PUBLIC WORKS DEPARTMENT

GOVERNMENT OF KERALA

KERALA STATE TRANSPORT PROJECT - II

EIA and EMP for
Kasargod – Kanhangad Road, Pilathara – Pappinisseri Road and Thalassery – Valavupara Road

Part I
Environmental Impact Assessment (EIA) Report

October 2012

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LIST OF ACRONYMS

ADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway & Transportation Officials
ADB	Asian Development Bank
ASI	Archaeological Survey of India
CADD	Computer Aided Design and Drafting
CARD	A German Software For Highway Design
COI	Corridor of Impact
CRZ	Coastal Regulation Zone
CW	Construction Works
CWRDM	Centre for Water Resource Development and Management
EAP	Environmental Action Plan
EASISM	Environmental and Social Impact Screening Model Developed by Consultants for Environmental and Social Assessment Screening of Road Projects
EIRR	Economical Internal Rate of Return
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMU	Environmental Management Unit
FIC	Financial Costs
FIDIC	Federation of Internationale des Ingeniers Conseils
GOI	Government of India
GOK	Government of Kerala
IRC	Indian Road Congress
IUCN	International Union for Conservation of Natural Resources
KFRI	Kerala Forest Research Institute
KSEB	Kerala State Electricity Board
KSTP	Kerala State Transport Project
MDR	Major District Roads
MOEF	Ministry of Environment and Forests
MOST	Ministry of Surface Transport
MORTH	Ministry of Road Transport and Highways
MLA	Member of Legislative Assembly
MSL	Mean Sea Level
NATPAC	National Association for Transportation Planning and Research Centre
NGO	Non Governmental Organization
NH	National Highway
NMT	Non Motorized Traffic
NOC	No Objection Certificates
NPV	Net Present Value
PAP	Projected Affected People
PCC	Project Co-Ordinating Consultants
PDF	Project Displaced Families
PIU	Project Implementation Unit
PIA	Project Influenced Area
PWD	Public Works Department
R & R	Resettlement and Rehabilitation

RAP	Resettlement Action Plan
ROW	Right of Way
RW	Road Wing
SEA	Sectoral Environmental Assessment
SH	State Highway
SIA	Social Impact Assessment
SOI	Survey of India
SOK	State of Kerala
SOS	Strategic Option Study
SPCB	State Pollution Control Board
STEC	State Committee on Science Technology And Environment
WB	World Bank
WWF	World Wild Life Fund

CHAPTER 1. INTRODUCTION

1.1. PROJECT BACKGROUND

Government of Kerala has decided to take up improvements of state roads with external assistance through Kerala State Transport Project (KSTP) and initially identified 1000 Km of roads for up-gradation in 1999. Feasibility studies conducted later prioritized the roads to be taken for improvements. Economic and social parameters played major roles in evolving the improvement options and the total length of the road considered for the study was later limited to 579 Km to be taken up in two stages, KSTP-I and II. In the KSTP-I, 254.8 Km roads were taken up for implementation with the assistance of World Bank and the project was completed recently. The road stretches considered in KSTP-I are listed in the Annexure 1.1. Currently, land acquisition works for KSTP II stretches are almost over and it is decided to take up improvements to balance 366.930 Km of roads under strategic financing options and contracting mechanisms. The state has applied for a loan from IBRD (World Bank) for implementing KSTP-II. The road stretches considered in KSTP-II are listed in the TABLE 1.1. This document comprises detailed EIA for the Kasaragod – Kanhangad (link 69), Pilathara - Pappinisseri (link 68) and Thalasseri-Valavupara (link 74) roads.

TABLE 1.1. ROADS UNDERTAKEN IN KERALA STATE TRANSPORT PROJECT - II

SL. NO	LINK NO.	ROAD NAME	LENGTH (KM)	EXISTING AVERAGE CARRIAGEWAY (CW) WIDTH (M)	PROPOSED CW WIDTH (M) (TOTAL IMPROVEMENT IS UP TO 15 M)
1	69.1	Kasaragod-Kanhangad	27.78	6.9	10
2	68.0	Pilathara-Pappinissery	20.90	6.7	10
3	74.0	Thalaserry-Valavupara	52.76	7.2	10
4	84.1-84.4	Punalur-Ponkunnam	82.11	5.9	10
5	84.5-84.8	Ponkunnam-Thodupuzha	50.32	6.4	10
6	4	Chengannor - Ettumanoor	40.880	7.8	10
7	5	Ettumanoor – Muvattupuzha	40.91	7.8	10
8	41.1 & 47	Perimbilavu – Pattambi - Perinthalmanna	47.345	--	10
Total			**363.005**		

The cumulative impacts of the project are the subject of a Sectoral Environmental Assessment (SEA) as the first step in the environmental approval process. The final SEA report was prepared and submitted to the World Bank and the State Public Works Department in October 2001. The SEA report indicates that corridor-specific EIA's would be prepared and circulated for review and comment for those road sections deemed to warrant such action in accordance with all appropriate GOI regulations and the World Bank's Operational Procedures. Details of these requirements are addressed in Chapter 3.

The objectives of the EIA study include but not limited to

- Evaluate potential impacts of the project
- Establish an engineering design philosophy that integrates environmental and social considerations into the project's detailed engineering design;
- Assess alternative project designs and provide input into project design;
- Design appropriate and practical mitigation and environmental management measures to be implemented during road construction and operation to avoid or minimize adverse impacts;
- Provide practical environmental and social management plans, including an Environmental Management Plan and a Resettlement Action Plan;
- Propose and design environmental enhancements to be incorporated in the project implementation plans.

1.2. EARLIER STUDIES

1.2.1. STRATEGIC OPTION STUDIES

The current project developed from the Strategic Option Study (SOS) report of April 1997. It recommended that 2810 km of roads be examined for feasibility following the investigation made of the State road network in terms of traffic flows and road capacities. The selection was made as those roads demanding the highest priority for investigation based upon the volume of traffic using each road, future traffic projections and the width and hence the capacity of the existing carriageway at that time. Excepting the Sabarimala pilgrimage season, no other environmental or social aspects were considered for the study.

1.2.2. FEASIBILITY STUDY

A feasibility study was carried out for the road network of 2810 km (68 links) identified by the SOS study except for 330 km of roads, which were later declared National Highways. However, at the time of their declaration as National Highways a number of surveys including environmental and social impact surveys had been conducted. These roads were then dropped from further study but the data already gathered were handed over to the Project Management Team (PMT)[1] as it could be useful for the National Highways division of the PWD.

1.2.3. ADDITIONAL FEASIBILITY STUDY

Following the initial feasibility study period, the Government of Kerala (GOK) proposed an additional 707 km of roads for investigation. As a result, the consultants had to carry out further reconnaissance surveys. Furthermore, since the SOS studies were conducted the entire socio-economic scenario had undergone major changes compared to other parts of India. The most notable changes were the establishment of a world-class international airport in Kochi (officially inaugurated in June 2000) and the declaration that Kerala as the first 100 % literate State in India.

[1] Formerly Project Implementation Unit(PIU)

1.2.4. RECONNAISSANCE WORK FOR ADDITIONAL FEASIBILITY STUDIES

The Louis Berger International (consultants) undertook further reconnaissance studies on the additional road sections. Some links could not be taken up under this project, as they required many kilometres of new roads along dense forests and sanctuaries.

1.2.5. SECTORAL ENVIRONMENTAL ASSESSMENT (SEA)

The SEA study undertaken has established that the two links under consideration in KSTP-II (Kasargod – Kanhangad Road and Pilthara – Pappinisseri Road) are passing through CRZ areas. Therefore CRZ clearance is required for these two project roads. The Project has to obtain consent to establish from the State Pollution Control Board (PCB). In the case of CRZ roads because of the World Bank's categorisation as Category *A* projects, and the requirement of CRZ Notification, 2011, an EIA report is to be prepared. This is the basis for the preparation of this document.

1.2.6. HIGH PRIORITY ROADS

The Feasibility Study identified approximately 1000 km of high priority roads, which required detailed design and associated studies in two or more Phases. The roads that are being subjected to detailed engineering studies are shown in **FIGURE 1.1**. The KSTP-I and KSTP-II roads are listed in **TABLE 1.1** and **TABLE 1.2**. The phase II designs were also completed in April 2001 except the documentation of the environmental and social reports. Further there were many design changes in the KSTP-1 roads including design changes for accommodating environmental and social aspects. As a result now the phase II designs are also being structured in the similar pattern.

1.2.7. KSTP ROAD SAFETY AUDIT REPORT

The Road Safety Audit was carried out at the request of the Government of Kerala and with the support of the World Bank and Design Consultants. There is no Road Safety Audit Manual for India or Kerala but Road Safety Audit is described in the *Manual for Safety In Road Design*, published by the Ministry of Surface Transport. The Road Safety Audit was specifically aimed at improving the 23 sections of highway in the Phase I and Phase II of the Kerala State Transport Project. The recommendations are being addressed by the Project.

1.2.8. EIA REPORTS PREPARED BY IN 1999

The EIA reports were prepared by the Louis Berger in 1999 for the all the project links. However, as land acquisition works could not be completed, GoK could not commence the project work.

1.2.9. ENVIRONMENTAL AND SOCIAL INDEPENDENT REVIEW REPORT, 2003

Further, in 2003, these projects were again considered for implementation. Being a Category A project, the World Bank requires an Independent Environmental and Social Review of all Environmental Assessment and Social documents including RAP by an independent Consultant. Accordingly, the review was carried out by SMEC in July 2003. Subsequently the EA documents were improved by Louis Berger in 2004, by suitably incorporating the independent review

observations and addressing the important recommendations of the KSTP-II environmental review consultants.

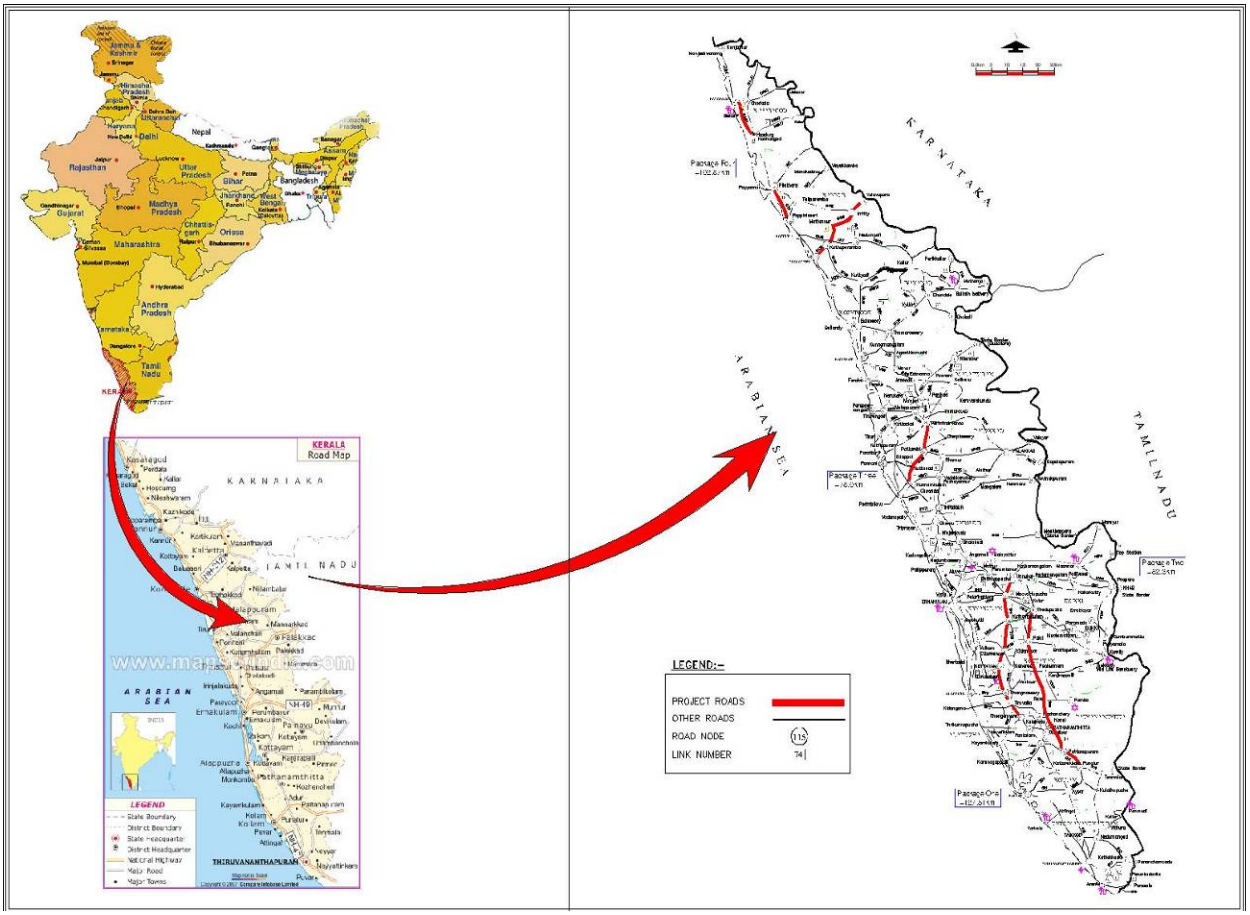


FIGURE 1.1. LOCATION MAP OF PROJECT ROADS IN KSTP PHASE II

Of these eight roads, detailed engineering designs and costing were done for the 7 roads excluding Perimbilavu – Pattambi - Perinthalmanna road in 2000 by the DPR Consultant. Later, a techno economic feasibility study of these roads was conducted by L&T RAMBOLL in 2010. L&T has taken up the study as the update of the feasibility report prepared in the year 2000. Topographic survey of the new road link Perimbilavu - Perinthalmanna also was completed by them and prepared a preliminary design and strip plan showing existing features and required land acquisition extent.

1.3. INDEPENDENT REVIEW OF EIA, 2012

Phase II of KSTP project is currently taken up for improvements under strategic financing options and contracting mechanisms by Government of Kerala. The state has applied for a loan from IBRD (World Bank) for the same. Land acquisition works for phase II stretches are almost over and it is decided to take up balance 366.93 km of roads. In this context, an independent review of EIA was undertaken by Wilbur Smith Asso. Pvt. Ltd., in 2012 for the three links - Kasaragod – Kanhangad (link 69), Pilathara - Pappinisseri (linlk 68) and Thalasseri-Valavupara (link 74) roads.

1.4. DOCUMENT ORGANISATION

Since all project roads including the three links considered in this report are part or sub projects of the same project (KSTP-II), current documentation is provided in the same structure, style and format as the earlier report prepared by Louis Berger. This approach has simplified the EIA process including review and evaluation to a certain extent.

The EIA is organized in accordance with the stipulations of the Environmental Impact Assessment Notification of 2006, GOI's *Handbook of Environmental Procedures and Guidelines* (1994), *Environmental Guidelines for Rail/Road and Highway Projects* and *EIA Guidance Manual for Highway Projects*. The World Bank guidelines were also considered and incorporated according to the World Bank Operational Policy 4.01 and the recommendations from World Bank Technical Paper Number 376: *Roads and the Environment: A Handbook*. Accordingly the entire document is organised in two volumes. Since all ecologically significant roads are considered in Phase II, independent review will be carried out for KSTP-II as required by the World Bank.

Part I - Environmental Impact Assessment (EIA) for the three links as a supporting document for the project road. It identifies the impacts and proposes measures to minimise and mitigate them. This does not include the land acquisition and other direct social impacts to private properties and structures. Refer the link to the Resettlement Action Plan (RAP) document at the end of this chapter for more details.

Part II - Environmental Management Plan; (EMP) is prepared separately for each of the three links. It comprises (i) a Generic Environmental Management Action Plan (Generic EMAP) for generic mitigation measures which are not directly linked to the site and (ii) a Link Specific Environmental Management Action Plan for those mitigation, which are specific to the location on site / link. Each of these is further separated to give separate EMAP for contractor and others. Accordingly, there are four types of EMAP table as follows:

1. Generic EMAP table for Contractor
2. Generic EMAP table for Others
3. Link Specific EMAP table for Contractor
4. Link Specific EMAP table for Others

all stand-alone Link-specific Environmental Management and Monitoring Plans for the three links prepared and submitted during February 2003 was later compiled and abridged to a single volume on WB request in order to reduce the number of bound volumes. The single volume Phase II EMP constitutes Part II of all EIA documents. Project Specific environmental management activities to be incorporated in both the construction and operational phases for each component of the Project are presented together with a monitoring plan specifying the type of monitoring proposed, the activities and/or conditions warranting environmental monitoring, the responsible agency or organization, the estimated costs and related factors.

TABLE 1.2. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT PARTS

<table>
<tr><td colspan="7">EXECUTIVE SUMMARY</td></tr>
<tr><td rowspan="5">PART I - ENVIRONMENTAL IMPACT ASSESSMENT
KASARGOD – KANHANGAD ROAD, PILATHARA – PAPPINISSERI ROAD AND THALASSERY – VALAVUPARA ROAD</td><td colspan="6">PART II - ENVIRONMENTAL MANAGEMENT PLAN</td></tr>
<tr><td colspan="2">VOLUME I – EMP FOR KASARGOD – KANJANGAD</td><td colspan="2">VOLUME II - EMP FOR PILATHARA – PAPPINISSERI</td><td colspan="2">VOLUME III - EMP FOR THALASSERY – VALAVUPARA</td></tr>
<tr><td>GENERIC EMAP</td><td>LINK SPECIFIC EMAP</td><td>GENERIC EMAP</td><td>LINK SPECIFIC EMAP</td><td>GENERIC EMAP</td><td>LINK SPECIFIC EMAP</td></tr>
<tr><td colspan="2">FOR CONTRACTOR*</td><td colspan="2">FOR CONTRACTOR*</td><td colspan="2">FOR CONTRACTOR*</td></tr>
<tr><td colspan="2">FOR PMT</td><td colspan="2">FOR PMT</td><td colspan="2">FOR PMT</td></tr>
</table>

The later part of the Volume 1 EIA[2] document is organized according to the World Bank requirements as follows:

Chapter 2 - Project Description-a brief description of the components of the KSTP Project, the manner in which the various proposed improvements were identified, and details of the proposed action along the project corridor.

Chapter 3 - Project Policy Legal and Administrative Frame Work-Presents the legal and administrative frame work of World Bank, Government of India, Government of Kerala and PWD. This section also highlights the various clearances required for the project.

Chapter 4 - Approach and Methodology-presents the methodology followed, different steps in the KSTP Environmental Assessment process, sources of data, data to be generated during the studies etc.

Chapter 5 - Baseline Conditions -an overview of the relevant aspects of the study area. The major headings of the statement of baseline conditions and the section that follows have been devised on the basis of MOEF's suggested outline and review procedures and supplemented to address World Bank concerns in specific sections:-

5.1: Natural Environment-presents the meteorological conditions of the area.

5.2: Regional Physical Setting-presents the physiography and drainage patterns; geology and seismology; soil conditions; existing and potential erosion patterns; and information with regard to quarries, crushers; and borrow pits.

5.3: Water Resources-presents the applicable water quality standards; existing surface water bodies and groundwater conditions; water resources and cross drainage structures within the project corridors/ potentially impacted areas (PIA).

5.4: Ambient Air Quality-presents the relevant air quality standards and the existing ambient air quality conditions, including a description of the locations of monitoring stations and the sampling and testing methods employed.

5.5: Ambient Noise Levels-presents the relevant noise standards and the existing ambient noise levels, including a description of the locations of monitoring stations and the sampling and testing methods employed.

[2] In this document EIA means EA and EMP considered together.

5.6: Flora, Fauna and Ecosystems-presents data with regard to mangrove/coastal ecosystems, forests and trees in the Project ROW.

5.7: Human Health and Safety-presents a discussion of health issues related to road projects, including available data with regard to the incidences of diseases and the relevance of truckers and the spread of disease as stipulated in the World Bank Guidelines. The topic has been expanded to address Road safety issues associated with the Kerala State Transport Project.

5.8: Cultural Resources-presents data with regard to shrines, monuments, temples and cultural artefacts.

5.9: Socio Economic Environment-In this section only those aspects, which helps to determine the impacts are provided.

Chapter 6 - Public Participation and Consultations-a description of coordination activities in the preparation of the EA, including coordination with Government Agencies, actions undertaken to obtain the views of local non-Government organizations (NGOs) and affected groups, and records of meetings and other activities, communications and comments.

Chapter 7 - Assessment of Potential Impacts -an examination of potential impacts related to the various construction activities during pre-construction, construction and post constructional phases. Chapter 7.0 follows basically the same sequence and numbering pattern as Chapter 5.0 to assist review.

Chapter 8 - Analysis of Alternatives-an examination of alignment, design and technical alternatives considered in the evolution of the Project

Chapter 9- Impact Mitigation and Avoidance-This Chapter is an examination of potential impact mitigation and avoidance actions related to them. This section follows essentially the same sequence and enumeration pattern as Chapter 5.0 and 7.0 to facilitate review.

Chapter 10 - Environmental Enhancement Measures-Enhancements are those, which further improve the road and will lead to the better acceptance of the project by the community. This includes tourism enhancements opportunities, parking areas for trucks, jeeps and other vehicles, bus stops, service areas, foot over bridges, aesthetically appealing road junctions, foot paths next to hospitals and educational institutions, pilgrim pathways.

1.4.1. RESETTLEMENT ACTION PLAN (RAP).

A separately bound Resettlement Action Plan (RAP) supplements the EIA. The preparation of the RAP has been completed. This report covers the Social Impacts such as Project Affected People, Project Displaced Persons, and the Action Plan for various activities associated with the land acquisition, compensation and rehabilitation.

CHAPTER 2. PROJECT DESCRIPTION

2.1. PROJECT LOCATION

The Project roads Pilathara-Pappinissery (Link 68) and Thalasseri-Valavupara (Link 74) are situated in the Kannur district of Kerala State and Kasargode-Kanjangad (Link 69) road is situated in the Kasargod district of Kerala State. The Kasaragod district is the northern most district of the Kerala State and Kannur is located immediately south of Kasaragod district. Among the various KSTP-I and KSTP-II roads, the link 68 and 69 are the farthest from the State capital. The locations of the link roads in the State of Kerala are shown in **FIGURE 2.1** to **FIGURE 2.3**. The map shows the most important roads of the region with respect to the project road under consideration.

Kasargode-Kanjangad section of length 28.60 km is a part of State Highway-57 which starts at Kasargode (Chainage –0+000) and ends at Kanjangad South (Chainage – 28+600), the total length of the stretch being 28.60 km. SH 57 runs parallel to NH – 17 which is one of the major NHs in Kerala. The project road lies in the Kasargode District in Kerala and passes through Uduma, Pallikkara, Chithari, Ajanoor and Hosdurg.

The Pilathara-Pappinisseri section of length 20.9km starts at Pilathara and ends at Pappinisseri, NH 66. This road lies in the district of Kannur and passes through Pazhayangadi and Kannapuram.

The Thalasserry- Valavupara section of 52.736 km length starts at Thalasserry and ends at Valavupara.This road lies in the district of Kannur and passes though Koothuparambu, Iritty and Mattannur.

FIGURE 2.1. LOCATION MAP OF KASARGOD – KANHANGAD ROAD

FIGURE 2.2. LOCATION MAP OF PILATHARA – PAPPINISERRY ROAD

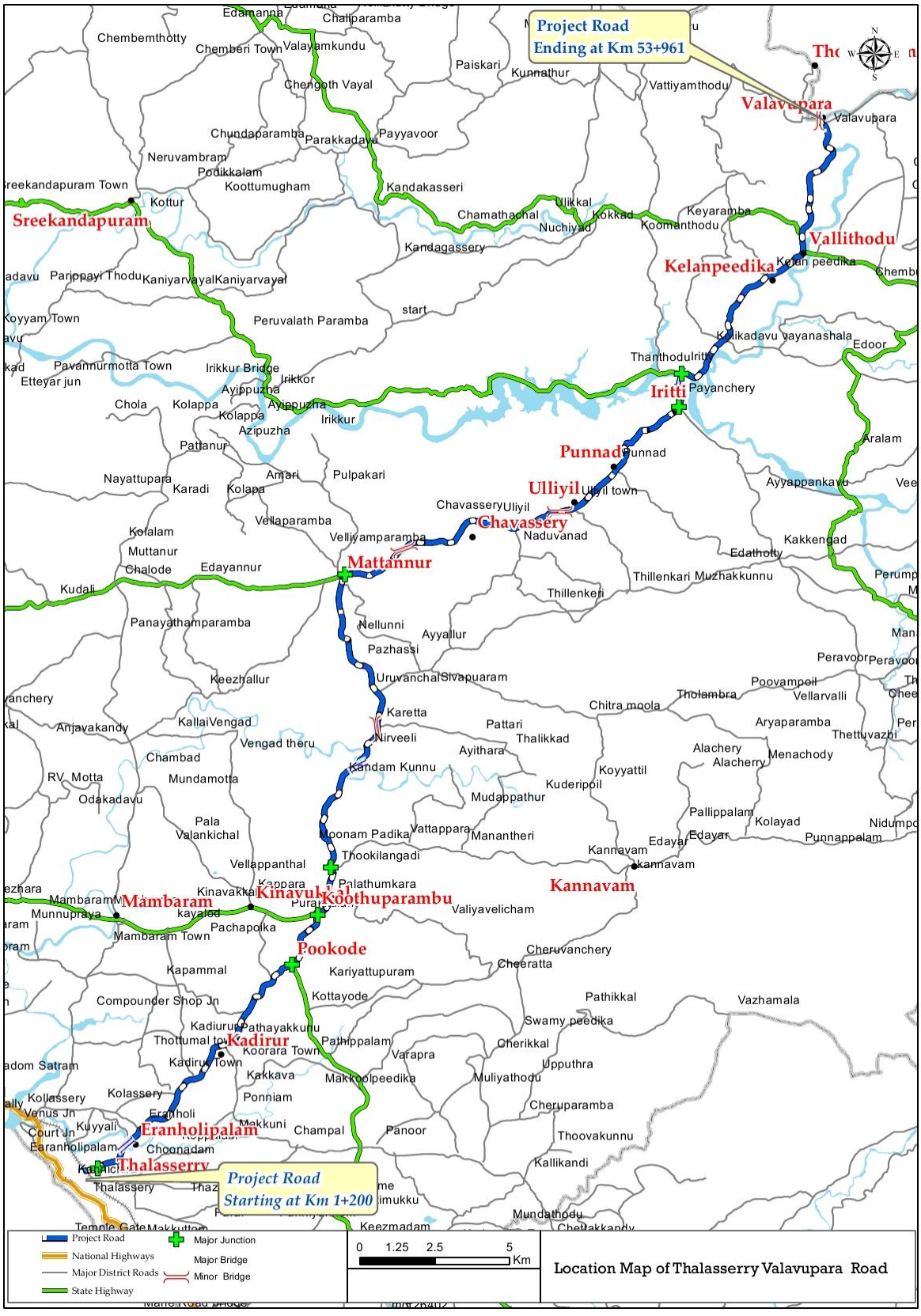


FIGURE 2.3. LOCATION MAP OF THALASSERY – VALAVUPARA ROAD

2.2. PHYSICAL DETAILS OF THE PROJECT CORRIDOR

Various surveys including those for environmental and social impacts have been carried out for the project roads. These were conducted during the Feasibility Study and updated during the revision of EIA. The ROW varies from 12.5m to 15 m and carriageway is throughout 10m for all the three project roads. At four lane locations, the ROW is more than 15 m. The traffic load estimated along KK road is AADT of 10616 vehicles and 11062 PCU. The traffic load estimated along PP road is AADT of 8353 vehicles and 8992 PCU. The traffic load estimated along TV road is AADT of 11078 vehicles and 12976 PCU. The estimated Economic Internal Rate of Return (EIRR) for the KK road (road link 69) is 35.7%, PP road (road link 68) is 38.02% and that of TV road (road link 74) is 20.91%. The ENPV for the KK road (road link 69) is 1,890.92 Million, PP road (road link 68) is 1,656.78 Million and that of TV road (road link 74) is 926.30 Million. The various environmental characteristics available for the physiographic locations-low land, mid land and high land (details of adjoining mid land also provided) of the links roads are provided in **TABLE 2.1.**

TABLE 2.1. ENVIRONMENTAL CHARACTERISTICS OF THE LINK ROADS

Sl. No.	Environmental Parameters	Link 68	Link 69	Link 74
1.	Topography	Plain to Hills and valleys	Plain to Hills and valleys	Nearly level to very gently sloping plain and moderately to steeply sloping ridges.
2.	Geology	Alluvium Charnockites Gneiss Sandy soil Lateritic soil	Alluvium Charnockites Sandy soil Lateritic soil	Soil alluvium, Charnockites, Dharwar (metavolcanic, meta sediments) and cordierite gneiss, Hornblende Biotitic gneiss and other unclassified crystalline.
3.	Annual Rainfall	2923 mm (average)	3593 mm (average)	2923 mm (average)
4.	Flood potential	Very common	Very common	Floods during monsoon
5.	Rivers / Streams / Irrigation canals / lakes / backwaters / ponds / chira	Valapattanam, Palayangadi river, Ramapuram River Kannpuram River ,Sulthan canal	Chanadragiri river, Chittari river, Nileswar river.	Eranholi river, Anjarakandi river. Valapattanam river and a number of other streams cross the road. Charal River parallel to the road for the last eight km.
6.	Soil	River alluvium, Brown Hydromorphic, Lateritic soil, Cosatal beach sand soil.	River alluvium, Brown Hydromorphic, Lateritic soil, Cosatal beach sand soil.	*Coastal alluvium, Red loam, Lateritic soil and Forest loam.*
7.	Erosion	Vigorous erosion during monsoon	Vigorous erosion during monsoon	Vigorous erosion during monsoon
8.	Mineral Resources	Deposits of ilmanite and clay in the PIA district.	Deposits of ilmanite and clay in the PIA district.	Deposits of ilmanite and clay in the PIA district.
9.	Industrial Development	The PIA district is moderately developed industrially	The PIA district is moderately developed industrially	The PIA district is not moderately developed industrially. Only four industrial units were identified in the project corridor.
10.	Land Use	Predominantly built up interspersed with agricultural areas	Predominantly built up interspersed with agricultural areas	Predominantly built up interspersed with agricultural areas
11.	Agriculture	Coconut, Paddy, Pepper, Ginger,	Coconut, Paddy, Pepper, Ginger,	Paddy fields, Coconut, Arecanut,

Sl. No.	Environmental Parameters	Link 68	Link 69	Link 74
		Tapioca	Tapioca	Banana, Pepper, Coco, Cashew, Teak, Rubber, Tapioca
12.	Vegetation (Private / Public)	Banyan tree, Tamarind Jackfruit tree, Mangoes	Banyan tree, Tamarind Jackfruit tree, Mangoes	Plantations and agricultural fields. No continuous avenue plantations.
13.	Parks, Sanctuaries	No Parks/Santuaries within the Project impat zone	No Parks/Santuaries within the Project impat zone	Aralam Sanctuary located beyond seven km
14.	Forest Land	No forestland identified.	No forestland identified.	No forestland identified.
15.	Endangered species	None identified	None identified	None identified
16.	Coastal Zone Regulation	Valapattanam north bank in Pappinissery Panchayat in CRZ-1, Stream crossing at Kannapuram, Eastern bank of the Thaliparamba-Pazhayangadi riverine system at Pungavu, Punnasseri to south bank of Pazhayangadi river, Northern bank of Pazhayangadi river, Ramapuram river crossing at Adithala are in CRZ-III	Bekal Fort & beach Seacoast north of Bekal including Bekal river crossing and Seacoast near Kottikulam Are in CRZ – I, Chittari river crossing at Chittari , Seacoast near Pallikara upto Bekal , Stream crossing at Kalanad, Stream crossing at Paravandaka , Stream crossing at Chammanad, South bank of Chandragiri river and North bank of Chandragiri are in CRZ-III	At Eranholi river where new bridge is proposed is fall in CRZ I A and CRZ IV
17.	Cultural resources, Historic, Religious Sites and Temples	There are 24 identified cultural properties along the project corridor. This include Temples, Mosques, Churches, Cremation ground, Hundi and shrine (very small religious place)	Hosdurg fort , Bekal fort , Chanadragiri Fort. And Ajanur are the	Five Temples, Four Churches, 30 Mosques and 10 Shrines identified on project corridor.
18.	Sensitive Noise Receptors	A number of schools and a few hospitals have been identified adjacent to the road corridor	A number of schools have been identified adjacent to the road corridor	22 schools, one college and 11 hospitals.
19.	Tourism	Important tourist locations such as Bakel fort, Chandragiri Fort are located adjacent to the road.	Tourism potential for Pappinisseri, where scenic beauty of natural mangroves patches exists	Important tourist locations such as Mahe, Iritti, Thalaserry located around the road.

2.3. IMPROVEMENT ALTERNATIVE CONSIDERED

The improvement alternatives considered by the consultants have generally been

- Improve to a 7.0 m wide carriageway with sealed shoulders and lined drains
- Improve to a 7.0 m main carriageway with two 1.5 m wide auxiliary lanes and 2.5 m sealed shoulders (total 15 m) and Improve to dual two lane carriageways (later abandoned).

A detailed analysis of alternatives is provided in the Chapter 8. The **BOX 2.1** briefly described the need for the improvement of Project roads in Kerala.

The Kasargod –Kanganhad and Pilathara – Pappinisseri project roads will provide a short cut to the vehicles operating through the National Highway-66 (NH-66, formerly NH 17) with a one way saving of 5-8 km. The State road network in Kerala generally provides a communication corridor for shorter journeys between the many towns and market centres and is not intended to compete with the National Highway System which provides for longer journeys and inter-state travel at greater speeds. The proposed treatments for all links are shown in **TABLE 1.2**.

BOX 2.1: Need of the Kerala State Transport Project

Transport development plays a crucial role in improving the States economic performance and to enhance the well being of its population. The growing tourism and industrial sectors in particular generate substantial demand for an increased road capacity. The present poor physical condition of the road network drains the economy considerably by way of a high rate of accidents, delays and high vehicle operating costs. There is an urgent need to improve pedestrian safety especially the provision of footpaths along many of the project roads. These highways are generally paved, single to two lane roads with widely varying traffic volumes. The identified State Highways and Major District Roads as having the highest priority for attention by virtue of their reduced carriageway width and/ or pavement condition, which result in capacity constraints for the volume of traffic that they carry, and their connectivity. The coastal link 68 being a sub project of KSTP it's development is vital in this region.

2.3.1. DEFINITION OF TERMS USED IN THE PROJECT

Nodes: Nodes are numbers representing urban centres or important road junctions usually used for start or termination points of project links.

Links and Sub-links: All project roads were identified by link numbers in the Project feasibility report of April 2000. According to this the 67 Links represented 2810 km of roads as identified by the SOS for detailed feasibility studies. A sub-link is a part of any specific project road (e.g. Link 58 has sub-links 58A and 58B or 58.1 and 58.2). Sub-links were created to identify differing conditions of traffic flow or road condition / geometry for the HDM analysis. Additional links were added to accommodate the additional 707 km.

Package: Packages were formulated for the purpose of creating attractive construction contracts to larger National and International Contractors. A package average of 100 km of project roads made up of two or more links. Contractors will not take interest to contracts if they are not of

sufficient size and profitability to merit attention. A Contractor may bid for more than one Contract. There are six contract packages identified in the Kerala State Transport Project.

ROW: The Right of Way is the land area legally available to the State PWD. Actual Right of way can only be established after a physical verification of all adjoining properties. The ROW is sometimes encroached upon both sides. ROW details were not made available to the consultants beyond the physical appearance of the Highway, which has been open to the public for unrestricted access. This aspect has been covered in detail in the RAP.

Available Corridor: Since the legal ROW details are not available the consultants were advised by the Client to consider the existing corridor width that is physically available and hence it is referred to as Available Corridor for the purpose of project preparation.

Realignment: Realignment usually refers to an increase in the horizontal curve radius but may be generally applied to any change in the vertical or horizontal alignment of a road.

Puramboke land: Puramboke land is of questionable ownership and is treated as revenue land for various Government requirements.

Project Influenced Area (PIA); the detailed definition of the term is furnished in Chapter 4. For all normal proposes the PIA is taken as the Corridor of Impact, i.e. 7 km on either side of the road thus requiring documentation of 14 km with the road as the centreline. However for some parameters this is not sufficient and hence much bigger areas like the District (transport accessibility by air, road or rail) in certain cases and the State (population, literacy etc) as a whole in certain other cases were considered.

Private trees: These are trees situated in the private properties within the required corridor, which will have to be compensated for in monitory terms according to the Resettlement Action Plan. In addition according to the tree planting strategy, two trees will be for each private tree lost.

Public trees: Public trees are those trees that are located within the available corridor of PWD or on Puramboke Land (nobodies land but accounted as land of Revenue department)

Corridor of Impact (COI): According to the MOEF requirements the general study area is seven kilometres on either side of the Project road.

Impact Corridor (IC): The environmental data has been collected for approximately 20 metres on either side as the immediate project impact area.

Bypass: A bypass is the term usually applied to a road, which provides an alternate route around a congested urban area. This normally helps to divert through traffic away from using the urban centre.

2.3.2. THE PROPOSED IMPROVEMENT WORK

The scope of work to be undertaken within the Kasargod – Kanhangad, Pilathara-Pappinissery and Thalassery – Valavupara project road improvement activities will include:

- Raising the formation level,

- Widening to 10 m wide carriageway from the existing intermediate lane width, pavement-strengthening,
- Drainage improvement with lined drains in urban areas/ or heavily built up areas
- Ducts of standard size on either side to take the utilities in urban areas and
- Drains under foot path in the narrow sections of built up areas
- Footpaths will be provided only in heavily built up areas adjacent to schools, hospitals etc.
- 2.5m wide sealed shoulders were planned but the client wished the 1.5m paved slow lanes to take up part of the width.
- Widening of the carriageway and associated land acquisition to expand the highway to two lanes or to the required width.
- Most of the available corridors widths vary within each link and could not accommodate the widening to two lanes without additional acquisition of land. The available corridor width is not consistent.

Construction of new parallel bridges. Construction of new parallel bridges to the existing major bridges (span greater than six meters) and widening of minor bridges to provide a minimum width of 8 metres.

Replacement of culverts and Construction of new culverts. The replacement/ rehabilitating of culverts will accommodate two full lanes for the full formation width.

Bypass. No bypasses have been considered under the project.

Realignment. Four realignments are considered in the project. All are located in this section.

Road safety measures (Bus Stops and Parking Area). Car parking areas may be provided wherever there is space available away from junctions and pedestrian crossings. The provision of bus lay-bys is included in the design.

Implementation of a Resettlement Action Plan (RAP). The RAP has been prepared separately and the implementation of the RAP is nearly completion. A separate RAP implementation report has also been prepared.

Summary of proposed improvement activities for the link roads are presented in **TABLE 2.2**. Contract may review and get approval from engineer in change for locations of all the improvement proposal.

TABLE 2.2. SUMMARY OF IMPROVEMENT PROPOSAL

Sl. No.	Particulars	Link 69	Link 68	Link 74
1	Starting Chainage	km 0+000 (Kasargod)	km 0+000 (Pilathara)	km 1+200 (Thalassery)
2	Ending Chainage	km 27+744 (Kanhangad)	km 20+900 (Pappinisseri)	km 53+936 (Valavupara)
3	Length	27.74 km	20.90 km	52.736 km
4	Classification	State Highway SH 57	Major District Road	State Highway SH 30
5	Proposed RoW	Min - 13 m & Max - 20m	Min - 13 m & Max - 20m	Min - 13 m & Max - 20m
6	Proposed Carriage Way width along with Paved shoulder	Built-up areas: 10m wide Rural areas: 10m	Built-up areas: 10m Rural areas: 10m wide ROB Location: 7.5m CW with 3.5m service roads	Built-up areas: 10m wide Rural areas: 10m
7	Junction Improvements	Major junctions- 4 Nos Minor junctions- 126 Nos	Major junctions - 3 Minor junctions - 77	Major junctions - 7 Nos Minor junctions - 185 Nos
8	Pavement Composition Details	Existing CW: Overlaid with 40mm BC+ PCC Widening: 40 BC + 75 DBM+ 250 WMM+200 GSB	Existing CW: Overlaid with 40mm BC+ PCC Widening: 40 BC + 75 DBM+ 250 WMM+200 GSB	Existing CW: Overlaid with 40 BC + 60 DBM + PCC Widening: 40BC+60 DBM+300WMM+200 GSB
9	Drains (both sides)	22194 m	20194 m	78423 m
10	Passenger Shelter	43 Nos	37 Nos	57 Nos
11	Crash barrier	1010 m	3260 m	1120 m
12	Pedestrian guard rail	4912 m	5365 m	7861 m
13	Parking spaces (Taxi, Auto Jeep)	Existing: 19 Nos New: 12 Nos	Existing: 9 Nos New: 3 Nos	Existing: 7 Nos New: 1 Nos
14	Oxbow Land	4 No's.	4 Nos.	31 Nos.
15	Bridge / Culvert	Total - 59 No's Major Bridge – 3 No's Minor bridge – 3 No's Viaduct – 1No ROB – 2 No's Culverts – 50 No's	Total - 43 Nos. Major Bridge – 1 No's Minor bridge 2 No's ROB – 2 No's Culverts – 38 No's	Total – 190 No's Major Bridge – 3 No' Minor bridge – 4 No's ROB – 1 No's Culverts – 182 No's
16	Noise Barrier	At all educational buildings for an height of 2 to 3 m-total length 42m	94 m at educational building areas	32 locations
17	Protection measures	Retaining wall- 4310m (including both sides), Stone Pitching 335 m, Turfing length – 16350m on LHS, 15750m on RHS	Stone Pitching 240 m including both sides, Turfing length – 480m including both sides	Retaining wall- 34300 m (including both sides)

2.4. DESIGN CROSS SECTIONS

A project description must entail the design cross sections to identify impacts for the chosen design cross sections adopted for the project road at various chainages. The relationship in general terms are very clear. A narrow cross-section against the existing wider ROW results in reduced impacts and vice versa. Generally there are thirteen types of design cross sections, the details of which are given in Annexure 2.1 to 2.3

2.5. OBJECTIVES AND BENEFITS

The objectives of the Project (KSTP) are to alleviate the current unsafe and congested conditions of the project road connecting the villages and towns, with one another and to the National Highway network for the benefit of the road users at large. A modest design speed for the safe and efficient movement of people and goods is seen as the objective and the designs of consultants reflect this. If this can be achieved it will represent a considerable improvement in the human environment. Most travellers presently face considerable anxiety in their daily use of the highway system; this is applicable to all pedestrians, drivers and passengers. With proper traffic engineering and enforcement of the rules of the road regulations there should also be a marked reduction in road traffic accidents.

2.6. DESCRIPTION OF MAJOR FEATURES

Major features of the Project improvements are as follows.

2.6.1. ROAD WIDENING

A total of three main cross-sections have been devised as illustrated in **FIGURE 2.4 to 2.10**. These sections are designed to take the urban, semi-urban and rural areas. For example the design **Type-1** Two Lane C/S is meant for at Urban Area with paved Footpath cum Hand Rail and Covered Drain and Type 2 'Two Lane C/S with paved Footpath cum Hand Rail and Covered Drain' meant for urban area is designed for the narrow corridor at urban sections. These sections are not required at rural sections where the width will be sufficient for drain and the paved/unpaved shoulders. These Figures graphically indicate the locations at which the various cross-sections will be employed. The three main cross-sections apply to the various portions of the three projects road widening and improvement activities.

2.6.2. TREE REMOVAL AND TREE PLANTING

The KSTP project will not encourage linear avenue planting on the roadsides due to the limited width and also due to the road safety concerns. This is discussed elaborately in the document titled ***'Landscaping, Tree planting and Environmental Enhancement Plan'*** provided in **Annexure 5.54** of Part II Environmental Management Plan. Nevertheless the project will provide adequate land in the abandoned sections due to numerous realignment options. The Puramboke land formed during the land acquisition process and the design options will also be used for plantations. The project incorporates a tree-planting scheme in which trees lost due to widening and other construction activities in the project will be replaced at a rate of three to one according to the provision of the Indian Forest Act.

2.6.3. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

A separately bound Environmental Management Plan is part of the EIA document. The Environmental Management plan addresses the following construction aspects. These include

- Water supply- Refers to water supply requirements at construction camps, construction, and also for the lost drinking water resources during resettlement and rehabilitation.
- Power plants- Refers to power plants required at camps, plants and at the construction sites etc.
- Raw materials- Raw materials are required for constriction of camps, plants etc
- Construction camps-This include camps for managers, engineers, technicians, laborers etc.
- Housing- This refers to all housing requirement at plant sites, camps etc.
- Quarries- Refers to quarries for the construction works
- Blasting - Refers to any blasting requirement at quarries, approach roads borrow areas etc.
- Access roads – required at camps, plant sites borrow areas and quarry areas
- Hazardous materials – require at plant sites, quarries etc
- Waste (all kind of solid and liquid wastes) quantities generated- wastes will be generated at construction zones, camps, plant sites etc.

Relevance of these items is discussed at the appropriate sections in the remainder of the document.

2.6.4. RESETTLEMENT ACTION PLAN

The social impacts especially the direct social impacts involving land acquisition are dealt separately in a separately bound Resettlement Action Plan prepared for KSTP-II roads. In order to make the land acquisition process transparent and easier, the State Government in 2000 formulated a separate resettlement policy.

In addition to the data provided here, social impacts and procedures associated with the project are the subject of a Resettlement Action Plan (RAP), the provisions of which are incorporated herein by reference. The entire exercise has been comprehensive in terms of time required for land acquisition and all associated procedures and economic feasibility. The final design decisions have substantially reduced the PAPs and PDPs.

2.7. SUMMARY OF FEATURES

Construction works are identified for the project roads within the Kerala State Transport Project. Those for these corridors are as follows:

- Widening to the required width
- Rehabilitation/replacement of bridges and culverts
- Provision of drainage
- Raising of the formation level at likely flood sections
- Provision of pedestrian facilities and road shoulders
- Tree planting
- Parking facilities
- Mitigation measures according to the CRZ regulations

- Other Environmental enhancement actions.

2.8. COST FOR THE PROPOSED LINK ROADS IMPROVEMENT

Cost estimates were prepared following the analysis of several alternatives of road widening, realignment, and pavement composition and included in the project (KSTP) Feasibility Study. The cost details are included in the Detailed Design Report. The estimates are based on the development of costs for various construction items including:

- Typical road components;
- Quantities of road components for various alternatives;
- Land acquisition,
- Resettlement and rehabilitation (R&R) costs,
- Environmental mitigation and enhancement costs,
- Contingencies including utility relocation costs,
- Engineering supervision and administration costs.

2.9. CONTRACT PACKAGES

The three project roads that are located at or near to the coastal zone are included in the Contract Package 4. The project road Pilathara-Pappinissery (Link 68) and Kasaragod- Kanhangad (Link 69) are located parallel to the coastal belt and the project Road Thalasseri – Valavupara road (Link 74) originate from Thalassery, which is a coastal town and extend up to Valavupara in Kerala – Karnataka Border.. This Link 74 Thalassery-Valavupara road is located perpendicular to the coast connecting lowland to midland, highland and finally to the Karnataka State. These project roads have been taken up for detailed engineering following the completion of the feasibility studies.

CHAPTER 3. APPLICABLE POLICIES AND LEGAL FRAME WORK

3.1. ENVIRONMENTAL LEGISLATION FRAMEWORK OF GOVERNMENT OF INDIA

The various prevailing environmental acts and rules relevant to the PWD activities are listed here. This includes National Acts & Rules administered by the Ministry of Environment & Forests, other National legislation that are relevant and State Acts & Rules

3.1.1. THE ENVIRONMENT (PROTECTION) ACT, 1986

This act provides for the protection and improvement of environment. It extends to the whole of India. The EA identifies Central and State Government standards set for the quality of the environment; emission or discharge of environmental pollutants; procedures and safeguards for handling hazardous substances; and relevant restricted development areas. The EIA document examines processes, materials and substances with potential to cause environmental pollution. The EA assesses if relevant standards will be breached, and confirms that relevant procedures and safeguards will be followed. Document includes procedures and safeguards for the prevention of accidents, which may cause environmental pollution and remedial measures for such pollution. The EA identifies mechanisms to notify the relevant authority in the event of a discharge of pollution exceeding the standards set.

3.1.2. THE ENVIRONMENTAL IMPACT ASSESSMENT NOTIFICATION 2006

The EIA notification dated 14th September, 2006 imposes certain restrictions and prohibitions on new projects or activities, or on the expansion or modernization of existing projects or activities based on their potential environmental impacts as indicated in the schedule to the notification, being undertaken in any part of India, unless prior environmental clearance has been accorded in accordance with the objectives of National Environment Policy as approved by the Union Cabinet on 18th May, 2006 and the procedure specified in the notification, by the Central Government or the State or Union territory Level Environment Impact Assessment Authority (SEIAA).

The notification has listed out the Projects or activities requiring prior environmental clearance under Category "A" and "B" based on the spatial extent of potential impacts, and potential impacts on human health and natural and man made resources. Category "A" projects require prior environmental clearance from MoEF on the recommendations of an Expert Appraisal Committee (EAC) and Category "B" projects require prior environmental clearance from State or Union territory Level Environment Impact Assessment Authority (SEIAA) on the recommendations of a State or Union territory Level Expert Appraisal Committee (SEAC). In the absence of a duly constituted SEIAA or SEAC, a category "B" project shall be treated as a Category "A" project.

New National Highways and expansion of National Highways greater than 30 km, involving additional right of way greater than 20m involving land acquisition is categorized as "A". All new

State Highway projects and State Highway expansion projects in hilly terrain (above1,000 m AMSL) and or ecologically sensitive areas are categorized as "B".Any project specified in Category 'B' will be treated as Category A, if located in whole or in part within 10 km from the boundary of: (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive areas and (iv) inter-State boundaries and international boundaries.

The Expert Appraisal Committee (EAC) shall determine the Terms of Reference for conducting the EIA based on the information furnished in the prescribed application Form 1. For grant of environmental clearance, they will carry out a detailed scrutiny of the application and other documents like the Final EIA report, outcome of the public consultations including public hearing proceedings, proceedings to which the applicant shall be invited for furnishing necessary clarifications in person or through an authorized representative. On conclusion of this proceeding, the EAC shall make categorical recommendations to the regulatory authority concerned either for grant of environmental clearance on stipulated terms and conditions, or for resubmission/rejection of the application for environmental clearance, together with reasons for the same.

The provision of above notification is not applicable for the project and hence doesn't require environmental clearance. Since proposed project envisages the expansion of the existing State Highway and it is not located in hilly terrain (above1,000 m AMSL) or ecologically sensitive areas.

3.1.3. COASTAL REGULATION ZONE NOTIFICATION, 2011

Vide CRZ Notification 2011, the Central Government has declared the coastal stretches of the country and the water area up to its territorial water limit as Coastal Regulation Zone and imposed restrictions on the setting up and expansion of industries, operations or processes etc. in the said Coastal Regulation Zone (CRZ). Following areas fall under CRZ:

1. The land area from High Tide Line to 500mts on the landward side along the sea front.
2. Land area between HTL to 100 mts or width of the creek whichever is less on the landward side along the tidal influenced water bodies that are connected to the sea.
3. The land area falling between the hazard line and 500mts from HTL on the landward side, in case of seafront and between the hazard line and 100mts line in case of tidal influenced water body.
4. Land area between HTL and LTL.
5. The water and the bed area between the LTL to the territorial water limit (12 Nm) in case of sea and the water and the bed area between LTL at the bank to the LTL on the opposite side of the bank, of tidal influenced water bodies.

Categorization of CRZ

I. CRZ I
    A. The areas that are ecologically sensitive and the geomorphological features which play a role in the maintaining the integrity of the coast.
    B. The area between Low Tide Line and High Tide Line.
II. CRZ II

A. The areas that have been developed up to or close to the shoreline.

III. CRZ III

A. The areas that are relatively undisturbed and those do not belong to either CRZ I or II which include coastal zone in the rural areas.

IV. CRZ IV

A. The water area from the Low Tide Line to twelve nautical miles on the seaward side.

B. The water area of the tidal influenced water body from the mouth of the water body at the sea upto the influence of tide which is measured as five parts per thousand during the driest season of the year.

V. Areas requiring special consideration

A. (i) CRZ area falling within municipal limits of Greater Mumbai.
(ii) The CRZ areas of Kerala including the backwaters and backwater islands.
(iii) CRZ areas of Goa.

B. Critically Vulnerable Coastal Areas (CVCA) such as Sunderbans region of West Bengal and other ecologically sensitive areas.

Activities permissible in CRZ under this notification are regulated and clearance needs to be obtained from the State Coastal Zone Management Authority for all permissible activities and subsequently from MoEF for the projects not covered in the EIA notification, 2006 but attracting para 4(ii) of the CRZ notification.

Applicable, as the project roads falls in CRZ areas at different locations, clearance has to be obtained from State Coastal Zone Management Authority as per CRZ Notification, 2011.

3.1.4. FOREST (CONSERVATION) ACT 1980

The Forest (Conservation) Act, 1980 prohibits diversion of forestland for non-forest use. As amended in 1988, no State Government or Authority shall make such diversions except with the prior approval of the Central Government.

Section 2 of the Act restricts the State Government on the de-reservation of forests or use of forestland for non-forest purpose. Section 3 of the Act empowers the Central Government to constitute an Advisory Committee (to advice the Government on the proposals received by it for the use of forest land for non-forest purposes).

Guidelines for diversion of Forest lands for non Forest Purpose, 2004

As per the above guidelines for compensatory afforestation, a special provision was made for central government projects which states that,

Compensatory afforestation may be raised on degraded forest land twice the extent of forest area being diverted. Certificate of Chief Secretary regarding non-availability of non-forest land for compensatory afforestation will not be insisted.

The State Governments will identify `blank forest' or degraded forest lands for compensatory afforestation. The State Governments of Madhya Pradesh and Rajasthan will identify such

degraded forest land in their States for compensatory afforestation of central projects in their respective States as indicated by the Chief Secretaries of these two States in the meeting of Committee of Secretaries held on 15.11.96.

Hence, twice the area of forest land diverted for the project has to be compensated under the Compensatory afforestation plan.

Not applicable, as the project road does not requires diversion of forest land for widening of existing road it does not require forest clearance under Forest Conservation Act, 1980.

Applicability of Forest (Conservation) Act to Roadside Strip Plantations

Large-scale plantations have been taken up by different state governments under social forestry and other programmes along the linear strips of lands, which had been acquired by Government Departments like Railway, Irrigation, PWD, etc. for specific purposes like laying of roads, railway lines and canals. In order to have a better control and management of these linear patches in many places these have been notified as protected forests. In the case of road projects, 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 18 February 1998. The new notification recognizes that the spirit behind the Forest (Conservation) Act was conservation of natural forests and not strip plantations.

In the case of roadside plantations notified to be protected, 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.

In the case of roadside plantations not yet notified as protected forests will not attract the provisions of Forest (Conservation) Act, 1980 for the purposes of widening or expansion or re-alignment. However, permission from District Collector for each district is required to obtain for the cutting and transportation of trees along the road.

3.1.5. THE WATER (PREVENTION & CONTROL OF POLLUTION) ACT, 1974

This provides for the prevention and control of water pollution and the maintaining and restoring of the wholesomeness of water. 'Pollution' means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms.

The act resulted in the establishment of the Central and State level Pollution Control Boards whose responsibilities include managing water quality and effluent standards, as well as monitoring water quality, prosecuting offenders and issuing licenses for construction and operation of certain facilities. The project requires consent for establishment (CFE) from the State Pollution Control Board pursuant to the Water (Prevention and Control of Pollution) Act, 1974, since the project activity involves in discharge of waste water from labour camps.

3.1.6. THE AIR (PREVENTION AND CONTROL OF POLLUTION) ACT, 1981

This Act provides for the prevention, control and abatement of air pollution. It is triggered by air polluting activity in an air pollution control area or when emissions of any air pollutant into the atmosphere exceed the standards set b the Central and State Boards.

The EA identifies air pollution control areas. The document identifies all air polluting activities and sources associated with the project. EA confirms that consent will be obtained for air pollution control area. The Environmental report describes mechanisms requested for the operation of industrial equipment to notify the State Board of an unforeseen release of air pollutants exceeding the standards. Remedial measures proposed to mitigate air pollution in air pollution control areas are described.

3.1.7. NOISE POLLUTION (REGULATION AND CONTROL) RULES 2000

As a result of considering the deleterious and psychological effects of the noise pollution on the human well-being, MOEF has drawn up the above rules, which have come to force with effect from February 14, 2000. According to the provisions of the rules notified a person might make a complaint to the designated 'Authority' in the event that the actual noise levels exceed the ambient noise standards by 10dB(A) or more as compared to the prescribed standards. The designated authority will take action against the violator in accordance with the provisions of these rules or other law in force.

The EA identifies all 'industrial', 'commercial', 'residential' and 'silent' zones within the project study area. EA assesses if the levels of noise generated by the project in any area exceeded the ambient air quality standards in respect of noise as specified in the Schedule of the Rules. The EA describes noise pollution control measures to achieve compliance with the ambient air quality standards in respect of noise. The EA document considers if a loudspeaker or public address system is needed for Project.

3.1.8. BIOLOGICAL DIVERSITY ACT, 2000

This Bill prevents persons undertaking biodiversity related activities without approval from the National Biodiversity Authority. It extends to the whole of India, and approval is required from the National Biodiversity Authority. There are particular restrictions if the Project involves the participation of non-Indian persons. The EA assesses if any biological resource is required for the Project (plants, animals and micro organisms or parts thereof). EA assesses if bio-survey or bio-utilisation is needed for the Project (surveyor collection of species, etc for any purpose). EA document outlines measure to avoid or minimize effects on biodiversity. This act is not applicable

for the project, since no biological resources (plants, animals and micro organisms or parts thereof) are required for the project

3.1.9. THE WETLANDS (CONSERVATION AND MANAGEMENT) RULES, 2010

The Ministry of Environment and Forests today notified the Wetlands (Conservation and Management) Rules, 2010. These Rules have been drafted by the Ministry of Environment and Forests to ensure better conservation and management and to prevent degradation of existing wetlands in India.

Wetland conservation has been accorded a high priority in India. Since 1987, the National Wetlands Conservation Programme of India has been financially supporting wetland conservation activities all over India. Under the Programme 115 wetlands have been identified for conservation and management till date. India is also a party to the Ramsar Convention under which 25 wetlands from India are included in the list of wetlands of international importance.

The Wetlands (Conservation and Management) Rules, 2010 is a positive step towards conservation of wetlands in India. The Ministry of Environment and Forests, recognising the importance of having a legal framework for the preservation and management of wetlands in India, drew up a Regulatory Framework drawing upon the recommendation of a wide spectrum of experts and stakeholders. Under the Rules, wetlands have been classified for better management and easier identification. Central Wetland Regulatory Authority has been set up to ensure proper implementation of the Rules and perform all functions for management of wetlands in India. Apart from necessary government representatives, the Authority shall have a number of expert members to ensure that wetland conservation is carried out in the best possible manner.

In order to ensure there is no further degradation of wetlands, the Rules specify activities which are harmful to wetlands such as industrialization, construction, dumping of untreated waste, reclamation etc. and prohibit these activities in the wetlands. Other activities such as harvesting, dredging etc may be carried out in the wetlands but only with prior permission from the concerned authorities. The project doesn't require clearance under this rule also.

3.1.10. ANCIENT MONUMENTS AND ARCHAEOLOGICAL SITES AND REMAINS RULES, 1959

As per the Ancient Monuments and Archaeological Sites and Remains Rules, 1959 Permission required for construction, etc and no person shall undertake any construction or mining operation within a protected area except under and in accordance with a permission granted in this behalf by the Central Government. Every application for permission under sub-rule (1) shall be made to the Central Government in Form-I at least three months before the date of commencement of the construction or operation. Provisions of this act are not applicable for the project.

3.1.11. PUBLIC LIABILITY INSURANCE ACT, 1991

The purpose of this act is to provide for public insurance liability for the purpose or providing immediate relief to the persons affected by accident occurring while handling any hazardous substances. This Act is applicable to the project and the EA confirms that appropriate insurance policy will be considered for the same. EA identifies hazardous materials associated with the

project. EA document identifies the major accident hazards and describes steps to prevent accident hazards and to limit their consequences to the environment. The EA indicates commitment to provide information, training and equipment to ensure workers safety. EA describes mechanisms to notify the concerned authority in the event a major accident occurs.

3.2. ENVIRONMENTAL LEGISLATION FRAMEWORK OF THE STATE

3.2.1. KERALA STATE FOREST DEPARTMENT

The State Forest Department is responsible for the protection of designated land and forest resources. In the case of the current project roads, no designated forest reserves are identified with in the PIA. The responsibility of forest department also includes the protection and management of trees located within public ROWs such as the National Highways, State Highways, consistent with the other goals and policies of the GOI. In Kerala, the trees at the sides of the PWD land are the property of the Forest Department. The Forest Department indicated that permission from the local forest office would be necessary for tree removal from the Link 68 project road ROW. To avoid delays, application will be forwarded to concerned Forest Officer for an early approval for tree removal. During construction only those trees that will be required on safety point of view will be cut and removed. The trees that will have to be removed will be marked prior to cutting. This is required, as there could be slight changes in the alignment or design because of the contractor's difficulties (e.g. for moving equipment). If such changes do occur a number of trees may be saved that would have been cut otherwise. Immediately after marking the trees, an application in plain paper (no prescribed application is available) will be filed with the local forest officer for obtaining a written permission. The Forest Department started to take the ownership of the State mangroves and the department now started planting mangroves in the PIA district (Kannur district) under the World Bank social forestry project. After the constitution of Kerala Coastal Zone Management Authority, all the activities are regulated in mangrove areas and KCZMA is also responsible for the protection of mangroves.

3.2.2. KERALA COASTAL ZONE MANAGEMENT AUTHORITY

Kerala State Coastal Zone Management Authority (KCZMA) has been established in compliance to the Orders of the Hon'ble Supreme Court in the matter 664 of 1993. The KSCZMA has been set up under the Environment (Protection) Act, 1986 by the Ministry of Environment and Forests. The KSCZMA main role is to enforce and monitor the CRZ Notification. 1991. All developmental activities in the CRZ area have to be recommended by the KSCZMA in accordance with the CRZ Notification, 2011 and approved CRZ of Kerala dated 27th September, 1996 (which was prepared in compliance with the Orders of the Hon'ble Supreme Court in 664 of 1993).

The KCZMA have the power to take the statutory measures for protecting and improving the quality of the coastal environment and preventing, abating and controlling environmental pollution in the coastal areas of the State of Kerala. The Authority also deal with environmental issues relating to Coastal Regulation Zone which may be referred to it by the Kerala State Government, the National Coastal Zone Management Authority or the Central Government. KCZMA is also responsible to identify ecologically sensitive areas in the Coastal Regulation Zone and formulate

area-specific management plans for such identified areas. The Authority also identify coastal areas highly vulnerable to erosion or degradation and formulate area specific management plans for such identified areas. The Authority ensures compliance of all specific conditions that are stipulated and laid down in the approved Coastal Zone Management Plan of Kerala.

3.2.3. KERALA STATE POLLUTION CONTROL BOARD

The State Pollution Control Board (SPCB) plays a major role in environmental management at the State level, particularly with regard to air and water issues. The main functions are to:

- Plan and execute state-level air and water initiatives;
- Advise State Government on air, water and industry issues;
- Establish emission standards based on National minimum standards;
- Issue consent orders (permits) for industrial air and water discharges;
- Issue "No Objection Certificates" for "industrial development" (defined in such a way as to include road projects).
- Publish statistics and disseminate information; and
- Take legal action against defaulters.

Action by the Kerala State PCB requires the submission of a questionnaire/application pursuant to the Water (Prevention and Control of Pollution) Act of 1974, the Cess Act of 1977 and Air (Prevention and Control of Pollution) Act of 1981. The prescribed public hearing fee is required to the project road under discussion in this report. The State PCB generally establishes a review panel and circulates the application for public review and comment in each affected district. In this case, such a review panel may not be required. The State PCB issues a No Objection Certificate (NOC) for follow up action.

3.2.4. STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY (SEIAA)

SEIAA Kerala has been constituted by Government of india in November 2011, authorising to deal with environmental Clearance for projects falling under category "B" of schedule in EIA notifications 2006. SEAC Kerala has also been constituted by Governent of India to assist SEIAA Kerala

3.2.5. KERALA STATE PUBLIC WORKS DEPARTMENT

A designated minister and Secretaries of IAS rank in the State administrative machinery generally manage the Kerala State Public Works Department as in other States. There are Chief Engineers separately for buildings and road sectors. In the road sector, there are Chief Engineer (National Highways) and Chief Engineer (State Roads). The project roads fall under the responsibility of the Chief Engineer (State Roads).

Project Management Team (PMT)3.

The PWD has established a Project Management Team (PMT) with Superintending Engineers, Executive Engineers, Assistant Executive Engineers, and Assistant Engineers, Environmental

[3] Formerly Project Implementation Unit (PIU)

Engineer, Sociologist and Land Development Officer with a support staff for the implementation of the project. A Chief Executive of IAS rank heads the PMT. Recently more members were inducted as additional members for land acquisition, financial management, irrigation etc. As a part of institutional strengthening, PWD has recently constituted five divisional offices as per GO (Rt) No.240/2002/PWD by redeploying existing staff positions. Details are provided with an organogram in the phase II EMP report.

The Project Management Team (PMT) was established exclusively for the implementation of Kerala State Transport Project. Prior to this, there was no institutional capacity within the Kerala State PWD to implement the environmental and social impact mitigation measures and the Environmental Management Plan during or after construction.

3.2.5.1. STATE ROAD POLICY

The PWD has recently adopted a State Road Policy. It aims at facilitating an efficient and safe road transportation system to fulfill the demand and the aspirations of the users for improving the quality of life and concomitant economic development. The policy document seeks to cover transportation of both passengers and freight, duly taking into account the environmental, technological, fiscal aspects related to motorized transport. The policy recognizes the important backward and forward linkages as manifest in developing an efficient road infrastructure on the one hand and the criticality of road safety on the other.

3.2.5.2. KERALA HIGHWAY PROTECTION ACT

The Kerala Highway Protection Act, 1999 approved by the State Government is a positive step towards achieving better roads in the State. The highlights of this new legislation are:

- Prevention and control of encroachment
- Control of ribbon development

Setting up of Highway Authorities for notified highways with powers to execute developmental schemes, control ribbon development and prevent encroachment. An officer not below the rank of an Executive Engineer of the PWD will be in charge of each Highway Development Authority. This act is applicable to the project.

3.2.5.3. THE KERALA ROAD FUND ACT 2001

This act provides for:

- Collection of user charges by private sector participants in road / bridge, bypasses projects etc.
- Setting up of a road fund outside the consolidated fund of the State to which will be channelised.

  10% of all motor vehicle taxes
  All toll revenues collected under the provisions of Kerala Tolls Act, 1986
  Contributions from central Road Fund, and
  Other identified sources of revenue

- Setting up the Road Fund Board, an independent statutory body having powers to

  -Approve all participation agreements

Allocate from the road fund subsidies/annuities/other assistance to private participants

(Source: www.pwd.kerala.gov.in)

The PWD currently has no formal environmental internal review procedures. The PWD has now established an Environmental Management Unit (EMU) to develop an in-house capacity to implement and manage environmental and social issues related to the highways as part of the KSTP. The EMU will be responsible for the mitigation measures adopted during and following construction and is formed for the implementation of this project.

3.2.5.4. ENVIRONMENTAL MANAGEMENT AS PER PWD MANUAL 2012

In order to enhance the positive environmental impacts and abate/mitigate negative environmental impacts of construction activities and related works, special section has been included for environment management in the PWD manual 2012 . Good environmental management also ensures compliance with all applicable National, State and Local Environmental legislations.The PWD manual 2012 recommends an Environmental and Social Management Unit (E&SMU) in the office of Chief Engineer Administration & Designs and at the General Divisions level. The cell will provide advice on all aspects of the environment requirements included in the Manual and also be responsible for monitoring the effectiveness of the implementation. The cell shall also conduct random environment inspection/audit during and after execution of the projects..

An Executive Engineer shall head the Environment and Social cell, and will be assisted by an Assistant Executive Engineer (Environment)/ Environmentalist and an Assistant Executive Engineer (Social), Sociologist and other support staff. The Environmental and Social Cell shall necessarily vet all major projects costing above Rs. 15crores for which detailed project report shall be prepared by the Project Preparation Unit (PPU).

All Engineers are responsible for ensuring that the environmental requirements warranted in the Manual are met in their respective job functions. Based on the works / projects being done, PWD needs to ensure that the necessary clearances are obtained prior to implementation and the clearance conditions are complied with during implementation. In the regular works / projects of the PWD, the environmental issues need to be properly and effectively managed. In principle, PWD needs to ensure the environmental compliance and safeguards in all its regular works / projects

To operationalise these activities, a standard EMP shall form a part of the PWD standard bid documents / contract agreements and shall be adhered to by the contractor who executes the work. PWD shall strive to ensure that the contractor's activities deliver quality construction without compromising on environmental performance. The standard EMP applies to the activities in construction site and ancillary activities such as the transportation of materials, sourcing of material and borrow areas. The contractor is responsible for ensuring all sub-contractors and any other people working on the project are aware of environmental issues and are in compliance to the EMP requirements.

In the context of the regular works / projects, PWD shall review the standard EMP and other guidance documents in order to determine whether additional Bill-of-Quantities (BOQ) items are necessary to achieve good environmental performance. If required, PWD shall ensure that these additional BOQ items are included in the standard bid documents / contract agreements.

Documentary evidence shall be available to demonstrate compliance with the standard EMP. This can include periodic progress reports, file notes, audit reports, photographs, and minutes of meetings or video. The contractor shall retain them in safekeeping for perusal by the PWD. Failure to reasonably satisfy and comply with the standard EMP requirements may result in the contractor receiving partial payment against the contract claims and also a noting in the contractor's performance certificate.

For certain works / projects, separate environmental impact assessments have to be conducted. This may be due to the MoEF requirements or funding agency – such as the World Bank or Asian Development Bank – requirements. This may also be due to the possible impacts on eco-sensitive areas or due to the large scale environmental impacts across the state. In all such cases, separate environmental impact assessments (EIAs) will be conducted and relevant environmental management plans (EMPs) will be prepared.

Conducting EIAs and preparing EMPs are studies that are done by external consultants on behalf of the PWD. Taking into account the particular context of these works / projects, the PWD shall prepare terms of reference for conducting the EIAs and preparing the EMPs. PWD shall refer to the EIA Notification 2006 for information on various aspects of conducting EIAs, its knowledge of the state and the dimensions of the proposed works / projects in preparing the terms of reference. Based on the report outcomes, the project planning and design shall be changed so that the environmental impacts are minimized.

Like other civil works, the project-specific EMP shall form a part of the contract agreement and shall be implemented by the contractor. Supervision of project-specific EMP implementation can be carried out by the PWD or given to Supervision Consultants (SC) based on the PWD capacity and the scale of the project. The contractor has to prepare his schedule for the physical implementation of the project-specific EMP and take periodic consent of the supervision authority as stipulated in the project-specific EMP. PWD has to ensure that the contractor obtains the necessary environmental clearances and also adheres to the project-specific EMP requirements through the pre-construction and construction stages.

After the construction stage is completed, the project-specific EMP will include activities during the operational phase. PWD shall ensure that these activities and ensure that the project-specific EMP is complied throughout the project cycle.

3.2.6. KERALA RESTRICTION ON CUTTING AND DESTRUCTION OF VALUABLE TREES RULES.

This Act is to provide the preservation of trees in the State of Kerala. As per this act, no person shall, without the previous permission in writing of the authorized officer, cut, uproot or burn, or cause to be cut, uprooted or burnt, any tree. No person shall cut or otherwise damage, or cause to

be cut or otherwise damaged, the branch of any tree and no person shall, without the previous permission in writing of the authorized officer, destroy any plant of any tree or do any act which diminishes the value of any such plant. This act is not applicable to this project.

