

PROJECT APPRAISAL REPORT

0.1 PROJECT BACKGROUND

National Highway Authority of India (NHAI) has been entrusted to implement the development of stretches of National Highway No. 6 under NHDP Phase-IV B. Group B (Package no. OR/DPR/NHDP-IV/09) on BOT/EPC mode. There are stretches where the intensity of traffic has increased significantly and there is requirement for augmentation of capacity for safe and efficient movement of traffic.

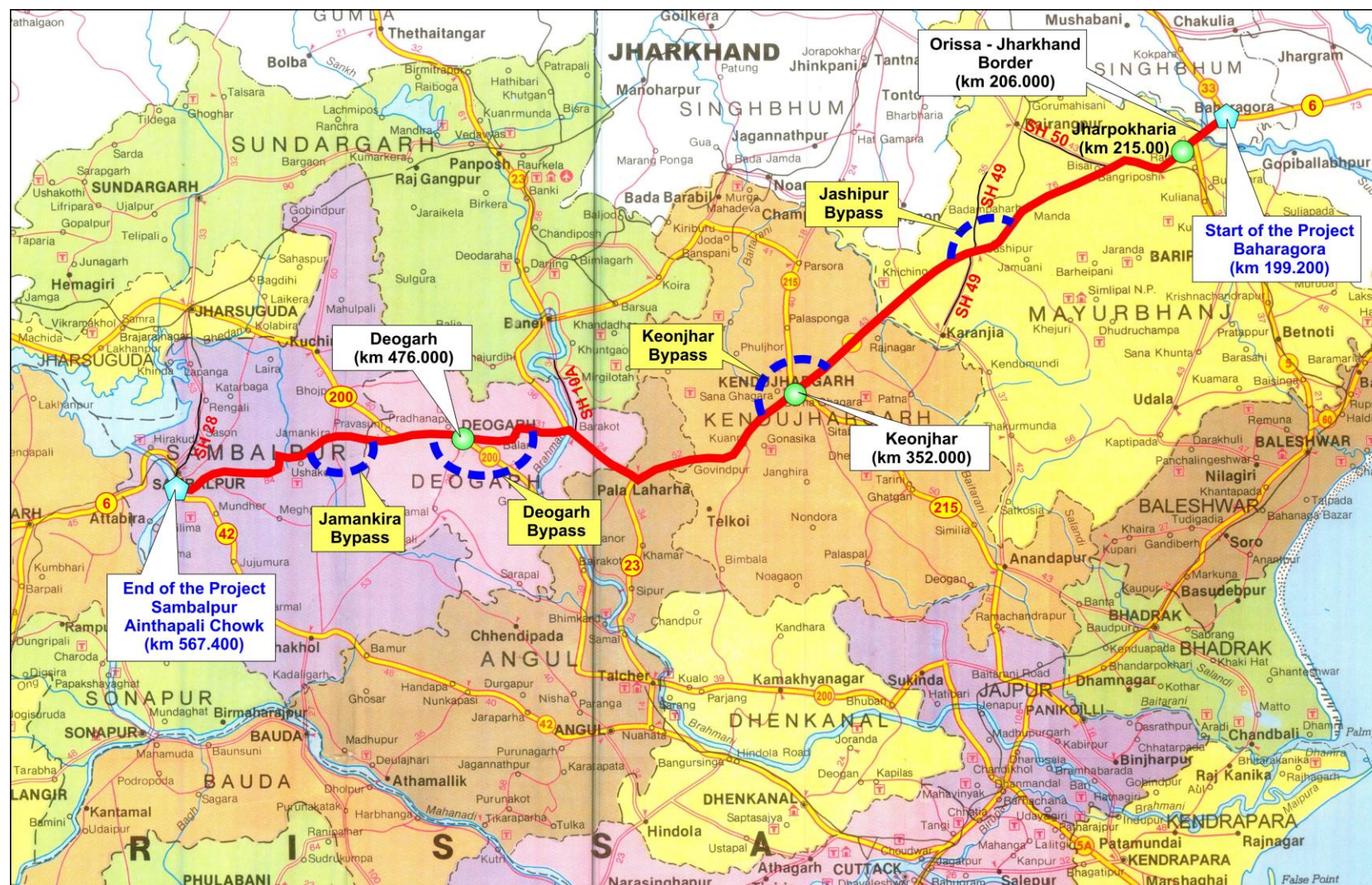
The project stretch of NH-6 is passing through Jharkhand and Orissa States, starting from Bahargora (km 199+200) and ending at Sambalpur 566+00 (design chainage 567+400). The project road passes through East Singhbhum, Mayurbhanj, Keonjhar, Angul, Deogarh and Sambalpur districts. The major settlements along the project road includes Ainthapali, Sindurpank, Padiabahal, Badrama, Kharumunda, Jamankira, Tainsar, Kurod, Barkote, Pallahara, Kantala, Jagmohanpur, Nipo, Kanjipani, Suakati, Jharbelda, Khiraitangari, Turmunga, Singda, Dari, Jasipur, Manada, Asana, Bisoi, Bangiriposi and Baharagora. Apart from these settlements the road also passes through lot of small settlements at many places.

