapanga	138	78	60	100	37	63	13	8	5	205	180	25	456
36	Jamudiha	10	6	4	0	0	0	0	0	0	50	47	3	60
37	Sarasakela	79	70	9	33	14	19	5	3	2	99	89	10	216
38	Murusuan	47	34	13	119	84	35	2	2	0	74	67	7	242
39	Jadichatar	10	8	2	0	0	0	0	0	0	3	3	0	13
40	Kesapanka	0	0	0	0	0	0	0	0	0	2	2	0	2
41	Putulia	23	23	0	2	1	1	27	27	0	89	80	9	141
42	Bankamaruni	25	15	10	27	16	11	1	1	0	15	12	3	68
43	Padmapur	14	10	4	42	33	9	6	6	0	389	337	52	451
44	Banajodi	5	5	0	21	17	4	2	2	0	66	64	2	94
45	Silisuan	66	65	1	109	103	6	1	1	0	92	85	7	268
46	Poipani	0	0	0	0	0	0	0	0	0	4	4	0	4
47	Tangarani	43	40	3	6	4	2	2	2	0	104	91	13	155
48	Raisuan	235	188	47	80	29	51	6	6	0	302	257	45	623
49	Khuntapada(KHA)	3	3	0	77	38	39	0	0	0	4	4	0	84
50	Gopinathapur	19	14	5	204	109	95	1	1	0	85	77	8	309
51	Jamunalia	0	0	0	1	1	0	0	0	0	4	4	0	5
52	Baliaguda	25	25	0	162	120	42	1	1	0	94	89	5	282
53	Mandua	18	17	1	2	1	1	0	0	0	122	102	20	142
54	Tangarpalasa	6	6	0	3	2	1	8	8	0	57	54	3	74
55	Naranapur	42	41	1	81	59	22	0	0	0	251	234	17	374
56	Haladiatangiri	2	2	0	0	0	0	0	0	0	98	86	12	100
57	Kanto	15	15	0	118	98	20	12	12	0	67	60	7	212
58	Kolimati	128	127	1	55	52	3	39	35	4	61	55	6	283
59	Amarnga	135	132	3	33	33	0	3	3	0	33	29	4	204

Annexure 3.4: Occupational Pattern among the Main Workers

Sl No	NAME OF VILLAGE	MAIN WORKER - CULTIVATION			MAIN WORKER - AL			MAIN WORKER - HH INDUSTRY			MAIN WORKER - OTHER			TOTAL MAIN WORKERS
		TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	
Keonjhar District														
1	Pratapposi	59	58	1	26	5	21	3	3	0	59	52	7	147
2	Taduabahal	186	149	37	283	75	208	2	2	0	30	28	2	501
3	Rimuli	288	216	72	94	59	35	35	29	6	402	367	35	819
4	Parsala	186	94	92	35	19	16	8	4	4	167	149	18	396
5	Sijukala	216	101	115	60	33	27	4	2	2	37	35	2	317
6	Murusuan	52	50	2	13	12	1	5	5	0	56	51	5	126
7	Dudhakundi	43	34	9	109	71	38	2	1	1	27	27	0	181
8	Rajabasa	66	62	4	2	2	0	18	6	12	84	79	5	170
9	Balibandha	136	125	11	114	82	32	7	5	2	249	210	39	506
10	Katalposi	7	7	0	0	0	0	0	0	0	13	12	1	20
11	Balabhadrapur	66	63	3	0	0	0	0	0	0	35	32	3	101
12	Sundhimurusuan	9	9	0	0	0	0	0	0	0	15	15	0	24
13	Arsala	218	211	7	48	44	4	35	34	1	226	213	13	527
14	Bankapatuli	45	36	9	86	52	34	14	11	3	42	40	2	187
15	Pipilia	121	118	3	174	118	56	3	3	0	101	90	11	399
16	Chandaposi	0	0	0	0	0	0	2	2	0	15	15	0	17
17	Bholabeda	430	360	70	28	20	8	27	18	9	37	30	7	522
18	Gobindapur	43	43	0	0	0	0	2	2	0	59	55	4	104
19	Badaposi	104	104	0	12	6	6	4	4	0	15	8	7	135
20	Gopalpur	14	14	0	10	9	1	2	2	0	31	29	2	57
21	Khantaghara	166	160	6	1	1	0	1	1	0	22	20	2	190
22	Khajurijuani	100	69	31	19	10	9	6	3	3	10	8	2	135
23	Khatrabeda	125	103	22	34	20	14	5	3	2	31	31	0	195
24	Chikinia/Chikina - Gobinpur	135	130	5	43	35	8	4	4	0	20	17	3	202
25	Dhenkikote	43	41	2	2	2	0	8	2	6	534	486	48	587
26	Sanmasinabilla	1	1	0	0	0	0	75	31	44	53	49	4	129