3.2.7. KERALA FOREST ACT AND ITS AMENDMENTS UP TO 2010

This act was enacted in Kerala in 1961 to unify and amend the law relating to the protection and management of forests in the state of Kerala. This act was amended many times. Permission is needed under this act for cutting of road side trees in the project corridors.

3.2.8. PADDY FIELDS AND WETLANDS CONSERVATION POLICY OF THE STATE GOVERNMENT

The Government of Kerala discourages all conversion of paddy cultivating areas to any other purpose. This activity is governed by the Land Utilisation Order of 1961 and the Kerala conservation of paddy land and wetland act, 2008. Due to the environmental impacts, the paddy field reclamation has been controlled to a great extent by the GOK. Several restrictive measures including total ban at certain locations are part of the statewide policy. As the present project doesn't convert any paddy land, this act is not applicable to the project.

3.2.9. PROTECTION OF RIVER BANKS AND REGULATIONS OF REMOVAL OF SAND POLICY OF THE STATE GOVERNMENT

The Government of Kerala discourages un-controlled sandmining from rivers. This activity is governed by the Kerala Protection of River Banks and Regulations of Removal of Sand Act, 2002. The current project does not envisage the sand mining and hence this policy is not applicable.

3.2.10. ECOLOGICALLY FRAGILE ZONE ACT 2007

It is important to highlight the Ecological Fragile Zone Act (2005) and its amendments (2006-07) in this context. This law is aimed at conserving ecologically fragile habitats in Kerala. Mangrove forests are also offered protection under this act. The Forest Department of Kerala is in the process of documenting most of the remnant natural mangrove patches and is attempting to bring a large portion of these patches under a Reserved Forest network. The process of notification began in early 2007 and is currently ongoing. Once this has been institutionalised, it is hoped that at least some of these patches will be conserved better. Our observations in the field and regular interactions over a period of six months with the Forest Department officials who are implementing the act indicate that it is perhaps the best possible management scenario to protect mangroves. This Act is not applicable to KSTP as no mangrove are disturbed / destroyed for this project.

3.2.11. OTHER STATE LEVEL LEGISLATION AND ACTS

The additional legislations, which are followed in Kerala, are as follows:

- Kerala Forest Rules
- Kerala Private Forests (Vesting and Assignment) Act
- Kerala Forest (Vesting & Management of Ecologically Fragile Lands) Act & Rules.

- Government Order – Kerala Forest (Vesting & Management of Ecologically Fragile Lands) Rules – Constitution of Tribunal
- Kerala Preservation of Trees Act
- Kerala Forest Produce Transit Rules
- Forest Settlement Rules
- Kerala Captive Elephants (Management and Maintenance)

In the particular context of the various construction activities, the provisions of these legislations should be kept in mind for their general relevance in the context of each works in the present project , but from clearance point of view, no clearance is required under the above state rules.

3.3. SUMMARY OF APPLICABLE POLICIES AND REGULATIONS

A summary of all applicable GOI policies and regulations are provided in the **TABLE 3.1**. Descriptions of all legal requirements are provided in this section.

TABLE 3.1. SUMMARY OF APPLICABLE GOI POLICIES AND REGULATIONS

Sl. No	Type of Clearance	Statutory Authority	Applicability	Project Stage	Responsibility
1.	CRZ clearance is required for the project	KCZMA	Applicable, since the project road is passing through CRZ zone	Pre construction	KSTP
2.	Tree felling permission	Kerala State Forests Department	Felling of avenue trees	Pre construction	KSTP
3.	Consent to Establish under the Air (Prevention & Control of Pollution) Act, 1981 and The Water (Prevention & Control of Pollution) Act, 1974.	Kerala State Pollution Control Board	For the entire project road	Pre construction	KSTP
4.	Consent to Establish under the Air (Prevention & Control of Pollution) Act, 1981 and The Water (Prevention & Control of Pollution) Act, 1974.	Kerala State Pollution Control Board	For operating hot mix plants, crushers and construction camps	Construction (Prior to work initiation)	Contractor
5.	Consent to Operate under the Air (Prevention & Control of Pollution) Act, 1981 and The Water (Prevention &	Kerala State Pollution Control Board	For operating hot mix plants, crushers and construction camps	Construction (Prior to work initiation)	Contractor

Sl. No	Type of Clearance	Statutory Authority	Applicability	Project Stage	Responsibility
	Control of Pollution) Act, 1974.				
6.	Permission to store Hazardous Materials under Hazardous Waste (Management and Handling) Act 1989	Kerala State Pollution Control Board	Storage and Transportation of Hazardous Materials and Explosives	Construction (Prior to work initiation)	Contractor
7.	Explosive license under The Explosives Act (& Rules), 1884 (revised in 1983)	Chief Controller of Explosives, petroleum & Explosive Safety Organization	Storage of explosive materials	Construction (Prior to work initiation)	Contractor
8.	PUC for vehicles for construction under Central Motor and Vehicle Act 1988	Motor Vehicle Department of Kerala	For all construction vehicles	Construction (Prior to work initiation)	Contractor
9.	Quarry lease deeds and license under The Mines Act, 1958	Mining and Geology Department of Kerala	Quarrying and borrowing operations	Construction (Prior to work initiation)	Contractor
10.	Extraction of sand from rivers	District level Expert committee under district collector and local govt. body	Extraction of Sand from rivers	Construction (Prior to work initiation)	Contractor
11.	Consent for ground water extraction	Kerala Ground Water Authority	Ground water extraction for construction camps	Construction (Prior to work initiation)	Contractor

3.4. CLEARANCE STATUS

The State level clearances are required prior to the World Bank Approval. Details are provided as follows.

From World Bank. The World Bank is the major source of funding for the Kerala State Transport Project in conjunction with State level investments, which are required for project preparation, land acquisition and counterpart funding. The Environmental clearance from the Bank is an integral part of the loan approval process.

From Government of Kerala. The three project roads are located with in the CRZ area. CRZ clearance from Coastal Zone Management Authority is required. Application filed for the clearance of three roads, which is likely to obtain by October 2012. The clearance from State PCB is required under air and water acts**.** Permission from State Forest department required for roadside tree removal.

3.5. ENVIRONMENTAL REQUIREMENTS

The various environmental requirements of World Bank, GOI for the project are described below.

3.5.1. APPLICABILITY OF VARIOUS WB SAFE GUARD POLICIES

The World Bank has 10 safeguard policies; the details and applicability of the safe guard policies to the project link roads are provided in the **TABLE 3.2**. According to this policy detailed management plan must be prepared for all triggered policies.

TABLE 3.2. APPLICABILITY OF WORLD BANK SAFE GUARD POLICIES TO KSTP- FOR ALL LINK ROADS

WB Safe-Guard Policy	Subject Category	Triggered Or Not	Reason For Its Applicability	Mitigation Measures	Document-ation
OP 4.01	Environmental Assessment	Triggered	Umbrella policy	All necessary mitigation measures incorporated.	EIA and EMP required.4
OP 4.04	Natural Habitats	Not triggered	No significant conversion of land use/natural habitats or mangrove areas.	Framed according to CRZ Regulations5	An EIA and EMP required.
OP 4.36	Forestry	Not triggered	Not Applicable	Not Applicable	Not Applicable
OP 4.09	Pest Management	Not triggered	Not Applicable	Not Applicable	Not Applicable
OP 4.30	Involuntary Resettlement	Triggered	Road widening will lead to loss of livelihoods, loss of land and Buildings etc	comprehensive Resettlement Action Plan	Resettlement Action Plan prepared
OP 4.20	Indigenous people	Not triggered	No separate Indigenous people development Plan is required for the Project.	Resettlement Action Plan takes adequate measures	Resettlement Action Plan prepared
OP 4.11	Cultural Property	Triggered	A number of temples, shrines, churches etc are located adjacent to road ROW.	Adequate mitigation measures if affected.	RAP implementation report.
OP 4.37	Safety of Dams	Not triggered	Not Applicable	Not Applicable	Not Applicable
OP 7.50	International waterways	Not triggered	Not Applicable	Not Applicable	Not Applicable
OP 7.60	Projects in disputed areas	Not triggered	Not Applicable	Not Applicable	Not Applicable

OP 4.01. Environmental Assessment

[4] EIA and EMP prepared for Phase-1 was reviewed by an independent Consultant according to the Bank norms
[5] World Bank guidelines, No 7 March 1994 EA Source book update

OP 4.01 intents to help ensure the environmental and social soundness and sustainability of investment projects and to support integration of environmental and social aspects of projects into the decision making process.

OP 4.01 specifies the environmental screening to be carried out for each proposed project to determine the appropriate extent and type of EA to be carried out. Projects are classified into one of following four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

- **Category A:** A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. A comprehensive Environmental impact Assessment Report is to be prepared for a Category A project.
- **Category B:** A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas – including wetlands, forests, grasslands, and other natural habitats – are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A Environmental Assessment.
- **Category C:** A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

The Bank classifies the KSTP as Category A, largely it is understood, based on the large number of project-affected people and the biodiversity of Kerala. In other words, the Bank classification is based on the anticipated cumulative social and environmental impacts due to the construction and operation of the Project.

Further if sensitive areas are within the potentially affected environment of a project or sub-project (as in the case of Pilathara-Pappinissery project road under discussion), if significant socio-economic impacts are anticipated or if otherwise warranted, Category A environmental documentation is required at the project-level. Clearance for the overall Programme is obtained, provided that:

- The SEA is found to conform to the cited guidelines. (Refer: Box 3.1 of App. A 3.1)
- The SEA is accompanied or followed by detailed design and project-level environmental documentation when necessary and provides assurance that the environmental issues will be properly addressed in the subsequent phases of the Programme. And
- All other feasibility, design, mitigation plans and financial responsibility requirements are acceptable.

OP 4.04. Natural Habitats

The objective of this policy is to promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions. Natural habitats are land and water areas where (i) the ecosystems' biological communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the area's primary ecological functions. As per O.P. 4.04, the Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs. Since marine turtle nesting is observed in some of the project villages, Operational Policy 4.04 is applicable to the project. Even though conversion of turtle nesting area is not anticipated in this project, the project proposes to include mitigation measures complying to this policy, such as minimizing habitat loss, etc.

OP 4.10. Indigenous Peoples

In the Indian context, the application of O.P. 4.10 is equated with the impacts to tribal population. As there is no tribal population in the sub-project villages, this policy is not applicable to the project.

OP 4.11. Physical Cultural Resources

This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Impacts on physical cultural resources should be addressed as an integral part of the EA process. The following projects are to be classified during the environmental screening process as Category A or B:

- Any project involving significant excavations, demolition, movement of earth, flooding, or other environmental changes; and
- Any project located in, or in the vicinity of, a physical cultural resources site.

The proposed project does not fall in any of the categories described above.

OP 4.12. Involuntary Resettlement

The bank's policy on involuntary resettlement covers those displaced by the project's activities. For any sub-project involving land acquisition and associated impacts, a draft RAP is required, prior to the approval of sub-project and borrowers will implement the RAP in advance of sub-project implementation. Since no land acquisition is involved in this sub-project, RAP is not prepared for this sub-project.

OP 4.36. Forests

The objective of this policy is to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests. This policy applies to the following types of Bank-financed investment projects:

- Projects that have or may have impacts on the health and quality of forests;
- Projects that affect the rights and welfare of people and their level of dependence upon or interaction with forests; and
- Projects that aim to bring about changes in the management, protection, or utilization of natural forests or plantations, whether they are publicly, privately, or communally owned.

The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical natural habitats. The proposed project does not affect any forest areas or related natural habitats.

3.6. SOCIAL IMPACTS-REQUIREMENTS

The World Bank has set out certain mandatory social impact mitigation requirements for loan projects. The Operational Policy 4.30[6] describes the Bank's policy and procedures for projects that involve involuntary resettlement. *This policy aims to improve, or at a minimum, sustain the same standard of living of the people who will be displaced because of a development project.* The policy also requires that projects minimize the need for involuntary resettlement. Where displacement is unavoidable, resettlement plans should pay particular attention to the vulnerable groups. In addition, the World Bank has special guidelines for addressing impacts upon the indigenous communities due to infrastructure projects.

3.7. ENVIRONMENTAL STANDARDS AND CODE OF PRACTICES

3.7.1. NATIONAL ENVIRONMENTAL STANDARDS RELEVANT TO THE PROJECT

3.7.1.1. STANDARDS FOR AIR QUALITY

National Ambient Air Quality Standards are presented in **Annexure 3.1**. While conducting environmental monitoring during the construction stage, the ambient air quality results should be compared with these standards and mitigation measures should be carried out if air pollution is exceeding the standards. Further, air quality modeling should be conducted for construction and operation stages of the project and mitigation measures should be carried out where air pollution is expected to be exceeding the standards.

The vehicles used for construction should meet the emission standards set by CPCB, which are presented as **Annexure 3.1.**

3.7.1.2. STANDARDS FOR NOISE LEVEL

National Ambient Air Quality Standards for noise are presented as **Annexure 3.2**. While conducting environmental monitoring during the construction stage, the noise level results should be compared with these standards and mitigation measures should be carried out if noise levels are exceeding the standards. Further, noise barriers should be constructed for sensitive receptors where traffic noise level is expected to be exceeding the standards during the operation stage of the project, based on noise level modeling.

The Central Pollution Control Board (CPCB) has specified that the maximum permissible sound pressure level for new diesel generator (DG) sets with rated capacity up to 1000 KVA,

[6] Involuntary Resettlement, The World Bank Operational Policy 4.30,June 1990

manufactured on or after the 1st January, 2005 shall be 75 dB(A) at 1 meter from the enclosure surface. The diesel generators used for the project should meet this noise limit.

Further, the vehicles used for construction should meet the noise limits set by CPCB, which are presented as **Annexure 3.2.**

3.7.1.3. STANDARDS FOR WATER QUALITY

National standards for drinking water (IS:10500) are presented as **Annexure 3.3**. National Standards for inland surface waters subject to pollution (IS:2296) are presented as **Annexure 3.4**. During environmental monitoring, ground water quality results should be compared with IS:10500 and surface water quality results should be compared with IS:2296. Pollution sources should be identified and mitigation measures should be carried out where water pollution is exceeding the standards.

National standards for discharge of effluents in presented as **Annexure 3.5**. Any effluent discharge from the construction camps should meet these standards.

3.7.1.4. STANDARDS FOR SAMPLING AND ANALYSIS OF AIR AND WATER

Various Indian Standards (IS) published by Bureau of Indian Standards for sampling and analysis of air and water should be followed by the laboratories conducting environmental monitoring of the project.

3.7.1.5. CODES OF PRACTICE OF INDIAN ROAD CONGRESS

Codes of Practice of Indian Road Congress (IRC), particular to environmental issues, which are relevant to the proposed project are presented as **Annexure 3.6**. These guidelines should be followed by the implementing agency during road construction.

3.7.2. STATE ENVIRONMENTAL STANDARDS RELEVANT TO THE PROJECT

3.7.2.1. ENVIRONMENTAL MANAGEMENT AS PER REVISED KERALA PWD MANUAL

Introduction

The revision of Kerala PWD Code and Manual was done as part of the Institutional Development and Technical Assistance component of the World Bank funded Kerala State Transport Project. The Kerala PWD Manual, which was prepared in 1972 has been revised by the Institutional Strengthening Action Plan (ISAP) Consultant. The revised PWD Manual was submitted to Government of Kerala for approval after scrutiny and revision by an Expert Committee, Chief Engineers' Committee and Chief Engineer (Projects).

The revised Kerala PWD Manual should be followed by the rank and file of the Department and pertains to investigation, design, estimating, tendering, execution and maintenance of all types of works generally carried out by the various wings of PWD. The Manual has been revised with references to day-to-day practice adopted in Kerala and elsewhere and with due regard to various Government orders and departmental circulars issued from time to time.

Several new sections such as Information Technology & Management Information System, Financial Management System, Geographical Information System, Road Maintenance Management

System, Environmental Management etc, are included in the revised PWD Manual, catering to the needs of modern-day management practices.

The revised PWD Manual has given importance to environmental protection and has incorporated environmental management measures in all the activities of the PWD. In order to achieve PWD's commitment towards environmental protection, an Environment Cell has been formed in PWD. The revised PWD Manual proposes an internal environmental clearance mechanism for all the projects to be implemented by PWD. Environmental clearance from the Environment Cell has been made mandatory for obtaining technical sanction for projects.

Environmental Management Provisions Incorporated in PWD Manual

Section 100 – Introduction and Organizational Setup of the revised PWD Manual proposes an Environment Cell under the Roads & Bridges and IT wing of the PWD, under **Sub-section 104.8.** An Executive Engineer shall be in charge of the Environment Cell, who will be assisted by an Assistant Executive Engineer and other support staff. The Environment Cell shall necessarily vet all major projects before the Technical Sanctions are issued. The cell will provide advice on all aspects of the environment requirements included in the Manual and also be responsible for monitoring the effectiveness of the implementation. The Cell shall also conduct random environment inspection / audit during and after project implementation.

Section 200 – Duties, Responsibilities and Powers of the Manual describes the duties of the Environment Cell, under **Sub-section 204.2.** The Cell has advisory, implementation, report and monitoring functions in relation to the environment requirements of the Code and Manual. On the one hand, the Environment Cell will provide technical advice and inputs in matters such as interpreting the environment requirements in particular conducts obtaining State / National Government clearances and taking precautions in conducting activities in eco-sensitive areas. On the other hands the Environment Cell shall periodically supervise, monitor, evaluate and report adherence to the environment requirements. The Environment Cell shall pro-actively work towards achieving better environment performance and shall also respond to request for advice and support.

The organization structure of Environment Cell is presented as **Figure 3.1.**

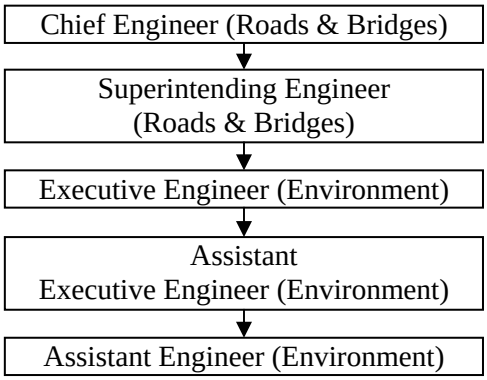


FIGURE 3.1. ORGANIZATION STRUCTURE OF ENVIRONMENT CELL

As per **Sub-section 202 – Duties and Responsibilities** under **Section 200 – Duties, Responsibilities and Powers** of the Manual, all Engineers are responsible for ensuring that the environment requirements included in the Manual are met in their respective job functions and adherence to the environment requirements are integral to the day-to-day responsibilities of Engineers. PWD Officers shall see that sufficient environment protection arrangements are strictly observed in the office premises as well as at work sites. Inspecting officers shall take necessary action in this regard.

Under **Sub-section 203 – Duties and Responsibilities Common to Specific Posts** under **Section 200** of the Manual, it is mentioned that all Executive Engineers and Assistant Executive Engineers have to ensure environmental aspects of all works.

As per **Sub-section 207.8.5**. under **Section 200** of the Manual, duties of the Executive Engineer (Environment) are the following:

1. Liaison with various wings of the department for the collection of information about projects.
2. Study the projects and initiate the screening and scoping.
3. Ensure the Prevention / Mitigation of Air Pollution, Noise Pollution, Soil Contamination and Water Pollution.
4. Protection of Site of Natural / Cultural Heritage.
5. Optimum use of Natural Resources.
6. Use or reuse or recycling of wastes generated during all stages of the project Execution.
7. Protection of Flora and Fauna.
8. Identify the Requirements of Environmental Procedures to be followed and permission to be obtained.
9. Arrange to prepare the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP), based on the requirement of permissions and sensitivity of the environment.
10. Ensure that the EMP forms part of the Contract document.
11. Evaluation of the Contractors' past performance on the implementation of the Environmental Management aspects.
12. Ensure that the cost of environmental works is included in the project cost.
13. Oversee the implementation of the EMP during the execution.
14. Oversee the implementation of the Closure Plans after the completion of the physical works.
15. Enhancement of the vacant land of the project by floriculture, horticulture, arboriculture etc.

16. Recording of the good environmental practices.
17. Conducting the induction and refresher training for Engineers and Contractors.
18. Review Contractor's Environment and Social Impact Assessment (ESIA) Action Plan.
19. Review of Environmental & Social Factors (RESF), Environment & Social Management Pan.
20. Verify the Project Report and to see that the environmental aspects are included before issuing Technical Sanction.

As per **Sub-section 207.8.5.1** under **Section 200** of the Manual, duties of the Assistant Executive Engineer (Environment) are the following:

21. Assisting to arrange the preparation of Environmental Management Plans for Projects, checking reports and furnish opinion or comments on the environmental issues during execution of project.
22. Ensuring that the Department / Contractors, while carrying out work at site, follow the EMP of the Project.
23. Providing feedback to the concerned Executive Engineer on all environmental issues of ongoing PWD projects and works, undertaking and / or coordinating all internal and external compliance monitoring and evaluation through suitable agency.
24. Reviewing of project proposals and preparation of tender documents for procurement of Environmental services (preparation of EIA and EMP) for PWD projects.
25. Examining EIA Report and formulate the plan and methodology for further study by the Consultant and, communicate the observations to the Executive Engineer (Environment). Interpretation of the requirements of the Environment Impact Assessment (ElA) documentation (inc1uding the Rehabilitation Action Plan (RAP) into an Environmental Management Plan (EMP).
26. Monitoring all construction activities as specified in the Environment Management Plan (EMP).
27. Liaison with Road Safety Cell, Arboriculture head and maintaining inter-departmental coordination.
28. Preparation of collaboration plan with the identified collaborating agencies in order to deliver the RAP (Resettlement Action Plan) entitlements, as well as other (social and natural) environmental deliverables during implementation and operation phases of the project.

As per **Sub-section 207.8.5.2** under **Section 200** of the Manual, duties of the Assistant Engineer (Environment) are the following:

29. Assisting the Assistant Executive Engineer, Environment.
30. Monitoring environmental impacts of projects and preparing all monitoring reports.

31. Assisting in preparing annual budget, EMP and selection of consultants & preparation of Operations / Plan of the unit with annual updates.
32. Disseminate the need for high environmental standards throughout PWD.
33. Arranging training on presenting environmental aspects to PWD officers in conjunction with HRD Cell.
34. Developing and updating database on environmental aspects and ESM (Environmental & Social Management).
35. Develop / implement ESM training program throughout PWD.

Section 1400 – Project Preparation of the Manual describes the various stages of project preparation such as investigation, design, estimates, schedule of rates and sanctions. Environmental aspects are to be considered at each stage of the project preparation to achieve the environmental management objectives of the Manual. Project preparation sequence is presented as **Figure 3.2.**

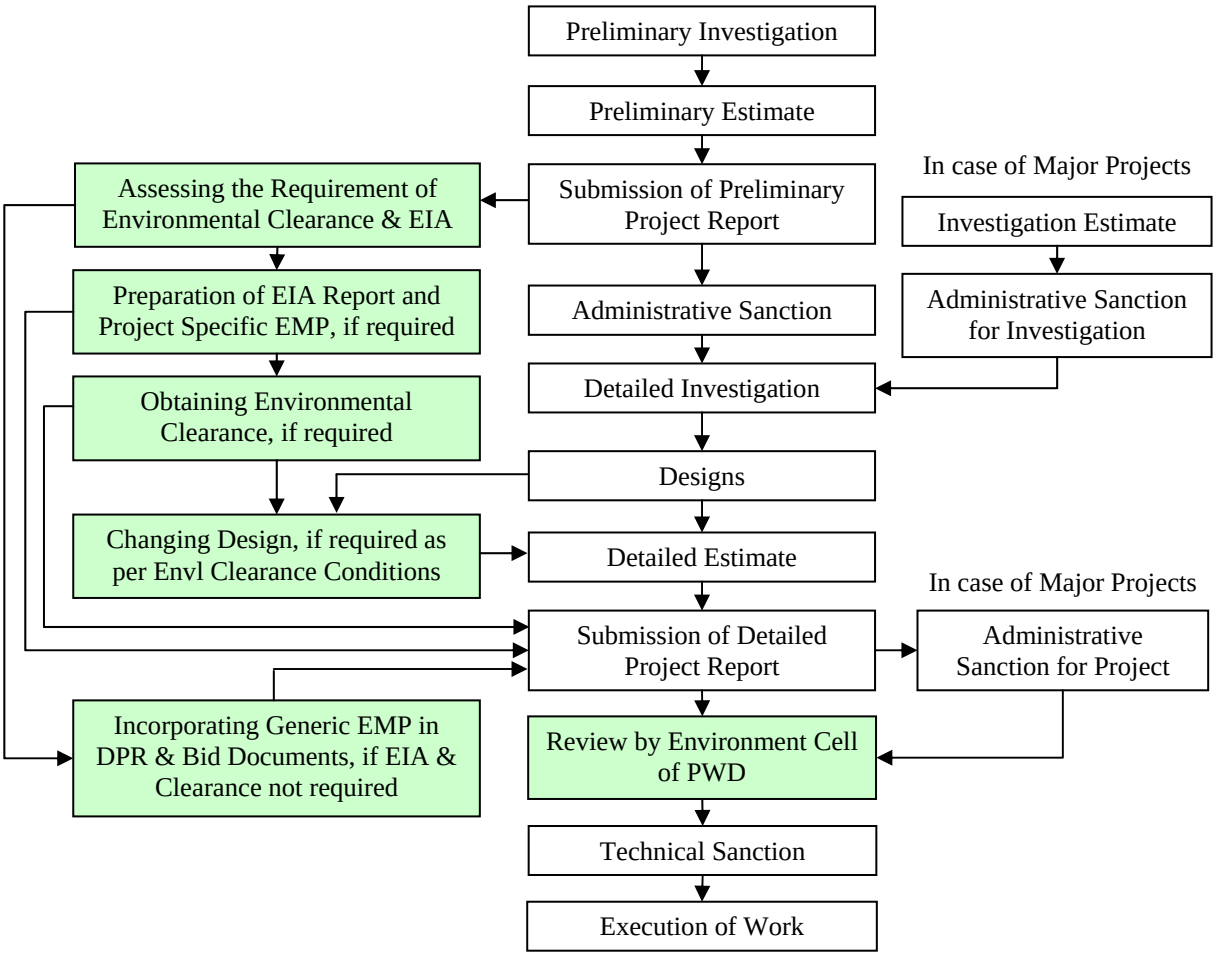


FIGURE 3.2. PROJECT PREPARATION SEQUENCE INCORPORATING ENVIRONMENTAL PROCEDURES

Under Sub-section 1504 – Investigation for Road Works under **Section 1500 - Investigation**, it is mentioned that the road alignment shall be decided giving consideration to environment

protection, particularly in eco-sensitive hill, forest areas and coastal zone areas. Tree cutting shall be avoided as far as possible while finalizing the road alignment.

Under Section 1900 – Sanctions, it is mentioned that the Environment Cell shall review all major projects for compliance to environmental regulations before being accorded Technical Sanction. Further, it is mentioned that the Detailed Project Report should necessarily contain the preparatory documents such as the Environmental Impact Assessment Report and / or the Environmental Management Plan and / or the Special Environmental Conditions to the Contract. The Environment Cell should vet these and a note provided prior to providing the Technical Sanction. This note should confirm the Project's adherence to the environmental requirement of the Code and Manual.

Under **Section 2300 – Execution of Works**, it is mentioned that all necessary clearances at the local, State and National levels shall be obtained prior to the start of work.

CHAPTER 4. APPROACH AND METHODOLOGY

4.1. BASIC APPROACH

The earlier EIA report has been prepared and presented as per requirements of the Environmental Impact Assessment notification, 2006 of Ministry of Environment and Forests (MoEF) under the Environment Protection Act, 1986 and World Bank Operational Policy 4.01. The guidelines of the Indian Road Congress (1989) and Environmental guidelines for Rail / Road / Highway projects of MoEF have also been followed. This report was reviewed independently and updated to reflect the present scenario. Thus, the current report is an updated version of earlier report.

The EIA process generally involves a number of steps in a logical sequence to be followed in order to have a clear insight into each and every aspect of the project. The findings of the Environmental Impact Assessment provided important feedback to the design/technical team especially in terms of the environmentally sensitive areas, utilities / facilities affected, water logged stretches and drainage patterns. It helped to modify the designs at locations where impacts had to be avoided and incorporate mitigation measures wherever the impacts were unavoidable due to other constraints. The major steps and their sequence adopted for the EIA of the present study are as follows.

The main concerns that have influenced the methodology of KSTP in general were many; nevertheless together with engineering studies and the Environmental Impact Assessment process there remain few typical concerns to address.

- Very high magnitude of social impact upon widening to full IRC standard road designs.
- Determination of practically possible optimum level of widening to a more or less fair width to cater for predicted traffic within the design life.
- High number of accidents especially those involving pedestrians.
- Very high land cost on the sides of the project road

4.2. STEPS IN THE PROCESS

4.2.1. ENVIRONMENTAL SCREENING

The Environmental Impact Assessment of the proposed improvements for the project road began with the adoption of an Environmental Screening procedure during the feasibility stage. The purpose of the screening was to review the proposed project activities and broadly identify the key environmental issues related to the project such as environmentally sensitive receptors along the alignment, change of land use; impacts on surface water bodies, availability of borrow areas, impacts on community facilities, impacts on ecologically sensitive areas, etc. The information gathered during the screening process helped in identifying the areas of concern

along the stretch and critical issues to be studied in detail. As the project has already been screed, no screening has been done during updation stage.

4.2.2. SCOPING

The scope of study for this assessment was determined by the requirements of the World Bank, earlier experience of the consultants on similar projects and discussion with experts. In addition, critical environmental issues identified during the screening process were also added to the scope of the study.

4.2.3. DELINEATION OF PROJECT IMPACT ZONE

To study the impacts of the project, two major zones have been identified that shall give fair idea of the impact on the project corridor:

- Direct Impact Zone (DIZ): This consists of a strip of land on either side of the centre line of the proposed alignment. 500 m width on either side of the centre line has been adopted for detailed inventory of environmental features.
- Indirect Impact Zone (IIZ): This consists of a strip of land of 15 Km width on either side of the proposed carriageway. Here, the existence of sensitive features was identified and possible impacts on them due to the project corridor were assessed.

4.2.4. RECONNAISSANCE SURVEYS

The environmental and the design team of the Consultants visited the project road alignment and information on each kilometer was collected using formats specifically prepared for each environmentally sensitive feature. The chainage-wise tree count mentioned in the earlier report for the entire stretch was also verified and updated on the basis of present design considerations. In April 2012, the environmental team carried out reconnaissance surveys for updating the earlier documentation of the environmental investigations and issues. In addition to field investigations and observations, further consultations were held with local officials and available environmental documentation was assembled for review.

4.2.5. SECONDARY DATA COLLECTION

Secondary information was collected from Survey of India Toposheets and District Planning Maps, Forest Working Plans, District Gazetteers, District Census Handbooks and other Government publications as well as earlier project reports prepared for the project region.

4.2.6. BASELINE ENVIRONMENTAL MONITORING

Fresh environmental monitoring was carried out for determination of ambient air quality, water quality, and noise level at various locations along the proposed alignment to establish the baseline status of these environmental parameters along the project area.

4.2.7. ESTABLISHING BASELINE ENVIRONMENTAL PROFILE

Documentation of the baseline conditions was updated. The data collected through the reconnaissance surveys and environmental monitoring were entered into specific data entry

formats for ease of analysis. Qualitative analysis was also carried out for parameters requiring descriptive data. Baseline environmental profile of the project impact zone was established by the compilation of all the above-mentioned information.

4.2.8. IDENTIFICATION AND EVALUATION OF POTENTIAL IMPACTS

Impacts of the project on various environmental components were identified at pre-construction, construction and operation phases of the project on the basis of assessment of proposed project activities and analytical review of baseline environmental status of the project impact zone. Further, the impacts were categorized into permanent or temporary and highly significant, moderately significant, less significant and non significant based on the character and magnitude of impacts.

4.2.9. ASSESSMENT OF ALTERNATIVES

The analysis of alternatives assumes very high significance for an Environmental Impact Assessment (EIA). The 'no action option' is to be considered among various options available. The process will ultimately help to determine which option is comparatively better than the other various options. In all studies at least few options are considered prior to the final selection of the alternative nevertheless the documentation is rarely carried out. The documentation will further improve the thought process towards various options considered. Various alternatives were assessed during the entire process of the study and a detailed study on identified alternatives were carried out during feasibility report preparation to minimize the impacts on environmental and social profile of the project impact zone

4.2.10. FINALISATION OF ALIGNMENT

Physical verification of the alignments in terms of the number of trees along the Highway and the presence of schools, hospitals and shrines was surveyed. Due to its earlier status of National Highway the corridor is different from the normal State Highways in terms of road width, number of curves, roadside trees and social forestry. The presence of built-up areas along most of the roadside made this the single largest parameter for alignment options. However in the case of various project roads social parameters determined the options. This was independently analysed to establish the viable design options. Most of the alignments were influenced by this criterion.

4.2.11. MITIGATION AND ENVIRONMENTAL ENHANCEMENT MEASURES

Environmental concerns were identified in the early stages of project preparation. This has enabled to streamline the design process and to avoid or otherwise mitigate potential impacts. Others will require appropriate actions in the construction and operational phases. Positive actions, not only avoid adverse impacts, but also capitalise on opportunities to correct environmental degradation or improve environmental conditions and were determined as documented in Chapter 9.

4.2.12. IDENTIFICATION OF THE REQUIREMENTS OF ENVIRONMENTAL REGULATIONS

Various government policies, laws, regulations and guidelines applicable to the project were reviewed with respect to identified environmental impacts. This established the need of various environmental clearances required for the project from respective government agencies.

4.2.13. INTEGRATION OF IMPACTS IN THE DESIGN PROCESS

The environmental impacts identified through the earlier tasks were used in the design formulation process to integrate environmental issues and for early identification of suitable mitigation measures. This task helped in identification of the required shifts in alignment based on environmental sensitive features and cultural resources along proposed alignment. It also helped in finalizing the bypass alignments. The consideration of environmental issues was an integral part of Highway Project preparation-a process generally referred to by the World Bank as "mainstreaming the environment". The design and decision-making process was undertaken so that environmental and resettlement and rehabilitation issues prompted appropriate actions. Such actions included a shift in alignments or a curve improvement based on road safety considerations. Such adjustments were weighed against benefits derived from reductions in village congestion, and improvements in road safety, and were incorporated in the design process. It was also necessary to ensure the maximum practical avoidance of sensitive areas (e.g. shrines, hospitals and CRZ areas) and adverse impacts upon the project affected persons, etc.

4.2.14. PREPARATION OF ENVIRONMENTAL MANAGEMENT PLAN

Much of the environmental degradation that happens during the construction stage of a highway can be prevented or controlled, if there is an appropriate system in place. Hence, this EMAP table has been specifically designed to capture all the impacts that take place during the entire life cycle of a project from design to operation stage. Accordingly, a thorough activity analysis was carried out listing out all the project activities, based on which an impact identification matrix was prepared to understand the impacts upon various environmental parameters such as land, water, air, noise, flora and fauna. Lastly, socio-economic impact upon people and solid waste generation was also considered as separate impacts.

Based on this exercise, a totally new Environmental Management Plan (EMP) has been prepared suggesting various mitigation measures to avoid or minimize the impacts of the project on the environment during the pre-construction, construction and operation phases. Two sets of guidelines were prepared and incorporated in the Generic EMAP table of EMP reports to enable the contractor to implement the project with least impact upon the environment– (i) Guidelines for entire project stretch including the project facilities like camps and sites and (ii) Guidelines exclusively for siting, management and restoration of project facilities like camps and sites. **Table 4.1** gives the list of these guidelines:

Table 4.1: Guidelines in Generic EMAP

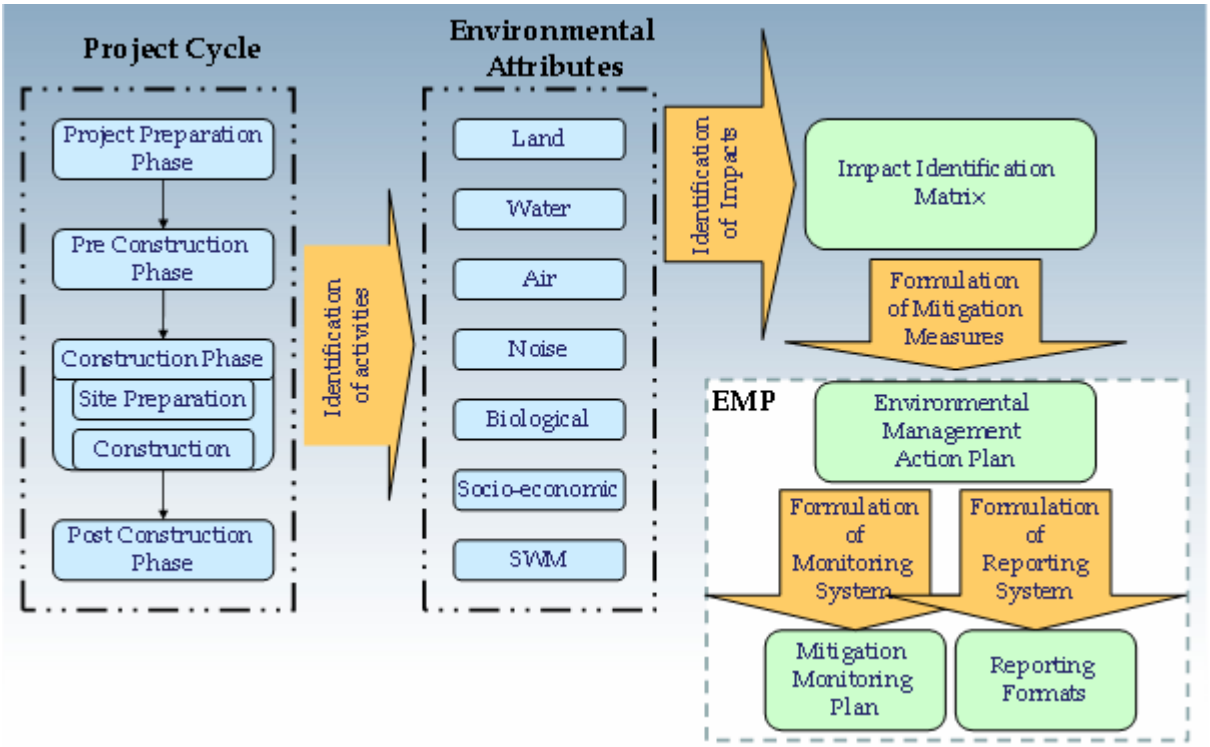
Sl. No.	Title
A	**Guidelines for entire project stretch**
1.	Guidelines for preparing comprehensive waste management plan

2.	Guidelines for top soil conservation and reuse
3.	Guidelines for Provision of Noise Barriers
4.	Guidelines to Ensure Worker's Safety during Construction
5.	Guidelines for Preparation of Traffic Management Plan
6.	Guidelines for Storage, Handling, Use and Emergency Response For Hazardous Substances
7.	Environmental monitoring plan
B	**Guidelines for project facilities**
1.	Guidelines for siting, management and redevelopment of construction camps
2.	Guidelines for siting, management and redevelopment of labour camps
3.	Guidelines for siting, management and redevelopment of quarrying and stone crushing operations
4.	Guidelines for siting, management and redevelopment of borrow areas
5.	Guidelines for siting and management of debris disposal site

The guidelines for project facilities have been structured with following objectives:

(i) It facilitates the selection of a site with least environmental impact,
(ii) It looks into the satisfaction of the land owner in case of leased out / rental out lands,
(iii) It guides the contractor with step by step measures in setting up of an efficient and environment friendly camp / site,
(iv) It ensure smooth, safe and efficient functioning of these camps and sites
(v) It guides the contractor in preparing a camp / site management and restoration plan to be submitted to CSC (prior to setting up of the camp/site)
(vi) It facilitates restoration of the site at the closure stage in a very environment friendly manner.

EMP assigns the responsibilities for various actions identified to limit the adverse impacts of the project. An environmental monitoring plan and an institutional framework have been proposed as part of the EMP for proper implementation and monitoring of mitigation measures. The cost for implementing the proposed environmental mitigation measures and carrying out the environmental monitoring has been worked out and is presented as part of the EMP for necessary budgetary allocations as part of the project cost .In order to implement various environmental requirements during pre construction, construction and operational phases, all mitigation and enhancement measures have been clearly built in to the Environmental Management Plan. All necessary mitigation and enhancement costs have been part of the BOQ.



4.2.15. LESSONS FROM REVIEW OF EMP IMPLEMENTATION, KSTP - I

The major findings from the review of implementation of EMP for KSTP – I, conducted by Wilbur Smith Associates in 2010 are given below:

Sl. No.	Issues in implementation of EMP	Measures incorporated in EMP for KSTP -II
1.	Lack of commitment by contractors CSC is helpless to take action against contractor	Penalty clause is included in the contract document
2.	Lack of awareness	Training by CSC and KSTP
3.	Too many reporting formats	A simplified reporting and monitoring system has been evolved with fewer reporting frequency.
4.	Impractical instructions in EMP	Unfeasible measures have been simplified – for eg,. Criteria of siting project facilities has been relaxed considering the topographic features of Kerala. Specific guidelines are added to enable the contractor implement the EMP very effectively.

A new monitoring and reporting system has been designed keeping above issues in mind, so that it ensures a smooth implementation of the EMP. The same is detailed in EMP Report.

4.2.16. CONTINUOUS PUBLIC CONSULTATION AND PARTICIPATION

Consultations with community or other stakeholders are an integral part of the Project activities The official level consultations started with the Kerala State Transport Project (KSTP) environmental investigations at the beginning of the project as early as in 1999. These consultations were considered for the environmental screening study carried out as a part of the Feasibility study reported in April 2000. The outcome of these consultations has been considered in the preparation of various submissions including the earlier Environmental Impact Assessment Report. Consultation in this DPR and EIA updation stage is required for dissemination of project information, for finalising subproject sites and alignment and for disseminating information on incorporation of social and environmental safeguards in the subproject design. Consultations with concerned officials, agencies and potentially affected persons continued throughout the EIA updation process and is supposed to continue as the project proceeds. The details of various consultations have been recorded for review and is provided in the chapter 6 - Public participation and consultation.

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CHAPTER 5. BASELINE ENVIRONMENT

The baseline environmental aspects of the link 69 –Kasargod – Kanhangad, link 68 - Pilathara-Pappinissery, and link 74 Thalasserry – Valavupara roads are provided in this Chapter. The data pertaining to the environmental scenario of the project location and Project Influence Area (PIA) is provided as defined in the Chapter 4. Details of the different aspects of the coastal ecosystems including mangroves are also provided. The coastal ecosystem is a sensitive area according to the relevant GOI notifications as provided in the Chapter 3. This Chapter describes the relevant physical, biological, social and environmental components along the project corridor.

The Environmental Data sheets, presenting all important features of project corridor has been presented in a separate volume in **Table 2.1** of stand-alone document Part II EMP Report, Volume I, II and III for link 69, 68 and 74 respectively. The Corridor of Impact as defined by the MOEF is documented for this study. In addition to the SEA findings, the Environmental Assessment carried out also indicated that this road qualifies for a comprehensive Environmental Impact Assessment (EIA) as per the GOI and MOEF guidelines. Baseline data and the existing conditions in the potentially impacted area are provided according to the World Bank and the GOI requirements. The discussions of potential impacts and mitigation measures that follow in Sections 7.0, and 9.0, follow the same sequence and numbering pattern.

5.1. METEOROLOGICAL AND CLIMATIC CONDITIONS

The entire Kerala region experiences a uniform climate with respect to physiographic location. No distinct winter and summer season are experienced in Kerala. Temperature, Rainfall and Humidity of the area are presented here. The seasonal variation of temperature and relative humidity in Kerala are not significant. The temperature inversions and winds are major factors influencing air quality. The frequency and intensity of rainfall cause drainage and flooding problems leading to the severe deterioration of the road fabric. The climate of Kerala can be broadly grouped into the following seasons in **TABLE 5.1.**

TABLE 5.1. CLIMATE OF THE PROJECT AREA

Sl. No	Monsoon Type	Period	Intensity
1	SW Monsoon	June, July, August and September	Very Heavy Rainfall (Up to 70 % of the total rains)
2	NE Monsoon	October, November and December	Heavy rainfall
3	Non Monsoon	January, February, March, April and May	Occasional rains

(Source: Meteorological Centre, Thiruvananthapuram)

This classification is adopted in the Environmental Assessment process; since the dynamics of the two monsoon seasons are different, the two monsoon seasons cannot be treated together. Normally the classification pre-monsoon, monsoon and post-monsoon seasons are taken for general purposes. The general term 'monsoon' always represents the entire monsoon period from June to December.

5.1.1. TEMPERATURE

In Kerala, during winter and summer a small relative variation of temperature are experienced hence it is neither very cold in winter nor very hot in summer. The mean maximum daily temperature within the considered corridor, even in the coldest month (January) rarely falls

below 21° C. The 'hot' season is from March to May when temperature reaches 37-38 ° C, the annual temperature variation is only 5 ° C.

5.1.2. RAIN FALL IN THE REGION

The onset of the monsoon normally occurs in early June in Kerala. Widespread heavy downpours are recorded until well into September. Usually 70-85 percent of the total annual rainfall occurs during June, July, August and September. The southwest monsoon lasts from the end of May until September, with peak average monthly rainfall in June (330mm) at Kovalam (Thiruvananthapuram). The northeast monsoon is in October and November with a peak average monthly rainfall in October of 280 mm at Kovalam (Thiruvananthapuram). The minimum average monthly rainfall of 20 mm occurs in January.

The average annual rainfall (from 1988-1995) of the PIA districts of three links is presented in **TABLE 5.2.** Climatic condition of Kasargod and Kannur districts are depicted in **FIGURE 5.1** and **FIGURE 5.2** respectively. The wind speed is highest during the south-west monsoon, the direction being from the northwest. In general, the wind speed decreases from November to April. The orographic features of the State mainly control direction and wind speed[1]. In Kerala, the distribution pattern of calm days indicates that the inland stations experience more calm days due to the sheltering effects of the Western Ghats. Wind speed at Palakkad is less than 5 km /hour. Wind direction and speed recorded at 8.30 hrs and 17.30 hrs for all the days during the period 1979-80 have been processed and shown as wind rose diagrams. The wind rose diagram for PIA is presented in the **FIGURE 5.3** and the details are furnished in the **TABLE 5.3**. Generally, wind from the north east and east prevails in the morning (8.30 hrs), while in the afternoon (1730 hrs) it is from the west and northwest. This is clearly attributable to the effects of land and sea breezes. The number of calms is higher in the mornings. This value is 50 numbers for Kannur. In the evening the number of calms is eighteen for Kannur station.

TABLE 5.2. AVERAGE ANNUAL RAINFALL FOR STATE AND DISTRICTS

District	Link No	Average	1988	1990	1995	2005	2010
Kerala State		2961	2653	2780	2952	2990.2	3024
Kasaragod	69	3593	-	4075	3542	2521	4012
Kannur	68 & 74	2923	3419	3214	2775	2642	3497

(Source: Meteorological Centre, Thiruvananthapuram)

TABLE 5.3. WIND DIRECTION AND SPEED FOR THE DISTRICTS

Location	Predominant Wind Direction	Sheltering Effect	Maximum Wind Speed km/Hour	Number Of Calms Morning / Evening
Kannur	NW	Coastal-No	5-10	50/18
Palakkad	East and West	Yes	<5	34/27
Kozhikode	NW	Coastal-No	20	12/3

(Source: Resource atlas of Kerala, 1984)

The percentage humidity is very high in the coastal regions and it varies between 95% in July - August and 60 % in January. The high level of humidity coupled with the relatively high temperature results in high unbearable sweating in human beings.

[1] Resource Atlas of Kerala-Centre for Earth Science Studies, Thiruvananthapuram

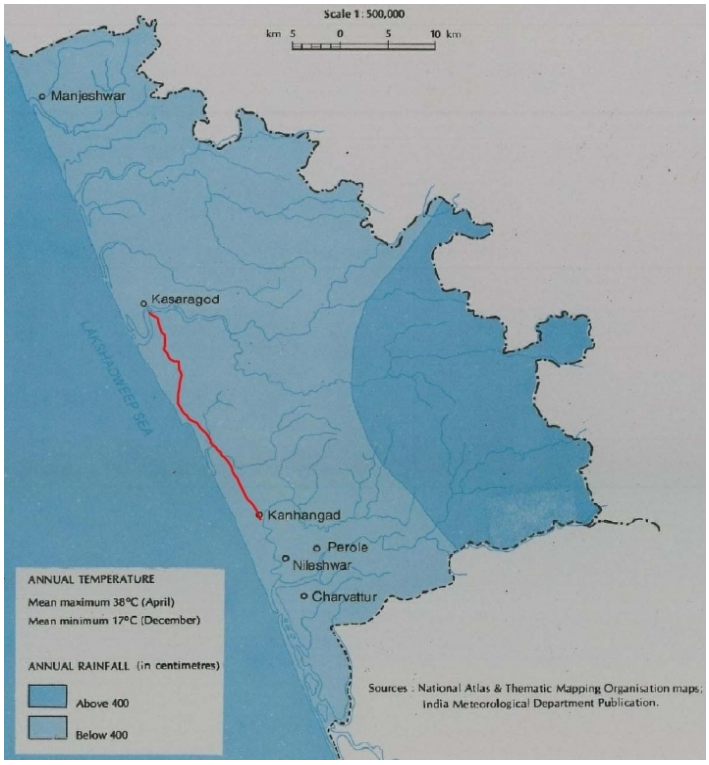


FIGURE 5.1. MAP OF THE KARARGOD DISTRICT SHOWING CLIMATIC CONDITION

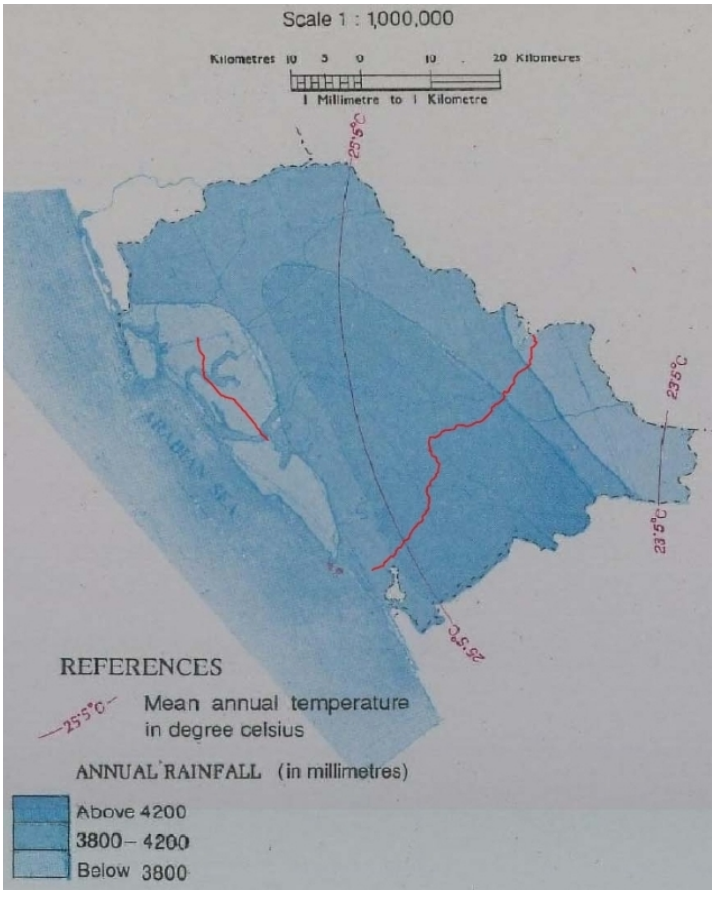


FIGURE 5.2. MAP OF THE KANNUR DISTRICT SHOWING CLIMATIC CONDITION

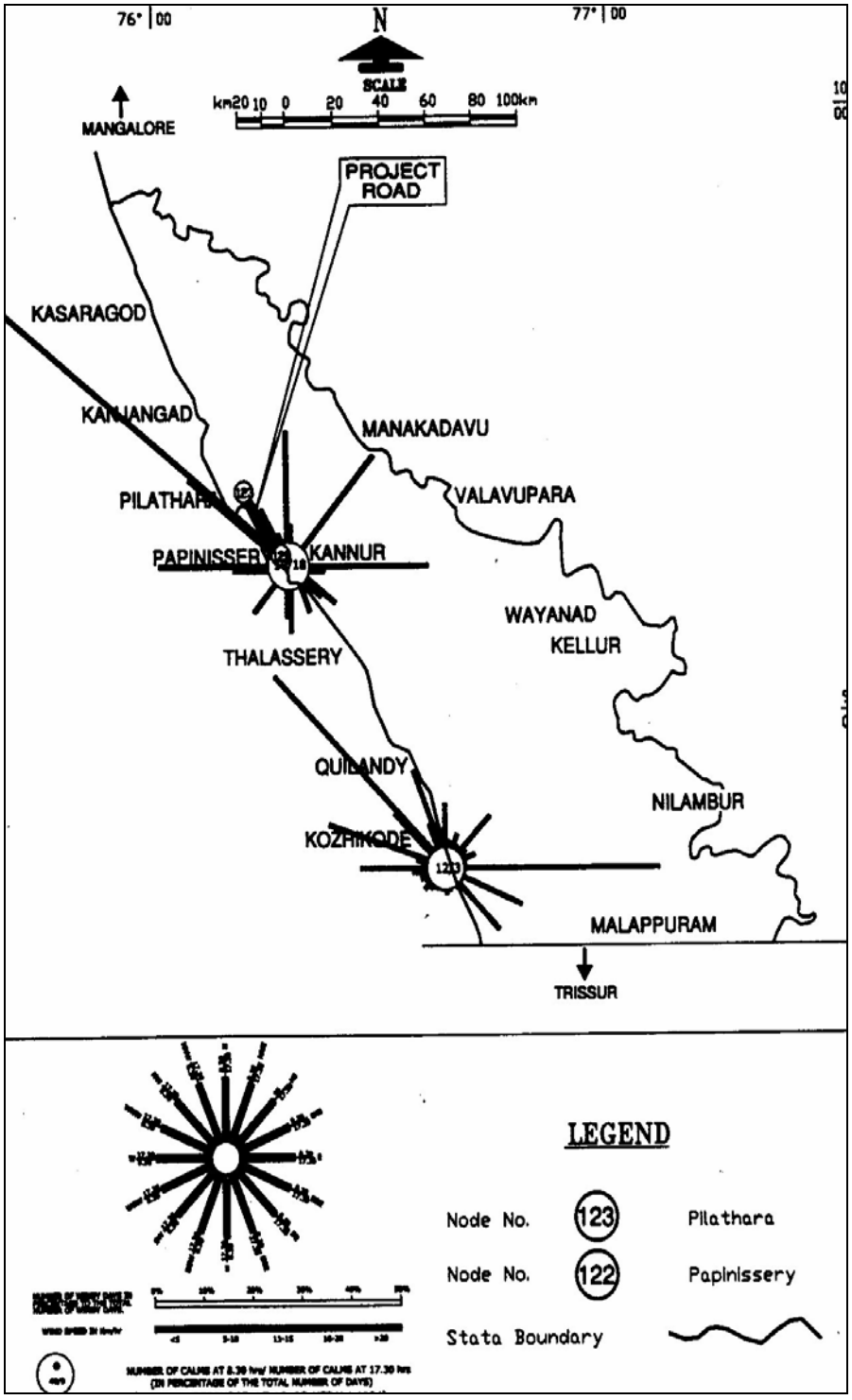


FIGURE 5.3. WIND SPEED AND DIRECTION IN PIA

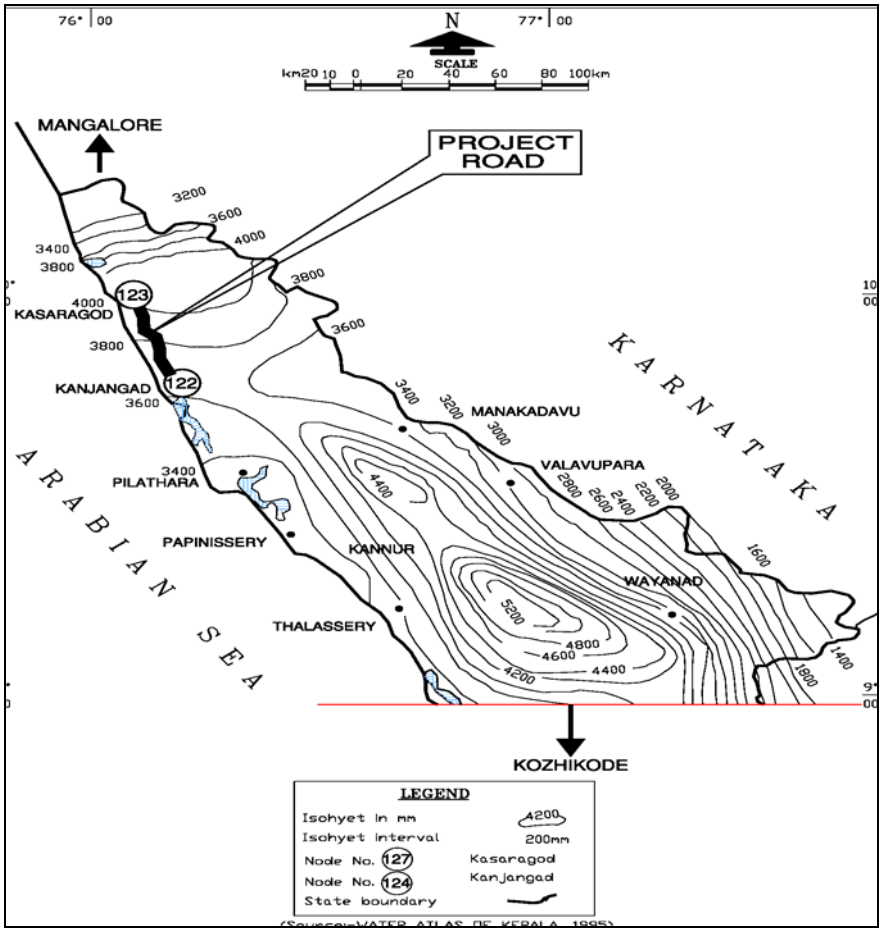


FIGURE 5.4. PROJECT ROAD IN RELATION TO ISOHEYTAL OF THE REGION

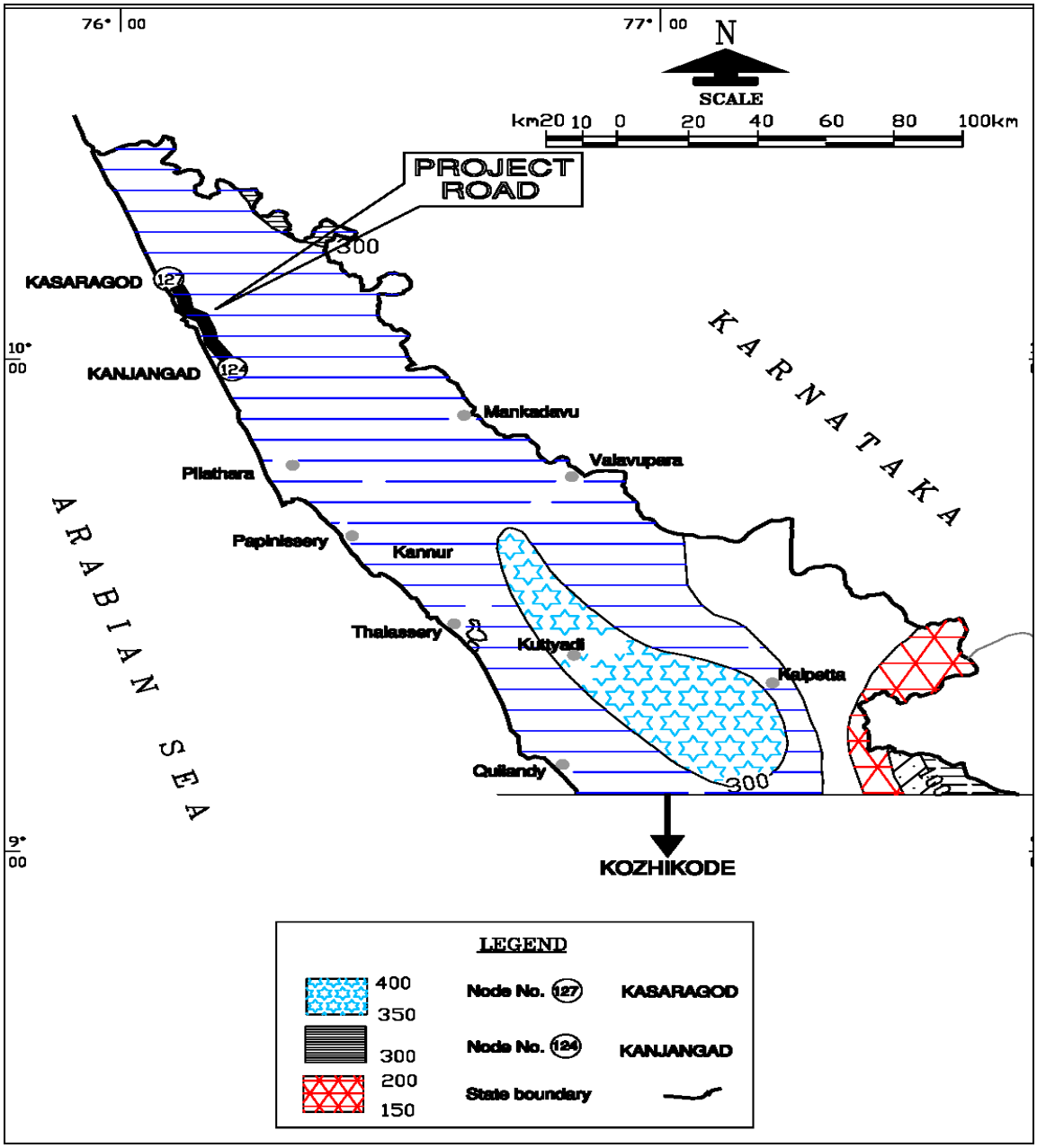


FIGURE 5.5. PROJECT ROAD IN RELATION TO SOUTH WEST MONSOON

5.2. REGIONAL PHYSICAL SETTINGS

5.2.1. PHYSIOGRAPHY

The project districts may be broadly divided into three natural topographic divisions. These are from west to east, the coastal plains called the lowlands (<7m) amsl, central undulating terrain called midlands (7m-76m), and the forest clad high ranges (forming part of Western Ghats) called the highlands (>76m). The elevation of the Project-Influenced Area from the mean sea level (m.s.l) is 10-80m. The topography is undulating with an average elevation of about 40m above m.s.l. Except first 6km, the Kasargod-Kanhandad Project road and Pilathara-Pappinisseri road are more or less completely located in the low land region. The **PLATE 5.1** shows the rich coastal mangrove vegetation in the region.

Plate 5.1. Coastal ecosystems near the end of the Pilathara – Pappinisseri project road

TABLE 5.4. NATURE OF THE ROADS IN TERMS OF THE PHYSIOGRAPHIC LOCATION

Link No.	Link No.	Physiographic Location	Elevation Above Mean Sea Level (m AMSL)	Nature Of The Road
Kasargod – Kanhangad	69	Coastal land	10-80	Located adjacent to coastal low land in-N-S direction
Pilathara-Pappinisseri	68	Coastal land	10-80	Located adjacent to coastal low land in-N-S direction
Thalaserry - Valavupara	74	Low land, Midland, High land	7-300	Across the State in an east westerly direction

5.2.2. GEOLOGICAL CHARACTERISTICS

Geologically the Kasargod district is occupied by recent alluvial formations of estuarine origin close to the coastal belt. The other rock types include charnockites and khondalites of Archaean age. Charnockites are the most prominent rock types among the crystalline rocks. The rock schist's and gneisses also cover large areas of the State. Recent to sub recent sediments within the low-lying areas and river valleys are also identified close to Kanhangad. The **PLATE 5.2** shows the landslide prone area in Kasargod – Kanhangad road. **FIGURE 5.6** and **FIGURE 5.7** shows the geology and mineral distributions for Kasargod and Kannur districts respectively. Economic minerals like bauxite, limeshell and china clay are abundant in coastal areas of the district.

Geologically the Kannur district is occupied by Charnockites and Khondalites of Archaean age. Charnockites are the most prominent rock types among the crystalline rocks. A band of Schist's and Gneisses rocks divided the district diagonally and also sedimentary rock types such as shale/clay and limestone are observed in the north- east portion of the district. The major minerals like limestone, sillimanite, graphite, bauxite, lignite, iron ore, clay, lime shell talc, steatite, etc. have been reported in the district.

The understanding of the geological characteristics helps in the assessment of seismic conditions, foundation requirements, groundwater characteristics, quarries and mineral resources in addition to archaeological resources within the PIA districts as required by the MOEF guidelines.

Plate 5.2 Landslide prone area in link 69

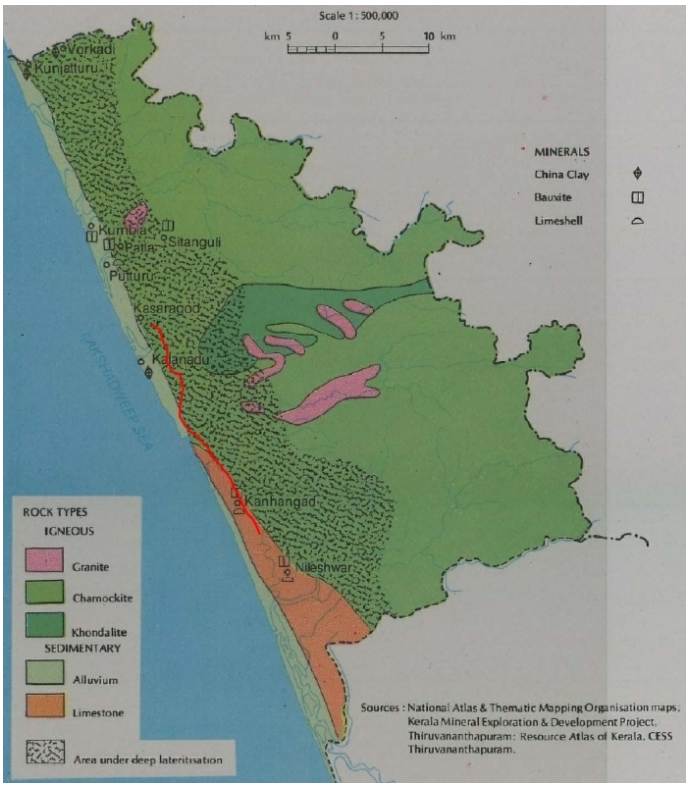


FIGURE 5.6. MAP OF THE KASARGOD DISTRICT SHOWING GEOLOGY AND MINERALS DISTRIBUTION

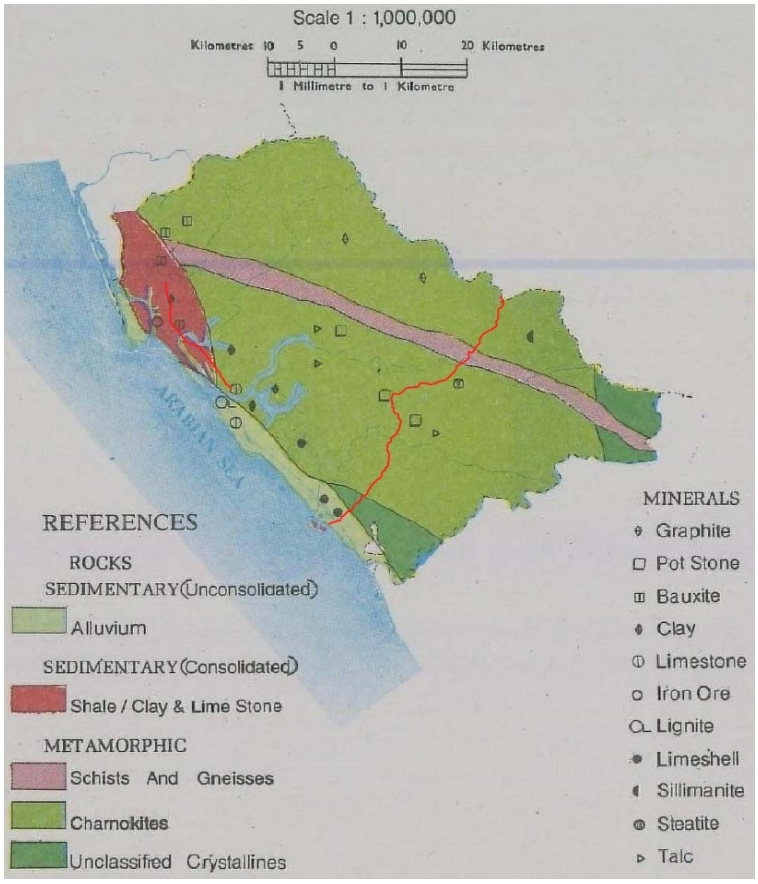


FIGURE 5.7. MAP OF THE KANNUR DISTRICT SHOWING GEOLOGY AND MINERALS DISTRIBUTION

5.2.3. SEISMIC CHARACTERISTICS

The entire Kerala region experienced earth tremors during 2000-2002. Except two tremors that occurred in south Kerala, all other tremors were of minor scale. The project corridor is within the Seismic Zones III as defined by the Indian Standard (IS) 1893-1984 Seismic Zoning Classification. The classification ranks potential seismic risk on a scale from I to V in which Zone I is the most stable and Zone V with basic horizontal seismic coefficient (α_o) of 0.08 is considered to be the least stable. The basic horizontal seismic coefficient (α_o) for Zone III is 0.04.

5.2.4. SOILS

The soils most commonly found in the PIA are: -

- River alluvium
- Brown hydromorphic soil and
- Lateritic soil
- Coastal beach sand soil

River alluvium. The alluvial formation include the estuarine sections of rich mangrove ecosystems where the area is used for coconut retting. The end of the project road is very close to this location. A depositional environment prevails along the coastal estuarine environment at this location where the sediment-laden streams deposit the sediments from rivers and streams because of the abrupt change in its velocity. The location is characterised by confluence of two rivers and the estuary.

Brown hydromorphic soil. This is most commonly found in areas of wetlands and is moderately rich in organic matter, nitrogen and potash but deficient in lime and phosphates.

Laterite. This is a typical weathering product under humid tropical conditions. In general this soil is acidic in nature and poor in available nitrogen, potash, phosphorous and organic matter. It is well drained, widely cultivated; a variety of crops like coconut, tapioca, rubber, arecanut, pepper, cashew etc can be grown successfully. Gravely soil of lateritic origin is generally available in the district.

Coastal beach sands. Along the beaches and immediately adjacent areas towards the landward side.

Soil characteristics of Kasargod and Kannur districts are depicted in **FIGURE 5.8** and **FIGURE 5.9** respectively. Major portion of the link 69 and 68 roads passes through coastal alluvium soil, where as link 74 passes through lateritic soil.