The project road within the 10 km buffer zone of the protected area starts at km 205.900 and terminates at km 310.500 in Mayurbhanj district. The protected area; Bio-sphere Zone, Similipal National Park, Similipal Tiger Reserve, Eco Sensitive Zone and Mayurbhanj Elephant Reserve falls under the jurisdiction of Rairangpur Forest Division in Mayurbhanj district.

The project road section is shown in the Index map at **Fig. 1**.

The project was put to bid on BOT but no bids were received. Then it was decided in the IMG meeting to bifurcate the project road in four packages with first package on EPC mode and rest three on BOT mode. Accordingly the project was divided in four parts and first package from Km 199.200 to Km 310.806 (Baharagora to Singara) is to be taken up on EPC Mode.

Fig. 1: Index Map



0.2 SOCIO-ECONOMIC PROFILE OF THE PROJECT INFLUENCE AREAS

The project intervention is targeted towards the development of inhabitants and will have target groups in sectors. Therefore, data pertaining to its inhabitants and their development status acquires significance as it depicts existing scenario of the project influence area and provides the baseline for future assessment. The proposed project road passes through the states of Orissa and Jharkhand. The existing alignment is passing through Keonjhar and Mayurbhanj districts of Orissa and East Singhbhum district of Jharkhand. In order to study the demography and socio-economic background of project influence area, a micro-level analysis has been undertaken comprising population characteristics, workforce, workers participation in major economic activities and other socio-economic features¹.

The findings of the assessment indicates that the alignment of the project road passes through sensitive locations, heavily congested built up areas and high volume of PAPs requiring mitigation measures and in choosing best alternatives for integration in the Engineering design while finalizing the alignment. Identification of requirement of bypasses, flyovers, service roads, way side amenities, major junctions, sign boards would also need to be done.

The improved road will facilitate speedy movement of men and material, at reduced cost of transportation and provide accessibility to areas not yet well connected with a good road network.

Agriculture occupies a vital place in the economy of the region providing employment to around 60% of the people. Apart from this major industries, handicraft works, silk weaving units, stone carving units involving skilled workers and Artisans also keep occupied major work force. The affected areas in the states of Jharkhand and Orissa are rich in mineral wealth and coal field in the region. It can be concluded that the project influence area has three distinct features viz., poor industrialization, large scale population engaged in farming and allied activities, presence of a high Scheduled Tribes population and insignificant SC population. However while agriculture sector remains the largest source of employment across the project influenced districts but commercial activities dominate the existing road corridor. These revelations will have a bearing on the project in terms of positive and adverse impacts due to the project road. Therefore, it is of utmost importance to assess the likely negative impacts on people and properties that would be caused due to the project in order to address them through proper mitigation measures.

0.3 TRAFFIC STUDIES & ANALYSIS

0.3.1 Traffic Surveys

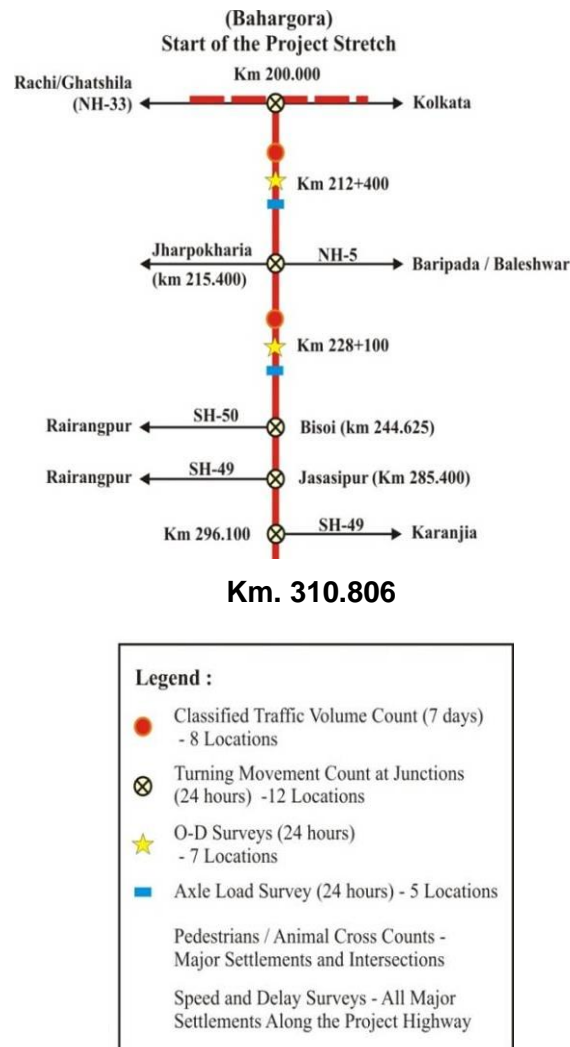
To capture traffic flow characteristics and travel pattern of users passing through the project road and other characteristics related to miscellaneous requirements the following primary traffic surveys were conducted.