27	Sanabarabeda	23	21	2	48	41	7	0	0	0	22	21	1	93
28	Kusunapur	36	36	0	19	9	10	10	10	0	211	152	59	276
29	Bata Harichandanpur /Harichanduapur	26	26	0	13	13	0	2	1	1	63	57	6	104
30	Golabandha	26	24	2	10	9	1	4	3	1	91	80	11	131
31	Dhuligarh	1	1	0	1	1	0	0	0	0	0	0	0	2
32	Uparadiha	40	36	4	26	21	5	2	2	0	498	466	32	566
33	Balijodi	85	75	10	108	66	42	15	11	4	76	66	10	284
34	Melana	210	194	16	130	121	9	17	10	7	17	16	1	374
35	Palasapanga	138	78	60	100	37	63	13	8	5	205	180	25	456
36	Jamudiha	10	6	4	0	0	0	0	0	0	50	47	3	60
37	Sarasakela	79	70	9	33	14	19	5	3	2	99	89	10	216
38	Murusuan	47	34	13	119	84	35	2	2	0	74	67	7	242
39	Jadichatar	10	8	2	0	0	0	0	0	0	3	3	0	13
40	Kesapanka	0	0	0	0	0	0	0	0	0	2	2	0	2
41	Putulia	23	23	0	2	1	1	27	27	0	89	80	9	141
42	Bankamaruni	25	15	10	27	16	11	1	1	0	15	12	3	68
43	Padmapur	14	10	4	42	33	9	6	6	0	389	337	52	451
44	Banajodi	5	5	0	21	17	4	2	2	0	66	64	2	94
45	Silisuan	66	65	1	109	103	6	1	1	0	92	85	7	268
46	Poipani	0	0	0	0	0	0	0	0	0	4	4	0	4
47	Tangarani	43	40	3	6	4	2	2	2	0	104	91	13	155
48	Raisuan	235	188	47	80	29	51	6	6	0	302	257	45	623
49	Khuntapada(KHA)	3	3	0	77	38	39	0	0	0	4	4	0	84
50	Gopinathapur	19	14	5	204	109	95	1	1	0	85	77	8	309
51	Jamunalia	0	0	0	1	1	0	0	0	0	4	4	0	5
52	Baliaguda	25	25	0	162	120	42	1	1	0	94	89	5	282
53	Mandua	18	17	1	2	1	1	0	0	0	122	102	20	142
54	Tangarpalasa	6	6	0	3	2	1	8	8	0	57	54	3	74
55	Naranapur	42	41	1	81	59	22	0	0	0	251	234	17	374
56	Haladiatanglri	2	2	0	0	0	0	0	0	0	98	86	12	100
57	Kanto	15	15	0	118	98	20	12	12	0	67	60	7	212
58	Kolimati	128	127	1	55	52	3	39	35	4	61	55	6	283
59	Amarnga	135	132	3	33	33	0	3	3	0	33	29	4	204