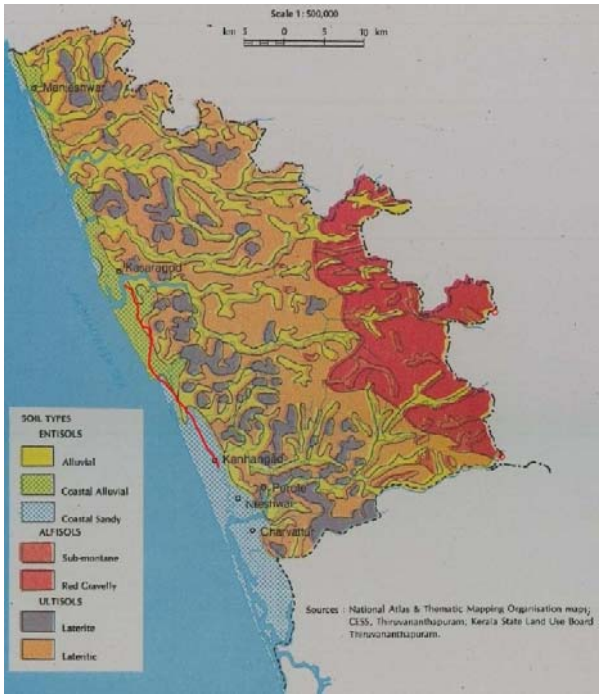


FIGURE 5.8. MAP OF THE KASARGOD DISTRICT SHOWING SOIL CHARECTERISTICS

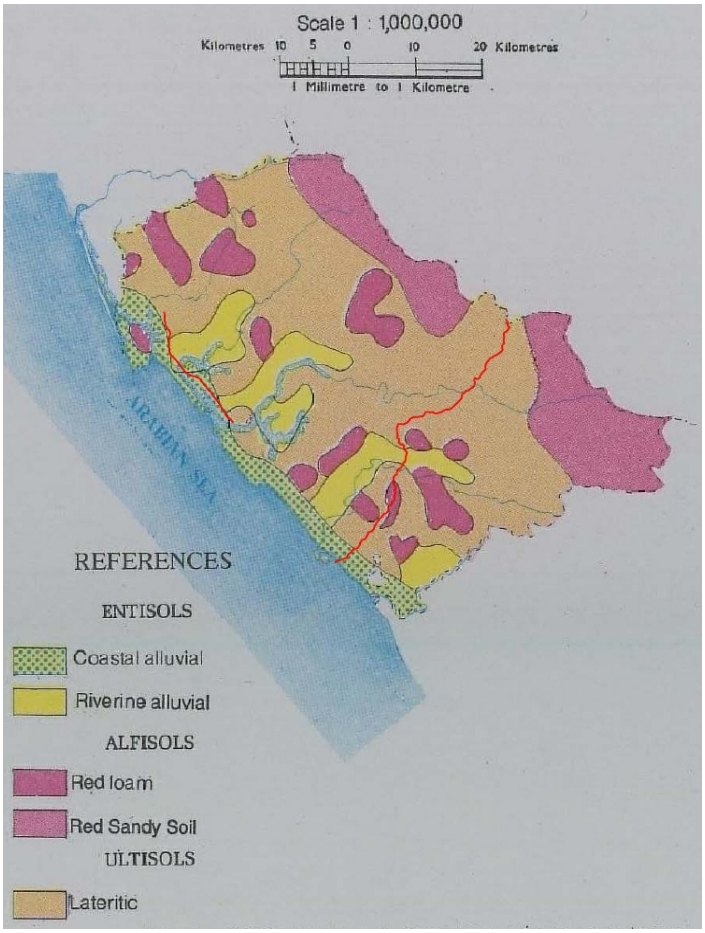


FIGURE 5.9. MAP OF THE KANNUR DISTRICT SHOWING SOIL CHARECTERISTICS

5.2.5. EROSIONAL CHARACTERISTICS

In this section there are two types of erosional environment. First one is erosion along the project road Kasaragod - Kanhangad and Pilathara-Pappinissery and along the river courses and the second one is the beach process along the seacoast parallel to the project road. The Ezhimala section of the coast is accretional (1966-90) where as the Pappinissery section is erosional (1966-99) according to the CZMP prepared in 1999.

Along the Thalassery - Valavupara road, scenario is quite different as the road crosses three physiographic regions of the State. The low land and mid land region is erosion prone while the highland is susceptible to land slides and land slips. The slided area usually undergoes heavy erosion immediately after the landslide / land slip. The project road passes through dense vegetated areas stabilised over a period of time. This will protect the land from being eroded to a great extent. Almost all development activity including road improvement works on soil results in higher rates of erosion. All project corridors are uniformly erosion prone on a minor scale except along the newly disturbed areas. No newly disturbed areas have been noticed in any of the project corridors.

5.2.5.1. LAND EROSION DUE TO MONSOON

During monsoon season all PIA rivers and streams carry considerable amount of sediment load to the sea from highlands and mid lands. The higher level of precipitation in the PIA district leads to erosion, landslides and landslips in the upper catchments. The landslides and landslips further aggravate the rate of erosion. Almost all development activity including road improvement works on soil results in higher rates of erosion. The project corridor is uniformly

erosion prone on a minor scale. Except the railway double lining work, no newly disturbed areas have been noticed in any part of the project corridor. The rate of ribbon developments along the sides of the project corridor is slow but continuous.

5.2.5.2. COASTAL SEA EROSION

There are at least two locations in **Kasaragod - Kanhangad** where the shoreline is very close to the project road i.e., within 100m. At Thrikkanad temple (Chainage 11.8) the elevation of road surface above mean sea level is approximately 0.50m only. In yet another location at Chainage 17.6, shoreline is 100 - 150m where sand dunes are located.

The coastal beach process also lead to sea erosion and accretion. Along the accretion areas new land is being added from the sea and along the erosion prone areas land is being eroded away. The Pappinissery semi urban area up to the end of the project road at NH-17 is located very close to the Valapattanam river estuary and is erosion prone. Mattul to Puthiyangadi is a barrier beach between Taliparamba-Palayangadi rivers and the sea. In some parts of this coast, sea walls are damaged due to depleting frontal beaches.

The beaches that border the Ettikulam estuary and the southern end of it are very wide and earmarked as the restricted areas of Naval Academy. The Ezhimala massif amidst the wide coastal plain can be considered as an area of outstanding natural beauty (CZMP 1995). The CRZ characteristics of the region are explained in the map number 67 and 68 in the Coastal Zone Management Plan prepared by the Government of Kerala.

TABLE 5.5. THE CRZ AREAS ALONG THE PROJECT ROADS

LINK No.		CRZ-ZONE
Kasaragod-Kanhangad		
1	Chittari river crossing at Chittari	CRZ-IV
2	Seacoast near Pallikara upto Bekal	CRZ-1
3	Bekal Fort & Beach[i] (Areas of outstanding natural beauty)	CRZ-I
4	Seacoast north of Bekal including Bekal river crossing	do
5	Seacoast near Kottikulam	do
6	Stream crossing at Kalanad	CRZ-IV
7	Stream crossing at Paravandaka	do
8	Stream crossing at Chammanad	do
9	South bank of Chandragiri river	do
10	North bank of Chandragiri	CRZ-IV
Pappinissery- Pilathara		
1	Valapattanam north bank in Pappinissery Panchayat	CRZ-1
2	Stream crossing at Kannapuram	CRZ-III, IV
3	Eastern bank of the Thaliparamba-Pazhayangadi riverine system at Pungavu	CRZ-III
4	Punnasseri to south bank of Pazhayangadi river	CRZ-III
5	Northern bank of Pazhayangadi river	do
6	Ramapuram river crossing at Adithala	CRZ-III, IV
Thalasseri-Valavupara		
1	River crossing at Erinholi	CRZ-IV

At Kappil beach (**PLATE 5.3** and **5.4**) where the chainage is 9.900, the shoreline is 500 - 1000m. Punchavi - Kanhangad is straight, uninterrupted narrow coastal area, which is severely eroded during the monsoon.

Plate 5.3. Kappil beach (CRZ – I & III) is being developed as a tourist spot (Chainage .9.900).

Plate 5.4. Photograph of Kappil beach with Mangrove associate.

The Kizhur village is an accreting/stable beach well protected by sea walls, which are farther in the backshore. This area falls under CRZ-II (CZMP, 1995). The beaches are relatively wide in the section Kalavayal - Agarasara hole. The Bekel hole in the north and Chittari Puzha in the south drain this section. The river out lets is closed during the fair weather period.

The Punchavi - Kanhangad section is classified as CRZ-II. This is straight, uninterrupted narrow coastal area, which is severely eroded during the monsoon (CZMP, 1995). In order to protect from erosion a sea wall is constructed for a length of about one kilometre adjacent to the Bekel area classified as CRZ-I (CZMP, 1995).

5.2.6. QUARRY AND CRUSHING OPERATIONS

The main material sources have been identified using information collected from the Kerala Highway Research Institute of the State PWD, which has been supplemented by identifying other potential sources and checking their suitability. On reviewing the previous reports, it is observed that approved borrow areas from local PWD for embankment/subgrade fill material is not available, however soil for embankment/subgrade are available from private sources within 5 km distance along the project road. Summary of the few borrow area is given below in **TABLE 5.6.**

TABLE 5.6. SUMMARY OF BORROW AREA

SL. No	District	Quantity Available
1	Kasaragod, Borrow area-1	21000 m3 /year
2	Kasaragod, Borrow area –2	15000 m3 per year
3	3km from Kanhangad towards Mavungal & 3km on NH-17	600 m3/year

(Source: Field Reconnaissance, 2012)

Metal quarry for coarse/fine aggregates- Available type of coarse aggregates in the vicinity of the project road is crushed rock from igneous rocks of granites or granitic type, which are generally well suited as materials for road construction. Summary of the metal quarry as reviewed from the earlier reports are as below-

TABLE 5.7. SUMMARY OF QUARRY

SL. No.	Location/ District	Production Capacity (m3 /year)	Product Material
1	Chandragiri river 5 km from Kasaragod	17,500	River Sand
2	Chittari river 1 km from Kasaragod	-	River Sand
3	(10 km from Kasaragod)	-	20 mm crushed stone
4	(10 km from Kasaragod)	-	6 mm crushed stone
5	4 km from Kanhangad towards Nileswar	25,839	20mm crushed stone
6			6mm crushed stone
7	6 km Kanhangad along NH-66, (formerly NH 17) & 3.5 km from Panathur	-	20 mm crushed stone
8		-	6mm crushed stone
9	2 km from Valapattanam towards Pappinissery	-	River Sand

Source: Field Reconnaissance, 2012

Apart from the above source of materials, the following additional quarries were identified during site visit

- Metal & River Sand Quarry near Thekkikil, 7 km from nearby KM 7+000 on LHS
- Cherembar Metal Quarry near Pallikkara, 10 km from nearby KM 16+000 on LHS
- Cheliyangod river sand, 600 m from nearby km 4+000 on RHS.
- Kottappara crusher about 13 km from Kanhangad on LHS (about 8 km from Mavungal on NH 17).
- Perladkka core quarry about 17 km from Uduma at km 9+000 on LHS (about 10 km from Poinachi on NH-66 (formerly NH 17)).

5.2.6.1. AVAILABILITY OF CONSTRUCTION MATRERIALS

Soil materials. Since the project road is located parallel to the coastal belt, all material sources are available towards the landward side of the project road. Granular soils suitable for the construction of embankments and sub-grades are available within a reasonable distance for use on the project road. The soils available along the alignment are suitable for use in the sub grade. For most of the project roads in plain / rolling country, soil will need to be obtained from private sources since departmental borrow areas are not available. The details of borrow sources identified and the characteristic properties of soils from these sources were ascertained through laboratory testing of samples. There are no major cut sections along the project road.

Quality of the soil along the road has been tested at three stations for Pb, Oil and grease. These are provided below in **TABLE 5.8.** Except Palayangadi where the Pb content is slightly above the limit prescribed by the USEPA (µg/g) in all other two stations the Pb content is within the limit. Oil and grease was not detected in any of the stations. Reason for the higher Pb content is the presence of large number of commercial vehicles and workshops in the area.

TABLE 5.8. SOIL QUALITY ANALYSIS ALONG THE PROJECT CORRIDOR

Link	Station	Concentration of Parameters	
		Lead in µg/g	Oil & grease mg/l (10% solution)
Link 69, Kasaragod - Kanhangad	Kasaragod	ND	ND
	Uduma	6.6	ND
Link 68, Pilathara-Pappinissery	Pilathara	11.9	ND
	Cherukunnu	8.6	ND

Link	Station	Concentration of Parameters	
		Lead in µg/g	Oil & grease mg/l (10% solution)
	Pappinissery	8.7	ND

(Source: PCB, 2002)

Sub-base material. Naturally occurring murrum / gravel is rarely available for direct use as sub-base material which satisfies grading and strength properties. Suitable sub base material can, be made locally by blending soil, aggregate / shingles and sand in suitable proportions to satisfy the specification requirements.

Base course material. Stone of suitable quality for use as aggregates for pavement courses as well as for concreting is available along the project roads within reasonable haul distances. There are a number of private crusher operators who supply crushed aggregates of different grades. From laboratory tests conducted, it has been observed that aggregates available from local stone crushers generally satisfy the specification requirements.

Fine Aggregate. River sand of suitable quality is available for use in the project roads within reasonable distances. Due to 'mining' phenomenon, the Government has heavily controlled the river sand mining. Quarry dust and quarry sand are available from private stone crusher owners, and this can also be used as fine aggregate for bituminous mixes.

Details of locations of material sources were also identified in the study as shown in **TABLE 5.7**. The **PLATE 5.5** shows an area close to Chiyamkode near link no 69 where sand mining is a thriving business.

Borrow Pits. Areas suitable for borrow pits (i.e., sources of material for the construction of embankments and use as fill) have been located in accordance with the Indian Roads Congress Specifications.

Plate 5.5. Photograph of the sand mining area at Chiyamkode

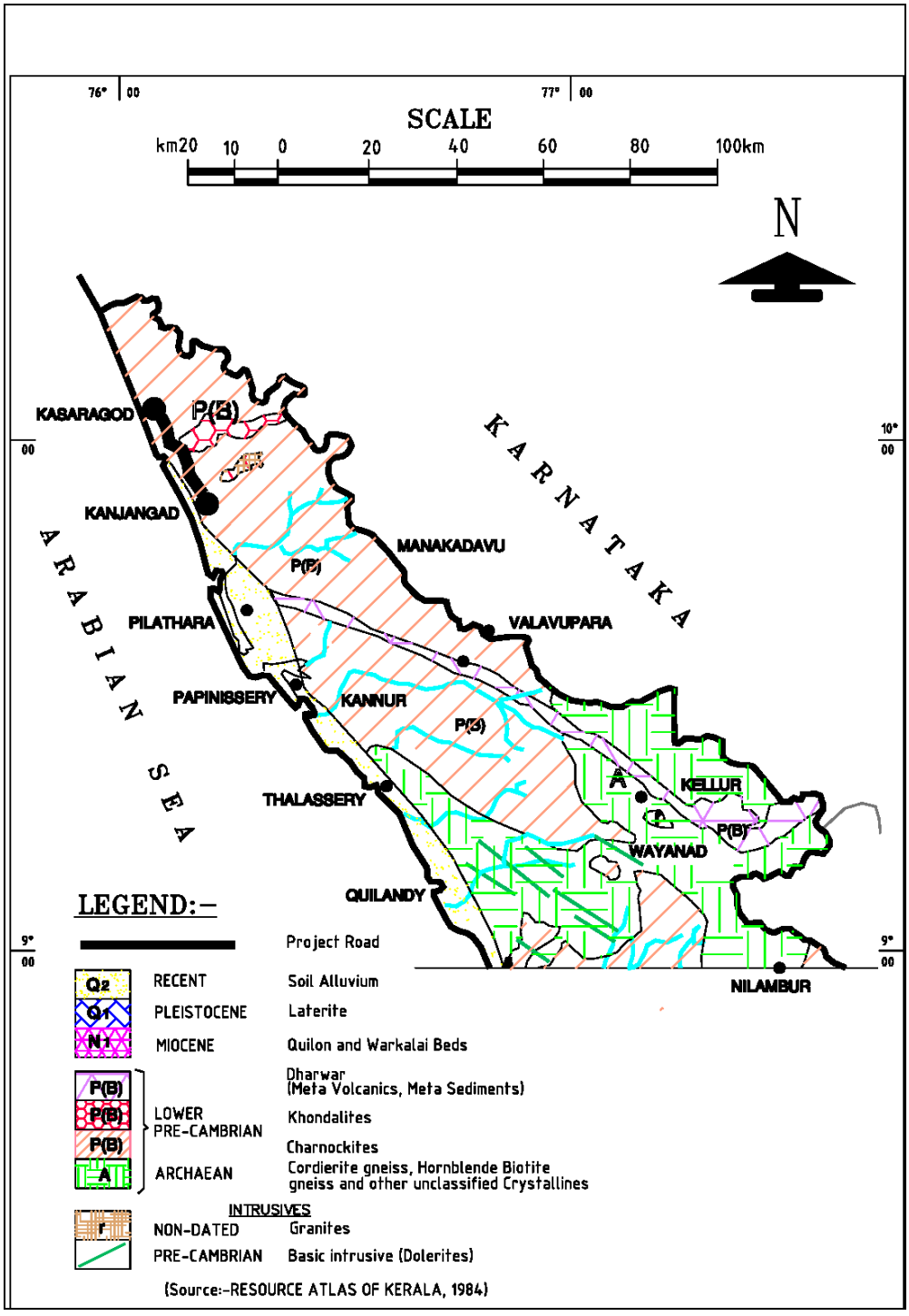


FIGURE 5.10. MAP OF KASARGOD REGION IN RELATION TO GEOLOGY

5.3. WATER RESOURCES

5.3.1. SURFACE WATER RESOURCES

The estuary and confluence point of Valapattanam and Palayangadi rivers are within three kilometres distance from the project road at Pappinissery. The various rivers and their tributaries that flow through the PIA district are shown in the **TABLE 5.9** and **TABLE 5.10** and **Annexure 3.52,** Part II, EMP Report, Volume I, II and III. Due to the tidal influence, all water bodies except ponds/wells are classified and included under CRZ regulations. In the PIA, all these rivers are comparatively shorter with respect to its total catchments and length. These rivers originate from the lower reaches of Western ghats and flows into the Arabian Sea. During monsoon the river often over flows; flooding adjacent areas. After monsoon season, except the lower estuarine portion closer to the sea, the upper reach goes dry.

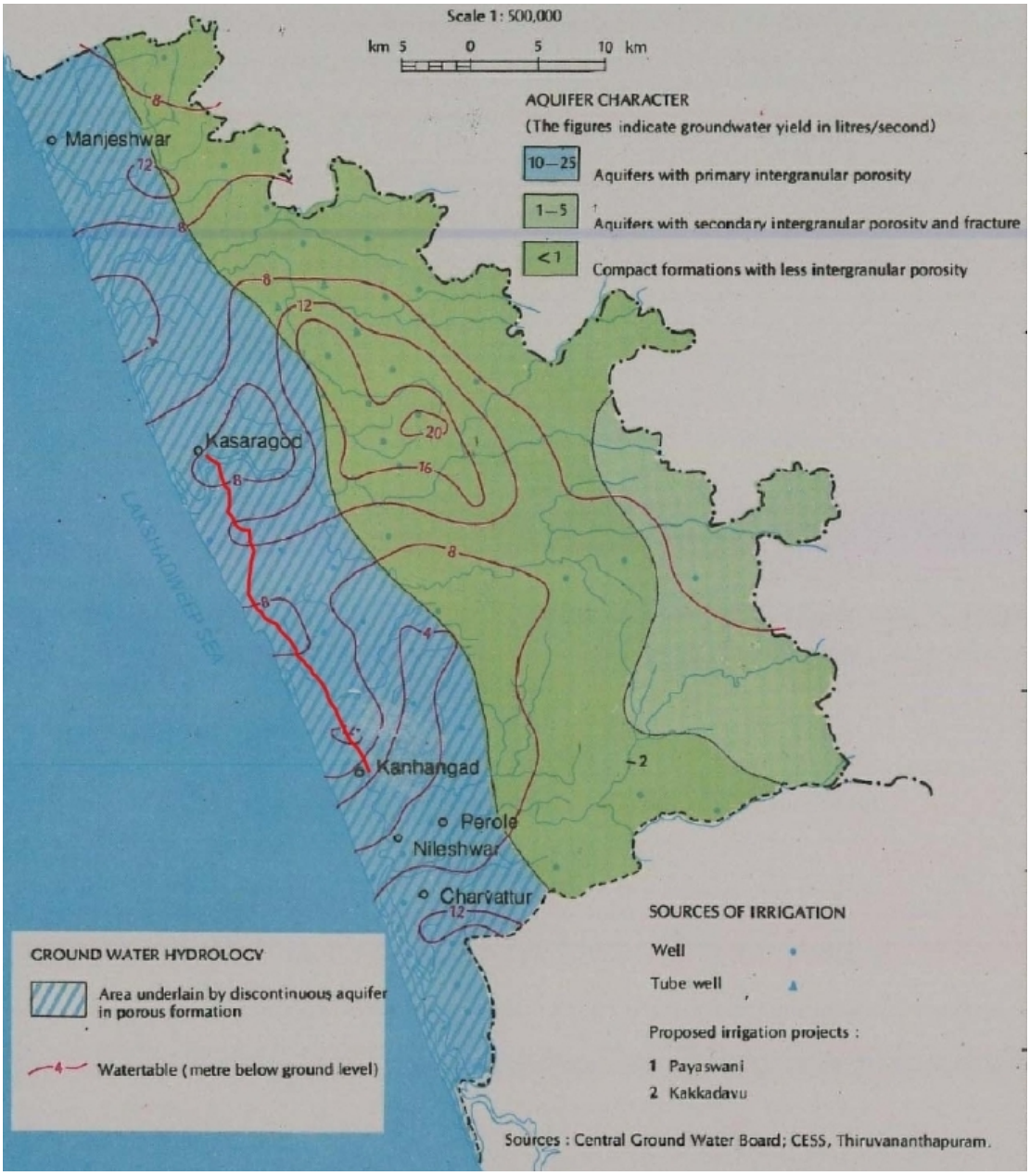


FIGURE 5.11. MAP OF THE KASARGOD DISTRICT SHOWING IRRIGATION AND HYDROGEOLOGY

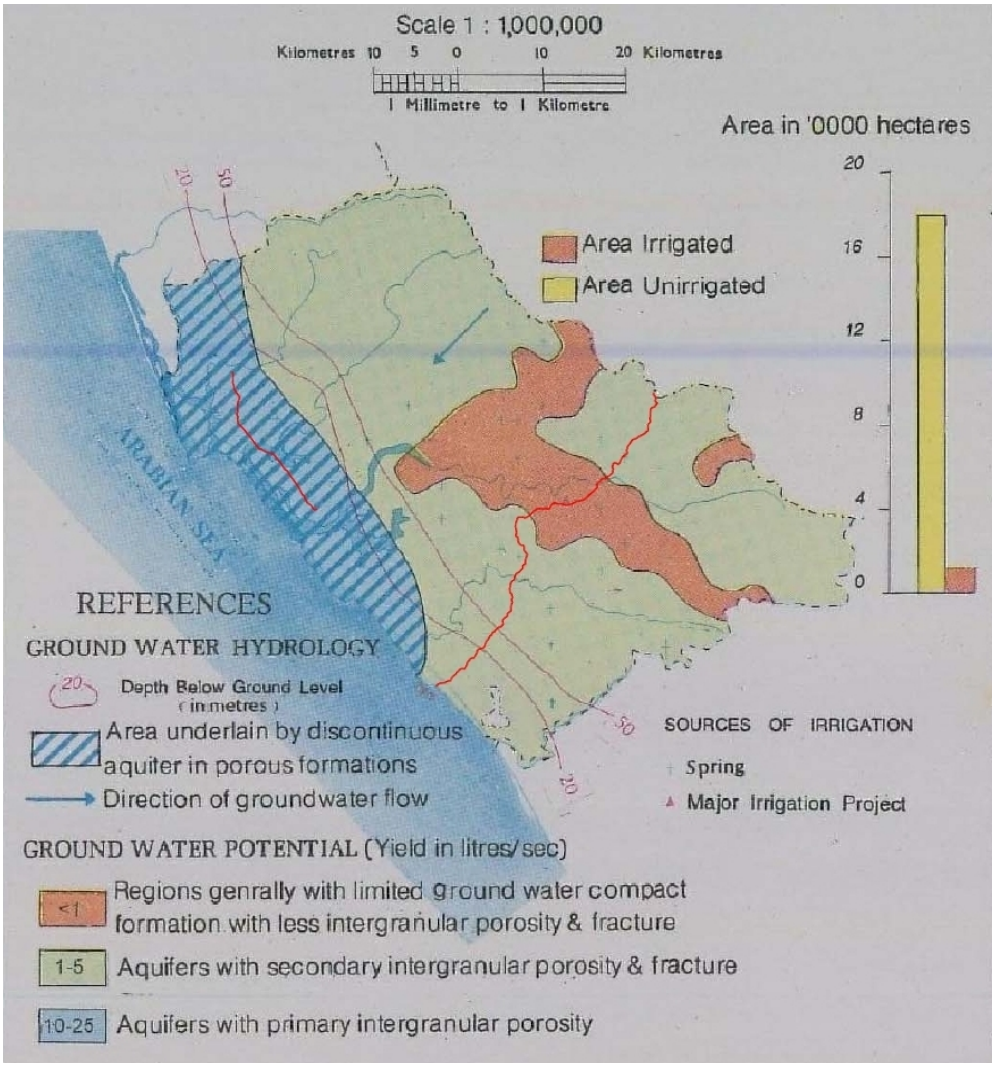


FIGURE 5.12. MAP OF THE KANNUR DISTRICT SHOWING IRRIGATION AND HYDROGEOLOGY

Palayangadi and Thaliparamba rivers have extensive mangrove ecosystems classified as CRZ-1 (CZMP, 1999).

TABLE 5.9. WATER BODIES ALONG THE PROJECT ROAD

Name of Water Body	Nature of Water Body	Relation to the Existing Road	Chainage
Link no.69			
Chandragiri River	Biggest water body along this route	River crossing the project Road	0.800
Chammanad	Stream	Road crossing the River	1.750
Paravandaka	Stream	Road crossing the River	2.600
Kalanadu Stream[2] (This is a very small basin)	A small stream near to the road	Crossing the stream	6.500
Bekal Hole	A small river (a tourist spot)	Road crossing the River	13.100
Pallikare Stream	A small stream	Road crossing the River	15.000

[2] Very small stream not considered in the 44 rivers of Kerala

Name of Water Body	Nature of Water Body	Relation to the Existing Road	Chainage
Chittari Hole	A river	Road crossing the River	18.300
Link no.68			
Valapattanam River (Plate 6)	River	Located close to the end change at Pappinissery	20.900
Palayangadi river(plate 7)	River	Crossing the road	6.900
Ramapuram River(Plate 9)	River	Crossing the road	4.600
Kannpuram River (plate 10)	Stream	Crossing the road	14.900
Link No.74			
Chirakkara	River	Across the road	2.900
Meruvampai	River	Across the road	19.750
Karetta	Canal	Across the road	21.170
Mattannur	Canal	Across the road	26.160
Kalaroad	Stream	Across the road	29.440
Uliyil	River	Across the road	35.290
Iritti - Valapattanam River	River	Across the road	42.000

Plate 5.6. Valapattanam River near Pappinissery with lazurious mangroves

Plate 5.7. Pazhayangadi River at chainage 6.900 in Link no. 68

Plate 5.8. Chirakkara at Erinholi in link no. 74

Plate 5.9. Ramapura River (chainage 14.200) in Link no. 68

The Western ghats and the Arabian Sea are much narrower towards northern part of the Kerala State. Most of the rivers are very small in terms of area of catchment's and the length and physical size of the river. Details of these rivers are shown in **TABLE 5.9**. The Pazhayangadi River flows parallel to the project road after chainage 6.900. (CESS, 2002)[3].

Plate 5.10 Chittari river in link no. 69

TABLE 5.10. MAJOR RIVERS DRAINING THE PIA DISTRICTS

Sl. No	Name Of River	Link No.	Length (km)	Catchment Area (sq. km)		
				Kerala	Karnataka	Total
1	Valapattanam River	74	110	1321	456	1867
2	Ramapuram River	68	19	52		52
3	Pazhayangadi river	68	82	469	70	539
4	Anjarakkandi	68	52	412		412
5	Chandragiri	69	104	1406		1406
6	Chittari	69	25	145		145
7	Peruvamba	68	51	300		300

(Source: Water Resources Atlas of Kerala)

The various rivers and their tributaries that flow through the PIA districts are shown in the **TABLE 5.9**. In the PIA, all these rivers are comparatively shorter with respect to its total catchments and length. These rivers originate from the lower reaches of Western Ghats and flow into the Arabian Sea. The Kalanadu and Kottikkulam streams are too small to be included in the 44 rivers of the State. During monsoon period, the river often over flows; flooding adjacent areas. After monsoon season, except the lower estuarine portion closer to the sea, the upper reach goes dry. The Chandragiri River/Bakel hole (river) has a large estuary, which is being used, as a tourist spot. Low lying areas: Low-lying areas along the project road are coastal sandy beaches, coconut plantations, paddy field areas and rivers and streams provided in **TABLE 5.16**. Most of these areas are included in CRZ category.

Plate 5.11. Chittari puzha Chainage 18.300

Plate 5.12. Chandragiripuzha Chainage 0.900

[3] CESS, 2002

The details of the project corridors that cross various river systems, sections having drainage issues etc., are indicated in the **Table 2.1** Environmental data sheet, Part II EMP Report, Volume I, II and III,. Bridge locations are also listed in data sheets.

5.3.2. DRAINAGE

The side drains are not available through out the project roads. The available drains are partly or completely choked due to the absence of regular maintenance. The choked drains some times lead to flash floods in the market areas.

The number of cross drainage structures and their locations with respect to road chainages are given in the environmental data sheets. An analysis of CD structures showed that the density of cross drainage structures is generally of the order of 2 to 4.6 per kilometre. The average CD structures per kilometre are found to be 3.00 per kilometre for the link 68. No new culverts are proposed along the 20.900 km length of the corridor. In addition to this, 20 number of culverts are to be widened to accommodate the design width and 43 number of culverts are to be reconstructed. There are only three bridges constructed across three rivers flowing across the corridor.

The Nileswar river is not crossing the project road. The link 69 Kasaragod - Kanhangad project road link in relation to river basins of the region are shown in **TABLE 5.9**. Details of these rivers are shown in **TABLE 5.10**. In addition, small rivulets also drain the Trikkamnad - Chemmad area. These rivulets are closed during the monsoon season. This could be to avoid salt-water ingress towards the landward side.

Plate 5.13. Bekal hole Chainage 13.100

There are 31 cross drainage structures and four bridges along the link no. 68. The number of cross drainage structures required for a road with a more or less north south alignment is naturally very high. The number of cross drainage structures and their locations with respect to road Chainages are given in the environmental data sheets. An analysis of CD structures showed that the density of cross drainage structures is generally of the order of 1 to 2 per kilometre. The average CD structures per kilometre are found to be 1.33 per kilometre. Additional culverts are also proposed wherever it is required. In addition to this a number of culverts are to be widened to accommodate the design width and a number of culverts are to be reconstructed. The designs for culvert widening are adjusted to one and two-side widening. There will be reconstruction wherever the existing structure is in a poor condition. The planned construction is for the full formation width.

In the case of link no. 74 there are 6 bridges and 175 culverts among which 9 are new. The terrain of both sections especially that of link 74, is mostly undulating and generally sloping from east to west.

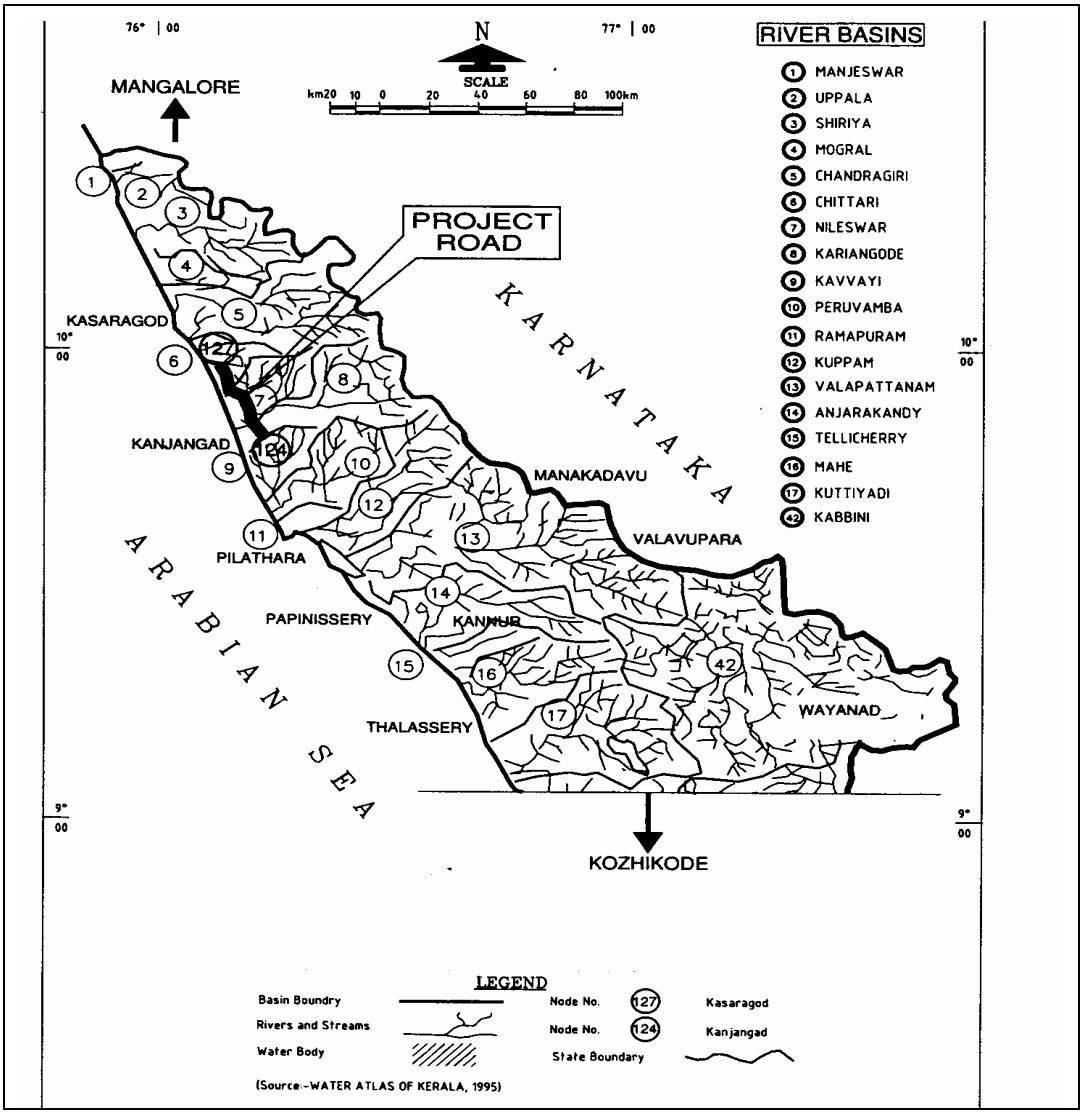


FIGURE 5.13. PROJECT ROAD IN RELATION TO RIVER BASINS OF THE REGION

5.3.3. GROUNDWATER IN THE PROJECT INFLUENCED AREA

Coastal region. As in other parts of Kerala, along the coastal belt (PIA) also groundwater is the main source of drinking water. Within the PIA the community drinking water sources are mainly groundwater. The groundwater sources are to be protected from seawater intrusion. At present sea water intrusion is not a problem in non-urban areas (PIA is predominantly rural) of the Project road.

The groundwater in the coastal region occurs predominantly under water table conditions in the alluvial deposits of recent age and these aquifers are normally a few tens of meters in thickness. Open wells of approximately 2m diameters are the common groundwater extraction method. In some places, the sandy aquifers may extend to depths of tens of metres.

Kasaragod: The community drinking water sources are mainly groundwater. Acute water scarcity is faced in the hilly areas in summer period due to drying up of dug wells. Dug wells in midland region get dried up if monsoon is delayed or if there is no summer showers. The increased dependence on borewells in midland areas leads to drying up of dug wells in lateritic mounds and slopes which affects the drinking water needs of farmers and poor people. As per

ground water information booklet of Kasargod district, 2007, (Refer **TABLE 5.11**) Kasargod block is the overexploited grorundwater block while the Manjeswar and Kanhangad are semi critical blocks.

Kannur: Kannur urban area is located away from the PIA. Decline in water level, water scarcity and pollution due to saline water intrusion are some of the major problems noticed in the Kannur district. Thalasserry and Kuthuparambu blocks, having a stage of ground waterutilisation of 150.79% and 96.68% respectively can be demarcated as vulnerable area on consideration of depletion of ground water level. Water scarcity is a severe problem faced by villagers living in hilly terrains due to the drying up of wells in summer season. Dug wells in the midland region also get dried due to the delay of monsoon rains or to the absence of summer showers. As per ground water information booklet of Kannur district, 2007, Thalasseri and Koothuparambu are critical blocks while there is no overexploited notified blocks in the district.

Thalassery town area are located in the coastal area. At this locations groundwater occur predominantly under water table conditions in the alluvial deposits of recent age and these aquifers are normally a few meters in thickness. The open hand dug wells are the common groundwater extraction structures. In some places the sandy aquifers may extend to depths of tens of metres. In the mid land region, groundwater is often encountered under water table conditions in the lateritic aquifers of 10 to 20m thickness. Wells of relatively large diameter of about 4 to 6m are the common groundwater extraction structures in the midlands. Only a portion of 10km of the link 74 falls in the highland region. The jointed and highly weathered zone forms the aquifer in this region. Groundwater occurs under water table conditions and can be exploited through dug wells.

TABLE 5.11. STATUS OF GROUND WATER IN THE PIA DISTRICTS

Category	Blocks in Kasargod District	Blocks in Kannur District
Safe block	Nileshwar	Nil
Semi critical/cririca l blocks	Manjeshwar & Kanhangad	Thalassery & Kuthuparambu
Over exploited block	Kasargod	Nil

5.3.4. WATER QUALITY

The baseline water quality studies are an integral part of any Environmental Assessment studies. Baseline environmental monitoring for various environmental attributes were conducted by the consultants in May 2012 for the project, as per the guidelines of CPCB. NABL accredited and MoEF approved, M/s Enviro Designs Eco Labs, Ernakulam conducted the environmental monitoring for the project.

FIGURE 5.14. MONITORING LOCATIONS OF KASARGOD – KANHANGAD ROAD

FIGURE 5.15. MONITORING LOCATIONS OF PILATHARA - PAPPINISSERI ROAD

The baseline status of surface and ground water quality along the project road has been established through sampling and analysis of various water quality parameters as part of the environmental monitoring conducted by the Consultants. The sampling locations were selected at representative locations based on existing land use and type of water body. Surface water samples were selected from rivers, while ground water samples were taken from open wells. The details of the same are presented in **TABLE 5.12** and depicted in **FIGURES 5.14, 5.15** and **5.16** for link no. 69, 68 and 74 respectively.

Sampling for water quality monitoring was conducted at all the locations once in May 2012. The surface water samples were collected and analysed as per the procedures specified in IS: 2296 and ground water samples were analysed as per the procedures specified in IS: 10500.

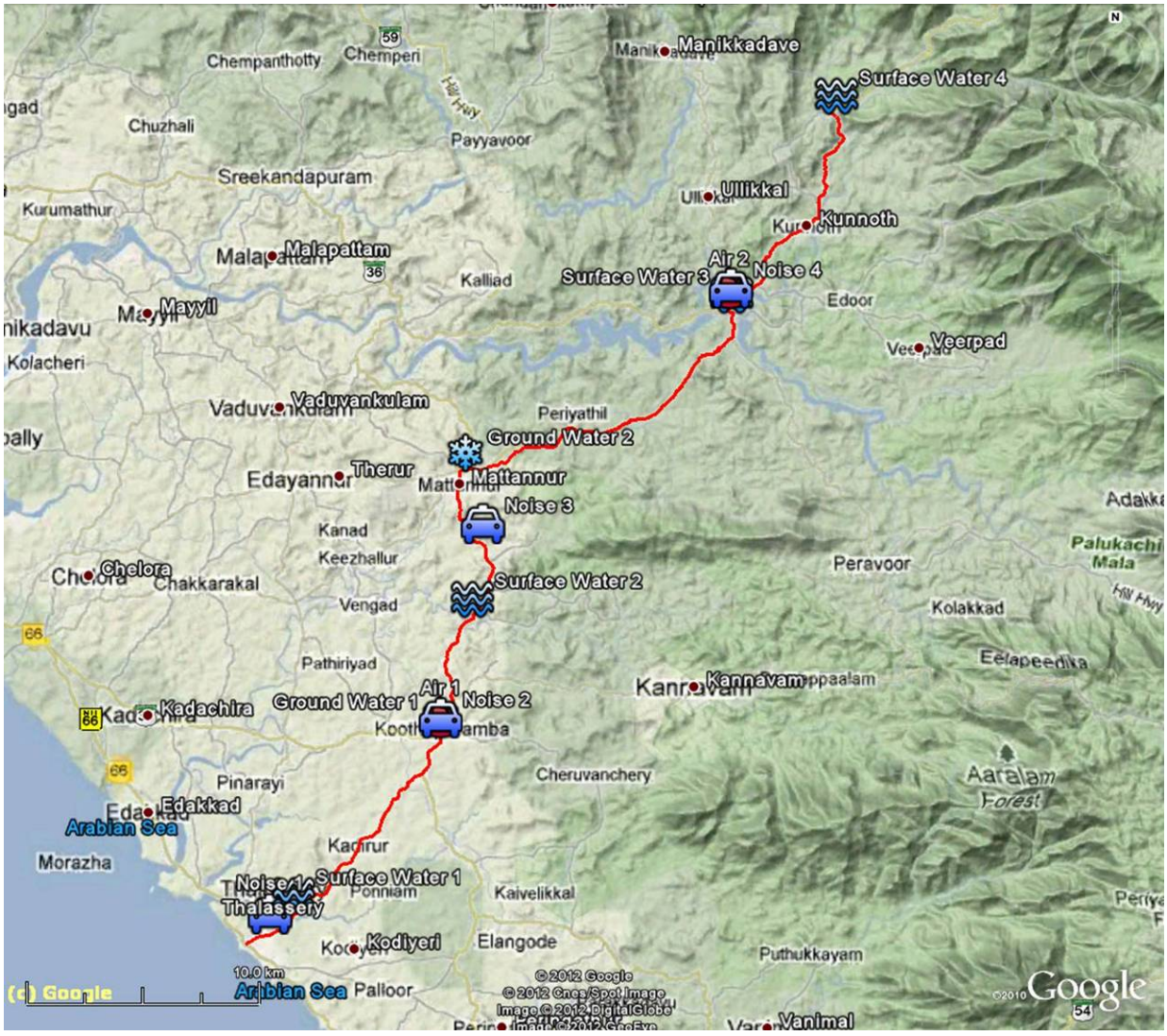


FIGURE 5.16. MONITORING LOCATIONS OF THALASSERI - VALAVUPARA ROAD

The prime objective of the baseline surface and ground water quality study was to establish the existing water quality of the study area to evaluate the anticipated impact of the proposed project and to suggest appropriate mitigation measures for implementation. This will also be useful for assessing the conformity to the standards of surface water quality during the construction and operation phase of the project. The monitoring results of all the three links for surface water quality and ground water quality are presented in **TABLE 5.13 to 5.15.**

TABLE 5.12. DETAILS OF SAMPLING LOCATIONS

Sample Code	Location in link No. 69	Location in link No. 68	Location in link No. 74
Surface Water Sampling Locations			
SW 1	Chandragiri River at Kasargod	Stream near Ramapuram Temple	River at Erinholi
SW 2	Bekal Hole River at Bekal	Pazhayangadi River	Anjarakandi River at Meruvambai
SW 3	Chittari River at Chittari	Valapattanam River	Valapattanam River at Iritty
SW 3			River at Valavupara

Sample Code	Location in link No. 69	Location in link No. 68	Location in link No. 74
Ground Water Sampling locations			
GW 1	Private Well at Kalanad	Well at Pilathara	Well at Koothuparambu
GW 2	Private Well at Kanhangad	Well at Kannapuram	Well at Mattannur

Source: Reconnaissance survey.

TABLE 5.13. WATER QUALITY ANALYSIS RESULTS OF LINK NO. 69

Sl No	Parameter	Unit	Value Reported					Desirable Limit as per IS 10500: 1991	Limit as per IS 2296: 1982 Class C
			Ground Water		Surface Water				
			GW 1	GW2	SW 1	SW 2	SW 3		
1.	Colour	Hazen	4.0	4.0	4.0	4.0	8.0	5	300
2.	Odour	--	Unobjectionable					Unobjectionable	-
3.	Taste	--	Agreeable					Agreeable	-
4.	Turbidity	NTU	BDL	0.8	2.3	0.7	4.2	5	-
5.	pH	--	6.71	6.33	7.83	7.30	7.75	6.5-8.5	6.5-8.5
6.	Dissolved Oxygen (Min)	mg/l	4.6	5.0	6.4	4.1	4.6	-	4
7.	BOD (3 days 27^{o}C)	mg/l	Nil	0.1	0.5	Nil	1.4	-	3
8.	Total Dissolved Solids	mg/l	176	196	53760	26660	62780	500	1500
9.	Total Hardness as $CaCO_3$	mg/l	72	100	4700	4500	5350	300	-
10.	Iron as Fe	mg/l	BDL	0.07	0.10	0.07	0.55	0.3	50
11.	Chloride as Cl	mg/l	49.98	51.98	289901.01	129905.97	339809.46	250	600
12.	Mineral Oil	mg/l	BDL	BDL	BDL	BDL	BDL	0.01	0.1
13.	Sulphate as SO_4	mg/l	17.29	32.40	3034.85	2717.26	3403.4	200	400
14.	Nitrate as NO_3	mg/l	0.07	6.88	0.26	0.32	0.48	45	50
15.	Total Coliforms	MPN/ 100ml	1600	1600	8	6	9	10	5000
16.	E.Coli	MPN/ 100ml	Absent		Present			0	-

Source: Environmental Monitoring

It has been inferred from the monitoring results that all important potability parameters of water are falling within the limit for surface water and ground water.

Surface water sources are already protected from saline water intrusion for small rivers. In other rivers such as the Valapatanam river the outflow to the sea prevents the seawater intrusion most of the year.

TABLE 5.14. WATER QUALITY ANALYSIS RESULTS OF LINK NO. 68

Sl No	Parameter	Unit	Value Reported					Desirable Limit as per IS 10500: 1991	Limit as per IS 2296: 1982 Class C
			Ground Water		Surface Water				
			GW 1	GW2	SW 1	SW 2	SW 3		
1.	Colour	Hazen	12	4	10	7.0	25	5	300
2.	Odour	-	Unobjectionable						
3.	Taste	-	Agreeable						
4.	Turbidity	NTU	2.2	BDL	3.5	1.1	136.4	5	-
5.	pH	-	6.03	6.75	7.22	7.28	7.25	6.5-8.5	6.5-8.5
6.	Dissolved Oxygen (Min)	mg/l	1.1	1.9	2.9	3.4	3.0	-	4
7.	BOD (3 days 27^{o}C)	mg/l	Nil	Nil	1.2	NIL	1.6	-	3
8.	Total Dissolved Solids	mg/l	268	288	45780	32820	52090	500	1500
9.	Total Hardness as $CaCO_3$	mg/l	68	168	8850	5200	5000	300	-
10.	Iron as Fe	mg/l	1.06	BDL	1.06	0.62	52.01	0.3	50
11.	Chloride as Cl	mg/l	124.96	67.98	22992.87	16294.95	27991.32	250	600
12.	Mineral Oil	mg/l	BDL	BDL	BDL	BDL	BDL	0.01	0.1
13.	Sulphate as SO_4	mg/l	8.74	29.67	2981.16	3012.1	2882.88	200	400
14.	Nitrate as NO_3	mg/l	1.53	4.62	0.67	0.47	0.55	45	50
15.	Total Coliforms	MPN/ 100ml	1600	11	8	2	130	10	5000
16.	E.Coli	MPN/ 100ml	Present		Absent		Present	0	-

Source: Environmental Monitoring

TABLE 5.15. WATER QUALITY ANALYSIS RESULTS OF LINK NO. 74

Sl No	Parameter	Unit	Value Reported					Desirable Limit as per IS 10500: 1991	Limit as per IS 2296: 1982 Class C
			Ground Water		Surface Water				
			GW 1	GW2	SW 1	SW 2	SW 3		
1.	Colour	Hazen	4.0	6.0	4.0	10	6.0	5	300
2.	Odour	-	Unobjectionable						
3.	Taste	-	Agreeable						
4.	Turbidity	NTU	1.2	1.8	2.4	2.5	2.1	5	-
5.	pH	-	5.39	5.21	7.13	5.26	6.93	6.5-8.5	6.5-8.5
6.	Dissolved Oxygen (Min)	mg/l	-	-	3.2	-	-	-	4
7.	BOD (3 days 27^{o}C)	mg/l	0.5	0.2	NIL	3.1	2.4	-	3
8.	Total Dissolved Solids	mg/l	52	40	42020	56	44	500	1500
9.	Total Hardness	mg/l	24	20	6500	24	24	300	-

Sl No	Parameter	Unit	Value Reported					Desirable Limit as per IS 10500: 1991	Limit as per IS 2296: 1982 Class C
			Ground Water		Surface Water				
			GW 1	GW2	SW 1	SW 2	SW 3		
	as $CaCO_3$								
10.	Iron as Fe	mg/l	BDL	0.53	0.15	0.59	0.74	0.3	50
11.	Chloride as Cl	mg/l	17.99	12	2119 3.43	17.99	10	250	600
12.	Mineral Oil	mg/l	---	---	BDL	---	--	0.01	0.1
13.	Sulphate as SO_4	mg/l	BDL	2.0	3394. 3	BDL	BDL	200	400
14.	Nitrate as NO_3	mg/l	1.93	0.25	0.38	0.39	0.05	45	50
15.	Total Coliforms	MPN/ 100ml	4	110	34	33	26	10	5000
16.	E.Coli	MPN/ 100ml	Absent		Absent		Prese nt	0	-

Source: Environmental Monitoring

5.3.5. EFFECTS OF FLOODS IN THE REGION

Due to heavy precipitation during monsoon season the occurrence of floods along the coastal road sections are not uncommon. The likely flood sections in the project are shown in **TABLE 5.16**. The Kannur district has an average annual precipitation of 2923 mm. Approximately 90 % of the rainfall is precipitated during the six monsoon months, the high intensity storms during the monsoon months result in heavy discharges in all rivers. The river consequently overflows and the heavy discharge rapidly reaches the midland and coastal regions spreading over lagoons and backwaters raising the general water level and submerging vast stretches of low lying land. The Kasaragod district has an average annual precipitation of 3593mm. At those places where the sea is very close to the road (at Kottikkulam fishing area and also the location of sand dunes) the coastal erosion and sea waves could reach up to the road surface during peak monsoon if the ongoing sand mining is not banned.

Local consultations indicated that the road embankment heights have been improved successively many times during past several years. In other places the monsoon effect on roads is the frequent flooding of road sections for many hours at a time. This will result in traffic disruption and damage to the road fabric.

TABLE 5.16. FLOOD PRONE SECTIONS IN THE PROJECT AREA

Location	Chainage		Length
	From	To	
Link No. 68			
Pilathara	0.000	0.250	250
Pilathara	1.300	1.450	150
Eripuram	5.025	5.125	100
Payangadi	6.325	6.600	275
Punnachery	9.260	9.340	80
Link No. 69			
Kalanad	3.250	3.550	300
Kottakkal	6.375	6.500	125
Kottakkal	7.350	7.475	125
Aralikkatta	14.600	14.800	200
Pallikkara	15.450	15.550	100
Chithari	18.350	18.475	125

Location	Chainage		Length
	From	To	
South Chithari	19.300	19.425	125
South Chithari	19.900	20.000	100
Hosdurg	25.700	25.900	200
Link No. 74			
Eranholi	3.875	4.000	125
Pookodu	11.700	11.800	100
Mattannur	27.500	27.600	100
Chouvassery	31.050	31.175	125
Chouvassery	32.375	32.500	125
Punned	37.075	37.200	125
Iritti	42.500	42.650	150
Madattil	44.350	44.450	100
Vallithodu	52.225	52.450	225

(Source: Consultants study 2001)

5.4. AMBIENT AIR QUALITY

The baseline status of the ambient air quality has been established through a scientifically designed network of Ambient Air Quality Monitoring (AAQM) stations selected at two representative locations based on land use and wind direction. Ambient air quality monitoring was conducted in May, 2012. The parameters measured during the monitoring along with their frequency of sampling are given in **TABLE 5.17.**

TABLE 5.17. AMBIENT AIR QUALITY PARAMETERS AND FREQUENCY OF SAMPLING

Parameters	Sampling Frequency
Particulate Matter 2.5 , PM2.5	Continuous Sampling for 24 hrs
Particulate Matter 10, PM10	
Sulphur dioxide, SO2	continous sampling for 8 hrs (three 8 hour samples in 24 hours)
Oxides of Nitrogen, NOx	
Carbon Monoxide, CO	

Source: Environmental Monitoring, 2012

Pre calibrated Respirable Dust Samplers (RDS) of Envirotech Instruments were used for monitoring of Particulate Matter 2.5 (PM2.5), Particulate Matter 10 (PM10) and gaseous pollutants like SO2 and NO2. Analysis techniques used for different air quality parameters are presented in **TABLE 5.18.**

TABLE 5.18. TECHNIQUES USED FOR THE ANALYSIS OF AMBIENT AIR QUALITY PARAMETERS

Sl. No	Parameter	Technique	Technical Protocol	Minimum Detectable Limit
1	Particulate Matter 2.5 ($PM_{2.5}$)	Respirable Dust Sampler (Gravimetric method)	IS-5182 (Part-4)	1.0 $\mu g/m^3$
2	Particulate Matter 10 (PM_{10})	Respirable Dust Sampler (Gravimetric method)	IS-5182 (Part-23)	1.0 $\mu g/m^3$
3	Sulphur Dioxide	Modified West and Gaeke	IS - 5182 (Part-2)	4.0 $\mu g/m^3$
4	Nitrogen Oxide	Modified Jacob & Hochheiser	IS - 5182 (Part-6)	4.0 $\mu g/m^3$
5	Carbon Monoxide	Non Dispersive Infra Red Spectroscopy (NDIR)	IS-5182 (Part-10)	1.145 mg/m^3

Source: Environmental Monitoring.

The prime objective of the baseline air quality study was to establish the existing ambient air quality of the study area. This will be useful for assessing the conformity to standards of the ambient air quality during the construction and operation phase of the project. The important sources of air pollution in the region are vehicular traffic and domestic fuel burning activities.

Details of monitoring results are presented in **TABLE 5.19** along with the revised CPCB ambient air quality standards. The results indicate that all Air quality parameters are well within the CPCB standards. The operation of commercial establishments and vehicular emissions are mainly responsible for increased particulate matters in Kasargod commercial area site. However, ambient air quality for all of the parameters is well within the Revised NAAQ Standards at all the locations. Therefore, during construction period, it is recommended to minimize the particulate matter by sprinkling the water during peak working hours. Apart from that, there are no major air polluting sources in the project area and generally, the air quality of the area is found to be good.

TABLE 5.19. AMBIENT AIR QUALITY ALONG THE PROJECT ROADS

Sampling Locations	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO (mg/m^3)
Kasargod (Commercial area)	39.6	81.2	15.07	13.17	1.23
Bekal (Residential area & CRZ)	17.5	56.4	10.8	10.8	0.8
Pilathara (Commercial Area)	20.8	71.2	14.8	13.17	1.27
Pappinissery (Residential area &CRZ)	16.3	53.5	12.1	10.67	1
Koothuparambu (Commercial area)	21.6	75.6	12.06	10.47	1.13
Iritty (Residential area)	15.8	54.1	7.73	6.83	0.6
Revised CPCB Standards					
Industrial, Residential, Rural &other Areas	60	100	80	80	2
Ecologically Sensitive Areas (Notified by Central Government)	60	100	80	80	2

Source: Environmental Monitoring.

All measured SPM & RSPM are within the limits set by the CPCB standard. All measured CO is much less than the CPCB standard. All measured SO2 and NOx values are much less than that of the CPCB standard.

5.5. AMBIENT NOISE LEVEL

A noise monitoring survey was conducted at four representative locations based on the land use of the area with the objective of assessing baseline noise levels, which can be later used to assess the impact of the total noise generated by the proposed project activities. Noise level monitoring was carried out continuously for 24 - hours with one hour interval at each location in May 2012 using a Luthron sound level meter capable of measuring the Sound Pressure Level (SPL) in dB(A). Hourly Leq values were computed by the noise integrating sound level meter and statistical analysis was done for measured noise levels at four locations in the study area. The Leq day, and Leq night calculated for four locations in the project road are presented in **TABLE 5.20.** The values are compared with the standards prescribed by CPCB for various zones.

Out of the twelve locations of noise monitoring, six locations represent silent zone, three locations represent residential areas, and three locations represent commercial area/zone. Noise level for day time in all locations are outside the prescribed limits of CPCB whereas noise level for night time in all the four locations are within the standard limits. The increase in noise level is due to vehicular traffic, honking at junctions, public activities, and industrial activities. The results essentially draw attention towards the necessity of noise pollution control measures along the project corridor.

TABLE 5.20. AMBIENT NOISE LEVEL ALONG THE PROJECT ROAD

Location	Category of Area / Zone	Noise level Values L_{eq} dB(A)		Applicable CPCB Standard L_{eq} dB(A)	
		Day	Night	Day	Night
Link No. 69					
Kasargod	Commercial	69.3	45.1	65	55
Govt. U.P. School, Uduma	Silent zone	54.3	39.9	50	40
Govt. High School, Pallikkara	Silent zone	56.2	39.9	50	40
Kanhangad	Residential	61.1	41	55	45
Link No. 68					
Pilathara	Commercial	65.1	45.3	65	55
Panchayat H.S School, Pappinissery	Silent zone	56.3	39.7	50	40
G.B.H.S, Cherukunnu,Kannapuram	Silent zone	58.4	40.9	50	40
Pazhayangadi	Residential	57.7	40.2	55	45
Link No. 74					
Thalassery	Commercial	68.4	44.2	65	55
Thaluk Hospital Koothuparambu	Silent zone	64.2	41.9	50	40
Pazhassy West U.P School,Mattannur	Silent zone	54.8	39.5	50	40
Iritty	Residential	55.3	40.2	55	45

Source: Environmental monitoring

The details of sensitive noise receptors along the project roads are as indicated in the **TABLE 5.21.**

TABLE 5.21. SUMMARY OF SENSITIVE NOISE RECEPTORS ALONG THE LINKS

Link No	Total No. of Schools	Total No. of Hospitals
68	12	3
69	13	5
74	14	4

5.6. FLORA AND FAUNA

5.6.1. COASTAL ECOSYSTEMS AND MANGROVES

The Project Influenced Area is predominantly coastal and estuarine. Currently a significant portion of mangroves in Kerala is restricted to these two districts among which Kannur PIA district is the richest district with regard to the mangrove ecosystem in the State (Mohan, 1999).

The Kannur district has 3500 ha[4] of mangrove ecosystem. This is the highest among the various districts of Kerala State. The mangrove ecosystem in the district is relatively less degraded as the Kerala Forest Department has also been proactive in mangrove conservation in these two districts. There is also support from various local NGOs like, Society for Environmental Education in Kerala [SEEK], towards mangrove conservation.

The Kasargod PIA district has 50ha[5] of mangrove ecosystem (**PLATE 14** and **15**). The mangrove ecosystem in the district is highly degraded. Its main occurrence is reported at Chittari river and Shiriya river in Kasaragod district. This region is a home for degraded mangroves. The degraded mangroves at Chittari River are comparatively better preserved when compared to the other mangrove areas of the district. Although the district has several rivers bordering with mangroves the Chittari hole and Bekal hole are important.

The mangrove ecosystem of these districts is nested within the backwater ecosystem of this area. This interlinked network of waterways forms an excellent matrix for the dispersal of mangrove propagules and the regulation of soil salinity: the two crucial factors determining mangrove presence and long term persistence in a landscape.
The distribution of mangroves in Kasargod and Kannur is extremely patchy, though there may have been extensive mangrove forests in the past. The species composition consisted of both true and associate mangrove species. *Avicennia officinalis* was the dominant species followed by *Rhizophora mucronata* Lamk. There was a clear zonation observed with *Kandelia candel* on the outward zone, followed by an assemblage of *Rhizophora mucronata*, *Bruguiera cylindrica*, *Ceriops decandra*, *Excoecaria agallocha* and *Aegiceras corniculatum*. In the core area, there are large old growth *Avicennia officinalis* trees. *Sonneratia alba* species can grow up to a height of about 15 m and has conical pneumatophores.The presence of regenerating individuals (saplings and young trees) of this species in natural mangrove patches is an indicator that such sites can harbour luxuriant mangrove vegetation.

Plate 5.14. Dense Mangrove vegetation as seen from the bridge at National Highway end Chainage 19.800

Plate 5.15. Terminating Chainage (20.900) of Link 68 bordered by mangrove vegetation.

Except at few locations, the coastal areas where the mangrove ecosystems are observed are mostly away from the project road but within the project influenced area. These are low-lying areas. Near the terminating Chainage there are vast areas of dense mangrove vegetation. (CWRDM, 2003). The plates above shows the distribution of major mangroves and associates in Kerala. This region is a home for comparatively best-preserved mangroves in the whole Kerala

[4] Refer Natural Resources of Kerala, 1999
[5] Natural Resources of Kerala 1999

coast. List of mangroves inventoried along the project corridor is provided in EIA Appendix-5.1. Most of the mangrove vegetation is observed in private holdings **(PLATE 5.16).**

Plate 5.16. Mangrove vegetation in private holding
(Chainage 14.600)

Plate 5.17. Mangrove vegetation is being cut and taken away for cattle feeding.
(Chainage 14.600)

Since mangrove cover has declined over the years, the locals' awareness and dependence on mangroves have subsequently decreased. The media attention given to the tsunami has, to an extent, increased the level of awareness about the importance of mangroves for coastal protection. Moreover, most of the mangrove patches in these districts are not under any protected area system and are in a densely human dominated landscape.

Because of the sensitive nature of the Coastal ecosystems a separate study on Coastal ecosystems was arranged through the experts of CWRDM. The report titled '*Coastal ecosystems including mangroves with special reference to KSTP Phase II project Road Link: Pilathara – Pappinissery- A status report'* need to be referred for additional reading. The relevant sections have been considered for the preparation of project specific Mangrove Afforestation Plan attached as a Part II EMP **Annexure 3.62** for all the link roads.

Considering their important role in the coastal ecosystem, particularly fisheries they deserve utmost care, preservation and development. They also come under the criteria of areas of rich genetic diversity and are likely to be inundated due to rise in sea level. Hence all those areas, even with a thin mangrove habitat are identified and broadly classified as Mangrove ecosystem areas' and categorised as CRZ-1 in the CZMP prepared by the Government of Kerala. Areas close to breeding and spawning grounds of fish and other marine life; Since mangroves are the spawning and breeding grounds of fish, a 50 m belt around them is also categorised as CRZ-I A.

The areas between the Palayangadi river and the project road was once full of coastal ecosystems. Along the Coastal Regulation Zone, the mangroves and inter tidal zones are the areas that are rich in genetic diversity. All these are categorised as CRZ-1. The Valapattanam-Palayangadi river estuary is about 2-3 km range from Pappinissery section of the project road.

Kaipad wetland systems: Kaipad wet land system which consist of marshes, swamps, ponds and paddy fields is a unique wet land system of Kerala. This system is spread over the Kannur, Thaliparambu and Thalasseri Thaluks of Kannur district. These swampy, water logged areas experience flood during monsoon and alinity during summer owing to their proximity to estuaries. Tidal currents enter the fields during high tide and flow out during low tide. Saline water from the sea enters the estuaries during the summer when the flow is low and it spreds in the low lying kaipad wetlands and this water keeps the area moist even in summer months. Kaipad farms are made by making bunds around the wet land sand these are protected by the mangrove plants growing around the kaipad farms. The Kaipad system of agriculture practice is traditionally empowered with local knowledge and it is interwoven with environmental conservation.

Scared groves are small patches of forest left untouched by the local inhabitants to be protected by local village folk deities. They are the home of local flora, fauna, gene pool and a mini biosphere reserve. Within this groves are locked ancient secrets of herbs and traditional medicine, primitive practices of sorcery and magic. The first documented study of sacred groves in North Kerala recorded 57 groves in Kannur district of Kerala state (Unnikrishnan, 1990). There are 352 groves in Kannur district of Kerala state according to Jayarajan (2004). Many sacred groves contain water resources such as ponds, streams and the vegetative mass that covers the floor of a grove can absorb water during raining season and releases it during the time of draught. These are last resorts in many of the animals and birds for the water requirement especially summer.

The Madai Sacred Grove, Eripuram, is located within a distance of less than 0.5 km from the link 68 corridor for Pilathira- Pappinissery road road link. This area is rich in typical sacred grove flora (especially orchids) and fauna. The grove is already under threat due to mining of clay and charcoal. The area needs preservation (**PLATE 18**).(CWRDM,2003)

Plate 5.18. Kannisseri Sacred Grove near chainage 3.2 in Link no. 68

Plate 5.19. The Madai Sacred Grove

Pungottu Kavu near Mattanur of Kannur with 35 acres of land have its own microclimate and as a result small fresh water perennial streams are originated inside the groves. This is due to the presences of huge floristic structure of these sacred groves.

Wildlife sanctuaries. Apart form the mangrove forests classified as CRZ-1, no forests/wildlife sanctuaries are present along the impact corridor of the project roads considered in this EIA. The Aralam wildlife sanctuary is located about 10 km away from the Link 74 project road which is more than the 7 km distance specified by the GOI for EIA studies. (Refer **FIGURE 5.17)**.

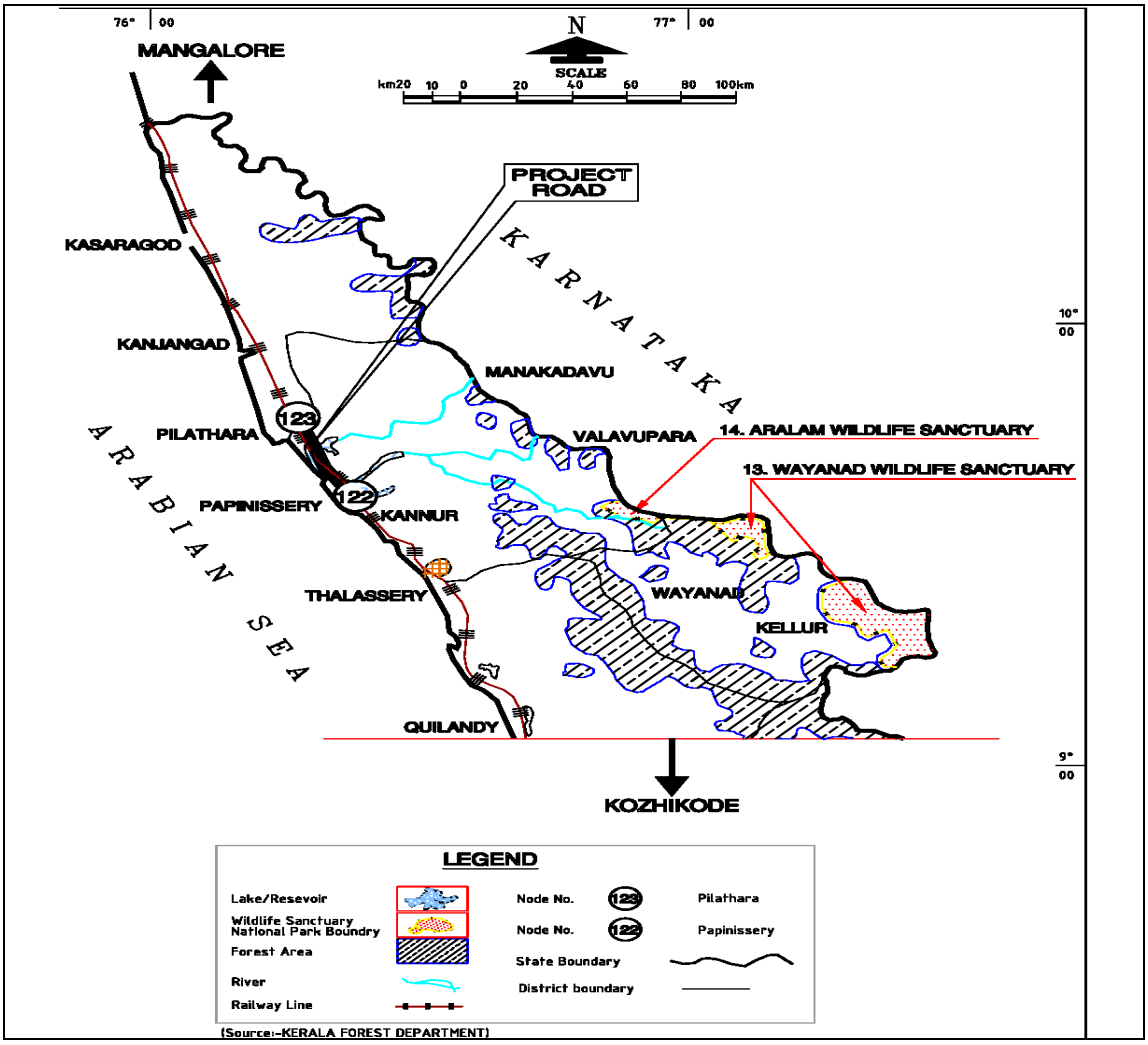
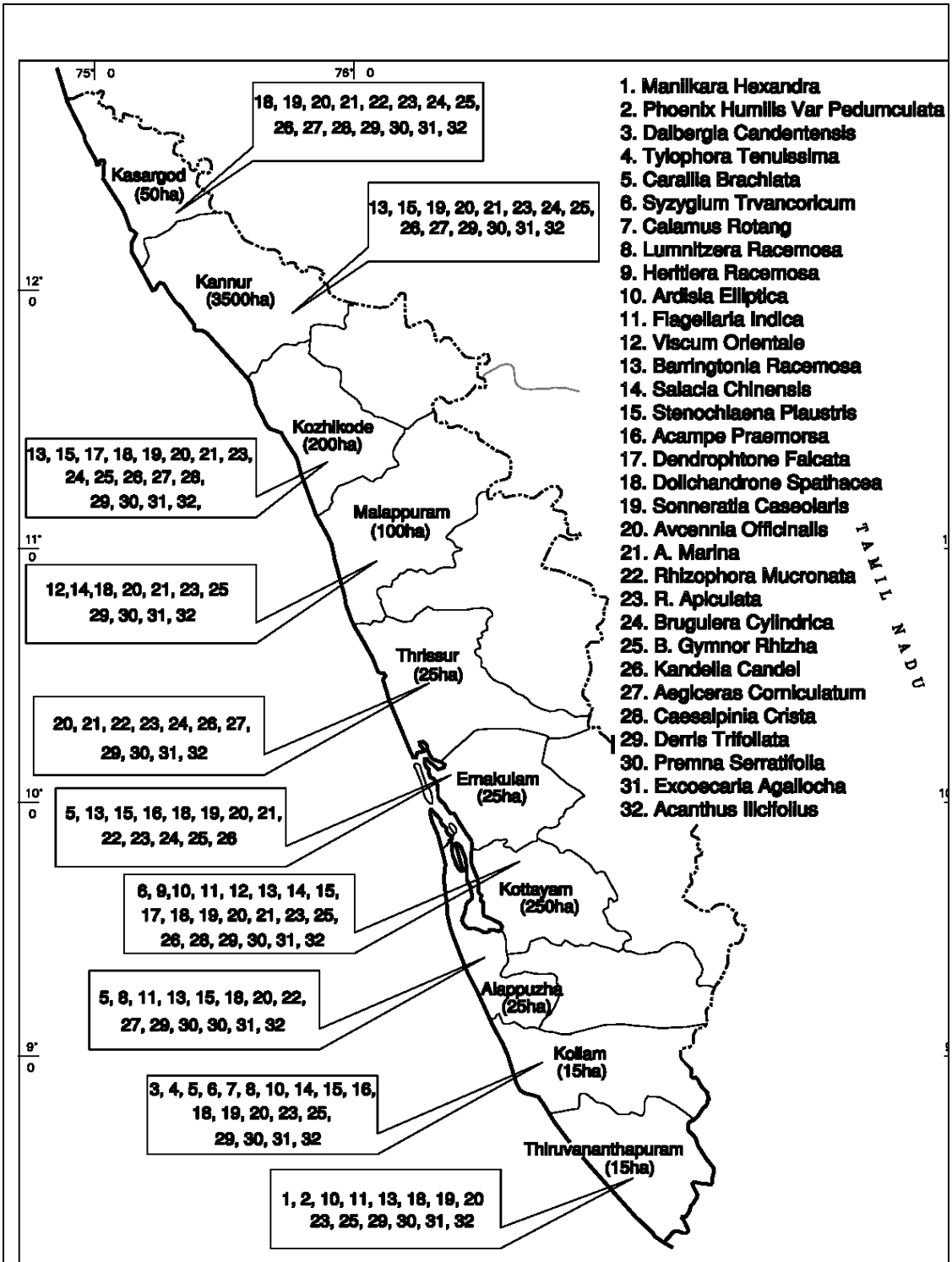


FIGURE 5.17. PROJECT ROAD IN RELATION TO SANCTUARIES AND NATIONAL PARKS THE REGION



Source : Mohan, 1977

FIGURE 5.18. DISTRIBUTION OF MANGROVE SPECIES IN KERALA

Plate 5.20. Mangroves Along the Banks of Erinholi River in link No. 74

Plate 5.21. Mangroves Near Chittari River

5.7. CRZ AREAS IN THE PROJECT CORRIDOR

Under the physiographic conditions of Kerala, the population density has tended to increase towards the coastal region. Even the unstable coastline has not deterred large human settlements in close proximity to the sea. Out of a total area of 38,863 sq. km. of Kerala, 3,355 sq. km. falls in the coastal area supporting a population of 72.72 lakhs. The density of coastal urban population is 4,228 per sq. km., as compared to the average urban density of 2,097 in the state. The coastal rural population density is 1700, far above the state average rural population density of 603. Considering the large number of people, the high concentration of industries, the existence of small and large ports, and the enormous fishing potential, the question of limiting development or putting in place a regime of regulatory measures for human activities on the coast is bound to be a highly contentious. The complexity of these problems is spelt out in the coastal zone management plan prepared by Centre for Earth Science Studies, Trivandrum.