- Manual Classified Traffic Volume Count (MCC)
- Junction Volume or Intersection Turning Movement Count Survey (TMC)
- Origin-Destination and Commodity Movement Survey (OD)
- Speed and Delay Survey
- Axle Load Survey
- Pedestrian/Cross Movement Count
- Willingness-to-pay toll Survey

The survey locations along with their chainages are presented schematically in the line diagram of the project road shown in **Fig. 2**.

¹ Most of the data are based on District Statistical Handbook, 2007.and official websites.

Fig. 2: Details of Traffic Survey Locations



Identification of Traffic Homogenous Sections

The project road is not going to be built as fully access controlled, thus the number of intersecting roads are bound to be numerous. On the basis of the observed traffic flows and reconnaissance, in the total stretch of about 111.606 km, a total of two homogeneous sections have been identified. The two homogeneous road sections have been used for the purpose of traffic analysis and forecasting in relation to pavement design; however, to examine the strategies for tolling and tollable traffic in chosen toll plaza locations, these homogeneous sections will be considered in addition to any other key information related to traffic. **Table 1** gives the details of the homogeneous sections identified for the project road.

Table 1: Homogeneous Sections of Project Road

Section Name	Homogeneous Section	Stretch (km)	Length (Km)	Traffic Volume (PCU/Day)
Baharagora-Jharpokharia	I	199+200 to 215+400	16.2	9323
Jharpokharia-Tangabila	II	215+400 to 296+100	80.7	7712

0.3.2 Average Daily Traffic (ADT)

The average daily traffic was computed for all the locations where the mid-block volume count survey was conducted. Daily traffic volumes from 7-day counts were averaged to find the Average Daily Traffic (ADT). Location wise and mode wise ADT values are given in **Table 2**. Also the peak hour flows and peak hour proportions of total daily traffic (over the average 24-hour volume count) were identified and are given in **Table 2**.

Table 2: Average Daily Traffic (ADT)

Station No.	Existing Chainage (km)	Location of Survey	ADT		Peak Hour Flows		Peak Hour proportion in daily Vehicle Vol.	Peak Hour proportion in daily PCU Vol.
			Vehi.	PCUs	Vehi.	PCUs		
MCC-1	212+400	Petrol Pump, Near Ghijodi Village	4784	9143	347	609	7.24	6.66
MCC-2	228+100	Bangriposi Village	5292	7502	392	485	7.41	6.47

0.3.3 Analysis of Turning Movement Count Data

Traffic surveys were carried out at five intersections along the project stretch. Out of the five junctions, 4 are three arm junctions, while 1 is 4-arm junction. The total traffic flows at the twelve surveyed junctions, are presented in **Table 3**.

The daily total approach volumes vary from 7,453 PCUs (4,875 vehicles) to 18,251 PCUs (14,965 vehicles). The highest total approach volume in terms of PCUs has been observed at Jharpokharia Chowk Junction at km 215+400. The lowest total approach volume is found at SH=49 Junction (km 296 +100).

Table 3: Daily Traffic Flows at Major Intersections

Name of Intersection	Count Station	Existing Chainage (Km)	Total Traffic (in Vehicles)	Total Traffic (in PCUs)
Bahargora (Jn with NH-33)	TMC1	199+200	10714	17918
Jharpokharia (Jn with NH-5)	TMC2	215+400	14965	18251
Bisoi (Jn with SH-50)	TMC3	244+625	6172	8622
Jassipur (Jn with SH-49)	TMC4	285+400	11263	13275
Jn with SH-49	TMC5	296+100	4875	7453

0.3.4 Analysis of O-D Survey Data

Origin and Destination survey was done at 2 locations along the project road. Data collected from the site was fed to the computer and compiled for the base year (2010), using the zoning system adopted for the study. Modewise O-D matrices for each location was prepared from the data collected to find the travel characteristics of the traffic.