60	Bandha	48	48	0	29	27	2	14	14	0	6	4	2	97
61	Dhakotha	72	72	0	33	33	0	14	11	3	122	112	10	241
62	Bhalukhuma	66	66	0	93	91	2	4	4	0	44	44	0	207
63	Biragobindapur	193	192	1	93	80	13	13	7	6	137	129	8	436
64	Talagaon	104	103	1	86	85	1	2	2	0	95	84	11	287
65	Indupura	3	3	0	97	93	4	0	0	0	6	5	1	106
66	Gohira	136	135	1	72	63	9	21	18	3	61	55	6	290
67	Belabhali	434	430	4	86	84	2	14	14	0	495	463	32	1029
68	Barigaon	143	142	1	45	43	2	0	0	0	150	146	4	338
69	Bailo	54	52	2	43	42	1	0	0	0	218	194	24	315
70	Hasanpur	59	59	0	32	29	3	0	0	0	33	26	7	124
71	Siapada	76	76	0	6	6	0	1	1	0	13	13	0	96
72	Naukana	28	27	1	0	0	0	0	0	0	18	18	0	46
73	Machhalo	244	241	3	120	114	6	2	2	0	99	92	7	465
74	Rudranarayanpur	39	39	0	1	1	0	0	0	0	77	73	4	117
75	Bamphidi	61	61	0	116	70	46	1	1	0	44	38	6	222
76	Sainkul	431	327	104	282	242	40	14	11	3	412	374	38	1139
77	Khalana	564	563	1	111	108	3	4	4	0	50	42	8	729
78	Gainthagodi	4	4	0	0	0	0	0	0	0	3	3	0	7
79	Nuagaon	145	143	2	56	56	0	12	12	0	200	198	2	413
80	Suanpada	23	21	2	8	8	0	4	4	0	53	53	0	88
81	Ramachandrapur	51	44	7	6	3	3	1	0	1	109	99	10	167
82	Jarda	70	70	0	4	4	0	0	0	0	57	54	3	131
83	Badapadana	225	223	2	146	146	0	25	23	2	151	141	10	547
84	Sanapadana	27	25	2	3	3	0	0	0	0	23	21	2	53
	Total	**7694**	**6861**	**833**	**4391**	**3238**	**1153**	**597**	**460**	**137**	**8394**	**7599**	**795**	**21076**
						Janpur District								
1	Andhari	47	47	0	19	18	1	1	1	0	82	78	4	149
2	Godarapal	29	28	1	3	3	0	0	0	0	1	1	0	33
3	Ragadi	70	68	2	14	14	0	6	5	1	129	122	7	219
4	Mangarajpur	51	51	0	8	7	1	1	1	0	40	39	1	100
5	Manjuri	18	17	1	8	7	1	0	0	0	13	11	2	39
6	Talagarh	239	237	2	40	39	1	6	4	2	155	149	6	440

7	Uparagarh	43	43	0	24	23	1	0	0	0	8	7	1	75
8	Itapur	1	1	0	0	0	0	0	0	0	8	7	1	9
9	Nayagarh	9	7	2	8	7	1	1	1	0	67	63	4	85
10	Naguan	58	55	3	3	3	0	0	0	0	41	37	4	102
11	Kuanrada	32	29	3	20	20	0	0	0	0	79	76	3	131
12	Talugan	52	52	0	33	27	6	4	4	0	34	34	0	123
13	Benapur	5	5	0	3	3	0	0	0	0	22	20	2	30
14	Nuapada	20	20	0	17	17	0	0	0	0	34	32	2	71
15	Alia	14	11	3	56	51	5	1	1	0	17	15	2	88
16	Dhanapur	129	126	3	8	6	2	3	3	0	22	18	4	162
17	Oupada	21	21	0	6	6	0	0	0	0	3	3	0	30
18	Mohammed Jamalpur	34	34	0	6	6	0	0	0	0	5	5	0	45
19	Pathara Pada	173	153	20	26	24	2	4	3	1	120	117	3	323
20	Alatiri	140	137	3	101	96	5	34	29	5	270	242	28	545
	Total	**1185**	**1142**	**43**	**403**	**377**	**26**	**61**	**52**	**9**	**1150**	**1076**	**74**	**2799**
	Grand Total	**8879**	**8003**	**876**	**4794**	**3615**	**1179**	**658**	**512**	**146**	**9544**	**8675**	**869**	**23875**