The **FIGURES 5.19** to **5.21** shows the CRZ areas along the three links marked by CESS. Some of these zones are located towards the seaward side are likely to be inundated due to rise in sea level. The Coastal Zone Management Plan prepared by the State Government in 1995 describes the coastal area of the PIA in the 63, 67, 67A, 67B, 67C, 68, 68A and 68B map numbers of CZMP.

Fig. 1b Sectors having CRZ along the highway alignment proposed for development (Kanhangad - Kasaragod)

FIGURE 5.19. CRZ AREAS (I, II & III) IN THE PROJECT INFLUENCED AREA OF LINK 69

Source: CESS, 2002

FIGURE 5.20. CRZ AREAS (I, II & III) IN THE PROJECT INFLUENCED AREA OF LINK 68

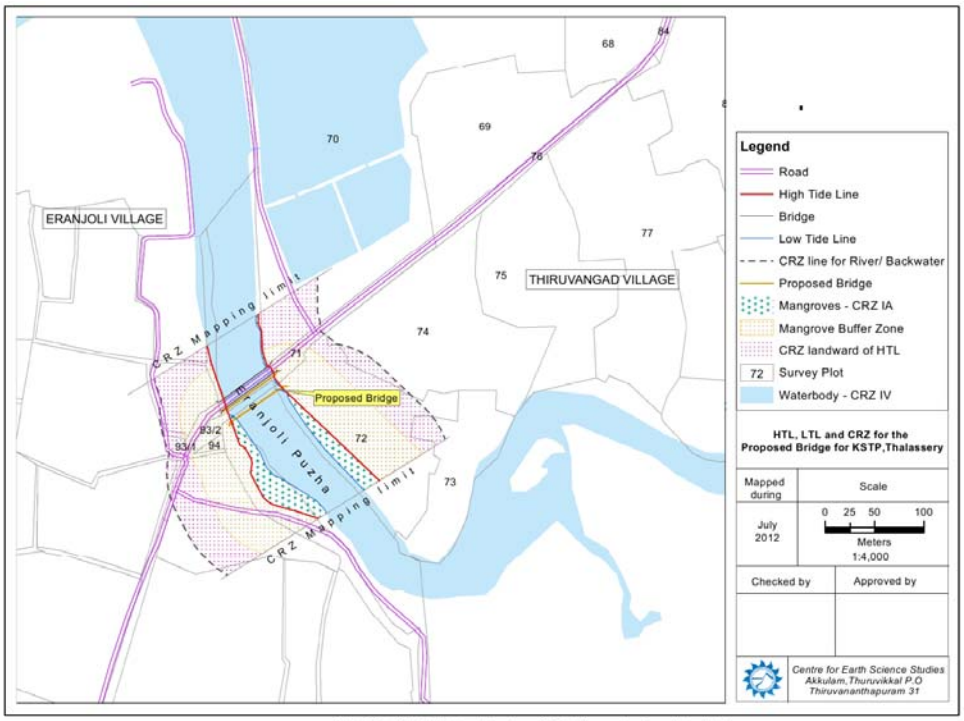


Fig 2. CRZ Map *(Refer CRZ Report for details)*

FIGURE 5.21. CRZ AREAS (I, II & III) IN THE PROJECT INFLUENCED AREA OF LINK 74

5.8. ROAD SIDE (AVENUE PLANTATION)

Due to its earlier status of National highway[6](wide and straight), there is adequate scope for raising social forestry along the roadsides. The species along the roadside include mangoes, tamarind, jackfruit tree and occasional banyan trees. Few of the banyan trees present are actually safety hazards as visible from **PLATE 5.22.**

Plate 5.22. Banyan tree a safety hazard (Ch. 3.200) in link 68

Public trees Along the project corridors, there is no continuous avenue plantation. Trees within the available corridor are surveyed and tabulated as shown in the **TABLE 5.22.**

[6] The Link 68,69.1(Phase II) and 40 (Phase I) considered in KSTP were National Highways in the past

TABLE 5.22. DETAILS OF EXISTING TREES WITHIN ROW ALONG THE PROJECT ROADS

Link No.	Trees Having 0.3-0.6 m GBH	Trees Having 0.6-0.9 m GBH	Trees Having 0.9-1.8 m GBH	Trees Having 1.8-2 m GBH	Trees Having >2 m GBH	Total
69	270	132	327	47	22	798
68	264	123	1123	32	0	1542
74	219	198	268	71	1	757

Source: Topographic Survey, 2012

The chainage-wise details of trees likely to be cut is given in the following tables:

TABLE 5.23. DETAILS OF LIKELY TREE REMOVAL ALONG LINK NO 69

Chainage (km)		Categorisation of tress based on GBH														
		0.3 - 0.6 m			0.6 - 0.9 m			0.9 - 1.8 m			1.8 - 2 m			>2m		
From	To	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
0+000	1+000	10	38	48	4	10	14	0	0	0	0	0	0	0	0	0
1+000	2+000	10	8	18	0	10	10	0	0	0	0	0	0	0	0	0
2+000	3+000	6	20	26	10	10	20	4	0	4	0	0	0	0	0	0
3+000	4+000	2	2	4	2	0	2	0	0	0	0	0	0	0	0	0
4+000	5+000	4	4	8	6	0	6	0	0	0	0	0	0	0	0	0
5+000	6+000	10	14	24	0	2	2	0	0	0	2	0	2	0	0	0
6+000	7+000	6	16	22	2	8	10	44	60	104	2	2	4	0	0	0
7+000	8+000	2	18	20	0	2	2	4	4	8	4	0	4	0	0	0
8+000	9+000	10	2	12	4	0	4	16	8	24	4	2	6	2	2	4
9+000	10+000	10	0	10	0	0	0	8	0	8	0	0	0	0	0	0
10+000	11+000	2	0	2	0	0	0	0	0	0	2	0	2	0	0	0
11+000	12+000	0	0	0	0	0	0	0	3	3	2	0	2	0	0	0
12+000	13+000	0	12	12	0	2	2	12	0	12	2	0	2	0	0	0
13+000	14+000	6	8	14	0	2	2	18	27	45	0	4	4	0	0	0
14+000	15+000	0	2	2	0	2	2	0	0	0	0	0	0	0	0	0
15+000	16+000	6	0	6	6	6	12	0	0	0	0	0	0	0	0	0
16+000	17+000	4	2	6	6	2	8	3	0	3	6	0	6	2	0	2
17+000	18+000	4	8	12	2	0	2	3	3	6	0	0	0	2	2	4
18+000	19+000	0	6	6	6	4	10	60	23	83	4	0	4	0	0	0
19+000	20+000	0	0	0	4	0	4	0	4	4	2	0	2	2	0	2
20+000	21+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21+000	22+000	0	0	0	0	6	6	0	4	4	0	6	6	2	0	2

Chainage (km)		Categorisation of tress based on GBH														
		0.3 - 0.6 m			0.6 - 0.9 m			0.9 - 1.8 m			1.8 - 2 m			>2m		
From	To	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
22+000	23+000	2	0	2	0	0	0	4	0	4	0	0	0	2	0	2
23+000	24+000	0	0	0	0	0	0	4	0	4	2	0	2	4	0	4
24+000	25+000	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
25+000	26+000	0	3	3	0	2	2	3	2	5	0	0	0	2	0	2
26+000	27+000	5	3	8	6	6	12	0	6	6	1	0	1	0	0	0
27+000	28+000	2	2	4	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total		102	168	**270**	58	74	**132**	183	144	**327**	33	14	**47**	18	4	**22**
Grand Total														**798**		

Source: Topographic Survey, 2012

TABLE 5.24. DETAILS OF LIKELY TREE REMOVAL ALONG LINK NO 68

Chainage (km)		Categorisation of trees based on GBH											
		0.3 - 0.6 m			0.6 - 0.9 m			0.9 - 1.8 m			1.8 - 2.0 m		
From	To	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
0+000	1+000	2	1	3	0	0	0	0	0	0	0	0	0
1+000	2+000	8	5	13	1	1	2	0	0	0	0	0	0
2+000	3+000	5	7	12	1	1	2	30	27	57	0	0	0
3+000	4+000	6	4	10	2	0	2	8	39	47	0	0	0
4+000	5+000	8	4	12	12	7	19	3	1	4	0	0	0
5+000	6+000	11	8	19	2	4	6	1	0	1	0	0	0
6+000	7+000	1	0	1	3	0	3	1	0	1	0	0	0
7+000	8+000	8	4	12	12	1	13	37	2	39	0	0	0
8+000	9+000	7	1	8	1	0	1	53	16	69	0	0	0
9+000	10+000	18	11	29	3	2	5	81	44	125	0	0	0
10+000	11+000	10	0	10	4	1	5	32	18	50	0	0	0
11+000	12+000	4	5	9	0	3	3	37	29	66	2	0	2
12+000	13+000	8	6	14	2	1	3	46	31	77	0	0	0
13+000	14+000	4	0	4	6	0	6	16	17	33	0	2	2
14+000	15+000	11	3	14	9	2	11	41	33	74	4	4	8
15+000	16+000	10	4	14	5	5	10	82	48	130	6	0	6
16+000	17+000	8	8	16	3	2	5	44	40	84	2	4	6
17+000	18+000	25	8	33	5	3	8	49	46	95	0	0	0
18+000	19+000	8	12	20	7	5	12	66	64	130	2	2	4
19+000	20+000	4	3	7	1	3	4	8	10	18	2	0	2
20+000	21+000	4	0	4	3	0	3	21	2	23	0	2	2
21+000	22+000	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total		170	94	**264**	82	41	**123**	656	467	**1123**	18	14	**32**
Grand Total													**1542**

Note: Greater than 2m girth size trees are not observed along the link road

TABLE 5.25. DETAILS OF LIKELY TREE REMOVAL ALONG LINK NO 74

Chainage (km)		Categorisation of tress based on GBH														
		0.3 - 0.6 m			0.6 - 0.9 m			0.9 - 1.8 m			1.8 - 2 m			>2m		
From	To	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
1+200	2+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+000	3+000	4	1	5	0	0	0	1	1	2	0	0	0	0	0	0
3+000	4+000	1	5	6	2	0	2	0	0	0	0	0	0	0	0	0
4+000	5+000	0	2	2	1	0	1	1	0	1	0	0	0	0	0	0
5+000	6+000	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6+000	7+000	3	0	3	1	0	1	0	0	0	0	0	0	0	0	0
7+000	8+000	9	0	9	0	1	1	1	0	1	0	0	0	0	0	0
8+000	9+000	4	6	10	2	1	3	0	0	0	0	0	0	0	0	0
9+000	10+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10+000	11+000	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
11+000	12+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12+000	13+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13+000	14+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14+000	15+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15+000	16+000	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0
16+000	17+000	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
17+000	18+000	2	2	4	0	0	0	1	1	2	0	0	0	0	0	0
18+000	19+000	2	3	5	0	1	1	0	0	0	0	0	0	0	0	0
19+000	20+000	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
20+000	21+000	11	4	15	0	1	1	0	0	0	0	0	0	0	0	0
21+000	22+000	14	7	21	7	5	12	1	3	4	0	0	0	0	0	0
22+000	23+000	6	5	11	1	5	6	1	2	3	0	0	0	0	0	0

Chainage (km)		Categorisation of tress based on GBH														
		0.3 - 0.6 m			0.6 - 0.9 m			0.9 - 1.8 m			1.8 - 2 m			>2m		
From	To	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
23+000	24+000	3	1	4	2	1	3	1	1	2	0	0	0	0	0	0
24+000	25+000	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
25+000	26+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26+000	27+000	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
27+000	28+000	3	1	4	1	3	4	5	5	10	0	0	0	0	0	0
28+000	29+000	0	6	6	5	7	12	10	16	26	0	0	0	0	0	0
29+000	30+000	4	11	15	6	8	14	1	6	7	0	0	0	1	0	1
30+000	31+000	5	10	15	5	4	9	0	0	0	0	0	0	0	0	0
31+000	32+000	0	3	3	2	6	8	3	6	9	0	1	1	0	0	0
32+000	33+000	2	2	4	5	2	7	7	6	13	0	0	0	0	0	0
33+000	34+000	1	1	2	3	3	6	8	7	15	1	6	7	0	0	0
34+000	35+000	1	4	5	9	4	13	5	5	10	3	9	12	0	0	0
35+000	36+000	2	2	4	1	2	3	4	1	5	0	4	4	0	0	0
36+000	37+000	4	2	6	9	0	9	12	7	19	1	0	1	0	0	0
37+000	38+000	3	4	7	3	5	8	21	13	34	0	1	1	0	0	0
38+000	39+000	1	0	1	5	6	11	9	10	19	0	0	0	0	0	0
39+000	40+000	1	0	1	1	6	7	10	2	12	0	1	1	0	0	0
40+000	41+000	2	3	5	1	3	4	8	15	23	0	0	0	0	0	0
41+000	42+000	1	3	4	2	5	7	0	0	0	0	0	0	0	0	0
42+000	43+000	0	1	1	2	1	3	1	3	4	0	2	2	0	0	0
43+000	44+000	1	2	3	4	4	8	0	1	1	15	3	18	0	0	0
44+000	45+000	1	0	1	6	3	9	13	11	24	1	8	9	0	0	0
45+000	46+000	1	2	3	1	4	5	8	5	13	3	6	9	0	0	0
46+000	47+000	0	1	1	1	1	2	2	1	3	2	0	2	0	0	0

Chainage (km)		Categorisation of tress based on GBH														
		0.3 - 0.6 m			0.6 - 0.9 m			0.9 - 1.8 m			1.8 - 2 m			>2m		
From	To	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
47+000	48+000	1	2	3	1	0	1	0	1	1	0	0	0	0	0	0
48+000	49+000	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0
49+000	50+000	0	4	4	0	3	3	0	2	2	0	0	0	0	0	0
50+000	51+000	2	0	2	1	1	2	0	1	1	0	0	0	0	0	0
51+000	52+000	1	2	3	0	5	5	0	0	0	0	0	0	0	0	0
52+000	53+000	0	3	3	1	4	5	0	2	2	3	0	3	0	0	0
53+000	53+936	0	2	2	0	1	1	0	0	0	1	0	1	0	0	0
SUB TOTAL		109	110	**219**	92	106	**198**	134	134	**268**	30	41	**71**	1	0	**1**
GRAND TOTAL																**757**

Source: Topographic Survey, 2012

Private trees: These are trees situated in the private properties within the required corridor, which will have to be compensated for in monitory terms according to the Resettlement Action Plan. In addition according to the tree planting strategy, two trees will be for each private tree lost. There are approximately 87 Nos of private owned trees that will have to be cut and removed. All these trees occupy the land to be acquired outside the right of way. Due to the limited widening, the number of private trees affected is very small compared to the total number of public trees along the available corridor.

Plate 5.23. Bigger trees inLink no. 74

Plate 5.24. Social forestry along the link no. 69

5.9. HUMAN HEALTH AND SAFETY

5.9.1. HUMAN HEALTH

As one out of the 14 districts of Kerala, Kannur district also has made notable achievements in health standards reflected in the attainment of a low infant mortality rate, low maternal mortality rate, low birth rate, low death rate, and high life expectancy at birth. This has been made possible through a wide network of health infrastructure and social factors such as women's high education levels, general health consciousness and awareness.

One of the recent health issues in highland region of Kasaragod and adjoining areas is the incidence of diseases due to the 'Endosulfan' an insecticide used for cashew cultivation. The insecticide is normally sprayed from an aircraft as this is the only practical way to cover the big cashew tree (Average size is 3 - 5 m height and 1 - 5 square metre canopy) plantations. The cultivation of cashews plantations is all towards the high land and a smaller area in the mid land. The Cashew cultivation is practically non-existent in the Coastal Project Influenced Area.

5.9.2. HIGHWAY SAFETY

This is one of the most important considerations for the Highway Authority and road designers. The issue has been right fully considered in Sectoral Environmental Assessment (SEA) report. This is addressed more elaborately due to its importance in the Kerala State Transport Project.

5.9.3. ROAD ACCIDENTS IN KERALA

The World Health Organization has revealed in its Global Status Report on Road Safety that more people die in road accidents in India than anywhere else in the world, including the more populous China. At least 13 people die every hour in road accidents in the country, the latest report of the National Crime Records Bureau reveals. However, road safety experts say the real numbers could be higher since many of these accident cases are not even reported.

The Kerala state is leading the country in terms of risk factors like high rate of road accidents and high injury rate due to road traffic crashes. Road accidents are considered to be the third major cause of death in the state. Heart ailments and cancer are the other diseases that take a heavy toll of human lives in the Kerala State. The state of Kerala has nearly 3% of the country's population but it has recorded about 10 % of the country's road traffic accidents. According to the causality figures recorded in major medical college hospitals in the state, nearly 70% of the head injuries are reportedly caused due to traffic crashes. Rapid increase in the number of motor vehicles especially during the last two decades has been the major reason for the increasing number of road accidents in our state. The vehicle population has increased by 10 times between 1980 and 2000 and by 3 times between 1990 and 2000. The accident rate of Kerala is the highest in the country with 15 accidents per 1000 vehicles, which is twice that of all Indian average. Even bigger states like Uttar Pradesh, Madhya Pradesh, Gujarat, Rajasthan and Andhra Pradesh have reported far less number of accidents compared to Kerala State (Economic Review 2010).

Records shows that rash and negligent driving on the part of the drivers is the main cause of road accidents. According to the records, almost 99.7% of the accidents were caused due to the fault of driver of motor vehicles. However, the rest of the accidents are reportedly caused due to other reasons like defective vehicle, bad weather, poor road surface, fault of pedestrians etc. Poor surface conditions, road cutting, lack of pedestrian crossing facilities, uncontrolled access streets and unmanned junctions, bad driving habits and lack of discipline by road users ,haphazard parking on road side, absence of proper bus bay and shelter, visual acuity of drivers , encroachments/dumping of materials on road and protruded lamp post, unscientific check barriers, speed breakers etc are the major reasons of road accidents.

With 23.9 fatalities per 10,000 vehicles in 1996 as compared to less than five in North America and Western Europe, India has a high accident rate7. The number of road accidents in Kerala is 24.16 per 1,000 vehicles versus the national average of 12.08. The **TABLE 5.26** shows the accident rate in Kerala from 1995-96 to 2011. The fatalities due to accident has increased by 53% in 2011 compared to 1995-96. As in other parts of India, the mixture of buses, lorries, cars, motorized rickshaws, motorcycles, bicycles and pedestrians travelling at vastly different speeds contribute to extremely unsafe road conditions.

TABLE 5.26. ACCIDENT RATES, KERALA, 1995-2011

ACCIDENT RATES	1995-96	96-97	97-98	98-99	99-2000	2011
Reported Accidents	37123	34702	33820	33296	37,072	35216
Personal Injuries	53475	51168	47668	46397	49,399	41379
Fatalities	2707	2707	2,668	2668	2711	4145

(Sources: Director-General of Police for the traffic accidents, and Motor Vehicle Department for vehicle statistics)

TABLE 5.27. DETAILS OF ROAD ACCIDENTS IN KERALA (01/01/2011 TO 31/12/2011)

DISTRICT	CASES	DIED	SERIOUSLY INJURED	INJURED
Kannur	1642	173	782	1619
Kasargod	777	92	470	676
Total	35216	4145	25110	16269

[7] Isaac 1999
[8] Elangovan 1999

There is a conspicuous absence of footpaths along most busy roads; the physical separation of vehicles and pedestrians is an essential feature of modern road design wherever there is any likelihood of conflict. Road junctions have few safety refuges for pedestrians and there is a total disregard by all drivers in observing rules relating to pedestrian crossings under the noses of the police officers. The project will address the road safety issues in all phase II road designs.

5.9.4. ENVIRONMENTAL ASPECTS INFLUENCING HIGHWAY DESIGN

The project highway design has applied all natural physical conditions. The analysis of some Kerala specific parameters is used in design decision-making. The designers have a clear understanding of the physical conditions of Kerala. There has been considerable research carried out to achieve this in the form of site surveys, scoping workshops, analysis of KSTP I lessons and Client/WB participation. Consultants have considered all these factors in the final output.

5.9.5. IMPORTANT ROAD SAFETY FACTORS IN KERALA

The following key factors make the pedestrian/vehicle movement along the road unsafe.

- Rolling terrain, and sharp bends
- Narrow corridor widths
- Lack of provision of road lining and signing
- High rate of localised pedestrian movement, and lack of dedicated footpaths
- Private property-compound walls and thick growth of trees etc.
- High density of population
- Lesser visibility to driver especially due to trees9 and poor enforcement of legislation against encroachers
- Unauthorised structures, posters and advertisement along road sides-encroachment
- Human factor-information and attitudes-lack of enforcement of basic rules of Road Traffic Act
- Storage of construction materials and rubbish on the road sides
- Lack of level differences between the black topped portion and "footpaths"
- Poor intersection layouts and absence of any priority systems
- Trees, utilities, electric and telephone posts etc
- Use of advertisement boards and unauthorised signs often encouraged by the authorities responsible for road safety
- Poor drainage

The **TABLE 5.28** shows some factors influencing road safety in the three physiographic regions. The ribbon development is a common phenomenon in Kerala. Pedestrian movement is not very high along the project road.

TABLE 5.28. PHYSIOGRAPHIC FACTORS INFLUENCING ROAD SAFETY

Sl. No	Parameters	Lowland Or Coastal Belt	Midland
1	Terrain,	Plane area	Rolling
2	Density of population,	Very high	High
3	Sharp bends,	High	Very high
4	Narrow corridor width,	Common	Very common
5	Pedestrian movement	Very high	Very high

[9] In Munnar, the tea gardens provide excellent visibility over long distances due to the very low height of the plants.

Sl. No	Parameters	Lowland Or Coastal Belt	Midland
6	Reduced visibility for drivers	Less	Less
7	Compound walls	Common	Very common
8	Tree growth	Not very thick	Thick
9	Density of road network	High	Very high
10	Speed of vehicles	High	High
11	Accident rates	High	High
12	Occurrence of curves and gradients	Moderate	High
13	Monsoon rainfall	Moderate	High
14	Road junctions	Very high	Very high
15	Public Trees	Few	More

The various factors including the operational stage traffic together demand great attention in upgrading the road network with road safety as one of the primary objectives. This may be achieved within the limits of the existing project and also by introducing a better appreciation by PWD Engineers for the periodic maintenance projects.

5.9.6. COMPREHENSIVE AND INTEGRATED ROAD SAFETY ACTION PLAN

The ongoing road safety programme has the following key elements:

- Appointment of two road safety specialists-Completed
- Road safety audit for the Phase I and II designs-Completed
- Preparation of a highway code for Kerala based on the IRC document with necessary modernization and translation into the Vernacular-Completed
- To act as advisor to the State Policy Committee and assist in the implementation of the policies with the many interested parties.
- Preparation of a road safety plan with the input from concerned agencies and organizations
- To train PWD engineers in road safety auditing on existing sites. Prepare a budget for improvement of existing conditions for any revised alignments, signing and lining with special attention to road junctions and to
- Prepare and hold workshops for interested parties in the road safety arena especially for PWD road maintenance engineers and the police.
- An 'Road safety awareness programme' targeting mainly the road users especially the school children is being taken up as one of the latest measures.

5.10. CULTURAL RESOURCES IN THE PIA DISTRICTS

Details of the shrines, churches, temples and mosques in the immediate vicinity of the Right of Way and needing to be protected are shown in the link specific Part II EMP in **Table 2.0** in **Annexure 3.61**. These include Temples, Mosques, Churches, Cremation ground, Hundi and shrine (very small religious place). The detailed analysis is provided in the Cultural Property Rehabilitation Plan. The same table also provides the impacted cultural properties. This is further

discussed in the impact chapter. The Project design philosophy and the nature of Kerala roads with respect to the cultural aspects are important deciding factors.

During the festival related to 'Munnupettumma' (meaning mother of three children) mosque at Pappinissery the street vendors occupy most of the roadside corridor as provided in the **PLATES 25** and **26**. The festival is celebrated during the month of February leading to severe traffic congestion as shown in plate 5.

Plate 5.25. A view of the street vendors doing brisk business along the sides of the project road (chainage 20.000)

Plate 5.26. Traffic congestion during the festival (chainage 20.000)

Hosdurg Fort. Hosdurg fort is in a completely ruined stage. A highly degraded cave is the only attraction. The monument is not properly preserved. This is located about 100m away from the project ROW of link 69.

Bekel Fort. The Bekal fort stands on a 35 - acre headland with the Western Ghats on its east and northern borders. This is located about 210 m away from the project road link 69. Refer Section 5.9.4 also for more details.

Chanadragiri Fort. This is situated on the bank of Chandragiri River south east of Kasaragod town. This town is known for the large 17th century Chandragiri Fort, one of a chain of forts located about 500 away from the road ROW towards the coasts. This is also not well preserved but an excellent spot for 'birds eye view' of the valley constituting the estuary, Chandragiri river and the sea cost. Major problem is the absence of a well-defined approach road to the fort.

Ajanur. The annual nine - day festival 'pattulsavam' is celebrated here. Various cultural and religious programmes are held during the festival. The village also has 13 mosques and one Church. There is also an 'Anandasram' founded in 1939 by swami Ramdas, a great Vaishnava Saint. The temple town is located five kilometres from Kanhangad in Hosdurg taluk. The famous Modiyam Kovilakam temple is dedicated to Goddess Bhadrakali. The ancient temple has intricate woodcarvings on Palazhimadhanam, Sitaswayamvaram and Dhakshayagam.

Thalasseri Fort. Tellicherry Fort is in Thalassery was built up by the British East India Company in 1708. In 1781 Hyder Ali, ruler of the Kingdom of Mysore, was unsuccessful in capturing the Fort in his campaign to control Malabar. His successor, Tipu Sultan, was forced to cede Malabar District to the British in 1792, at the conclusion of the Third Anglo-Maratha War. The square fort, with its massive walls, secret tunnels to the sea and intricately carved huge

doors, is an imposing structure. The fort was once the nucleus of Thalassery's development. It is now a historical monument protected by ASI.

5.11. SOCIO ECONOMICS

Only those socio-economic aspects, which help to determine the impacts, are described in this section. The population statistics of the coastal villages in the PIA district is provided in **TABLE 5.29**. The density of population varies from 711 at Ramanthali to 4373 at Valapattanam urban area.

TABLE 5.29. POPULATION STATISTICS OF THE COASTAL VILLAGES IN THE PIA DISTRICT

Name of the Panchayat	Area (sq.km)	Households nos	Population nos	Density Nos/sq.km
Ramanthali	29.99	3224	21325	711
Madayi	16.71	4792	33488	2004
Mattul	12.82	3108	24262	1893
New Mahe	5.08	2308	17732	3491
Cheruthazham	32.18	4166	23099	718
Ezhome	18.95	3022	17715	935
Kunhimangalam	15.44	2875	17279	1119
Karivellur-Peralam	22.23	3686	19062	857
Pattuvam	16.85	2289	14207	843
Cherukunnu	15.37	2669	16246	1057
Kalliasseri	15.73	4143	25005	1590
Kannapuram	14.39	3177	18158	1262
Pappinissery	15.24	4820	30754	2018
Chirakkal	13.56	6070	39838	2938
Puzhathi	9.17	4506	30616	3339
Valapattanam	2.04	1114	8920	4373
Kasaragod Municipality	16.68	8047	50126	3005
Kanhangad Municipality	39.54	9639	57165	1446
Uduma	23.54	5225	32441	1378
Pallikare	39.09	5584	34696	888
Chemnad	40.11	6536	41651	1038
Thalasseri				

(Source : CZMP, 1995)

5.11.1. LAND USE IN THE PIA

The project road link 68 passes through the villages Pappinissery, Kallissery, Kannapuram, Cherukunnu, Ezhome and Cheruthazham. The Kannupuram is highly urbanised compared to other villages. The remaining areas are rural and semi urban. There are no urban areas (municipalities and towns) along the project road. About three Kilometers near Cherukunnu is classified as CRZ-1.

The landward side towards the lateritic mounds and beyond are fairly well populated. The environmental data sheet attached with the EMP provides the location details of every one-kilometre section. The **TABLE 5.30** is the project road in relation to land use of the area. The main land use in the region is agriculture. Land use characteristics of the region include: agriculture, built-up areas, water bodies-streams, rivers, estuaries, ponds, mangrove forests and Urban Areas.

Land use characteristics are discussed in the relevant sections (eg. Agriculture in the Section 5.9.2). The urban areas along the project road are the Kasaragod Municipality and Kanhangad Municipality, Thalsseri Municipality, Koothuparambu Municipality and Mattannur Municipality. The remaining areas are rural and semi urban. The Kasaragod Municipality , Kanhangad Municipality and Thalsseri Municipality municipal areas are classified as CRZ-II. Most of the coastal belt is sparsely populated.

TABLE 5.30. LAND USE ALONG THE PIA

Link	Districts	Municipality	Land Use
Link 69	Kasargod	Kasaragod Municipality and Kanhangad Municipality	Agriculture Water bodies - streams, rivers, estuaries, ponds, Built - up areas, Transport, Urban areas
Link 68	Kannur	Pappinissery, Kallissery, Kannapuram, Cherukunnu, Ezhome and Cheruthazham	Agriculture Water bodies - streams, rivers, estuaries, ponds, Built - up areas, Transport Urban areas
Link 74	Kannur	Thalasseri, Kuthuparambu, Mattannur	Agriculture Water bodies - streams, rivers, estuaries, ponds, Built up areas, Transport Urban areas Plantation areas

5.11.2. AGRICULTURE IN THE DISTRICT

The major agricultural activities in the region include paddy cultivation, coconut, cashew nut, banana and other cash crops like areca nut, coco etc. The coastal lands are dominated by coconut gardens and occasionally by areca nut. In the first section near Pilathara there is a valley portion with paddy cultivation.

5.11.3. INDUSTRIES IN THE PIA

The PIA districts are industrially backward despite being rich in natural resources and other infra-structural facilities. The Kannur district has a flourishing traditional handloom industry both in the rural and urban area. It was also a thriving centre for hosiery industry but has subsequently declined due to various reasons.

Kannur is also the centre for production of cashew nut, copra, rice, tiles, electric bulbs, hard board and plywood. Kannur town has countries best-run beedi cooperative which produces the famous brand *Kerala Dinesh Beedi*. In the small scale sector there are 12206 industrial units as on 31-3-2001 out of which 2929 are textile based industrial units which forms a major portion (24%) of the total SSI units

A bauxite and talc mining industry is located near Naval academy junction. This industry uses the project road for transportation of their mined products. There are 13 medium scale industrial units in the district. Handloom forms a major portion of the industrial units in the district. The district is also well known for its Beedi industry. Prohibition of smoking has adversely affected this industry recedntly. The major Beedi company viz; Dinesh Beedi has adopted product

diversification. There are about 1200 textile based industries and 130 rubber based industries in Kasargod disctrict

The coir and handloom industries are important sources of livelihood. There is only one industrial estate, which is located at Kasaragod town. The major industries are involved in the manufacture of handloom, beedi, tiles and coir products. Beedi rolling is an important occupation of the district.

5.11.4. TOURISM IN THE PIA

The **FIGURE 5.22** shows the project road in relation to the tourist centres of Kerala.

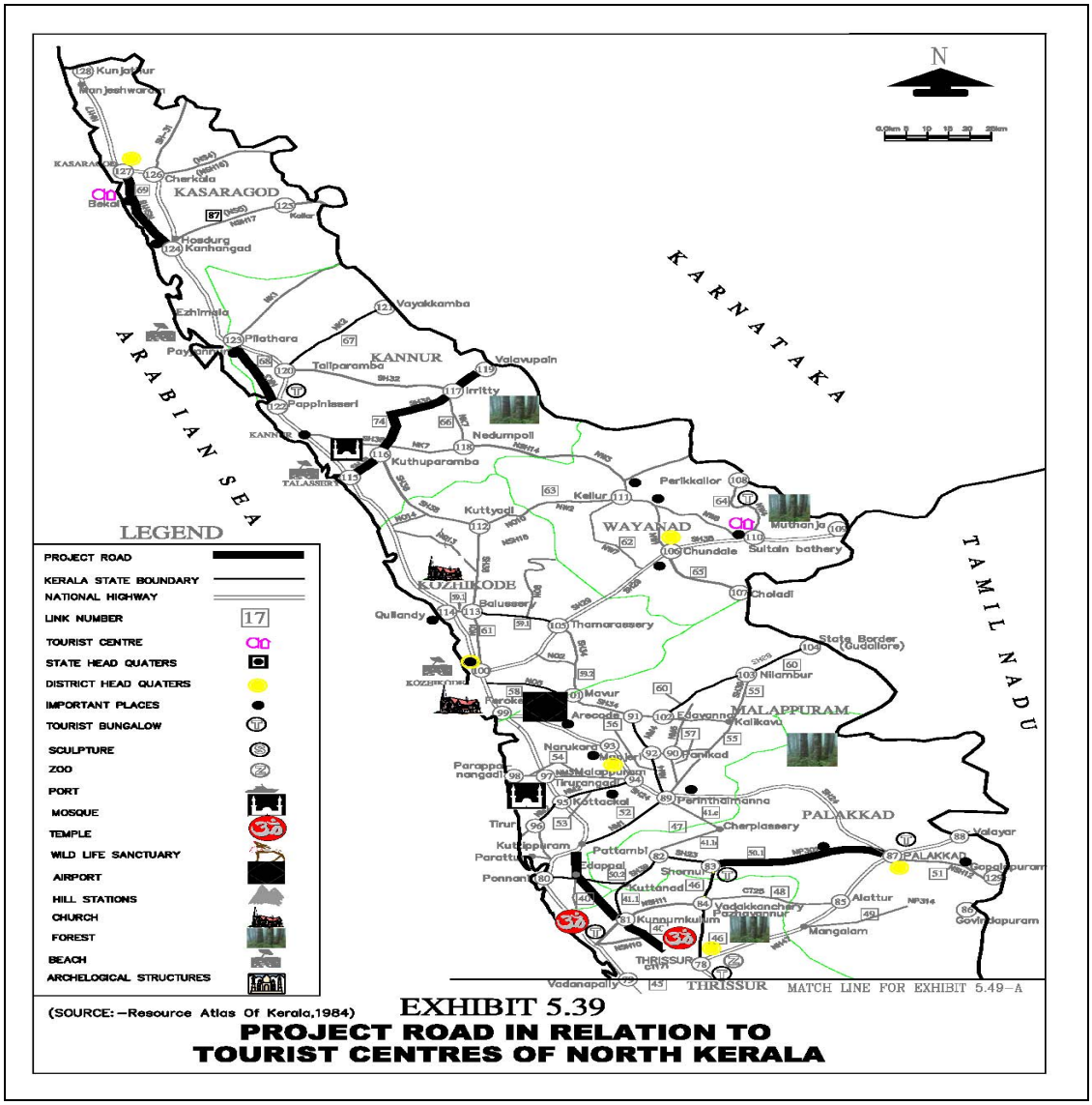


FIGURE 5.22. PROJECT ROAD IN RELATION TO TORIST CNETRES OF REGION

Ezhimala A small hilly town besides the sea is perched at height of 265 metres and is located within the PIA district towards seaward side. A top the hill there is an ancient mosque with sculptured stone pillars. At the foot of the hill there is a cave and an old burial chamber. The combination of high hills and beautiful beach has made Ezhimala a tourist resort.

At present Ezhimala is taken over by the GOI for establishing the Asia's largest naval academy. A wealth of rare medicinal plants is also found in Ezhimala and surrounding areas.

Madayi Beach The tiny village 22 km from Kannur is known for the 12 the century mosque built by Malik Iban Dinar. There is also a fine beach at Madai.

Linkage to west coast canal. The project road is very close to the **West Coast Canal** and the newly constructed **Sulthans canal**. The tourism development being the most important agenda of the State Government these linkages will be highly productive for the local development.

Parassinikadavu Muthappan temple. The famous temple is located 18km from Kannur on the banks of river Valapattanam. It is one of the important pilgrim sites of Kerala. The temple is known for its ritual art form "Muthapan Theyyam" performed everyday in the early mornings and evenings. A peculiar custom here is offering of toddy and dried fish to the deity. Pleasure boating facilities are available.

Parassinikkadavu Snake farm. The unique snake farm is located 14 km from Kannur amidst scenic settings. It is dedicated to preservation and conservation of the snakes. There are about 150 snakes of different species housed in hygienic and scientifically maintained pits and glass cages. The various poisonous and non-poisonous varieties of snakes in the farm are cobras, King cobra, Russel viper, Pit viper, Python etc.

Pythal Mala/Vaithal Mala Pythal Mala is an enchanting hill station, situated 4,500 ft. above sea level near the Kerala - Karnataka border, is rich in flora and fauna. Abundant in flora and fauna, this place is now being developed as a hill resort. There is a proposal to set up a zoo at the top of the hill. The enchanting hill station offers a challenging trek to those inclined to stretch their legs. Trekkers are rewarded by a profusion of exotic flora and fauna and an exhilirating view from the top. The 300 acre wide sprawling area is a safe home to numerous birds, hundreds of butterflies, rare plants and trees.

Madayipara Madayipara is a significant spot owing to its bio-diversity as well as history. In the past, Madayipara was the administrative center of the Ezhimala kings. In and around Madayipara, one can find remnants from the past. At the southern side of the hill, stand the remains of a fort called Pazhi Kotta. Here one can also find watchtowers at the four corners of the fort. Between AD 14 and AD 18, Madayipara used to be the site for the coronation ceremony of the rulers of the princely state of the erstwhile Kolathunadu. The hillock of Madayipara, which carries several signs of historic relevance, is also a place important from a religious point of view. Here, a pond in the shape of a hand held mirror, connected to ancient jewish setllers is another historic attraction. Similarly, a temple at this site, called Vadukunda Siva Temple and the adjoining lake, about an acre in extension form yet another attraction at Madayipara. The lake near the temple will not go dry even in hot summer months and remains a source of nourishment to life forms at Madayipara. The pooram festival of Madayi Kavu held at Madayipara has been responsible for much of its fame. With regard to the bio-diversity of Madayipara, it has been found that the region contains about 300 flowering plants, about 30 varieties of grass, and several insect-eating plant species. Madayipara is also home to several rare medicinal herbs, which are sought by people from near and far off places. Coming to avian life, Madayipara sustains about 100 species of butterflies and about 150 species of birds. Among the biggest butterflies in the world, the Atlas butterfly is a visitor to Madayipara.

Aralam Wlidlife Sacntuary The Aralam Sanctuary is located on the western slopes of the Western Ghats. It is the northern most wildlife sanctuary of Kerala. It was established in 1984. The headquarters of the sanctuary is near Iritty, a small town in the link no 74. The Aralam Sanctuary is spread over 55 sq km of undulating forested highlands on the slopes of the Western Ghats. The highest peak here - Katti Betta - rises to a majestic 1145 m above sea level.

Covered with tropical and semi evergreen forests, the Aralam Sanctuary is home to a vast variety of flora and fauna endemic to the Western Ghats. Herds of deer, elephant, boar and bison are common sights. Leopards, jungle cats and various types of squirrels are also seen here.
Bekel. The Bekal fort, an area of archaeological importance, is categorised as CRZ-I. This is also an area of outstanding natural beauty classified as '**no development zone'**. With its wide coastal plain and aesthetics, it is a potential area for tourism development. The coastal area is sparsely populated. However the landward areas starting from the smaller lateritic mounds are fairly well populated. A sea wall is constructed for a length of about one kilometre adjacent to the Bekal area. (Details are also provided in section 5.8). The Bekal fort and adjoining areas are classified as CRZ-1. This will necessitate framing of suitable environmental impact mitigation measures as well as the environmental enhancement measures. The Bekal beach is one of the finest attractions for tourists.

Kasaragod. Kasaragod is situated on the seacoast bordered by hilly Kodagu and Mangalore districts of Karanataka in the east and north. With its unique natural and cultural attractions Kasaragod is known as the land of gods, forts, rivers, hills and beautiful beaches. Backwater trips on the Chandragiri river and the Valiyaparamaba are fascinating experiences. Refer section 5.8 also.

Beaches. Kodi cliffs, Kappil and Pallikare beach are other attractions. The areas between Kudulu and Kasaragod are categorised as CRZ-II as it marks the municipal limit of Kasaragod. The Central Plantation Crops Research Institute (CPCRI) is situated along the coast. The Kottikkulam promontory (location between Chandragiri river and Bekal hole), which abut against the sea is an area of out standing natural beauty (CZMP, 1995)

Chanadragiri. This is about four km from Kasaragod town along the project road. The river, Arabian Sea and the sunset are the important attractions. The southern and northern part of the Chandragiri outlets is a long spit of nearly 2km and 1.5 km respectively (CZMP, 1995). Refer section 5.8 also.

Valiyaparamba backwater. (30 kms from Bekal fort): This is perhaps the most scenic backwater stretch in Kerala. Fed by four rivers and with numerous little islands, Valiyaparamba is turning in to a much - favoured backwater resort that offers delightful backwater cruises. This is not located within the PIA.

The **FIGURE 5.22** shows the project road in relation to the tourist centres of Kerala.

5.11.5. FISHERIES IN THE REGION

Fishing is a prime source of livelihood like any other coastal stretch of Kerala State. The coastal belt parallel to the project road in general is sparsely populated compared to the southern sections of the State. The important fishing area is Puthiyangadi, kottikkulam and Kappil. The Ezhimala hill region is visible in the same plate on the background.

CHAPTER 6. PUBLIC PARTICIPATION & CONSULTATION

The WB's Environment Policy mandates the requirements for effective public consultation and information disclosure in the Environment Assessment (EA) process. Public consultation is an important element of the planning and implementation of projects and is embedded in the World Bank's safeguard policies on environment, involuntary resettlement, and indigenous peoples. Public consultation is necessary to ascertain the public's views and perceptions regarding the project. The EIA process also mandates the details of public consultations such as - the persons consulted, issues discussed, response to the concerns raised by public etc. The state being highly literate and densely populated, public participation exercise was very useful to incorporate suggestions, environmental mitigation and enhancement measures. The participation exercise was an integral part of the environmental and social assessment process starting early from the feasibility stage continued through KSTP- I design and entering to KSTP-II design and the process will continue through out the implementation phase. The State being unique in its environmental features with respect to climatic and geographical set up, the consultations held during phase I programme are in general applicable to the KSTP- II roads.

6.1. PROJECT SPECIFIC LOCAL CONSULTATIONS CONDUCTED FROM 1999 ONWARDS

The official level consultations started with the Kerala State Transport Project (KSTP) environmental investigations at the beginning of the project as early as in 1999. These consultations were considered for the environmental screening study carried out as a part of the Feasibility study reported in April 2000. The details of the key participants, venue, subjects discussed and other aspects are tabulated and presented in the Part-I, EIA Report, Appendix 6.1 prepared in earlier studies. The details of scoping workshop are given in appendix 8.3.

These consultations are considered the then requirements of various Government agencies for clearing the project regarding environmental and forestry aspects at district, state and national level. After submission of the feasibility report, a number of consultations were carried out by the then consultants with the State Pollution Control Board, the Forest Department, Archaeological Department, Centre for Earth Science Studies, State Committee on Science Technology and Environment, Centre for Water Resources Development and Management etc. A series of project specific local consultations were also conducted by the previous consultants before the preparation of the EIA report. **PLATE 6.1** shows earlier consultation done with people at Chainage 15.000 regarding amenities near the bridge. **PLATE 6.2** shows local consultation at Chainage 5.800. **PLATE 6.3** shows local consultations done at chainage 16.700 in 2002. The outcome of these consultations has been considered in the preparation of various submissions including the earlier Environmental Impact Assessment Report of Loius Berger.

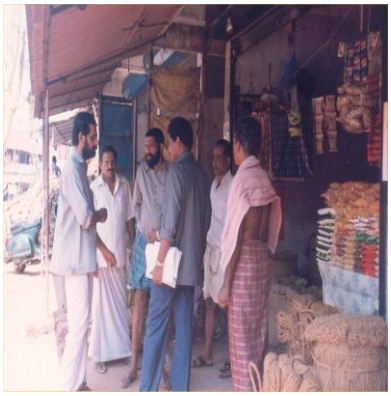
		
Plate 6.1. Consulted people at Chainage 15.000 regarding amenities near the bridge	**Plate 6.2.** Local consultation at chainage 5.800	**Plate 6.3.** Local consultations at Chainage 16.700

TABLE 6.1. CONSULTATION WITH LOCAL PEOPLE

ISSUES RAISED	RESPONSE OF THE KSTP TEAM
• People voiced concern over losing their land and was apprehensive about the Compensation packages • The major issue of contention along this road relates to road safety due to a cut section. The location is Chandragiri Bridge before Kalana Junction, where there are two earth cuttings of approximately 10 metres depth and the road passes through them. The depth of the road has caused many accidents and even otherwise, causes damage to the motor vehicles.	• Land acquisition will be minimised to the maximum was explained to them • Also explained the compensation packages and land value calculation in the R&R policy document. • The design of the road has proposed a viaduct at this location to ease gradients and reduce accidents.

Major community Issue

This road is used mostly as a bypass for the NH-66. It starts at the Kasaragod Press Club Junction and ends at the NH-66 at Kanhangad (Hosdurg) town. This road is already wide enough because the Government has already acquired sufficient land on either side. However, there are narrow sections, especially after the Kalanad Junction in Kasaragod area and in Pallikare, near the Bekal Fort area. The meetings along this road evinced much interest of the owners of the local commercial establishments and their responses to the project were positive.

However, meetings with the household members proved to be difficult. In most of the households the respondents were women and being mostly Muslims, it was difficult to get information from them for social reasons.

The major issue of contention along this road relates to road safety due to a cut section. The location is after the Chandragiri Bridge before Kalanad Junction, where there are two earth cuttings of approximately 10 metres depth and the road passes through them. The following diagram shows it:

6.2. REGIONAL SCOPING WORKSHOPS

Apart from the project specific local consideration, a number of regional scoping workshops were alos conducted in 2000. The details of the environmental and social scoping workshops are given in the **TABLE 6.2**. There were three workshops instead of one at State level to maximise the participation at Thiruvananthapuram, Kochi and Kozhikode. All concerned parties were formally invited to attend project level meetings. The total invitees were for Thiruvananthapuram, Kochi and Kozhikode workshop was 200. The **PLATE 6.4** and **6.5** shows the scoping workshop session at Kochi.

Plate 6.4. Regional Scoping Session at Kochi

Plate 6.5. Scoping Session Participants at Kochi.

TABLE 6.2. ENVIRONMENTAL AND SOCIAL SCOPING WORKSHOPS

SL NO	SCOPING WORKSHOP	DATE	DISTRICTS COVERED	NUMBER OF PEOPLE PARTICIPATED	NUMBER OF PEOPLE INVITED
1	Thiruvananthapuram	Jan 6, 2000	Thiruvananthapuram, Kollam, Alappuzha, Pathanamthitta	57	80
2	Kochi	Jan 25, 2000	Ernakulam, Kottayam Thrissur, Palakkad and Idukki	47	60
3	Kozhikode	Feb 2, 2000	Malappuram, Kozhikode, Kannur, Kasarkode,Wayanad	51	60
				155	200

The information provided to the participants during the workshop include KSTP project summary for highways and waterways project. The initial findings on impacts and environmental issues during presentation were disclosed. There were photographic displays and displays from press. Project proponents invited NGO, Government agencies and other stakeholders to identify social and environmental concerns and issues that should be addressed in project preparation and provided information about the project enabling informed participation. Several dozen participants attended the regional scoping sessions and stakeholder workshops. Inputs from these events influenced design decisions and subsequent assessment activities.

The project authorities explained that at present highways are largely neglected and there is ample scope for improvement if it is properly planned. The minutes of all three scoping workshops are presented in Volume 1 Appendix 6.2. The objective of the workshops was to gather observations and concerns from the public, NGOs, and experts for the scoping of the environmental and social aspects of the project. Apart from the organizers, the names of the various NGOs and officials who attended the workshop are included in the minutes as appended in Volume I Appendix 6.2.

6.2.1. SCOPING WORKSHOP AT THIRUVANANTHAPURAM

MAIN ISSUES

Water logging on roads (flooding sections) recurs during the monsoons due to inappropriate design for the soil conditions and poor drainage. Strict laws and regulations should facilitate land acquisition. The importance of heritage tourism and the need for creating a cultural awareness in Kerala was emphasised.

MAIN CONCERNS

There is a land degradation problem in Kerala due to the varying terrain and the fact that approximately 40% of the landmass of the State is prone to landslides and slope instability. The apparent absence of coordination between the PWD and other line departments need to be corrected. The inadequate traffic signals, signboards and milestones and the frequent digging within the highways are very important concerns. The effective width of the roads is reduced with inadequate provisions for the pedestrians using the roads and also due to the existence of the utility poles.

It is also mentioned that the environmental and social impacts couldn't be solved by the PWD alone. There should be a realistic and pragmatic approach towards these problems.

RECOMMENDATIONS

The road alignments and widths in Kerala are unscientific, which may be improved with the use of satellite survey information. Considering the physical set up of Kerala, the design of north - south roads and the east-west roads should be different.

Consideration should be given to a proper water management system, minimizing disturbance to the paddy fields, and the biotic issues during the execution of the project. A committee should examine the environmental aspects and ensure that the guidelines are being followed. The biological aspects of the environment should be given more importance in this project. Various mitigation measures and safeguards should be ensured to protect the bio-diversity of the State. The importance of the NGO involvement in this project that the mitigation measures for various negative impacts can be formulated by conducting talks with stakeholders like NGOs, local people, etc. The coordination of various agencies should facilitate the rehabilitation programme, undertaking awareness classes for the pedestrians, and creating road management committees at the Panchayat level.

6.2.2. SCOPING WORKSHOP AT ERNAKULAM

Apart from the organizers, the various NGOs and officials who attended the workshop are listed in the minutes as appended in the Appendix 6.2.

MAIN ISSUES

The climate of Kerala is important. Statistically speaking Kerala receives 90% of its annual rainfall, in about 10 hrs. Tree cover of Kerala has decreased considerably. The following data of the decreasing trend of forest cover in the year 1900 - 70% forested area, 1950 - 50% forested area. 2000 - 25% forested area.

MAIN CONCERNS

A large percentage of accidents are taking place in the rural areas. Approximately 300 km of roads of the 2800 km pass through ecologically sensitive areas. The economic interest and environmental aspects are prime concerns in the selection of the roads.

RECOMMENDATIONS

The principles of island biology should be taken into account as Kerala can be compared to an Oceanic island. Ecologically sensitive roads if important will be subjected to detailed Environmental investigations to prepare an EIA in order to obtain formal MOEF clearance in case these are included for further investigations.

6.2.3. SCOPING WORKSHOP AT KOZHIKODE

MAIN ISSUES

The Telecom and Kerala Water Authority works are affecting the road traffic. Space is required outside the road formation for separation of the utilities and drainage facility. All roads will become drains during the monsoon season and there are sewerage outlets to the road. Surface water is entering the roads. There is very little budget for road improvements in Kerala. The facility of roads is limited and there are no proper traffic regulations. Providing standard width is impractical. It is time to prevent the garbage being thrown into the drains.

MAIN CONCERNS

Overloading of vehicles is a serious concern as this causes accidents and damage to the road as well. Hence it was necessary to control these aspects. The past history of the road development should be evaluated. Ribbon development is everywhere.

There are about 103 Scheduled Castes (SC) and Scheduled Tribes (ST) in Kerala. Most of these weaker sections live along the roadsides. In the case of low - income groups, rehabilitation will be very difficult as the culture is linked with the land they hold. The encroachers should be classified and given compensation. In the case of SC and ST rehabilitation, it is always better to be spread and mixed with all other communities but they usually don't like the idea preferring a colony.

RECOMMENDATIONS

- Putting ducts is good, but suggested to have removable slabs along footpaths so that the telephone cables can be taken through the ducts provided below the slabs.
- There should be better facilities for road crossings. There should be economic assistance from the concerned departments and the present cables, which are already laid, cannot be removed. Suggested to have Parallel roads and bypass roads to get away from the present narrow roads.
- Capillary effect on the roads should be considered and also the topography and climate. Access roads are the main problem for PWD Roads. These should be included in the project.

- There is an urgent need for effective control of visual pollution. Road markings should be considered. In the case of bypasses it is possible to collect betterment revenue. It would be very useful to every one if the already approved alignments were considered.
- In the case of provision of water supply pipes along the roadsides, the department could pay the expenses. Widening will in fact shift the existing pipeline towards the center so provision for the relaying of pipes should be made.
- The cost of relaying of pipes should be included in the project budget. The environmental and social concerns of this pipe laying should be taken into account.
- Ecologically sensitive areas should be avoided.
- Rehabilitation of the people should be given more importance. The impact on low - income groups is high although the cost of land acquisition is very low.
- There should be some way out for the storm water drains. In all project related matters there should be 100 % transparency. If this is done there will not be any difficulty in convincing the people.
- Social and environmental impact should be considered seriously.
- The roads are very important for social advancement. People should be made aware about the various positive aspects of the project.

SCOPING BASED ON SCOPING WORKSHOPS

A change in the original Terms Of Reference (TOR) was not required after the scoping sessions. All issues and the public concerns were considered in the EA process without any change in the original TOR with all issues and public concerns positively considered for the design as well as Environmental Assessment.

Phase II participation programme

As a part of the phase II participation programme, the project has planned a much better participation preferably on project affected panchayat basis. These are designed based on the experience from Phase I programme to meet the various inadequacies that occurred during the KSTP-I participation. From all consultations, necessity of much higher scale of participation was evident. During these the follow up meetings the KSTP team will explain the nature of the project, project impacts, project components including social and environmental components etc. The various queries regarding the compensation and other aspects of the project will be discussed / answered according to the project policy on Resettlement and Rehabilitation. A report will be prepared and formally submitted to the Bank in February 2004.

6.3. PUBLIC CONSULTATIONS CONDUCTED AS PART OF THE INDEPENDENT REVIEW OF EIA

Providing for people's participation in project design and development is a way to improve environmental governance by providing a mechanism to influence decisions about the use and management of natural resources. Based on the remark of the recent World Bank review mission in July, 2012, a series of FGDs were arranged jointly by KSTP officials and the consultants along the project roads to update the earlier consultation process.

6.3.1. RATIONALE FOR FGDS

The focus Group Discussion adopted for this project involved one time discussion of various topics related to the project such as environmental issues, loss of access and saftey; involving 6-12 individuals selected to meet specific criteria in order to broadly represent a particular segment of society such as drivers, merchants, pedestrian passengers etc. This one-time face-to-face meetings were structured to be informal to encourage open discussion among participants in a relaxed atmosphere and were a good way to gauge the opinions of the public.

6.3.2. OBJECTIVES OF THE RECENT FGDS

The main objective of the FGDs conducted recently were the following:

- To solicit the views of affected communities/individuals on environmental and social problems;
- To gather inputs from the affected communities/individuals in crucial decisions regarding mitigation of the identified environmental and social issues; and
- To minimize public resistance to changes by providing them a platform in the decision making process.

6.3.3. DATE AND VENUE OF FGDS

The FGDs were conducted in the following locations along the project roads on 26th and 27th of July, 2012.

KASARGOD -KANHANGAD ROAD	PILATHARA PAPPINISSERI ROAD	THALASSERY VALAVUPARA ROAD
Kasargod town - (Project start point), Kottaruvam, Melparambu, Uduma, Chandagiri fort, Kottikkulam, Bakel, Kananhangad	Pilathara–Chumaduthangi, Pazhayangadi, Cherukunnu, Pappinisseri	Thalasseri–ROB, Erinholi, Koothuparambu, Nirmalagiri College Jn., Mattannur, Iritty.

6.3.4. ISSUES RAISED AND RESPONSE TO THE CONCERNS

Altogether the team met 94 persons representing various segments of society such as drivers, merchants, and pedestrian passengers. The compliance to the general queries raised by them and the specific issues raised by the public along with the responses to their concerns are summarized in the following tables.

TABLE 6.3. GENERAL QUERIES FROM PUBLIC

SL NO	STAKEHOLDER CONCERNS/SUGGESTIONS	COMPLIANCE
1.	Why the width of the road is not uniform at all places?	Paved surface is uniform through out the road length
2.	Whether public will loose access to the roads during construction?	No. Where there is loss of access, alternate arrangements will provided as part of the project.
3.	Who will determine the time and routes for traffic diversion?	KSTP in consultation with police department will finalise this.
4.	Who is determining the value of land? What is the system of determining the	Based on the guidance value already fixed.

	fair value?	
5.	How will you ensure the safety of passengers /pedestrians during construction?	This will be ensured by adopting proper Traffic Management Plan prepared by the contractor.
6.	Whether there will be any speed restriction during and after construction of the road?	Yes. This is part of guidelines for Traffic Management Plan in the EMP These are also included in the construction site management procedures
7.	Will the road cater to the demands for pedestrians and cyclists after construction?	Raised pedestrian crossing and footpaths are proposed for safety of pedestrians
8.	Will the road restrict accesses and how will I gain access to my property/shop?	Access road development are proposed wherever access is cut off
9.	What is the mechanism to ensure quality of construction?	The supervision consultant will ensure the quality of construction. The maintenance is also the responsibility of the contractor for the five years after construction.

TABLE 6.4. SPECIFIC CONCERNS AND RESPONSE

NO.	STAKEHOLDER CONCERNS/SUGGESTIONS	RESPONSE
1	Footpath, cycle path and parking area necessary in all junctions	Footpaths, hand rails and street lighting have been provided in the school locations, junctions and in built ups and parking areas provided. For accommodating slow moving vehicles 1.5 m paved shoulders are proposed on both sides of the main carriageway.
2	Drainage and water logging problems should be removed	The project design has provision for footpath with covered drains in built-ups, covered drains in semi urban locations and earthen drain in other areas.
3	Protection of paddy fields and wetlands	No paddy land is reclaimed for the road. Necessary retaining wall and pitching are proposed as protection measures for embankments and cut slopes
4	Road safety problems: road signages, speed reducing bumps, curve straightening and sight distance needed	Comprehensive road safety plan is part of the proposals. Raised pedestrian crossings are proposed at junctions and near schools.
5	Provide bus bay at the stops and build waiting sheds with adequate size and facility. Provide lay bays for long distance vehicles such as trucks.	Bus bays with approach tapering and passenger shelters have been planned as per acquired land availability. Truck lay bye are not proposed as there is scarcity of land and a truck lay bye require 0.2 ha land per location.
6	Preserve existing trees along the roads.	While finalising alignment, this criteria has already been adopted Trees only within 1m of formation width on either

NO.	STAKEHOLDER CONCERNS/SUGGESTIONS	RESPONSE
		side will be cut. There existing trees will be preserved. Three times the number of trees cut are proposed to be planted.
7	Plant trees at least 5 m away from main carriage way to avoid accidents and address safety issues	This has been incorporated in designs according to provisions of IRC SP 21...
8	Provide signal light at every junction.	A system of prioritized traffic movement is envisaged with proper channelization including signs, islands, delineation, dedicated raised pedestrian crossing, hand rails and retro-reflected markings at all major junction.
9	Provide permanent arrangements for laying of cables, pipelines, etc. by the side of the road to prevent periodic cutting of the roadsides.	Cross utility ducts have been proposed for accommodating utilities. At built ups, space is reserved below footpath for accommodating utilities.
10	Avoid height difference between shoulder and paved surface at both sides of the road.	Edge drop will be avoided by implementing appropriate routine maintenance plan.
11	Use reflectors to show the demarcation line.	Raised pavement markers are proposed and included in the BoQ.
12	Provide comfort stations and rest places in major junctions	Development of Ox-bow land is part of this proposal. There are three number of ox-bow land developments. Type A is with proper lighting, sitting arrangements and eating arrangements besides parking facility and toilets. There will be adequate tree and shrub planting. Type B is same category with less facility arrangements where as the type C is the open type with fewer facilities. Type A and B will be developed as a separate project by KSTP in consultation with other state departments.
13	Provide speed breakers at all junctions	Speed calming measures are provided at all major junctions and intersecting roads
14	Handrails provided for footpath should not block access to shops	This is already taken care in the proposal and more specific arrangement will be done during project implementation stage.
15	Provide slope stabilisation measures for landslip prone area at Kasargod – Kanhangad road	Environmental friendly protection measures such as Rubble Masonry Breast Wall with shotcrete treatment and Stone Pitching have been included in the DPR.
16	Complete all necessary land acquisition for project, vacate the stay orders from High court	As per the information from KSTP officials, LA is almost completed. Remaining part will be completed before the commencement of the project.
17	Discrimination is seen in the land acquisition done for the project	No such discrimination is reported. All the LA activities will be completed prior

NO.	STAKEHOLDER CONCERNS/SUGGESTIONS	RESPONSE
		to the commencement of the project.
18	The current pavement uplifting works near the ROB of Thalasseri-Valavupara road is totally unnecessary considering the proposal under KSTP	The current improvement work was considered for mitigating the water logging issues of the area on an urgent basis.
19	Address the traffic block problem in the Kasargod – Kanhangad project road due to the Railway cross at Uduma Junction.	ROB is already constructed 1 km away from the mentioned site and during the closure time of the railway gate traffic can be diverted through the ROB. As the approach road is not under KSTP, new ROB is not possible there.

6.3.5. CONCLUSION

Environmental concerns raised by the community during the FGD have been incorporated to the extent possible in the project preparation and in that sense the FGD was successful. However, the public consultation process of KSTP should continue till the completion of the project.

6.3.6. PUBLIC DISCLOSURE OF KSTP-II DOCUMENTS

The project will disclose all KSTP-II environmental and social documents at the World Banks Project Information Centre at Washington and also at the PIC of Banks New Delhi office. Simultaneously all documents will be made public in Kerala at the District Information Centres with suitable press note for the public attention. After the World Bank approval, EIA/EMP documents relating to the three roads will be disclosed at the relevant offices in Kerala PWD, KSTP and World Bank.

Public Consultation for Kasargod - Kanhangad Road

Plate 6.6 FGD done at Kasaragod

Plate 6.7 Discussion done with PWD officials at Kottaruvam

Plate 6.8 FGD done at Kottaruvam	**Plate 6.9** FGD done at Uduma
	
Plate 6.10 FGD done at Bakel	**Plate 6.11** FGD done at Kanhangad

Public Consultation for Pilathara Pappinisseri Road	
	
Plate 6.12 FGD done at Chumaduthangi	**Plate 6.13** Discussion done at Pazhayangadi
	
Plate 6.14 FGD done at Cherukunnu	**Plate 6.15** FGD done at Pappinisseri

Public Consultation for Thalassery Valavupara Road	
	

Plate 6.16 FGD done at ROB, Thalasseri	**Plate 6.17** FGD done at Erinholi
	
Plate 6.18 FGD done at Koothuparambu BS	**Plate 6.19** Discussion done at Koothuparambu
	
Plate 6.20 FGD done at Nirmalagiri	**Plate 6.21** FGD done at Mattannur
	
Plate 6.23 FGD done at Iritty	**Plate 6.24** FGD done at Koothuparambu

6.3.7. PHASE II FINAL DESIGN OUTPUT

The final design out put has integrated many existing facilities of the people for example bus stops, parking areas for auto rickshaws, cars, jeeps and mini tempos etc. These are already located along the project roads and have been presented in EMP report. These are the rights of the people and hence it is not necessary to consult them for every location instead the project has to integrate the facilities in to the design. This is a direct contribution from the environmental investigations including consultations. The consultation carried out in the very early stages of the project has established the need for these kinds of facilities. The principle followed is that if the project takes the existing facility of people then the project will have to compensate or replace it. It is also recommended that the alternate arrangements should be at least qualitatively equivalent if not superior to the existing ones. Although additional land acquisition for parking areas is the work of

the local bodies, the project has taken all these for implementation. There are two reasons behind this. First reason is that if this is left for local bodies like municipally, this will never be implemented or delayed for years together due to lack of local resources as well as due to other priorities. This can defeat the objective of the project. Secondly, these are important factors that will improve the road safety standards and reduce accidents.

CHAPTER 7. ASSESSMENT OF POTENTIAL IMPACTS

This chapter discuss the impacts due to the project activities upon different components of the local, and or regional environment. Specifically the environmental components are the same that are discussed in the **Chapter 5** baseline environment and broadly include Physical, Biological and Social environment. Potential impacts could occur during construction phase as well as during the operational phase. The fact that the project road is already operational makes the operational impacts during post constructional stage insignificant in many cases.

Earlier two of the the project roads (Link no. 68 and 69) were part of the National Highway 66 (earlier NH 17) network. This was down graded to State highway status due to some unknown reason. Now the process could be reversed due to shorter route when upgraded to a better designed road status. The condition of the developed project road will be similar/better than that of many existing national highways. This reversal of the traffic from national highways could be one of the most significant impacts due to the project. Therefore impacts during construction are most important. The various impacts due to the improvement and construction of the project road are presented. Wherever necessary the impacts during construction and operational stages are discussed separately.

Major Positive Impacts

- Diversion of traffic from NH 66 (earlier NH 17)
- Reduced noise and air pollution.
- Reduced risk of accidents.
- Improved accessibility and connectivity.
- Reduced vehicle operating and maintenance cost.
- Savings in fuel consumption.
- Improved facilities to road users.
- Improved quality of life.
- Improved aesthetics.
- Generation of local employment.

Induced Impacts

Ribbon developments and consequent impact to coastal ecosystems

Improved commercial and tourism activities

Minor Impacts

All other impacts such as erosion, tree removal, impact to cultural properties etc are of smaller magnitude and have been considered for mitigation and avoidance.

7.1 METEOROLOGIC AND CLIMATIC IMPACTS

As indicated earlier there are very few trees to be cut and removed for widening and improvement of the project road. The impact due to the tree removal would be an increased exposure to sunlight. Other than this, there would not be any change in the micro climatic conditions in the area due to the project improvement activities during construction phase. The

impacts such as potential drainage problems, flooding, air quality impacts, etc. are discussed under the appropriate headings.

Operational Phase. During operational phase induced impacts like ribbon developments will be accelerated due to the improved nature of the road. Between Puthiyangady river and the railway gate in link no 68 (Chainage 6.600) some accelerated destruction of mangroves are also anticipated. These impacts otherwise could occur in the same magnitude but for a slightly longer period. None of these impacts are expected to introduce any significant impacts to natural environment.

7.2 IMPACTS TO REGIONAL PHYSICAL SETTINGS

7.2.1 IMPACTS TO PHYSIOGRAPHY

Physiography Impacts. The physiographic impacts due to a road improvement project are minimum except along the realignments. Four oxbow lands are there along the project road link no 68, 4 oxbow lands along the project road link no 69 and 31 oxbow lands along the project road link no 74. No bypasses are considered. In addition to this, there will be slight improvement of small curves due to safety reasons. This will also open up new area of disturbance leading to a change in the existing embankment heights. Proposed chainages where embankment heights will be raised are shown in Part II, EMP **Annexure 3.47**. In the case of link 68 there are only two locations, link 69 there are 60 locations and link 74 there are 464 locations where embarkment heights will be raised A summary of the total length of these sections are provided in Table **Table 7.1**. Potential erosion impacts are discussed under section 7.2.5. The potential impacts of borrow pits, including their potential topographic impacts, are discussed under section 7.2.4.

TABLE 7.1. PROPOSED CHAINAGES WHERE EMBANKMENT HEIGHT WILL BE RAISED

NO. OF LOCATIONS	PLACE NAMES	TOTAL LENGTH (m)	NO OF LOCATIONS CLOSE TO TIDAL WAVES (50- 100m AWAY)
	LINK-68		
2	Ramapuram, Pappinissery	200	2
	LINK-69		
60	Please refere Annexure 5. 43 in EMP	3420	--
	LINK-74		
464	Please refere Annexure 5. 43 in EMP	34300	NA

During construction period. During the period of construction, chances of erosion are very high to the altered embankments. The heavy precipitation during monsoon will aggravate the rate of erosion unless suitable mitigations measures are taken. Erosion along the sloping Section I will be higher than the Section 2. All surface water bodies except isolated freshwater bodies like ponds across which the road passes are all included in sensitive CRZ areas and need special mitigation measures. The preserved topsoil heap and storage also will be subjected to erosion, if proper measures are not taken. The management measures are given in EMP report.

During operational stage. During the operational period, immediately after the construction works, there will be plenty of scope for erosion due to the left over during the construction period. Once all activities proposed in the project including landscaping, tree planting and shrub planting are complete, the entire corridor will be stabilised and further erosion will be negligibly small.

The cut section between Kasaragod town area and Chandragiri River is important. Considerable cutting will be required along the section. As described earlier there are three cut sections, which will supply considerable quantity of material for the road completion work.

Potential Drainage Impacts. The proposed improvements to the existing cross drainage structures will have significant positive impacts as it is expected to remediate the current flooding problem in the project roads mentioned in section 5.3.5 to a great extent. Cross drainage provisions will be upgraded where ever necessary to accommodate the 25-year floods in the case of culverts. In addition to the existing culverts new ones are also proposed to take care of the increased runoff, or correct existing inadequacies in drainage. The construction of culverts will be for the full formation width.

During construction period. The material storage places, newly constructed embankments and work areas etc may be subjected to erosion during the monsoon period. The nearby surface water bodies could be contaminated depending on the type of material stored. The topsoil heap and storage also will be subjected to erosion, if proper measures are not taken. The management measures are given in EMP report.

Plate 7.1. Major cut section inlink no. 69, which will be further widened as a part of the project

During operational stage. Immediately after construction, there will be erosion due to the small and minor erosional features left behind during construction stage. After the stabilisation i.e. complete construction including landscaping, tree planting, erection of gabions, retaining walls etc the effective erosion will be negligible. The water quality in roadside ponds will be improved after one or two monsoon seasons. As the construction period will cover a minimum of three monsoon seasons the erosional impacts if any immediately after the construction will be in a phased manner thus nullifying the adverse impacts on the surface water bodies.

7.2.2 GEOLOGICAL IMPACTS

As described earlier in the base line Chapter 5, the project roads on a local basis can be divided into two sections. Geologically these two terrains are different. First part is lateritic and the second part is coastal alluvial swampy formations.

Since most part of the two project roads (Link 68 &69) is located within in the coastal belt, the geological aspects of the corridor need to be assessed, as there could be an increase in the traffic especially heavy vehicles such as multi axle trucks moving with heavy containers etc. This consideration is mainly due to an expected shift of vehicles from the National highway to the project roads due to shorter distance. Nevertheless the alluvial coastal areas throughout the available corridor may undergo slight compaction due to the construction of embankments and also due to the increased traffic along the road corridor.

Sand Mining issue. The requirement of sand for concrete and macadam based pavements especially for the structural works is a matter of concern as the 'sand mining' is already an issue in Kerala.