0.3.5 Axle Load Survey

The survey was carried out using the electronic axle-weighing pad at five locations for duration of 24 hours. Due to the requirement of stopping the vehicle for weighing, it was not possible to weigh all the commercial vehicles passing through the site. So commercial vehicles were weighed on a random sampling basis. Vehicles selected for axle load survey comprised of Buses, LGVs, 2-axle trucks and 3-axle trucks and MAVs.

The values of VDF were calculated by dividing the sum of all the Equivalency Factor by the number of Samples. To calculate the cumulative number of standard axles to be catered for in the design in terms of msa, category-wise VDF is required. The VDF calculated for all commercial vehicles of different axle configuration on the basis of axle load survey carried out on NH-6 at five locations is given in **Table 4**.

Table 4: Vehicle Damage Factor (VDF) for Observed Commercial Vehicles at Various Locations on NH-6

Vehicle Type	km 212+000	km 228+100
	AL-1	AL-2
LGV	0.15	0.08
Bus	0.96	0.93
2-Axle Truck	3.09	4.79
3-Axle Truck	4.96	5.93
MAV	10.63	9.32

0.3.6 Proposed Growth Rates

As the future patterns of change in population, GDP, agriculture, industries, and services can be estimated with limited accuracy. The growth rates obtained from the elasticity method are considered as most probable. However, for sensitivity analysis two more scenarios are developed taking into consideration of 10% lower and 10% higher growth rate. 10% lower growth rate is known as pessimistic and 10% higher growth rate is known as optimistic.

0.4 ENGINEERING SURVEY AND INVESTIGATIONS

The consultants have carried out engineering surveys and investigations that include Topographic Surveys, Road Inventory and Pavement Condition Surveys, Alignment Studies, Pavement Surface Roughness Survey, Initial Environmental Screening and Assessment, Social Screening Assessment, Pavement Composition Investigations, Material Investigations for Construction Materials, Inventory and Condition Surveys for Bridges, Culverts and other Structures.

0.4.1 Land Use and Terrain

The project road passes through a number of habitated areas on both sides, the land use by the side of the existing road includes reserve forest, protected forest including Badarma wildlife sanctuary, agricultural, residential and commercial.

The project road passes through plain, rolling and hilly terrain including Ghat area named Bangiposi Ghat (km 229.200 to 235.00).

0.4.2 Geometrics

The horizontal alignment for majority of stretches conforms to IRC standards. At few locations it was observed that the horizontal alignments has S curves, broken

back curves and small radius not conforming the IRC Standards. Roadway gradient generally conforms to IRC Standards and at few locations vertical curves do not conform to IRC Standards.

0.4.3 Carriageway shoulder and roadway width

The carriageway width is generally 7.0 m .

Generally, 1.00 2.50 m wide earthen shoulder on either side exists in plain and rolling terrain but in some stretches a mix of paved shoulder and earthen shoulders exist. One meter wide earthen shoulder on either side exists in hilly section.

0.4.4 Junctions

9 major and 42 minor intersections exist along the project road.

0.4.5 Road Side Drains

Lined and unlined drains exist in ghat areas and town areas mainly in Bisoi, Jassipur.

0.4.6 Road Side Furniture's

Km stones are currently observed along the road in the most of the stretches except some stretches where they are missing or uprooted at some locations. Caution boards, road sign boards, speed limit boards, warning of potential hazard and wide life sanctuary locations boards are found along the project corridor at many locations.

0.4.7 Bridges and Culverts

There are 207 culverts, 4 major, 16 minor bridges, 1 flyover, 3 vehicular under passes and 1 pedestrian under pass.

0.5 PAVEMENT CONDITION AND PAVEMENT COMPOSITION

Overall riding quality is good from Bahargora to Singara except Bahargora to subarnrekha bridge where the riding quality is very poor. Roughness screening has been conducted along the project road. Based on the roughness measurement studies, the km wise roughness in IRI and BI units has been calculated. The maximum IRI value was measured as 13.52 m per km and minimum IRI value was recorded 1.51 m per km.