Annexure 3.5: Distribution of Population by SC & ST

Sl No	NAME OF VILLAGE	SC POPULATION			ST POPULATION			POPULATION		
		TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE
	Keonjhar District									
1	Pratapposi	35	15	20	11	8	3	526	272	254
2	Taduabahal	0	0	0	736	380	356	953	485	468
3	Rimuli	951	498	453	1428	701	727	4263	2145	2118
4	Parsala	308	160	148	114	57	57	1351	690	661
5	Sijukala	0	0	0	227	116	111	653	328	325
6	Murusuan	43	24	19	775	432	343	1036	571	465
7	Dudhakundi	10	4	6	505	246	259	578	284	294
8	Rajabasa	0	0	0	184	96	88	642	325	317
9	Balibandha	190	89	101	934	470	464	2015	1021	994
10	Katalposi	0	0	0	65	33	32	266	138	128
11	Balabhadrapur	0	0	0	113	57	56	410	192	218
12	Sundhimurusuan	0	0	0	139	62	77	168	81	87
13	Arsala	248	117	131	281	154	127	2847	1458	1389
14	Bankapatuli	26	11	15	770	356	414	977	471	506
15	Pipilia	78	39	39	1089	539	550	1638	814	824
16	Chandaposi	1	1	0	6	4	2	25	23	2
17	Bholabeda	147	72	75	1549	775	774	1967	979	988
18	Gobindapur	0	0	0	24	13	11	336	168	168
19	Badaposi	0	0	0	416	211	205	494	248	246
20	Gopalpur	10	6	4	275	135	140	504	251	253
21	Khantaghara	70	37	33	547	276	271	659	335	324
22	Khajurijuani	12	6	6	372	195	177	442	231	211
23	Khatrabeda	41	19	22	416	207	209	706	355	351
24	Chikinia/Chikina - Gobinpur	34	20	14	786	380	406	1000	486	514
25	Dhenkikote	169	84	85	563	302	261	2097	1156	941
26	Sanmasinabilla	3	1	2	384	202	182	883	452	431
27	Sanabarabeda	34	14	20	356	186	170	460	234	226
28	Kusunapur	0	0	0	298	151	147	848	417	431
29	Bata Harichandanpur /Harichanduapur	0	0	0	310	147	163	958	475	483
30	Golabandha	196	98	98	254	128	126	534	269	265
31	Dhuligarh	0	0	0	6	3	3	9	4	5
32	Uparadiha	118	62	56	968	476	492	2443	1255	1188
33	Balijodi	21	12	9	848	445	403	971	502	469
34	Melana	30	15	15	1401	704	697	1628	827	801
35	Palasapanga	83	38	45	285	153	132	1269	654	615
36	Jamudiha	99	51	48	286	143	143	679	338	341
37	Sarasakela	109	54	55	312	155	157	953	489	464
38	Murusuan	79	36	43	416	208	208	862	432	430
39	Jadichatar	0	0	0	324	165	159	365	188	177
	Kesapanka	0	0	0	61	27	34	61	27	34
41	Putulia	64	42	22	205	110	95	803	454	349
42	Bankamaruni	0	0	0	89	47	42	216	108	108
	Padmapur	189	95	94	639	336	303	1903	1026	877