GOK has controlled the exploitation of these resources in almost all areas, limiting the harmful effects on the environment. The analysis done by consultants revealed that adequate quantities of quarry sand/dust would be available for the use of KSTP from approved sand mines. It is also a one-time requirement during the construction period of two years. The use of manufactured sand is also reccomended.

7.2.3 SEISMIC IMPACTS

The project construction activities are anticipated to have no impact on the area's seismic conditions. The Thalassery – Valavupara road is crossing one deep seated fault known as Kuthuparamba fault. Besides there are many more minor faults and fractures that can generate minor tremors as a result of crustal readjustment. The area's seismic characteristics have been considered for design of all structures. The recent tremors of Kerala were all minor. Minor tremors will not be resulted from the road improvements nor such tremors will create any significant impact on the constructed road . In the case of bridges along the project roads, due consideration was paid while designing based on IRC -6, 2010.

In the case of Thalasseri – Valavupara road, the seismic tremors during the monsoon season could trigger large-scale landslides and land slips along the highland region of Link 74. It is also possible that the fissures and fractures developed during the past earthquakes could take large quantities of water during the monsoon season, which could accelerate the landslide process in the mountainous region along Link 74.

The ghats along link no 69 and 74 is known for frequent landslides especially during monsoon season. Proposed widening may cause destabilization of hill slope at ghat locations. Hence, minimum RoW has been proposed at ghat sections to avoid further disturbance to the hill slopes. Slope protection works are also proposed in these sections. No impact is envisaged during operation phase of the project and hence no mitigation proposed. However, periodic surveillance shall be conducted to check slope stability of the land slide prone areas.

7.2.4 IMPACT ON TOP SOIL QUALITY

In many locations, along the corridors a raising of the embankment height is required. The last one kilometre of the project road at Pappinissery is located in the alluvial swampy formation bordered by mangrove vegetation. At this location, a geometric correction is required to correct the existing unsafe driving conditions**.** The impact on soil quality will be confined to the available corridor along the project road, immediately adjacent areas and the sites of borrow pits and cut sections.

Plate 7.2 . Location where the geometric correction is required in Link 68 (Chainage 20.800).

All borrow pits are to be identified towards the landward side of the project road in the interior areas in the midland. In most of the cases, the distance from the centre line to the borrow pit locations is expected to be 10-20 km. The network of roads available throughout the area will facilitate the material transport. Due to very high density of road network it is not possible to clearly identify the haul routes.There will be some adverse impacts due to the creation and

operation of borrow pits. But, to minimise the same, Generic EMAP Table in Part II EMP reports – Vol. I, II and III provides detailed guidelines for effectve management and re-development of borrow areas (Refer **Annexure 3.4** of EMP) for link 69, 68 and 74.

7.2.5 EROSIONAL IMPACTS

The impact on soil due to the project will be in terms of topsoil erosion. Strengthening and widening of the existing roads will not cause significant soil erosion. Soil erosion may occur at bridge locations, along the steep and un-compacted embankment slopes, earth stockpile locations and wherever vegetation cleared areas. Soil erosion will have cumulative effect such as destabilisation of embankments, turbidity and siltation of water bodies, drainage problems, etc. Establishment of construction camp and movement of construction vehicle and machineries on agriculture land will result in compaction of top soil. Also utilisation of productive top soil present in barrow area and quarry area for road construction can lead to loss of top soil. Further, soil pollution would take place to a negligible extent due to spillage of construction material, oil, fuel, grease and asphalt around the construction yards. Disposal of construction waste and domestic waste in unscientific way may result in loss of productive land.

The rivers and streams in the PIA districts are undergoing vigorous erosion from the upstream. The eroded soil quality materials are being taken in to the sea due to the heavy monsoon in-flows. Beyond the project road towards the seaward side a depositional environment prevails. As a result streams carrying sediment loads are deposited. The project design considerations and construction activities will not accelerate the rate of erosion. The proposed improvement of the project will be along the available corridor and to the immediately adjacent area already acquired for the project.

Unless precautionary measures are taken especially during the monsoon season all construction/disturbed areas along the project road will be susceptible to erosion leading to the loss of fertile topsoil. Design has taken in to account all areas, which require stabilisation. There could be permanent loss of agriculture/productive soils especially paddy field areas due to widening and borrow areas. The effect will be minimum due to the fact that no bypasses are considered along the project roads. A total of thirty nine realignments are considered for various reasons. These are provided in **Table 7.2**. There could be potential loss of topsoil along these stretches. Top soil conservation has been incorporated as a major mitigation measure and detailed guidelines for the same are incorporated in the in the EMAP Table given in Part II EMP Reports Vol . I, Vol II and Vol III for link 68, 69 and 74 respectively.

TABLE 7.2. REALIGNMENTS ALONG PROJECT ROADS

SL. NO	NAME OF THE LINK	LINK NO.	NUMBER OF REALIGNMENTS	TOTAL LENGTH (KM)
1	Kasargode – Kanhangad	69	4	1.050
2	Pilathara - Pappinissery	68	4	0.380
3	Thalassery – Valavupara	74	31	4.510
	Total		**39**	**5.940**

The improvements in the project corridor will not lead to any additional significant erosion. Retaining walls or toe walls will be constructed in the side slopes of raised berms.

Road drainage will be upgraded to accommodate 25-year floods. All drainage ways will be of suitable size and alignment to minimise any potential erosion. Along the Mattul to Puthiyanagadi stretch sea walls are constructed all along the coast with frontal beaches (CZMP, 1995).

Immediately north of Valapattanam - Thaliparamba river mouth, wide beaches are present seaward of sea walls supporting extensive social forestry (CZMP, 1995).

The eroded soil quality materials are being taken in to the sea due to the heavy monsoon in flows. The project design considerations and construction activities will not accelerate the rate of erosion. The improvement of the project is along the available corridor and to the immediately adjacent area to be acquired for the project. The improvements in the project corridors will not lead to any additional significant erosion except at cut sections. For these section, enough management measres are suggested in the EMP.

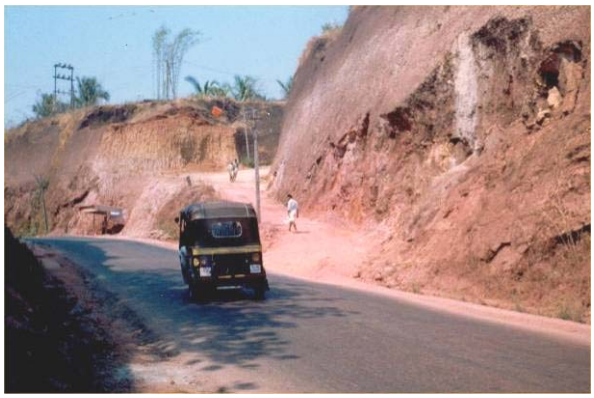


Plate 7.3. Erosion prone cut section, which will be further widened as a part of the project

During operational phase, better access can lead to conversion of agricultural land to commercial and residential purpose close to project road, especially in rural areas. This may result in loss of productive land and agriculture produce. Establishing project facilities like construction camps, labour camps near low lying areas and near bridge approaches, during monsoon, can lead to the erosion of the embankment formation. Borrow areas if not rehabilitated properly will cause soil erosion. Detailed guidelines for the same are incorporated in the in the Part II EMP Reports Vol . I, Vol II and Vol III for link 68, 69 and 74 respectively.

7.2.6 QUARRY AND CRUSHING OPERATIONS

There is an increased importance to quarries and crushing operations due to difficulty to obtain good quality sand for construction. Due to the prevailing sand mining issue, manufactured sand, quarry sand and quarry dusts are widely used for road construction purpose. There are no quarries immediately adjacent to the project roads; nevertheless a number of commercial rock quarries are available towards the interior areas of the project roads 10-30 km away from CRZ areas. It is difficult to establish the haul roads due to large number of options available. The quarries of commercial suppliers are largely established quarries working for many years. In case the Contractor has to open new quarries there will be a series of possible impacts such as tree cutting, spoiling of landscape, topsoil loss and safety of the workers etc. These are described in the corresponding mitigation section and also in the detailed guidelines for siting, development, management and redevelopment of camps/sites incorporated in Part II Environmental Management Plan Vol. I, Vol II and Vol III for link 68, 69 and 74.

7.3 WATER RESOURCES IN THE REGION

7.3.1 IMPACT ON SURFACE WATER RESOURCES

IMPACTS DURING CONSTRUCTION

The project roads are crossing rivers, canals and streams on their way and are abutting lakes, ponds and tanks, wells, bore wells, etc. Disposal of construction debris near the vicinity of water bodies may cause stagnation/ diversion of natural drainage. Water supply units present adjacent to project roads within the proposed RoW will be impacted. Drawing of water for construction camps for domestic use from local water sources may disturb water supply use for the local inhabitants. Construction activity at bridge and culvert locations may cause water pollution. The construction of existing culverts, widening of the existing culverts and the demolition of

unwanted culverts etc will definitely pollute the water unless special care is taken to mitigate and minimize these impacts. The positive impacts on the other hand will improve the drainage condition of the project road allowing a safe all weather roads useful to all road users.

Source of construction water. The water requirement for construction work will be met from the rivers, streams etc. Mitigation measures are described in the corresponding mitigation section. There will not be any scarcity of water for the construction water requirement. The water requirement will be of the order of 12,000 to 1717 KLPD for road construction and dust suppression, 12 KLPD for domestic use in labour camps and the requirement varies depending on the rainfall pattern. During monsoon season the requirement will be minimum for dust suppression, compaction etc. **Table 7.3** shows the possible impacts on water bodies due to the project.

TABLE 7.3. POTENTIAL IMPACTS TO WATER BODIES

WATER BODIES AFFECTED	POTENTIAL IMPACTS/COMMENTS
Link No. 69	
Chandragiri river	Erosion from cut section between Kasaragod and river for approximately three kilometres. Pollution from construction material.
Bekel Hole	Erosion could occur from new embankments and new construction sites. Pollution from construction material.
Chittari Puzha	Chances of direct pollution from construction material sources
Kalanadu Stream	Chances of direct pollution from construction material sources
Paravandaka Stream	Chances of direct pollution from construction material sources
Chammanad Stream	Chances of direct pollution from construction material sources
LINK NO. 68	
Valapattanam River	Degradation of mangrove forests
Ramapuram river	Chances of direct pollution from construction material sources
Palayangadi river	Chances of direct pollution from construction material sources
Kannpuram River	Chances of direct pollution from construction material sources
LINK NO. 74	
Chirakkara	Chances of degradation of mangrove forests and Chances of direct pollution from construction material sources
Meruvampai	Chances of direct pollution from construction material sources
Karetta canal	Chances of direct pollution from construction material sources
Mattannur canal	Chances of direct pollution from construction material sources
Kalaroad stream	Chances of direct pollution from construction material sources
Uliyil river	Chances of direct pollution from construction material sources
Iritti Valapattanam River	Chances of direct pollution from construction material sources

Plate 7.4. Valapattanam River near Pappinissery with lazurious mangroves	**Plate 7.5.** Pazhayangadi River at chainage 6.900 in Link no. 68
	
Plate 7.6. Chirakkara River at Erinholi in link no. 74	**Palte 7.7.** Ramapura River (chainage 14.200) in Link no. 68
	
Plate 7.8. River at Iritty in link no. 74	**Plate 7.9.** Chittari river in link no. 69

IMPACTS DURING OPERATIONAL STAGE

The operational stage impacts will be minimum due to the overall measures adopted by the project to contain the direct, indirect and long-term impacts. The project also used the avoidance (eg. IRC Standard width) as a strategy to limit the impacts to an acceptable level. Moreover, the project has planned environmental enhancement measures, which will also allow reversing any possible long-term impacts. There will not be any significant increased runoff as there could be little additional surface area as a result of the implementation of the project. All the three rods have adequate right of way, at most of the sections the required land is minimum. During operational stage, the berms will be improved, embankment slopes stabilised or protected by rip-rap or other materials including planting to prevent soil erosion.

Water quality in roadside surface water bodies' such as ponds adjacent to the ROW may show slight improvements after road upgradation due to reduced erosion from improved roadside berms and embankment slopes stabilized or protected by riprap or other material including planting to prevent soil erosion. Lack of proper drainage arrangement may result in soil erosion, subsequently leading to turbidity and siltation of nearby natural water bodies. Spillage of edible oil, crude oil, lubricants and other hazardous chemical due to road accidents close to natural drainage will cause alterations in water quality. Unscientific disposal of debris and construction

materials in low lying areas shall lead to flooding during rainy season. Water shall be utilised for maintenance of trees planted along project roads.

7.3.2 IMPACT ON DRAINAGE PATTERN

Impact to drainage pattern during construction and operational stages are separately provided. Since the drainage impacts are very crucial due to the heavy intensity rainfall, necessary care need to be taken to avoid extensive damage caused by erosion. The impact in the urban, semi urban areas and the cut sections will be likely to be much higher. The cross drainage provisions will have to be upgraded where ever necessary to accommodate the floods in case of culverts. In addition to cross drainage structures, in critical areas, the longitudinal drainage needs to be addressed. It is also necessary to find locations for additional CD structures and also to remove unwanted CD structures.

IMPACT DURING CONSTRUCTION

There will be impacts to the existing drainage pattern due to the various construction activities including reconstruction of new cross drainage structures. During construction, there could be impact to the drainage pattern due to the various construction activities including topsoil preservation, temporary or permanent storage of waste material and other related construction activities. The construction or improvement of the cross drainage structures of the project road could also temporarily disturb the existing drainage patterns. More over the project has considered many realignments along link 74. This will also disturb the drainage pattern unless appropriate mitigation measures are provided. No bypasses are considered in this project that will generate higher impacts during construction.

As a part of the KSTP road widening and improvement, the existing cross drainage structures will be replaced /repaired /widened as per the design requirement. The locations of all CD structures are provided in the environmental data sheets. The development, improvement or reconstruction of cross drainage structures should consider the possibility of stream water being polluted because of the various construction materials (cement, petroleum, oil, lubricants, paint, lime etc). Mitigation measures are described in the corresponding mitigation sections. The EMP has contractual provisions to avoid these kinds of impacts.

IMPACT DURING OPERATION

Immediately after construction a possible issue could be the non linking of side drainage/CD and natural stream courses. This has been addressed in the design stage. During Operational stage, there will not be any adverse impact on the existing drainage pattern. Many realignments are included in the project that will add new provisions for drainage. The increased drainage will improve and preserve the quality of the constructed road for longer period. There will not be any threat to the CD structures due to the sand mining in this area. The increased drainage facilities will provide greater safety and stability to the project road.

7.3.3 IMPACT ON GROUNDWATER RESOURCES IN THE PIA

Impacts during construction and operational period have been separately provided.

IMPACTS DURING CONSTRUCTION

There are a number of open hand dug wells and water taps of Public Water Supplies (PWS) along the project roadsides and also in the area that will be ultimately acquired for widening. Most of the PWS and open wells will be impacted. Extraction of ground water for construction activities and domestic use of labour camps will result in depletion of local ground water table. Sources of ground water such as open wells, hand pumps and deep tube wells will be affected

due to widening of project road at specific locations. Selection of construction camps adjacent to open well will lead to contamination of ground water due to unscientific usage of water near open wells.

The likely impacted water sources are provided in the **TABLE 7.4**. The locations of all drinking water bodies identified are provided in the environmental data sheets. The **PLATE 7.10** shows a well located immediately adjacent to Link 68. A number of accidents are reportedly taking place at this location. During construction period only surface water and no groundwater will be required for the construction activities.

Plate 7.10. A well located adjacent to Link 68 (Chainage 17.000)

TABLE 7.4. LIKELY IMPACTED DRINKING WATER SOURCES

LINK NO	DRINKING WATER SUPPLIES		
	PUBLIC WATER SUPPLIES	PUBLIC OPEN WELL	BORE WELL
69	8	1	4
68	10	3	
74	11	11	2

During operation stage, the proposed construction of embankments at rolling terrain will reduce the permeability of the unpaved shoulder and further decrease the ground water recharging rate to greater extent due to surface runoff. Paved surface of the roads will reduce the percolation of runoff water and decrease the ground water recharge.

7.3.4 IMPACT ON WATER QUALITY IN THE PIA

There could be impacts during construction and operational stage of the project.

IMPACT DURING CONSTRUCTION

There are various water bodies such as rivers, streams and canals crossing/abutting the project roads. Some impacts are anticipated on the water quality of these water bodies during the construction phase. Discharge of untreated waste water generated from construction camps and labour camps to nearby water bodies will lead to deterioration of water quality. Runoff from hill slopes, embankments and earthen shoulder may increase the chances of soil erosion, which result in turbidity and siltation of water bodies. Cleaning of construction mechinaries, equipments and vehicles shall deteriorate the water quality.

As a usual practice everywhere, the debris and other concrete waste material of the existing structures will be dumped to the watercourses during dismantling of existing structures. Mitigation measures are discussed in the relevant sections and included in the Environmental Management Plan.

The construction activities near bridges and CD structures will bring in pollution in the form of cement, petroleum, oil lubricants and other materials and chemicals (e.g. lime) to the near by

water bodies. Other than this, no significant adverse impacts to surface water or water quality are anticipated.

IMPACT DURING OPERATION

During operational stage, no impacts on water quality or availability of water are anticipated. If construction activities open new pathways or approach roads to the water bodies that may lead to cleaning of vehicles using river water bringing pollution. This allows the vehicles to enter directly to the water body or very close to the water body leading to severe pollution at that particular location. So far no such likely locations have been identified along the project corridors. In general the water quality is expected to be slightly improved due to an improved road, constructed to environment and engineering standards. Impact during operational phase is comparatively minimum than construction phase. The common impact during operation stage is spillage of petroleum and other hazardous materials due to road accidents, which may deteriorate the water quality to considerable extent.

7.3.5 FLOODS DURING MONSOON SEASON

Although two of the project roads (link 68 & 69) are more or less completely located in the coastal areas, the effect of flooding is not acute. This is mainly due to a small raise in the embankment levels during successive State funded annual maintenance activities. In the case of link no. 74 which runs perpendicular to coast also, flooding problem is not so acute.

IMPACTS DURING CONSTRUCUTION

The project construction activities will not add to any flooding effect. On the other hand it will reduce the flooding effect due to a rise in embankment height, due to the increased and efficient cross drainage structures (CDs) and longitudinal drainage structures.

The raising of formation levels in this section is primarily for improving the vertical geometry and also for drainage provisions.

There are some flood prone aresas which will be flooded using heavy monsoon. The **PLATE 7.11** shows an area, which was improved to avoid flash flooding. The location appears to be affected by earth subsidence. The topography indicates an underlying weak rocky zone. The week zone could be fractures, fissures and fault zones. Flooding will destroy the road fabric and loss of resources inviting frequent maintenance.

Plate 7.11. Earth Subsidence Area in Link 69

IMPACTS DURING OPERATION

The impact of flooding during operational stage will be minimum, as the design had considered these aspects. This aspect has been further examined in the corresponding mitigation sections 9.3.5. Along the new alignments new CD structures have been planned wherever it is required.

7.4 AIR QUALITY IMPACTS

This is one of the most important negative impacts due to the road construction activities. Air quality issues are addressed in two phases: the constructional and operational phases. Potential impacts and mitigation actions related to them (if any) are identified as follows.

7.4.1 IMPACTS DURING CONSTRUCTION PHASE

Vehicular emissions are one of the major sources of air quality impacts of highway projects. As the project envisages improvement of road conditions for smooth traffic flow, the project will have beneficial impact on air quality of the region during its operation. But, impacts on air quality during the construction phase of the project will be considerable as the amount of work involved in improvement of the road is significant. However, any possible impacts will be transitory. Anyhow, provision of adequate air pollution control equipment, like dust filters and measures like dust suppression by water sprinkling and planting of green belt may further help to significantly reduce the impact.

Emission of CO_2 and NO_X due to combustion of diesel from vehicles, hot mix plant, batch mix plant, diesel generator sets etc. will be a principal cause of air pollution during the construction phase. The main impacts include dust generation, fumes from the hot mix plants, crushers, vehicles and from the transportation of all types of construction material. The effect will be considerably less during the wet monsoon period for about six months. Hot-mix plants will require careful siting particularly with regard to sensitive receptor areas. (e.g. coastal mangrove areas, CRZ areas, schools and hospitals). The siting will consider the social aspects because of the density of population and ribbon development. (Refer EMAP provided in EMP). The proposed consultation activities during construction period will help to improve these issues. Asphalt and hot mix plants are required to be located at least 250m away from the nearest sensitive receptor. The extent of potential impacts during the construction period will vary according to the types of emission controls used, requirements to cover trucks transporting fill material, the types of pollution control devices used and the supervision exercised over the project. Fugitive dust generation due to operations such as excavation of construction materials in barrow and quarry areas, loading, transportation and unloading of construction materials, cutting and drilling of rock masses and dust due to other construction activities. Fugitive dust released during above activity may cause immediate effect on construction workers, inhabitant around the alignments especially those residing in downward wind direction. This could be controlled through adequate water sprinkling on daily basis during dry seasons. Most of the generated pollutants due to these construction activities are limited to construction phase and confined to impact zone.

The **Table 7.5** shows the pollution areas that will have to be monitored during construction. Deails of monitoring, frequency and responsilibilty is given in EMAP provided in EMP.

TABLE 7.5. PROPOSED AREAS FOR POLLUTION MONITORING

POLLUTION SOURCE AREAS THAT WILL HAVE TO BE MONITORED	LIKELY SOURCE OF POLLUTION	REMARKS
Construction areas	Dust, and vehicle emissions	
Completed sections	Dust, and vehicle emissions, POL	If not closed properly
Incomplete sections	Dust, and vehicle emissions	Due to the incomplete constriction operations
Diversion for structural works	Dust, noise and vehicle	Structural diversions will be

POLLUTION SOURCE AREAS THAT WILL HAVE TO BE MONITORED	LIKELY SOURCE OF POLLUTION	REMARKS
	Pollution	minimum due to the difficulty to select alternative routes.
Asphalt and hot mix plants	Bituminous fumes, dust, heat and vehicle emissions	Usually located close to the construction corridor.
WMM Plant	Dust and vehicle emissions	
Quarry sites	Dust emissions from explosives, and vehicles	Sites often far away from the construction area
Borrow areas	Primarily dust with vehicle emissions.	Sites often far away from the construction area
Workshops	Mainly POL fumes & dust	Occasionally Contractor resort to a number of workshops.

7.4.2 IMPACTS DURING OPERATIONAL PHASE

The air quality impacts will be reduced considerably as improved road conditions and resultant smooth trafiic flow would be a marked improvement in the traffic emissions even though there could be a definite increase in the traffic. The various road improvement measures in fact ease flow of traffic with a constant cruising period. In addition to this, there will be a better parking space, better safety measures and a better road surface. The base line conditions will be established and this will help to verify the air quality improvement.

Traffic along the Link no. 68 and 69 is expected to increase due to the shorter and safer route when compared to the NH 66 (earlier NH 17) running almost parallel but further towards landward side of the project roads. With improved vehicle performance on a better, and wider, road surface, the air pollution should be reduced.

The doubling of the railway network has alredy diverted a portion of the long distance bus travellers including tourists (E.g. Mumbai – Mangalore - Kozhikode route) along railway route.

The vehicular emissions have damaging effects on both human health and ecology. There is a wide range of adverse health/environmental effects of the pollutants released from vehicles. The effects may be direct as well as indirect covering right from reduced visibility to cancers and death in some cases of acute exposure of pollutants specially carbon monoxide. These pollutants are believed to directly affect the respiratory and cardiovascular systems. In particular, high levels of sulphur dioxide and Suspended Particulate Matter are associated with increased mortality, morbidity and impaired pulmonary function.

After improvement of the existing road, the traffic is expected to move smoothly at higher designed speed which will assure lower emissions of gaseous pollutants. The rate of emissions of various types of vehicles is presented in **Table 7.6**. However, the extent of these impacts, at any given time will depend upon the rate of vehicular emission within a given stretch of the road; and the prevailing meteorological conditions. The impacts will have strong temporal dependence as both of these factors vary with time. The temporal dependence would have diurnal, seasonal as well as long-term components.

TABLE 7.6. RATE OF EMISSIONS OF VARIOUS TYPES OF VEHICLES

EMISSIONS	EMISSION FACTORS IN GM/KM/VEHICLE
1. For Diesel Vehicles	
	Speed (km/hr)

	30	40	50	60	70	80
CO	12.53	9.40	7.52	6.27	5.37	4.70
NO_X	22.28	16.71	13.37	11.14	9.55	8.36
2. For Petrol Vehicles						
	Vehicles					
	Car	2 Wheeler	3 Wheeler			
CO	2.72	2.0	4.0			
NO_X	0.58	0.5	0.5			

Source: Indian Institute of Petroleum

The trends in air quality situation as shown in Box 7.1 is highly positive. There are significant changes anticipated in current emission characteristics due to fuel combustion (sulphur content of diesel, fuel, lead, etc.); levels of engine maintenance, average vehicle age, improved vehicles etc. Such changes as might occur would be likely to have a beneficial impact. Grade changes within the project corridor are eased and would reduce adverse impacts due to vehicular emissions.

Box 7.1. Kerala Specific Air Quality and Trends in Roads and Vehicles in India

The effect of lush ever green vegetation with its inherent biodiversity is a very important positive factor for clean air as experienced in Kerala. The presence of lush green vegetation as observed in Kerala is actually the mitigation measures proposed for air quality degradation by environmentalists in the form of green belt, avenue planting etc in all developmental projects. In Kerala, the presence of lush evergreen vegetation towards the landward side if considered on a regional basis will reduce/nullify any adverse impacts to a large extent.

The high precipitation and the 600 km long coastal belt in Kerala are another two positive factors in controlling the air quality. The rainfall in Kerala is three times (120 - 130 rainay days) that of the national average. This will reduce adverse impacts to a large extent especially in the case of Suspended Particulate Matter (SPM) and Respirable Particulate Matter-PM10 (RPM) levels. On the other side, the recent trend of high quality fuels (like Pb free) is also a promising trend to keep good air quality in the future.

The improved vehicle performance due to improved vehicles will further reduce the over all air quality impacts. The improved cars with less pollution labelled as Euro I, Euro II and India 2001 etc is now in the market. In the year 2005 Bharat stage-III emission norms have been implemented in 11 megacities for all the new vehicles except 2 & 3 wheelers while Bharat stage-II norms have been implemented all over the country. For issues related to the implementation of emission regulations the MoRT&H is advised by a separate committee the Standing Committee on Implementation of Emission Legislation. The MoRT&H has formed this committee to discuss future emission norms, related test procedures and the implementation strategy.

For containing vehicular pollution, the Government has taken important initiatives in recent years. The Union Government and the Provincial Governments in India have been emphasizing the need for planning and developing strategies to implement mitigation measures to maintain the urban air quality and make the cities cleaner and greener for achieving better air quality and good health for its citizens. Over the past decade or so, the government has bought in statutes aimed at regulating and monitoring industrial and vehicular pollution across the country.

7.5 IMPACT ON NOISE QUALITY

The project specific impact mitigation plan in the EMP will address the link-specific noise mitigation. The ambient noise levels are generally high and the widening of the roads are not a very significant level so as to reduce the noise impacts. Potential noise impacts can be identified in two phases: the construction and operational phases are as follows.

7.5.1 IMPACT DURING CONSTRUCTION

During the construction phase of the roads, the major sources of noise pollution are vehicles transporting the construction material to the construction yard and the noise generating activities at the yard itself. Mixing, casting and material movement are primary noise generating activities in the yard and will be uniformly distributed over the entire construction period. Construction activities are expected to produce noise levels in the range of 80 - 95 dB (A).

Moroever, the construction equipment will have high noise levels, which can affect the personnel operating the machines. Use of proper Personal Protective Equipment (PPE) such as ear muffs will mitigate any adverse impact of the noise generated by such equipment.

The noise levels in the working environment are compared with the standards prescribed by Occupational Safety and Health Administration (OSHA-USA) which in-turn are being enforced by Government of India through model rules framed under the Factories Act. The acceptable limit for each shift being of 8-hour duration; the equivalent noise level exposure during the shift is 90 dB (A). Hence, noise generated due to various activities in the construction camps may affect workers, if equivalent 8-hour exposure is more than the safety limit. ACGIH (American Conference of Government Industrial Hygienists) proposed an 8 hour Leq limit of 85 dB (A). Exposure to impulses or impact noise should not exceed 140 dB (A) (Peak acoustic pressure). Exposure to 10,000 impulses of 120 dB (A) is permissible per day.

The noise likely to be generated during excavation, loading and transportation of material will be in the range of 90 to 105 dB (A) and this will occur only when all the equipment operate together and simultaneously. This is however, is a remote possibility. The workers in general are likely to be exposed to an equivalent noise level of 80 to 90 dB (A) in an 8-hour shift, for which all statutory precautions should be taken into consideration.

Due to various construction activities, there will be temporary noise impact in the immediate vicinity of the project corridor. The construction activities will include the excavation for foundations and grading of the site and the construction of structures for the facilities. The loading and unloading of construction materials, crushing plants, asphalt production plants, movement of heavy vehicles, transportation etc produce higher noise levels during the constructional stage.

Constructional noise impacts are a temporary phenomenon. General conclusions can be based on the types of construction work anticipated, the likely equipment required and their associated range of noise levels. The construction activities will include scarifying the existing road, shaping the site and constructing the structures and facilities. **Table 7.7** is the typical noise levels associated with highway construction, and **TABLE 7.8** is the typical noise levels of principal construction equipment, provide representative construction noise levels associated with some activities.

TABLE 7.7. TYPICAL NOISE LEVELS ASSOCIATED WITH HIGHWAY CONSTRUCTION

ACTIVITY	NOISE LEVELS, dB(A)
Grading & Clearing	84
Excavation	89
Foundations	88
Erection	79
Finishing	84

Notes: Measured as L_{eq} assuming 70 dBA Ambient Noise Level.

The presence of sensitive noise receptors including schools, hospitals etc. are a concern during construction stage. The construction noise is generally intermittent and depends on the type of operation, location and function of the equipment and the equipment usage cycle, it attenuates quickly with distance.

Potential construction related noise levels of 85-90 dBA at 50 feet (15 metres) from the source would be reduced to less than 62 dBA 2,000 feet (610 metres) from the source. Excavation noise levels, for example, assuming bulldozer, loader and dump truck activity only, would yield a L_{eq} of approximately 85 dBA at 50 feet. These noise levels would decrease by about three or four dBA with every doubling of distance and would be reduced to approximately 67 dBA at 800 feet (244 metres).

TABLE 7.8. TYPICAL NOISE LEVELS OF PRINCIPAL CONSTRUCTION EQUIPMENT (NOISE LEVEL IN dB(A) AT 50 FEET)

Clearing		**Structure Construction**	
	Bulldozer 80		Crane 75-77
	Front end loader 72-84		Welding generator 71-82
	Jack hammer 81-98		Concrete mixer 74-88
	Crane with ball 75-87		Concrete pump 81-84
Excavation & Earth Moving			Concrete vibrator 76
	Bulldozer 80		Air compressor 74-87
	Front end loader 72-84		Pneumatic tools 81-98
	Dump truck 83-94		Bulldozer 80
	Jack hammer 81-98		Cement and dump trucks 83-94
	Scraper 80-93		Front end loader 72-84
Grading and compacting			Dump truck 83-94
	Grader 80-93		Paver 86-88
	Roller 73-75	**Landscaping and Clean-Up**	
Paving			Bulldozer 80
	Paver 86-88		Backhoe 72-93
	Truck 83-94		Truck 83-94
	Tamper 74-77		Front end loader 72-84
			Dump truck 83-94
			Paver 86-88
			Dump truck 83-94

Source: U.S. Environmental Protection Agency, *Noise From Construction Equipment and Operations, Building Equipment and Home Appliances*, NJID, and 300.1, December 31, 1971.

7.5.2 OPERATIONAL IMPACTS ON NOISE QUALITY

As the road and traffic already exists, there won't be any significant increase in noise impacts, on the contrary the improvement of the road and the mitigation measures will reduce the noise impacts. The project roads (link 68 and 69) were earlier part of the national highway network. A qualitative improvement of the roads could attract significant traffic from the NH 66 (formerly NH 17) because of the shorter distance along the project road. It is also likely that the project road will qualify to rollback to its earlier status of National Highways. However, uninterrupted movement of heavy and light vehicles at high speeds may cause increase in ambient noise levels on the project road. It may have negative environmental impacts on the sensitive religious receptors such as temples and mosques close to the project road. Noise barriers have been recommended for all the sensitive receptors at identified locations.

7.6 IMPACTS TO FLORA AND FAUNA

7.6.1 COASTAL ECOLOGY AND MANGROVE ECOSYSTEMS

Most of the CRZ regions are ecologicaly fragile and vulnarable. (box 7.2 and Mangrove Afforestation Plan, **Annexure 3.62** in EMP)**.** As the road and traffic already exists in these roads, the impacts will confine to the available corridors and the newly acquired lands for widening and curve improvement.

BOX 7.2. Private sector coastal ecosystems
Several existing patches of healthy mangroves in Kerala need to be brought under an appropriate management regime to protect them from further decline. The disputes over ownership of the land and access to the natural resources (e.g. fisheries) should be immediately looked into with the consent and participation of local resource users. Existing policies like Ecologically Fragile Lands Act [2007] can be further bolstered and implemented in other states to improve the conservation of mangroves on the ground. Finally, there needs to be greater interaction between policy makers, local users of mangroves, mangrove biologists and representatives of NGOs. The future of mangroves does not rely on a single stakeholder group alone and neither will a single community be affected if mangroves decline and disappear. It is thereby pertinent at this juncture to seek greater collaboration amongst stakeholder groups to help conserve mangroves better.

7.6.2 IMPACT DURING CONSTRUCTION

Cutting of avenue trees are envisaged along the existing/proposed RoW of both sides of the project roads. The total number of trees to be felled for the project road is given in **Annexure 3.55** of Part II EMP Report, Vol. I, II and III for link no. 69, 68 and 74 respectively. Tree inventory was carried out along the existing road and along the proposed realignments. The project roads are not passing through / abutting forest areas and there is no need of forest land to be diverted for the proposed project. No Impacts are anticipated on wildlife during construction phase due to activities such as cutting of trees, lighting at construction site during night time, cutting of rock masses, noise generated due to construction machineries and regular movement construction vehicles. In the absence of proper accident management mechanisms, accidents of vehicles carrying hazardous chemicals during construction and operation phases will be hazardous to flora and fauna of the region. Aquatic flora and fauna of the streams and rivers present along the project roads may get affected due to accidents of vehicles carrying hazardous material.

The project road improvement work is not expected to create large-scale adverse impact on the coastal ecosystems especially the mangrove areas as the proposed improvements have been strictly followed along the existing RoW so as to avoid impacts on mangrove areas. All efforts have been paid to protect the existing trees in the ROW.

The trees within the private properties are protected by individuals by solid boundary walls, fencing etc. Construction activities will impact upon vegetation adjacent to the existing highway. Details with regards to public trees along the project road are provided in **Annexure 5.54,** tree planting and landscaping, in Part-II EMP Report, Volume – I, II and III for the project links 69, 68 and 74.

The project roads improvement work is not expected to result in any adverse impact on the coastal ecosystems especially the mangrove areas. On the other hand the planned environmental enhancement measures of this project will positively benefit the coastal ecolosystems particularly the mangroves. Some specific issues along the project roads are discussed below:

Mangroves in Link 68: As mentioned erlier, the end chainages of link no. 68 is having laxurient mangrove vegetation. The details are given in section 5.6.1 of this report. Enough management provisions have been provided to ensure the protection of this mangroves. The Pappinisseri Eco-Tourism Society, has developed a mangrove theme park at Pappinisseri, close to the end of Pilathara – Pappinisseri road and was closed by KCZMA.

Bekal in Link 69: The most sensitive area (CRZ-1) along the link no 69 project road lies at chainage 14.100 km. This is a no development zone, where no activities are permitted. The Bekal Fort is not abutting but located 200m away from the edge of the project road. The adjoining area will positively benefit from the good road for tourists to reach the location thus benefiting the local community economically. Both north and south of Bekal, the project road passes through CRZ-III areas. In all CRZ-III area (4.5 km) the road widening will be mostly within the Right of Way. The fort, which stands on a 35-acre headland that runs in to the Arabian Sea, is the largest and best-preserved fort in the State.

Thalassery in Link 74: At the initial stretch of link 74, a new 30m-long bridge will be constructed at Eranholi, where a small growth of mangrove vegetation is present. This area is classified as CRZ-II area, which is part of the Thalassery urban area.

Other than the mangrove vegetation there are no threatened or endangered plant species or habitats or species known to be within the ROW of the project roads and also across the seven-kilometre COI (seven kilometre, on either side) (Part II EMP **Annexure 3.56**). Plant species within the ROW are very common native species. The trees within the private properties are protected by the individuals by solid boundary walls, fencing etc. Construction activities will impact upon vegetation adjacent to the existing highway.

Impact to Private trees. Throughout the project roads there are many trees in private ownership. Those trees, which are required to be removed for the purpose of this project, will be the subject of compensation and likely replanting at the rate of three trees planted against every tree removed. The projects 'tree planting strategy' encourages the people immediately adjacent to the road to plant high canopy trees. (Part II EMP **Annexure 3.56** - Landscaping, Tree Planting & Environmental Enhancement Plan). The private trees will be compensated as per the Resettlement Action Plan prepared for the project.

During operational stage, the overall aesthetics of the area shall improve with landscaping and avenue plantation in the project stretch. Roadside tree plantation shall be restored and maintained as per the compensatory plantation plan. No impacts are anticipated on terrestrial ecosystem except spillage of hazardous chemicals due to road accidents.

7.6.3 SOCIAL FORESTRY

7.6.4 DURING PRE-CONSTRUCTION STAGE

The project roads improvements will require the removal of some trees whose details are provided in chapter 5 section 5.6 in this report. Among this nearly 50 percent are medium-sized trees. As mentioned earlier, in spite of its earlier status of NH, there is no continuous tree plantation along the road corridors. A road safety audit has been carried out for all Phase I and Phase II roads. Unfortunately for safety reasons some trees along the ROW which are dangerous to traffic at some locations will have to be removed.

7.6.5 DURING CONSTRUCTION STAGE

During construction stage, all efforts shall be taken to avoid any impact on social foretry by the construction workers. The labour camp shall be provided with LPG in order to avoid cutting of trees for fuel purpose.

7.6.6 HUMAN HEALTH AND SAFETY

Review of KSTP Phase I revealed that the construction camps are rarely well managed by the contractors. The labour camps are very important with regard to environmental management as the impact due to the construction workers camp could be of higher magnitude. The type of adverse impacts could be any one or more of the following.

- Unauthorized tree felling to get fuel-wood even when alternative fuel is made available
- Pollution and other adverse impact to coastal ecosystems including mangrove vegetation
- Poaching of edible animals and birds of the locality in spite of prohibition
- Poor sanitation arrangement and improper methods used for disposal of solid wastes and effluent
- Indigenous people getting invaded by imported construction labour-force, due to lack of discipline
- Transmission of communicable diseases to the local people by the construction workers due to inappropriate health monitoring facilities
- Creating hazardous traffic flow at construction site due to lack of concern about the local needs and provision for pedestrians

7.6.7 ROAD SAFETY, TRAFFIC MANAGEMENT AND ACCIDENT MANAGEMENT

Road safety being very important in Kerala with third highest accident prone State in India, a number of activities have been taken up in the project to benefit not only the KSTP but the entire State. The road safety concerns along the project road during construction and operational phases are separately provided.

7.6.8 DURING CONSTRUCTION

The work sites along the project roads are usually dangerous with large scale excavated land, debris, heavy machineries, cut trees (waiting for transportation). The Contractors usually does not bother the 'off' work time' such as the nighttime and holidays. Many accidents at work sites are reported during night often happen due to the absence of well-defined signages. Mitigation measures are described in the relevant sections. There will be traffic management problems unless proper diversion or alternate routes are provided. Often the contractors open both sides of the road creating very dangerous situations.

Box 7.3. Summary of the KSTP Road Safety Audit Report

This Road Safety Audit was carried out at the request of the Government of Kerala and with the support of the World Bank and the Design Consultants. There is no Road Safety Audit Manual for India or Kerala but Road Safety Audit is described in the Manual for Safety. In Road Design, published by the Ministry of Surface Transport. The Road Safety Audit Report was specifically aimed at improving the sixteen sections of highway in the Phase I and Phase II of the Kerala State Transport Project. The road safety audit has brought out clearly the dangerous road safety culture of Kerala. The recommendations include change in the design drawings especially at Junctions. The audit once again brought out the dangerous situation of pedestrians in Kerala. This was also brought out by environmental, social and engineering studies. There are also recommendations to improve lining and signing provision for pedestrians, parking areas, need for traffic calming, crash barriers, speed barriers,

improvement of oxbow lands etc. besides the inbuilt provision of bus bays, footpaths etc in the design drawings. A road safety action plan was also prepared as a part of the road safety audit.

7.6.9 DURING OPERATIONAL STAGE

During operational stage, there won't be any such dangerous road safety situations, as the project will provide necessary signages, information boards etc in all recommended and needed locations. More over the widened road will have many facilities such as parking areas that will positively contribute to road safety.

On a long term basis the project may require more parking areas and road safety measures as the daily addition of vehicles on the vehicle population on the road shows a rapidly increasing trend.

7.7 IMPACT TO CULTURAL PROPERTIES

There are a number of impacted cultural properties as provided in the Part II EMP. Except in some cases only compound walls or hundi will be affected. No archaeological structures are affected due to the planned improvement of the corridor but two archaeological structures close to the project road link no. 69, i.e. Bakel Fort and Chandragiri fort. The project has prepared a cultural property rehabilitation plan to avoid or minimise any adverse impacts due to the KSTP project. The mitigation plans are also provided in the respective sections. The project will reduce the traffic congestion with the widening and improvement measures during the Sabarimala Pilgrim season.

7.7.1 IMPACT DURING CONSTRUCTION

The project road improvement according to the planned design will necessitate the demolition of part of some compound walls of the temples. Similarly few temples, mosques and shrines will be impacted. Most of these impacts are very minor scale. The environmental team discussed the various aspects, with the temple representatives regarding the proposed demolition of the wall. The mitigation measures are discussed in the relevant chapter.

The project road improvement according to the planned design will necessitate the demolition of part of compound wall of the temple at Trikkamnad in link 69. Similarly many temples, mosques and shrines will be impacted. The mitigation measures are discussed in the relevant Chapter. The weeklong festival at Trikkannad temple will also be adversely affected. Suitable mitigation measures are discussed in the mitigation Chapter.

The **PLATE 7.12 & 7.13** shows a cultural property at chainage 26.1 of link no. 69 that will be impacted. If central widening is followed, both the main temple and the shrine will be impacted. The shrine is located on a solid raised platform with few trees as shown in the Plate. The platform is made of laterite bricks. Both the main temple and the adjacent shrine will not be impacted with appropriate mitigation measures as described in the mitigation and avoidance section 9.8.1.

Plate 7.12. Shrine at Chainage 26.1 of link no 69

Plate 7.13. Temple at Chainage 26.1 of link no 69

7.7.2 IMPACT DURING OPERATION

The Bekel region and Trikkammanad temple region will positively benefit from the road improvement due to the availability of a better access road and also due to the environmental enhancement proposals included in the project. Since the area at Bekal is classified as CRZ-1 a 'no development zone', the project has included adequate attention as provided in the relevant Chapter on mitigation.

The environmental enhancement proposals (Chapter 10) like better organised parking areas, bus bays and other information boards to tourists etc, will increase the tourism prospects of the region including the cultural properties and associated festivals. The overall road safety precautionary measures inherent in the project design will also positively benefit the region.

7.8 SOCIO-ECONOMIC IMPACTS

7.8.1 IMPACTS ON PRESENT STATUS OF LIVELIHOOD

POSITIVE IMPACTS

The accessibility and connectivity increases as it is the major connectivity between the various towns in the project corridoors. Thus the time of travel between these places shall reduce significantly. With advent of the two-lane highway, the vehicle operating and maintenance cost is expected to go down substantially. These benefits can be attributable to smooth and even roads and low congestion. Savings in fuel consumption can be attributed to low congestion and relatively less travel time due to proposed improvements. The proposed road alignment shall also include general amenities like bus bays, pedestrian passes, road sign boards, street lights, medical aid etc and thus overall facilities to the road users shall improve. The proposed project is expected to improve the quality of life of the people residing in the project zone in terms of their economic, social and health status. Land value in the nearby areas of the proposed alignment will increase substantially. The overall aesthetics of the area shall improve with proposed landscaping and avenue plantation in the project stretch. Improvement of local tourism is envisaged due to better road infrastructure. Effective and enhanced connectivity can be expected throgh the project roads from and between various parts of North Kerala. During the construction stage of the project, both skilled and unskilled labours will be employed from the local villages to enhance the livelihood and economic standard of the people.

NEGATIVE IMPACTS

Improvement of proposed project road requires acquisition of productive agriculture land, demolition of commercial and residential building, felling of trees required for up-gradation of road and shifting of public facilitating utilities such as electric poles, electric transformers, telephone lines, water supply lines, open and under ground sewage lines etc. Some of the community resources such as religious structures, hospitals, educational institutes, market places, panchayath meeting places and cattle grazing places will be affected.

7.8.2 IMPACTS ON LAND USE CHARACTERISTICS

IMPACT DURING PRE AND CONSTRUCTION STAGES

During pre-construction stage, the existing land use characteristics of the acquired land will be changed to transportation land including parking areas, bus bays, rest areas etc. Up-gradation of project road requires acquisition agricultural land, commercial/ residential land and forest land, wherever the existing RoW is not accommodating design scheme. This is part of the project objectives. The roadside trees and bushes will also be cleared for the construction of the road. Other than this, there will not be any land use impact during construction stage. The impact on land use characteristics also include impact to ancillary sites such as borrow areas, quarry areas, labour camps, contractors camps etc. In all newly opened Quarries, borrow area, labour camps etc. there will be land use changes on a temporary basis. Loss of productive agricultural land may result from the establishment of construction camps, batch mix plant and hot mix plant, quarry and barrow area. This results in minor change in agricultural yield due to project activities. Temporary change in land use at bridges and culvert locations shall be encountered to facilitate the existing traffic by alternate routes. Land selected for barrow and quarry area will change the land use pattern permanently.

TABLE 7.9. DISTRIBUTION OF KSTP II AFFECTED POPULATION

LINK NO	TOTAL PROJECT AFFECTED PERSONS (PAP)	PROJECT AFFECTED FAMILIES (PAF)	PROJECT DISPLACED FAMILIES (PDF)	TOTAL LAND REQUIRED (Ha)
68	8170	1634	357	6.23
69	4685	937	422	2.98
74	2,675	4966	727	25.14
Source: RAP, KSTP				

LAND USE IMPACTS DURING OPERATIONAL STAGE

An induced impact is the ribbon developments through out the project road. Encroachment of RoW will invite parking and road safety issues. During operational stage, there will be induced impacts on the land use, immediately bordering the available corridor. The rate of ribbon developments along the sides of the project corridors is expected to be slow but continuous. Between the railway level crossing and the Puthiyangady river, on both sides (Chainage~0700 in Link no 68) the mangrove vegetation is being removed slowly but gradually as a part of ribbon developments. An increased traffic could lead to a higher value for the land and there will be induced ribbon developments along the project corridors. These developments will be mostly close to the urban and semi urban pockets and also at the tourist locations. Better access can lead to conversion of agricultural land to commercial and residential purposes close to project roads, especially in rural and urban areas. This leads to decrease in agriculture production and loss of productive lands. Aesthetics of the PIA regions shall change permanently.

7.8.3 IMPACT ON AGRICULTURE IN THE AREA

IMPACTS DURING CONSTRUCTION

Some of agricultural land will be acquired and converted to transportation land in these three project corridors. Except the impact to ancillary construction sites such as borrow area, quarry areas etc, no adverse impacts are expected to the agricultural activities in the PIA region of the project corridosr. The positive impacts include better communication and transport facilities due to the project.

Induced impacts include conversion of paddy fields by people adjacent to the road for residential and commercial purposes.

IMPACTS DURING OPERATIONAL STAGE

The envisaged land use changes will adversely impact the area of agricultural use. The agricultural areas immediately adjacent to the project road may be converted to business establishments as well as new dwelling units. Other than this, there will not be any adverse impacts on the agricultural activities in the area.

7.8.4 IMPACT ON INDUSTRIAL SECTOR

The industrial sectors will positively benefit due to the improved roads in the region. Other than this, there will not be any impact on the industrial sector.

Easy connectivity to the waterways is very important for industrial development. Once the waterways of Kerala is fully developed these connectivity will provide economic boosts due to a growth in tourism and industrial sector. The west coast canal will provide cheapest or economic mode of cargo transport.

7.8.5 IMPACT ON TOURISM ACTIVITIES

The impacts are provided separately for constructional and operational phases. Induced impact on tourism is a possibility but cannot be visualised at this stage.

IMPACTS DURING CONSTRUCTION

During construction, there will be slight difficulties for the road users. Although during construction period a significant decrease in the number of tourists is not anticipated, there will be definite difficulties to move along the project corridors. The mitigation measures are proposed and provided in the respective sections.

IMPACTS DURING OPERATIONAL STAGE

Operational stage impacts are generally positive and will improve the prospects of tourism in the region. Overall development in the sector will improve the local economic situation thus helping the locals to obtain better employment opportunities. A significant traffic from the NH 66 through the Thaliparamba region could be shifted to link 68 due to a saving of distance.

7.8.6 IMPACT ON FISHERIES SECTOR IN THE REGION

The fisheries sector will also positively benefit due to the construction and operation stages of the project road. The benefit could be an increase in the transportation facilities.

7.8.7 SOLID WASTE COLLECTION AND DISPOSAL AT CONSTRUCTION CAMP

IMPACTS DURING CONSTRUCTION

Various construction activities such as demolition of structures, cutting of earth and rock mass for widening in some sections of project road, scarification of existing pavement will results to generation of huge quantity of construction waste. Further, substantial amount of domestic waste will also generate from workers camps. Improper disposal of these wastes may obstruct water flow resulting in reduction in water carrying capacity of the water body. Unscientific disposal of domestic waste may cause filthy smell resulting in health problems in workers and local residents. Improper collection waste from construction site may lead to traffic congestion and inconvenience for commuters. Enough management provisions are included in EMP to address these issues.

IMPACTS DURING OPERATIONAL STAGE

No impact is envisaged during operation phase of the project and hence no mitigation proposed.

CHAPTER 8. ANALYSIS OF ALTERNATIVES

8.1 INTEGRATION OF ENVIRONMENTAL CONSIDERATIONS IN THE ALTERNATIVES

The social and environmental considerations were an integral part of the design and environmental assessment process. In the case of link no 68, there are two sections, which can be treated different in this Chapter for a detailed analysis.

Section 1 from Puthiyangady river up to Pilathara (at the NH junction) is aligned away from the coastal belt towards the mid land in a north south direction.

Section 2 The project road from Pappinissery to Madai up to Pazhayangadi river (NW-SE) is exclusively located in the coastal belt and aligned parallel to the coast.

The section –1 is a typical mid land region with a small valley (paddy field area) and hilly regions. The section starts from the National highway on the extreme north.

The section-2 passes through the coastal CRZ areas, a sensitive zone according to the GOI laws where dense mangrove vegetation and coastal swamps exist. These are the comparatively best-preserved coastal ecosystems when compared to the other coastal sections of the Kerala. All streams and river crossing the road within the PIA in this link are CRZ related and hence require impact mitigation measures. The second section is densely populated with a gradual increase in elevation till it touches the Puthiyangady river.

In all Phase II roads including the Kasaragod-Kanhangad project road, the material along the cut and fill sections can be balanced. This is due to the fact that the proposed widening is very small throughout the corridor. The total land requirement for the thre roads is 34.53ha ha only including for the realignments. The retaining walls/toe walls are provided in all required locations as given in the Environmental Management Plans.

The broad consideration, which ends with the selection of these links, includes the physiographic characteristics of the Kerala. The first section is located in lowlands, which is a sociologically and CRZ sensitive area. The second section is in midlands, which is a sociologically sensitive area.

The retaining walls will be provided in all required locations as given in the Environmental Management Plans. The cut soil material are included in the estimation of soil together with material from borrow areas. The analysis of alternatives has been prepared in accordance with the requirements of the World Bank and GOI guidelines.

8.2 "WITH" AND "WITHOUT" SCENARIOS (NO ACTION REQUIRED)

In the case of the project roads under consideration, consideration of the 'No Action' and 'Action alternatives' have been examined as provided in the following subsections.

8.2.1 NO ACTION ALTERNATIVE

Because of some unknown reasons, the Pilathara-Pappinissery road was de-notified to State Highway. Along NH 66 (formerly NH 17) the one-way road distance from Pilathara to Pappinissery is 5 - 8 km more than the project road. The 'no action alternative' will prevail and this will continue even when a shorter, attractive, coastal road exists. The distance will add to the Mangalore-Kozhikode travellers and also tourists who want to move closer to coastal areas

unless some thing special exists in the interior part of the State. Link 69 project road was also de-notified with the new alignment being along the Cherkala semi urban area. One possible reason could be to avoid the difficult terrain through which the road passes. At present through NH 66 the road distance from Kasaragod to Kanhangad is 8 - 10 km more than the project road.

The 'no action alternative' will prevail and this will continue even when a shorter, attractive, coastal road exists. The economic development of the region will not take place. Link 74 road will have an impact to the local area development especially the education sector. As the road crosses all physiographic regions of the State, the road is a link road to all educational institutions in the Kannur district from interior areas. The local people in the area also depend on the neighbouring State for education and business activities.

Accidents and road safety will remain as an issue to be resolved. The other aspects that will not be improved include no improvements beyond limited routine maintenance and rehabilitation of roads without any taking of land or buildings, removal of trees or other disturbance to the environment. There would be no improvements to drainage systems beyond their restoration to existing levels of service, no removal of impediments to pedestrians or construction of facilities for pedestrians and other slow moving traffic. This would leave the highway in its current appalling state.

The over all improvement will allow a gradual shifting of traffic from the national highways to much better and safer and beautiful coastal Project road. The 'no action' option will not allow a change in the level of service along this alignment.

As described earlier in both (no action and action cases) cases, the fact that the project road was part of the National Highways predominates. The nature of the road is not sufficient to meet the development of the region. Traffic flow is impaired by conflicts between local, and through traffic, mixed with pedestrian movements and by continuous ribbon development and inadequate and/or inappropriate roadside facilities along the narrow corridors.

The unsafe conditions and the environmental consequences (air and noise pollution and degraded environmental conditions) will continue and worsen. The no improvement condition and in the long term be a serious impediment to the development of the economy and thus to the improvement of conditions for all sections of the population.

Coastal ecosystems. 'No action alternative' will not change the status of the coastal eco-systems. In the long run the sensitive coastal systems will continue to deteriorate in the same pace leading to large-scale destruction of mangroves in the region.

8.2.2 Action Alternative

Population and traffic growth will continue to occur and exacerbate in an already critical situation. The "with" scenario, has been determined to be economically viable and would meet the local communities aspirations to a large degree. It would, thereby, contribute to the development goals of the project regions and thus to the entire Kerala State, improve road safety conditions, enhance economic efficiency and growth potential of the area, and improve the well-being and livelihood of those within the potentially affected area of the project road.

Potential negative environmental impacts associated with the "with" scenario can be reduced through good engineering practice and, where warranted, appropriate mitigation and enhancement actions as specified herein.

A comparative statement of No Action Alternative and Action Alternative is shown in **TABLE 8.1.**

TABLE 8.1. A COMPARATIVE STATEMENT OF NO ACTION ALTERNATIVE AND ACTION ALTERNATIVE

NO ACTION ALTERNATIVE	ACTION ALTERNATIVE
Narrow corridor remains	Corridor will be widened and improved
Travel distance saving does not arise	Travel distance savings
Heavy vehicles will continue to operate along the National highways	There will be marked shift of traffic to the project links
No Coastal Zone Management Plan will be prepared	In spite of very limited impact to the coastal ecosystems, a project specific Mangrove Management plan will be prepared & implemented.
The mangroves and coastal ecosystems will continue to degrade	There will be protection for mangroves and mangrove plantation as per the environment enhancement Plan with international loan assistance
No awareness will be built in the local Groups and NGOs	There will be a number of awareness meetings to the local people & NGOs
Road safety and accidents will continue to be the same	There will be substantial improvements with regard to road safety and accidents
Tourism prospects remains dull	Tourism prospects will improve, which cannot be visualised at this stage.
There will not be any environmental enhancement to the region for tourism and recreation	There will be a number of measures for improving the environmental conditions that will help for tourism and recreation.

The analysis clearly shows that the 'no action' alternative is not a prudent course of action. This alternative "do nothing" is not acceptable and has already been rejected by the State Government as demonstrated by the implementation of the Kerala State Transport Project phase - II.

The Chapter 2 Project descriptions and the road safety aspects outlined in the baseline section emphasise that the **'No Action Alternative'** is not a sensible avenue under the present circumstances.

The overall improvement of the project road will improve the status of the project road and possibly lead to a re-notification as National Highways.

Coastal ecosystems. The action alternative will improve the status of the coastal eco-systems with the planting of additional mangroves (Refer Coastal Zone Management Plan attached in the phase II EMP). The mangroves planted as a part of the project mitigation and enhancement measure will be added to the State reserve. Proposed fencing will restrict the entry of people to the mangrove areas. In addition an awareness workshop at the local level will make the region the best-preserved mangrove ecosystem in Kerala. This will benefit students, teachers and researchers besides the tourist's and bird watchers and Ornithologists.

8.3 DESIGN DECISION CONSTRAINTS FOR VARIOUS ALTERNATIVES

Since the project roads selected under the project are of almost similar character throughout Kerala, it was necessary to take a viable decision on the extent of developments due to the Social implications including the high cost of land. The team of *Engineers, Economists, Sociologists* and *Environmentalists* of PMT and PWD found that widening to the IRC standard (30m) or any other standard would affect large-scale population. Therefore the issue was discussed at all levels for

an implementable option affecting least number of people and properties and should have minimum environmental impacts. These meetings were held at government, department and consultant's level and also with public participation at various stages involving experts from related fields individually and sometimes collectively. These deliberations were also held in the field on the project roads for easier understanding among the specialists involved for quicker decisions.

The following decision constraints were considered in particular.

- The legal right of way (ROW) could not be established.
- Severe limitations were found with respect to the available corridors width and the existing geometry.
- A rigid adherence to a particular design standard would necessitate substantial realignments, in a large number of locations, which are linked to substantial land acquisition, environmental impacts and social hardships to the population.
- The decision to widen on any one side was difficult except in the case of curve improvements. One side widening was generally selected on the grounds of least cost and inconvenience to the frontages.
- The present rate of accidents, road indiscipline, vehicle speeds, present road condition and road safety, particularly pedestrian safety was matters of serious concern and influenced every decision that was taken.

The widening of the pavement with the provision of footpaths in built-up areas as necessary would result in a seven-metre width pavement and 2.5 metre wide footpaths / shoulders. This standard could only be accommodated within a 12 metre physical Right-of-Way, with some narrowing if necessary, to avoid the costly acquisition of roadside property.

TABLE 8.2. WIDENING ALTERNATIVES CONSIDERED FOR THE PROJECT ROADS

ROAD LINK	30M COI	15M COI	12M COI	10M COI
LINK 69: KASARAGOD - KANHANGAD				
Number of affected PAPs	1614	965	563	114
Number of structures affected	603	441	311	29
Magnitude of land take (ha)	22.69	11.79	3.35	1.5
LINK 68: PILATHARA - PAPPINISSERI				
Number of affected PAPs	--	--	--	--
Number of structures affected	--	--	--	--
Magnitude of land take (ha)	--	--	--	--
LINK 74: THALASERRY - VALAVUPARA				
Number of affected PAPs	3052	2675	600	38
Number of structures affected	724	1190	142	12
Magnitude of land take (ha)	84.83	13.87	7.05	0.62

Source: Louis Berger Report 2004

The costs of land and accommodation works are very high and the designs need to avoid even small areas of land acquisition wherever possible.

8.4 ENGINEERING ALTERNATIVES CONSIDERED

The engineering alternatives considered were reasonable and potentially viable alternatives with regard to the project roads. In the case of eliminated or discarded alternatives the reason for their elimination and in those cases of detailed investigation alternatives have been documented.

The design and decision-making process was undertaken so that environmental, resettlement and rehabilitation issues prompted the early identification of appropriate actions. Such actions included, for example, shift in alignments/realignments based on an awareness of the locations of cultural resources and biological resources such as areas of roadside trees and the early identification of short realignments to reduce local impacts. Such adjustments were weighed against benefits derived from reductions in congestion in built-up areas andimprovement of road safety and were incorporated in the design process to ensure that the maximum practical avoidance of sensitive areas (e.g. shrines, hospitals, CRZ areas) and adverse impacts to the Project Affected Persons (PAPs), etc. The alternatives found to warrant documented consideration in the process are as follows.

8.4.1 ALIGNMENT AND WIDENING ALTERNATIVES

Some of the project roads have some sharp curves which affect the visibility of drivers. For example, the project road link no 68 has four sharp curves in section I Pilathara to Pazhayangadi (0-6.9km) . Except along the built-up areas, the width of the road is also comparatively higher perhaps due to its earlier status as National Highways.

Relatively minor shifts of the ROW to one side or the other (or both) in the same area and incorporating the existing ROW are significant in the context of the Kerala State Transport Project and such shifts have avoided adverse impacts in many instances.

Four types of widening alternatives have been devised by the erlier consultants. Three out of four of the alternatives have been employed in various segments along the ROW for Phase I and Phase II roads.The fourth alternative has been dropped in order to reduce the effective land take for road improvement. The four sets of alternative cross sections provide a "menu" from which the cross-section most appropriate to a particular circumstance can be and has been employed (e.g. for rural areas, for urban areas etc). The widening/ improvement of bridges proposed in the previous reports have been generally followed for preparing DPR in 2012 except in the case of bridges with poor structural condition. In such cases appropriate decisions to satisfy the requirement have been taken.

However, the original proposals were examined with a judicious methodology evolved by the consultant in proposing retention, reconstruction and strengthening etc. of the structures with due contingence to the economic aspect. Condition of the structure, IRC design standard requirement, as well as geometric feature played key roles in such a decision.

The widening and strengthening of the pavement will take place along its existing alignment with only minor changes in the position of the centre line horizontally and vertically. The newly improved road may not therefore conform strictly to the ideal design standard, but will represent a major improvement upon the service provided by the existing route. In urban areas improvements of the roadway slightly to either side of the centreline of the ROW, is dictated by circumstance and minimises environmental and social impacts.

8.4.2 BYPASS ALTERNATIVES CONSIDERED IN THE PROJECT

No bypass alternatives were considered under the project. None of the semi urban areas along the project route require a bypass to decongest the existing traffic scenarios.

8.4.3 REALIGNMENT ALTERNATIVES CONSIDERED IN THE PROJECT

Pilathara - Pappinissery (Link 68): A total of four realignment alternatives have been considered in section I under the project to avoid sharp curves. All realignments considered

have been finally included in the design drawings after thorough field verifications. The developments along the section I will have least consequences in the coastal eco systems.

Kasargod - Kanhangad (Link 69): A total of four realignment alternatives have been considered for link 69 also. All realignments considered have been finally included in the design drawings after thorough field verifications. These are considered for safety reasons in Kasaragod - Kanhangad link road.

Thalassery - Valavupara (link 74): A total of thirty one realignment alternatives have been considered for link 74. All realignments considered have been finally included in the design drawings after thorough field verifications. These realignments are considered for safety reasons in various sections.

8.4.4 ENGINEERING ALTERNATIVES CONSIDERED IN INITIAL DESIGNS 2004

To avoid major social impacts, the options are shifting the centre line to right side, left side or concentric widening (i.e. both sides). Opting to widen to either the right or left of the roadway facilitates the preservation of various environmental and social resources on the side avoided. The qualitative aspects of various resources to be avoided in each section were considered as a part of the analysis. Alternatives were analysed for all possible sections of the road based on the information and analysis supplied by the initial screening and feasibility analysis followed by field checks with the least adverse environmental and social consequences. Nevertheless some impact to boundary wall of cultural properties and buildings are inevitable with most appropriate mitigation measures.

ALTERNATIVE 1

Improve to a 7.0 m wide pavement with sealed shoulders. The adverse impact on the realigned / bypassed community resulting from Alternative 1 can be addressed by appropriate mitigation measures.

ALTERNATIVE 2

Alternative 2 is to improve to a 7.0 m main carriageway with two 1.5m wide auxiliary lanes and sealed shoulders.

The potential impacts on the physical and social features of the environment are judged to be higher in Alternative 2 combined with the fact that Alternative 2 indicates a higher EIRR and NPV and is thus rated more economically viable, as well as the preferred alternative from a capacity and safety perspective, has led to the selection of Alternative 2 for the higher trafficked roads.

The provision of kerbs and footpaths is attractive to pedestrians also the creation of bus lay-bys and parking areas wherever land areas permit, especially in village locations but cognisant of the detrimental effect of parking on visibility especially near pedestrian crossings and road junctions.

The absence of a design standard will not generally inhibit speeds below 50 km/hr as is demonstrated by the present road alignment. It must be remembered that with smooth machine-placed surfaces and even slightly improved alignments, drivers will tend to drive faster; this makes driver education and the imposition of speed limits even more important.

ALTERNATIVE 3

Alternative three is to improve to a dual two-lane carriageway of 10 m.

The early economic and traffic projections of two-lane roads will reach traffic capacity within 10 to 15 years on some of the project routes pointing to the need to consider dual two lane carriageways.

The separation of pedestrians from vehicles can be achieved by the provision of footpaths wherever needed. There is an almost similar dilemma in trying to separate the large number of two wheeled and slower moving vehicles from the faster larger vehicles on the roads as traffic volumes increase.

Drivers will need education in the use of these roads but the effective removal of slow moving vehicles increases the efficiency of the main traffic lanes. In effect it reduces the number of vehicles using them in such a way that within the project life no roads would require dual two-lane carriageways.

The very positive advantages of this option must still be offset against the need to widen most of the existing road corridors, which generally offer ROW of only 10 or 12 metres width, and many sections as little as nine metres width.

Where land purchase is required on the scale anticipated it must be substantiated by road lines designed to accept engineering standards and the adherence to these standards will incur the need for even greater land requirements dictated by the use of minimum curvature radii and minimum vertical and horizontal sight distances. The use of Option Three was subsequently dropped from further consideration.

8.4.5 JUNCTION ALTERNATIVES

Pilathara - Pappinissery (Link 68):

Three major junctions are present along the project stretch. All at grade junctions have been designed in accordance with IRC SP 41 by providing provisions for merging, diverging and crossings. Provisions for safe pedestrian crossing have been considered. Care has been taken to minimize the conflict and improve the safety and aesthetics. Junction improvement drawings are presented in Volume III Drawings (Drawing number PP-1D-40-001). The junctions previously designed were reviewed and brought to the minimum standards as per IRC. The major junctions are listed in Table 8.3. There are 38 minor junctions present along the project road and proposed to improve to minimum standards, details are given in Table 6.9. The pavement of intersecting roads is proposed to match with finished road level of the project road. 25 m of minor intersecting road and 50 to 100 m of major intersecting roads are considered to accommodate this. However this is subject to change as per actual site conditions.

TABLE 8.3. LIST OF MAJOR JUNCTIONS IN LINK NO. 68

SL NO	CHAINAGE (KM)	TYPE	CLASSIFICATION OF ROAD CROSSING	REMARKS
1	0+000	'Y'	NH	LHS to kannur
2	6+080	'+'	MDR	LHS to thaliparamba rhs to muttam
3	20+900	'T'	NH	LHS to thaliparamba rhs to kannur

Kasargod-Kanhangad (Link 69):

Four major junctions are present along the project stretch. All at grade junctions have been designed in accordance with IRC SP 41 by providing provisions for merging, diverging and crossings. Provisions for safe pedestrian crossing have been considered. Care has been taken to

minimize the conflict and improve the safety and aesthetics. Junction improvement drawings are presented in Volume III Drawings (Drawing number KK-1D-40-001). The junctions previously designed were reviewed and brought to the minimum standards as per IRC. Addition acquisition is required at these locations. The junctions are listed in Table 8.4. There are 126 numbers of minor junctions present along the project road and proposed to improve to minimum standards. The pavement of intersecting roads is proposed to match with finished road level of the project road. 25 m of minor intersecting road and 50 to 100 m of major intersecting roads are considered to accommodate this. However this is subject to change as per actual site conditions.

TABLE 8.4. LIST OF MAJOR JUNCTIONS IN LINK NO. 69

SL NO	CHAINAGE (KM)	NAME OF JUNCTION	CLASSIFICATION		REMARKS	PROPOSED IMPROVEMENTS
			LHS	RHS		
1	0+000	Kasargod	T		Major LHS Towards New bus stand RHS towads Railway station	At grade
2	4+780	Melparambu	T		Major RHS towards Chandragiri Fort	At grade
3	24+000	Kanhangad	+		Major LHS Towards Panathur,RHS Towards Railway station	At grade
4	27+732	Road End	Y		Major Ends at NH-17 junction	At grade

Thalaserry – Valavupara (Link 74): Seven major junctions are present along the project stretch. All at grade junctions have been designed in accordance with IRC SP 41 by providing provisions for merging, diverging and crossings. Provisions for safe pedestrian crossing have been considered. Care has been taken to minimize the conflict and improve the safety and aesthetics. Junction improvement drawings are presented in Volume III Drawings (Drawing number TV-1D-40-001). The junctions previously designed were reviewed and brought to the minimum standards as per IRC. The junctions are listed in Table 8.5. There are 7 numbers of Major junctions and 73 numbers of minor junctions present along the project road and proposed to improve to minimum standards. The pavement of intersecting roads is proposed to match with finished road level of the project road. 25 m of minor intersecting road and 50 to 100 m of major intersecting roads are considered to accommodate this. However this is subject to change as per actual site conditions.

TABLE 8.5. LIST OF MAJOR JUNCTIONS IN LINK NO. 74

SL NO.	CHAINAGE (KM)	NAME OF JUNCTION	CLASSIFICATION	REMARKS	PROPOSED IMPROVEMENTS
1	1+500	Town Hall	T	Towards RHS Thalaserry Town	At grade
2	11+850	Pookode	T	RHS SH 38 Towards Panoor	At grade
3	13+900	Koothuparambu	T	LHS SH Towards Kannur	At grade
4	15+600	Thokkilangadi	T	RHS towards Kottiyoor	At grade

5	27+100	Mattanur	T	LHS SH 38 Towards Kannur	At grade
6	41+700	Payancheri Junction	T	RHS towards Nedumpoyil	At grade
7	42+290	Iritty -Check post	T	LHS towards Irikkur (SH 36)	At grade

8.4.6 ENVIRONMENTAL ENHANCEMENT AND ROAD SAFETY ALTERNATIVES

The following environmental enhancement alternatives were considered in addition to the impact mitigation measures. These measures are required for landscaping, and to improve road safety measures. The project has taken into consideration the various road safety implications in the design. Having fully convinced the importance of road safety, the World Bank requested the State Government to carry out a road safety audit for the final Phase II designs. A road safety specialist carried out the Road Safety Audit during June 2001. This audit has considered the various road safety alternatives and measures carried out to arrive at the final design. The recommendations of Kerala Road Saftey Act 2007 have also been considered. The iRAP manual (International Road Assessment Programme) manual 2011 and iRAP Safer Roads investment Plans were also considered for the designs. Moreover, recently the road safety expert of World Bank made some suggestions in July 2012. Most of the road safety measures suggested by them have been incorporated in the final designs especially those of important road junctions.

Bus stops/Bus bays. The bus lay-bys were integrated with the design when the environmental and social investigations underlined the need for the same. This is to improve road safety and to reduce accidents.

Parking areas. The provision for parking areas within the limited width of widening is also recommended from the environmental investigations. This is to improve road safety and to reduce accidents. Due to the sufficient availability of land at many sections there are several opportunities for environmental enhancement. Majority of the trees could be saved. All bigger trees such as Banyan trees at urban sections could be saved and the appearance of tree can be further improved by providing platforms (Eg. EMP BOQ Bill No. 11, Sl. No. 11-13 for Link 69). This allows an opportunity and space for people to arrange discussion and meetings. In tourist areas, besides parking areas, the space will allow for shrub and tree planting which will improve the value of the project corridor.