0.5.1 Existing Pavement Strength

Structural strength evaluation studies for various section of the existing two-lane pavement were carried out using Benkelman Beam Deflection technique in accordance with the CGRA procedure given in IRC: 81-1997. Deflection surveys were carried out as per the terms laid down in the TOR.

0.6 SOIL AND MATERIAL INVESTIGATIONS

As part of the project study, the Consultants carried out Soil and Material Investigations, analysis of existing sub-grade soil properties as well as investigation on sources of available construction materials for the proposed construction works concerning to embankment sub-grade, sub-base and top layers (bituminous/concrete) of road pavement.

0.7 HYDROLOGY AND DRAINAGE

- The project road stretch begins from Bahargora in the state of Jharkhand, crosses major rivers Subarnrekha, Bandhan in the state of Orissa. The project road catchment is part of major river basins namely, Subarnrekha

- Network of road side lined and unlined drains are existing in Ghat area and in town areas mainly in Bisoi, Jassipur.
- The drainage facility seems to be adequate; as such no major road stretch has been reported overtopped. The road stretches which get overtopped are in vicinity of overtopped bridges/ Culvert locations.
- Most of the existing bridges are having Bank Protection.

0.8 PROPOSED IMPROVEMENTS

0.8.1 Roads

Two possible alternatives provided for the main alignment in the draft feasibility report were discussed with NHAI officers. The final feasibility was accordingly modified keeping in view the comments made in the presentation and discussions. However, this proposal was further discussed with NHAI and further modified keeping in view the financial viability, NHAI grant during construction and concession period. Accordingly the following proposal is finally adopted.

- Km 199.200 to km 310.806 : Upgrading and widening of existing 2 lane to 4 lane including one bypass (Jashipur) and one realignment (Bisoi) as per IRC-SP: 84-2009.

The following cross section has been adopted for the project road.

Sl. No.	Description	Median (m)	Carriageway (m)	Paved Shoulder (m)	Earthen Shoulder (m)
1	4 Lane divided Highway in open country areas	4.50	2x7.25	2x1.50	2x2.0
2	4 Lane divided Highway in built areas without Service Road	2.00	2x7.25	2x1.50	2x2.0
3	4 Lane divided Highway in built areas with 7.0 m wide Service Road	2.00	2x7.25	2x2.0	-
4	4 Lane divided Highway in Hilly terrain	2.00	2x7.25	-	Hill Side -1.50 Valley Side -2.0

The typical cross sections are enclosed at the end of the chapter 5 of this volume.

0.8.2 Bypasses

1 bypass is proposed along the alignment. The detail is given below:-

(i) Jasipur (km 284.130 to km 287.770)

Bypass has been proposed on right hand side of the existing road and for link to NH-49 also as lot of houses, structures of the town are on the left hand side of the road. The length of this bypass is 3.640 km.

0.8.3 Realignment

1 Realignment has been proposed at Bisoi on Left side of existing road as existing ROW is insufficient at site and poor geometrics of road. The length of realignments is 1.020 km.

0.8.4 Proposed Right of Way (PROW)

The proposed right of way for the entire project is 45.0 m.

0.8.5 Geometric Design

Horizontal Alignment

In the section where alignment is in hilly areas, curves have been improved to the adopted design standards. Desirable minimum design speed has been maintained in most of places but at certain locations desirable minimum design speed has been reduced to absolute minimum or less than absolute minimum design speed due to site constraints.

Vertical Alignment

The profile of the project alignment has been designed primarily on the basis of DTM data collected during the topographic survey. The vertical profile is linked with bridges and structures. The vertical geometry of the existing road is improved by providing smooth vertical curves. The Ruling gradient has followed at most of the places but at certain location the Limiting gradient has followed due to site constraint.

0.8.6 Proposed Service Road

0.940 km Service road has been provided in this stretch of NH-6 as per detail given below:

Sl. No.	Left Side Service Road			Right Side Service Road		
	From (km)	To (km)	Length (m)	From (km)	To (m)	Length (m)
1	263630.0	264570.0	940.0	263630.0	264570.0	940.0

0.8.7 Widening Evaluation Options for Proposed Alignment

Selection of Widening Scheme

The three widening options has been adopted.

- i) New 2 lane carriageway is left side of the existing section.
- ii) New carriageway is right side of existing section.
- iii) Concentric widening, symmetrical about the center of existing carriageway

The following considerations are also kept in mind to design the project road

- i) **Technical Considerations** – Geometric, earthwork, built-up sections, cross drainage works, junction layout, relocation of existing utilities, bypass sitting, construction costs, and maintenance costs.
- ii) **Environmental Consideration:** – No. of Trees to be cut, location of water bodies, monitoring, operation and training of air quality, noise, and water quality, redevelopment of borrow areas by tree plantation and fisheries.
- iii) **Social Consideration:** Area and type of Land Acquisition, location of hot spots such as water bodies and religious places, resettlement and rehabilitation problems.