44	Banajodi	30	12	18	705	368	337	1018	535	483
45	Silisuan	71	39	32	1024	514	510	1140	575	565
46	Poipani	0	0	0	117	65	52	117	65	52
47	Tangarani	81	37	44	94	48	46	521	262	259
48	Raisuan	346	185	161	1368	669	699	3852	1962	1890
49	Khuntapada(KHA)	0	0	0	135	67	68	141	71	70
50	Gopinathapur	12	6	6	663	322	341	1100	542	558
51	Jamunalia	0	0	0	234	114	120	278	133	145
52	Baliaguda	439	235	204	286	150	136	833	443	390
53	Mandua	3	0	3	412	206	206	553	285	268
54	Tangarpalasa	199	104	95	261	148	113	538	291	247
55	Naranapur	288	152	136	411	245	166	1518	836	682
56	Haladiatangiri	48	28	20	368	190	178	473	252	221
57	Kanto	64	32	32	451	230	221	1027	518	509
58	Kolimati	36	21	15	1430	770	660	1713	915	798
59	Amarnga	64	29	35	643	324	319	990	487	503
60	Bandha	455	230	225	4	2	2	459	232	227
61	Dhakotha	118	62	56	6	4	2	935	486	449
62	Bhalukhuma	248	131	117	18	10	8	924	494	430
63	Biragobindapur	361	189	172	1057	537	520	2079	1057	1022
64	Talagaon	330	187	143	958	545	413	1757	996	761
65	Indupura	112	67	45	9	5	4	404	212	192
66	Gohira	0	0	0	1511	760	751	1665	835	830
67	Belabhali	221	110	111	366	188	178	4004	2100	1904
68	Barigaon	48	27	21	0	0	0	1331	681	650
69	Bailo	689	350	339	0	0	0	1240	647	593
70	Hasanpur	0	0	0	0	0	0	434	235	199
71	Siapada	0	0	0	3	3	0	419	217	202
72	Naukana	0	0	0	0	0	0	203	99	104
73	Machhalo	338	163	175	85	41	44	1870	898	972
74	Rudranarayanpur	0	0	0	136	70	66	445	217	228
75	Bamphidi	153	75	78	287	139	148	1003	500	503
76	Sainkul	513	253	260	740	373	367	3985	1956	2029
77	Khalana	212	105	107	41	22	19	3029	1518	1511
78	Gainthagodi	0	0	0	0	0	0	25	11	14
79	Nuagaon	310	150	160	0	0	0	2041	1003	1038
80	Suanpada	241	121	120	30	15	15	548	289	259
81	Ramachandrapur	85	43	42	19	12	7	598	314	284
82	Jarda	22	12	10	0	0	0	509	261	248
83	Badapadana	367	175	192	68	32	36	2239	1114	1125
84	Sanapadana	0	0	0	0	0	0	282	126	156
	Total	**9902**	**5050**	**4852**	**33707**	**17179**	**16528**	**90638**	**46328**	**44310**
	Percentage	**10.9**	**10.9**	**11.0**	**37.2**	**37.1**	**37.3**	*	*	*
					Janpur District					
	Andhari	250	134	116	118	57	61	888	449	439
	Godarapal	30	13	17	191	95	96	364	186	178
	Ragadi	184	92	92	0	0	0	976	495	481
	Mangarajpur	0	0	0	0	0	0	339	165	174
	Manjuri	134	56	78	0	0	0	149	65	84
	Talagarh	570	285	285	0	0	0	1980	1029	951
	Uparagarh	31	15	16	181	97	84	262	134	128
	Itapur	0	0	0	0	0	0	39	20	19

9	Nayagarh	184	99	85	8	4	4	381	203	178
10	Naguan	68	34	34	0	0	0	438	237	201
11	Kuanrada	6	2	4	258	126	132	506	248	258
12	Talugan	131	68	63	1	1	0	475	246	229
13	Benapur	69	39	30	79	41	38	191	102	89
14	Nuapada	17	9	8	0	0	0	369	192	177
15	Alia	72	43	29	123	65	58	394	213	181
16	Dhanapur	132	72	60	0	0	0	790	410	380
17	Oupada	22	10	12	0	0	0	167	86	81
18	Mohammed Jamalpur	190	97	93	25	10	15	431	214	217
19	Pathara Pada	11	6	5	227	125	102	1224	639	585
20	Alatiri	461	241	220	7	3	4	2118	1095	1023
	Total	**2562**	**1315**	**1247**	**1218**	**624**	**594**	**12481**	**6428**	**6053**
	Percentage	**20.5**	**20.5**	**20.6**	**9.8**	**9.7**	**9.8**	*	*	*
	Grand Total	**12464**	**6365**	**6099**	**34925**	**17803**	**17122**	**103119**	**52756**	**50363**
	Percentage	**12.1**	**12.1**	**12.1**	**33.9**	**33.7**	**34.0**	*	*	*

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