Cultural property rehabilitation plan. In addition to compensation and rehabilitation of the affected/impacted cultural properties there will be enhancement for other cultural properties close to the ROW.

Rest areas. The redundant portion of the realigned sections can be suitably developed for tree planting, restaurant and resting facilities in future.

8.5 ECONOMIC ALTERNATIVES

Following alternatives are considered by the consultants for the economic analysis.

Without Project Situation: The first is a 'without project' (do minimum) where the existing intermediate lane project road is considered as such in its present condition and without improvement. In this case the future traffic volume is assumed to continue to flow along the existing road only. In the HDM model analysis, this 'do minimum' alternative will form the first / base strategy against which all other strategies will be compared.

With Project Situation: This corresponds to the reconstruction of the existing road sections of the project road to two lane carriageway (7m) with hard & soft shoulders and appropriate other improvement works like alignment correction, pavement reconstruction, widening / reconstruction of CD structures.

The later comprises of the strategy of the 'with project' situation in the HDM model. In order to arrive at the net benefits associated with this strategy, these are compared to the 'do minimum' / 'without project' alternative separately. By comparing the above alternatives, the net agency costs and net user costs and finally net project benefits associated with the project during its analysis period are calculated for the proposed improvement options separately, in order to arrive at their economic internal rate of return (EIRR) and economic net present value (ENPV). More details on economic alternatives and cost analysis are provided in chapter 8 of Detailed Project Report.

CHAPTER 9. IMPACT MITIGATION AND AVOIDANCE

Apart from impact mitigation, many impacts have been avoided with suitable changes in the design or by small design compromises without jeopardizing the road safety concern. Mitigation measures have been planned for all identified impacts. Where the effects of the mitigation measures are not adequate or total, the project strategy was to reduce the effect of impacts to an acceptable level. In order to further improve the situation a number of environmental enhancement measures are devised as provided in the **Chapter 10**.

The mitigation measures are devised and aimed to the extent possible to reduce and mitigate the effect of environmental impacts due to the construction and operation of the project. The environmental mitigation costs for different mitigation measures are provided in Part II Environmental Management Plan. The *Bill No 11 of BOQ* closely links to the Environmental Management Plans of the project roads. The bill no 2 and 3 also include actions that will allow other detailed environmental mitigation works such as topsoil conservation and site clearance. The three bills include all the environmental management and mitigation costs of the project corridor for actual implementation.

9.1 METEOROLOGY AND CLIMATE

Under the heading natural environment; temperature, rainfall and humidity are included. The effect of clearing of vegetation, cutting of a few trees etc will not itself contribute to generate any impact of noticeable nature and does not warrant any special mitigation measures.

There are very few trees along the project corridor, which will be cut and removed due to safety reasons. There will be removal of trees from the private properties also. Although the private trees will be compensated, the project will plant trees as a compensation package at the rate of three per tree removed. However unlike other KSTP project corridors the replanting of trees will be carried out along the project corridors. Therefore other than the envisaged replanting of trees, no other mitigation measures are required.

9.2 PHYSICAL SETTING OF THE REGION

9.2.1 PHYSIOGRAPHY

The physiographic changes are due to the change in embankment height, new alignments such as realignments and due to the substantial geometric corrections either to the left or right side of the alignment. The Part II EMP furnishes these chainages along the entire project roads where there would be a comparatively significant rise in the embankment height.

The overall construction activities will bring in a number of additional changes along the corridor. The changes are mainly due to the additional construction material that will be used as a part of the widening and improvement of the project road. In some sections for example in Pilathara – Pappinisseri road, the first few kilometres from Pilathara, the gradient has been suitably adjusted in the design, resulting some additional changes along the project corridor. The cross section alternatives presented in the **Chapter 2** provides a good picture of the embankment alterations. The actions that will be taken to ensure embankment stabilisation are construction of retaining walls, toe walls, selection and use of less erodable material, placing of gabions and riprap and sound compaction, particularly around bridges and culverts. Retaining wall or toe walls will be required in all watercourses with planting of mangroves and rip-rap

(stone pitching). The effort of the Contractor for stabilisation will get quick results if carried out in the monsoon season. Re-vegetation, soding and seeding will allow the stabilisation of embankment. All this needs to be carried out immediately after the construction to avoid erosion of the constructed embankment. Contract documents for the project roads has specified that final forming and re-vegetation must be completed as soon as possible following fill placement to enable a rapid regeneration of stabilising ground cover.

Monitoring and construction supervision according to the terms of the contract will be undertaken by the Construction Supervision Consultant (CSC) to ensure that regeneration efforts are successful. In the last 200m of the Pilathara - Pappinissery section adjacent to coastal swampy areas **(PLATE 9.1 & 9.2)** the project will construct metal fencing along the project road in order to prevent public from entering and destroying the mangaroves / dumping waste in that area .

Plate 9.1. Pilathara-Pappinissery section adjacent to coastal swampy areas (chainage 20.700)

Plate 9.2. Avifauna and Mangroves Near Valapattanam Bridge

The berms and batter slopes of road embankments are required to be seeded with a fast growing crop and native seed mix immediately after fill placement to prevent scour and to encourage stabilisation. Grass sods will be used wherever feasible. Berms, embankment slopes and road cuts are required to be stabilised by re-vegetation with unpalatable (grazing resistant) plant species, placement of fibre mats, rip-rap, rock gabions, or other appropriate technologies. Most areas to be cleared of vegetation are roadside berms to be covered by pavement and will not need re-vegetation or to be stabilised. Installation of drainage structures and raising of road formation levels may create exposed slopes that will be stabilised before the onset of the monsoon.

Discharge zones from drainage structures will be furnished with riprap to reduce erosion when required. Where necessary, grass sods will be imported and laid to provide ready made turfing. Down drains/chutes will be lined with rip-rap/masonry or concrete to prevent erosion. Side slopes will be adjusted to 1:1.5 or flatter to reduce erosion potential or, if steeper, stabilised, covered with riprap or other material to prevent soil erosion. These requirements are clearly specified in the construction contracts. Construction in erosion and flood prone areas will be limited to the dry season.

Mitigation for disposal of waste material generated /Scarified Black top. The total scarified bituminous material to be removed from the existing road surface has been estimated for all the three roads and is provided in the respective EMPs. Although the total material to be disposed seems to be very high, the actual material to be disposed per kilometre would be of the order of 500 cubic metres only. The in-situ requirement quantity will be of the order of 50% after the excavation of 0.5 metre of topsoil. The remaining 50% cubic metres will be used as fill material for parking areas.

9.2.2 GEOLOGICAL CHARACTERISTICS

As described earlier in analysis of alternatives, some of the sections of the project roads are lying exclusively in the coastal belt. These sections pass through few mangrove swamps. The first section passing through the mangrove areas has developed with cracks on the road surface due to the wet nature (due to capillary rise) of the embankment. The project will construct retaining walls on both sides of the project roads in these sections. The design has taken adequate measures to strengthen the embankment base.

The location of estuary is within two kilometres from the project road link no 68 at Pappinissery. The compaction of the material is possible with the increased traffic along this corridor. The impacts will be negligible due to the fact that the road and traffic already exists.

Sand requirement is a one-time requirement during the construction period for three years. The project, as a mitigation measure towards sand mining issue, will resort to quarry sand and dust from quarries. The project Environmental Management Plan will make provisions for increased use of quarry dust and sand to avoid the mining effect on river sand.

Since the project road has taken all necessary testing for a suitable design the expected impacts due to the geological factors are nil.

9.2.3 SEISMIC CHARACTERISTICS OF THE REGION

As described earlier in **Chapter 5,** the Project Corridor is within the Seismic Zones III as defined by the Indian Standard (IS) 1893 (Part I): 2002 Seismic Zoning Classification. The basic horizontal seismic coefficient (α_o) for Zone III is 0.04. Seismic factor has been considered for designing of all culverts and bridges. Other than this no other mitigation measures are necessary.

9.2.4 IMPACT ON SOIL QUALITY

During the construction period, the EMP stipulates the preservation of topsoil from the construction areas as per the gudelines given in **Annexure 3.7**. This guideline gives detailed measures about preserving fertile topsoil as so to avoid erosion during rainfall and flooding (along coastal area) during monsoon. If required the soil heap will be protected by rock boulders or ridges with gaps filled by soil. The heaped area will be sufficiently drained to avoid any flooding events. The MoRTH specifications including those mentioned in EMP has specified the need to store and utilise the topsoil.

During the monsoon season, all construction/disturbed areas along the project road that will be susceptible to erosion will be maintained properly to avoid large-scale erosion of soil from the work area. Areas requiring soil stabilisation have been identified during all surveys and have been taken into account in the construction design. There could be permanent loss of agriculture/productive soils especially paddy field areas due to widening\ borrow areas.

All borrow pits are identified in the interior areas in the midland. In most of the cases, the distance to the borrow pit locations is expected to be 10-30 km. The network of roads available throughout the area will facilitate the material transport. It is not possible to clearly identify the haul routes because of the various options and constraints available. The specific locations of borrow pits identified are provided in the baseline section. There will be significant adverse impacts due to the creation of borrow pits. The contractual clauses in the EMP will address these issues.

9.2.5 EROSION

The envisaged project design considerations and construction activities will not accelerate the rate of erosion. The improvement of the project will be along the available corridor and to the immediately adjacent area to be acquired for the project. The design was in accordance with the standards of the Indian Roads Congress (IRC) pursuant to surveys carried out as per "IRC:56-2011 Recommended Practices for Treatment of Embankments and rode side slops for erosion control" The improvements along the project corridor will not itself lead to any additional significant erosion. Raised berms will, wherever necessary, be stabilised by retaining walls, rip-rapping, fibre mats, sodding, and/or replanting. Road drainage will be upgraded to accommodate the 25-year floods. All drainage ways will be of suitable size and aligned to minimise any potential erosion.

If proper measures are not taken, the nearby surface water bodies will be contaminated depending on the type of material stored. The Contractor will have to take the necessary precautions to avoid erosion. All material storing places will be covered using tarpaulin. The topsoil heap and storage also will be subjected to erosion, if proper measures are not taken. The measures required at the topsoil preserved sites include lining of the soil heap boundary with bricks or rocks of boulder size. The EMP will ensure that the topsoil will be stored to avoid erosion during the monsoon months.

As in other parts of Kerala, the project roads region receive heavy monsoon showers. The project has considered and provided adequate arrangement for both longitudinal and cross drainage structures. As the Kasaragod - Kanhangad region receives long spell of rainfall, the project has considered and provided adequate arrangement for both longitudinal and cross drainage structures. This will allow much better drainage facilities and thus avoid scouring and erosion of the embankment and the road itself. The drainage facilities at urban, semi urban and village areas are considered to fit into the local conditions. The cross-sections at cut sections that are employed in the project have provision for increased longitudinal drainage. The drainage facilities at cut sections would be according to the design cross-section for cut sections.

The project has avoided chances of erosion to the extent possible in the CRZ areas. Wherever possible suitable measures are suggested for CRZ preservation and ecological enhancement. This includes fencing (will help the vegetation to grow strongly thereby reducing erosion) retaining wall, toe wall construction. These measures are practical and consistent with other social and environmental concerns (e.g. tree preservation, buildings), wherever possible the widening of the project road has been planned to take place away from the water bodies. A mangrove afforestation plan has also been formulated for the project which will be implemented through Kerala Forest and Wild Life Department. All developmental activities at or close to CRZ areas will be well thought out and well planned. These are specially incorporated in the Environmental Management Plan (EMP). The cooperation with local people and authorities are an integral part of the project planning. The public consultation conducted as part of the project will continue throughout the project implementation and operation phases.

Contractor's construction establishments: There should be sediment trap in all ancillary areas like construction camps, labour camps, plant areas, borrow areas etc. The area should be well drained and the water should be collected in a pit trapping the sediment load in the run off. The eroded sediment thus collected can be brought back for use. The leakage and erosion from the material storage places could lead to the contamination of surface water bodies.

TABLE 9.1 provides the details of mitigation measures proposed to control erosion.

TABLE 9.1. MITIGATION MEASURES TO CONTROL EROSION

EROSION ACTIVITY	MITIGATION MEASURES	REMARKS/REFERENCE TO EMP
Top soil heap	Boundary lining using rock boulders and coconut leaves, split coconut and tarpaulin sheets	Especially during monsoon Refer EMAP during construction period.
Drainage along the sides of the road	Longitudinal drainage provision through out the project corridor with or without lining.	Depending on the location, requirement varies.
Drainage across the road	Cross drainage provision in the form of culverts and bridges through out the project corridor with or without lining. New CD structures are also planned where ever necessary including the realignment sections	This will allow much better drainage facilities and thus avoiding scouring and erosion of the embankment and the road itself
Material storage places	Rock boulders and coconut leave mat /Bamboo etc can be employed as a cost effective local methods instead of the use of tarpaulin sheets.	Hand made coconut leaf mat is locally available material and the promoting of this will provide and encourage employment.
Cut sections	The cross-sections at cut sections that are employed in the project have provision for increased longitudinal drainage	Stabilisation of the cut sections against erosional activity is very important.

9.2.6 QUARRY AND CRUSHING OPERATIONS

The impacts due to the operation of borrow areas and quarry areas have been considered in the EMP. The Contractor will have to prepare and implement a contractors quarry management plan clearly describing all activities relating to quarries and quarry materials. The opening and closing of the quarry need to be clearly mentioned. The quarry management plan should have approvals from all concerned agencies. The environmental mitigation costs have been estimated and included in the BOQ bill no11. In order to encourage and ensure the implementation, the cost for the preparation of the plan itself is included. The specific task that will have to be addressed have been identified and included. Existing sources in active operation are likely to be used. Contractors may; however, select other supply options provided that they are cost competitive, provide material meeting established quality standards in an environmentally sound manner.

9.3 WATER RESOURCES IN THE REGION

There will not be any significant adverse impacts to surface water bodies. The project roads cross a number of rivers, streams and canals whose details provided in the respective sections. The mitigation measures will include actions to avoid the obstruction of stream courses due to material storage or dumping. The EMP clearly identifies all mitigation measures requiring attention. The contract clauses are included for all categories.

9.3.1 SURFACE HYDROLOGY

The water withdrawal points for the construction should be developed and operated in a manner that will not disturb the surface hydrology. Except isolated ponds and wells, all water bodies crossing the project road links 68 and 69 are coming under the purview of CRZ notification. In

the case of link no74 only one river is coming under this category. The intake points should be developed, operated and closed in an environmental friendly manner. The Contractor will be required to prepare a water management plan regarding the use of water resources, intake points, operation of the vehicles, and closing of disturbed areas. The plan should have the approval of the construction supervision consultants and the PMT.

There are a number of dos and don'ts for the contractor as provided below:

- Contractor's vehicles shall not be allowed to wash in rivers or streams. This is to avoid potential pollution from oil residues.
- Contractors shall not use water from the community drinking water sources such as;
  - Public water supply schemes
  - Community spring water sources
  - Community hand pumps
  - Community bore wells / shallow tube wells
  - Location of the streams from which the Community takes drinking water
- Contractor shall obtain all legal approvals and clearances from the concerned departments.
- Contractor shall consult the local communities where the water source has been identified.

The actions in the Management plan for CRZ areas during construction could be:

Temporary arrangement for parking of water tankers to avoid large-scale disturbance to the region including destruction of plants. This will be developed under the condition that after the use the entire area will be developed in a manner suitable to enhance the Coastal ecosystem/CRZ area.

Temporary arrangement to enter the water body/ stream or river:

The increased runoff due to widening of the roadway will be negligibly small. Water quality in roadside ponds adjacent to the ROW may show slight improvement after road upgrading due to reduced erosion from improved roadside berms and embankment slopes stabilised or protected by riprap or other material including planting to prevent soil erosion. Water requirement for this will be met from the surface water sources like canals, streams, ponds, lakes, chiras etc. The requirement will be considerably reduced during monsoon. Conversely, during summer season, i.e., during March-April-May the requirement will be much higher. During this period, the small water bodies will be generally dry; however, there will not be any major difficulty in obtaining water for construction.

9.3.2 DRAINAGE PATTERN IN PIA

There are a few new bridges along the links under consideration. Many realignments have been considered necessary in this project. The only work that will be affecting the drainage pattern is the improvement/reconstruction of the culverts and the longitudinal drains. The fact that the roads already exist and the avoidance of bypasses have been made the overall impacts to a minimum level. The impacts mitigation due to the ancillary construction sites such as the operation of borrow areas, quarry areas, contractors and other labour camps have been considered in the EMP. The contractors are to prepare a borrow area and quarry area

management plan and obtain approval from the Engineer (Supervision consultants). Environmental mitigation costs have been estimated and included in the BOQ bill no11.

Contractors establishments: appropriate drainage should be planned in all areas for the storm water flow.

Cross Drainage. Cross drainage structures will be replaced in accordance with the standards of the Indian Roads Congress (IRC) pursuant to surveys carried out as per IRC SP35-1990 and IRC:34-2011 - Recommendations for Road Construction in Areas Affected by Water Logging, Flooding and/or Salts Infestation (First Revision). Adequate numbers of new CD works are provided in the design drawings wherever the new alignments (Refer **Chapter 2 Table 2.3**) are proposed. Complete details of the Cross Drainage facilities are provided in the **Chapter 5**, **section 5.3.2**. The designs for culvert widening are adjusted to one and two-side widening. There will be reconstruction where ever the existing structure is in a poor condition. The planned construction is for the full formation width. IRC:34-2011 - Recommendations for Road Construction in Areas Affected by Water Logging, Flooding and/or Salts Infestation (First Revision) was also considered for designing.

9.3.3 GROUNDWATER IN THE PIA

There will not be any groundwater requirement for construction, as the construction water will be completely met from the rivers and streams. All affected wells / hand pumps and PWS within the proposed construction zones have been identified as shown in EMP- Environmental Data Sheet. There will be no net loss of water access points. In the event that wells must be relocated, temporary alternative water sources (e.g. new wells, trucked potable water) will be provided to ensure that local residents have ready daily access to potable water. Large scale exploitation of groundwater being a sensitive issue, all approvals must be obtained.

Wells and Hand Pumps. New wells and hand pumps will be provided as specified by the Resettlement Action Plan (RAP). Along the project corridors many wells and hand pumps will have to be removed because of improvement in the available corridor width. The loss of existing private hand pumps is included in the RAP and they will be replaced as a rehabilitation measure. All public wells and additional wells, if required, as a result of the rehabilitation measures are also included and in the EMP the cost has been considered. Water sources should be properly developed for meeting drinking water standards and other requirements.

Contractors establishments and practice: In all major workshop areas where the oil spillage will be very high, oil - water separator pit should be constructed. This can make sure that the oil spillages are not infiltrated in to groundwater and get in to the open hand dig wells (community drinking water source).

9.3.4 WATER QUALITY

The water quality impacts will be controlled, mitigated or minimised by the enforcement of all applicable laws and regulations. This is built in to the Environmental Management Plan. The upgrading of the project road link will reduce erosion from the roadway and result in minor improvements in water quality (i.e. reduced silt loads). Care has been taken in the design to provide side drainage.

Wherever practical and consistent with other environmental concerns widening of the project road has been planned to avoid water bodies. Where this was not possible (CD work along the

banks of CRZ water bodies[1] for Cross drainage) slope protection is required to be installed until embankment surfaces are stabilised. Co-ordination with local agencies is recommended to ensure that any future developments along the existing ROW in the vicinity of water bodies and other sensitive areas are well controlled. Contract provisions have been incorporated in the bid documents to ensure that construction camps and other potential sources of secondary impacts are properly sited and provided with drainage and wastewater treatment facilities. The provisions for waste disposal at service centres and construction labour camps are the contractual obligations of the contractor.

The avoidance of CRZ water bodies and stream courses during the work of CD structures to the extent possible will itself a mitigation or impact minimisation measure against any possible contamination or destruction to mangroves or other elements of the ecosystem. As the source of construction water could be the water bodies streams and rivers, efforts shall be maintained to avoid any impacts to the ecosystems as mentioned above. More over the mangrove afforestation plan has been designed for the use of CRZ water bodies for any construction activity including withdrawal of water for construction. Necessary cost for this work has been included in the BOQ bill number 11.

The KSPCB under its 'consent to establish' for KSTP I roads directed that effluent treatment facilities namely septic tanks and soak pits and adequate sanitation facilities shall be provided for the construction force. The domestic effluent during construction phase shall be treated to achieve the effluent standards as stipulated below:

- pH 6-8.5,
- Bio chemical Oxygen Demand (3 days at 27°C)-30 mg/l, max
- Suspended solids 100 mg/l. max
- Oil &Grease 10mg/l, max

9.3.5 FLOODS DURING MONSOON SEASON

The section II of the project road is more flood prone as it is located in the coastal low land. Increase in embankment heights are considered in all known areas of flood prone sections. Throughout the corridors there will be an increase of 20-30 cm height due to the additional material that will be used during the construction work. In all other flood prone and coastal stretches suitable mitigation measurers have been framed and provided in the EMP. Storm drainage provisions will be upgraded to accommodate 25-year floods. The adequate cross drainage structures and longitudinal drainage structures will also help to effectively drain the area very quickly. At the end of link 68 where swampy area exists a number of mitigation measure are proposed including fencing. Junction improvements, footpath and curve improvements are also planned to have an overall positive impact. The project has planned a small bridge (viaduct) across the only subsidence region in link no 69. This is a major improvement along the project corridor, as it will allow even the multi axial trucks along the corridor.

9.4 AIR QUALITY

Air quality issues are addressed in two phases: the construction and operational phases.

[1] CRZ water bodies-the water bodies such as stream, rivers coming under the purview of CRZ regulations

9.4.1 DURING CONSTRUCTION STAGE

The KSTP construction phase will be difficult because of the ribbon development throughout the road network. Asphalt and hot-mix plants are required to be located at least 500 metres away from the nearest sensitive receptor (e.g. school, hospital). As a Kerala specific relaxation, this distance is relaxed to 250m by the KSPCB due to the practical difficulty in maintaining the distance. Operators are required to install emission controls. Road surfaces, excavation and construction sites will be sprayed to keep them moist for dust control. Trucks carrying earth, sand or stone will be covered with tarpaulin sheets to avoid spilling.

Potential significant adverse impacts upon adjacent residents or site employees during construction will be mitigated by either discontinuing until favourable conditions are restored, or, if warranted, sites will be watered to prevent dust generation, particularly at crushing plants. Machinery and equipments are required to be fitted with pollution control devices, which will be checked at regular intervals to ensure that they are in working order. The best available pollution control technologies are required.

Avoidance itself will be a suitable mitigation or minimisation measure to sensitive areas. As a special mitigation measure to coastal sensitive areas no construction machinery and plants will be established towards the seaward side of the project road. No construction contractors plants will be established near Mangrove areas and water bodies. All approval from concerned agencies must be obtained prior to the construction related activities in sensitive water bodies.

Contractors establishments: For the concrete batching plants, crusher plants and hot mix plants the contractor must obtain all necessary approvals from the State Pollution Control Board. The crusher plants should be suitably covered with hoods to minimise the dust pollution. The approach roads should be well maintained so that it is free from dust formation.

9.4.2 DURING OPERATIONAL STAGE

The net air quality impact during the operational phase of the project road is expected to be beneficial. Improvements in road surface condition and traffic capacity will alleviate local congestion and improve traffic flow, thereby reducing engine idling and the contribution it makes to local air quality degradation. With improved vehicle performance on a better road surface, the air pollution should actually be reduced. Provision for designated parking areas for auto rickshaws, cars, jeeps etc will improve the road safety conditions and traffic management situations decongesting the traffic corridor thereby positively contributing to air quality improvements. Paving and provision of adequate side drainage in villages will significantly reduce human exposure to air pollution, including both vehicular emissions and roadside dust.

9.5 NOISE QUALITY

Noise issues are considered in two phases: the construction and operational phases as follows.

Confining construction activities of the project road links to social working hours and employing noise controlled construction equipment of international standards will mitigate noise impacts during the construction phase for the local population. Measures will include:

Source Controls, i.e. requirements that all exhaust systems be maintained in good working order; properly designed engine enclosures and silencers will be employed; and regular equipment maintenance will be undertaken.

Site Controls, i.e. requirements that stationary equipment will be placed as far away from sensitive receptors as possible (i.e. aggregate crushers, etc.); disposal sites and haul routes will be

selected to minimise objectionable noise impacts; and shielding mechanisms will be employed where possible.

Time and Activity Constraints, i.e. operations will be scheduled to coincide with periods when people are least likely to be affected; work hours and work days will be limited to less noise sensitive times as far as possible.

Community Awareness, i.e. public notification of construction operations will incorporate noise considerations and methods to handle complaints should be included.

9.5.1 OPERATIONAL NOISE IMPACT MITIGATION

It is anticipated that there will be 'measurable' decrease in noise levels as the measured values indicate high noise levels in the region. Estimated noise levels due to road use following construction warrant consideration of mitigation actions in regard to those sensitive receivers for which noise levels may exceed the ambient noise standards specified by the Noise Pollution (prevention and control) Rules 2000 of the Ministry of Environment and Forests, Government of India. Mitigation at these locations may include the posting of signs prohibiting the use of horns and, to the extent possible, landscape planting to serve as noise barriers. The effect of noise can be reduced considerably by the combined effect of sound insulating walls and green barriers. The typical designs for noise barriers are enclosed in the EMP document. The principle of the designed barrier is also explained in the design sections. Proposed project mitigation actions include the following:

Sound Insulating Walls for Silence Zones. This is basically a stone or brick wall to act as a sound barrier. This may be necessary in the case of hospitals and medical centres, schools and other educational institutions. A number of schools and a few hospitals have been identified adjacent to the road corridor. The level of improvement is marginal and not to any recommended standards of IRC (30m) or any other standards due to various factors unique to Kerala. Therefore in order to address the issue of noise levels along silence zones, the noise barriers have been recommended for all silence zones. Although the wall is meant for noise reduction, it will also serve as a safety barrier with only one or two authorised outlets for people and vehicles to move in or out. This will also serve as the barrier for preventing dust during summer and muddy water during the monsoon acting as a physical barrier to the highway. This is necessary and evident when viewing the current behaviour of the drivers; the speed of the vehicles is often considerably higher than the design speed (or speed for the level of service) of the road. The PMT would be responsible for the implementation of this work. In order to project the environmental significance of the wall, the wall will be painted green.

Green Barriers for Silence Zones. These are simply a thick layer of green plantation of Asoka trees acting as noise attenuating objects. These trees may be planted just "inside" and adjacent to the sound insulating wall. The PMT will be responsible for the implementation of this work. Details of the implementation are provided in the Part II - EMP.

Raising Walls for Silence Zones. This includes the cost of increasing the height of already existing walls around hospitals / schools if necessary. In addition to schools (educational institutions), hospitals are also identified adjacent to the road corridor. The PMT will be responsible for the implementation of this work.

Noise mitigation techniques will be employed as may be warranted at each of the sensitive receptor sites. Definitive noise levels will be empirically determined at each site and selection of the mitigation technique will be made on a site-specific basis in consultation with property

owners. The mitigation costs have been estimated as a part of the environmental costs of the project in Part II - EMP.

9.6 FLORA AND FAUNA

The project road link no 68 end in Pappinissery has thick mangrove vegetation bordering the project road. The project has devised an impact minimisation strategy. Ideal conditions prevail in the area in the form of comparatively better-preserved mangroves, confluence of two rivers (Valapatinam and Thaliparamba rivers) the estuary and the Sea coast itself.

The **impact mitigation actions** include long term planning for the NH project road junction, foot path on all sides of the junction and metal fencing whole along the sides of the mangrove vegetation. All these facilities will improve a safe/controlled access to these ecosystems without causing any degradation.

As part of the **Environmental enhancement** strategy,

- PMT and the local PWD will organise an awareness programme at the local level
- Environmental awareness boards will be placed at all critical locations
- Plantation of mangroves will be carried out with the help of State Forest and Wildlife Department

All the above discussed impact minimisation, mitigation and enhancement measurers have been reviewed after the receipt of a study report from the Centre for Water Resources Development and Management [2](CWRDM) in March 2003. The cost for mangrove planting shall be worked out jointly with Kerala Forest Department. The cost of planting mentioned in the EMP is tentative and has been decided in consultation with the sector experts. The mangrove afforestation plan has highlighted the methods of planting of mangroves.

Roadside trees. The loss of trees will be mitigated by planting at least three trees per tree removed from the roadsides. Similarly in addition to compensation at appropriate market rate, the trees removed from the private land also will be replaced at the same rate. The loss of trees and vegetation at ancillary sites like borrow areas, quarry areas, labour camps, WMM plant, hot mix plant etc. will also be mitigated according to the measures adopted in the Environmental Management Plan.

Private trees. The trees/plants/shrubs lost on construction site under in take points if any will be considered for replanting as per EMP. Throughout the project road, there are trees in private ownership. Those trees, which are required to be removed for the purpose of this project, will be subjected to compensation and likely replanting at the rate of three trees planted against every tree removed (refer EMP).

The project's "tree planting strategy" encourages the people immediately adjacent to the road to plant high canopy trees. (Part II – EMP, **Annexure – 5.56,** Landscaping, Tree Planting & Environmental Enhancement Plan). Necessary training will be imparted to the Contractors and the Supervision Consultants immediately after mobilisation.

[2] This is an autonomous research institute established by GoK under KSCSTE.

9.7 HUMAN HEALTH AND SAFETY

Human health and safety is increasingly important during highway construction, improvement and operation due to various reasons. These are based on the fact that the 'highway corridors' act as corridor for spread of diseases. In this case as the road and traffic already exists, this will not be the case. This Resettlement Action Plan has taken care of this aspect. The Kerala Road Saftey Authority Act 2007 is a positive step in Kerala towards ensuring human health and safety.

9.7.1 HUMAN HEALTH

All measures required to mitigate noise pollution in silence zones have been discussed under noise mitigation. Similarly, all measures required to mitigate air pollution in sensitive areas have been discussed under air quality mitigation. Other than these, no further mitigation actions are regarded as necessary for air and noise issues.

The EMP has given sufficient attention with regard to health and safety of their workers, maintain and cleanup campsite, and respect the rights of local landowners. If located outside the ROW, written agreements with local landowners for temporary use of the property will be required and sites must be restored to a level acceptable to the owner within a predetermined time period. The Contractor, prior to the establishment of the camps, will have to develop the workers camp restoration plan to the satisfaction of the Construction Supervision Consultants or the Engineer.

In order to protect the need of the migrant labourers if employed, they shall be provided with facilities for cooking, eating and sleeping. The Contractor needs to observe all labour laws and ensure minimum daily wages. The EMP has made provisions to monitor the labour requirements.

The contractor must provide all Personnel Protective Equipments (PPE) to all personnel working for the project execution and exposed to various kinds of risks. Appropriate environment and safety measures should be in place. Clearances from various agencies for fuel storage should also be obtained. Relevant fire safety equipment should be installed.

9.7.2 HIGHWAY SAFETY DURING CONSTRUCTION

The Indian Roads Congress (IRC) has recently come out with guidelines[3] on road safety in road construction zones. This will be the basis for the construction road safety and will be strictly implemented after incorporating in the contract documents.

9.7.3 HIGHWAY SAFETY DURING OPERATION

Highway safety was of paramount important to Kerala State Transport Project. Because of the special relevance to this project, all road safety aspects are dealt with separately in **Chapter 5** on Health and Safety aspects. A heavy thrust on the road safety aspects of the entire State itself is being paid by a State road sector safety programme covering all road networks.

[3] IRC: SP: 55:2001,Guide lines on safety in road construction zones and IRC:SP:44-1996 Highway Safety Cod

9.7.3.1 LACK OF PARKING SPACE FOR AUTORIKSHAWS AND JEEPS

There should be space provided for parking off the roads without interfering with the smooth flow of traffic. Along the project roads, in almost all rural areas the populace is heavily dependant on rickshaws, jeep services and cars / taxis. The car users, especially taxis are very high. All urban and semi-urban centres require parking spaces for auto rickshaws and jeeps as shown in **Annexure 5.57,** Part II – EMP, Volume I, II and III. This is also shown in the Environmental Data Sheet prepared for the project road.

Plate 9.3. Typical Location where parking area required.

9.7.3.2 LACK OF SUFFICIENT SPACE FOR BUS STOPS AND BUS LAYBYS

Bus stops should not obstruct the free flow of traffic. The location of bus stops should provide sufficient space to the commuters, especially the large number of school children, to safely wait. The pedestrians should be safe from both approaches. In this project there is an inbuilt (included in the design) provision for bus stops as provided in **Chapter 10**. There are numerous locations, which require bus stops that are discussed separately later in **Chapter 10** - Environmental Enhancements. The introduction of some courtesy on the roads as a result of driver education should enable buses to rejoin the traffic stream without any belligerence or danger.

9.7.3.3 UNPLANNED ILLEGAL DIGGING ON ROAD SIDES

The State PWD as the Highway Authority is responsible for the Right of Way (ROW) of all main roads in Kerala. Any detrimental activity by any other department on the road Right of Way should be seen as illegal unless carried out with the permission of the Highway Authority (HA). Any digging for laying of pipes, cables etc should be subject to clearances and approvals from the PWD. Regular PWD co-ordinating meetings are an essential part of planning any road works with police participation. Proper planning and implementation can save a considerable amount of money, save a number of people from accidents, and reduce inconvenience to the public.

The project has provision for utility ducts through out the entire corridor and also ducts crossing the road for crossing of utilities at regular intervals.

9.7.3.4 PARTLY COVERED / UNEVENLY COVERED OPEN DRAINS

A formal system of drainage improvement needs to be developed to permanently cover the drains rendering them to be safe footpaths at least in all urban and semi-urban areas. The PWD needs to fund the operations and improve engineer's awareness. The project design has taken this into account.

9.7.3.5 INADEQUATE EMBANKMENT HEIGHT IN FLOODING AREAS

The PWD should have some signing programme to warn of flash flood sections. In all flood-prone sections the road should be raised properly and drained with adequately sized culverts to

the extent that such flooding shall not affect the smooth flow of traffic during monsoon seasons. Any borrow pits opened for this purpose must be controlled with proper licensing / approvals / agreements etc.

9.7.3.6 ENCROACHMENT OF VARIOUS TYPES

The Highway Protection Bill is a positive step to control encroachment. Local engineers must become more familiar with the legal limits of the ROW and encroachments should be addressed severely and quickly. Narrow corridors with poor visibility and no provision for pedestrians cannot afford to accommodate encroachers.

9.7.3.7 PARKING OF VEHICLES ON BOTH SIDES OF THE ROAD

The parking of vehicles on both sides should not be allowed at any location, especially in urban areas. One-side parking may allow free flow of traffic. This could be addressed in each town and should be enforced.

9.7.3.8 TREES, VEGETATIOPN, FORESTS AND WILD LIFE

For road safety purposes, it is necessary to remove some trees along the corridor to assist the free flow of traffic and improve safety and visibility. Road frontages must be requested to trim overhanging growth to prevent the obstruction of roads and footpaths**.** The fruits and coconut leaves of dense coconut trees grown on the sides throughout the corridor is also matter of concern due to the chance of falling on pedestrians, vehicles etc.

9.7.3.9 UTILITIES

Illegal digging must be stopped by the PWD. New works may make provisions for utilities to avoid unnecessary digging along the road corridors especially along narrow sections. Road openings should be controlled by the PWD which needs to recover the cost of reinstatement or installation of safety aids from the promoting authorities. The project has included a provision for longitudal and cross utility ducts.

9.7.3.10 EFFECTS OF MONSOON ON ACCIDENTS

Engineering designs with suitable signing and pedestrian facilities can assist in avoiding many dangers. These are considered in the designs. This has been further reviewed in the light of recent road safety audit.

9.7.3.11 NUMEROUS ROAD INTERSECTIONS

The Rules of the road regulations are very clear on priority at junctions. The PWD must sign and line the appropriate priorities and they must then be enforced by police action with support from the courts. This aspect was considered in the design especially at Pappinissery, Pilathara and Naval Academy Junctions.

9.7.3.12 DANGEROUS OVERTAKING OF VEHICLES

The drivers of Government-owned vehicles including the State-run KSRTC BUS services are most easily targeted for driver education programmes in the short term. Driver education, proper law enforcement and strict penalties by the Courts must be used to curb dangerous driving practices.

9.7.3.13 TEMPORARY FISH AND VEGETABLE MARKETS AND AUTOMOBILE WORKSHOPS

This cannot be allowed to continue for safety reasons especially in all town areas (eg. Naval Academy junction) of the Project roads. The local authorities should provide additional space for fish and vegetable markets. There should be stringent conditions for setting up automobile workshops, e.g. license being issued only after fulfilling all requirements.

9.7.3.14 SPEED LIMITS IN URBAN AREAS

Speed limits through all heavily built-up areas and adjacent to schools and other institutions are essential. The use of lower limits, which are difficult to enforce, should be discouraged. Proper signing and enforcement is essential and requires more police training and more effective Court action. The use of properly - constructed speed bumps in restricted areas may be considered (to IRC Specifications).

9.7.3.15 DISPOSAL OF SOLID WASTE/MUNICIPAL WASTE IN MARKET AREAS

The State Government should encourage the local Municipal authorities to acquire additional separate land for solid waste disposal and adopt hygienic systems of collection and disposal. In the short term, liaison with the PWD to control the placing of skips on more appropriate sites would be most beneficial.

9.7.3.16 PEDESTRIAN SAFETY

The capital investment needed to carry out this project is aimed not only at improving the infrastructure to service State departments but also to bring major improvements in the efficiency of the existing roads and to improve the quality of life for road users. The anticipated improvements should result in improved efficiency and a reduction in traffic accidents with greater travel enjoyment to all road users. This will be dependent upon implementing the recommended safety measures. In addition, provisions for footpaths next to schools and hospitals have been made in the design.

9.8 CULTURAL RESOURCES IN THE REGION

The project has prepared a Cultural Property Rehabilitation Plan (CPRP). During construction especially at the time of Sabarimala pilgrim season and also the temple festivals along the project road, there will be temporary access problems for the Pilgrims/tourists to the cultural properties. The rehabilitation plan clearly defines the type of structures needed to compensate any losses or the need to carry out some enhancement measure.

9.8.1 MITIGATION PLAN FOR TEMPLE/MOSQUE FESTIVALS

At the time of construction in link no 68, the 'Moonnu Petta Umma' mosque festival at Pappinissery in February every year require freezing of all major activities in the first ten kilometres by the construction Contractor. Nevertheless the Contractor can continue any activity that will not directly affect the people participating in the local festivals. The planning should be in such a way that the activities at the mosque area is minimum and the road surface is adequate for street vendors.

The project in link no 69 during implementation stage needs to break at two occasions to respect the two weeklong social festivals.

The shrine at chainage Km 26.1 in link no. 69 will be avoided by suitably accommodating with the structure in the form of an island as shown in the design **FIGURE 9.1**. The design has been suitably accommodated as one way at this location keeping the structure intact in the form of an island. The impact to the temple adjacent to the shrine located on the left side was also avoided by widening towards right side. Nevertheless the Contractor can continue any activity that will not directly affect the people participating in the local festivals.

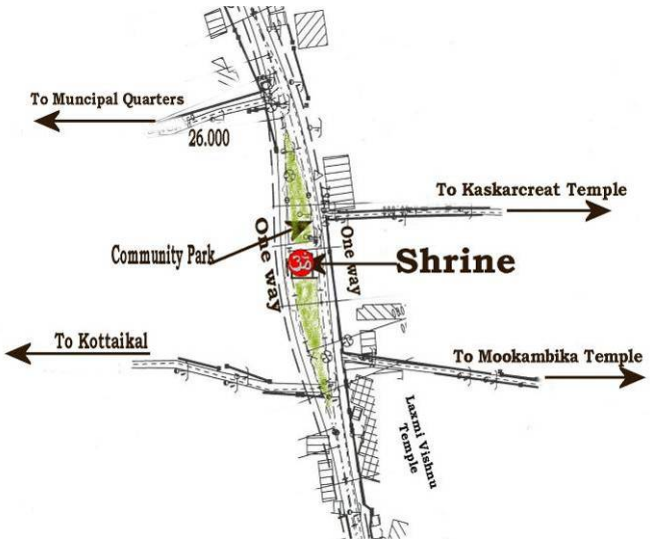


FIGURE 9.1. MITIGATION MEASURES FOR CULTURAL PROPERTY

9.8.1.1 THRIKKANAD TEMPLE FESTIVAL (LINK 69)

There could be a break of 10 days in the contract period during the eight-day festival at Thrikkanad temple. The construction work will stop one day prior to the festival and one day after the festival. The contractors can do any work other than that on the road that will inhibit the free flow of traffic.

9.8.1.2 ANJANUR TEMPLE FESTIVAL (LINK 69)

This is a ten-day festival. Since the temple is located three kilometres away from the main project road no specific mitigation actions are required during construction Phase. Nevertheless the Contractor needs to make sure that the construction activities are not against the interest of the visiting pilgrims.

9.9 SOCIO-ECONOMICS

In this section only those items that will help to determine impacts are discussed.

9.9.1 LAND USE IN THE PIA

9.9.1.1 DURING CONSTRUCTION

With regard to ribbon developments PWD need to enforce the applicable laws with the assistance of the agencies concerned. The major land use impact would be the conversion of all acquired land to transportation land. A total of 34.53ha of land will be converted to transportation land in these three project links. The total land requirement has been estimated to be 6.23 ha for link 68, 2.98 Ha for link 69 and 25.31 Ha for link 74. In link no 69 the additional requirement of land is .007ha only where as it is 0.0118 ha in link 68 and 1.5 Ha in link 74. The impact on land uses will be limited to the land use of the construction camp, labour camps and various plants such as the WMM plant and the hot mix plant. This is a temporary effect. The Contractor will have to prepare a management plan for all these items for an efficient and

effective restoration (Refer EMP). The supervision consultants will ensure its proper implementation.

9.9.2 AGRICULTURE IN THE DISTRICT

No specific mitigation measures are warranted for impact to agriculture areas. Linkage to National Highways, Railways and West Coast canal are major factors that will help agriculture.

9.9.3 INDUSTRIES IN THE PIA

Industries will positively benefit out of the increased transportation and linkages. On the other hand the pollution from increased and existing industries need to be contained by proper implementation of the pollution control laws. Linkage to National Highways, Railways and West Coast canal will help to a positive growth of the industry.

9.9.4 TOURISM IN THE PIA

9.9.4.1 DURING CONSTRUCTION

Passenger traffic including the tourist traffic should not be affected. There should be strict enforcement of IRC road safety measures as indicated in the regulations (Refer IRC: SP: 55:2001). More over the traffic will not be closed during construction period, as it will affect the schedule of the passengers as well as the tourist's visiting the area. During festival season freezing of main activities will be required.

9.9.4.2 DURING OPERATION

Linkage to National Highways, Railways and West Coast canal will help to a positive growth of the tourism. The area will positively benefit from these linkages.

9.9.5 FISHERIES IN THE REGION

No mitigation actions are warranted during construction and operational phases of the project. The eco-restoration programme for mangroves will positively benefit fisheries sector, as it is a breeding ground for many fish species.

CHAPTER 10. ENVIRONMENTAL ENHANCEMENTS

The institutional arrangements for the implementation of environmental and social mitigation and enhancement measures are described in the separately bound Environmental Management Plan (EMP).

As discussed in the previous chapters number of general mitigation and minimisation measures are considered wherever appropriate according to the degree of impacts. Nevertheless these measures are not adequate to reverse the environmental degradation and other long-term impacts. Further efforts are also made to include other measures, which will be a value addition to the project and increases the social accessibility of measures taken in the project. The various environmental enhancement measures taken include,

- Provision for parking areas
- Bus bays
- Bus waiting shed with inbuilt Kiosk
- Cultural property enhancement
- Rest area development (Development and Improvement of Oxbow land)
- Development of parks for community use
- Development of platforms for aesthetically beautiful trees and structures
- Improvement to drinking water sources
- Bathing ghats along river banks close to the roads

Since the project roads are passing through CRZ, it need special care for providing any additional enhancement measures. The development without adequate ecological knowledge may further deteriorate the already threatened coastal ecosystems. The KSTP has taken adequate environmental impact mitigation and enhancement measures, which will help to preserve the fragile coastal ecosystems. A separate study of these ecosystems was carried out by CWRDM to understand the coastal ecosystem and to devise suitable mitigation measures. Based on these findings project has further reviewed the various recommendations in October 2003. The project there for has taken the execution of the work as an opportunity to implement various environmental enhancement measures to achieve sustainable development. The specific activities are discussed in the Environmental Management Plans for each road and an overview is presented in this Chapter.

10.1 ENVIRONMENTAL ENHANCEMENT MEASURES FOR BEACHES

The beach at Madai and the Ezhimala are the two major tourist attractions along link no 68. The project will improve all access roads including the access road to these areas. Provision of tourist signboards at the access roads is also included in the Bill of Quantities.

The two beaches along the project road link no 69 are Pallikare and Kappil Beach.

10.1.1 PALLIKARE BEACH (BEKAL BEACH)

This is already a tourist location. This is being developed as an international tourist destination. A parking area will be developed for the development of the beach. The parking facility will be arranged either on the PWD land or in the local Government land depending upon the

availability. The PWD will seek opportunities for fee collection from the parking areas. The EMP will include design for site-specific requirements.

10.1.2 KAPPIL BEACH

The Kappil beach has not developed in to a full-scale tourist location. Government and other local agencies are making all efforts for developing various tourism related facilities at this location. The PWD will help the local Government with regard to protection and preservation of mangrove associates located along the beaches.

10.1.3 KODI CLIFFS

The towering cliffs between the Kappil Beach and Chandragiri fort is another site for viewing the sunset. The project will provide access provisions from the roadside and also information boards in all tourist areas.

10.2 PUBLIC TRANSPORT AND CONVENIENCE

The expected traffic reversals from National highways require adequate parking spaces for all types of vehicles especially trucks. Other required facilities include rest areas, bus bays and bus shelters.

10.2.1 PARKING AREAS FOR TRUCKS

The project roads provide adequate space for developing major parking slots at various places along the project roads. No additional land requirement would be required.

10.2.2 BUS BAYS

Separate space for bus lay-bys and bus shelters are one of those safety measures out of many that are necessary to help reduce accidents and increase public convenience. The bus bays and bus shelters should be located outside the carriageway and should not affect the free flow of traffic. There should be pedestrian crossing facilities and proper signing of bus stops. Entry of other vehicles to the bus lay-bys must be prohibited. Taking all these aspects into consideration, bus lay-bys have been built into the designs as shown in **TABLE 10.1**. The number of bus lay bys in the project roads is shown in the environmental data sheet attached to the EMP.

The link 74 Thalassery - Valavupara has the highest number of bus waiting sheds per kilometre length. It is not practical to provide bus bays in all these locations. Therefore the team of specialists after visiting the project corridor recommended bus bays and bus waiting sheds with a better rational. However in all existing waiting shed locations new bus shelters are planned without a bus bay. This provision is strictly subjected to local conditions especially land requirement away from the traffic corridor.

TABLE 10.1. DISTRIBUTION OF NEW BUS BAYS IN THE PROJECT ROADS

LINK NO	NEW BUS BAYS
68	37
69	43
74	57

10.2.3 BUS SHELTERS / BUS WAITING SHEDS

The bus stop should have bus shelters or bus waiting sheds in a region experiencing six monsoon months. This is necessary in a high rainfall, hot and humid country. The local municipal or Panchayath authorities normally provides these with agreement to the sitting by PWD Engineers.

Action required. A budgetary provision for bus shelters and signing is included in the construction cost. A uniform design (main portion-skeleton) for the construction of bus shelters for the KSTP project has been made (**FIGURE 10.1**). The local bodies can raise funds out of advertisement in a glass lit case as in many western countries. This will not spoil the bus-waiting shed as the advertisement are not pasted but clipped to the baseboard in an illuminated glass case. The entire advertisement is inbuilt fixed in the skeleton design. The design for bus shelters is provided in the DPR (Drawing No. KK 1D-60-009, PP 1D 60-009 & TV 1D-60-009).

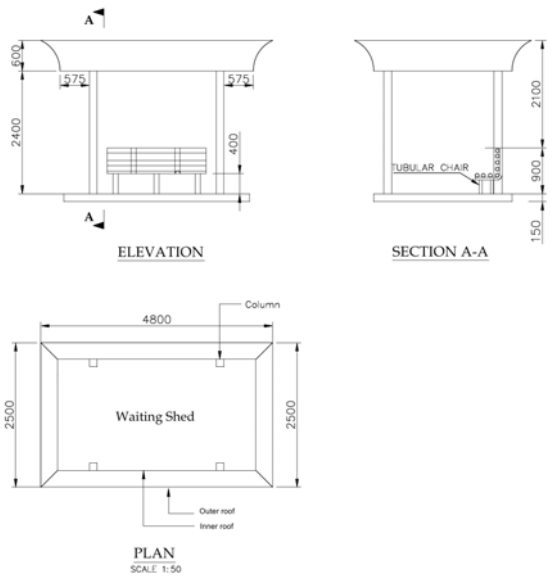


FIGURE 10.1. BUS WAITING SHED

10.3 PARKING SPACE OR BAYS

10.3.1 AUTO RICKSHAW STAND

In Kerala, it was only recently that this has become an integral part of both rural and urban life. Both the number of auto rickshaws and the commuters are increasing. The latest trend indicates that people from all walks of life are using them for many purposes from simple shopping to travel to hospitals, schools etc even on a monthly contract basis. The nursery school children are regularly being taken and returned to houses on a contract basis. This shows the importance of auto rickshaws in everyday life. Design for autorikshaw parking area is provided in **FIGURE 10.2**.

Action required. There should be separate designated parking cum passenger picking-up space for auto-rickshaws in urban, semi-urban and village market areas as identified in the detailed inventory of project road is included in environmental data sheet as **Table 2.1** of the Part II EMP report**.** The project has adequate PWD land for developing in to parking areas. Land of the order of two cents (80 sq.m) minimum will be required for a safe parking area.There should be separate traffic regulations to keep everything in order for auto-rickshaw / operators including photo identity card and identity number.

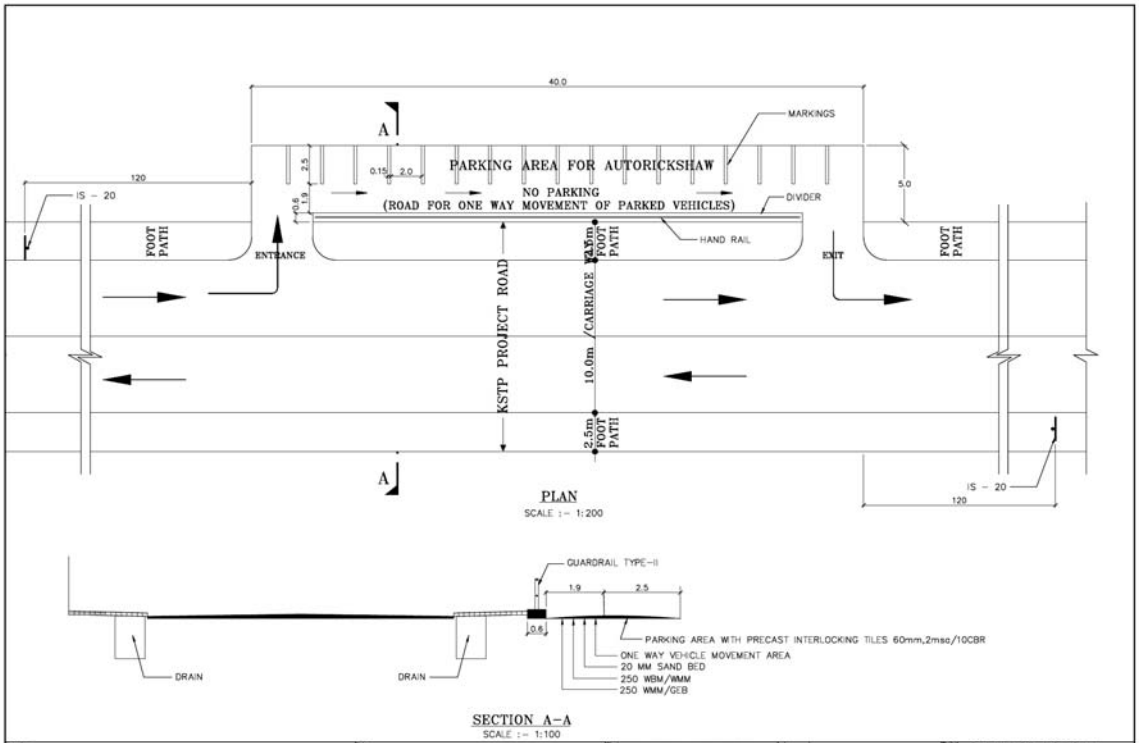


FIGURE 10.2. DESIGN FOR AUTORIKSHAW PARKING AREA

10.3.2 TAXI STAND FOR JEEPS AND CARS

There is sufficient land availability for the construction of various requirements. If the space is not a constraint, the jeep and taxi car parking areas should be constructed separately since the kind of users are different for these two vehicles. Normally, taxi cars carry tourists and official-level travellers whereas the jeeps are serving bulk travellers and mostly non-tourist passengers. The Resettlement Action Plan (RAP) has a provision to buy land for parking areas. The trucks should not be allowed to enter the towns during the peak traffic times. The local Municipal authorities need to provide alternative parking areas for truckers. **FIGURE 10.3** provides the design for taxi parking. There will be provision for separate parking space for these vehicles. The space required will be of the order of 50 cents (200 sq.m). This space should be secure and away from the existing available corridor. Raised footpaths will be required at these locations. The project will develop many of the existing parking areas especially that of Auto rickshaws.

10.3.3 ENHANCEMENT TO CULTURAL PROPERTIES

In addition to mitigation measures cultural properties located close to the project road will be improved by providing/constructing suitable enhancement measures.

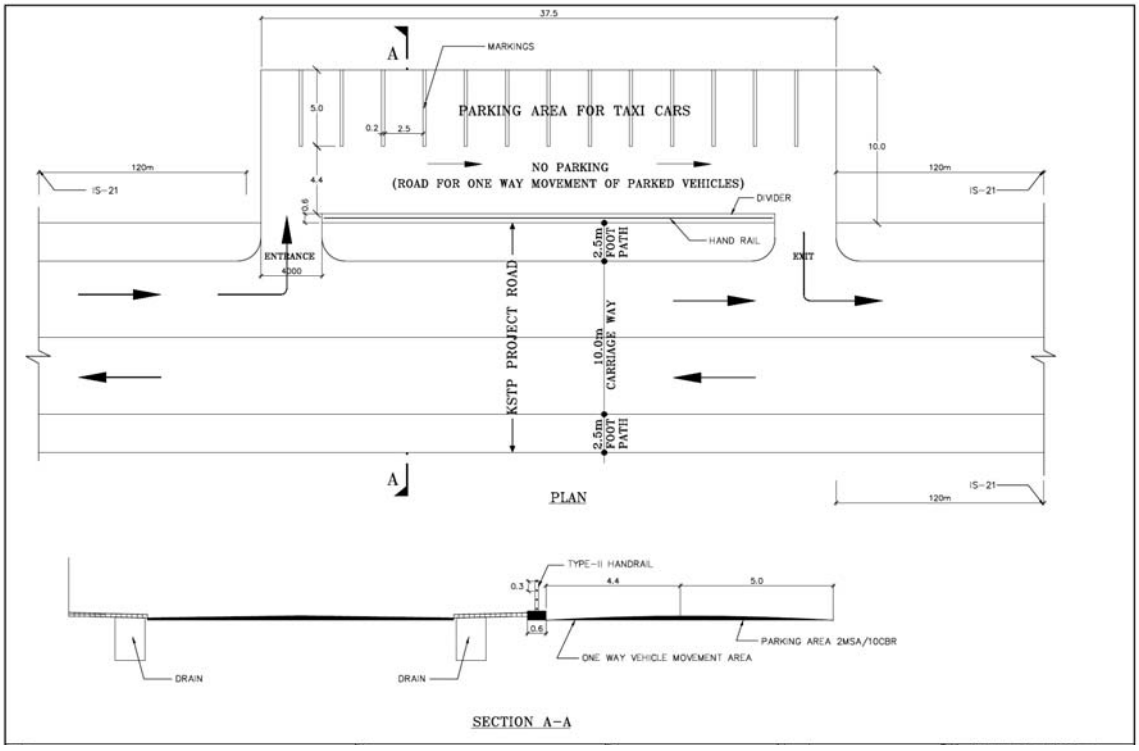


FIGURE 10.3. PROPOSED PARKING AREA DESIGN FOR TAXI (CAR / JEEP)

10.4 TREE PLANTING

10.4.1 ROADSIDE TREE PLANTING

The existing trees along the roadside should not be removed if they are not affecting the road safety of the location. There should not be any new trees planted too close to the roadsides, as it will affect the visibility of the vehicle drivers on the road. In urban and municipal areas the tree planting should be away from the existing available corridor. Detailed guidelines are provided in **Annexure 3.56** -.landscaping, tree planting and environmental enhancement plan for kerala state transport project (kerala specific policy for road side tree planting) in EMP.

Action required. The tree planting on the private land outside the ROW should be encouraged by various incentives. This will be the responsibility of local Municipal Authorities and the Forest Department who could possibly make young trees available for specific sites. This could be carried out through an awareness programme involving NGOs. A tree planting strategy has been developed for the Project which is given in **Annexure 3.56** of the EMP.

10.4.2 MANGROVE MANAGEMENT PROGRAMME

The Kerala State Transport Project (KSTP) as a part of its Environmental Enhancement Plan for the coastal CRZ roads has prepared a Mangrove Afforestation Plan as listed in **Annexure 3.62** of the EMP. The plan has been prepared in tune with the various GOK, GOI and WB requirements for the widening and improvement of the existing highways. Considering the three project roads under KSTP, the focus of this programme is restricted only to mangroves occurring in the two northernmost PIA districts of Kerala: Kasargod and Kannur.

10.5 TOURISM ENHANCEMENTS

10.5.1 DISPLAY OF TOURIST LEVEL INFORMATION

Kerala is a tourist area (popularly known as 'Gods own Country') and many travellers use the Kerala roads and enjoy the scenic beauty. The clear display of the name of tourist locations including name of rivers or back waters and the length and catchment areas would be a very positive step for encouraging tourism with investment from Tourism as well as PWD.

10.5.2 REST AREA

The rest area and oxbow land development proposal which was part of the original proposal as three types has been decided to be taken as a separate project by KSTP and now only type C development is the part of the current project. However, the basic details are given below.

10.5.2.1 TOURIST FACILITIES

Tourism promotion should include the provision of international standard (hygiene) restaurants, shopping centres and rest areas. There should be all weather restaurants with parking and shopping facilities. Kerala traditional art, culture, painting etc could be displayed here with a mini shopping centre.

There can be many arrangements, which shall be made to attract a wide variety of people with economic rates and hygienic conditions. This is considered in the development of rest areas. There are a number of ideal locations for such a venture in project roads.

10.5.2.2 REST AREAS

The location for tourist facilities can also be developed for toilet facilities especially for woman tourists and travellers. The availability of such facilities needs no advertisement as it will become popular within a very short period of time. There should be small restaurant and sitting facilities with adequate hygiene and drinking water availability. This can also be attached to the improvement of Puramboke land/oxbow land.

Type A - **O**xbow lands which are big enough to buid restaurants, comfort stations, parking facilities, lighting and sitting arrangements. The specifit nature of this will be decided by KSTP in consultation with other state departments and will be taken up as a separate activity.

Type B - This is more or less similar to Type A, but space availability is comparatively less than Type A.

Type C - At minor realignment locations, where the land to provide parking space for vehicles is scarce, only landscaping is provided to improve the aesthetics of the road and also with environmental considerations. This type of oxbow land is categorised as Type-C and the cost estimated for such type is around Rs. 2,00,000.

Annexures

Annexure 1.1. Roads Undertaken in Kerala State Transport Project - I

Sl. No.	Link No.	Road Name	Length km	Existing Average Carriageway (CW) Width (m)	Proposed CW Width (m) [1] (Total improvement is up to 15 m)
1	1	Taikkod-Kottarakkara	46.02	7.10	10
2	2	Kottarakkara-Adoor	20.85	6.70	7
3	3	Adoor-Chengannur	23.58	7.10	7
4	6	Muvattupuzha-Angamaly	31.40	7.33	10
5	40	Thrissur-Kuttipuram	33.08	6.76	10
6	50.1	Palakkad-Shornur	45.30	7.17	7
7	70	Muvattupuzha-Thodupuzha	17.83	5.51	7
8	72	Taikkod-NH47	12.60	4.20	10
9	73	Alappuzha-Changanaserry	24.14	7.00	7
Total			**254.80**		

[1] Refer proposed total improvement in Chapter 2

Annexure 2.1. Design Cross Sections of Kasargod – kanhangad road

There are ten typical design cross sections in Kasargod – Kanhangad road as shown below in FIGURE 2 to .11. These cross sections are

- **Type-1** Two Lane C/S at Urban Area with paved Footpath cum Hand Rail and Covered Drain **Type-2** Two-lane C/s at semi-urban Area with covered drain
- **Type-3** Two-lane C/s at Rural Area with Earthen Drain
- **Type-4** Two-lane C/s with paved Footpath cum Hand Rail and Covered Drain on LHS and earthen drain on RHS
- **Type 5** Two-lane C/s with paved Footpath cum Hand Rail and Covered Drain on RHS and earthen drain on LHS
- **Type-6** Two-lane C/s at covered drain on LHS and earthen drain on RHS
- **Type 7** Two-lane C/s at covered drain on RHS and earthen drain on LHS
- **Type 8** Two-lane C/s at ROB Approach with RoW 11m
- **Type 9** Four-lane C/s at Rural area With center median and paved footpath with Covered Drain on Both sides
- **Type-0** Typical proposal scheme adopted for T-Beam superstructure (new construction/reconstruction

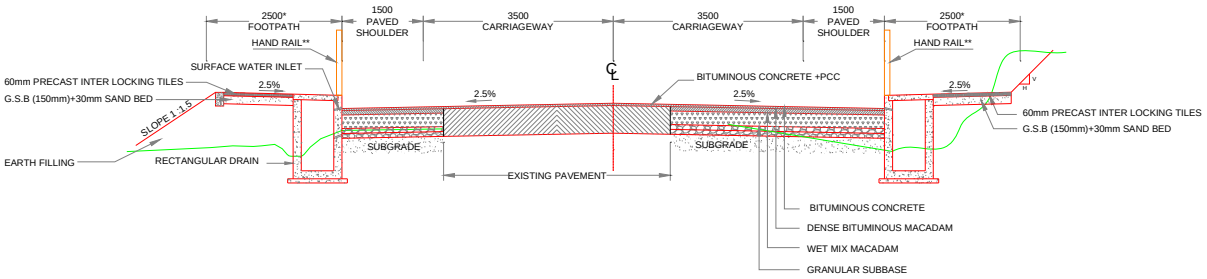


FIGURE 2. TYPICAL CROSS SECTION- TYPE-1

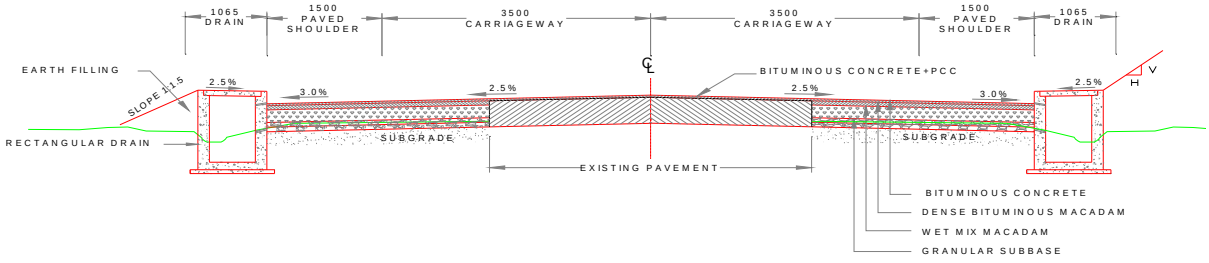


FIGURE 3. TYPICAL CROSS SECTION- TYPE-2

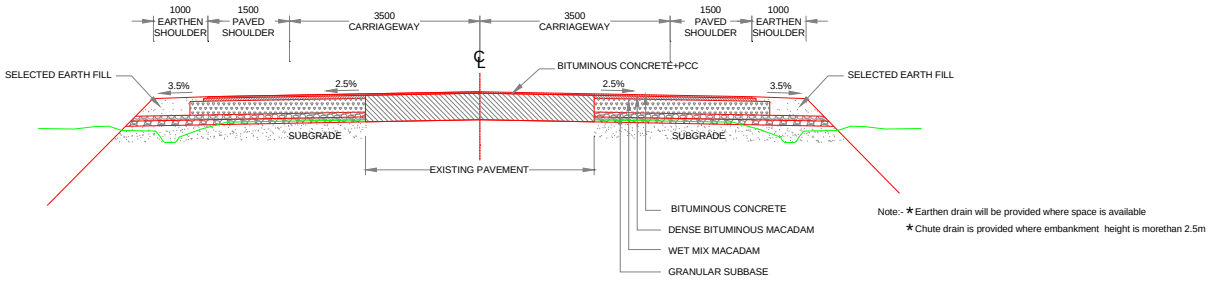


FIGURE 4. TYPICAL CROSS SECTION- TYPE-3

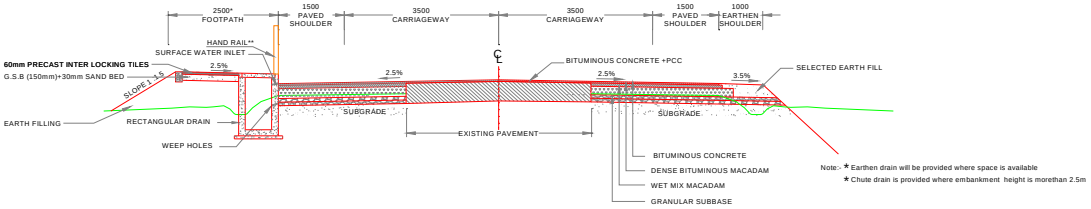


FIGURE 5. TYPICAL CROSS SECTION- TYPE-4

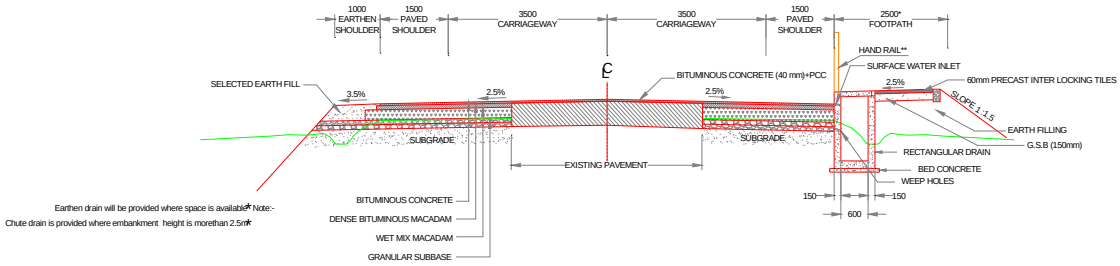


FIGURE 6. TYPICAL CROSS SECTION- TYPE-5

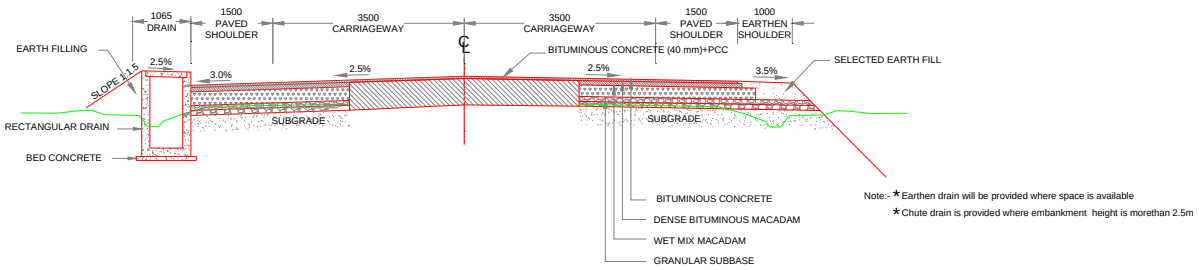


FIGURE 7. TYPICAL CROSS SECTION- TYPE-6

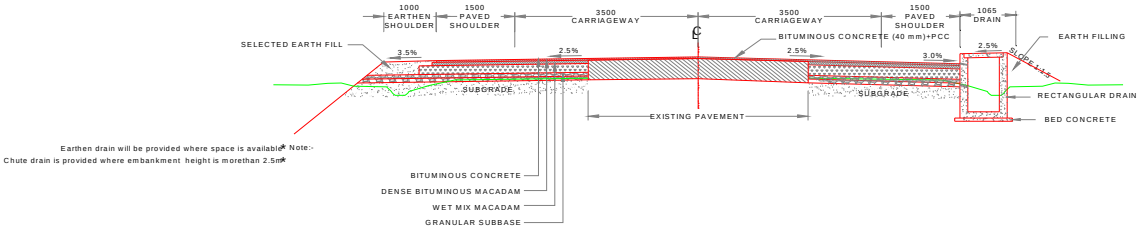


FIGURE 8. TYPICAL CROSS SECTION- TYPE-7

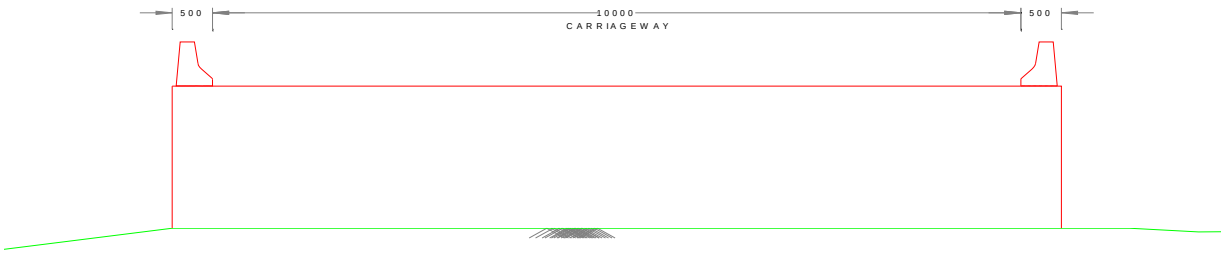


FIGURE 9 TYPICAL CROSS SECTION- TYPE-8

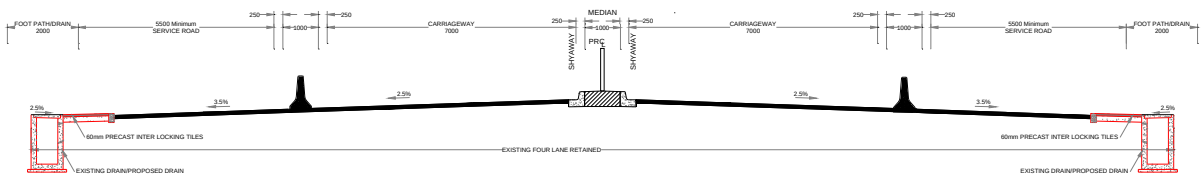


FIGURE 10 TYPICAL CROSS SECTION- TYPE-9

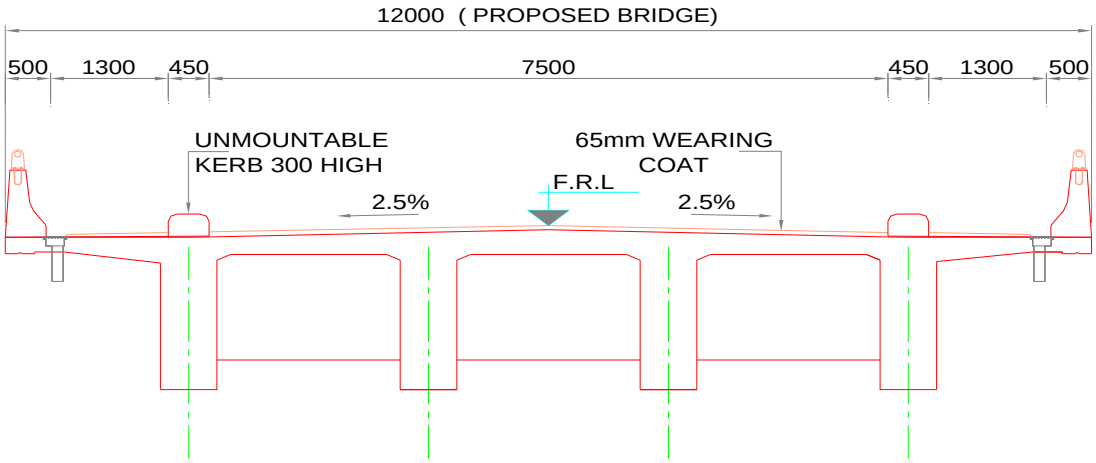


FIGURE 11 TYPICAL CROSS SECTION- TYPE-0

TABLE 1. DESIGN CROSS SECTIONS APPLIED ALONG THE CORRIDOR 69

Chainage in km		TCS Type	Length (m)
From	To		
0+000	0+120	Type 1	120
0+120	0+130	Type 7	10
0+130	0+180	Type 2	50
0+180	0+250	Type 7	70
0+250	0+500	Type 6	250
0+500	0+730	Type 3	230
0+730	0+916	Type 0	186
0+916	1+080	Type 2	164
1+080	1+410	Type 7	330
1+410	1+502	Type 2	92
1+502	1+600	Type 6	98
1+600	2+600	Type 3	1000
2+600	2+612	Type 0	12
2+612	2+750	Type 3	138
2+750	3+000	Type 2	250
3+000	3+277	Type 7	277
3+277	3+327	Type 8	50
3+327	3+457	Type 0	130
3+457	3+517	Type 8	60
3+517	3+850	Type 2	333
3+850	4+500	Type 3	650
4+500	5+100	Type 2	600
5+100	6495	Type 3	1395
6+495	6+520	Type 0	25
6+520	7+735	Type 3	1215