0.8.8 At-grade intersections

1 National Highways at place and 2 State Highways are joining the project alignment where junctions have been provided and 4 junctions have also been provided at the start and end point of bypasses and realignments. Total 9 nos. of major junctions and 42 minor junctions have been proposed for entire project length.

0.8.9 Median opening

The proposed median openings are located in such a way to facilitate safe crossing to the local turning traffic. The openings are generally proposed at a distance not less than 2 km.

0.8.10 Toll Plazas

The 2 toll plaza's are proposed for this stretch of road. The locations of toll plaza's are given below:-

1. Toll plaza I : At km 216.050
2. Toll plaza II : At km 277.000

0.8.11 Bus Bays, Truck lay byes and Way Side Amenities

76 bus bays, 8 truck lay byes and 4 nos of way side amenities are proposed along the project road.

0.8.12 Bridge and Structures

	Major (No.)	Minor (No.)	Total (No.)
New 4-lane bridges on existing alignment	- 0	1	= 1
New 2-lane bridges	- 0	0	= 0
New 4-lane bridges on bypass / realignment	- 0	0	= 0
Existing bridges to be widened	- 0	12	= 12
Additional 2-lane bridges	- 4	16	= 16
New 4-lane flyover	-		= 01
New 4-lane vehicular underpasses	-		= 03
New 2-lane Pedestrian underpasses	-		= 01

0.8.14 Road Side Drains

The details of proposed drains are as under:

Lined Drains Rectangular: 4 lane with service roads proposed in Urban areas.

Unlined Drains Trapezoidal: Rural areas have been proposed on either side except in hilly areas

0.8.15 Retaining Earth Wall, Retaining Wall and Breast Wall

4.244 km of RE wall is to be proposed in structure approaches. Retaining wall and Breast wall are to be provided in hilly terrain.

0.9 PAVEMENT DESIGN

Existing Pavement Strengthening

Pavement was designed on the basis of cumulative number of standard axles expected on the pavement for the design life of 15 yrs. Based upon the design chart of IRC-37-2001 the composition of pavement is evaluated for respective design traffic and design sub-grade CBR.

To delineate the project corridor into homogeneous sections and to evaluate sections requiring reconstruction and strengthening, the following parameters are considered;

- a) Strength (4-days soaked CBR at field dry density) of existing pavement sub-grade
- b) Composition of the existing pavement
- c) Characteristic deflection, and
- d) Existing pavement condition.

Based on careful review of the above considerations and design traffic, the entire project road is categorized into homogeneous sections for new or widening sections and for overlay and reconstruction sections.

The design recommendations for main road are presented in **Table 5 to 8**.

Table 5: Recommended Overlay and Reconstruction Composition

Sl. No.	Section	Chainage (Km)		Length of Section (Km)	Adopted Design Traffic (msa)	Recommended Overlay / Reconstruction Composition (mm)			
		From	To			BC	DBM	WMM	GSB
1	Section-1	199.200	215.360	16.160	55	40	115	250	-
2	Section-2	215.360	232.935	17.575	40	40	50	-	-
3	Section-3	232.935	234.640	1.705	40	40	100	250	-
4	Section-4	234.640	239.625	4.985	40	40	-	-	-
5	Section-5	239.625	243.880	4.255	40	40	100	250	-
6	Section-6	243.880	255.430	11.550	40	40	100	-	-
7	Section-7	255.430	262.370	6.940	40	40	100	250	-
8	Section-8	262.370	279.490	17.120	40	40	50	-	-
9	Section-9	279.490	296.015	15.525	40	40	100	-	-
10	Section-10	296.525	297.890	1.365	60	40	125	-	-
11	Section-11	297.890	310.806	12.916	60	40	50	-	-

Table 6: Recommended Pavement Composition for New Construction

Section No.	Chainage (km)			No. of Lanes	Adopted Traffic (msa)	Design CBR (%)	Pavement Composition (mm)				Remarks
	From	To	Length (Km)				BC	DBM	WMM	GSB	
Section 1	199.200	215.360	16.160	4	55	10	40	115	250	200	--
Section 2	215.360	295.920	80.560	4	40		40	100	250	200	--
Section 3	295.920	310.806	14.836	4	60		40	125	250	200	--