Chainage in km		TCS Type	Length (m)
From	To		
11+600	13+090	Type 3	1490
13+090	13+154	Type 0	64
13+154	13+600	Type 3	446
13+600	13+850	Type 1	250
13+850	14+100	Type 2	250
14+100	14+370	Type 9	270
14+370	14+477	Type 2	107
14+477	14+554	Type 2	77
14+554	14+590	Type 2	36
14+590	15+010	Type 0	420
15+010	15+300	Type 2	290
15+300	15+600	Type 1	300
15+600	17+000	Type 3	1400
17+000	17+200	Type 2	200
17+200	17+300	Type 7	100
17+300	18+200	Type 3	900
18+200	18+360	Type 2	160
18+360	18+436	Type 0	76
18+436	19+300	Type 3	864
19+300	19+550	Type 6	250
19+550	21+000	Type 3	1450
21+000	21+040	Type 7	40
21+040	21+500	Type 2	460
21+500	22+400	Type 3	900
22+400	22+990	Type 2	590

Chainage in km		TCS Type	Length (m)
From	To		
7+735	7+758	Type 0	23
7+758	8+100	Type 3	342
8+100	8+590	Type 7	490
8+590	8+600	Type 2	10
8+600	8+880	Type 7	280
8+880	9+800	Type 3	920
9+800	10+300	Type 2	500
10+300	10+900	Type 1	600
10+900	11+580	Type 2	680
11+580	11+600	Type 6	20

Chainage in km		TCS Type	Length (m)
From	To		
22+990	23+140	Type 7	150
23+140	23+195	Type 2	55
23+195	24+980	Type 9	1785
24+980	25+240	Type 2	260
25+240	25+460	Type 7	220
25+460	25+570	Type 2	110
25+570	25+664	Type 6	94
25+664	25+870	Type 2	206
25+870	26+040	Type 7	170
26+040	26+070	Type 2	30

Annexure 2.2. Design Cross Sections of Pilathara – Pappinisseri Road

There are thirteen typical design cross sections as shown below in FIGURE 12 to 22. These cross sections are

- **Type-1** Two-lane C/s at Urban Area with paved footpath and covered drain(**Hand Rails Provided at Major Junctions)
- **Type-2** Two-lane C/s at Urban Area with covered drain
- **Type-3** Two-lane C/s at Rural Area with Earthen Drain
- **Type-4** Two-lane C/s at with paved Footpath cum Hand Rail and Covered Drain on LHS and earthen drain on RHS
- **Type 5** Two-lane C/s at with paved Footpath cum Hand Rail and Covered Drain on RHS and earthen drain on LHS
- **Type-6** Two-lane C/s at covered drain on LHS and earthen drain on RHS
- **Type 7** Two-lane C/s at covered drain on RHS and earthen drain on LHS
- **Type 8** Two-lane C/s at elevated stretch at ROB locations
- **Type 9** Two-lane C /s at ROB Approach
- **Type-10** Two-lane C/s at approaches ROW 17m from km 19+603 to km 19+698 and from km 20+195 to km 20+305
- **Type-11** Two-lane C/s at RoB viaduct structure stretch RoW 18m
- **Type-12** Two-lane C/s at RoB approaches RoW 19.5m
- **Type-0** Typical proposal scheme adopted for T-Beam superstructure (new construction/reconstruction

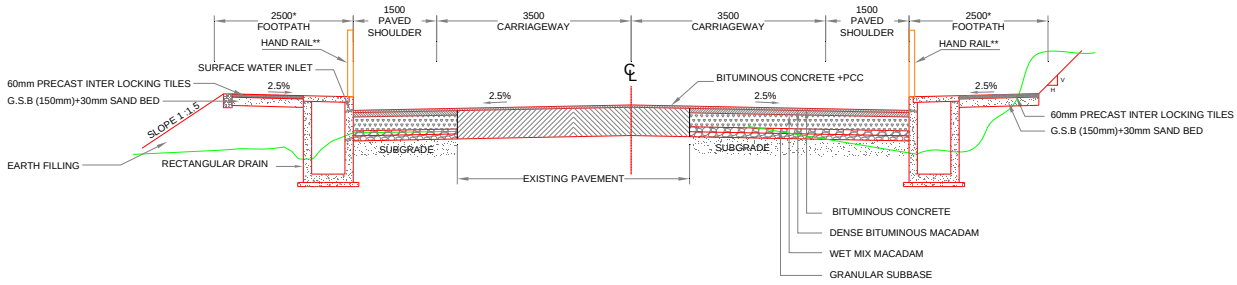


FIGURE 12. TYPICAL CROSS SECTION- TYPE-1

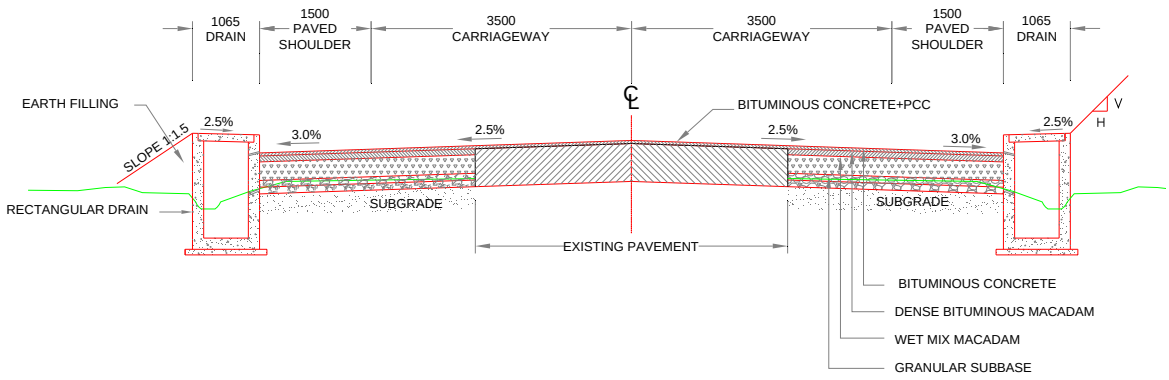


FIGURE 13. TYPICAL CROSS SECTION- TYPE-2

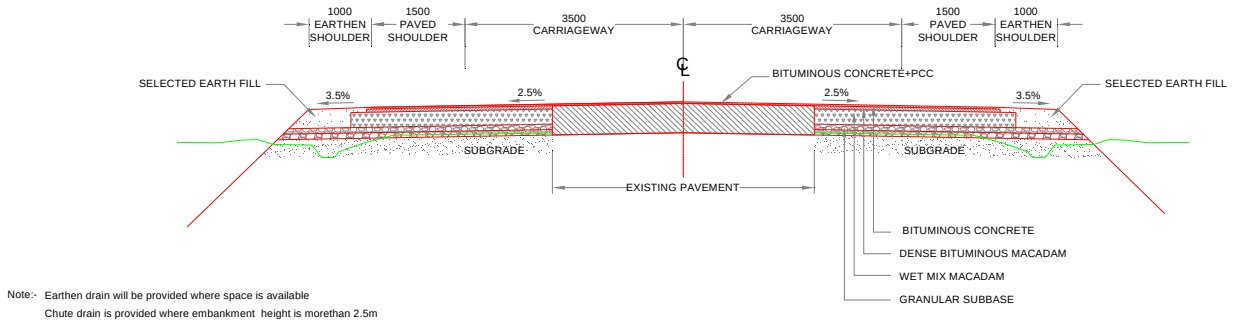


FIGURE 14. TYPICAL CROSS SECTION- TYPE-3

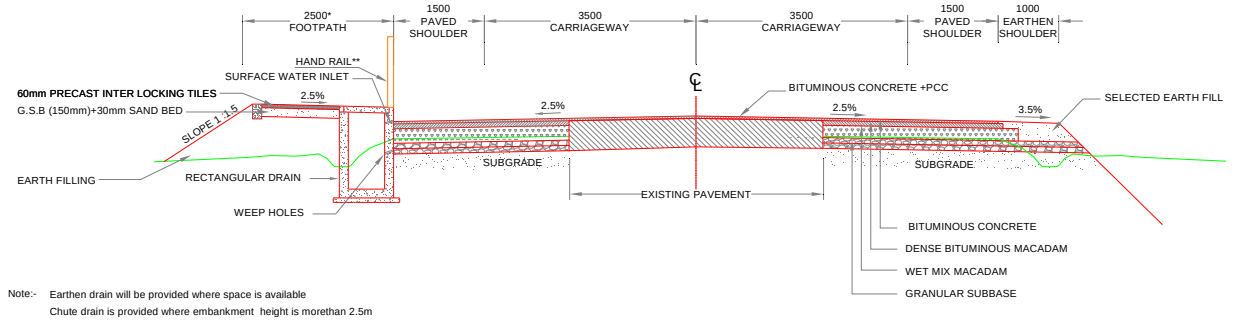


FIGURE 15. TYPICAL CROSS SECTION- TYPE-4

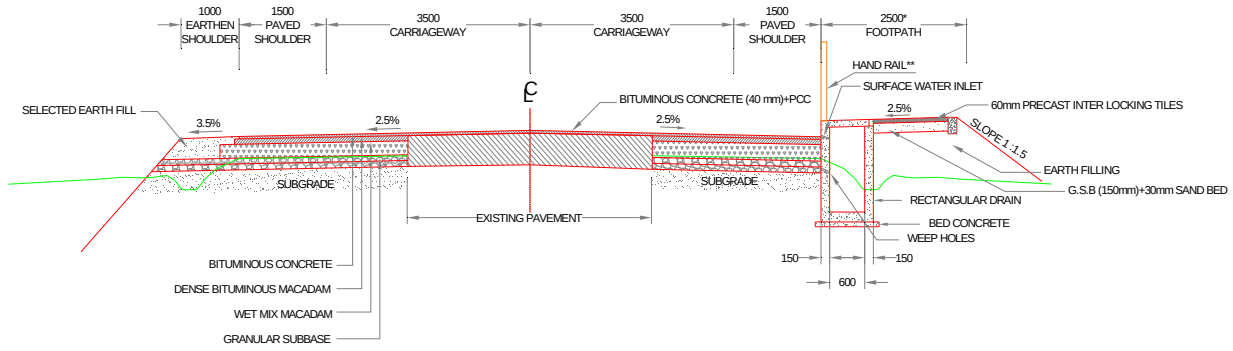


FIGURE 16. TYPICAL CROSS SECTION- TYPE-5

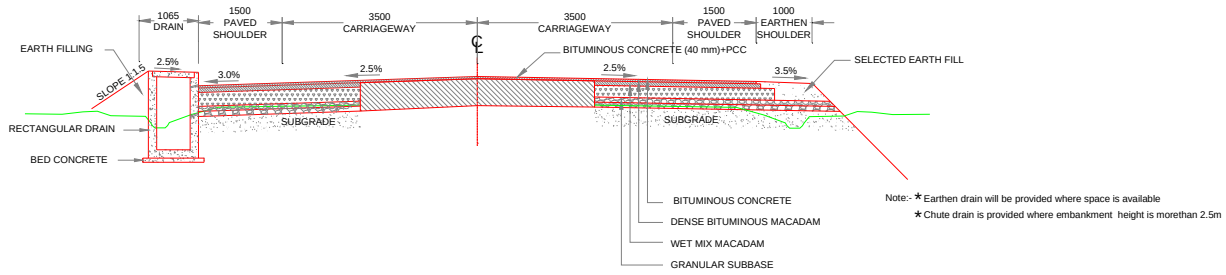


FIGURE 17. TYPICAL CROSS SECTION- TYPE-6

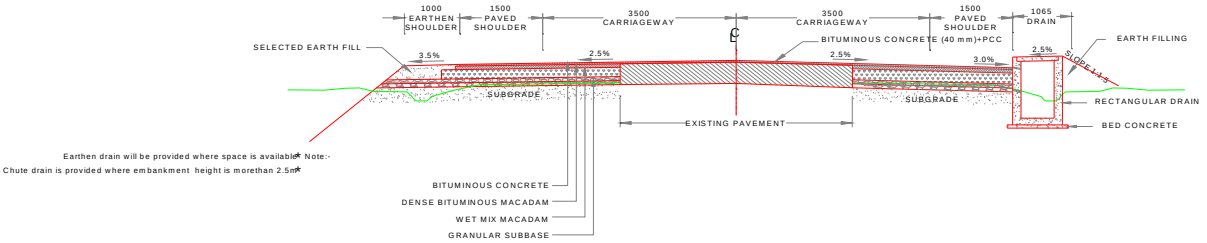


FIGURE 18. TYPICAL CROSS SECTION- TYPE-7

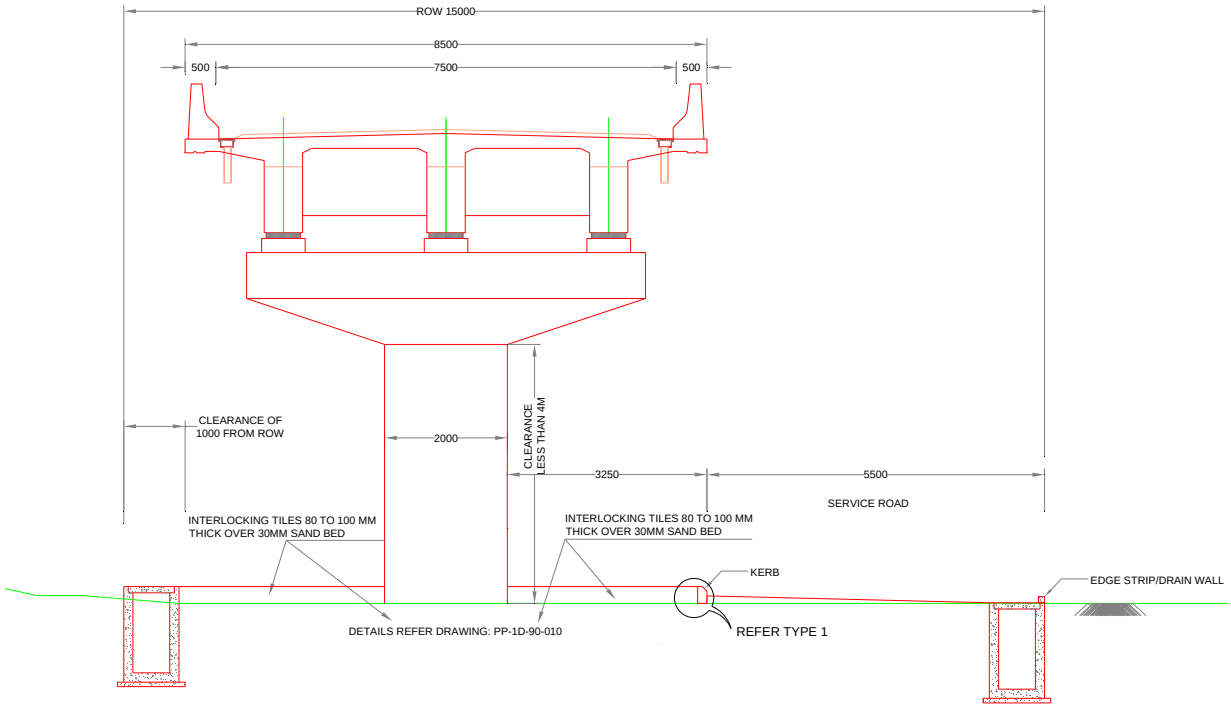


FIGURE 19. TYPICAL CROSS SECTION- TYPE-8

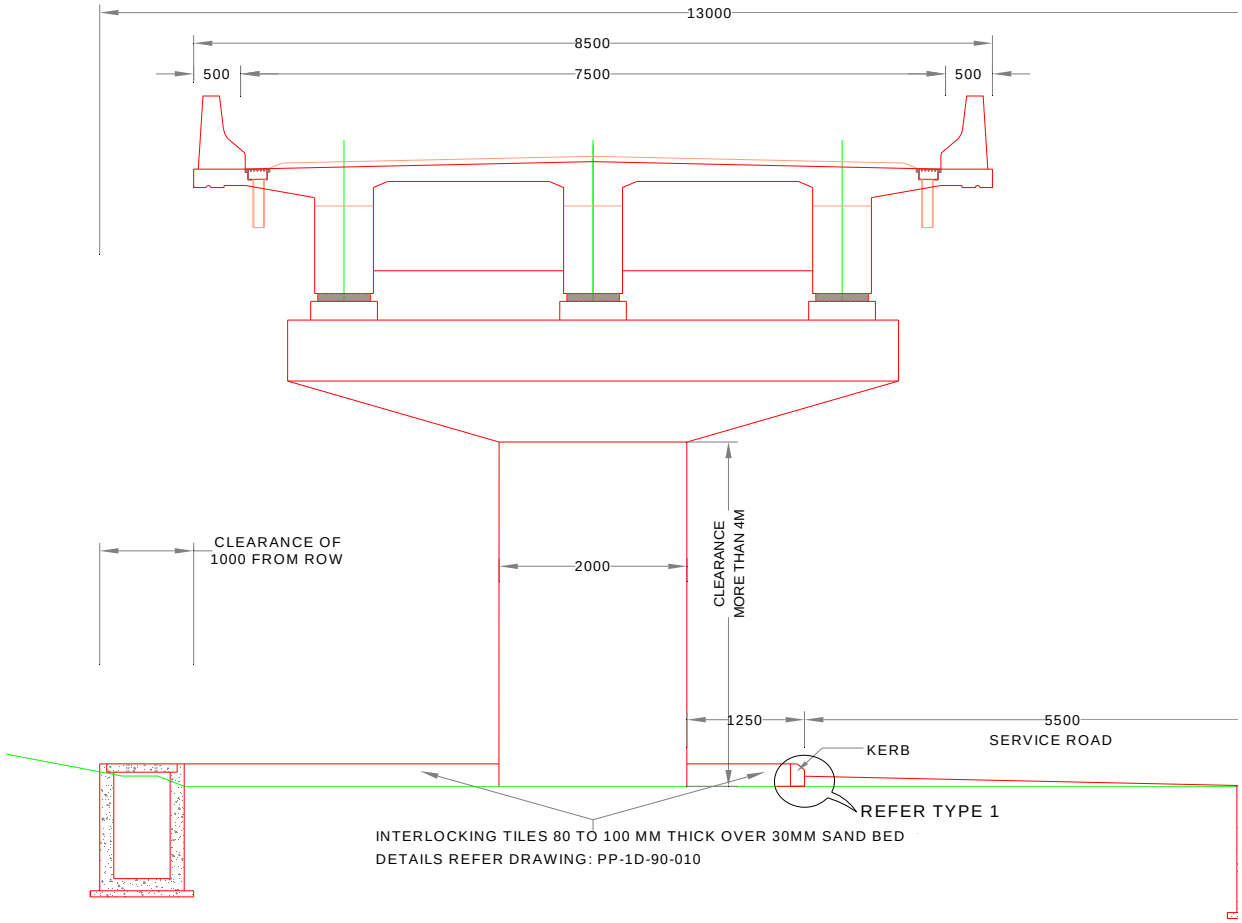


FIGURE 20. TYPICAL CROSS SECTION- TYPE-9

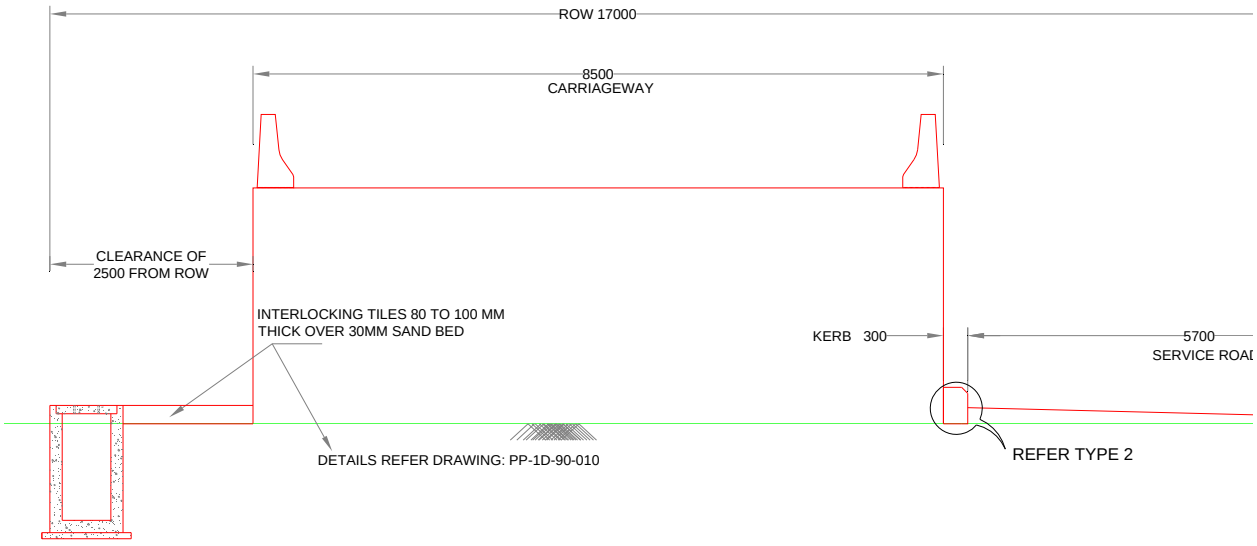


FIGURE 21. TYPICAL CROSS SECTION- TYPE-10

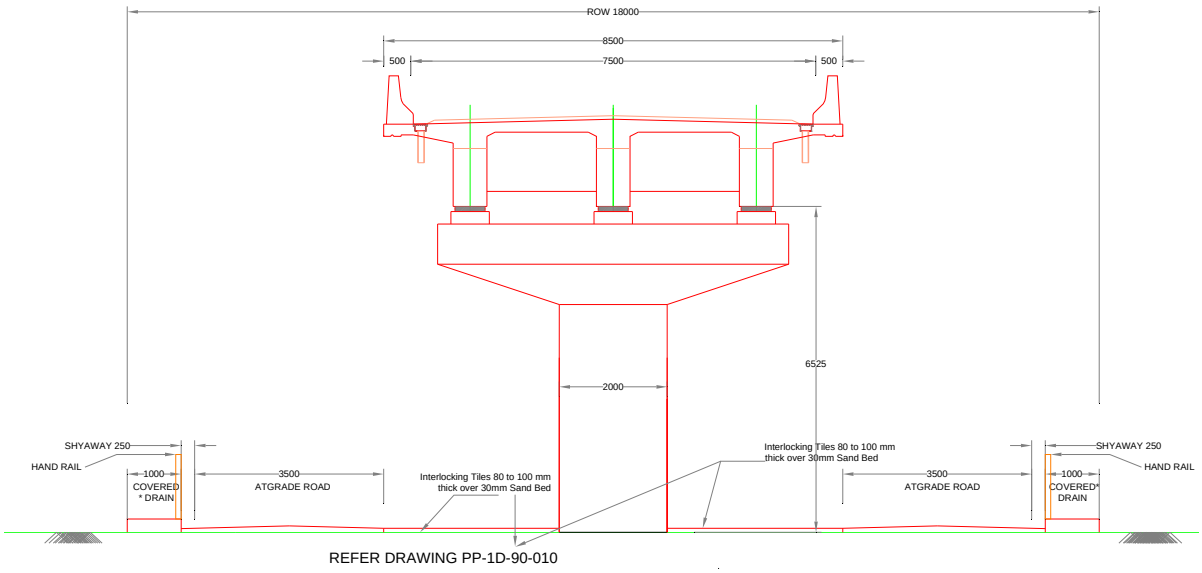


FIGURE 22. TYPICAL CROSS SECTION- TYPE-11

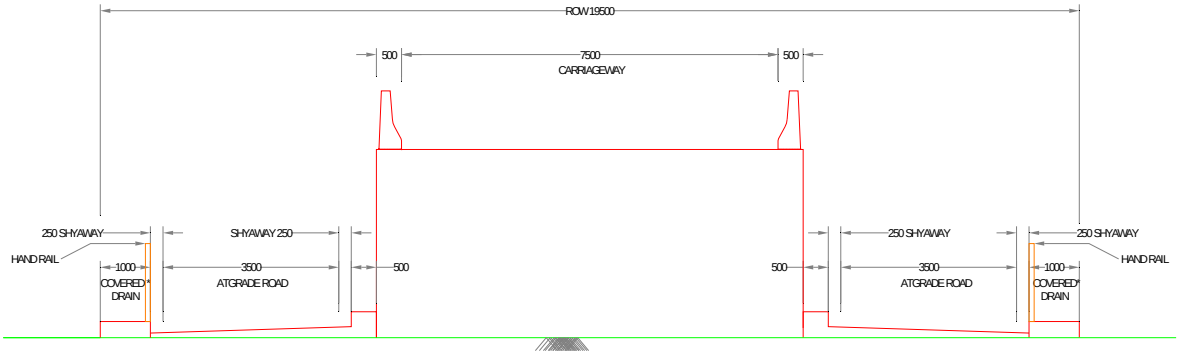


FIGURE 23. TYPICAL CROSS SECTION- TYPE-12

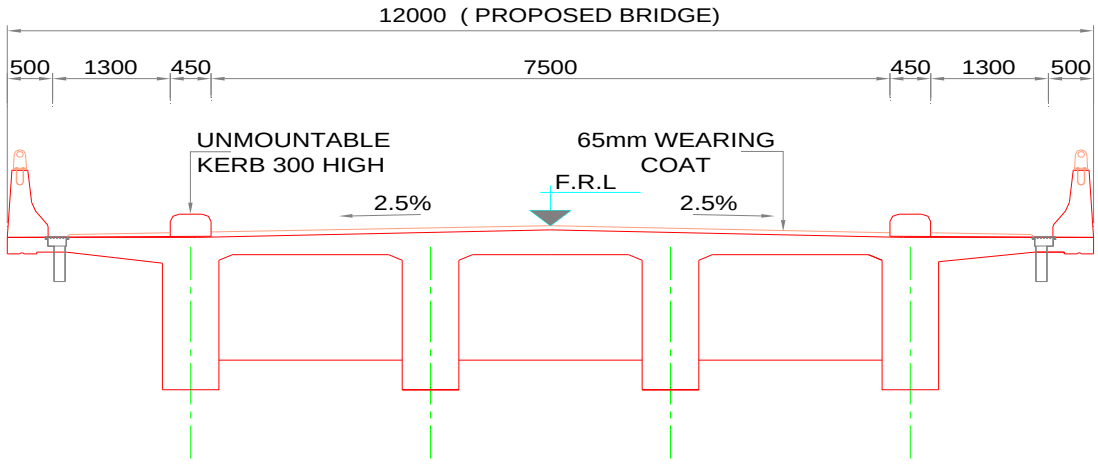


FIGURE 24. TYPICAL CROSS SECTION- TYPE-0

TABLE 2 DESIGN CROSS SECTIONS APPLIED ALONG THE CORRIDOR 68

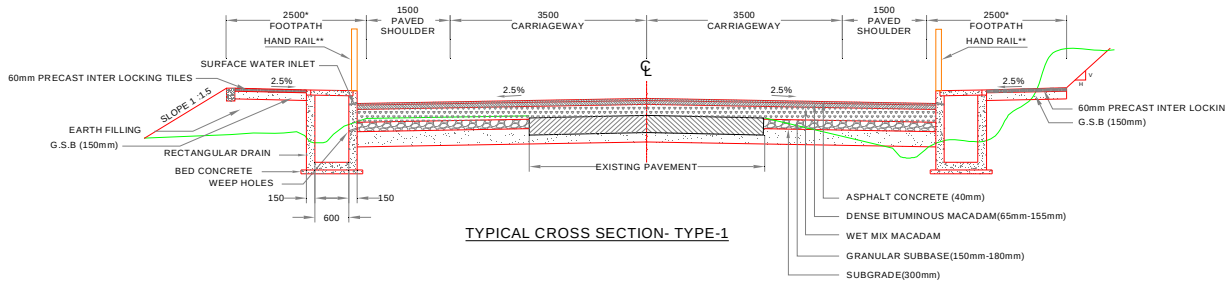
Sl No	Chainage (km)		TCS Type
	From	To	
1	0+000	0+200	Type 3
2	0+200	1+100	Type 3
3	1+100	1+420	Type 1
4	1+420	1+890	Type 5
5	1+890	2+400	Type 1
6	2+400	2+800	Type 2
7	2+800	2+950	Type 3
8	2+950	3+100	Type 1
9	3+100	3+350	Type 3
10	3+350	3+600	Type 6
11	3+600	4+150	Type 3
12	4+150	4+250	Type 0
13	4+250	5+500	Type 3
14	5+500	6+200	Type 1
15	6+200	6+500	Type 2
16	6+500	6+815	Type 1
17	6+815	7+010	Type 0
18	7+010	7+088	Type 3
19	7+088	7+358	Type 12
20	7+358	7+401	Type 11
21	7+401	7+438	Type 0
22	7+438	7+481	Type 11

Sl No	Chainage (km)		TCS Type
	From	To	
23	7+481	7+820	Type 12
24	7+820	10+900	Type 3
25	10+900	11+700	Type 2
26	11+700	11+900	Type 6
27	11+900	12+675	Type 2
28	12+675	14+929	Type 1
29	14+929	14+960	Type 0
30	14+960	15+800	Type 2
31	15+800	16+700	Type 3
32	16+700	17+000	Type 2
33	17+000	17+700	Type 3
34	17+700	18+100	Type 2
35	18+100	19+150	Type 5
36	19+150	19+500	Type 2
37	19+500	19+603	Type 1
38	19+603	19+698	Type 10
39	19+698	19+797	Type 8
40	19+797	20+034	Type 9
41	20+034	20195	Type 8
42	20+195	20305	Type 10
43	20+305	20+900	Type 1

Annexure 2.3. Design Cross Sections of Thalaserry - Valavupara Road

There are thirteen typical design cross sections as shown below in FIGURE 2.27 to 2.39. These cross sections are

- **Type-1** Two Lane C/S at Urban Area with paved Footpath cum Hand Rail and Covered Drain
- **Type-2** Two-lane C/s at semi-urban Area with covered drain
- **Type-3** Two-lane C/s at Rural Area with Earthen Drain
- **Type 4** Two-lane C/s with paved Footpath cum Hand Rail and Covered Drain on LHS and earthen drain on RHS
- **Type 5** Two-lane C/s with paved Footpath cum Hand Rail and Covered Drain on RHS and earthen drain on LHS
- **Type-6** Two-lane C/s at covered drain on LHS and earthen drain on RHS
- **Type 7** Two-lane C/s at covered drain on RHS and earthen drain on LHS
- **Type 8** Existing Four lane C/s at urban Area with paved Footpath cum Hand Rail and Covered Drain
- **Type-0** Typical proposal scheme adopted for T-Beam superstructure (new construction/reconstruction



TYPICAL CROSS SECTION- TYPE-1

FIGURE 25 TYPICAL CROSS SECTION- TYPE-1

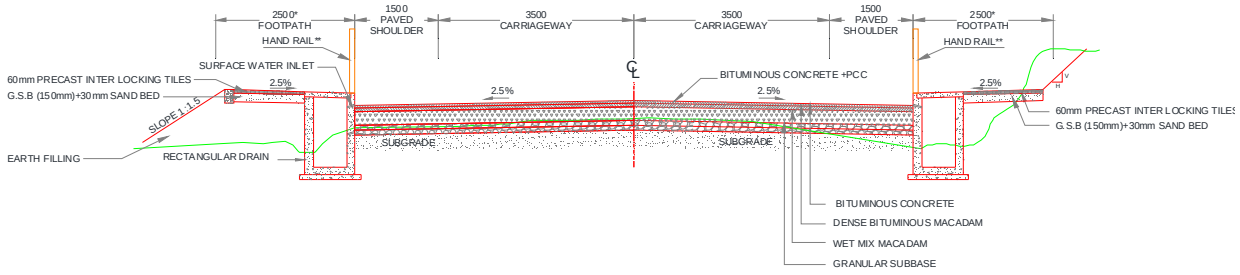


FIGURE 26. TYPICAL CROSS SECTION- TYPE-1A

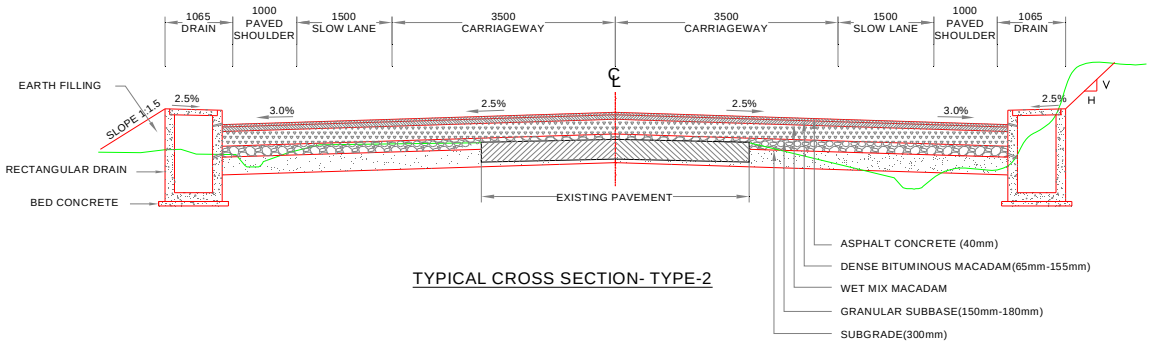


FIGURE 27. TYPICAL CROSS SECTION- TYPE-2

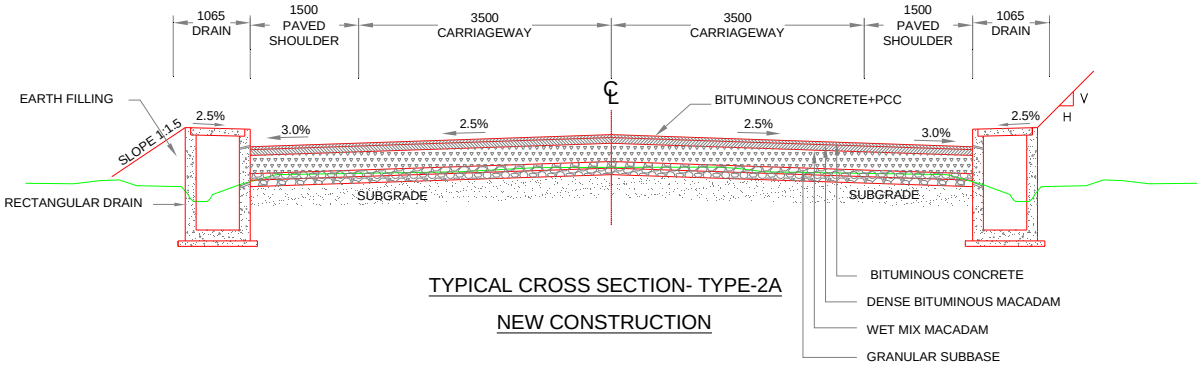


FIGURE 28. TYPICAL CROSS SECTION- TYPE-2A

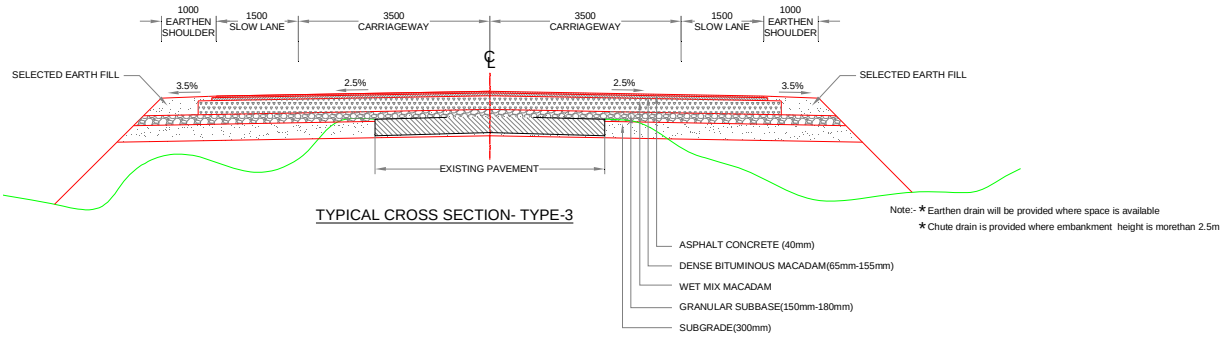


FIGURE 29. TYPICAL CROSS SECTION- TYPE-3

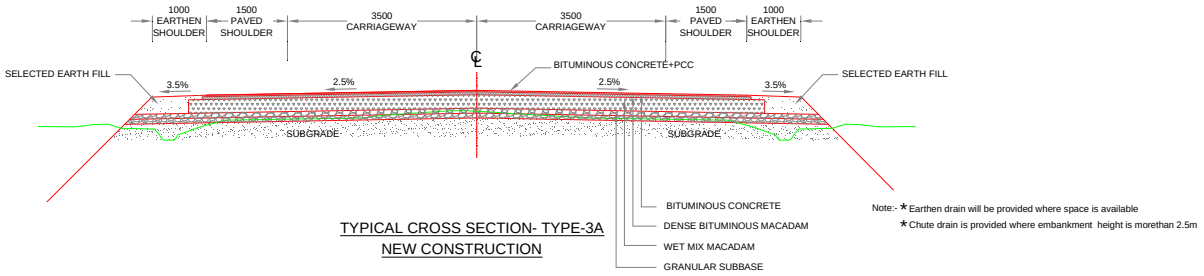


FIGURE 30. TYPICAL CROSS SECTION- TYPE-3A

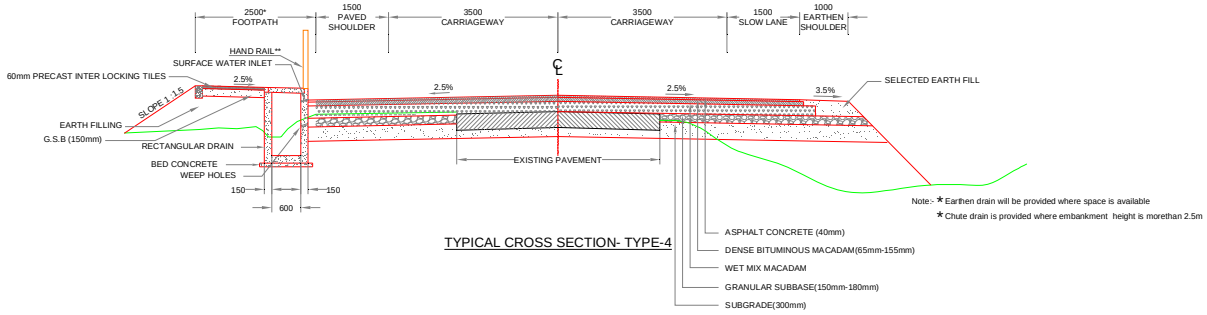


FIGURE 31. TYPICAL CROSS SECTION- TYPE-4

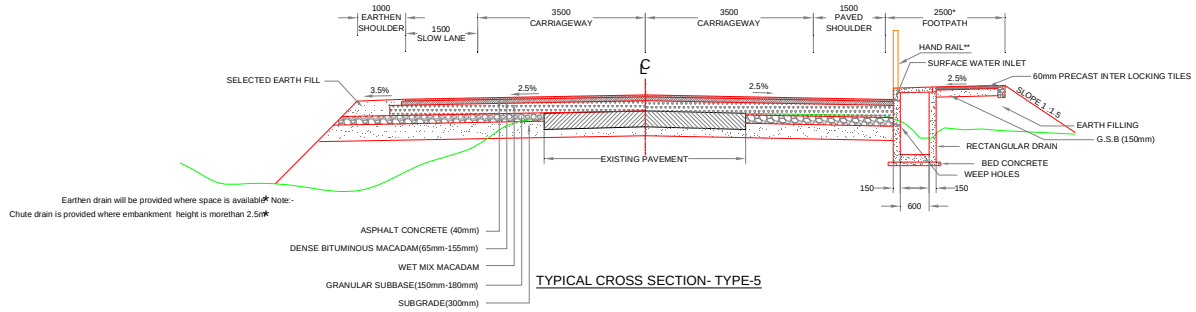


FIGURE 32. TYPICAL CROSS SECTION- TYPE-5

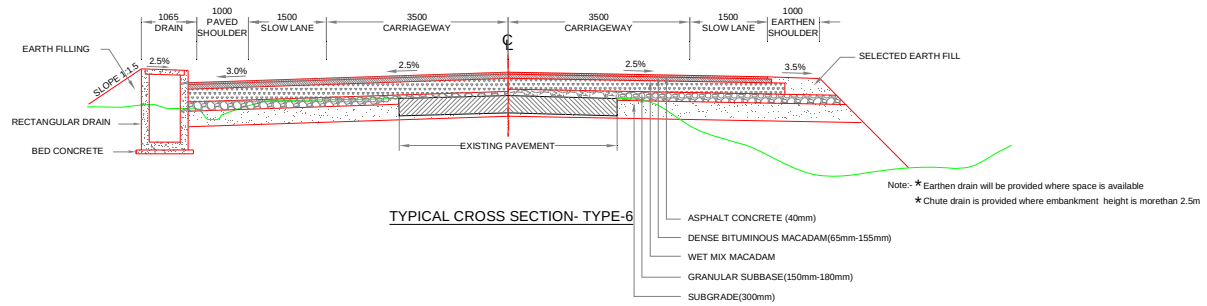


FIGURE 33. TYPICAL CROSS SECTION- TYPE-6

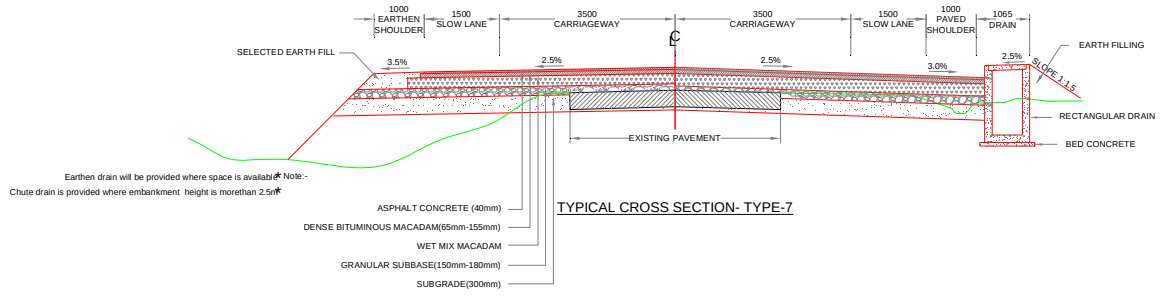


FIGURE 34. TYPICAL CROSS SECTION- TYPE-7

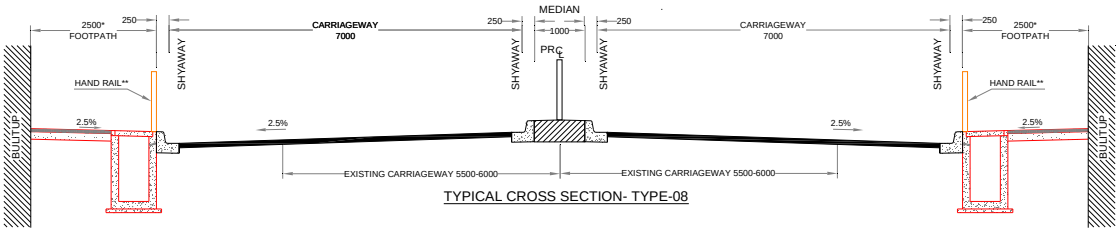


FIGURE 35. TYPICAL CROSS SECTION- TYPE-8***

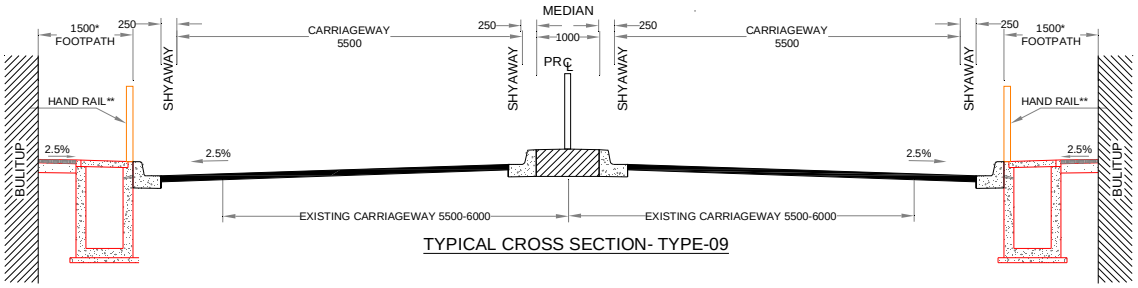


FIGURE 36. TYPICAL CROSS SECTION- TYPE-9

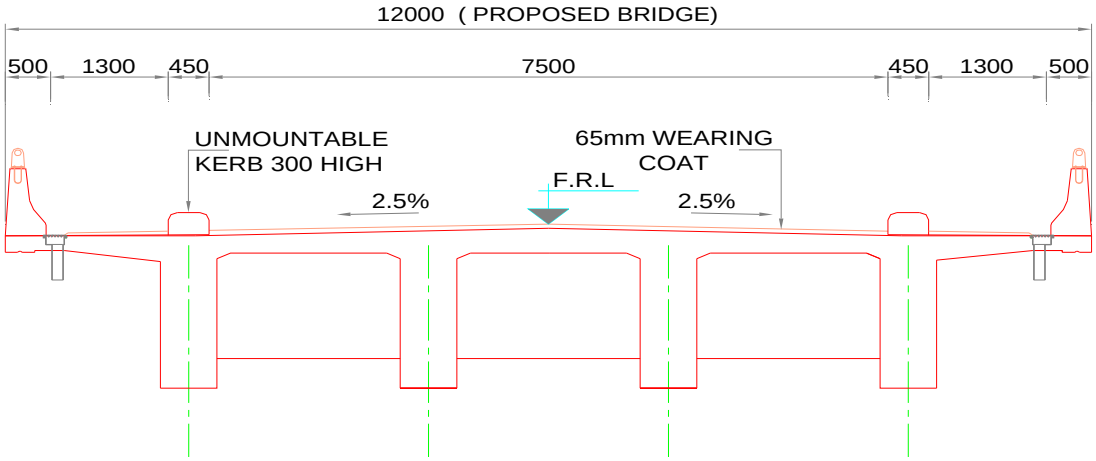


FIGURE 37. TYPICAL CROSS SECTION- TYPE-0

***Varies During Construction**

**** Hand Rails provide at Major Intersections**

*****Parking area available is enhanced and retained with physical barrier of mountable kerbs**

TABLE 3. DESIGN CROSS SECTIONS APPLIED ALONG THE CORRIDOR 74

Sl.	Chainage (km)	TCS

Sl. No.	Chainage (km)	TCS

	From	To	
1	1+200	2+880	Type 1
2	2+880	2+945	Type 0
3	2+945	3+100	Type 1
4	3+100	3+400	Type 2
5	3+400	3+660	Type 1
6	3+660	3+900	Type 2
7	3+900	4+250	Type 1
8	4+250	4+500	Type 2
9	4+500	6+570	Type 1
10	6+570	6+640	Type 2
11	6+640	7+000	Type 2A
12	7+000	8+250	Type 1
13	8+250	8+500	Type 2
14	8+500	9+000	Type 1
15	9+000	9+540	Type 2
16	9+540	9+700	Type 1
17	9+700	10+700	Type 2
18	10+700	11+145	Type 1
19	11+145	11+700	Type 2
20	11+700	11+960	Type 1
21	11+960	12+520	Type 9
22	12+520	12+640	Type 2
23	12+640	13+000	Type 9
24	13+000	15+105	Type 1
25	15+105	15+360	Type 9
26	15+360	15+750	Type 1
27	15+750	16+260	Type 2
28	16+260	16+420	Type 2A
29	16+420	16+600	Type 2
30	16+600	17+400	Type 8
31	17+400	18+200	Type 1
32	18+200	18+375	Type 5
33	18+375	18+600	Type 3
34	18+600	18+880	Type 1
35	18+880	19+080	Type 2
36	19+080	19+470	Type 1
37	19+470	19+500	Type 3
38	19+500	19+550	Type 6
39	19+550	19+600	Type 3
40	19+600	19+743	Type 3A
41	19+743	19+806	Type 0
42	19+806	19+900	Type 3A
43	19+900	20+316	Type 3
44	20+316	20+839	Type 1
45	20+839	20+880	Type 2
46	20+880	21+000	Type 2A
47	21+000	21+165	Type 2

	From	To	
61	23+970	24+500	Type 1
62	24+500	26+402	Type 2
63	26+402	29+320	Type 1
64	29+320	29+650	Type 2A
65	29+650	29+827	Type 3
66	29+827	32+396	Type 1
67	32+396	32+850	Type 3
68	32+850	33+030	Type 3A
69	33+030	33+140	Type 2
70	33+140	33+300	Type 2A
71	33+300	34+900	Type 2
72	34+900	35+390	Type 3A
73	35+390	35+430	Type 0
74	35+430	35+480	Type 3A
75	35+480	36+027	Type 1
76	36+027	36+638	Type 2
77	36+638	37+077	Type 6
78	37+077	37+177	Type 2
79	37+177	37+567	Type 3
80	37+567	37+970	Type 1
81	37+970	38+500	Type 3A
82	38+500	38+640	Type 1
83	38+640	39+000	Type 2
84	39+000	39+870	Type 3A
85	39+870	39+900	Type 3
86	39+900	41+630	Type 1
87	41+630	42+100	Type 9
88	42+100	42+270	Type 0
89	42+270	42+560	Type 3A
90	42+560	42+920	Type 2
91	42+920	43+140	Type 2A
92	43+140	43+900	Type 2
93	43+900	44+170	Type 2A
94	44+170	44+395	Type 1
95	44+395	44+430	Type 3
96	44+430	44+610	Type 3A
97	44+610	44+750	Type 3
98	44+750	44+880	Type 1
99	44+880	45+000	Type 3
100	45+000	45+160	Type 3A
101	45+160	45+300	Type 2
102	45+300	45+530	Type 3
103	45+530	46+020	Type 3A
104	46+020	46+100	Type 3
105	46+100	47+000	Type 3A
106	47+000	47+908	Type 3
107	47+908	48+350	Type 1

Sl. No.	Chainage (km)		TCS Type
	From	To	
48	21+165	21+183	Type 0
49	21+183	21+250	Type 7
50	21+250	21+350	Type 1
51	21+350	21+520	Type 3A
52	21+520	21+580	Type 3
53	21+580	21+800	Type 3A
54	21+800	21+920	Type 2
55	21+920	22+450	Type 3
56	22+450	23+000	Type 1
57	23+000	23+300	Type 2
58	23+300	23+500	Type 1
59	23+500	23+675	Type 2
60	23+675	23+970	Type 3

Sl. No.	Chainage (km)		TCS Type
	From	To	
108	48+350	48+540	Type 2
109	48+540	48+720	Type 2A
110	48+720	49+469	Type 1
111	49+469	49+670	Type 2
112	49+670	50+320	Type 3A
113	50+320	50+520	Type 3
114	50+520	51+600	Type 3A
115	51+600	51+900	Type 3
116	51+900	53+100	Type 3A
117	53+100	53+500	Type 2
118	53+500	53+620	Type 3A
119	53+620	54+000	Type 3

Annexure 2.4. Codes of Practice of Indian Road Congress (IRC) in terms of Environment

Sl. No.	IRC Code	Description
1	IRC:34-2011	Recommendations for Road Construction in Areas Affected by Water Logging, Flooding and/or Salts Infestation (First Revision)
2	IRC:56-2011	Recommended Practices for Treatment of Embankment and Roadside Slopes for Erosion Control (First Revision)
3	IRC:90-2010	Guidelines of Selection, Operation and Maintenance of Bituminous Hot Mix Plant (First Revision)
4	IRC:103-1988	Guidelines for Pedestrian Facilities
5	IRC:104-1988	Guidelines for Environmental Impact Assessment of Highway Projects
6	IRC:SP:21-2009	Guidelines on Landscaping and Tree Plantation
7	IRC: SP: 42 – 1994	Guidelines on Road Drainage
8	IRC: SP: 44 – 1996	Highway Safety Code
9	IRC: SP: 48 – 1998	Hill Road Manual
10	IRC: SP: 88 - 2010	Road Safety Audit Manual

Annexure 3.1. Institutional Aspects of Environmental Management

1. GOI -INSTITUTIONAL SETTING FOR ENVIRONMENTAL ANALYSIS

1.1.1 MINISTRY OF ENVIRONMENT AND FOREST (MOEF)

The Ministry of Environment and Forests (MOEF) is the organisation responsible for environmental matters in India. exhibit 3.1 indicates the organisational structure of India's Environmental Management System. The current framework has evolved largely since the creation of the MOEF in 1985. Many States already had State Pollution Control Boards (SPCBs) located in the Departments of Public Health to perform functions as outlined in India's Water and Air Acts.

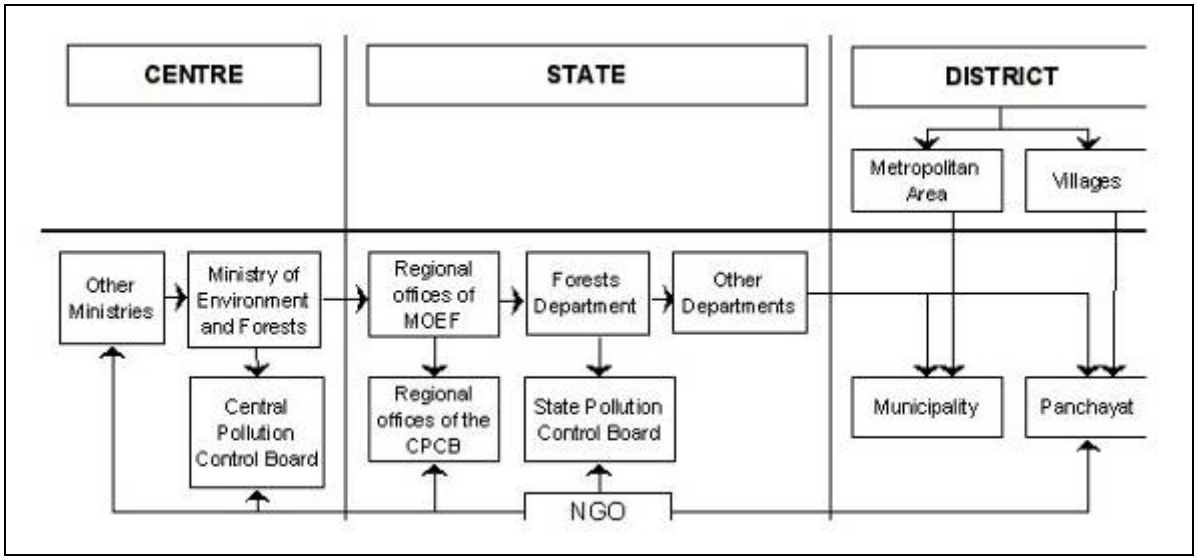


FIGURE 1 : GOI ENVIRONMENTAL MANAGEMENT ORGANISATION

Source: Adapted from World Bank Report T-6910-IN, December 3,1996

The MOEF is the agency primarily responsible for the review and approval of EIAs pursuant to GOI legislation. As a part of its EIA review procedures, MOEF requires the submission of an application, the EIA and accompanying Resettlement Action Plan (RAP) for review by an Environmental Appraisal Committee. Before approval can be granted, a No Objection Certificate (NOC) from the State Pollution Control Board (PCB) and State Forest Department (both discussed below) must also be obtained. A summary of applicable GOI policies and regulations are provided in chapter3.

1.1.2 CENTRAL POLLUTION CONTROL BOARD (CPCB)

The CPCB is a statutory authority attached to the MOEF and located in New Delhi. It was constituted in 1974 (and thus predates MOEF). Its major functions are to:

- Advise the Central Government with regard to water and air pollution matters;
- Plan and implement water and air pollution programmes;
- Co-ordinate activities of the State Pollution Control Boards;
- Organise popular air and water campaigns;
- Increase Public awareness;
- Compile air and water data and provide guidelines;
- Set air and water standards.

1.1.3 MOEF REGIONAL OFFICE

Kerala is located in the Southern Region (Bangalore MOEF office), which includes Kerala, Tamil Nadir and Karnataka. The Southern Region office is responsible for:

- Evaluation of proposals for diversion of forestlands;
- Assist in the preparation of the National Forestry Action Plan (NFAP);
- Assist Paryavaran Vahinis[2];
- Provide technical and scientific consultations on biological diversity;
- Monitoring of conditions following environmental clearance;
- Pursuing pollution control measures by industries and local bodies;
- Collecting and furnishing information in relation to Environmental Impact Assessment of projects, pollution control measures, methodology and status, legal and enforcement measures, environmental protection in special conservation areas such as wetlands, mangroves and biological reserves; and
- Co-ordination functions.

1.1.4 MUNICIPALITIES AND PANCHAYATH

Municipalities and panchayats are expected to play an increasing role in Environmental Management at the District level and States may delegate functions. Under certain amendments municipalities may be involved in:

- Urban and town planning;
- Water supplies;
- Solid waste management and sanitation;
- Urban forestry;
- Protection of the environment; and
- Promotion of the ecological aspects of urban development.

1.1.5 OTHER ENTITIES WITH ENVIRONMENTAL RESPONSIBILITIES

Other entities and their environmental tasks include the following.

Ministry of Agriculture **Prevention and control of desertification**
Conservation and regeneration of watersheds
Protection of irrigation command areas
Conservation and regeneration of forest
Prevention and control of pollution
Ministry of Water Resources Prevention and control of floods
Conservation and regeneration of wetlands
Conservation and regeneration of coral reefs
Protection of irrigation command areas
Monitoring water quality

Ministry of Rural Development **Conservation and management of land and soil**

2 Paryavaran Vahini Programme - an adjunct to the NEAC (National Environmental Awareness Campaign) launched in 1992/93 to involve community members in reporting and monitoring as well as awareness programmes.

Prevention and control of drought
Conservation and regeneration of forest
Prevention and control of pollution

Ministry of Power **Prevention and control of pollution**

Recycling of resources
Conservation and management of energy

Ministry of Petroleum **Protection of mining and oil extraction areas**

Recycling of resources
Prevention and control of pollution
Conservation and management of energy

Department of Ocean development **Conservation of coral reefs and coastal regions**

Conservation and relegation of island resources

Ministry of Urban Development Prevention and control of pollution

2. WORLD BANK PROCEDURAL AND REGULATORY REQUIREMENTS.

2.1.1 ENVIRONMENTAL IMPACTS-REQUIREMENTS

Environmental requirements of the World Bank are specified in detail in its Operational Policy (OP) 4.01 and other related OPs. In instances in which the procedural and regulatory requirements differ, the more stringent applies. The procedural and regulatory aspects of those requirements and those of the Ministry of Environment and Forests (MOEF), Ministry of Surface Transport (MOST) and the State Public Works Department (PWD) can be summarized as follows: The World Bank environmental requirements are based on a three-part classification system

Category A - requires a full Environmental Assessment (EA)
Category B - projects require a lesser level of environmental investigation.
Category C - projects require no environmental analysis

The Bank classifies the KSTP as Category A, largely it is understood, based on the large number of project-affected people and the biodiversity of Kerala. In other words, the Bank classification is based on the anticipated cumulative social and environmental impacts due to the construction and operation of the Project.

Further if sensitive areas are within the potentially affected environment of a project or sub-project (as in the case of Kasaragod -Kanhangad project road under discussion), if significant socio-economic impacts are anticipated or if otherwise warranted, Category A environmental documentation is required at the project-level. Clearance for the overall Programme is obtained, provided that:

- The SEA is found to conform to the cited guidelines. (Box 3.1)
- The SEA is accompanied or followed by detailed design and project-level environmental documentation when necessary and provides assurance that the environmental issues will be properly addressed in the subsequent phases of the Programme. And
- All other feasibility, design, mitigation plans and financial responsibility requirements are acceptable.

The World Bank determined that the KSTP required an SEA to "develop simple, standard and practical recommendations to be included in the design and construction of the project" including:

- Proper use of existing borrow areas and quarries;
- Landscaping of borrow areas and spoil tips;
- Development of proper storage areas specifically for diesel fuel and bitumen;
- Rehabilitation of the ROWs through replanting;
- Minimizing soil erosion;
- Protection, enhancement and proper management of sensitive habitats;
- Establishment of an Environmental Management Unit within the PWD.

BOX 3.1 Importance of Sectoral approach

In recognition of the needs of large, multi-year lending programmes likely to involve a number of projects or sub-projects such as the KSTP, the Bank's procedures also provide for the preparation of a Sectoral Environmental Assessment (SEA) as that term is defined by its OP 4.01- 07 dated October 1991. A SEA is designed to accommodate a number of circumstances, particularly *"the Bank's increasing use of programmatic, sector-oriented and time-slice investment programs (which) have served to build up a demand for a Sectoral EA approach*".[3]

Within this approach, the sections of road upgrading projects not involving significant additional ROW acquisition or affecting sensitive areas or large numbers of PAPs are generally considered Category B projects, provided that the potential environmental concerns are addressed within the SEA and that the mitigation actions incorporated in the SEA (if applicable) are implemented. The SEA can hasten environmental clearance of projects or sub-projects in that, they do not warrant such intensive investigation. It can therefore simplify and expedite the implementation process and reduce potential risks and uncertainties.

The required SEA for the Project has been formally submitted to the PIU together with all other Project documents. In addition to the documentation and commitments in the SEA, World Bank approval is also contingent upon the completion of detailed designs for 25 percent of the total Project, the securing of all necessary environmental approvals for these actions from MOEF and other GOI agencies and the completion of project-level EAs where warranted. There are six road links in the Phase II construction activities.

2.1.2 SOCIAL IMPACTS-REQUIREMENTS

The World Bank has set out certain mandatory social impact mitigation requirements for loan projects. The Operational Policy 4.30[4] describes the Bank's policy and procedures for projects that involve involuntary resettlement. *This policy aims to improve, or at a minimum, sustain the same standard of living of the people who will be displaced because of a development project.* The policy also requires that projects minimize the need for involuntary resettlement. Where displacement is unavoidable, resettlement plans should pay particular attention to the vulnerable groups. In addition, the World Bank has special guidelines for addressing impacts upon the indigenous communities due to infrastructure projects. This document specifically requires the project authorities to include consultation with and informed participation of the tribal population. However, the reconnaissance survey has indicated that there are no tribal habitations along the corridor.

[3] The World Bank Environmental Assessment Source book
[4] Involuntary Resettlement, The World Bank Operational Policy 4.30,June 1990

3. GOI AND GOK POLICIES, LEGAL AND ADMINISTRATIVE FRAME WORK

3.1.1 ENVIRONMENTAL REGULATIONS

Indian National Framework: The major elements of the Indian legal framework for environmental management are:

The Constitution - provides for the protection and improvement of the environment and states that it shall be the duty of every citizen of India to protect and improve the national environment, including forest, lakes, rivers, and wildlife and to have compassion for living creatures. Primary responsibility for administration and implementation of the GOI policy with respect to conservation, ecologically sustainable development and pollution control rests with the MOEF and 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 (29 of 1986) revised in 1997.

The following key legislations pertain: -

Water (Prevention and Control of Pollution) Act of 1974 and Cess Act of 1977. This act has resulted in the establishment of the central and State level pollution control boards whose responsibilities include managing water quality and effluent standards as well as monitoring water quality, prosecuting offenders and issuing licences for construction and operation of certain facilities in the industrial sector.

Air (Prevention and Control of Pollution) Act of 1981. The SPCB is empowered to set air quality standards and monitor and prosecute offenders under this act.

Environment (Protection) Act of 1986 - enacted in the wake of the Bhopal gas tragedy, the Act is an umbrella legislation that provides a framework for Central and State Authorities established under previous laws. It provides a single focus for the protection of the environment and sought to "plug" several loopholes.

Forest (Conservation) Act 1980 as amended. Under this law the PWD must obtain administrative approval from the Forest Department to clear over 20 hectares of designated forestland and in 1986 when the MOEF enacted the Environmental Protection Act, the entire linear stretches of road side plantations along the State highways were declared as protected forests (refer Box 3.2 for more details). According to this although the land is under the control of State Government, due to its protected Status, approval of Central, Regional or State Government for using the land for widening and rehabilitation must be granted.

At the State level, Government was empowered to declare reserves and protected forest and was also given the authority to acquire land for extension and preservation of forests. In December 1996, a Supreme Court judgement further defined the types of forests to be protected. Depending on the size of the tract to be cleared, clearances are required from the following levels of Government.

- If the forest exceeds 20 hectares then prior permission of Central Government is required.
- If the forest is between 5 to 20 hectares the regional Office of Chief conservator is empowered;
- If the forest is below or equal to five hectares the State Government may give permission; and,
- If the construction area is more than 40 % forest, permission to undertake any work is required from the Central Government, irrespective of the size of the area.

Box 3.2 Applicability of Forest conservation act to Roadside strip Plantations

The 18 February 1998 MOEF circular on linear plantations on roadsides, Canal and railway lines modified the applicability of provisions of Forest (Conservation) Act, 1980 to linear plantations. The new modification recognises that the spirit behind the Forest (Conservation) Act was conservation of natural forests and not strip plantations. In the case of the "notified to be protected" roadside plantations, the clearance may be given by the concerned regional office of the MOEF, irrespective of the area of plantation lost. While issuing the approval, in place of normal provisions for compensatory afforestation, the regional offices will stipulate a condition that for every tree removed at least two trees should be planted. If the concerned Regional office does not issue the decision within thirty days of the receipt of fully completed application, the project proponent may proceed with widening/expansion under intimation to the State Forest Department, and the MOEF.

In the case of Kerala, the entire State cover green vegetation and this makes the strip and linear plantations less significant for a development project like the KSTP.

Wildlife (Protection) Act of 1972. This Act has allowed the Government to establish a number of National Parks and Sanctuaries over the past 25 years. This Act prohibits an activity within National Park and Sanctuary areas.

The EA identifies National Park and Sanctuary areas within the project study area. The EA confirms that permission from the Chief Wildlife Warden will be sought for:

Undertaking activity in a National Park or Sanctuary area.; and labourers and contractors entering a National Park or Sanctuary area. Document identifies the extent of habitat destruction, including number of trees removed. The EA document describes mitigation measures to minimise habitat destruction.

Policy Statement on Abatement of Pollution of 1992. Affirmed the Government's intention to integrate environmental and economic aspects in development planning with an emphasis on the preventive aspects of pollution and the "polluter pays" principle.

The Public Liability Insurance Act of 1991. Under the heading of land use, the following are also noted to be of potential relevance to the Project:

- The Urban Land (Ceiling and Regulation) Act of 1976.
- The Model Regional and Town Planning and Development Law of 1985.
- Provisions in State Acts on Town and Country Planning.
- The Industries (Development and Regulation) Act and Amendment of 1951 and 1987.
- The Mines & Minerals (Regulation & Development) Act and Amendments of 1957 and 1984.
- The Coal Mines (Conservation and Development) Amendment Act of 1985

4. ROAD DEVELOPMENT POLICY

The draft Road Development Policy for Kerala (1999) prepared by the Government of Kerala, (GoK) underlines capacity expansion of its primary road network as the key priority and an integral element of the State's economic development strategy. The policy's overall objective is to promote *"a sustainable road network providing connection to all cities, towns and villages, and allowing safe and efficient travel between them."*

The Government seeks to address the following key road sector issues:

(a) Addressing network deficiencies and improving road sector financing:

The draft road policy outlines Government's strategic approach to improve the network capacity. GoK aims to rehabilitate existing high- and medium-density corridors in a phased and timely manner and upgrade the network to comply with modern highway design standards. Greater emphasis will be placed on road maintenance. PWD will be encouraged to contract out maintenance and operations to private contractors on a pilot basis and use more modern technology for road pavement and treatments. The Government aims to provide adequate funds to meet the growth demand, simultaneously exploring avenues of private sector participation in the transport sector. Since budget allocations alone are not expected to meet the road sector's growing requirements, the State intends to supplement its road sector resource allocation by instituting a wider base of road user charges. The Government recently legislated the establishment of a State Road Fund that will seek to generate user charges through road tolls and dedicated fuel levies. The Roads and Bridges Development Corporation of Kerala (RBDCK), recently established by the GoK, will seek to raise funds through loans, shares and grants from financial institutions in order to construct and maintain identified roads and bridges. RBDCK recently awarded contracts to build railway over-bridges in the state and several NH bypasses will be built as BOT schemes in the near future.

(b) Enhancing institutional capacities:

The Government has committed itself to improve the performance of the road sector. In particular, steps are being taken to modernise and improve the PWD's performance, covering all its activities so that it keeps pace with new developments and requirements. With this in view, a consultant was engaged to undertake an Institutional Development Strategy (IDS) study to help establish a strategy for developing the PWD's technical, managerial and financial capabilities to effectively manage the State road transport network and to be responsive to road users' demands. Based on the study's recommendations, an Institutional Strengthening Action Plan (ISAP) listing the institutional development activities that are to be implemented during the next five years and beyond was developed and debated. The Government has formally endorsed the ISAP. Based on the ISAP, the PWD is developing a programme for:

- Human resource development strategy
- Improving pwd's financial management capacities
- Capacity building for planning and policy functions
- A management information system
- Strengthening environmental and social impact monitoring
- Improving procurement procedures
- Strengthening road safety engineering capacities

The state PWD has started implementation of some of the above. These measures are expected to reform PWD into a modern agency that will serve as a knowledge provider, while sourcing private sector capacities. ISAP implementation activities will be supported by IDS technical assistance consultants and three PWD staff working groups to seek institution-wide feedback on the ISAP. The institutional development consultants, who will serve as external experts to assist PWD in refining and implementing the ISAP, will work closely with the staff working groups that oversee,

- Organisational restructuring and institutional strengthening
- Management and quality systems
- Information technology and management information systems

(c) Reducing accident rates and mitigating environmental and social impacts:

Kerala's high accident rates have prompted the Government to address road safety problems by introducing road safety audits for new road projects and analysing accident blackspot locations. PWD has developed, as part of project preparation, a draft comprehensive and integrated State Road Safety Action Plan, which includes recommendations for the following road safety sub-sectors:

- Coordination and management of road safety,
- Accident data systems,
- Safety publicity campaign,
- Safety engineering,
- Safety education for children,
- Traffic legislation and enforcement,
- Driver training and testing,
- Vehicle safety standards,
- Emergency aid to road accident victims, and
- Safety research.