Table 7: Pavement Crust Details at Toll plazas

Sl. No.	Toll Plaza Location	Thickness of PQC (mm)	Thickness of DLC (mm)	GSB Layer (Drainage Layer) (mm)
1	Km 216.050	300	100	150

Sl. No.	Toll Plaza Location	Thickness of PQC (mm)	Thickness of DLC (mm)	GSB Layer (Drainage Layer) (mm)
2	Km 277.000	280	100	150

Table 8: Pavement Crust Details for Bypass Roads

Sl. No	Name of Place for Bypasses / Realignments	Chainage (km)			Adopted Traffic (msa)	Design CBR (%)	Pavement Composition (mm)			
		From	To	Length (Km)			BC	DBM	WMM	GSB
1	Bisoi (realignment)	243.880	244.900	1.020	40	10	40	100	250	200
2	Jashipur	284.130	287.770	3.640	40		40	100	250	200

Design of Service Road

Considering a design traffic of 5 msa, the pavement composition for service road in this section is determined as per design chart of IRC: 37 – 2001 and is furnished here below in **Table 9**.

Table 9: Pavement crust details for service roads

Sl. No	Design Traffic (msa)	Design CBR (%)	Pavement Composition (mm) (IRC: 37 -2001)			
			SDBC	DBM	WMM	GSB
1	5	9	25	50	250	150

0.10 ENVIRONMENTAL SCREENING OF THE PROJECT

The detailed design of the project has been closely co-ordinate with the preparation of the Environmental Screening Report.

The Environmental Screening Report preparation led to identification of potential negative environmental impacts and development of feasible remedial measures (including avoidance, mitigation and enhancements which will help in finalization of detailed design of the project by incorporating these measures into design.

Policy, Legal And Administrative Framework

The project will require prior clearances from the Ministry of Environment Forest and Climate Change, New Delhi under Wildlife (Protection) Act, 1972 and Forest (Conservation) Act, 1980.

Ecological Resources

The project evolve concentric widening and improvement of curves at some place which will replace the vegetation cover of the uniformly distributed trees along the existing road. The road passes through thick forest vegetation cover at many places along the project road.

Protected Forest / Reserve Forest

The road passes through about 28.940 km length of various type of forest 44 tree species are observed along the project area.

Protected Area

The project road in protected area starts at Km 205.900 at the start point of the Elephant Reserve, Mayurbhanj district, Odisha and terminates at Km 310.500, at the end point of Bio-sphere Zone boundary, in District, Mayurbhanj, Odisha under the jurisdiction of Rairangpur Forest Division. The total existing length of the project road within the protected areas is 100.5 km.

The entire protected area falls in the Mayurbhanj district under Rairangpur Forest Division. The kilometer wise details of the protected area within the 10 kilometre buffer zone of the project road are as follows:

S. No	Name of Protected Area	Start Point	End Point	Total Length
1.	Elephant Reserve	Km 205.900	Km 215.000	9.1 km
		Km 262.000	Km 275.000	13 km
		Km 294.450	Km 310.500	16.05 km
Total				38.15
2.	Bio-Sphere Reserve	Km 217.000	Km 252.000	35 km
		Km 282.000	Km 310.000	28 km
Total				63 km
3.	National Park/Similipal Tiger Reserve	Km 226.000	Km 252.500	25.5 km
4.	Eco Sensitive Zone	Km 215.000	Km 306.000	91 km
Total Length of the Project Road within the 10 kilometre buffer zone of the Protected Area in section km 205.900 to 310.500				104.6 km

The section from kilometer 217.000 to 310.000 of the Biosphere Reserve is common portion with the Elephant Reserve, National Park/Similipal Tiger Reserve and Eco Sensitive Zone.

No wildlife except snakes, rodents, mangroves, civets etc are present within the immediate corridor of impact. No endangered or rare species was observed during the site visit. The proposed bypasses do not cause fragmentation of any wildlife habitat nor did such bypasses cut across any wild animal migration route.

Socio Cultural Environment

The project highway traverses through a number of settlements and is often dotted with religious and cultural properties, which though not of archaeological significance are nevertheless, very significant to the community. Cultural properties along the project highway were identified and documented based on site surveys. The major settlements have been proposed to be bypassed through a new alignment. None of these places are likely to be impacted by the project.

Educational Institute

There are 49 schools & colleges located within 30 m distance from the ECL along the road.

Industries

There is no major industrial activity along the project corridor although a few small industries have been coming along side project road.