The plan also recommends establishing a PWD Road Safety Unit. As for environmental and social impact issues, the GoK's approach is to identify potential impacts early in the planning process and programme accordingly so as to avoid or mitigate adverse effects of road development. The policy is to prepare and implement Environmental Management Plans (EMP) whenever required, and to develop codes for environmental practice related to State road construction and maintenance.

Annexure 3.2. National Ambient Air Quality Standards by CPCB

"[SCHEDULE VII]
[See rule 3(3B)]
NATIONAL AMBIENT AIR QUALITY STANDARDS

S.No	Pollutants	Time-weighted average	Concentration in ambient air		Method of measurement
			Industrial Residential, Rural & other Areas	Ecologically Sensitive Area (Notified by Central Government)	
1	Sulphur Dioxide (SO_2) µg/m³	Annual*	50	20	-Improved West and Geake
		24 hours**	80	80	-Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2) µg/m³	Annual*	40	30	-Modified Jacob & Hochheiser
		24 hours**	80	80	(Na-Arsenite) - Chemiluminescence
3	Particulate Matter (Size less than 10 µm) or PM_{10} µg/m³	Annual*	60	60	-Gravimetric -TOEM
		24 hours**	100	100	-Beta attenuation
4	Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$ µg/m³	Annual*	40	40	-Gravimetric -TOEM
		24 hours**	60	60	-Beta attenuation
5	Carbon Monoxide (CO) mg/m³	8 hours**	02	02	- Non Dispersive Infra Red (NDIR)
		1 hour**	04	04	Spectroscopy

* Annual Arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

Annexure 3.3. National Ambient Air Quality Standards for Noise by CPCB

Sl. No.	Area	Leq dB (A)	
		Day Time*	Night Time**
1	Industrial Area	75	70
2	Commercial Area	65	55
3	Residential Area	55	45
4	Silent Zone***	50	40

Notes :

* Day Time -- 0600 hour to 2100 hour (15 hours)

** Night time --2100 hour to 0600 hour (09 hours)

*** Areas upto 100 metres around certain premises like hospitals, educational institutions and courts may be declared as silence zones by the competent authority ;

Annexure 3.4. National Standards for Drinking Water (IS:10500)

Sl. No	Substance or Characteristic	Requirement (Desirable Limit)	Permissible Limit in the absence of Alternate source
Essential characteristics			
1	Colour, (Hazen units, Max)	5	25
2	Odour	Unobjectonable	Unobjectionable
3	Taste	Agreeable	Agreeable
4	Turbidity (NTU, Max)	5	10
5	pH Value	6.5 to 8.5	No Relaxation
6	Total Hardness (as $CaCo_3$) mg/lit., Max	300	600
7	Iron (as Fe) mg/lit, Max	0.3	1
8	Chlorides (as Cl) mg/lit, Max.	250	1000
9	Residual free chlorine, mg/lit, Min	0.2	--
Desirable Characteristics			
10	Dissolved solids mg/lit, Max	500	2000
11	Calcium (as Ca) mg/lit, Max	75	200
12	Copper (as Cu) mg/lit, Max	0.05	1.5
13	Manganese (as Mn)mg/lit, Max	0.1	0.3
14	Sulfate (as SO_4) mg/lit, Max	200	400
15	Nitrate (as NO_3) mg/lit, Max	45	100
16	Fluoride (as F) mg/lit, Max	1.9	1.5
17	Phenolic Compounds (as C_6H_5OH) mg/lit, Max.	0.001	0.002
18	Mercury (as Hg)mg/lit, Max	0.001	No relaxation
19	Cadmium (as Cd)mg/lit, Max	0.01	No relaxation
20	Selenium (as Se)mg/lit, Max	0.01	No relaxation
21	Arsenic (as As) mg/lit, Max	0.05	No relaxation
22	Cyanide (as CN) mg/lit, Max	0.05	No relaxation
23	Lead (as Pb) mg/lit, Max	0.05	No relaxation
24	Zinc (as Zn) mg/lit, Max	5	15
25	Anionic detergents (as MBAS) mg/lit, Max	0.2	1
26	Chromium (as Cr^{6+}) mg/lit, Max	0.05	No relaxation
27	Polynuclear aromatic hydro carbons (as PAH) g/lit, Max	--	--
28	Mineral Oil mg/lit, Max	0.01	0.03
29	Pesticides mg/l, Max	Absent	0.001
30	Radioactive Materials		
	i. Alpha emitters Bq/l, Max	--	0.1
	ii. Beta emitters pci/l, Max	--	1
31	Alkalinity mg/lit, Max	200	600
32	Aluminium (as Al) mg/l, Max	0.03	0.2
33	Boron mg/lit, Max	1	5
Bacteriological Parameters			
a) For water entering a distribution system Coliform count in any sample of 100 ml should be zero(0). b) For water in a distribution system (i) E Coli count in 100 ml of any sample must be zero (0). (ii) Coliform organisms should not be more than 10 per 100 ml in any sample. (iii) Coliform organisms should not be present in 100 ml of any two consecutive samples or more than 5% of the samples collected for the year.			

Annexure 3.5. National Standards for Inland Surface Waters Subject to Pollution (IS:2296)

Class C – Drinking water with conventional treatment followed by disinfection.

Sl No.	Parameter and Unit	Class C
1	Taste	--
2	Odour	--
3	Colour (True) (Hazen unit), Max	300
4	pH (Min and Max)	6.5 - 8.5
5	Conductivity (25^{o}C) µS/cm, Max	--
6	DO (mg/L), Min	4
7	BOD (3 Days 27^{o}C) (mg/L), Max	3
8	Total Coliforms (MPN/100 mL), Max	5000
9	TDS (mg/L), Max	1500
10	Oil and Grease (mg/L), Max	0.1
11	Mineral oil (mg/L), Max	--
12	Total Hardness as $CaCO_3$ (mg/L), Max	--
13	Chlorides as Cl (mg/L), Max	600
14	Sulfates as SO_4 (mg/L), Max	400
15	Nitrates as NO_3 (mg/L), Max	50
16	Free CO_2 (mg/L), Max	--
17	Free NH_3 as N (mg/L), Max	--
18	Fluorides as F (mg/L), Max	1.5
19	Calcium as Ca (mg/L), Max	--
20	Magnesium as Mg (mg/L), Max	--
21	Copper as Cu (mg/L), Max	1.5
22	Iron as Fe(mg/L), Max	50
23	Manganese as Mn (mg/L), Max	--
24	Zinc as Zn (mg/L), Max	15
25	Boron as B (mg/L), Max	--
26	Barium as Ba (mg/L), Max	--
27	Silver as Ag (mg/L), Max	--
28	Arsenic as As (mg/L), Max	0.2
29	Mercury as Hg (mg/L), Max	--
30	Lead as Pb (mg/L), Max	0.1
31	Cadmium as Cd (mg/L), Max	0.01
32	Chromium as Cr^{6+} (mg/L), Max	0.05
33	Selenium as Se (mg/L), Max	0.05
34	Cyanide as CN (mg/L), Max	0.05
35	Phenols as C_2H_5OH (mg/L), Max	0.005
36	Anionic detergents as MBAS (mg/L), Max	1
37	PAH (mg/L), Max	--
38	Pesticides (µg/L), Max	--
39	Insecticides (µg/L), Max	0

Sl No.	Parameter and Unit	Class C
40	Alpha emitters (μC/mL), Max	10^{-9}
41	Beta emitters (μC/mL), Max	10^{-8}
42	Percent Sodium (%),Max	--
43	Sodium Absorption Ratio, Max	--

Annexure 3.6. National Standards for Discharge of Effluents

S. No.	Parameter	Inland surface water	Public sewers	Land for irrigation	Marine/coastalar eas
.	2		3	.	.
.	.	(a)	(b)	(c)	(d)
1	Colour and odour	All efforts should be made to remove colour and unpleasant odour as far as practicable		All efforts should be made to remove colour and unpleasant odour as far as practicable	All efforts should be made to remove colour and unpleasant odour as far as practicable
2	Suspended solids mg/l, max.	100	600	200	(a) For process waste water (b) For cooling water effluent 10 per cent above total suspended matter of influent.
3	Particle size of suspended solids	shall pass 850 micron IS Sieve	-	-	(a) Floatable solids, solidsmax. 3 mm (b) Settleable solids, max 856 microns
4	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5	Temperature	shall not exceed 5^{oC} above the receiving water temperature			shall not exceed 5^{oC} above the receiving water temperature
6	Oil and grease, mg/l max,	10	20	10	20
7	Total residual chlorine, mg/l max	1.0	-	-	1.0
8	Ammonical nitrogen (as N),mg/l, max.	50	50	-	50
9	Total kjeldahl nitrogen (as N);mg/l, max. mg/l, max.	100	-	-	100
10	Free ammonia (as NH3), mg/l,max.	5.0	-	-	5.0
11	Biochemical oxygen demand (3	30	350	100	100

S. No.	Parameter	Inland surface water	Public sewers	Land for irrigation	Marine/coastalar eas
.	2		3	.	.
.	.	(a)	(b)	(c)	(d)
	days at 27oC), mg/l, max.				
12	Chemical oxygen demand, mg/l, max.	250	-	-	250
13	Arsenic(as As).	0.2	0.2	0.2	0.2
14	Mercury (As Hg), mg/l, max.	0.01	0.01	-	0.01
15	Lead (as Pb) mg/l, max	0.1	1.0	-	2.0
16	Cadmium (as Cd) mg/l, max	2.0	1.0	-	2.0
17	Hexavalent chro-mium (as Cr + 6),mg/l, max.	0.1	2.0	-	1.0
18	Total chromium (as Cr) mg/l, max.	2.0	2.0	-	2.0
19	Copper (as Cu)mg/l, max.	3.0	3.0	-	3.0
20	Zinc (as Zn) mg/l, max.	5.0	15	-	15
21	Selenium (as Se)	0.05	0.05	-	0.05
22	Nickel (as Ni) mg/l, max.	3.0	3.0	-	5.0
23	Cyanide (as CN) mg/l, max.	0.2	2.0	0.2	0.2
24	Fluoride (as F) mg/l, max.	2.0	15	-	15
25	Dissolved phos-phates (as P),mg/l, max.	5.0	-	-	-
26	Sulphide (as S) mg/l, max.	2.0	-	-	5.0
27	Phenolic compounds (as C6H50H)mg/l, max.	1.0	5.0	-	5.0
28	Radioactive materials: (a) Alpha emitters micro curie mg/l, max. (b)Beta emitters micro curie mg/l	10-7 10-6	10-7 10-6	10-8 10-7	10-7 10-6
29	Bio-assay test	90% suivival of fish after 96 hours in 100% effluent	90% suivival of fish after 96 hours in 100% effluen	90% suivival of fish after 96 hours in 100% effluen	90% suivival of fish after 96 hours in 100% effluen
30	Manganese	2 mg/l	2 mg/l	-	2 mg/l

S. No.	Parameter	Inland surface water	Public sewers	Land for irrigation	Marine/coastalar eas
.	2		3	.	.
.	.	(a)	(b)	(c)	(d)
31	Iron (as Fe)	3mg/l	3mg/l	-	3mg/l
32	Vanadium (as V)	0.2mg/l	0.2mg/l	-	0.2mg/l
33	Nitrate Nitrogen	10 mg/l	-	-	20 mg/l

* These standards shall be applicable for industries, operations or processes other than those industries, operations or process for which standards have been specified in Schedule of the Environment Protection Rules, 1989.

Annexure 5.1. List of Mangroves in Kasaragod District

(Source.CWRDM, 2003)

Sl. No	Scientific Name	Local Name	Family
1	Exoeceria agallocha L.	Kannampotti,kommatti	Euphorbiaceae
2	Sonneratia caseolaris (L.) Engl.	Blathi, thirala	Lythraceae
3	Bruguiera cylindrica (L.) Bl.	Chakkara kandal	Rhizophoraceae
4	Acanthus ilicifolius L.	Chulli, Pyinga chulli	Acanthaceae
5	Avicinnia marina (Forsk.) Vierh.	Uppatti	Avicenniaceae
6	Acanthus ilicifolius L.	Chulli	Acanthaceae
7	Aegiceras corniculatum (L.) Blanco	Pookandal	Myrsinae
8	Avicennia marina (Forsk.) Vierh.	Uppatti	Avicenniaceae
9	Avicennia officinalis L.	Uppatti/ Oori	Avicenniaceae
10	Bruguiera cylindrica (L.) Bl.	Chakkara Kandal	Rhizophoraceae
11	Kandelia candel (L.) Druce	Kandal	Rhizophoraceae
12	Rhizophora apiculata Blume	Kandal	Rhizophoraceae
13	Rhizophora mucronatra Lamk.	Pranthan Kandal	Rhizophoraceae

MANGROVE ASSOCIATES OF KANHANGAD-KASARGOD ROAD

Sl. No	Scientific Name	Local Name	Family
1	Alternanthera sessilis (L.) R.Br. ex. DC	Kozhuppacheera	Amaranthaceae
2	Crinum deflexum Ker.	-	Amaryllidaceae
3	Cyperus alopecuroides Rottb.	-	Cyperaceae
4	Cyperus javanicus Hoult.	-	-do-
5	Cyperus sp.	-	-do-
6	Fimbristylis dichotoma Vahl.	-	-do-
7	Fimbristylis spathacea Roth.	-	-do-
8	Paspalum vaginarum S.W.	-	Poaceae
9	Ardisia littoralis Andr.	-	Sapotaceae
10	Clerodendron inerme Gaertn.	Neernochi	Verbenaceae
11	Phragmites kerka Trin.	-	Poaceae
12	Caesalpinia crista L.	-	Caesalpiniaceae
13	Dalbergia candenatensis Prain.	-	Papilionaceae
14	Cerbera odollam Gaertn.	Odollanga	Apocynaceae
15	Hibiscus tiliaceus L.	Veliparuthi	Malvaceae
16	Thespesia populnea (L.) Sol. ex Corre	Poovarasu	-do-
17	Pandanus fascicularis Lamk.	Kythachakka	Pandanaceae
18	Premna serratifolia L.	Kozhiappa	Verbenaceae
19	Quassia indica (Gaertn.) Nooteb.	-	Simaroubaceae
20	Barringtonia racemosa (L.) Spreng.	Samudraksha	Barringtoniaceae
21	Dolichandrone spathacea Seem.	Neerpongillium	Bignoniaceae

Sl. No	Scientific Name	Local Name	Family
22	Callophyllum inophyllum L.	Punna	Guttiferae
23	Heritiera litoralis Dryand	-	Sterculiaceae
24	Derris trifoiata Lour	Pannivalli	Papilionaceae
25	Acrostichum aureum L.	Machumthol	Pteridaceae

Annexure 5.2. Fauna along the Project Road

Mammals of the Study Area

Sl. No	Scientific Name	Local Name	Family
1	Viverra megaspila Blyth	Verugu	Viverridae
2	Viverricula indica Desmarest	Cheruverugu	-do-
3	Herpestes edwardsi (Geoffroy)	Keeri	Herpestidae
4	Herpestes fuseus Waterhouse	Chenkeeri	-do-
5	Canis aureus (Linnaeus)	Kurukkan	Canidae
6	Vulpus bengalensis (Shaw)	Kurunari	-do-
7	Lutra lutra (Linnaeus)	Neernaya	Mustelidae
8	Ratufa indica (Erxleben)	Malayannan	Sciuridae
9	Funambulus palmarum (Linnaeus)	Annan	-do-

Reptiles of the Study Area

1	Calotes versicolor (Daudin)	Onthu	Agamidae
2	Mabuya carinata (Schneider)	Arana	Scincidae
3	Varanus bengalensis (Daudin)	Udumbu	Varanidae
4	Coluber mucosus (Linnaeus)	Chaera	Colubridae
5	Xenochrophis piscator (Schneider)	Neerkoli	-do-

Amphibians of the Study Area

Amphibians:			
1	Rana tigrina	Thavala	Ranidae
2	Rana hexadactyla	Thavala	-do-

Birds of the Study Area

Sl. No	Scientific Name	Local Name	Family
1	Dendrocygna javanica	Choolan eranda	Dendrosygniidae
2	Anas querquedula L.	Vari eranda	Anatidae
3	Nettapus coromandelianus (Gmelin)	Pachha eranda	-do-
4	Coracias benghalensis indica Lantham	Panakaaka	Coracidae
5	Alcedo atthis Kleinschmidt	Podiiponmann	Alcidinidae
6	Ceryle rudis	Pulli meenkotthi	-do-
7	Halcyon smyrnensis fusca (Boddaert)	Meenkotthichaan	Alcidinidae
8	Pelargopsis capensis	Kaakameenkothi	Dacclonidaea
9	Merops orientalis L.	Naatuvelitatta	Meropidae
10	Merops philippinus Lantham	Valiya velitatta	-do-
11	Centropus sinensis parroti Stresemann	Chempothu	Cuculidae
12	Eudynamys scolopacea (L.)	Kuyil	-do-
13	Cuculus micropterus Gould	Kuyil	-do-

Sl. No	Scientific Name	Local Name	Family
14	Streptopelia chinensis (Gmelin)	Aripravu	Columbidae
15	Amaurornis phoenicurus Pennat	Kulakozhi	Rallidae
16	Gallinula chloropus indica Blyth	Pattakozhi	-do-
17	Porphyrio porphyrio (L.)	Nelakozhi	-do-
18	Calidris minuta	-	-do-
19	Gallinago gallinago	Visharivalan	Scolopaecidae
20	Tringa glareola	Pullikaadakokku	-do-
21	Tringa hypoleucos	Neerkkada	-do-
22	Tringa nebularia	Pachhakali	-do-
23	Tringa ochropus	Karimban kaadakokku	-do-
24	Tringa tatanus	Chorakali	-do-
25	Metopidius indicus (Lantham)	Naadan thamarakozhi	Jacanidae
26	Hydrophasianus chirurgus (Scopoli)	Vaalan thamarakozhi	-do-
27	Charadrius alexandrinus	Cherumanlakozhi	-do-
28	Charadrius mongolus	-	-do-
29	Charadrius dubius	Aatumanlkozhi	-do-
30	Vanellus indicus	Chorakannithittiri	-do-
31	Glareola lactea Temminck	Valiyameevalkkada	Glareolidae
32	Larus brunnicephalus Jerdon	Kadalpaatha	Laridae
33	Chlidonias hybrida indica (Stephens)	Kari aala	-do-
34	Sterna aurantia	Puzha aala	-do-
35	Circus aeruginosus (L.)	Kari thappi	Accipitridae
36	Haliaecus leucogaster	Vellavayaran kadal parunthu	-do-
37	Haliastur indica (Boddeart)	Krishna parunthu	-do-
38	Milvus migrans govinda (Skyes)	Chakkiparunthu	-do-
39	Pandion haliaetus (L.)	Thaliparunthu	-do-
40	Podiceps ruficollis capensis Salvadori	Mungamkozhi	Podicipedidae
41	Phalacrocorax niger (Vieillot)	Cheriya neerkaaka	Phalacrocoracidae
42	Ardea cineria rectirostris Gould	Chaaramundi	Ardeidae
43	Ardea pupurea malinensis Meyen	Chayamundi	-do-
44	Ardeola grayii grayii (Skyes)	Kulakokku	-do-
45	Bubulcus ibis coromandus (Boddeart)	Kaalimundi	-do-
47	Butroides striatus	Chinnakokku	-do-
48	Casmerodius albus	Perumundi	-do-
49	Egretta gularis schistacea (Hemprich & Ehrenberg)	Thirimundi	-do-
50	Egretta garzetta (L.)	Chinnamundi	-do-
51	Ixobrychus cinnamomeus (Gmelin)	Mazhakoccha	-do-
52	Ixobrychus flavicollis (Latham)	Karikoccha	-do-
53	Ixobrychus sinensis (Gmelin)	Manjakochha	-do-
54	Mesophoyx intermedia	Cherumundi	-do-
55	Nycticorax nycticorax (L.)	Pathirakokku	-do-

Sl. No	Scientific Name	Local Name	Family
56	Ciconia episcopus (Boddeart)	Karinkokku	Ciconiidae
57	Hirundo daurica erythropygia Sykes	Varayan kathrika	Hirundinidae
58	Hirundo rustica guttularis Sepoli	Vayalkothikathrika	-do-
59	Nectarinia asiatica (Latham)	Karuppan thenkili	Nectarididae
60	Nectarinia zeylonica flaviventris (Hermann)	Manjathenkili	-do-
61	Lonchura punctulata	Chootiyatta	Dasseridae
62	Lonchura malacca	Aatachemban	-do-
63	Lonchura striata	Aatakaruppan	-do-
64	Acridotheres tristis (L.)	Maadatha	Sturnidae
65	Corvus macrorhynchos culminates Sykes	Balikaaka	Corvidae
66	Corvus splendens protegatus Madrasz	Kaaka	-do-
67	Dendrocitta vagabunda Whistler	Oolennjali	-do-
68	Columba livia intermedia Strickland	Ambalapraavu	Columbidae
69	Pycnonotus cafer (L.)	Nattubulbul	Pycnonotidae
70	Turdoides afinis affinis (Jerdon)	Kariyilakili	-do-
71	Motacilla maderaspatensis Gmelin	Vaalukulukipakshi	Motacilidae
72	Oriolus oriolus Sykes	Manjakili	Oriolidae

Fishes of the Study Area

Sl. No	Scientific Name	Local Name	Family
1	Etroplus suratensis (Bloch)	Irimeen	Cichlidae
2	Etroplus maculates (Bloch)	Chootachi	-do-
3	Tilapia mossambica Peters	Tilopi	-do-
4	Mugil cephalus Linnaeus	Malan	Mugilidae
5	Liza parsia (Hamilton)	Thirutha	-do-
6	Liza tade (Forsskal.)	Kanambu	-do-
7	Chanos chanos (Forsskal.)	Poomeen	Chanidae
8	Lates calcarifer (Bloch.)	Narimeen	Centropomidae
9	Megalopes cyprinoids (Broussonet)	Palankanni	Megalopidae
10	Lutjanus argentimaculatus (Forsskal.)	Chemballi	Lutjanidae
11	Glossogobius giurus (Hamilton)	Poolan	Gobiidae
12	Stenogobius malabaricus	Kurudan	-do-
13	Eleotris fusca (Bloch. & Schneider)	Noongal	Eleotridae
14	Leiognathus sp.	Mullan	Leiognathidae
15	Scatophagus argus (Linnaeus)	Kachchai	Scatophagidae
16	Lepturucnthus savala	Thalayan	Truiciuridae
17	Cynoglossus sp.	Maantha	Cynoglossidae
18	Arius sp.	Etta	Ariidae
19	Mastacembelus sp.	Aaron	Mastacembilidae
20	Anchoviella sp.	Nechal	Engraulidae
21	Carangoides sp.	Prachi	Carangidae
22	Hyporhamphus limbatus Valenciennes	Koyala	Exocoetidae
23	Xenetodon cancila L (Hamilton)	Koyala	Belonidae

Sl. No	Scientific Name	Local Name	Family
24	Secutor sp.	Mullan	Leiognathidae
25	Sillago sihama (Forsskal)	Kolan	Sillaginidae
26	Lactarias lactarias (Schneider)	Kadu	Lactarridae
27	Sphyreena sp.	-	Sphyraenoidae
28	Chirocentrus dorab	Mullavala	Chirocentridae
29	Pampus argenteus (Euphrasen)	Aakoli	Stromteidae
30	Pampus chinensis (Euphrasen)	Aakoli	Stromteidae
31	Channa marulius (Hamilton)	Varaal	Channidae
32	Daysciaena albida (Cuvier)	Kora	Sciaenidae
33	Thysariophrys indicus (Linnaeus)	Aeri	Platycephalidae
34	Rasbora daniconius (Hamilton)	Kananjon	Cyprinidae
35	Aplocheilus lineatus (Val.)	Maanathukanni	Cyprinodontidae
36	Synaptura sp.	Maantha	Soleidae

Crabs of the Study Area

Sl. No	Scientific Name	Local Name
1	Scylla serrata	Puzhanhandu
2	Charybdis cruciata	-
3	Portunus pelagicus	Kadalnhandu
4	Portunus sanguinolentus	Kadalnhandu
5	Maluta lunaris	-
6	Uca sp.	Ottakaalan nhandu
7	Eupagurus sp.	-

Prawns of the Study Area

Sl. No	Scientific Name	Local Name
1	Penaeus monodon	Kaara
2	Penaeus indicus	Naaran
3	Metapenaeus dobsoni	Poovalan
4	Metapenaeus affinis	Kalanthan
5	Metapenaeus merguensis	-
6	Metapenaeus monoceros	Choodan
7	Macrobrachium sp.	Kaalankonchu
8	Panulirus homarus	Cheetakonchu

Molluscs of the Study Area

Sl. No	Scientific Name	Local Name
1	Meretrix costa	Elambakka
2	Meretrix meretrix	Koorka
3	Perna indica	Kallumakkai
4	Perna viridis	Kallumakkai
5	Crassostrea madrasensis	Muru
6	Crassostrea malabarica	-
7	Crassostrea cuculata	-
8	Pinctada fucata	Muthuchippi

Sl. No	Scientific Name	Local Name
9	Cordium sp.	Muthuchippi
10	Arca sp.	Muthuchippi
11	Cardite bicolor	Muthuchippi
12	Tridacha gigas	Muthuchippi
13	Bullia sp.	-
14	Telescopium sp.	Purikka
15	Fusinus sp.	-
16	Terebra sp.	-
17	Murex sp.	-
18	Villorita cyprinoids	-
19	Pila virens	-
20	Limnaea sp.	-
21	Indoplanorbis sp.	-
21	Bellamya sp.	-
23	Paphia malabarica	-

Insects of the Study Area

Sl. No	Scientific Name	Local Name	Order
1	Scolopendra	Pazhuthara	Chilopoda
2	Spirostreptus	Cheratta	Diplopoda
3	Gerres	-	Hemiptera
4	Corixa	-	-do-
5	Gryllotalpa	-	Orthoptera
6	Mantis religiosa	-	Dictyoptera
7	Gomphus	-	Odonata
8	Libelluta	-	-do-
9	Anthia sexguttata	-	Coleoptera
10	Myrmeleon	Kuzhiaana	Neuroptera

Butterflies of the Study Area

Sl. No	Scientific Name	Local Name	Family
1	Idea malabarica	Malabar tree nymph	Danaidae
2	Danaus chrysippus	Plain tiger	-do-
3	Danaus genutia	-	-do-
4	Tirumala limniace	Blue tiger	-do-
5	Parantica algea	Glassy blue tiger	-do-
6	Euploea core	Common core	-do-
7	Mycalesis perseus	Common bush brown	Satyrinae
8	Mycalesis patnia	Glad eye bush brown	-do-
9	Lethe rohira	Common tree brown	-do-
10	Ypthima ceylonica	Ceylon four ring	-do-
11	Orsotriaena medus	Nigger	-do-
12	Ypthima huebneri	Common four ring	-do-
13	Melanitis leda	Common evening brown	-do-
14	Melanitis phedima	Dark evening brown	-do-
15	Elymnias hypermnestra	Common palmfly	-do-

16	Ariadne merione	Common castor	Nymphalidae
17	Junonia iphita	Chocolate pancy	-do-
18	Junonia lemonias	Lemon pancy	-do-
19	Junonia atlites	Grey pancy	-do-
20	Hasora badra	Common awl	Hesperiidae
21	Celaenorrhinus leucocera	Common spotted flat	-do-
22	Matapa aria	Common red eye	-do-
23	Celaenorrhinus ambareesa	Malabar spotted flat	-do-
24	Triodes minos	Southern birdwing	Papilonidae
25	Pachliopta hector	Crimson rose	-do-

Annexure 6.1. Official Consultation done Earlier

SL NO	NAME & ADDRESS	FAX AND PHONE NUMBER	DATE OF CONSULTATION	SUBJECT DISCUSSED	REMARKS
1	Mr Abdu Sammad Soil Conservation Specialist Kerala State Land Use Board Vikas Bhavan	Phone:442231 (O) 447830 (O) 475147 (R)	May 10, 1999	Soil Conservation Data and Resource base available at Land Use Board.	No Published data .No books on Sale
2	Mr. Haridas P Nair Systems Manager, (On deputation from ISRO) Kerala State Remote sensing and Environment	360982 (R) Office: 440624, 447830 & 442231 kerrsec@400.nicgw.nic.in	May 10, 1999	Remote sensing and GIS facilities available at this Office	No Published data .No books on Sale
3	Mr.M. Boominathan National Transportation Planning and Research Center (NATPAC) ,PRS Road,Thycaud, TVM 695 014	Phone:322624, 322581, 322681 Fax 91-0471-329414	May 6, 1999	Various Activities of NATPAC especially R&R and Environmental aspects	No in-house Staff for R&R and Environmental Aspects.
4	Dr M Baba Director in Charge /Land use Commissioner Kerala State Land Use Board	442231(O) Fax:441167	Consulted	Consulted mainly about waterways With Mr. Malhotra of PCC. Some informal discussion about the CRZ Management Plan for Kerala was also discussed.	Received the Environmental Management plan after two days.
5	Mr. PKV Nair , Survey Of India (SOI) CGO Complex,Poomkulam (PO) TVM PIN 695522	Phone:481852(O)	April 16, 1999	For Restricted and unrestricted SOI maps	PIU (PWD) submitted Application and later we received the SOI sheets
6	Mr. KK Thankappan State Editor,KERLA GAZATIERS	322618(O) 340823(R)	Consulted	With Mr William Cumming of PCC.	All useful gazetteers purchased.
7	Mr. VK Sinha, Chief Conservator of Forests (Wild Life) Forest Department	Phone:322217(O) 363958(R)	Consulted	No time for him to devote for this project and asked us to give it in writing.	Later we submitted our requirements never replied.
8	Mr. PK Surendranathan Asari, Principal Chief Conservator of Forests(Development &Project), Forest Department	Phone:321610 321374(R) Fax Email:	No formal consultation required till date.	Invited for Scoping Workshop through a formal letter.	Did not attend the scooping workshop.
9	Mr. K Sasidharan Nair, Principal Chief Conservator of	Phone:321798 (O) 325584 (R)	Consulted	He indicated that unlike other States here forest conservation measures are active &	He directed me to the Forest information office at social forestry

SL NO	NAME & ADDRESS	FAX AND PHONE NUMBER	DATE OF CONSULTATION	SUBJECT DISCUSSED	REMARKS
	Forests (General) Forest Department			successful ,land taking will have adhered Forest conservation rules (GOI & GOK)	division
10	Mr. Bhaskaran Census Department Deputy Director Operations CGO Complex,Poomkulam (PO),TVM,PIN 695522	Phone: 481860 Fax Email:	Consulted	For Restricted and unrestricted SOI maps	PIU (PWD) submitted Application and later we received the SOI sheets
11	Dr. Basak Executive Director, CWRDM,Kunnamangalam (MBR),Kozhikode, Pin 679573	Phone:0495355864 & 356242 Fax: Email:	Consulted formally and Informally	On sediment and water testing and Analysis and also on Scoping workshop	Consulted on advice from Prof. M. Jaya Kumar of State Committee on Science Technology And Environment.
12	Prof. M Jayakumar State Committee of Science & Technology & Environment Thycaud, Thiruvananthapuram		Consulted with environmental team of the project	Mainly CRZ and Waterways project. Need for Sediment testing water quality testing etc. Mr Kumar recommended CWRDM for sediment sampling and Analysis.	CRZ related to Kuttanad area
13	Mr Vijaya Bhas Environmental Engineer, Kerala State Pollution Control Board (KSPCB), Plamood	Phone: 318153 to 55 (3 nos) Fax No:	Consulted	Nothing specific has come out from the discussion	Purchased a book titled Environmental standards published by the SPCB
14	Survey Society Michel Gomas /Shanmugam/KM Soman, Additional Director, Director of land Survey and Records Opposite to Sri Mulam Club,	Phone: 325492	Consulted	Cadastral maps availability for the project Work. Resurvey work is in Progress.	Resurvey maps are also Available. Also received few district wise maps prepared by the department
15	Friends of Trees-Thiruvananthapuram Branch (FOT) Mr Thomas Poulose,B-8 Jawahar Nagar Thiruvananthapuram	Phone320954	Contacted	Project Environmentalist did a consultation with Mr Thomas Paulos as the contact person of the Organization	NGO
16	Er.Sathish Kumar, PWD City Road Section 3, Public Works Department, PMG	Phone: 364659 (R)	Consulted	No strip Plans are available for Kerala road network.	

SL NO	NAME & ADDRESS	FAX AND PHONE NUMBER	DATE OF CONSULTATION	SUBJECT DISCUSSED	REMARKS
17	Mr. R Radhakrishna, Ex, President, Kerala Shasthra Sahithy Parishath (KSSP),- Vanjiyoor, Mathrubhoomi road TVM	525427(O) 752210(R)	April 30, 1999	Land Acquisition, Road accidents and Road safety maintenance concern. They have promised their help.	NGO
18	Mr Bijoy Alex Director WWF Kerala State Office, Rupa,A-10 Tagore Nagar TC 15/989 Vazhuthakkad, TVM-695014,Kerala	Phone:0471-325183 323568 (R) 0471-436499 Fax: Email	Sept 17, 1999	Dr Bijoy Alex, three personnel whom Should be included as resource persons.	KN Changappa, Sr Manager, Tata Tea limited, HRW & EPA. Mohan Alember, DFO Munnar. Mr Jim Sacharia, Research range officer, Periyar.
19	Dr Roy George Education Officer World Wide Fund For Nature-India Thiruvananthapuram	325183	June 4, 1999	Forest wildlife aspects related to KSHP Their publications: The Natural resources of Kerala-WWF India, Kerala State Office. Land use control on Paddy fields Coastal zone Management Plan.	Dr Roy George education officer, recommended some other resource persons of the state for consultation. Prof Nandakumar Department of Geography, University College TVM, Prof. Kunjikrishnan.He also promised me some recommendations at a later stage.
20	Friends of Periyar Mr Joseph Karoor President, Periyar wild Life Reserve Po Thekkady Idukki,Pin 685 536	Phone:04863-22169(R)	Consulted 04/99	Their main concerns are The forest and wild Life Protection Landslides are also a concern. He also pointed out the complication due to the arrival of settlers in the high ranges.	NGO. He later attended scooping workshop.
21	Contacted: Mr Jalaludheen Indian Meteorological Department Meteo centre Thiruvanathapuram-695033	Phone:322471(P) 322894(())	May 14, 1999	Number of stations in Kerala & Type of data available.	Data available for eight centers spread across Kerala. Data on Temp, Pressure, Rainfall, Humidity and wind data are available on cost basis.
22	Mr Nanda Kumar D Sr Lecturer Geography Dept University College	Phone:474490 After 8 PM 327413(R)	June 24, 1999	His main concerns are that no good Road maps are available. He develops the map, which is now available, and this is the map given in the CES Resource Atlas. He is happy that people are actually working on the ground to collect basic data.	Very shortly he is leaving India for Higher education (PhD).

SL NO	NAME & ADDRESS	FAX AND PHONE NUMBER	DATE OF CONSULTATION	SUBJECT DISCUSSED	REMARKS
23	KG Mohanan Pillai, Director, Forest Information Bureau (FIB) PTP Nagar, Thiruvanathapuram.	360965(O)	Sept 17, 1999	Forest and wild life sanctuary maps. Forest and wildlife published data. Forestry publications and brochures.	Collection Procedures
24	Dr Shankar Scientist band Head EIA group Kerala Forest Research Institute (KFRI). Thrissor-680 653	0487-282064 E-Mail- libkfri@md2vsnlnet.in	Jan 26, 2000	He offered his help on any forestry studies. Presented a case study on Eco-tourism project in Kerala.	Indicated about anew sanctuary coming up.
25	Prof: E .Kunji Krishnan Department of Zoology University College Thiruvanathapuram	442853(R)	June 21 2000	His main concern is whether the fund will be utilized properly. He wants a working accounting procedure within the PWD setup. Who can guaranty a honest setup where the funds are timely and properly utilized	He pointed out instances where the gross mis-utilisation of funds from world Bank and ADB had taken place.
26	Dr PKK Nair Director Environmental Resources Research Center, PBNo1230, Peroorkada Thiruvanathapuram 695005 Kerala India	0471-432159 0471-435115 0471-433159(R)	Consulted 23/06/99	Bio-diversity issues, Natural conservation measures, a complete EIA is necessary for any Road widening Project. Development of Parks along the Road. Medicinal Plants Etc. Parking Places especially for the Sabarimala Pilgrim center.	Planting on both sides with trees or bushes especially in those places where there are paddy fields.
27	Mr Sivakumar Warblers and Waders NGO, Thiruvanathapuram.	431300	March 1, 2000	Endangered flora and Fauna	They are only working on endangered avifauna.
28	Dr. Khandoori, Chief Conservator of Forests (Special Afforestation) and Nodal Officer, Thiruvananthapuram	328347 (O) 357005 (R)	October 13, 2000	Rock blasting inside forest is banned. According to Kerala Preservation of Trees act (KPT act), permission from DFO is needed for cutting certain species of trees. According to Supreme court direction regarding avenue trees, no tree can be felled without a management plan. If forestland is acquired for any purpose, afforestation at a rate of 2500 plants per hectre is to be carried out.. Book on rates of afforestation is available.	The tree species of Sandalwood, Teak, Rosewood, Irul, Thempavu, Kambakam, Chembakam, Chidachi, Chandanavembu and Cheemi are included in KPT act.

SL NO	NAME & ADDRESS	FAX AND PHONE NUMBER	DATE OF CONSULTATION	SUBJECT DISCUSSED	REMARKS
29	Mr. K. Suresh Menon Divisional ManagerKerala Forest Development Corporation, Kottayam		October 24, 2000	Felling of road side trees is to be carried out by forest department.	
30	Dr. J.K. Sharma Director, Kerala Forest Research Institute, Peechi	0487-282064 E-Mail- libkfri@md2vsnlnet.in	October 21, 2000	KFRI is providing only research data to forest department for preparation of Sanctuary management plan. List of flora and fauna for each district has been prepared under the proples plan compaign. Not much research has been carried out on mangroves.	Some publication of KFRI were obtained.
31	Mr. James Zacharia, Mr. Sivadas, Mr. Kumaran Assistant Conservators of Forest Project Tiger Nattassery, Kottayam	0481 – 565940	October 24, 2000	Elephant migration routes are intercepted by roads. Elephants will not be able to cross fills. For rock blasting along Idukki – Puliyanmala road. Permission from KSEB will be required since dam is situated very close to the road.	For information in elephant crossing points on the road, contact Dr. Easa of KFRI. They are interested in attending any workshops to be held in future.
32	Mr. N. Sasidharan Divisional Forest Officer, Collectorate, Kottayam		October 24, 2000	For cutting trees on road side, apply to Assistant Conservator (Social Forestry) having jurisdiction over the area.	KPT act is applicable to private land only.
33	Mr. N. Sasidharan, Divisional Forest Officer, Collectorate, Kottayam		October 24, 2000	Forest land along Idukki – Puliyanmala road. From Cheruthoni to Idukki, both sides of the road are handed over to Idukki Development Authority (IDA). Land is to be purchased from them. Encroachers will have to be rehabilitated. After Idukki, the land belongs to Cardamom hills RF. It has a dual status. It is revenue land, but the trees are owned by the Forest Department. The area is encroached by private parties. For cutting trees on roadside, apply to Assistant Conservator (Social Forestry) having jurisdiction over the area.	KPT act is applicable to private land only.
34	Mr. P.K. Surendranathan Asari, Principal Chief Conservator of Forests,		December 15, 2000	Rock blasting along Idukki – Puliyanmala road is not permitted since it is situated very close to the wild life sanctuary.	

SL NO	NAME & ADDRESS	FAX AND PHONE NUMBER	DATE OF CONSULTATION	SUBJECT DISCUSSED	REMARKS
	Thiruvananthapuram			However, concealed blasting can be done. No emission or noise is permitted. For Punalur – Thodupuzha road, forest clearance is not needed..	
35	Dr. D.S. Rao, Chief Conservator of Forests (Development)		December 15, 2000	Forest department is not conducting any study on mangroves now. A project report on development of mangroves at Kumarakom was prepared 2-3 years ago.	Agricultural University is conducting a study on mangroves. Another study is being carried out by Dr. Mohanan of CESS.
36	Mr. P. John Samuel, Additional Director, Department of Mining and Geology, Government of Kerala	0471 – 447429, 0471 – 556939 Fax: 0471 - 447429	January 3, 2000	Controlled blasting near sanctuary areas to break hard and massive rocks	Suggested concealed blasting using a chemical called ECONAX or AQUANAX. Series of small drill holes, fill it with the chemical tightly, seal it and keep it for 24 hours. Rock will develop cracks.
37	Mr Rajendran Thampi –World bank Project Chief Conservator of Forests	328347 (O)	February 5, 2001	The World bank Forestry project is being carried out by the various officials as part of their routine work. No Separate machinery for the Project.	The project activities include pulp wood plantation steak plantations, natural forest management, Sectoral management etc
38	Dr. Khanduori Chief Conservator of Forests (Special Aforestation) and Nodal Officer, Thiruvananthapuram	328347 (O)	February 5, 2001	Road side tree planting, forest nurseries and official rates, Forestry Clearance and application procedures	
39	Mr Balakrishnan, Forest Range Officer	0498-205696(O) 0498 –204451®	June 9, 2002	Mangrove Plantation Programme	
40	Mr. Krishnan,Deputy Superintendent, ASI, Bakel		February 12, 2001	Excavation of residential areas and royal enclosures is in progress within Bakel Fort	
41	Local Member of Legislative Assembly (MLA)		May 9, 2002	Foot over Bridge mainly for school children	This will cover both railway line and project road
42	Dr P.N Unni Scientist CWRDM,Kozhikode, Kerala	: 0495-200675	April 30, 2002	Coastal Ecosystems in Kannur and Kasaragod districts	A copy of recently published Paper on Mangroves In Valapattanam river Basin provided
43	Mr Mohan & Mr Verma Scientist , CESS Thiruvananthapuram	0471-442231&441167	March 22, 2002	Various literature references obtained from CESS Web site on mangroves and coastal Ecosystems	

SL NO	NAME & ADDRESS	FAX AND PHONE NUMBER	DATE OF CONSULTATION	SUBJECT DISCUSSED	REMARKS
44	Mr Varghese Nodal Officer Kerala Forest Department	0471-328347	July 9, 2002	Phase II Forestry and CRZ Clearances. Requested for the proceedings of a workshop conducted by Forest Department at Kannur	Shared a Proceedings of the workshop on Mangroves
45	Dr Kamalkshan Kookat State Science Technology and Environment	0471-543701 to 705	July 11, 2002	CRZ related Environmental clearance for the Three phase II roads	
46	Dr. Thomas (head of Dept) Dr. Kurian (Scientist) Dept of Marine Science, CESS	0471-442231&441167	July 12, 2002	Preparation of Status Report for coastal zone Management Committee clearance	Requested to send formal letter to the Director, CESS

Annexure.6.2. Kerala State Transport Project

Scoping Workshop - 1
Thiruvananthapuram, 18th January, 2000

MINUTES

An environmental and social scoping workshop was held on the 18th January in the PWD Rest House at Thycaud, Thiruvananthapuram. This was the first of the three that were proposed to help identify priority environmental and social issues, covering the districts of Thiruvananthapuram, Kollam, and Parthanamthitta. Mr. Karrappuni, Chief Engineer, Roads and Bridges Department of the PWD opened the workshop with a keynote address. Mr. David Wood, Team Leader of the PCC, made a welcome speech. Mr. Dushyantha Kumar, Director of the Project Implementation Unit, was Chairman.

Apart from the organizers, the various NGOs and officials who attended the workshop included:

- K. Viswanath, Director, Mitraniketan.
- M.P. Muraleedharan, Geological Survey of India, Kerala Unit, Trivandrum.
- K.M. Ravindran, Special Officer, Roads and Bridges Development Corporation.
- Shiju Cherian, Kodumon Grama Vikasana Samithy, Pathanamthitta.
- C. Christu Das, Director, The Dale View, Punalal P.O., Poovachal (via), Trivandrum.
- Dr. S.P. Thampi, Director, Marine Archeology, Govt. of Kerala, Trivandrum.
- K. Thomas Paulose, Vice President, Friends of the Trees, Trivandrum.
- S. Chandra Mohan, Asst. Director, Kerala State Land Use Board, Trivandrum.
- Sudheer Babu, S., Environmental Engineer, Kerala State Pollution Control Board.
- Abdul Samad, Specialist (Soil Conservation), Kerala State Land Use Board.
- C.K. Karunakaran, Secretary, Friends of Trees, Trivandrum.
- Anil Kumar, P.V., Rajiv Gandhi Cultural Study Centre, Venganoor, Trivandrum.
- Edwin George, The Salvation Army, Kawdiar, Trivandrum.
- Mr. Sunder, Project Coordinator, Rajiv Gandhi Centre, Trivandrum.
- Tommy Cyriac, Consultant, Finance Department, Govt. of Kerala.
- Jacob Mohan George, Asst. Executive Engineer, Trivandrum.
- Ms Sonia Kapoor, Environmental Specialist, The World Bank, New Delhi.

Mr. Karrappuni mentioned that the aim of the project is to rehabilitate and improve the existing roads with minimal acquisition of land and minimum dislocation of people and maximum benefit to the population at large. The objective of the workshop is to gather inputs and concerns from the public, NGOs, and experts for the scoping of the environmental and social aspects of the project.

After the welcome address, the various experts addressed the audience with their assigned topics for discussion. Mr. Andrew Blelloch, Environmental Specialist, talked on the environmental and social assessment process for the highways. Bill Cummings, Social Impact Specialist, talked on the environmental and social assessment process for the waterways. Mr. Sundara Rajan, Environment Impact Coordinator, talked on the environmental concerns in highways and waterways, and Dr. Biswanath Debnath, Social Impact Coordinator, discussed social concerns relating to highways.

The participants joined the discussion with their presentation. Mr. M.P. Muralidharan of the Geological Survey of India talked about the physical environment. He mentioned that the road alignments and widths in Kerala are unscientific, which may be made better with the use of satellite survey information. Moreover, water logging on roads recurs during monsoons due to

inappropriate design for the soil conditions. He suggested that the design of north-south roads and the east-west roads should be different.

Mr. Abdul Samad of the Kerala Land Use Board mentioned that there is a land degradation problem in Kerala due to the varying terrain and the fact that approximately 40% of the landmass of the State is prone to landslides and slope instability. He also mentioned that consideration should be given to a proper water management system, minimizing disturbance to the paddy fields, and the biotic issues during the execution of the project.

Mr. Sudheer Babu of the Kerala State Pollution Control Board mentioned that the PWD has to submit an application for conducting public hearing with the prescribed fees and 20 copies of the executive summary of the project for clearance by the KSPCB. The KSPCB will convene a panel for conducting the public hearing and subsequently make recommendations to the MoEF.

Mr. Christu Das, Director of Dale View, mentioned the apparent absence of coordination between the PWD and other line departments. He criticized the inadequate traffic signals, signboards and milestones and the frequent digging within the highways.

Mr. Ravindran, Special Officer, Roads and Bridges, described the difficulties involved in land acquisition for the roads. He mentioned that the effective width of the roads is reduced due to inadequate provisions for the pedestrians using the roads and also due to the existence of the utility poles.

Mr. Thomas Paulos, Vice President of Friends of the Tress and a retired town planner, also mentioned the difficulties involved in land acquisition for the roads. He mentioned that strict laws and regulations should facilitate land acquisition.

Mr. Karunakaran, Secretary of Friends of Trees mentioned that a committee should examine the environmental aspects and ensure that the guidelines are being followed. He maintained that the biological aspects of environment should be given more importance in this project. Various mitigation measures and safeguards should be ensured to protect the bio-diversity of the State.

Dr. Thampi of the Dept. of Archeology dealt at length with the importance of heritage tourism and the need for creating a cultural awareness in Kerala.

Ms Sonia Kapoor of the World Bank discussed the importance of the NGO involvement in this project and explained that the mitigation measures for various impacts can be formulated by conducting talks with stakeholders like NGOs, local people, etc. She also mentioned that the environmental and social impacts cannot be solved by the PWD alone. Hence, we should be realistic and pragmatic in dealing with these problems.

Mr. Anil Kumar of the Rajiv Gandhi Cultural Study Centre urged that coordination of various agencies should facilitate the rehabilitation programme, undertaking awareness classes for the pedestrians, and creating road management committees at the panchayat level. The workshop closed with thanks to the various attendees by the Chairman.

KERALA STATE TRANSPORT PROJECT

Scoping Workshop - 2
Ernakulam, 25th January, 2000

MINUTES

An environmental and social scoping workshop was held on the 25th January in Hotel Renaissance, Ernakulam. This was the second of the three that were proposed to help identify priority environmental and social issues, covering the districts of Alappuzha, Ernakulam, Kottayam, Thrissur, Idukki, and Palakkad. The Project Implementation Unit (PIU), Irrigation Department and PCC decided to cover the entire Waterways issues at this scooping workshop. The Thiruvanathapuram workshop also discussed the waterways issue at a low profile. Er. E.K. Govindan, Superintending Engineer, Roads and Bridges Department of the PWD Central Circle, Aluva, opened the workshop with a keynote address. Mr. Andrew Blelloch, Environmental Specialist in the PCC, made a welcome speech. Mr. Dushantha Kumar, Director of the Project Implementation Unit, was Chairman.

Apart from the organizers, the various NGOs and officials who attended the workshop included:

Mr. K. K. Abdul Gaffoor, KSINC, Kochi.
Dr. Shankar from the Kerala Forest Research Institute, Peechi, Thrissur.
Mr. Ravindran from the Kerala Shastra Sahitya Parishad, Thrissur.
Dr. Komala Valli Amma, SE, ID , Govt. of Kerala, Thiruvananthapuram.
Dr. V.N.Sivasankara Pillai ,Cochin University for Science and Technology, Kochi.
Mr. Raji G. Nair, Assistant Executive Engineer, Irrigation Department, Kollam.
Mr. Joseph J. Karoor from the Friends of Periyar, Thekkady.

Mr. Govindan mentioned that the traffic volume in Kerala is annually increasing at the rate of 10-11% and discussed the vital role of the road network in the state's development activities. He also mentioned that the aim of the project is to rehabilitate and improve the existing roads with minimal acquisition of land and minimum dislocation of people and maximum benefit to the population at large and the resettlement and rehabilitation objectives would be followed up with the panchayat level discussions.

After the keynote and welcome address, the various experts addressed the audience with their assigned topics for discussion. Mr. Andrew Blelloch, Environmental Specialist, talked on the environmental and social assessment process for the highways. Mr Willium Cummings, Social Impact Specialist, talked on the environmental and social assessment process for the waterways. Mr. Sundara Rajan, Environment Impact Coordinator, talked on the environmental concerns in highways and waterways, and Dr. Biswanath Debnath, Social Impact Coordinator, discussed social concerns relating to highways.

The participants joined the discussion with their presentation. Dr. Komala Vally Amma briefly described the Kerala waterways and made a comparison of the relative maintenance costs of the railways, the highways and the waterways and mentioned the cost per km in the waterways is Rs. 1000/- while it is Rs. 5000/- in the two other modes.

Mr. K K. Abdul Gafoor of KSINCO described at length certain waterways related facts of the cargo transport in Kerala. He mentioned that IWT carry both passengers and cargo. Industrial raw materials are being transported by IWT in Ernakulam area. Many parts of Inland Waterways have insufficient infrastructure facilities. Another problem faced by IWT sector in Kerala is insufficient loading and unloading, facilities. Only 75% capacity of the boats and barges is being used. Optimum size capacity of the barge is 500 MT but now only 150 MT vessels operate. The width

and depth of Inland Water ways are not sufficient for this purpose. There is a future for Water Transport in Kerala for tourism as well as Cargo transport. The roads and railways have already reached a stratum point. Main problem associated is the hanging of power lines. There is a proposal for a joint venture high-speed catamaran service through the coastal area from Ernakulam to Thiruvanathapuram with private participation. Valiyathura in Thiruvananthapuram is easily accessible by the Harbor Engineering Department. Mr. Kumar suggested that their facts be put forwarded to the W.B officials when they reach Kochi.

Mr Raveendran of Kerala Shastra Sahithya Parishath mentioned the bad condition of National water way -3. He is of the opinion that National Waterways are not developed properly. He further talked about two facts first is about the optimum use of present roads and the second one is the construction companies building new roads.

Mr. Regi G Nair – Asst. Engineer Irrigation Department, Kollam talked on the optimization of the containerization.

Dr. Shankar- Kerala Forest Research Institute, Peechi – Scientist in-charge, Agro forestry cum publicity. He compared Kerala to an Oceanic island. The principles of island biology should be taken into account. The climate of Kerala is also important. Statistically speaking Kerala receives 90% of its annual rainfall, in about 10 hrs. Tree cover of Kerala has decreased considerably. He clarified the following data of decreasing trend of forest coverage in the year 1900 –70% forested area, 1950 – 50% forested area. 2000 – 25% forested area. He presented a case study of Forest related EIA the Thenmala eco-tourism project for the participants. He explained the methodology followed to arrive at reasonable conclusions.. The EIA also focused on attitudes and approaches of people. Landslides usually occur in Erattupetta, Kulathupuzha region. Placing project components makes matrices. The eco tourism project is a registrered charitable society. Mr. Mohanlal of the Indian Forest Service is the Secretary of the Thenmala ecotourism Society.

To a question from Mr Joseph J Karoor Friends of Periyar, Thekkady consultants stated that approaximately 300 km length of roads out of 2800 km passes through ecologically sensitive areas. Consultants also explained the selection and screening process of roads. They indicated that economic interest and environmental aspects are prime concerns. Ecologically sensitive roads will not be deleted but will be subjected to detailed Environmental investigations to prepare an EIA in order to obtain MOEF for clearance in case these are included for further investigations. The consultants mentioned that a large percentage of accidents are taking place in rural areas.

A resident of Kuttanad area (Professor at CUSAT) where the three proposed waterways are planned explained the reasons for negligence of IWT. One of the main reasons is due to the faster mode of Road and Rail Transport. There are some private operators of boats. His impression is that through water ways only Cargo transport is possible and it is not profitable also. There are many country boats plying in Kuttanad area, which serves as a means of transport for the local people.

Dr. Komalavalli Amma mentioned that at present waterways are neglected and there is ample scope if it is properly developed.

KERALA STATE TRANSPORT PROJECT

Scoping Workshop – 3
Kozhikode, 2th February, 2000

MINUTES

An environmental and social scoping workshop was held on the 2h February in Hotel Malbar Palace, Kozhikode. This was the last of the three workshops that were proposed to help identify priority environmental and social issues, covering the districts of Kasarkode, Kannur, Kozhikode, Malappuram and Wayanad. Kozhi kode workshop also discussed the waterways aspects in a low profile. Er.K Narayanan, Superintending Engineer, Roads and Bridges Department of the PWD North Circle, Kozhikode, opened the workshop with a keynote address. Mr. Andrew Blelloch, Environmental Specialist in the PCC, made a welcome speech. Mr. Dushantha Kumar, Director of the Project Implementation Unit, was Chairman.

Apart from the organizers, the various NGOs and officials who attended the workshop included:

Mr U Chandran Assistant General Manager Telecom Department, Kozhikode
Mr KD Joseph, Assistant EE, Kerala State Pollution Control Board, Kozhikode
Mr AM Jayan, Town Planner, Calicut Development Authority, Kozhikode.
Mr. Shanmugan , Assistant Executive Engineer, Kerala Water Authority, Kozhikode
Mr. KG Harshan . Assistant Executive Engineer, Kerala Water Authority, Kozhikode
Mr KM Unnikrishnan, Society for Protection of Environment, Kerala.
Mr Mohan Kumar, Deputy Director, Anthropology, KIRTADS, Kozhikode
Mr Dinesh Kumar, RASTA, Kozhikode
Mr Jayendran, Executive Engineer, PWD,Vadakara
Mr. Narayanan Namboothiri, EE roads division Manjeri
Mr.Abdul Khader, Executive Engineer, PWD Roads Division, Kozhikode

Mr. Narayanan during his keynote address mentioned that the state government has undertaken major policy reforms as a part of this project with the World Bank Assistance. An institutional Development Study is planned to review the institutional needs, options and resource requirements for sustainable road sector management reforms in planning financing and development of network assets. Er. Narayanan mentioned that the traffic volume in Kerala is annually increasing at the rate of 10-11% and discussed the vital role of the road network in the state's development activities. He also mentioned that the aim of the project is to rehabilitate and improve the existing roads with minimal acquisition of land and minimum dislocation of people and maximum benefit to the population at large and the resettlement and rehabilitation objectives would be followed up with the Panchayat level discussions.

After the keynote and welcome address, the various experts addressed the audience with their assigned topics for discussion. Mr. Andrew Blelloch, Environmental Specialist, talked on the environmental and social assessment process for the highways. Mr Willium Cummings, Social Impact Specialist, talked on the environmental and social assessment process for the waterways. Mr. Sundara Rajan, Environment Impact Coordinator, talked on the environmental concerns in highways and waterways, and Dr. Biswanath Debnath, Social Impact Coordinator, discussed social concerns relating to highways.

Mr Narayanan Namboothiri mentioned that Telecom and Kerala Water Authority works are affecting the road traffic. He argued for an out side the road space formation for separate space for the utilities and drainage facility. He mentioned about a proposal for Nilambur bypass. This bypass alignment identified is about two km mainly passing through paddy fields.

Mr U Chandran of Telecom department opined that suggestions for putting ducts are well and good. He also suggested having removable slabs along footpaths so that the telephone cables can be taken through the ducts provided below the slabs. He sought better facilities for crossing of roads. Mr Kumar later replied that there should be economic assistance from the concerned departments and the present cables, which are already laid, cannot be removed.

Mr Abdul Khader told that in this project the past history of the road development should be evaluated. Ribbon development is everywhere. He is in favour of parallel roads and bypass roads to get away from the present narrow roads. He mentioned that all roads become drains during monsoon season and there are sewerage outlets to the road. Surface water is entering the roads. Capillary effect on the roads should be considered and also the topography and climate. In Kerala there is very little budget for road improvements. He told that facility of roads is limited and there are no traffic regulations. Providing standard width is impractical. Access roads are the main problem for PWD Roads. These should be included in the project. Mr Kumar later replied that environmental and social concerns are given high weight age in this project. He mentioned that that minimum width of the road is provided according to the traffic. State has to justify all investments to the bank. Capillary rise is considered in this project design. Geometric correction of roads will be carried out wherever feasible. Mr Sundara Rajan later explained that total solution of our problems cannot be achieved by any single project however all viable alternatives will be taken in to consideration. He mentioned that state government has taken a major initiative towards most of the problem through the recently introduced Highway protection bill.

Mr KD Joseph mentioned that during public hearings public concerns are carefully considered.

Mr Jayan of Calicut Development Authority. He is in favour of controlling visual pollution effectively. The road markings should be considered. In the case of bypasses it is possible to collect betterment revenue. He stated that it will be very useful to every one if the already approved alignments are considered.

Mr Shanmugam of Kerala Water Authority mentioned that in the case of provision of water supply pipes provided along the roadsides, the department could pay the expenses. Widening in fact shift the existing pipeline towards the center so provision of relaying of pipes should be made.

Mr KG Harshan of KWA told that the cost of relaying of pipes should be included in the project budget. He also told that there are environmental and social concerns of this pipe laying should be taken in to account.

Mr Unnikrishnan representing an NGO mentioned the need for avoiding ecologically sensitive areas. Rehabilitation of the people should be given more importance. The impact on low-income groups is high although the cost of land acquisition is very low. There should be some way out for the storm water drains. It is time to prevent the garbage being thrown in to the drains. In all project related matters there should be 100 % transparency. If this is done there will not be any difficulty in convincing the people. Social and environmental impact should be considered seriously.

Mr Mohan Kumar of Kerala Institute for Research training and development studies for SCs and STs mentioned that there are about 103 SCs and STs in Kerala. Most of these weaker sections live along the roadsides. In the case of low income group's rehabilitation will be very difficult as the culture is linked with the land they hold. The encroachers should be classified and given compensation. Mr Mohan Kumar mentioned that in the case of SC and ST rehabilitation, it is always better to be spread and mixed with all other communities but they usually don't like the idea than a colony.

Mr Dinesh kumar of RASTA an NGO mentioned that the roads are very important for social advancement. People should be made aware about the various positive aspects of the project.

Mr Jayendran mentioned that overloading of vehicles is a serious concern as this cause accidents and damage to the road as well. Hence he explained the need for controlling these aspects. In the case of drainage accidents and divider accidents it should not be charged against the people who construct this. Mr Sundara Raja later mentioned that in foreign countries this is charged to the corporate body not to individuals.

Annexure 6.3. List of People Consulted as Part of Recent FGD (June -July 2012)

Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II *Public Consultation*

Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:	Kasargod – Kanhangad		
Link No.:			
Local place name:	Kasargod		
Venue:			
Date :	26/7/2012	Time	9:30 am

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1	Chroy Ramakkadavu Chemmanad, P.O., Kasargod	236208	[signature]
2	Muraleedharan, Mullerin House Mulleria, Kasargod dt	9946253671	[signature]
3	Vidhyadharan (Traffic Police) Chithra Nivas Parappa P.O, Kanhangad.	9495765932	[signature]
4	Krishnan Nair M. Chedikanki Mani House, Chandragiri	423365	[signature]
5.	Brijesh K. New Tops Bakery Kasargod.	9945748762	[signature]

Wilbur Smith Associates Pvt. Ltd. 1 Kerala State Transport Project

Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II — ***Public Consultation***

Chairman 3:1

Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:	Kasargod – Kanhangad		
Link No.:			
Local place name:			
Venue:	Kottarvam		
Date :	26/7/2012	Time	10:15 am.

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1	Omana. Thandanthottil House Paravanadukkam P.O Kalanad		ഓമന [illegible]
2	Janaki Thandanthottil Paravanadukkam P.O. Kalanad.		
3	Suma K. Thandanthottil House		[illegible]

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Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II | ***Public Consultation***

Kerala State Transport Project (Phase – II) 44700

Public Consultation Details

Project Area:	
Link No.:	
Local place name:	
Venue:	Kalanadu Village - Mel Parambu
Date :	26/7/2012 Time 10:45 am

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1	Sham Sudhin (Ambalathara) Akkara Kunnu Aravankaram, Kalanad	9947508750	[signature]
2.	P. Muralidharan (Ambalathara) Pallipuram Kalanad P.O Kasaragod Dist	9446144084	[signature]
3	B.A. HASAINAR	9995938132	[signature]
4.	Mohanan M.K. Kairali Home Kalanadu P.O	9645671074	[signature]
5	Anvar K.A. Chandragiri Fort S/o. Hameed, Kadavath (H) Kalanad P.O.	9995037741	[signature]
6	Prasanna K. W/o. Asokan Keezhoor Thayyath Kalanad P.O	8714498319	[signature]

Wilbur Smith Associates Pvt. Ltd. 1 Kerala State Transport Project

Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II **Public Consultation**

Kerala State Transport Project (Phase – II) 8+8

Public Consultation Details

Project Area:	KK Road		
Link No.:			
Local place name:			
Venue:	Uduma		
Date :	26/7/2012	Time	11:55 am

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1.	Dharmadharan C. Chappayil Uduma.	9947439785	[signature]
2.	Unnikrishnan. K Kannikulangara house Udma	9447826935	[signature]
3.	Ganeshan V.K Baravayal. Udma	9497286180	[signature]
4.	Haridas Santhi Kokal Uduma P.O.	9447439299	[signature]
5.	Asok Kumar K.V. Kokkal Home Uduma. P.O.	9447621664	[signature]
6.	Purushothaman Puthiyavalappil overbridge, Kolum, Uduma P.O.	9446281481	[signature]

Wilbur Smith Associates Pvt. Ltd. 1 Kerala State Transport Project

Kerala State Transport Project (Phase – II) 13+500

Public Consultation Details

Project Area:			
Link No.:			
Local place name:			
Venue:	[illegible]		
Date :	26/7/17	Time	12.30

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1.	[illegible]	9746953146	
2.	[illegible] KL60-9946	9656986052	
3.	[illegible]	9447940792	
4.	[illegible]	9895105429	
5.	[illegible]	9633732425	
6.	[illegible]	7293859869	

Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II — ***Public Consultation***

21+001

Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:			
Link No.:			
Local place name:			
Venue:	Maaliyam		
Date :	26/7/2012	Time	1: 15 pm

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1.	[illegible]	9446774437	[signature]
2.	[illegible] S/o [illegible]	9847047857	[signature]
3.	K. V. [illegible]	9605866868	[signature]
4.	[illegible] K.V. [illegible]	9961339333	[signature]
5.	Mohammed Kunhi M.K. M.K. House Kattadry Koloveyal Kanhange	9747303549	[signature]
6.	K.V. IBRAHIM. Thufeeq manzil Maaliyam Road. [illegible]	9656676637	[signature]

Wilbur Smith Associates Pvt. Ltd. 1 Kerala State Transport Project

Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II **Public Consultation**

Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:			
Link No.:			
Local place name:			
Venue:	Kanhangad		
Date :	26/7/2012	Time	1:45 pm

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1	B. Dathendran S/o [illegible] [illegible], Kanhangad	8089295238	[signature]
2.	[illegible] K. [illegible] kadappuram Kanhangad	9947[illegible]5	[signature]
3.	[illegible]	9947281734	[signature]
4.	[illegible]	9747750878	[signature]
5	[illegible]	9495723538	[signature]
6	Joseph Royal Footwear Bus stand, Kanhangad	04672 204022 9446577396	[signature]

Wilbur Smith Associates Pvt. Ltd. 1 Kerala State Transport Project

Kerala State Transport Project (Phase – II)

1+3

Public Consultation Details

Project Area:			
Link No.:			
Local place name:			
Venue:	Pilathara – [illegible]		
Date :	26/7/12	Time	3:40

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1.	[illegible]	9747485472	
2.	[illegible]	9514647416	
3	[illegible] C.V. [illegible]	9567727120	
4	[illegible]	9605850934	
5	[illegible]	9495364822	

Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:			
Link No.:			
Local place name:			
Venue:	[illegible]		
Date :	26/7/2012	Time	4:05 pm

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1.	[illegible]	9895267643	
2	[illegible]	9847445829	
3	[illegible]	9746535306	
4.	[illegible] K.P. Home [illegible] P.O.	9526365094	
5.	Raghavan. K.P. S/o Kannan. Mathummal house, kannom Ezhome. P.O.	9895659791	
6.	[illegible]	9562877630	

Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:	P. P. Road.		
Link No.:			
Local place name:			
Venue:	[illegible]		
Date :	26/7/12	Time	4:30 pm

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1.	[illegible]	9744376332	
2.	[illegible]	9947157272	
3.	[illegible]	9544066396	
4.	[illegible]	9961212160	
5.	[illegible]	9846180730	
6.	Renjith Kumar Meethal House Mothamma	9961501056	

Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II | ***Public Consultation***

Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:	P. P. Road -		
Link No.:			
Local place name:			
Venue:	[illegible]		
Date :	26/7/12	Time	5.00 pm

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1.	[illegible]	9495099460	[signature]
2.	[illegible] V. V. [illegible]	9895255694	[signature]
3.	Beverly John Johns Villa Pappinissery	04972 787338	[signature]
4	Sandosh Mayon valappil K. Kannapuram	9947536815	[signature]
5	[illegible]	9497049935	[signature]
6	P. B. [illegible]	9526522933	[signature]

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Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:	T. V. Road		
Link No.:			
Local place name:			
Venue:	R.C.B		
Date :	27/7/2012	Time	9:40 am

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1	Sajeev P. Grolaler Plastics T.C Road, Thalassery-4	2343133	
2.	Sreenivasan C.S. Trading T.C. Road, Thalassery	9744322969	
3.	Sivaji. Multex TC Road, Thalassery	9995332001	
4.	Ranjith Janaki Sadhan Dharmadam Thalassery	9037795630	
5.	Purushu Family Hypermarket TC Road, Thalassery	9847660953	
6.	Ravindran M.V. Ree Furniture. T.C. Road, TLCY	9446667615	

Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II — *Public Consultation*

Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:			
Link No.:			
Local place name:			
Venue:	Erinholi		
Date :	27/7/12	Time	10:15

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1	K.V. Sreedharan, Lakshmy Agencies, Erinholi, TC Road, TLCY	9947649456	[signature]
2	Sreejesh Sukumaran, Amrutha Stores, Erinholy Bridge, Chirakkara Post.	9387527529	[signature]
3	Sukumaran, Jisha Nivas, Kavumbhagom P.O, TLCY	2398064	[signature]
4	Shakkeer, Bithdhulmad, Moriakkunnu, Chirakkara PO	8907878343	Shakeer
5	[illegible] M., [illegible]		[signature]

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Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II | ***Public Consultation***

Kerala State Transport Project (Phase – II) 14+000

Public Consultation Details

Project Area:			
Link No.:			
Local place name:			
Venue:	Kosthuparambu		
Date :	27/9/2012.	Time	11:00 am

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1.	Vasu Manikkam Navavasu Koothuparambu	9847534613	[signature]
2.	Prajesh Paclingam Kundhoorpayil	9947894622	[signature]
3.	[illegible]	9495245654	[signature]
4.	Rijesh Rijina Nilavu Navavaal, Koothuparambu	9495265754	[signature]
5.	Naseer Sheenas Koothuparambu	9447086573	[signature]
6.	Shamseer Sajeen Manzil Menoori, K. Parambu	9747588932	[signature]

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Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II

[illegible]

Public Consultation

Sl. No	Name & Address	Phone Number	Signature
6	[illegible] K. Karayal Maniyoor Koothuparamba	9562415157	[signature]
7.	Sumesh P.R Sashemalayam Maloor P.O K. Paramba	9995717034	[signature]
8.	[illegible]	9656903204	[signature]
9	Benny Myalil Kolayad P.O Peravoor, Chittari parambu	9447613016	[signature]
10	[illegible]		[signature]

Wilbur Smith Associates Pvt. Ltd. 2 Kerala State Transport Project

Kerala State Transport Project (Phase – II) 17:500

Public Consultation Details

Project Area:			
Link No.:			
Local place name:			
Venue:	നീലേശ്വരം College		
Date :	27/7/2012	Time	11:40 am

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1	[illegible] നീലേശ്വരം	0490-2366650	
2.	[illegible]	9387304661	
3.	[illegible]	04470180249	
4	[illegible]	9447373928	
5	[illegible]		

Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:	T. V. Road		
Link No.:			
Local place name:			
Venue:	[illegible]		
Date :	27/7/12	Time	12:15 pm

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1	[illegible]	9946270[illegible]	
2	[illegible]	9447642499	
3	[illegible]	9495561313	
4	[illegible]	9847050324	
5	[illegible]	8547590970	
6	[illegible]	9747575667	

Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II *Public Consultation*

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Kerala State Transport Project (Phase – II)

Public Consultation Details

Project Area:	TV Road		
Link No.:			
Local place name:	[illegible]		
Venue:	Iritty Jn		
Date :	27/7/17	Time	1:20 pm

Registration Form

Sl. No	Name & Address	Phone Number	Signature
1	[illegible] M.T. [illegible]	9495654960	[signature]
2	[illegible] C.P. [illegible]	9048001303	[signature]
3	Jestin Antony, Elavunilkandel Kanichar po	8806512534	[signature]
4	Vilas ks, Kanthalamukkil Peravoor po	9605329323	[signature]
5	Bijesh. Puravballil Kallumal P.o, Iritty	9946618393	[signature]
6	Vijesh Abraham, Thazhathuvadakel (H), Iritty po	9495534675	[signature]

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Consultancy Engineering Services for Detailed Engineering Designs and Financing Option Study for KSTP II

Public Consultation

Sl. No	Name & Address	Phone Number	Signature
7	Rijeesh . Thekkemuriyil (H) Pattussery, Iritty. P.O, Kannur. Kerala.	9744894176	[signature]
8.	M.M. Davins, Mankoottathil P.O. Padiyoor.	9846046957	[signature]
9.	P.M. Rajan. Parackal. Kolluvayal. P.O. Iritty. Kannur. 670703	9947744268	[signature]
10	Johnson. K.T. Cherupachuchiraayil (House) Padiyoor (P.O) Iritty. Kannur. (Dist). Kerala	9446657542	[signature]

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