Public Consultation

Community consultations were held with Project Affected Persons (PAPs), other stakeholders and the general public to know their view about the proposed road

and incorporate their suggestions while finalizing the alignment. A Village level consultation was held at various Villages / Towns. The people were generally in favour of construction of the road, as it would reduce traffic congestion, increase safety and improve socio-economic status of the area. TOR presentation has been done and cleared by MOEF. Final clearance being applied after completing all the requirement of MOEF. On the basis of community consultations following recommendations have been made:

- Compensatory plantation of trees; as per state forest department for each tree removed in accordance with state guidelines.
- Adoption of stringent control measures for air and noise pollution during construction and operation particularly near settlements and junctions.
- Provision of adequate cross drainage structures.
- Protection of wildlife at sanctuaries
- Protection and enhancement of Ponds
- Protection and relocation of religious structures
- Employment opportunity to local persons
- Prevention of deterioration in surface water quality through sediment control and adoption of a protocol for material handling & storage.
- Safety measures at work site through traffic management and provision of personal protective equipment for work force.
- Protection of sensitive receptors like schools and hospitals close to ROW from high noise level
- Impacting minimum number of cultural properties like temples/shrines coming close to ROW.

Analysis of Alternatives

The analysis of alternatives has been made on the basis of “with and without project scenarios” in terms of potential environmental impacts. On the basis of analysis we can say that project acquires positive/beneficial impacts “With” project scenario and will greatly enhance social and economic development of the region compared to “Without” project scenario, which will lead to further deterioration in the quality of life. This will also improve the existing environment through Implementation mitigation measures proposed in EIA/EMP.

Four bypasses and two realignments have been proposed to offer better connectivity and to run smooth traffic in the congested settlements where ROW is limited. It will avoid acquisition of structures, houses and displacement of existing population residing in these areas. The final selection of the by-passes has been done after consideration of some options and the most feasible one has been selected on engineering, social, environmental and cost considerations

0.11 PRELIMINARY COST ESTIMATE

0.11.1 Unit Rates

The unit rates are based on the basic rates as per State Schedule of Rates for the year 2013. As the entire project road length is more than 300 km, the representative section has been selected and rates have been worked out to get the realistic cost. For road embankment borrow areas have been identified along the project road and average lead has been taken as 3 km. For stone metal quarries have been identified along the length of the road and average lead has

been worked out. The cost of the stone aggregates at site has been worked out by taking the quarry rates, cartage cost and Royalty as per State Schedule of Rates. The unit rates have been worked out by taking the cost of materials as provided in the State Schedule of Rates except for cement steel and bitumen for which current market rates have been provided. The rates of hire charges of Machinery have been provided as per State Schedule of Rates for the year 2013. The component of labour, material and machinery has been provided as per Standard Data Book of the Ministry of Road Transport and Highways.

0.12.2 Construction Cost

The cost of rehabilitation and upgradation of NH-6 to 4-lane from Km 205.900 to km 310.500, for flexible pavement alternative comes out to Rs. 851.444 crore with the cost of rupees 8.14 crores/kilometer.

0.13 ECONOMIC ANALYSIS RESULTS

The economic analysis is carried out within the broad framework of social cost-benefit analysis. The appraisal compares the total transport costs in situations of “with” the project and “without” the project alternatively called the “base case” or the “do minimum case” for the project highway.

The project is found to be economically viable.

The underlying objective of economic analysis is to maximize the returns on the investment. The concept behind the economic appraisal of the project is that if it is implemented, the resulting in minimize the total transport cost and maximize the benefits of road users with compare to the ‘base (Do-Nothing)’ situation.

Table 10: Result of Economic Evaluation (with Time Saving)

Package No	IRR (%)	NPV (Rs. Million)
Widening of existing 2 Lane highway to 4- lane from km 199.200 to km 310.806.	21.10%	8002.013

Sensitivity Analysis

Sensitivity Analysis has been carried out to examine the effect on economic viability of the project due to change in the level of the key input factors, including construction cost, variation in traffic etc. The sensitivity of the IRR and NPV has been studied under the following change in conditions.

- Condition I : 15% increase in project cost, benefits remain unchanged.
 Condition II : 15% decrease in benefits, project cost remains unchanged.
 Condition III : 15% increase in project cost & 15% decrease in benefits.

The results of sensitivity analysis are given in **Table 11**.

Table 11: Sensitivity Analysis Results for Package 1(with Time Saving)

Condition	IRR (%)	NPV (Rs. Million)
I.	17.10%	5527.626
II.	18.90%	5789.982
III.	15.20%	3315.593

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